

# **UTAH'S PRIVATE FOREST LAND CHARACTERISTICS**

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## EXECUTIVE SUMMARY

Utah's forests are important sources of wood, water, grazing, wildlife habitat, and recreational opportunities. Though the bulk of these forests are publicly owned, private forests are providing increasing amounts of wood as supply from public lands dwindles. The following are some of the most important points to be made about these private forests:

- Private forests (excluding woodlands) make up about 20% of Utah's commercial forests or timberlands and about 1.1% to 1.5% of the state's total land area.
- Much of this private forest land forms a fringe around much larger tracts of public forest.
- Summit, Carbon, Wasatch, and Morgan counties contain nearly half of Utah's private commercial forest or land, with a total of about 400 thousand acres.
- 62% of Utah's private forest lands are aspen dominated forest types. Much of this aspen is likely old and declining due to fire suppression, but aspen is fairly easily regenerated after clearcutting with some precautions.
- Lodgepole pine types amount to about 2% of private forest land and are also fairly easy to regenerate with clearcutting, though clearcut openings must usually be kept small due to a general lack of cone serotiny in this species in Utah.
- Other private forest land types in Utah include mountain fir (19%), ponderosa pine (10%), and spruce-fir (7%). These types are much more difficult to regenerate after logging or other disturbances, yet their presence in the state is very valuable from a forest products, wildlife, and watershed standpoint.
- More of Utah's total timber harvest (at least 17%) is coming from private forest lands than in the past, amounting to 10.7 million board feet in 1992. This figure has likely increased in the last few years.
- Only about 15% of private forest land shows evidence of past logging, with most of that (75%) having occurred before 1985. Over one-third of this harvest occurred in the Northeast Multi-County Planning Area, with little harvest occurring in the Wasatch Front and Central Areas.
- The Weber River Watershed Management Unit has the largest proportion of its area in private land at 12.9% (202 thousand acres); its total forest coverage in all ownerships was also the highest at 22.2%.
- The Uinta Unit has the most forest in all ownerships with nearly 1.5 million acres and 21.2% of its land area, followed by the Sevier River Unit at just over one million acres, but only 15.3% of its area. The Lower Colorado Unit has the least forest area at 72 thousand acres.
- The Uinta and West Colorado Units each have over 100 thousand acres of private forest, but private forest as a proportion of their total land area is only 2.1% and 1.3% respectively.
- The Bear River and Jordan River Units are next to the Weber River Unit in private forest land acreage as a proportion of their total area at 4.0% and 3.3% respectively.
- The Southeast Colorado and GSL Desert/Columbia Units have the lowest amounts and proportions of private forest land.
- Half of these forests occur at elevations between 7,500 and 8,500 feet.

## OVERVIEW

This project involved gathering data from a number of sources to accurately represent acreages, locations, and other characteristics of Utah's private forest lands. Of particular interest were private commercial forest lands, sometimes called timberlands, that produce or are capable of producing crops of industrial wood. Timber-related activities taking place on these lands also were of interest, though availability of such information was limited.

Maps showing forest land locations, acreages, and other information were derived from a geographic information system (GIS) that included vegetation, ownership, and other pertinent data layers. Data also were obtained from the USDA Forest Service, including inventory data that gives some indication of the extent and timing of private land timber harvest activities.

The following sections include a short description of methods used and a qualitative and quantitative assessment of the data presented on the GIS-derived maps and obtained from the Forest Service.

## METHODS

This project involved obtaining as much information about Utah's private forest lands (and nearby public lands) as possible in a short time (less than two months). Therefore, existing information sources were utilized, including GIS-based data from the Utah Gap Analysis Program to assess acreages and locations of various forest types by different ownerships, data from previously published Forest Service reports for statewide acreage summaries, and unpublished data from a recent (1991-95) Forest Service forest inventory of Utah for acreage summaries and indications of private timber harvest activity.

The Utah Gap Analysis Program (Utah Cooperative Research Unit, Utah State University, Logan, UT 84322-5210; biod@nr.usu.edu) has developed a GIS that contains many data layers that were of interest in this study. In particular, we used the Gap vegetation layer to characterize the locations and acreages of various forest types, the Gap ownership layer to characterize public versus private ownership, and several other Gap features including watershed boundaries, county lines, county seats, and lakes (Edwards *et al.* 1995).

The Gap vegetation layer was primarily derived from Landsat Thematic Mapper scenes taken in 1988 and 1989 with subsequent field checking at 1,758 field training sites. Overall accuracy of the GAP cover type mapping is 75.3%. Gap ownership data were obtained from BLM 1:100,000-scale Surface Management Status maps. The minimum ownership parcel size mapped was 40 acres, while the minimum parcel size we used for vegetation was 5 hectares (12.35 acres).

The GIS was used to make several maps with acreage summaries, including 1) a map of the

state's private, federal, and state forests (found earlier in this report); 2) a map of the state's non-federal (private and state) forests by watershed management unit (found earlier in this report); 3) a map of non-federal land in ten commercial forest types (roughly equivalent to timberland); 4) a map of non-federal timberlands versus private woodlands (less productive lands, with non-commercial species); and 5) a map of private timberlands by 1,000 foot elevation intervals. For Utah Gap program details, contact the author or the Gap program at the address noted above. A web page also is available that contains a great deal of information about the Gap program, including a Gap Analysis Encyclopedia. Its Universal Resource Locator (URL) is:

<http://www.gap.uidaho.edu/gap/index.html>

Forest Service data also were used, including several figures from a 1992 summary of U.S. forest resources statistics (Powell *et al.* 1993). Most of the figures for Utah in this reference date from before 1987. We also obtained preliminary forest inventory figures on private forest land from the USDA Forest Service Intermountain Research Station Inventory, Monitoring, and Evaluation Unit (507 25th St., Ogden, UT 84401; (801)625-5388). This inventory is part of a continuous forest inventory that the Forest Service conducts in each state approximately every 10 years, with the most recent data collected for Utah between 1991 and 1995.

It is difficult to compare seemingly similar acreages from Gap, the 1993 Forest Service report, and the recent Forest Service inventory, and discrepancies can be found. These discrepancies stem from differences in techniques and in cover type definitions and from error inherent to the inventory and remote sensing techniques. Some of the figures presented in Powell *et al.* (1993) include Indian Lands as private lands, while Indian Lands were included under federal lands in the Gap analysis we conducted. Wherever possible we have pointed out or attempted to reconcile such discrepancies in this report. All maps produced in this report are derived from Gap data layers, while some tabular data is based on Forest Service figures.

## **RESULTS: UTAH'S PRIVATE FORESTS**

### **General Description of Utah's Forests**

Utah's forests are scattered throughout the state, with water availability the primary limiting factor. Forests therefore occur mostly at higher elevations (above 5,000 feet) where precipitation is adequate, though forest presence and species composition at various elevations is heavily influenced by slope, aspect, soil, fire and other disturbance history, and climatological variation on a local or regional scale. Some forests even occur at fairly low elevations along riparian corridors. Most of Utah's forests are located in a north-south band roughly paralleling Interstate 15, with other significant forest areas in the Uinta, La Sal, and Raft River Mountains (Van Hooser and Green 1983).

Following an elevational gradient from low tree line to high tree line, forest or woodland cover

types found in Utah include oak-mountain mahogany, pinyon-juniper, ponderosa pine, Douglas-fir, aspen, lodgepole pine, and spruce-fir (Long 1995). Commercial forests or timberlands are all at higher elevations and consist mostly of coniferous species, though aspen is becoming increasingly valuable as markets are developed.

Utah’s forests have been heavily used since European settlement in the mid-1800's for wood products, grazing, recreation, wildlife habitat, and as critical watershed areas. More recently, recreation has become the dominant use of most of Utah’s public and private forests. Uses of Utah’s forests will be covered in detail in a later section.

## Land Areas

Utah’s land area is about 53 million acres, with nearly a third of that forest (including timber and woodlands)(Table 1). This proportion is similar to that for the entire United States, which is 33% forested. Timberland (reserved or non-reserved forest land producing or capable of producing crops of industrial wood) makes up 3.4 million acres or about 21% of the state’s forest land, with the remainder in less productive or less commercially valuable woodlands like pinyon-juniper, oak, and maple. Differences between Gap and Forest Service timberland figures may partly be due to differences in definitions of timberland and Gap forest types used.

Table 1. Utah’s total area and area in various forest classes as of 1987. Discrepancies in sums and percentages may occur due to rounding errors. Source Powell *et al.* (1993) and Utah Gap.

<b>Land Types</b>	<b>Acreage (1,000's of acres; <i>Gap figures in italics</i>)</b>	<b>Percent of Total</b>
Timberland	3,424 ( <i>5,156</i> )	6.6% ( <i>9.5%</i> )
Other (mostly woodland)	12,809	24.4%
<b>Total Forest Land</b>	<b>16,234</b>	<b>31.0%</b>
Other Non-forest Land	36,354	69.0%
<b>Total State Area</b>	<b>52,588</b>	<b>100%</b>

## Ownership

Ownership of Utah’s timberlands is primarily public (80.6%), with most of that administered by the USDA Forest Service (Table 2). The remainder is in private, non-industrial ownership, with Powell *et al.* (1993) showing 597,000 acres of private timberland in 1987, or about 1.1% of the state’s total

land area. Gap showed about 834 thousand acres of the types we included in commercial forest, closer to the Forest Services figures from 1952, 1962, and 1977 of 824, 821, and 735 thousand acres respectively (Powell *et al.* 1993)(see map titled “Utah’s Private and Public Forests” earlier in this report). Again, differences in definitions of timberland and the Gap forest types we included as commercial account for the discrepancies between Forest Service and Gap acreages. For example, the Forest Service in 1978 showed less than one-half of the state’s aspen acreage as commercial timberland (Van Hooser and Green 1983), while with Gap we had no way to distinguish between commercial and non-commercial areas within a forest type.

Table 2. Utah timberland (not including woodlands) ownership in 1987. Discrepancies in sums and percentages may occur due to rounding errors. Source Powell *et al.* (1993) and Utah Gap.

<b>Utah Timberland Owners</b>	<b>Acreage (1,000's of acres; <i>Gap figures in italics</i>)</b>	<b>Percent of Total Timberland (Percent of Utah’s Total Area)</b>
National Forest	2,108	68.5%
BLM	175	5.7%
Other Federal	31	1.0%
<b>Total Federal Timberland</b>	<b>2,314</b>	<b>75.2% (4.4%)</b>
State	150	4.9%
County, Municipal	17	1.0%
<b>Total Public Timberland</b>	<b>2,481 (4,323)</b>	<b>80.6% (4.7%)</b>
Farmers/Ranchers	318	10.3%
Non-Farmers/Ranchers	279	9.1%
<b>Total Private Timberland</b>	<b>597 (834)</b>	<b>19.4% (1.1%)</b>
<b>Total Public Timberland</b>	<b>2,481 (4,323)</b>	<b>80.6% (4.7%)</b>
<b>Total Timberland</b>	<b>3,078 (5,156)</b>	<b>100% (5.8%)</b>

Private, federal, and state commercial forest distribution (calculated from Gap) is shown in Table 3 and in the map titled “Utah’s Private and Public Forests” included earlier in this report. In nearly all cases, private forests comprise a fringe around larger public forest tracts, primarily National

Forest. Most timberland and woodland is in northern Utah (from “Utah Private Forests and Woodlands” map that shows private woodland acreage and distribution). Summit, Carbon, Wasatch, and Morgan counties contain nearly half (48%) of Utah’s private commercial forest lands and have over 10% of their land area in private forest (Table 3). Summit and Carbon counties alone contain 32% of Utah’s private forest land. The Northeastern Area contains much more private forest than any other at about 283 thousand acres and 3.8% of its land area.

Table 3. Commercial forest acreage (from ten Gap timber types) by county and by State of Utah Multi-County Planning Area. Percentages indicate the proportion of a county or area (or the state) in forest in a particular ownership. Discrepancies in sums and percentages may occur due to rounding errors. Source Utah Gap.

County and Multi-County Planning Area (County/Area Acreage)	Private Forest Acreage	Public/Federal Forest Acreage	Public/State Forest Acreage	Forest Acreage Totals
Box Elder (4,314,455 ac)	8,232 ac (0.2%)	17,594 ac (0.4%)	562 ac (0.01%)	26,388 ac (0.6%)
Cache (750,170 ac)	43,070 ac (5.7%)	96,626 ac (12.9%)	14,189 ac (1.9%)	153,885 ac (20.5%)
Rich (694,744 ac)	18,915 ac (2.7%)	31,282 ac (4.5%)	1,739 ac (0.3%)	51,937 ac (7.5%)
Weber (421,993 ac)	31,019 ac (7.4%)	21,649 ac (5.1%)	1,810 ac (0.4%)	54,478 ac (12.9%)
<b>Bear River Area (6,181,362 ac)</b>	<b>101,236 ac (1.6%)</b>	<b>167,151 ac (2.7%)</b>	<b>18,300 ac (0.3%)</b>	<b>286,688 ac (4.6%)</b>
Juab (2,179,726 ac)	7,973 ac (0.4%)	51,393 ac (2.4%)	4,736 ac (0.2%)	64,102 ac (2.9%)
Millard (4,375,734 ac)	2,012 ac (0.05%)	83,568 ac (1.9%)	2,002 ac (0.05%)	87,581 ac (2.0%)
Piute (489,666 ac)	5,873 ac (1.2%)	120,948 ac (24.7%)	16,590 ac (3.4%)	143,411 ac (29.3%)
Sanpete (1,024,857 ac)	29,501 ac (2.9%)	221,768 ac (21.6%)	4,836 ac (0.5%)	256,105 ac (25.0%)
Sevier (1,227,070 ac)	42,281 ac (3.4%)	308,143 ac (25.1%)	3,794 ac (0.3%)	354,218 ac (28.9%)
Wayne (1,577,442 ac)	918 ac (0.1%)	123,318 ac (7.8%)	5,865 ac (0.4%)	130,101 ac (8.2%)
<b>Central Area (10,874,495 ac)</b>	<b>88,558 ac (0.8%)</b>	<b>909,138 ac (8.4%)</b>	<b>37,823 ac (0.3%)</b>	<b>1,035,518 ac (9.5%)</b>
Daggett (462,205 ac)	4,312 ac (0.9%)	133,067 ac (28.8%)	4,459 ac (1.0%)	141,837 ac (30.7%)
Duchesne (2,077,036 ac)	46,866 ac (2.3%)	457,632 ac (22.0%)	8,346 ac (0.4%)	512,844 ac (24.7%)
Summit (1,202,677 ac)	140,860 ac (11.7%)	425,453 ac (35.4%)	3,275 ac (0.3%)	569,588 ac (47.4%)
Uintah (2,882,381 ac)	8,075 ac (0.3%)	228,619 ac (7.9%)	4,833 ac (0.2%)	241,527 ac (8.4%)
Wasatch (773,282 ac)	82,735 ac (10.7%)	257,451 ac (33.3%)	16,748 ac (2.2%)	356,934 ac (46.2%)
<b>Northeastern Area (7,397,581 ac)</b>	<b>282,848 ac (3.8%)</b>	<b>1,502,222 ac (20.3%)</b>	<b>37,661 ac (0.5%)</b>	<b>1,822,731 ac (24.6%)</b>
Carbon (949,948 ac)	122,877 ac (12.9%)	84,942 ac (8.9%)	15,787 ac (1.7%)	223,606 ac (23.5%)



County and Multi-County Planning Area (County/Area Acreage)	Private Forest Acreage	Public/Federal Forest Acreage	Public/State Forest Acreage	Forest Acreage Totals
Emery (2,853,097 ac)	14,621 ac (0.5%)	108,604 ac (3.8%)	5,186 ac (0.2%)	128,411 ac (4.5%)
Grand (2,363,668 ac)	7,610 ac (0.3%)	71,207 ac (3.0%)	21,900 ac (0.9%)	100,717 ac (4.3%)
San Juan (5,075,109 ac)	13,322 ac (0.3%)	92,496 ac (1.8%)	8,859 ac (0.2%)	114,677 ac (2.3%)
<b>Southeastern Area (11,241,822 ac)</b>	<b>158,430 ac (1.4%)</b>	<b>357,249 ac (3.2%)</b>	<b>51,732 ac (0.5%)</b>	<b>567,411 ac (5.0%)</b>
Beaver (1,654,445 ac)	2,781 ac (0.2%)	105,686 ac (6.4%)	5,184 ac (0.3%)	113,651 ac (6.9%)
Garfield (3,330,992 ac)	12,122 ac (0.4%)	533,950 ac (16.0%)	4,735 ac (0.1%)	550,807 ac (16.5%)
Iron (2,113,373 ac)	37,000 ac (1.8%)	118,248 ac (5.6%)	5,910 ac (0.3%)	161,157 ac (7.6%)
Kane (2,627,394 ac)	17,937 ac (0.7%)	66,195 ac (2.5%)	675 ac (0.03%)	84,807 ac (3.2%)
Washington (1,556,197 ac)	6,921 ac (0.4%)	29,571 ac (1.9%)	258 ac (0.02%)	36,750 ac (2.4%)
<b>Southwestern Area (11,282,401 ac)</b>	<b>76,761 ac (0.7%)</b>	<b>853,650 ac (7.6%)</b>	<b>16,762 ac (0.1%)</b>	<b>947,173 ac (8.4%)</b>
Davis (406,287 ac)	2,443 ac (0.6%)	10,854 ac (2.7%)	---	13,297 ac (3.3%)
Morgan (390,669 ac)	56,745 ac (14.5%)	5,587 ac (1.4%)	1,608 ac (0.4%)	63,940 ac (16.4%)
Salt Lake (515,409 ac)	19,448 ac (3.8%)	49,501 ac (9.6%)	605 ac (0.1%)	69,554 ac (13.5%)
Tooele (4,663,097 ac)	15,775 ac (0.3%)	36,623 ac (0.8%)	2,628 ac (0.1%)	55,026 ac (1.2%)
Utah (1,369,998 ac)	30,848 ac (2.3%)	186,833 ac (13.6%)	11,039 ac (0.8%)	228,719 ac (16.7%)
<b>Wasatch Front Area (7,345,460 ac)</b>	<b>125,259 ac (1.7%)</b>	<b>289,398 ac (3.9%)</b>	<b>15,880 ac (0.2%)</b>	<b>430,536 ac (5.9%)</b>
<b>State Totals (54,323,019 ac)</b>	<b>833,092 ac (1.5%)</b>	<b>4,078,808 ac (7.5%)</b>	<b>178,158 ac (0.3%)</b>	<b>5,090,057 ac (9.4%)</b>

Garfield County contains the most federal commercial forest land with nearly 534 thousand acres or 13% of the state's total. Wasatch County, however, has the largest proportion of its land area in federal forest at one third. As with private forest, the Northeastern Area contains the most federal forest acreage at 1.5 million acres and 20% of its land area. Nearly half, 48% or 85 thousand acres, of state-owned forest land is found in Grand, Wasatch, Piute, Carbon, and Cache counties. The Southeastern Area contains the most state-owned forest at 52 thousand acres, mainly due to the large acreages in Grand and Carbon counties.

### **Acreage and Location of Private Forests by Forest Type**

Ten Gap forest types were used to represent commercial forest (the term "forest" is used in the following discussions and on the maps to denote these ten types; other types will be referred to as "woodlands"). These types were dominated by the following commercially important tree species: aspen, lodgepole and ponderosa pines, subalpine and white firs, and Engelmann and blue spruces. The

ten forest types used were:

- Aspen--Deciduous forest dominated by quaking aspen with associated conifer species spruce, fir, Douglas-fir, and pine and shrub species snowberry and serviceberry.
- Aspen/Conifer--Deciduous forest with principally quaking aspen dominant or co-dominant with conifers.
- Lodgepole--Conifer forest dominated by lodgepole pine with associated species Engelmann spruce and subalpine fir.
- Lodgepole/Aspen--Conifer-deciduous forest with lodgepole pine dominant or co-dominant with aspen.
- Mountain Fir--Conifer forest dominated by white fir and Douglas-fir with associated species ponderosa pine, pinyon, Engelmann and blue spruce, and subalpine fir.
- Mountain Fir/Mountain Shrub--Conifer forest or woodland with mountain fir dominant/ associated or co-dominant with mountain shrubs.
- Ponderosa Pine--Conifer forest dominated by ponderosa pine with associated species pinyon, juniper, white fir, and Douglas-fir.
- Ponderosa Pine/Mountain Shrub--Conifer forest or woodland with ponderosa pine dominant/associated or co-dominant with mountain shrubs.
- Spruce-Fir--Conifer forest dominated by Engelmann and blue spruce and subalpine fir with associated species lodgepole pine, white fir, Douglas-fir, limber pine, and bristlecone pine.
- Spruce-Fir/Mountain Shrub--Conifer forest or woodland with spruce-fir dominant/ associated or co-dominant with mountain shrubs.

Woodland types used for the private forests and woodlands map included:

- Juniper--Conifer forest dominated by Rocky Mountain, Utah, and one-seed junipers with associates pinyon and mountain-mahogany and shrubs sagebrush and blackbrush.
- Lowland Riparian--Riparian areas generally lower than 5500 feet; principal woody species include Fremont cottonwood, saltcedar, netleaf hackberry, velvet ash, desertwillow, sandbar willow, and squawbush.
- Mountain Riparian--Riparian areas generally above 5500 feet; principal woody species include willow, narrowleaf cottonwood, thinleaf alder, water birch, black hawthorn, Rocky Mountain maple, red-osier dogwood, and wild rose.
- Pinyon--Conifer forest dominated by pinyon with associates juniper, ponderosa pine, white fir, Douglas-fir, and shrub species Gambel oak and sagebrush.
- Pinyon-Juniper--Conifer forest co-dominated by pinyon and juniper with associated tree species mountain-mahogany and shrub species sagebrush.

A map titled "Utah's Private Forests" was compiled (and is available from the authors) that shows acreages and locations for ten Gap forest types. Aspen is by far the dominant type, comprising

62% of Utah's private forests (includes both aspen dominated types), followed by much smaller acreages of mountain fir (19%), ponderosa pine (10%), spruce-fir (7%), and lodgepole pine (2%). Most of these types are distributed throughout the state in proportion to the presence of private forest land in a given area, though ponderosa pine is absent from northern Utah and lodgepole pine is absent from southern Utah.

### **Elevation of Utah's Private Forests**

Water availability is the primary determining factor affecting Utah forests. However, reliable precipitation data was not available at the scale needed for our GIS analysis. Elevation data was available, and since higher elevation generally means higher precipitation and cooler temperatures, we mapped private forest land by elevation (see map titled "Utah's Private Forests by Elevation"). Half of Utah's private forests are found between 7,500 and 8,500 feet, and nearly a third between 8,500 and 9,500 feet. Very little occurs below 6,500 feet and only 6% occurs above 9,500 feet. The highest elevation forests are found mostly in the Uintas and the La Sals, the Fish Lake and Monroe Mountain areas south and east of Richfield, and east of Price.

### **Utah's Private Forest Land Uses**

Timber Harvest Wood from Utah's private and public forests has been extensively harvested since European settlement in the mid-1800's. Harvest may have declined in the mid-1900's (data are unavailable), but it appears that private timber harvest now may be increasing due to recent high prices and supply tightening in the Pacific Northwest and throughout the West. The proportion of the state's total timber harvest coming from private lands rose from 6% in 1966 to 12% in 1970 and 17% in 1992 (Setzer and Wilson 1970, Green and Setzer 1974, Keegan *et al.* 1995). This 1992 harvest amounted to about 10.7 million board feet of timber (not including fuelwood)(Keegan *et al.* 1995).

Though they likely are harvesting more timber than in the past, Utah's private forest landowners are not timber oriented overall. A recent survey of these landowners in Utah showed that 5% of respondents had harvested timber from their land (Brunson *et al.* 1996). Though Gap data were not useful for determining levels of private timber harvest, we were able to obtain private timber harvest figures from the 1991-95 Forest Service inventory which is summarized in Table 4. In this inventory an area was determined to have been harvested by observation of a plot by the inventory crew. The time of the last timber harvest on the plot was estimated and coded as within the past year, 1-3 years, 3-10 years, or beyond 10 years. Since these measurements took place over a four year interval, some of the cutting time categories in Table 4 overlap.

Private timber harvest statewide is 135,500 acres, or 15% of the private timberland available (Table 4). Most of this timber (75%), however, was harvested prior to 1985, and only 7% was harvested in 1992-93. The most active area in terms of total timberland harvested, with 49,700 acres, was the Northeastern Area, but no plots showed harvest activity after about 1983. The Southeastern

Area had the largest proportion of timberland harvested, at 42%, and had evidence of the most recent harvesting, with 37% occurring in 1992-93.

Twenty percent of the state's private woodland showed some indication of harvest, with the Central Area showing the greatest proportion harvested at 33%. Care must be taken in interpreting any of these data below the state level, however, since smaller areas represent relatively few sample plots and therefore can have a large sampling error. For example, the table shows no timberland harvest since 1983 in the Northeastern Area, yet it seems certain that harvesting has occurred.

Table 4. Private timberland and woodland acreage harvested and timberland harvest timing by Utah Multi-County Planning Area. Percentages in parentheses are the proportion of an area's total timberland or woodland that has been harvested. Source is Forest Service Intermountain Station inventory data collected between 1991 and 1995. Data are preliminary and acreages are rounded to the nearest 100 acres.

<b>Multi-County Planning Area and Counties Included</b>	<b>Timberland Harvest<sup>1,2</sup></b>	<b>Timberland Harvest Timing</b>	<b>Woodland Harvest<sup>1,3</sup></b>
Bear River Area (Box Elder, Cache, Rich, Weber Counties)	23,000 ac (18%)	53% harvested before 1981, 47% 1981-88	55,700 ac (24%)
Central Area (Juab, Millard, Piute, Sanpete, Sevier, Wayne Counties)	8,200 ac (28%)	100% harvested 1985-92	57,200 ac (33%)
Northeastern Area (Daggett, Duchesne, Summit, Uintah, Wasatch Counties)	49,700 ac (12%)	100% harvested before 1983	49,100 ac (16%)
Southeastern Area (Carbon, Emery, Grand, San Juan Counties)	24,500 ac (42%)	63% harvested before 1983, 37% 1992-93	14,600 ac (16%)
Southwestern Area (Beaver, Garfield, Iron, Kane, Washington Counties)	25,300 ac (22%)	79% harvested before 1985, 21% 1985-92	34,800 ac (19%)
Wasatch Front Area (Davis, Morgan, Salt Lake, Tooele, Utah Counties)	4,800 ac (3%)	100% harvested before 1981	55,100 ac (17%)
<b>State Totals</b>	<b>135,500 ac (15%)</b>	<b>75% harvested before 1985, 8% 1981-88, 10% 1985-92, 7% 1992-93</b>	<b>266,500 ac (20%)</b>

<sup>1</sup> Care must be taken in interpreting data below the state level. Smaller areas represent relatively few sample plots and therefore can have a large sampling error.

<sup>2</sup> Timberland as defined by the Forest Service is land producing or capable of producing crops of timber species. Mixed stands of timber species and woodland trees are classified as timberland if timber species have 5% or more crown cover.

<sup>3</sup> Woodland is forest land with 10% or more crown cover, but less than 5% crown cover in timber species.

**Non-timber Land Uses** Important non-timber private forest uses in Utah include grazing, firewood gathering for personal use, and personal and fee hunting (Brunson and Kuhns 1995). Recreation, however, is by far the number one use of forest land in Utah, both public and private. The Wasatch-Cache National Forest that abuts most of the Wasatch Front accounted for 6.7 million recreation visitor-days in 1980, making it the busiest national forest in the country in terms of recreation (Van Hooser and Green 1983). And Brunson and Kuhns (1995) found that various recreational uses were the most common benefits received by Utah forest landowners from their land, and were the main reasons they owned forest land.

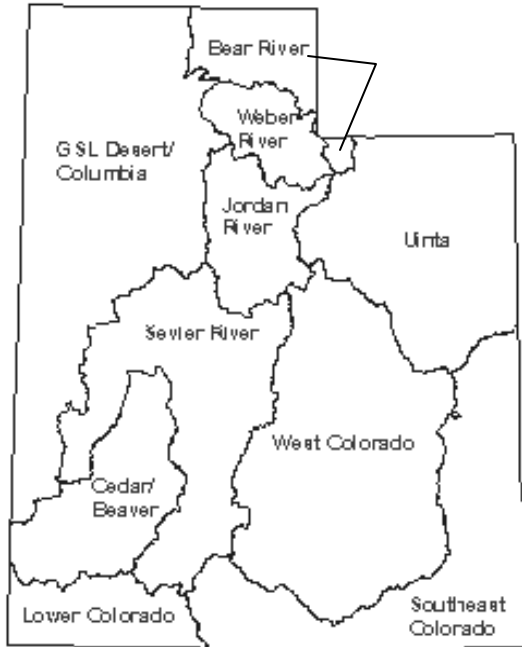


Figure 1. Utah watershed management units.

### Private Forests by Watershed Management Unit

One major concern about timber harvest activities on forest lands is their effect on water quality. We therefore used Gap to analyze the location and timber types of private, public federal, and public state lands for ten watershed management units that correspond to hydrologic basins defined by the Utah Division of Water Resources for the State Water Plan (Figure 1). For more information on these units contact the division. A web page describing these units is located at URL:

<http://www.eq.state.ut.us/eqwq/shed.htm>

Table 5 shows the commercial forest acreage (includes the ten Gap types mentioned previously) in each watershed management unit broken down by private, public/federal owned, or public/state owned. A map titled “Utah’s Private and State Forests by Watershed” also shows forest distribution by watershed. The Uinta Unit has the most forest in all ownerships with nearly 1.5 million acres and 21.2% of its land area, followed by the Sevier River Unit at just over one million acres, but only 15.3% of its area. The Lower Colorado Unit has the least forest area at 72 thousand acres.

Table 5. Private, public/federal, and public/state commercial forest acreage (ten Gap timber types) by watershed management units. Percentages in parentheses indicate the proportion of a unit’s acreage in a particular ownership. Discrepancies in sums and percentages may occur due to rounding errors. Source Utah Gap.

Unit Name and Total Land Area in Acres	Private Forest Acreage	Public/Federal Forest Acreage	Public/State Forest Acreage	Unit Forest Acreage Totals
Bear River Unit (2,049,634 ac)	82,365 ac (4.0%)	227,379 ac (11.1%)	16,493 ac (0.8%)	326,237 ac (15.9%)
Cedar/Beaver Unit (3,643,580 ac)	29,569 ac (0.8%)	160,597 ac (4.4%)	9,630 ac (0.3%)	199,796 ac (5.5%)
GSL Desert/Columbia Unit (11,824,762 ac)	24,754 ac (0.2%)	68,711 ac (0.6%)	7,752 ac (0.1%)	101,217 ac (0.9%)

<b>Unit Name and Total Land Area in Acres</b>	<b>Private Forest Acreage</b>	<b>Public/Federal Forest Acreage</b>	<b>Public/State Forest Acreage</b>	<b>Unit Forest Acreage Totals</b>
Jordan River Unit (2,478,572 ac)	80,676 ac (3.3%)	369,346 ac (14.9%)	16,786 ac (0.7%)	466,808 ac (18.8%)
Lower Colorado Unit (2,224,030 ac)	27,199 ac (1.2%)	44,148 ac (2.0%)	790 ac (0.04%)	72,137 ac (3.2%)
Sevier River Unit (6,727,606 ac)	88,881 ac (1.3%)	914,058 ac (13.6%)	26,341 ac (0.4%)	1,029,280 ac (15.3%)
Southeast Colorado Unit (6,932,478 ac)	20,688 ac (0.3%)	130,531 ac (1.9%)	17,270 ac (0.2%)	168,488 ac (2.4%)
Uinta Unit (6,945,637 ac)	144,982 ac (2.1%)	1,276,801 ac (18.4%)	52,198 ac (0.8%)	1,473,982 ac (21.2%)
Weber River Unit (1,566,905 ac)	201,960 ac (12.9%)	140,854 ac (9.0%)	5,428 ac (0.3%)	348,242 ac (22.2%)
West Colorado Unit (9,888,433 ac)	131,735 ac (1.3%)	746,195 ac (7.5%)	25,415 ac (0.3%)	903,345 ac (9.1%)
<b>State Totals (% of Row Total)</b>	<b>832,809 ac (16.4%)</b>	<b>4,078,620 ac (80.1%)</b>	<b>178,103 ac (3.5%)</b>	<b>5,089,533 ac</b>

Private forest is most abundant in the Weber River Unit, at over 200 thousand acres and 12.9% of the unit's total land area. The Weber River Unit has the highest proportion of forest coverage at 22.2%. The Uinta and West Colorado Units each have over 100 thousand acres of private forest, but these are much larger watersheds than the Weber River, and private forest as a proportion of their total land area is only 2.1% and 1.3% respectively. The Bear River and Jordan River Units are next to the Weber River Unit in private forest land acreage as a proportion of their total area at 4.0% and 3.3% respectively. The Southeast Colorado and GSL Desert/Columbia Units have the lowest amounts and proportions of private forest land.

### **Silvicultural Limitations and Concerns by Forest Type**

Each forest type found in Utah has its own ecological characteristics and responds to natural and human caused disturbances in specific ways. Timber harvest and harvest-related disturbances like road building, skidding, and slash treatment are especially important and pertinent to this report. The following is a summary of silvicultural and other concerns for aspen, lodgepole pine, Douglas-fir (roughly equivalent to mountain fir), ponderosa pine, and spruce-fir forest types. Silviculture refers to the science and practice of producing and caring for a forest. The basis of good silviculture is the regeneration of a desirable forest after harvesting or other stand-replacing disturbances. See Long (1995) for a more in-depth discussion of the silviculture of the following types, and see Burns and Honkala (1990) for descriptions of the silvics of each species involved.

### Aspen

- Important for wildlife habitat, grazing, biodiversity, and as a visual resource; becoming more important for its wood fiber value as markets have developed in Utah.
- Easily regenerates after clearcutting or burning by producing numerous root sprouts; rarely reproduces from seed in the West.
- Extensive root damage on skid trails and landings can reduce sprouting.
- Initially out-competes associated conifers in a clearcut or fire because of sprouting from an established root system, forming large, genetically identical clones.
- Shade intolerant and short-lived, so lack of disturbance eventually leads to replacement by more shade tolerant conifers like spruce and fir; this is common in Utah due to fire suppression.
- Non-aspen sites can be slowly colonized by root system ingrowth and sprouting from neighboring clones.
- Replacement of an aspen stand by existing conifers can be encouraged by cutting or girdling aspen while leaving the conifers alone.
- Clearcutting of a mixed aspen-conifer stand is likely to lead to replacement with pure aspen.

### Lodgepole Pine

- Important for its wood and for wildlife habitat.
- Shade intolerant and tends to occur in fairly pure stands; typically regenerates well after a fire or clearcut.
- May release seed from serotinous cones (closed cones that store viable seed for many years), though cone serotiny is highly variable from stand to stand; serotiny generally greater with younger, more frequently disturbed stands.
- Slash with serotinous cones can be lopped and scattered to distribute seeds and should not be piled until late summer (air temperatures must exceed 85°F for seed release).
- Over-dense regeneration with high cone serotiny can be avoided by minimizing soil disturbance and less site preparation.
- Stands with low or absent cone serotiny should be harvested in small clearcuts so seeds can be wind-disseminated from adjacent lodgepole stands.
- Mountain pine beetle and dwarf mistletoe are serious pests, especially on older and otherwise unhealthy or damaged trees.
- Mistletoe controlled by clearcutting with site preparation to destroy infected advanced regeneration; clearcuts large to minimize disease spread from edges.
- Mountain pine beetle controlled by conversion to non-host species, thinning to maintain vigor, and increased age-class diversity.

### Douglas-fir/Mountain Fir

- Important timber and recreation resource and provides critical wildlife habitat.
- Refers to sites where Douglas-fir could dominate climax stands, but several other species may be present, including true firs, spruces, and lodgepole and ponderosa pines.
- Intermediate in shade tolerance, so undisturbed Douglas-fir stand can be replaced by more shade



tolerant subalpine fir or Engelmann spruce; fairly common in Utah due to fire suppression.

- Group selection or shelterwood necessary for reproduction since most associated species need some protection to regenerate naturally or as planted seedlings.
- Clearcutting if aspen or lodgepole pine is present will likely regenerate the stand to those species.
- Careful overstory removal can regenerate a stand where adequate advanced regeneration is present.
- Clearcutting or overstory removal without adequate advanced regeneration will lead to conversion to shade intolerant species or to a poorly stocked stand of a shade tolerant species such as subalpine fir.
- Important pests are western spruce budworm, various bark beetles, and dwarf mistletoes; control by improving stand vigor, increasing species and age-class diversity, and using even-aged systems where appropriate.

### Ponderosa Pine

- Limited to southern portion of Utah, but important where present for wood, wildlife (northern goshawk and others), grazing, and recreation.
- Shade intolerant; fire suppression on higher sites favors replacement by more shade tolerant associates; overstory removal of ponderosa pine can increase this trend.
- Withstands moderate intensity ground fires when older because of thick bark.
- Well adapted to fairly warm, dry sites; grows in fairly pure stands at lower elevations and in more mixed stands on higher, cooler, and moister sites.
- On dry sites group selection or shelterwood methods can provide a seed source and seedling protection; small clearcuts or light shelterwoods can be used on moister sites.
- Good site preparation and protection from livestock are important for natural regeneration.
- Seedling planting is sometimes used for regeneration.
- Mountain pine beetle is a serious pest encouraged by old, low vigor stands with large trees; ips beetles attack stressed trees and can reproduce in slash and other downed material, so slash treatment is essential.

### Spruce-Fir

- Important for wood fiber, though spruce is worth considerably more than fir; wildlife habitat, recreation, and watershed values also important.
- Highest elevation type; dominated by subalpine fir, which is very shade tolerant, and Engelmann spruce, which is slightly less tolerant, often present as codominants in climax stands.
- Other associated species are lodgepole and limber pines, Douglas-fir, and aspen.
- Regeneration after harvest is difficult; group selection and shelterwood methods can be used; protection is needed for seedling survival; planting and protection of advanced regeneration help.
- Stands can be very complex in structure and age distribution; group shelterwood can be used in more uneven-aged stands; openings should be less than two times tree height for good protection but more than one tree height to favor spruce.
- Fires are infrequent but important in dry years; windthrow is an important disturbance factor.
- Root diseases, bark beetles, and the western spruce budworm are important pests; control spruce bark beetles by removing attacked or susceptible trees and treating slash.



## BIBLIOGRAPHY

- Brunson, M.W. and M.R. Kuhns. 1995. Characteristics and Attitudes of Utah's Private Forest Owners. Unpublished survey results. Can be obtained from authors. 3 pp.
- Brunson, M.W., D.T. Yarrow, S.D. Roberts, D.C. Guynn Jr., and M.R. Kuhns. 1996. Nonindustrial private forest owners and ecosystem management: Can they work together? *J. of Forestry* 94(6):14-21.
- Burns, R.M. and B.H. Honkala. 1990. *Silvics of North America: Volume 1. Conifers and Volume 2. Hardwoods.* USDA Forest Service Ag. Handbook 654. 675 pp and 877 pp.
- Edwards, T.C., C.G. Homer, S.D. Bassett, A. Falconer, R.D. Ramsey, and D.W. Wight. 1995. Utah Gap Analysis: An Environmental Information System. UT Coop. Fish & Wildlife Res. Unit Final Proj. Report 95-1. Includes maps and CD-ROM's. 46 pp.
- Green, A.W. and T.S. Setzer. 1974. The Rocky Mountain Timber Situation, 1970. USDA Forest Service Resource Bulletin INT-10. 78 pp.
- Keegan, C.E., D.P. Wichman, and D.D. Van Hooser. 1995. Utah's Forest Products Industry: A Descriptive Analysis, 1992. USDA Forest Service Resource Bulletin INT-RB-83. 21 pp.
- Long, J.N. 1995. The Middle and Southern Rocky Mountain Region. Chapter 8 in: *Regional Silviculture of the United States*, ed. J.W. Barrett. Wiley & Sons, NY. pp 335-386.
- Powell, D.S., J.L. Faulkner, D.R. Darr, Z. Zhu, and D.W. MacCleery. 1993. Forest Resources of the United States, 1992. USDA Forest Service GTR RM-234. 132 pp.
- Setzer, T.S. and A.K. Wilson. 1970. Timber Products in the Rocky Mountain States, 1966. USDA Forest Service Resource Bulletin INT-9. 89 pp.
- Van Hooser, D.D. and A.W. Green. 1983. Utah's Forest Resources, 1978. USDA Forest Service Resource Bulletin INT-30. 58 pp.