This volume, **Volume IIa: Hardwoods with Spruce in Alaska (PMS 836, NFES 2668),** is part of the second phase of the natural fuels photo series. This is an addition to **Volume II: Black Spruce and White Spruce types in Alaska (PMS 831, NFES 2581).** This volume can be used as a stand-alone document or can be removed and inserted into the back of Volume II.

# Stereo Photo Series for Quantifying Natural Fuels

## Volume IIa: Hardwoods with Spruce in Alaska

Roger D. Ottmar and Robert E. Vihnanek

## ABSTRACT

**Ottmar, Roger D.; Vihnanek, Robert E. 2002.** Stereo photo series for quantifying natural fuels. Volume IIa: hardwoods with spruce in Alaska. PMS 836. Boise, ID: National Wildfire Coordinating Group, National Interagency Fire Center. 41 p.

A series of single and stereo photographs display a range of natural conditions and fuel loadings in hardwood ecosystems undergoing succession to spruce in Alaska. Each group of photos includes inventory information summarizing vegetation composition, structure and loading, woody material loading and density by size class, forest floor depth and loading, and various site characteristics. The natural fuels photo series is designed to help land managers appraise fuel and vegetation conditions in natural settings.

Keywords: Woody material, biomass, fuel loading, natural fuels, Alaska hardwoods, quaking aspen, *Populus tremuloides*, paper birch, *Betula papyrifera*, balsam poplar, *Populus balsamifera*, white spruce, *Picea glauca*, black spruce, *Picea mariana*.

## COOPERATORS

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**Additional copies of this publication may be ordered by mail/fax from: National Interagency Fire Center, ATTN: Great Basin Cache Supply Office, 3833 S. Development Avenue, Boise, ID 83705. Order NFES #2668.**

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## WHAT IS THE NATURAL FUELS PHOTO SERIES?

The first phase of the natural fuels photo series was a collection of six volumes, each representing a region of the United States. Volume I included sites in mixed-conifer, western juniper, sagebrush, and grassland ecosystem types in the interior Pacific Northwest. Volume II included sites in black spruce and white spruce ecosystem types in Alaska. Volume III included sites in lodgepole pine, quaking aspen, and gambel oak ecosystem types in the Rocky Mountains. Volume IV included sites in pinyon-juniper, sagebrush, and chaparral ecosystem types in the Southwest. Volume V included sites in red and white pine, northern tallgrass prairie, and mixed oak ecosystem types in the Midwest. Volume VI included sites in longleaf pine, pocosin, and marsh grass ecosystem types in the Southeast.

Generally, sites include wide-angle and stereo-pair photographs supplemented with information on living and dead fuels, vegetation, and stand structure and composition within the area visible in the photographs (fig. 1). This volume (Volume IIa) is an addition to Volume II and includes sites in hardwood ecosystems undergoing succession to spruce in Alaska. The sites in this volume provide a basis for appraising and describing woody material, vegetation, and stand conditions in many areas throughout south-central and interior Alaska.

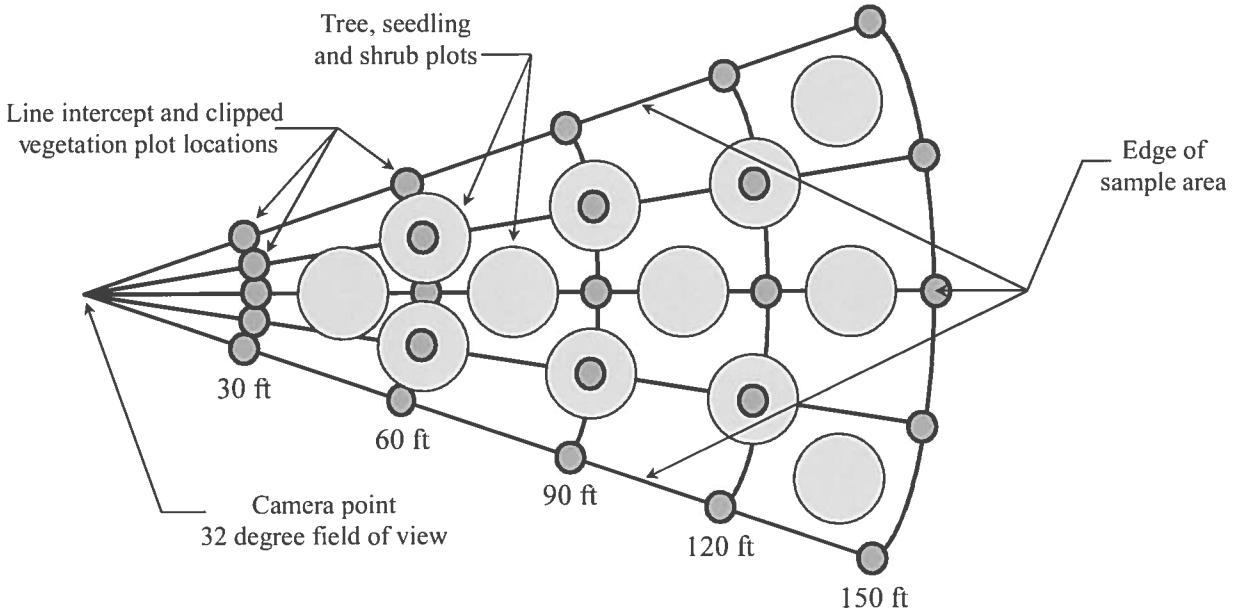


**Figure 1**--Photo series sample area layout. Forty random azimuth line transects (one at each point on the 30- and 150-foot arcs, and two at each point on the 60-, 90-, and 120-foot arcs) and 12 clipped vegetation plots (two to three per arc) were located within the sample area. Trees, tall shrubs, low shrubs, and seedlings were inventoried on 12 systematically located sample plots.

## Why is the Photo Series Needed?

These photo series are land management tools that can be used to assess landscapes through appraisal of living and dead woody material and vegetation (i.e., fuels) and stand characteristics. Once an assessment has been completed, stand treatment options, such as prescribed fire or harvesting, can be planned and implemented to better achieve desired effects while minimizing negative impacts on other resources.

The photo series has application in several branches of natural resource science and management. Inventory data such as these can be used as inputs for evaluating animal and insect habitat, nutrient cycling, and microclimate, for example. Fire managers will find these data useful for predicting fuel consumption, smoke production, fire behavior, and fire effects during wildfires and prescribed fires. In addition, the photo series can be used to appraise carbon sequestration, an important factor in predictions of future climate, and to link remotely sensed signatures to live and dead fuels on the ground.

Ground inventory procedures that directly measure site conditions (e.g., fuel loading and arrangement, vegetation structure and composition, etc.) exist for most ecosystem types and are useful when a high degree of accuracy is required. Ground inventory is time consuming and expensive, however. Photo series can be used to make quick, easy, and inexpensive determinations of fuel quantities and stand conditions when less precise estimates are acceptable.

## How was the Photo Series Developed?

Sites photographed for the series in this volume were selected to represent a range of conditions in Alaska hardwood ecosystems undergoing succession to spruce. Photographs were taken and fuel loading, stand structure, and composition data were collected by using the procedures of Maxwell and Ward (1980) as a guide. Sites are ordered with increasing relative density (percentage of stems) of spruce trees >2 inches diameter at breast height (d.b.h.).[1]

## Photographs

Stereo-pair photographs are included in this guide. The three-dimensional image obtained by viewing the photographs with a stereoscope will improve the ability of the land manager to appraise natural fuel, vegetation, and stand structure conditions. Two larger wide-angle photographs (spring/leaf-off and summer/leaf-on views) have been included for additional comparisons. The marker in these photographs is a 1-foot square, and the pole is painted in contrasting colors at 1-foot intervals to provide scale. The pole is 30 feet from the camera. The summary data relate to the field of view of the stereo-pair photographs but are based on measurements taken in the sample area only (see fig. 1). No sampling occurs in the foreground between the camera and the sign.

## Photograph and Information Arrangement

The photographs and accompanying data summaries are presented as single sites organized into one series. Each site is arranged to occupy two facing pages. The upper page contains wide-angle (50mm) photographs taken before and after leaf flush, in spring (May) and summer (June/August),

[1]D.b.h. is measured 4.5 feet above the ground.

respectively, and general site, stand, and understory vegetation information. The lower page includes the stereo-pair photographs and summaries of overstory structure and composition, forest floor depth, loading and constancy, and dead and down woody material loading and density by size class.

## SITE INFORMATION

The camera point of each site was located with a global positioning system (GPS) receiver using the WGS-84 datum. Vegetation type (Viereck et al. 1992) and Society of American Foresters (SAF) cover type (Eyre 1980), indicators of current vegetation condition, were assigned for all sites. When available, the fire history of each site was included, based on communications with local land managers. Total unit biomass was computed as a combination of aboveground (understory vegetation, saplings, and trees), forest floor, and woody material biomass.

## STAND INFORMATION

Tree species present at each site are listed in order of abundance and the percentages of live stems and dead stems are reported for each species.[2] Crown closure of hardwoods and spruce was measured with a forest densitometer at 95 systematically located points in the sample area. Seedling composition and density were estimated using twelve 0.005-acre circular plots representing 43 percent of the sample area; all trees less than 4.5 feet tall were considered seedlings. Understory spruce coverage (includes spruce with heights to approximately 6 feet) was estimated using line intercept transects (Canfield 1941). Other understory species coverages were estimated using line intercept transects and are listed in order of abundance. The listing of understory species was not meant to be a complete vegetation inventory and may represent only a portion of the actual species richness of the sampled areas.

## UNDERSTORY VEGETATION

Lifeforms were divided into tall shrub, low shrub (shrub species that typically do not reach heights greater than 5 feet), herbaceous (forb and graminoid species), and seedling (tree species only) categories. The two most abundant species for each understory vegetation lifeform category are listed, with the cumulative coverage of all applicable species reported for each category. Low shrub and herbaceous vegetation heights were measured at 25 points located systematically throughout the sample area. Low shrub and herbaceous vegetation biomass was determined by sampling 12 square, clipped vegetation plots (2.69 square feet each) also located systematically throughout the sample area (fig. 1). All live and dead low shrub and herbaceous vegetation within each square plot was clipped at ground level, separated and returned to the laboratory for oven drying. Understory vegetation and other collected material were oven-dried at a minimum of 158 °F for at least 48 hours before weighing and determination of area loading. Tall shrubs (*Alnus* spp. and *Salix* spp.) and tree seedlings were measured in twelve 0.005-acre circular plots. Coverages were not estimated for these lifeform categories. Tall shrub average height is the average height of shrubs greater than 4.5 feet tall. Tree seedling heights were not measured. Biomass was calculated for tall shrubs from species- and size-specific allometric equations (Roussopoulos and Loomis 1979). Tree seedling biomass was calculated by assuming a typical size (Ottmar and Vihnanek unpublished data) and using the appropriate species- and size-specific allometric equation (Barney et al. 1978, Brown 1976, Roussopoulos and Loomis 1979, Telfer 1969). Equations for *Picea mariana* were substituted for *Picea glauca* and *Tsuga mertensiana*.

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[2]A list of scientific and common species names used in this volume appears on page 7.

## Saplings and Trees

As with tall shrubs and tree seedlings, overstory trees and saplings were sampled in twelve 0.005-acre circular plots located systematically throughout the sample area (fig. 1). Tree measurement data were summarized by d.b.h. size class and by tree status (all, live, or dead). The two most abundant tree species for each size class are listed with their relative density of live and dead stems. Height to crown base (reported as ladder fuel height in previous photo series volumes) was defined as the height of the lowest, continuous live or dead branch material of the tree canopy, and height to live crown was defined as the height of the lowest continuous live branches of the tree canopy. Live crown mass (live branches and foliage) and aboveground mass (crown and bole) values were calculated from species- and size-specific allometric equations (Barney et al. 1978; Brown 1978; Harding and Grigal 1985; Roussopoulos and Loomis 1979; Singh 1981, 1984; Stocks 1980; Yarie and VanCleve 1983).

## Forest Floor Information

Surface material and duff depth were calculated as the average of measurements taken every 5 feet between the 30- and 150-foot arcs of the three center transects for a total of 75 measurements (fig. 1). Duff depths were measured from the bottom of the surface material layer to the top of the mineral soil layer (or to ice). The depth of the different forest floor types was calculated as an average of the depth only where that type was encountered during sampling. Therefore, the depths reported for the different forest floor types are not unit-wide averages, and do not necessarily sum to total depth. Loading of each surface material and duff type was calculated from bulk density values derived from field measurements (table 1), and was weighted by depth and constancy. Constancy is an indicator of how consistently the various forest floor components occur in the sample area, and is expressed as a percentage of the total number of measurements. The amount of exposed mineral soil at each site can be estimated by subtracting the constancy of the total forest floor from 100 percent.

**Table 1**--Forest floor bulk densities.

| Surface Material Type | Bulk Density | Duff Type | Bulk Density |
|---|---|---|---|
| | $tons \cdot acre^{-1} \cdot inch^{-1}$ | | $tons \cdot acre^{-1} \cdot inch^{-1}$ |
| Live and dead moss (pleurocarpous) | 2.33 | Moss (pleurocarpous), upper layer only | 7.19 |
| Lichen (Cladoniaceae) | 6.36 | Lichen | 7.08 |
| Lichen (foliose) | 5.10 | Rotten wood | 18.70 |
| Spruce | 3.00 | Spruce | 18.70 |
| Hardwood | 1.93 | Hardwood | 10.59 |
| Mixed spruce and hardwood | 2.47 | Mixed spruce and hardwood | 14.64 |

## Woody Material

Measurement techniques used for inventorying dead and down woody material were patterned after the planar intersect method outlined by Brown (1974) and described by Maxwell and Ward (1980). Forty transects of random azimuth starting at 25 systematically located points within the sample area were used to determine woody material loading and density (fig. 1). Woody material data are reported by size classes that correspond

to timelag fuel classes used in fire behavior modeling (see, for example, Burgan and Rothermel 1984).[3] Woody material in 10-hour, and 100-hour and larger size classes was tallied on transects that were 10 feet and 30 feet long, respectively. Woody material loading in the 1-hour size class (and the 10-hour and 100-hour size classes for several of the sites) was determined by collecting, oven drying, and weighing all pieces in twelve 2.69-square-foot sample plots. The decay class and the actual diameter at the point of intersection were measured for all pieces >3 inches in diameter. All woody material ≤ 3 inches in diameter was considered sound. Woody material loading and woody material density were calculated from relationships that use number of pieces intersected and transect length (and wood specific gravity for loading) developed by Brown (1974) and Safranyik and Linton (1987), respectively.

## USING THE PHOTO SERIES

The natural fuels photo series is a tool for quickly and inexpensively evaluating a variety of fuel and vegetation conditions. Because of its ease of use, however, care must be taken when evaluating field sites to compare only with photo series sites that are appropriate matches. It is acceptable, however, to use the data from more than one site from the photo series when evaluating a site in the field (e.g., woody material loading from one site in the photo series and tree density from another site in the photo series to best match the conditions of a given field site).

Make a visual inventory of the site by observing fuel and stand conditions within the field of view and comparing them with the stereo-pair photographs as follows, remembering that the data tables relate to the area behind the sign in the stereo-pair photographs:

- Observe each characteristic for a specific size class of woody material on the ground (e.g., 3.1 to 9.0-inch woody material loading).
- Select a photo series site (or sites) that nearly matches (or brackets) the observed characteristics.
- Obtain the quantitative value for the characteristic being estimated from the data summary accompanying the selected photo series site, or interpolate a value between sites.
- Repeat these steps for each size class or stand characteristic of interest.

The total loading or stand condition can then be calculated by summing the estimates. If the site being inventoried has areas with obvious differences in woody material or stand conditions, the user should make separate determinations for each area and then weight and cumulate the loading for the whole site.

Characteristics not distinguishable in the photographs are forest floor depth, loading and bulk density, and proportions of sound and rotten woody material. If values for these characteristics are desired in the inventory, they must be derived from independent sampling or observations.

The 20 National Fire-Danger Rating System fuel models (Burgan 1988, Deeming et al. 1977), the 13 fire behavior fuel models (Albini 1976), and the 16 Canadian Forest Fire Danger Rating System Fire Behavior Prediction System fuel types (Forestry Canada Fire Danger Group 1992) are very general in content and broadly applied; consequently, we chose not to assign one of these existing fuel models or types to individual sites in this photo series. The photo series was designed to provide sufficient fuel and vegetation data from which managers could generate their own customized fuel models or types.

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[3] 1-, 10-, 100- and 1000-hour timelag fuels are defined as woody material ≤0.25 inch, 0.26-1.0 inch, 1.1-3.0 inches, and >3.0 inches in diameter, respectively.

## Species List

Scientific and common species names are from NRCS (2002) and Viereck et al. (1992).

| Scientific Name | Common Name |
|---|---|
| **Trees:** | |
| *Betula papyrifera* Marsh. | Paper birch |
| *Picea glauca* (Moench) Voss* | White spruce |
| *Picea mariana* (P. Mill.) B.S.P. † | Black spruce |
| *Populus balsamifera* L. | Balsam poplar |
| *Populus tremuloides* Michx. | Quaking aspen |
| *Tsuga mertensiana* (Bong.) Carr. | Mountain hemlock |
| **Tall Shrubs:** | |
| *Alnus sinuata* (Reg.) Rydb. | Sitka alder |
| *Alnus* spp. | Alder |
| *Salix* spp. | Willow |
| **Low Shrubs:** | |
| *Acer glabrum* Torr. | Rocky mountain maple |
| *Ledum groenlandicum* Oeder | Bog Labrador tea |
| *Linnaea borealis* L. | Twinflower |
| *Oplopanax horridus* Miq. | Devilsclub |
| *Rosa acicularis* Lindl. | Prickly rose |
| *Rubus arcticus* L. | Nagoon-berry |
| *Shepherdia canadensis* (L.) Nutt. | Russett buffaloberry |
| *Vaccinium uliginosum* L. | Bog blueberry |
| **Low Shrubs:** | |
| *Vaccinium vitis-idaea* L. | Lingonberry |
| *Viburnum edule* (Michx.) Raf. | High bushcranberry |
| **Herbaceous:** | |
| *Actaea rubra* (Ait.) Willd. | Red baneberry |
| *Athyrium filix-femina* (L.) Roth | Common ladyfern |
| *Calamagrostis canadensis* (Michx.) Beauv. | Bluejoint |
| *Cornus canadensis* L. | Bunchberry dogwood |
| *Epilobium angustifolium* L. | Fireweed |
| *Equisetum pratense* Ehrh. | Meadow horsetail |
| *Galium* spp. | Bedstraw |
| *Geocaulon lividum* (Richards.) Fern. | False toadflax |
| *Gymnocarpium dryopteris* (L.) Newman | Western oakfern |
| Liliaceae | Lily |
| *Lupinus arcticus* S. Wats. | Arctic lupine |
| *Moehringia lateriflora* (L.) Fenzl | Bluntleaf sandwort |
| *Pyrola asarifolia* Michx. | Liverleaf wintergreen |
| *Pyrola secunda* L. | Sidebells wintergreen |
| *Trientalis europaea* L. | Arctic starflower |
| *Zigadenus elegans* Pursh | Mountain deathcamus |

*Includes the hybrid *Picea glauca* x *sitchensis*, also known as *Picea* x *lutzii* Little (Lutz spruce; Viereck and Little 1972).

†Includes, if present, the hybrid *Picea glauca* x *mariana* (Rosendahl spruce; Little and Pauley 1958).

## Metric Conversions

1 inch (in) = 2.54 centimeters
1 foot (ft) = 0.3048 meter
1 square foot = 0.0929 square meter
1 acre (ac) = 4,046.9 square meters
1 acre = 0.4047 hectare

1 pound (lb) = 0.4536 kilogram
1 ton = 907.2 kilograms
1 ton = 0.9072 metric ton
1 pound/acre (lb/ac) = 1.1209 kilogram/hectare
1 pound/acre = 1.1209 E-04 kilograms/square meter

1 ton/acre = 0.2242 kilogram/square meter
1 ton/acre = 2,241.7023 kilograms/hectare
1 ton·acre$^{-1}$·inch$^{-1}$ = 8.8256 kilograms/cubic meter
1 ton·acre$^{-1}$·inch$^{-1}$ = 8825.6 grams/cubic meter
1 ton·acre$^{-1}$·inch$^{-1}$ = 8.8256E-03 grams/cubic centimeter

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# ALASKA HARDWOODS
# PHOTO SERIES

A SERIES OF 15 SITES
AH 01 THROUGH AH 15

## NOTES TO USERS:

1. Sites are ordered with increasing relative density (percentage of stems) of spruce trees >2 inches d.b.h.
2. A list of scientific and common species names can be found on page 7.
3. Wide-angle photographs were taken before leaf flush in May 2001, and with leaves in June and August 2000. All stereo-pair photographs were taken in May 2001. All sampling was performed in July and August 2000.
4. The marker in these photographs is a 1-foot square, and the pole is painted in contrasting colors at 1-foot intervals. The pole is 30 feet from the camera.
5. A distinction is made between rotten and sound woody material for pieces larger than 3 inches in diameter.
6. Total unit biomass, live crown mass, aboveground mass, forest floor loading, and woody material loading are reported in tons per acre, whereas understory biomass is reported in pounds per acre. Trace coverage of understory species is indicated either as "trace" or as "t."
7. Depth values reported for surface material, duff, and total forest floor are not unit-wide averages (null values are not included in average), and, as such, the total forest floor depth is not the sum of surface material and duff depths. Depth values for surface material subtypes are similarly treated with respect to the overall surface material depth.

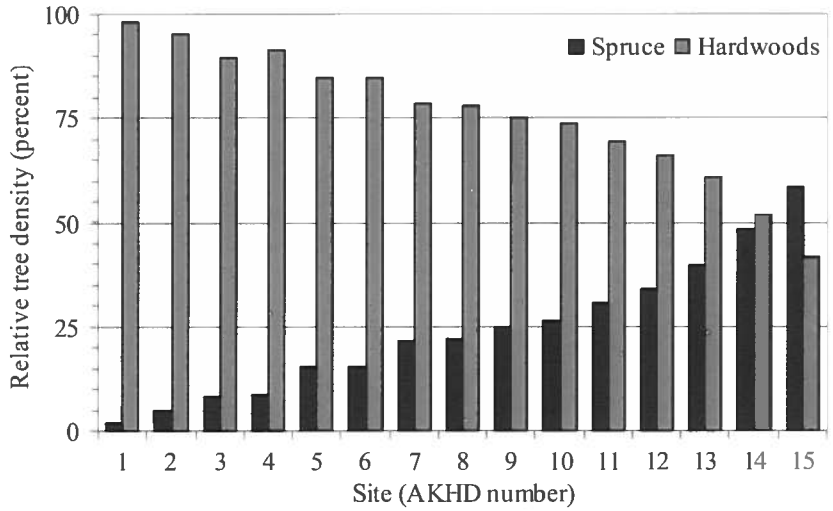



**Figure 2**--Alaska hardwood photo series site order by relative density of spruce and hardwood trees >2 inches d.b.h.

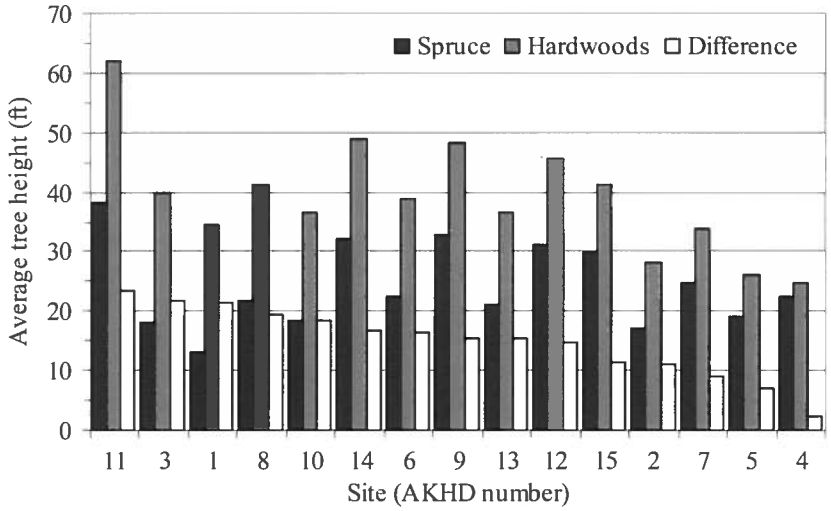



**Figure 3**--Alaska hardwood photo series site order by the difference of the average height of spruce and hardwood trees >2 inches d.b.h.

# AKHD 01 ALASKA HARDWOODS

May

June

## SITE INFORMATION

Site location: N 61° 59' 42.50"
W 145° 21' 42.73"
Elevation: 1,300 feet

Vegetation type: Open Quaking Aspen Forest

SAF cover type: Aspen

Fire history: Unknown

Total unit biomass: 72.64 tons/acre

## STAND INFORMATION

Trees (% of stems: live/dead): *Picea glauca* (59/0), *Populus tremuloides* (34/7)

Crown closure: 52% hardwood, 4% conifer

Seedlings (stems per acre: live/dead): *Picea glauca* (8,219/17), *Populus tremuloides* (0/252)

Understory spruce coverage: 33%

Understory (% cover): *Shepherdia canadensis* (16), *Epilobium angustifolium* (10), *Linnaea borealis* (7), *Vaccinium vitis-idaea* (5), *Geocaulon lividum* (3), *Salix* spp. (na)

## UNDERSTORY VEGETATION

| | Lifeform | | | |
|---|---|---|---|---|
| | Tall shrub | Low shrub | Herbaceous | Seedling |
| Most common species | *Salix* spp. | *Shepherdia canadensis* | *Epilobium angustifolium* | *Picea glauca* |
| Second most common species | -- | *Linnaea borealis* | *Geocaulon lividum* | *Populus tremuloides* |
| Coverage (percent) | na | 28 | 13 | na |
| Avg. height (ft) | na | 0.4 | 1.0 | na |
| Biomass (lbs/ac) | 1 | 2,250 | 138 | 349 |

## Saplings and Trees

| | Size class (diameter at breast height) | | | | |
|---|---|---|---|---|---|
| | Saplings (≤ 2") | 2 - 4" | 4 - 9" | > 9" | > 2" |
| Most common species (percent of stems: live/dead) | *Picea glauca* (75/1) | *Populus tremuloides* (97/0) | *Populus tremuloides* (100/0) | -- | *Populus tremuloides* (98/0) |
| Second most common species (percent of stems: live/dead) | *Populus tremuloides* (15/9) | *Picea glauca* (3/0) | -- | -- | *Picea glauca* (2/0) |
| Tree density (stems/ac) | 2,650 | 570 | 218 | 0 | 788 |
| Live | 2,399 | 570 | 218 | 0 | 788 |
| Dead | 251 | 0 | 0 | 0 | -- |
| Avg. d.b.h. (in) | 0.6 | 2.9 | 5.8 | -- | 3.7 |
| Live | 0.6 | 2.9 | 5.8 | -- | 3.7 |
| Dead | 0.7 | -- | -- | -- | -- |
| Avg. height (ft) | 9 | 33 | 36 | -- | 34 |
| Live | 9 | 33 | 36 | -- | 34 |
| Dead | 10 | -- | -- | -- | -- |
| Avg. height to crown base (ft) | 1 | 12 | 24 | -- | 15 |
| Live | 1 | 12 | 24 | -- | 15 |
| Dead | 6 | -- | -- | -- | -- |
| Avg. height to live crown (ft) | 4 | 22 | 25 | -- | 23 |
| Live crown mass (tons/ac)† | 0.26 / 0.12 | 0.04 / 0.49 | 0.00 / 1.52 | 0.00 / 0.00 | 0.04 / 2.01 |
| Aboveground mass (tons/ac) | 1.78 | 6.43 | 17.97 | 0.00 | 24.40 |

† Spruce live crown mass / hardwood live crown mass

## Forest Floor

| | Depth* (in) | Loading (tons/ac) | Constancy* (percent) |
|---|---|---|---|
| Surface material | 1.6 | 3.04 | 93 |
| Moss | -- | -- | -- |
| Lichen | -- | -- | -- |
| Conifer litter | -- | -- | -- |
| Hardwood litter | 1.6 | 3.04 | 93 |
| Duff | 2.9 | 33.92 | 100 |
| Total Forest Floor | 4.5 | 36.96 | 100 |

*Sample size (n) = 75

## Woody Material

| | Loading (tons/ac) | | | Density (pieces/ac) | | |
|---|---|---|---|---|---|---|
| Diameter (in) | Sound | Rotten | Total | Sound | Rotten | Total |
| ≤ 0.25 | 0.5 | 0.0 | 0.5 | -- | -- | -- |
| 0.26 - 1.0 | 0.6 | 0.0 | 0.6 | -- | -- | -- |
| 1.1 - 3.0 | 6.0 | 0.0 | 6.0 | -- | -- | -- |
| 3.1 - 9.0 | 0.2 | 0.8 | 1.0 | 20 | 102 | 122 |
| 9.1 - 20.0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 |
| Total | 7.3 | 0.8 | 8.1 | 20 | 102 | 122 |

# AKHD 02 ALASKA HARDWOODS

May

June

## SITE INFORMATION

Site location: N 61° 59' 40.69"
W 145° 21' 41.93"
Elevation: 1,285 feet

Vegetation type: Open Quaking Aspen Forest

SAF cover type: Aspen

Fire history: Unknown

Total unit biomass: 54.05 tons/acre

## STAND INFORMATION

Trees (% of stems: live/dead): *Picea glauca* (68/0), *Populus tremuloides* (22/10)

Crown closure: 50% hardwood, 2% conifer

Seedlings (stems per acre: live/dead): *Picea glauca* (3,807/84), *Populus tremuloides* (34/302)

Understory spruce coverage: 41%

Understory (% cover): *Epilobium angustifolium* (9), *Linnaea borealis* (8), *Shepherdia canadensis* (6), *Vaccinium vitis-idaea* (2), *Geocaulon lividum* (2), *Zigadenus elegans* (t)

## UNDERSTORY VEGETATION

| | Lifeform | | | |
|---|---|---|---|---|
| | Tall Shrub | Low Shrub | Herbaceous | Seedling |
| Most common species | -- | *Linnaea borealis* | *Epilobium angustifolium* | *Picea glauca* |
| Second most common species | -- | *Shepherdia canadensis* | *Geocaulon lividum* | *Populus tremuloides* |
| Coverage (percent) | na | 16 | 11 | na |
| Avg. height (ft) | -- | 1.8 | 0.8 | na |
| Biomass (lbs/ac) | 0 | 646 | 117 | 173 |

## Saplings and Trees

| | Size class (diameter at breast height) | | | | |
|---|---|---|---|---|---|
| | Saplings (≤ 2") | 2 - 4" | 4 - 9" | > 9" | > 2" |
| Most common species (percent of stems: live/dead) | *Picea glauca* (80/0) | *Populus tremuloides* (90/8) | *Populus tremuloides* (67/0) | -- | *Populus tremuloides* (88/8) |
| Second most common species (percent of stems: live/dead) | *Populus tremuloides* (9/11) | *Picea glauca (2/0)* | *Picea glauca* (33/0) | -- | *Picea glauca* (4/0) |
| Tree density (stems/ac) | 5,838 | 990 | 100 | 0 | 1,090 |
| Live | 5,200 | 906 | 100 | 0 | 1,006 |
| Dead | 638 | 84 | 0 | 0 | 84 |
| Avg. d.b.h. (in) | 0.8 | 2.9 | 5.1 | -- | 3.1 |
| Live | 0.8 | 3.0 | 5.1 | -- | 3.2 |
| Dead | 0.9 | 2.7 | -- | -- | 2.7 |
| Avg. height (ft) | 9 | 28 | 27 | -- | 28 |
| Live | 9 | 28 | 27 | -- | 28 |
| Dead | 11 | 24 | -- | -- | 24 |
| Avg. height to crown base (ft) | 2 | 19 | 12 | -- | 18 |
| Live | 2 | 19 | 12 | -- | 18 |
| Dead | 7 | 16 | -- | -- | 16 |
| Avg. height to live crown (ft) | 3 | 19 | 13 | -- | 19 |
| Live crown mass (tons/ac)[†] | 1.34 / 0.15 | 0.14 / 0.83 | 0.54 / 0.27 | 0.00 / 0.00 | 0.68 / 1.10 |
| Aboveground mass (tons/ac) | 4.45 | 10.94 | 5.05 | 0.00 | 15.99 |

[†] Spruce live crown mass / hardwood live crown mass

## Forest Floor

| | Depth* (in) | Loading (tons/ac) | Constancy* (percent) |
|---|---|---|---|
| Surface material | 1.0 | 1.97 | 100 |
| Moss | -- | -- | -- |
| Lichen | -- | -- | -- |
| Conifer litter | 1.0 | 0.29 | 12 |
| Hardwood litter | 1.0 | 1.68 | 88 |
| Duff | 2.2 | 25.05 | 100 |
| Total Forest Floor | 3.2 | 27.02 | 100 |

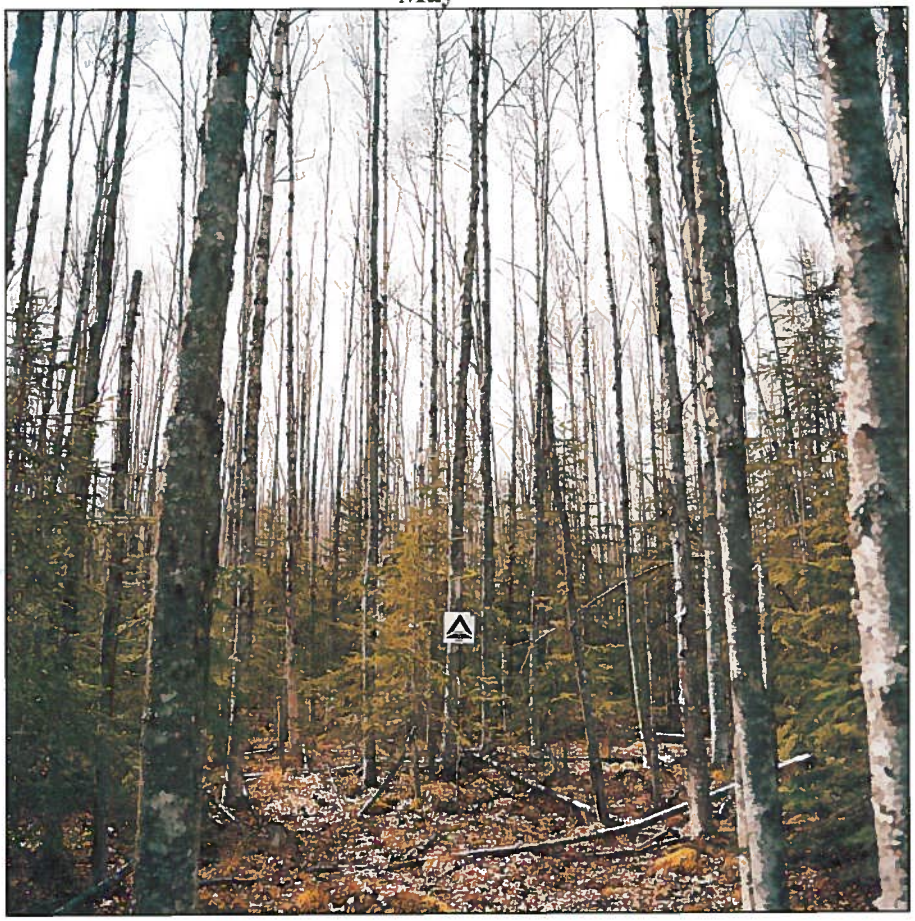
*Sample size (n) = 75

## Woody Material

| | Loading (tons/ac) | | | Density (pieces/ac) | | |
|---|---|---|---|---|---|---|
| Diameter (in) | Sound | Rotten | Total | Sound | Rotten | Total |
| ≤ 0.25 | 0.2 | 0.0 | 0.2 | -- | -- | -- |
| 0.26 - 1.0 | 0.7 | 0.0 | 0.7 | -- | -- | -- |
| 1.1 - 3.0 | 2.6 | 0.0 | 2.6 | -- | -- | -- |
| 3.1 - 9.0 | 0.0 | 2.3 | 2.3 | 0 | 165 | 165 |
| 9.1 - 20.0 | 0.0 | 0.3 | 0.3 | 0 | 5 | 5 |
| Total | 3.5 | 2.6 | 6.1 | 0 | 170 | 170 |

# AKHD 03 ALASKA HARDWOODS

May



June

## SITE INFORMATION

Site location: N 60° 54' 42.06"
W 149° 36' 31.67"
Elevation: 160 feet

Vegetation type: Closed Paper Birch Forest

SAF cover type: Paper Birch

Fire history: 1910s (stand replacement)

Total unit biomass: 107.13 tons/acre

## STAND INFORMATION

Trees (% of stems: live/dead): *Betula papyrifera* (46/20), *Picea glauca* (21/0), *Tsuga mertensiana* (12/1)

Crown closure: 93% hardwood, 2% conifer

Seedlings (stems per acre: live/dead): *Tsuga mertensiana* (235/0), *Betula papyrifera* (168/17), *Picea glauca* (134/0)

Understory spruce coverage: 7%

Understory (% cover): graminoid (t), *Rosa acicularis* (t), *Linnaea borealis* (t), *Cornus canadensis* (t), *Epilobium angustifolium* (t)

## UNDERSTORY VEGETATION

| | Lifeform | | | |
|---|---|---|---|---|
| | Tall Shrub | Low Shrub | Herbaceous | Seedling |
| Most common species | -- | *Rosa acicularis* | graminoid | *Tsuga mertensiana* |
| Second most common species | -- | *Linnaea borealis* | *Cornus canadensis* | *Betula papyrifera* |
| Coverage (percent) | na | trace | trace | na |
| Avg. height (ft) | -- | 0.6 | 1.1 | na |
| Biomass (lbs/ac) | 0 | trace | trace | 41 |

## Saplings and Trees

| | Size class (diameter at breast height) | | | | |
|---|---|---|---|---|---|
| | Saplings (≤ 2") | 2 - 4" | 4 - 9" | > 9" | > 2" |
| Most common species (percent of stems: live/dead) | *Picea glauca* (42/0) | *Betula papyrifera* (53/29) | *Betula papyrifera* (100/0) | -- | *Betula papyrifera* (74/16) |
| Second most common species (percent of stems: live/dead) | *Tsuga mertensiana* (28/2) | *Picea glauca* (14/0) | -- | -- | *Picea glauca* (8/0) |
| Tree density (stems/ac) | 889 | 822 | 637 | 0 | 1,459 |
| Live | 621 | 587 | 637 | 0 | 1,224 |
| Dead | 268 | 235 | 0 | 0 | 235 |
| Avg. d.b.h. (in) | 1.1 | 3.1 | 5.4 | -- | 4.1 |
| Live | 0.8 | 3.2 | 5.4 | -- | 4.4 |
| Dead | 1.7 | 2.6 | -- | -- | 2.6 |
| Avg. height (ft) | 8 | 27 | 51 | -- | 38 |
| Live | 8 | 33 | 51 | -- | 42 |
| Dead | 8 | 13 | -- | -- | 13 |
| Avg. height to crown base (ft) | 0 | 20 | 34 | -- | 27 |
| Live | 0 | 20 | 34 | -- | 27 |
| Dead | 0 | -- | -- | -- | -- |
| Avg. height to live crown (ft) | 1 | 21 | 34 | -- | 28 |
| Live crown mass (tons/ac)[†] | 0.44 / 0.00 | 0.63 / 0.22 | 0.00 / 5.21 | 0.00 / 0.00 | 0.63 / 5.43 |
| Aboveground mass (tons/ac) | 1.66 | 10.95 | 46.34 | 0.00 | 57.29 |

[†] Spruce and *Tsuga mertensiana* live crown mass / hardwood live crown mass

## Forest Floor

| | Depth* (in) | Loading (tons/ac) | Constancy* (percent) |
|---|---|---|---|
| Surface material | 1.6 | 3.42 | 100 |
| Moss | 2.0 | 1.76 | 37 |
| Lichen | -- | -- | -- |
| Conifer litter | -- | -- | -- |
| Hardwood litter | 1.4 | 1.66 | 63 |
| Duff | 4.1 | 40.71 | 99 |
| Total Forest Floor | 5.7 | 44.13 | 100 |

*Sample size (n) = 75

## Woody Material

| | Loading (tons/ac) | | | Density (pieces/ac) | | |
|---|---|---|---|---|---|---|
| Diameter (in) | Sound | Rotten | Total | Sound | Rotten | Total |
| ≤ 0.25 | 0.5 | 0.0 | 0.5 | -- | -- | -- |
| 0.26 - 1.0 | 0.7 | 0.0 | 0.7 | -- | -- | -- |
| 1.1 - 3.0 | 2.4 | 0.0 | 2.4 | -- | -- | -- |
| 3.1 - 9.0 | 0.1 | 0.4 | 0.5 | 5 | 29 | 34 |
| 9.1 - 20.0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 |
| Total | 3.7 | 0.4 | 4.1 | 5 | 29 | 34 |

# AKHD 04 ALASKA HARDWOODS

May

June

## SITE INFORMATION

Site location: N 60° 37' 46.04"
W 150° 49' 14.33"
Elevation: 270 feet

Vegetation type: Open Spruce-Paper Birch Forest

SAF cover type: Black Spruce-Paper Birch

Fire history: 1969 (stand replacement)

Total unit biomass: 39.20 tons/acre

## STAND INFORMATION

Trees (% of stems: live/dead): *Betula papyrifera* (59/18), *Picea mariana* (23/0)

Crown closure: 49% hardwood, 7% conifer

Seedlings (stems per acre: live/dead): *Picea mariana* (3,958/0), *Betula papyrifera* (67/973)

Understory spruce coverage: 41%

Understory (% cover): *Salix* spp. (na), *Epilobium angustifolium* (8), *Cornus canadensis* (4), *Vaccinium vitis-idaea* (4), *Vaccinium uliginosum* (3), *Ledum groenlandicum* (2)

## UNDERSTORY VEGETATION

| | Lifeform | | | |
|---|---|---|---|---|
| | Tall Shrub | Low Shrub | Herbaceous | Seedling |
| Most common species | *Salix* spp. | *Vaccinium vitis-idaea* | *Epilobium angustifolium* | *Picea mariana* |
| Second most common species | -- | *Vaccinium uliginosum* | *Cornus canadensis* | *Betula papyrifera* |
| Coverage (percent) | na | 9 | 15 | na |
| Avg. height (ft) | 5 | 0.3 | 0.9 | na |
| Biomass (lbs/ac) | 657 | 238 | 77 | 288 |

Note: disregard disturbed area in foreground (data represent area behind sign).

## Saplings and Trees

| | Size class (diameter at breast height) | | | | |
|---|---|---|---|---|---|
| | Saplings (≤ 2") | 2 - 4" | 4 - 9" | > 9" | > 2" |
| Most common species (percent of stems: live/dead) | *Betula papyrifera* (58/19) | *Betula papyrifera* (86/5) | *Betula papyrifera* (100/0) | -- | *Betula papyrifera* (87/4) |
| Second most common species (percent of stems: live/dead) | *Picea mariana* (23/0) | *Picea mariana* (9/0) | -- | -- | *Picea mariana* (9/0) |
| Tree density (stems/ac) | 7,230 | 369 | 17 | 0 | 386 |
| Live | 5,854 | 352 | 17 | 0 | 369 |
| Dead | 1,376 | 17 | 0 | 0 | 17 |
| Avg. d.b.h. (in) | 0.8 | 2.8 | 4.2 | -- | 2.9 |
| Live | 0.9 | 2.8 | 4.2 | -- | 2.9 |
| Dead | 0.6 | 2.5 | -- | -- | 2.5 |
| Avg. height (ft) | 9 | 24 | 29 | -- | 25 |
| Live | 10 | 25 | 29 | -- | 25 |
| Dead | 6 | 9 | -- | -- | 9 |
| Avg. height to crown base (ft) | 4 | 7 | 9 | -- | 8 |
| Live | 4 | 7 | 9 | -- | 8 |
| Dead | 5 | -- | -- | -- | -- |
| Avg. height to live crown (ft) | 4 | 8 | 9 | -- | 8 |
| Live crown mass (tons/ac)† | 0.55 / 0.30 | 0.11 / 0.12 | 0.00 / 0.01 | 0.00 / 0.00 | 0.11 / 0.13 |
| Aboveground mass (tons/ac) | 9.90 | 5.01 | 0.49 | 0.00 | 5.50 |

† Spruce live crown mass / hardwood live crown mass

## Forest Floor

| | Depth* (in) | Loading (tons/ac) | Constancy* (percent) |
|---|---|---|---|
| Surface material | 1.6 | 3.76 | 96 |
| Moss | 1.8 | 2.16 | 52 |
| Lichen | 1.6 | 0.66 | 8 |
| Conifer litter | -- | -- | -- |
| Hardwood litter | 1.3 | 0.93 | 36 |
| Duff | 2.3 | 17.28 | 85 |
| Total Forest Floor | 3.7 | 21.04 | 96 |

*Sample size (n) = 75

## Woody Material

| | Loading (tons/ac) | | | Density (pieces/ac) | | |
|---|---|---|---|---|---|---|
| Diameter (in) | Sound | Rotten | Total | Sound | Rotten | Total |
| ≤ 0.25 | 0.3 | 0.0 | 0.3 | -- | -- | -- |
| 0.26 - 1.0 | 0.5 | 0.0 | 0.5 | -- | -- | -- |
| 1.1 - 3.0 | 0.5 | 0.0 | 0.5 | -- | -- | -- |
| 3.1 - 9.0 | 0.5 | 0.4 | 0.9 | 19 | 34 | 53 |
| 9.1 - 20.0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 |
| Total | 1.8 | 0.4 | 2.2 | 19 | 34 | 53 |

# AKHD 05 ALASKA HARDWOODS

May

June

## SITE INFORMATION

Site location: N 60° 28' 22.18"
W 150° 24' 54.63"
Elevation: 335 feet

Vegetation type: Closed Quaking Aspen-Spruce Forest

SAF cover type: Aspen

Fire history: July 1947 (stand replacement), 1843

Total unit biomass: 60.82 tons/acre

## STAND INFORMATION

Trees (% of stems: live/dead): *Picea mariana* (51/1), *Populus tremuloides* (23/25)

Crown closure: 45% hardwood, 16% conifer

Seedlings (stems per acre: live/dead): *Picea mariana* (2,348/101), *Populus tremuloides* (17/235), *Betula papyrifera* (134/0)

Understory spruce coverage: 22%

Understory (% cover): *Geocaulon lividum* (8), *Vaccinium vitis-idaea* (7), *Linnaea borealis* (3), *Cornus canadensis* (2), *Epilobium angustifolium* (1), *Ledum groenlandicum* (t)

## UNDERSTORY VEGETATION

| | Lifeform | | | |
|---|---|---|---|---|
| | Tall Shrub | Low Shrub | Herbaceous | Seedling |
| Most common species | -- | *Vaccinium vitis-idaea* | *Geocaulon lividum* | *Picea mariana* |
| Second most common species | -- | *Linnaea borealis* | *Cornus canadensis* | *Populus tremuloides* |
| Coverage (percent) | na | 10 | 11 | na |
| Avg. height (ft) | -- | 0.2 | 0.4 | na |
| Biomass (lbs/ac) | 0 | 631 | 155 | 131 |

## Saplings and Trees

| | Size class (diameter at breast height) | | | | |
|---|---|---|---|---|---|
| | Saplings (≤ 2") | 2 - 4" | 4 - 9" | > 9" | > 2" |
| Most common species (percent of stems: live/dead) | *Picea mariana* (63/0) | *Populus tremuloides* (68/17) | *Populus tremuloides* (100/0) | -- | *Populus tremuloides* (69/16) |
| Second most common species (percent of stems: live/dead) | *Populus tremuloides* (9/28) | *Picea mariana* (14/1) | -- | -- | *Picea mariana* (14/1) |
| Tree density (stems/ac) | 4,680 | 1,509 | 34 | 0 | 1,543 |
| Live | 3,338 | 1,241 | 34 | 0 | 1,275 |
| Dead | 1,342 | 268 | 0 | 0 | 268 |
| Avg. d.b.h. (in) | 1.0 | 2.8 | 5.3 | -- | 2.8 |
| Live | 1.0 | 2.8 | 5.3 | -- | 2.9 |
| Dead | 1.2 | 2.6 | -- | -- | 2.6 |
| Avg. height (ft) | 10 | 25 | 33 | -- | 25 |
| Live | 10 | 26 | 33 | -- | 26 |
| Dead | 11 | 22 | -- | -- | 22 |
| Avg. height to crown base (ft) | 2 | 16 | 20 | -- | 16 |
| Live | 2 | 16 | 20 | -- | 16 |
| Dead | 9 | 16 | -- | -- | 16 |
| Avg. height to live crown (ft) | 3 | 17 | 20 | -- | 17 |
| Live crown mass (tons/ac)[†] | 1.14 / 0.13 | 0.65 / 0.87 | 0.00 / 0.15 | 0.00 / 0.00 | 0.65 / 1.02 |
| Aboveground mass (tons/ac) | 8.37 | 14.00 | 2.00 | 0.00 | 16.00 |

[†] Spruce live crown mass / hardwood live crown mass

## Forest Floor

| | Depth* (in) | Loading (tons/ac) | Constancy* (percent) |
|---|---|---|---|
| Surface material | 1.5 | 3.27 | 97 |
| Moss | 1.7 | 2.30 | 58 |
| Lichen | 0.4 | 0.03 | 1 |
| Conifer litter | 1.2 | 0.14 | 4 |
| Hardwood litter | 1.2 | 0.80 | 34 |
| Duff | 3.4 | 29.47 | 97 |
| Total Forest Floor | 4.9 | 32.74 | 97 |

*Sample size (n) = 71

## Woody Material

| | Loading (tons/ac) | | | Density (pieces/ac) | | |
|---|---|---|---|---|---|---|
| Diameter (in) | Sound | Rotten | Total | Sound | Rotten | Total |
| ≤ 0.25 | 0.1 | 0.0 | 0.1 | -- | -- | -- |
| 0.26 - 1.0 | 0.5 | 0.0 | 0.5 | -- | -- | -- |
| 1.1 - 3.0 | 2.3 | 0.0 | 2.3 | -- | -- | -- |
| 3.1 - 9.0 | 0.3 | 0.1 | 0.4 | 19 | 10 | 29 |
| 9.1 - 20.0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 |
| Total | 3.2 | 0.1 | 3.3 | 19 | 10 | 29 |

# AKHD 06 ALASKA HARDWOODS

May

June

## SITE INFORMATION

Site location: N 63° 52' 27.22"
W 145° 10' 44.47"
Elevation: 1,255 feet

Vegetation type: Open Quaking Aspen Forest

SAF cover type: Aspen

Fire history: between 1925 and 1930 (stand replacement)

Total unit biomass: 66.44 tons/acre

## STAND INFORMATION

Trees (% of stems: live/dead): *Picea mariana* (82/0), *Populus tremuloides* (7/11)

Crown closure: 51% hardwood, 0% conifer

Seedlings (stems per acre: live/dead): *Picea mariana* (3,623/50), *Populus tremuloides* (235/0), *Betula papyrifera* (17/0)

Understory spruce coverage: 46%

Understory (% cover): *Salix* spp. (na), *Vaccinium vitis-idaea* (17), *Ledum groenlandicum* (9), *Linnaea borealis* (6), *Calamagrostis canadensis* (6), *Epilobium angustifolium* (2)

## UNDERSTORY VEGETATION

| | Lifeform | | | |
|---|---|---|---|---|
| | Tall Shrub | Low Shrub | Herbaceous | Seedling |
| Most common species | *Salix* spp. | *Vaccinium vitis-idaea* | *Calamagrostis canadensis* | *Picea mariana* |
| Second most common species | -- | *Ledum groenlandicum* | *Epilobium angustifolium* | *Populus tremuloides* |
| Coverage (percent) | na | 32 | 12 | na |
| Avg. height (ft) | 8 | 0.4 | 1.6 | na |
| Biomass (lbs/ac) | 599 | 872 | 115 | 165 |

## Saplings and Trees

| | Size class (diameter at breast height) | | | | |
|---|---|---|---|---|---|
| | Saplings (≤ 2") | 2 - 4" | 4 - 9" | > 9" | > 2" |
| Most common species (percent of stems: live/dead) | *Picea mariana* (96/1) | *Populus tremuloides* (23/59) | *Populus tremuloides* (54/32) | -- | *Populus tremuloides* (41/44) |
| Second most common species (percent of stems: live/dead) | *Populus tremuloides* (0/3) | *Picea mariana* (18/0) | *Picea mariana* (14/0) | -- | *Picea mariana* (15/0) |
| Tree density (stems/ac) | 2,969 | 285 | 369 | 0 | 654 |
| Live | 2,852 | 117 | 252 | 0 | 369 |
| Dead | 117 | 168 | 117 | 0 | 285 |
| Avg. d.b.h. (in) | 0.7 | 3.1 | 5.6 | -- | 4.5 |
| Live | 0.7 | 3.4 | 5.6 | -- | 4.9 |
| Dead | 1.7 | 2.9 | 5.6 | -- | 4.0 |
| Avg. height (ft) | 7 | 23 | 46 | -- | 36 |
| Live | 7 | 26 | 48 | -- | 41 |
| Dead | 13 | 22 | 42 | -- | 30 |
| Avg. height to crown base (ft) | 0 | 20 | 32 | -- | 28 |
| Live | 0 | 17 | 34 | -- | 28 |
| Dead | 5 | 32 | 25 | -- | 27 |
| Avg. height to live crown (ft) | 1 | 16 | 34 | -- | 29 |
| Live crown mass (tons/ac)[†] | 0.72 / 0.00 | 0.25 / 0.09 | 0.49 / 1.41 | 0.00 / 0.00 | 0.74 / 1.50 |
| Aboveground mass (tons/ac) | 2.97 | 3.75 | 27.14 | 0.00 | 30.89 |

[†] Spruce live crown mass / hardwood live crown mass

## Forest Floor

| | Depth* (in) | Loading (tons/ac) | Constancy* (percent) |
|---|---|---|---|
| Surface material | 1.9 | 4.30 | 100 |
| Moss | 2.1 | 3.50 | 71 |
| Lichen | -- | -- | -- |
| Conifer litter | -- | -- | -- |
| Hardwood litter | 1.5 | 0.81 | 29 |
| Duff | 2.7 | 20.78 | 100 |
| Total Forest Floor | 4.6 | 25.08 | 100 |

*Sample size (n) = 75

## Woody Material

| | Loading (tons/ac) | | | Density (pieces/ac) | | |
|---|---|---|---|---|---|---|
| Diameter (in) | Sound | Rotten | Total | Sound | Rotten | Total |
| ≤ 0.25 | 0.3 | 0.0 | 0.3 | -- | -- | -- |
| 0.26 - 1.0 | 0.9 | 0.0 | 0.9 | -- | -- | -- |
| 1.1 - 3.0 | 2.5 | 0.0 | 2.5 | -- | -- | -- |
| 3.1 - 9.0 | 2.5 | 0.1 | 2.6 | 161 | 5 | 166 |
| 9.1 - 20.0 | 0.4 | 0.0 | 0.4 | 5 | 0 | 5 |
| Total | 6.6 | 0.1 | 6.7 | 166 | 5 | 171 |

# AKHD 07 ALASKA HARDWOODS

May

June

## SITE INFORMATION

Site location: N 61° 37' 05.32"
W 144° 30' 56.14"
Elevation: 1,285 feet

Vegetation type: Closed Quaking Aspen-Spruce Forest

SAF cover type: White Spruce-Aspen

Fire history: Unknown

Total unit biomass: 103.87 tons/acre

## STAND INFORMATION

Trees (% of stems: live/dead): *Populus tremuloides* (34/25), *Picea glauca* (35/6)

Crown closure: 52% hardwood, 17% conifer

Seedlings (stems per acre: live/dead): *Picea glauca* (688/403), *Populus tremuloides* (604/50)

Understory spruce coverage: 2%

Understory (% cover): *Alnus* spp. (na), *Rosa acicularis* (t), *Vaccinium vitis-idaea* (t), *Geocaulon lividum* (t)

## UNDERSTORY VEGETATION

| | Lifeform | | | |
|---|---|---|---|---|
| | Tall Shrub | Low Shrub | Herbaceous | Seedling |
| Most common species | *Alnus* spp. | *Rosa acicularis* | *Geocaulon lividum* | *Picea glauca* |
| Second most common species | -- | *Vaccinium vitis-idaea* | -- | *Populus tremuloides* |
| Coverage (percent) | na | trace | trace | na |
| Avg. height (ft) | 9 | 0.7 | 0.2 | na |
| Biomass (lbs/ac) | 525 | trace | 98 | 86 |

## Saplings and Trees

| | Size class (diameter at breast height) | | | | |
|---|---|---|---|---|---|
| | Saplings (≤ 2") | 2 - 4" | 4 - 9" | > 9" | > 2" |
| Most common species (percent of stems: live/dead) | *Picea glauca* (46/11) | *Populus tremuloides* (54/17) | *Populus tremuloides* (87/5) | -- | *Populus tremuloides* (65/13) |
| Second most common species (percent of stems: live/dead) | *Populus tremuloides* (8/35) | *Picea glauca* (28/1) | *Picea glauca* (8/0) | -- | *Picea glauca* (21/1) |
| Tree density (stems/ac) | 2,130 | 1,157 | 621 | 0 | 1,778 |
| Live | 1,157 | 939 | 587 | 0 | 1,526 |
| Dead | 973 | 218 | 34 | 0 | 252 |
| Avg. d.b.h. (in) | 11.0 | 2.9 | 5.7 | -- | 3.8 |
| Live | 12.6 | 2.9 | 5.6 | -- | 4.0 |
| Dead | 9.1 | 2.5 | 7.6 | -- | 3.2 |
| Avg. height (ft) | 11 | 27 | 41 | -- | 32 |
| Live | 13 | 29 | 41 | -- | 33 |
| Dead | 9 | 20 | 41 | -- | 23 |
| Avg. height to crown base (ft) | 4 | 14 | 28 | -- | 19 |
| Live | 3 | 14 | 28 | -- | 19 |
| Dead | 5 | 13 | -- | -- | 13 |
| Avg. height to live crown (ft) | 4 | 15 | 29 | -- | 21 |
| Live crown mass (tons/ac)[†] | 0.68 / 0.05 | 1.20 / 0.66 | 0.66 / 3.37 | 0.00 / 0.00 | 1.86 / 4.03 |
| Aboveground mass (tons/ac) | 3.04 | 14.40 | 47.98 | 0.00 | 62.38 |

[†] Spruce live crown mass / hardwood live crown mass

## Forest Floor

| | Depth* (in) | Loading (tons/ac) | Constancy* (percent) |
|---|---|---|---|
| Surface material | 1.6 | 3.23 | 100 |
| Moss | 0.9 | 0.13 | 7 |
| Lichen | -- | -- | -- |
| Conifer litter | 0.9 | 0.11 | 4 |
| Hardwood litter | 1.7 | 2.99 | 89 |
| Duff | 3.0 | 31.17 | 99 |
| Total Forest Floor | 4.6 | 34.40 | 100 |

*Sample size (n) = 75

## Woody Material

| | Loading (tons/ac) | | | Density (pieces/ac) | | |
|---|---|---|---|---|---|---|
| Diameter (in) | Sound | Rotten | Total | Sound | Rotten | Total |
| ≤ 0.25 | 0.3 | 0.0 | 0.3 | -- | -- | -- |
| 0.26 - 1.0 | 0.6 | 0.0 | 0.6 | -- | -- | -- |
| 1.1 - 3.0 | 1.3 | 0.0 | 1.3 | -- | -- | -- |
| 3.1 - 9.0 | 0.9 | 0.7 | 1.6 | 58 | 54 | 112 |
| 9.1 - 20.0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 |
| Total | 3.1 | 0.7 | 3.8 | 58 | 54 | 112 |

# AKHD 08 ALASKA HARDWOODS

May

June

## SITE INFORMATION

Site location: N 61° 05' 53.78"
W 149° 50' 06.01"
Elevation: 280 feet

Vegetation type: Closed Paper Birch Forest

SAF cover type: Paper Birch

Fire history: Unknown

Total unit biomass: 113.05 tons/acre

## STAND INFORMATION

Trees (% of stems: live/dead): *Picea glauca* (40/32), *Betula papyrifera* (27/1)

Crown closure: 74% hardwood, 15% conifer

Seedlings (stems per acre: live/dead): *Betula papyrifera* (386/117), *Picea glauca* (184/17)

Understory spruce coverage: 23%

Understory (% cover): *Calamagrostis canadensis* (16), *Cornus canadensis* (12), *Viburnum edule* (8), *Gymnocarpium dryopteris* (7), *Acer glabrum* (4), *Salix* spp. (na), *Alnus* spp. (na)

## UNDERSTORY VEGETATION

| | Lifeform | | | |
|---|---|---|---|---|
| | Tall Shrub | Low Shrub | Herbaceous | Seedling |
| Most common species | *Salix* spp. | *Viburnum edule* | *Calamagrostis canadensis* | *Betula papyrifera* |
| Second most common species | *Alnus* spp. | *Acer glabrum* | *Cornus canadensis* | *Picea glauca* |
| Coverage (percent) | na | 14 | 40 | na |
| Avg. height (ft) | 12 | 1.2 | 1.8 | na |
| Biomass (lbs/ac) | 29 | 311 | 309 | 78 |

## Saplings and Trees

| | Size class (diameter at breast height) | | | | |
|---|---|---|---|---|---|
| | Saplings (≤ 2") | 2 - 4" | 4 - 9" | > 9" | > 2" |
| Most common species (percent of stems: live/dead) | *Picea glauca* (65/4) | *Betula papyrifera* (49/20) | *Betula papyrifera* (88/0) | *Betula papyrifera* (100/0) | *Betula papyrifera* (67/11) |
| Second most common species (percent of stems: live/dead) | *Betula papyrifera* (19/12) | *Picea glauca* (28/3) | *Picea glauca* (12/0) | -- | *Picea glauca* (21/1) |
| Tree density (stems/ac) | 805 | 637 | 537 | 17 | 1,191 |
| Live | 671 | 486 | 537 | 17 | 1,040 |
| Dead | 134 | 151 | 0 | 0 | 151 |
| Avg. d.b.h. (in) | 1.2 | 2.9 | 5.7 | 9.1 | 4.2 |
| Live | 1.2 | 3.0 | 5.7 | 9.1 | 4.5 |
| Dead | 1.2 | 2.5 | -- | -- | 2.5 |
| Avg. height (ft) | 12 | 29 | 47 | 55 | 37 |
| Live | 12 | 33 | 47 | 55 | 40 |
| Dead | 8 | 14 | -- | -- | 14 |
| Avg. height to crown base (ft) | 3 | 19 | 29 | 24 | 24 |
| Live | 3 | 19 | 29 | 24 | 24 |
| Dead | 0 | -- | -- | -- | -- |
| Avg. height to live crown (ft) | 4 | 19 | 29 | 26 | 25 |
| Live crown mass (tons/ac)[†] | 0.42 / 0.02 | 0.73 / 0.13 | 1.31 / 5.03 | 0.00 / 1.01 | 2.04 / 6.17 |
| Aboveground mass (tons/ac) | 1.66 | 8.05 | 43.01 | 4.67 | 55.73 |

[†] Spruce live crown mass / hardwood live crown mass

## Forest Floor

| | Depth* (in) | Loading (tons/ac) | Constancy* (percent) |
|---|---|---|---|
| Surface material | 1.7 | 3.41 | 100 |
| Moss | 1.7 | 0.21 | 5 |
| Lichen | -- | -- | -- |
| Conifer litter | -- | -- | -- |
| Hardwood litter | 1.8 | 3.20 | 95 |
| Duff | 4.6 | 48.44 | 100 |
| Total Forest Floor | 6.3 | 51.85 | 100 |

*Sample size (n) = 75

## Woody Material

| | Loading (tons/ac) | | | Density (pieces/ac) | | |
|---|---|---|---|---|---|---|
| Diameter (in) | Sound | Rotten | Total | Sound | Rotten | Total |
| ≤ 0.25 | 0.4 | 0.0 | 0.4 | -- | -- | -- |
| 0.26 - 1.0 | 0.5 | 0.0 | 0.5 | -- | -- | -- |
| 1.1 - 3.0 | 1.5 | 0.0 | 1.5 | -- | -- | -- |
| 3.1 - 9.0 | 0.3 | 0.2 | 0.5 | 19 | 15 | 34 |
| 9.1 - 20.0 | 0.0 | 0.6 | 0.6 | 0 | 10 | 10 |
| Total | 2.7 | 0.8 | 3.5 | 19 | 25 | 44 |

# AKHD 09 ALASKA HARDWOODS

May

June

## SITE INFORMATION

Site location: N 63° 41' 28.19"
W 144° 28' 20.24"
Elevation: 1,345 feet

Vegetation type: Open Spruce-Balsam Poplar

SAF cover type: Balsam Poplar

Fire history: Unknown

Total unit biomass: 110.07 tons/acre

## STAND INFORMATION

Trees (% of stems: live/dead): *Picea glauca* (72/0), *Populus balsamifera* (25/3)

Crown closure: 34% hardwood, 14% conifer

Seedlings (stems per acre: live/dead): *Picea glauca* (503/0)

Understory spruce coverage: 2%

Understory (% cover): *Alnus* spp. (na), *Salix* spp. (na), *Viburnum edule* (12), *Equisetum pratense* (12), *Rosa acicularis* (11), *Cornus canadensis* (7), *Calamagrostis canadensis* (1), *Trientalis europaea* (t)

## UNDERSTORY VEGETATION

| | Lifeform | | | |
|---|---|---|---|---|
| | Tall Shrub | Low Shrub | Herbaceous | Seedling |
| Most common species | *Alnus* spp. | *Viburnum edule* | *Equisetum pratense* | *Picea glauca* |
| Second most common species | *Salix* spp. | *Rosa acicularis* | *Cornus canadensis* | -- |
| Coverage (percent) | na | 23 | 20 | na |
| Avg. height (ft) | 16 | 1.4 | 1.0 | na |
| Biomass (lbs/ac) | 9,371 | 228 | 140 | 21 |

## Saplings and Trees

| | Size class (diameter at breast height) | | | | |
|---|---|---|---|---|---|
| | Saplings (≤ 2") | 2 - 4" | 4 - 9" | > 9" | > 2" |
| Most common species (percent of stems: live/dead) | *Picea glauca* (99/0) | *Picea glauca* (67/0) | *Populus balsamifera* (73/10) | *Populus balsamifera* (100/0) | *Populus balsamifera* (66/9) |
| Second most common species (percent of stems: live/dead) | *Populus balsamifera* (1/0) | *Populus balsamifera* (22/11) | *Picea glauca* (17/0) | -- | *Picea glauca* (25/0) |
| Tree density (stems/ac) | 1,325 | 151 | 486 | 101 | 738 |
| Live | 1,325 | 134 | 436 | 101 | 671 |
| Dead | 0 | 17 | 50 | 0 | 67 |
| Avg. d.b.h. (in) | 1.0 | 3.0 | 6.2 | 11.3 | 6.2 |
| Live | 1.0 | 3.0 | 6.1 | 11.3 | 6.3 |
| Dead | -- | 3.6 | 6.5 | -- | 5.8 |
| Avg. height (ft) | 10 | 27 | 47 | 59 | 45 |
| Live | 10 | 26 | 49 | 59 | 46 |
| Dead | -- | 34 | 26 | -- | 28 |
| Avg. height to crown base (ft) | 1 | 7 | 26 | 39 | 24 |
| Live | 1 | 7 | 26 | 39 | 24 |
| Dead | 0 | -- | -- | -- | -- |
| Avg. height to live crown (ft) | 3 | 10 | 26 | 39 | 25 |
| Live crown mass (tons/ac)† | 0.80 / 0.01 | 0.39 / 0.05 | 2.12 / 1.61 | 0.00 / 3.39 | 2.51 / 5.05 |
| Aboveground mass (tons/ac) | 1.59 | 2.35 | 34.45 | 26.53 | 63.33 |

† Spruce live crown mass / hardwood live crown mass

## Forest Floor

| | Depth* (in) | Loading (tons/ac) | Constancy* (percent) |
|---|---|---|---|
| Surface material | 1.5 | 2.84 | 100 |
| Moss | 0.9 | 0.11 | 5 |
| Lichen | -- | -- | -- |
| Conifer litter | -- | -- | -- |
| Hardwood litter | 1.5 | 2.73 | 95 |
| Duff | 2.9 | 30.32 | 100 |
| Total Forest Floor | 4.4 | 33.16 | 100 |

*Sample size (n) = 75

## Woody Material

| | Loading (tons/ac) | | | Density (pieces/ac) | | |
|---|---|---|---|---|---|---|
| Diameter (in) | Sound | Rotten | Total | Sound | Rotten | Total |
| ≤ 0.25 | 0.2 | 0.0 | 0.2 | -- | -- | -- |
| 0.26 - 1.0 | 0.8 | 0.0 | 0.8 | -- | -- | -- |
| 1.1 - 3.0 | 1.2 | 0.0 | 1.2 | -- | -- | -- |
| 3.1 - 9.0 | 3.1 | 1.1 | 4.2 | 146 | 68 | 214 |
| 9.1 - 20.0 | 0.4 | 0.3 | 0.7 | 5 | 5 | 10 |
| Total | 5.7 | 1.4 | 7.1 | 151 | 73 | 224 |

# AKHD 10 ALASKA HARDWOODS

May

June

## SITE INFORMATION

Site location: N 63° 47' 46.78"
W 145° 02' 38.59"
Elevation: 1,660 feet

Vegetation type: Closed Quaking Aspen-Spruce Forest

SAF cover type: Aspen

Fire history: Unknown

Total unit biomass: 61.49 tons/acre

## STAND INFORMATION

Trees (% of stems: live/dead): *Picea mariana* (64/4), *Populus tremuloides* (26/1), *Betula papyrifera* (4/1)

Crown closure: 49% hardwood, 13% conifer

Seedlings (stems per acre: live/dead): *Picea mariana* (855/0), *Populus tremuloides* (17/0), *Betula papyrifera* (17/0)

Understory spruce coverage: 38%

Understory (% cover): *Salix* spp. (na), *Alnus* spp. (na), *Ledum groenlandicum* (8), *Vaccinium vitis-idaea* (5), *Rosa acicularis* (1), *Calamagrostis canadensis* (t), *Pyrola secunda* (t)

## UNDERSTORY VEGETATION

| | Lifeform | | | |
|---|---|---|---|---|
| | Tall Shrub | Low Shrub | Herbaceous | Seedling |
| Most common species | *Salix* spp. | *Ledum groenlandicum* | *Calamagrostis canadensis* | *Picea mariana* |
| Second most common species | *Alnus* spp. | *Vaccinium vitis-idaea* | *Pyrola secunda* | *Populus tremuloides* |
| Coverage (percent) | na | 14 | trace | na |
| Avg. height (ft) | 10 | 0.4 | 0.7 | na |
| Biomass (lbs/ac) | 3,166 | 340 | 2 | 39 |

## Saplings and Trees

| | Size class (diameter at breast height) | | | | |
|---|---|---|---|---|---|
| | Saplings (≤ 2") | 2 - 4" | 4 - 9" | > 9" | > 2" |
| Most common species (percent of stems: live/dead) | *Picea mariana* (89/6) | *Populus tremuloides* (58/0) | *Populus tremuloides* (73/0) | -- | *Populus tremuloides* (62/0) |
| Second most common species (percent of stems: live/dead) | *Populus tremuloides* (3/2) | *Picea mariana* (35/0) | *Betula papyrifera* (27/0) | -- | *Picea mariana* (26/0) |
| Tree density (stems/ac) | 1,057 | 520 | 185 | 0 | 705 |
| Live | 973 | 503 | 185 | 0 | 688 |
| Dead | 84 | 17 | 0 | 0 | 17 |
| Avg. d.b.h. (in) | 1.1 | 2.8 | 5.4 | -- | 3.5 |
| Live | 1.2 | 2.8 | 5.4 | -- | 3.5 |
| Dead | 0.8 | 2.1 | -- | -- | 2.1 |
| Avg. height (ft) | 11 | 27 | 45 | -- | 32 |
| Live | 12 | 27 | 45 | -- | 32 |
| Dead | 9 | 6 | -- | -- | 6 |
| Avg. height to crown base (ft) | 1 | 14 | 23 | -- | 17 |
| Live | 1 | 14 | 23 | -- | 17 |
| Dead | 2 | -- | -- | -- | -- |
| Avg. height to live crown (ft) | 2 | 15 | 23 | -- | 17 |
| Live crown mass (tons/ac)† | 0.59 / 0.01 | 0.54 / 0.31 | 0.00 / 1.00 | 0.00 / 0.00 | 0.54 / 1.31 |
| Aboveground mass (tons/ac) | 1.80 | 5.78 | 12.01 | 0.00 | 17.79 |

† Spruce live crown mass / hardwood live crown mass

## Forest Floor

| | Depth* (in) | Loading (tons/ac) | Constancy* (percent) |
|---|---|---|---|
| Surface material | 1.9 | 3.79 | 100 |
| Moss | 1.8 | 0.90 | 21 |
| Lichen | -- | -- | -- |
| Conifer litter | -- | -- | -- |
| Hardwood litter | 1.9 | 2.89 | 79 |
| Duff | 3.6 | 35.34 | 100 |
| Total Forest Floor | 5.5 | 39.13 | 100 |

*Sample size (n) = 75

## Woody Material

| | Loading (tons/ac) | | | Density (pieces/ac) | | |
|---|---|---|---|---|---|---|
| Diameter (in) | Sound | Rotten | Total | Sound | Rotten | Total |
| ≤ 0.25 | 0.3 | 0.0 | 0.3 | -- | -- | -- |
| 0.26 - 1.0 | 0.4 | 0.0 | 0.4 | -- | -- | -- |
| 1.1 - 3.0 | 0.3 | 0.0 | 0.3 | -- | -- | -- |
| 3.1 - 9.0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 |
| 9.1 - 20.0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 |
| Total | 1.0 | 0.0 | 1.0 | 0 | 0 | 0 |

# AKHD 11 ALASKA HARDWOODS

May

June

## SITE INFORMATION

Site location: N 60° 36' 20.18"
W 150° 47' 06.08"
Elevation: 365 feet

Vegetation type: Closed Spruce-Paper Birch-Quaking Aspen Forest

SAF cover type: White Spruce-Paper Birch

Fire history: Unknown

Total unit biomass: 171.99 tons/acre

## STAND INFORMATION

Trees (% of stems: live/dead): *Betula papyrifera* (35/11), *Picea glauca* (23/8), *Populus tremuloides* (19/4)

Crown closure: 59% hardwood, 10% conifer

Seedlings (stems per acre: live/dead): *Betula papyrifera* (134/0), *Populus tremuloides* (117/0), *Picea glauca* (0/17)

Understory spruce coverage: 0%

Understory (% cover): *Gymnocarpium dryopteris* (37), *Pyrola secunda* (10), *Rosa acicularis* (7), graminoids (7), *Oplopanax horridus* (3), *Viburnum edule* (2), *Salix* spp. (na)

## UNDERSTORY VEGETATION

| | Lifeform | | | |
|---|---|---|---|---|
| | Tall Shrub | Low Shrub | Herbaceous | Seedling |
| Most common species | *Salix* spp. | *Rosa acicularis* | *Gymnocarpium dryopteris* | *Betula papyrifera* |
| Second most common species | -- | *Oplopanax horridus* | *Pyrola secunda* | *Populus tremuloides* |
| Coverage (percent) | na | 13 | 59 | na |
| Avg. height (ft) | na | 1.8 | 1.6 | na |
| Biomass (lbs/ac) | 3 | 268 | 547 | 24 |

## Saplings and Trees

| | Size class (diameter at breast height) | | | | |
|---|---|---|---|---|---|
| | Saplings (≤ 2") | 2 - 4" | 4 - 9" | > 9" | > 2" |
| Most common species (percent of stems: live/dead) | -- | *Picea glauca* (0/100) | *Betula papyrifera* (38/19) | *Populus tremuloides* (56/11) | *Betula papyrifera* (35/12) |
| Second most common species (percent of stems: live/dead) | -- | -- | *Picea glauca* (37/6) | *Betula papyrifera* (33/0) | *Picea glauca* (23/8) |
| Tree density (stems/ac) | 0 | 17 | 268 | 151 | 436 |
| Live | 0 | 0 | 201 | 134 | 335 |
| Dead | 0 | 17 | 67 | 17 | 101 |
| Avg. d.b.h. (in) | -- | 3.6 | 6.7 | 12.2 | 8.5 |
| Live | -- | -- | 6.8 | 12.0 | 8.9 |
| Dead | -- | 3.6 | 6.4 | 13.1 | 7.1 |
| Avg. height (ft) | -- | 23 | 44 | 77 | 55 |
| Live | -- | -- | 54 | 77 | 63 |
| Dead | -- | 23 | 12 | 80 | 25 |
| Avg. height to crown base (ft) | -- | 4 | 19 | 54 | 32 |
| Live | -- | -- | 19 | 54 | 33 |
| Dead | -- | 4 | -- | -- | 4 |
| Avg. height to live crown (ft) | -- | -- | 20 | 55 | 34 |
| Live crown mass (tons/ac)† | 0.00 / 0.00 | 0.00 / 0.00 | 2.64 / 2.55 | 0.00 / 7.77 | 2.64 / 10.32 |
| Aboveground mass (tons/ac) | 0.00 | 0.27 | 30.87 | 71.01 | 102.15 |

† Spruce live crown mass / hardwood live crown mass

## Forest Floor

| | Depth* (in) | Loading (tons/ac) | Constancy* (percent) |
|---|---|---|---|
| Surface material | 2.6 | 5.37 | 99 |
| Moss | 3.7 | 2.90 | 33 |
| Lichen | -- | -- | -- |
| Conifer litter | -- | -- | -- |
| Hardwood litter | 2.0 | 2.47 | 65 |
| Duff | 3.9 | 36.88 | 99 |
| Total Forest Floor | 6.4 | 42.25 | 99 |

*Sample size (n) = 75

## Woody Material

| | Loading (tons/ac) | | | Density (pieces/ac) | | |
|---|---|---|---|---|---|---|
| Diameter (in) | Sound | Rotten | Total | Sound | Rotten | Total |
| ≤ 0.25 | 0.4 | 0.0 | 0.4 | -- | -- | -- |
| 0.26 - 1.0 | 0.4 | 0.0 | 0.4 | -- | -- | -- |
| 1.1 - 3.0 | 1.3 | 0.0 | 1.3 | -- | -- | -- |
| 3.1 - 9.0 | 10.2 | 6.2 | 16.4 | 365 | 321 | 686 |
| 9.1 - 20.0 | 5.0 | 3.8 | 8.8 | 54 | 58 | 112 |
| Total | 17.3 | 10.0 | 27.3 | 419 | 379 | 798 |

# AKHD 12 ALASKA HARDWOODS

May

June

## SITE INFORMATION

Site location: N 64° 41' 28.48"
W 146° 56' 26.44"
Elevation: 895 feet

Vegetation type: Closed Spruce-Paper Birch Forest

SAF cover type: White Spruce-Paper Birch

Fire history: Unknown

Total unit biomass: 128.56 tons/acre

## STAND INFORMATION

Trees (% of stems: live/dead): *Betula papyrifera* (43/14), *Picea glauca* (34/5), *Picea mariana* (2/2)

Crown closure: 71% hardwood, 14% conifer

Seedlings (stems per acre: live/dead): *Betula papyrifera* (352/67), *Picea glauca* (0/17)

Understory spruce coverage: 11%

Understory (% cover): *Alnus sinuata* (na), *Viburnum edule* (27), *Equisetum pratense* (12), *Calamagrostis canadensis* (6), *Cornus canadensis* (6), *Rosa acicularis* (2), *Linnaea borealis* (2)

## UNDERSTORY VEGETATION

| | Lifeform | | | |
|---|---|---|---|---|
| | Tall Shrub | Low Shrub | Herbaceous | Seedling |
| Most common species | *Alnus sinuata* | *Viburnum edule* | *Equisetum pratense* | *Betula papyrifera* |
| Second most common species | -- | *Rosa acicularis* | *Calamagrostis canadensis* | *Picea glauca* |
| Coverage (percent) | na | 31 | 25 | na |
| Avg. height (ft) | 13 | 0.6 | 1.3 | na |
| Biomass (lbs/ac) | 691 | 238 | 123 | 60 |

## Saplings and Trees

| | Size class (diameter at breast height) | | | | |
|---|---|---|---|---|---|
| | Saplings (≤ 2") | 2 - 4" | 4 - 9" | > 9" | > 2" |
| Most common species (percent of stems: live/dead) | *Picea glauca* (55/18) | *Betula papyrifera* (35/20) | *Betula papyrifera* (61/13) | *Betula papyrifera* (75/0) | *Betula papyrifera* (51/15) |
| Second most common species (percent of stems: live/dead) | *Betula papyrifera* (9/9) | *Picea glauca* (35/5) | *Picea glauca* (26/0) | *Picea glauca* (25/0) | *Picea glauca* (30/2) |
| Tree density (stems/ac) | 184 | 335 | 386 | 67 | 788 |
| Live | 117 | 251 | 336 | 67 | 654 |
| Dead | 67 | 84 | 50 | 0 | 134 |
| Avg. d.b.h. (in) | 1.5 | 2.9 | 6.3 | 11.5 | 5.3 |
| Live | 1.6 | 2.8 | 6.6 | 11.5 | 5.7 |
| Dead | 1.4 | 3.2 | 4.3 | -- | 3.6 |
| Avg. height (ft) | 13 | 24 | 50 | 70 | 41 |
| Live | 14 | 26 | 54 | 70 | 45 |
| Dead | 10 | 19 | 24 | -- | 21 |
| Avg. height to crown base (ft) | 3 | 10 | 25 | 26 | 19 |
| Live | 3 | 11 | 24 | 26 | 19 |
| Dead | 4 | 3 | 40 | -- | 22 |
| Avg. height to live crown (ft) | 6 | 12 | 25 | 28 | 20 |
| Live crown mass (tons/ac)[†] | 0.09 / 0.00 | 0.47 / 0.05 | 2.32 / 5.74 | 2.08 / 4.50 | 4.87 / 10.29 |
| Aboveground mass (tons/ac) | 0.47 | 4.21 | 43.01 | 29.63 | 76.85 |

[†] Spruce live crown mass / hardwood live crown mass

## Forest Floor

| | Depth* (in) | Loading (tons/ac) | Constancy* (percent) |
|---|---|---|---|
| Surface material | 1.8 | 3.44 | 100 |
| Moss | 0.6 | 0.02 | 1 |
| Lichen | -- | -- | -- |
| Conifer litter | 1.5 | 0.12 | 3 |
| Hardwood litter | 1.8 | 3.31 | 96 |
| Duff | 3.8 | 41.37 | 100 |
| Total Forest Floor | 5.5 | 44.81 | 100 |

*Sample size (n) = 75

## Woody Material

| | Loading (tons/ac) | | | Density (pieces/ac) | | |
|---|---|---|---|---|---|---|
| Diameter (in) | Sound | Rotten | Total | Sound | Rotten | Total |
| ≤ 0.25 | 0.4 | 0.0 | 0.4 | -- | -- | -- |
| 0.26 - 1.0 | 0.9 | 0.0 | 0.9 | -- | -- | -- |
| 1.1 - 3.0 | 2.3 | 0.0 | 2.3 | -- | -- | -- |
| 3.1 - 9.0 | 2.0 | 0.3 | 2.3 | 88 | 34 | 122 |
| 9.1 - 20.0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 |
| Total | 5.6 | 0.3 | 5.9 | 88 | 134 | 122 |

# AKHD 13 ALASKA HARDWOODS

May

August

## SITE INFORMATION

Site location: N 64° 14' 04.84"
W 149° 18' 33.16"
Elevation: 720 feet

Vegetation type: Closed Spruce-Paper Birch Forest

SAF cover type: White Spruce-Paper Birch

Fire history: Unknown

Total unit biomass: 83.27 tons/acre

## STAND INFORMATION

Trees (% of stems: live/dead): *Picea glauca* (51/10), *Betula papyrifera* (27/12)

Crown closure: 49% hardwood, 36% conifer

Seedlings (stems per acre: live/dead): *Picea glauca* (8,068/906), *Betula papyrifera* (0/17)

Understory spruce coverage: na

Understory (% cover): *Salix* spp. (na), *Vaccinium vitis-idaea* (8), *Ledum groenlandicum* (3), *Rosa acicularis* (3), *Calamagrostis canadensis* (1), *Cornus canadensis* (t)

## UNDERSTORY VEGETATION

| | Lifeform | | | |
|---|---|---|---|---|
| | Tall Shrub | Low Shrub | Herbaceous | Seedling |
| Most common species | *Salix* spp. | *Vaccinium vitis-idaea* | *Calamagrostis canadensis* | *Picea glauca* |
| Second most common species | -- | *Ledum groenlandicum* | *Cornus canadensis* | *Betula papyrifera* |
| Coverage (percent) | na | 14 | 1 | na |
| Avg. height (ft) | 8 | 0.6 | 0.8 | na |
| Biomass (lbs/ac) | 432 | 164 | trace | 426 |

## Saplings and Trees

| | Size class (diameter at breast height) | | | | |
|---|---|---|---|---|---|
| | Saplings (≤ 2") | 2 - 4" | 4 - 9" | > 9" | > 2" |
| Most common species (percent of stems: live/dead) | *Picea glauca* (58/14) | *Betula papyrifera* (53/4) | *Betula papyrifera* (86/0) | -- | *Betula papyrifera* (57/3) |
| Second most common species (percent of stems: live/dead) | *Betula papyrifera* (11/17) | *Picea glauca* (43/0) | *Picea glauca* (7/7) | -- | *Picea glauca* (39/1) |
| Tree density (stems/ac) | 3,405 | 1,677 | 235 | 0 | 1,912 |
| Live | 2,332 | 1,610 | 218 | 0 | 1,828 |
| Dead | 1,073 | 67 | 17 | 0 | 84 |
| Avg. d.b.h. (in) | 1.2 | 2.8 | 4.6 | -- | 3.0 |
| Live | 1.3 | 2.8 | 4.7 | -- | 3.0 |
| Dead | 1.0 | 2.3 | 4.4 | -- | 2.7 |
| Avg. height (ft) | 13 | 29 | 43 | -- | 30 |
| Live | 14 | 29 | 45 | -- | 31 |
| Dead | 9 | 16 | 21 | -- | 17 |
| Avg. height to crown base (ft) | 7 | 14 | 21 | -- | 15 |
| Live | 7 | 14 | 21 | -- | 15 |
| Dead | -- | -- | -- | -- | -- |
| Avg. height to live crown (ft) | 7 | 15 | 21 | -- | 16 |
| Live crown mass (tons/ac)† | 1.71 / 0.05 | 2.29 / 0.35 | 0.19 / 0.44 | 0.00 / 0.00 | 2.48 / 0.79 |
| Aboveground mass (tons/ac) | 6.57 | 18.72 | 9.62 | 0.00 | 28.34 |

† Spruce live crown mass / hardwood live crown mass

## Forest Floor

| | Depth* (in) | Loading (tons/ac) | Constancy* (percent) |
|---|---|---|---|
| Surface material | 2.4 | 5.23 | 100 |
| Moss | 2.6 | 3.76 | 61 |
| Lichen | 0.9 | 0.06 | 1 |
| Conifer litter | -- | -- | -- |
| Hardwood litter | 1.9 | 1.40 | 37 |
| Duff | 4.7 | 40.42 | 100 |
| Total Forest Floor | 7.1 | 45.65 | 100 |

*Sample size (n) = 75

## Woody Material

| | Loading (tons/ac) | | | Density (pieces/ac) | | |
|---|---|---|---|---|---|---|
| Diameter (in) | Sound | Rotten | Total | Sound | Rotten | Total |
| ≤ 0.25 | 0.5 | 0.0 | 0.5 | -- | -- | -- |
| 0.26 - 1.0 | 0.4 | 0.0 | 0.4 | -- | -- | -- |
| 1.1 - 3.0 | 0.9 | 0.0 | 0.9 | -- | -- | -- |
| 3.1 - 9.0 | 0.0 | 0.4 | 0.4 | 0 | 29 | 29 |
| 9.1 - 20.0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 |
| Total | 1.8 | 0.4 | 2.2 | 0 | 29 | 29 |

# AKHD 14 ALASKA HARDWOODS

May

June

## SITE INFORMATION

Site location: N 64° 39' 14.77"
W 148° 41' 04.83"
Elevation: 710 feet

Vegetation type: Closed Quaking Aspen-Spruce Forest

SAF cover type: White Spruce-Aspen

Fire history: Unknown

Total unit biomass: 115.47 tons/acre

## STAND INFORMATION

Trees (% stems: live/dead): *Picea glauca* (53/3), *Populus tremuloides* (35/9)

Crown closure: 42% hardwood, 42% conifer

Seedlings (stems per acre: live/dead): *Picea glauca* (268/0), *Populus tremuloides* (34/0)

Understory spruce coverage: 11%

Understory (% cover): *Geocaulon lividum* (8), *Rosa acicularis* (7), *Equisetum pratense* (6), *Viburnum edule* (3), *Shepherdia canadensis* (2), *Vaccinium vitis-idaea* (1), *Linnaea borealis* (t)

## UNDERSTORY VEGETATION

| | Lifeform | | | |
|---|---|---|---|---|
| | Tall Shrub | Low Shrub | Herbaceous | Seedling |
| Most common species | -- | *Rosa acicularis* | *Geocaulon lividum* | *Picea glauca* |
| Second most common species | -- | *Viburnum edule* | *Equisetum pratense* | *Populus tremuloides* |
| Coverage (percent) | na | 12 | 14 | na |
| Avg. height (ft) | -- | 1.1 | 0.7 | na |
| Biomass (lbs/ac) | 0 | 182 | 55 | 12 |

## Saplings and Trees

| | Size class (diameter at breast height) | | | | |
|---|---|---|---|---|---|
| | Saplings (≤ 2") | 2 - 4" | 4 - 9" | > 9" | > 2" |
| Most common species (percent of stems: live/dead) | *Picea glauca* (80/15) | *Picea glauca* (60/3) | *Populus tremuloides* (59/2) | -- | *Populus tremuloides* (41/10) |
| Second most common species (percent of stems: live/dead) | *Populus tremuloides* (0/5) | *Populus tremuloides* (15/22) | *Picea glauca* (39/0) | -- | *Picea glauca* (48/1) |
| Tree density (stems/ac) | 335 | 671 | 990 | 0 | 1,661 |
| Live | 268 | 503 | 973 | 0 | 1,476 |
| Dead | 67 | 168 | 17 | 0 | 185 |
| Avg. d.b.h. (in) | 1.5 | 3.0 | 5.5 | -- | 4.5 |
| Live | 1.5 | 3.1 | 5.5 | -- | 4.6 |
| Dead | 1.7 | 2.9 | 5.3 | -- | 3.1 |
| Avg. height (ft) | 14 | 28 | 49 | -- | 41 |
| Live | 14 | 28 | 49 | -- | 42 |
| Dead | 14 | 28 | 54 | -- | 30 |
| Avg. height to crown base (ft) | 2 | 10 | 25 | -- | 20 |
| Live | 2 | 7 | 25 | -- | 19 |
| Dead | 1 | 23 | 48 | -- | 27 |
| Avg. height to live crown (ft) | 5 | 14 | 30 | -- | 25 |
| Live crown mass (tons/ac)[†] | 0.29 / 0.00 | 1.69 / 0.14 | 4.59 / 4.34 | 0.00 / 0.00 | 6.28 / 4.48 |
| Aboveground mass (tons/ac) | 0.81 | 9.56 | 69.03 | 0.00 | 78.59 |

[†] Spruce live crown mass / hardwood live crown mass

## Forest Floor

| | Depth* (in) | Loading (tons/ac) | Constancy* (percent) |
|---|---|---|---|
| Surface material | 1.6 | 3.38 | 100 |
| Moss | 2.0 | 1.16 | 25 |
| Lichen | -- | -- | -- |
| Conifer litter | -- | -- | -- |
| Hardwood litter | 1.5 | 2.22 | 75 |
| Duff | 2.9 | 28.56 | 100 |
| Total Forest Floor | 4.5 | 31.94 | 100 |

*Sample size (n) = 75

## Woody Material

| | Loading (tons/ac) | | | Density (pieces/ac) | | |
|---|---|---|---|---|---|---|
| Diameter (in) | Sound | Rotten | Total | Sound | Rotten | Total |
| ≤ 0.25 | 0.5 | 0.0 | 0.5 | -- | -- | -- |
| 0.26 - 1.0 | 0.6 | 0.0 | 0.6 | -- | -- | -- |
| 1.1 - 3.0 | 1.6 | 0.0 | 1.6 | -- | -- | -- |
| 3.1 - 9.0 | 1.1 | 0.2 | 1.3 | 88 | 19 | 107 |
| 9.1 - 20.0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 |
| Total | 3.8 | 0.2 | 4.0 | 88 | 19 | 107 |

# AKHD 15 ALASKA HARDWOODS

May

June

## SITE INFORMATION

Site location: N 64° 40' 44.35"
W 148° 33' 40.56"
Elevation: 675 feet

Vegetation type: Closed Spruce-Paper Birch Forest

SAF cover type: Black Spruce-Paper Birch

Fire history: Unknown

Total unit biomass: 92.37 tons/acre

## STAND INFORMATION

Trees (% of stems: live/dead): *Picea mariana* (47/23), *Betula papyrifera* (26/4)

Crown closure: 55% hardwood, 33% conifer

Seedlings (stems per acre: live/dead): *Picea mariana* (34/319)

Understory spruce coverage: 7%

Understory (% cover): *Alnus* spp. (na), *Equisetum pratense* (9), *Linnaea borealis* (t), *Rosa acicularis* (t), *Geocaulon lividum* (t), *Cornus canadensis* (t), *Calamagrostis canadensis* (t), *Pyrola asarifolia* (t), *Ledum groenlandicum* (t)

## UNDERSTORY VEGETATION

| | Lifeform | | | |
|---|---|---|---|---|
| | Tall Shrub | Low Shrub | Herbaceous | Seedling |
| Most common species | *Alnus* spp. | *Linnaea borealis* | *Equisetum pratense* | *Picea mariana* |
| Second most common species | -- | *Rosa acicularis* | *Geocaulon lividum* | -- |
| Coverage (percent) | na | trace | 9 | na |
| Avg. height (ft) | 13 | 0.7 | 0.8 | na |
| Biomass (lbs/ac) | 3,054 | 11 | 55 | 32 |

## Saplings and Trees

| | Size class (diameter at breast height) | | | | |
|---|---|---|---|---|---|
| | Saplings (≤ 2") | 2 - 4" | 4 - 9" | > 9" | > 2" |
| Most common species (percent of stems: live/dead) | *Picea mariana* (41/50) | *Picea mariana* (61/8) | *Betula papyrifera* (52/2) | -- | *Picea mariana* (51/7) |
| Second most common species (percent of stems: live/dead) | *Betula papyrifera* (4/5) | *Betula papyrifera* (27/4) | *Picea mariana* (39/7) | -- | *Betula papyrifera* (39/3) |
| Tree density (stems/ac) | 939 | 872 | 772 | 0 | 1,644 |
| Live | 419 | 771 | 705 | 0 | 1,476 |
| Dead | 520 | 101 | 67 | 0 | 168 |
| Avg. d.b.h. (in) | 1.3 | 3.1 | 5.2 | -- | 4.1 |
| Live | 1.4 | 3.1 | 5.1 | -- | 4.1 |
| Dead | 1.2 | 2.9 | 5.9 | -- | 4.1 |
| Avg. height (ft) | 15 | 29 | 41 | -- | 35 |
| Live | 20 | 31 | 42 | -- | 36 |
| Dead | 11 | 15 | 30 | -- | 21 |
| Avg. height to crown base (ft) | 5 | 10 | 16 | -- | 13 |
| Live | 6 | 11 | 17 | -- | 14 |
| Dead | 5 | 5 | 3 | -- | 4 |
| Avg. height to live crown (ft) | 12 | 18 | 24 | -- | 20 |
| Live crown mass (tons/ac)[†] | 0.33 / 0.00 | 2.60 / 0.11 | 3.93 / 3.56 | 0.00 / 0.00 | 6.53 / 3.67 |
| Aboveground mass (tons/ac) | 1.52 | 11.55 | 44.64 | 0.00 | 56.19 |

[†] Spruce live crown mass / hardwood live crown mass

## Forest Floor

| | Depth* (in) | Loading (tons/ac) | Constancy* (percent) |
|---|---|---|---|
| Surface material | 1.4 | 2.76 | 100 |
| Moss | 2.1 | 0.66 | 13 |
| Lichen | -- | -- | -- |
| Conifer litter | -- | -- | -- |
| Hardwood litter | 1.3 | 2.09 | 87 |
| Duff | 2.7 | 28.12 | 100 |
| Total Forest Floor | 4.1 | 30.88 | 100 |

*Sample size (n) = 75

## Woody Material

| | Loading (tons/ac) | | | Density (pieces/ac) | | |
|---|---|---|---|---|---|---|
| Diameter (in) | Sound | Rotten | Total | Sound | Rotten | Total |
| ≤ 0.25 | 0.4 | 0.0 | 0.4 | -- | -- | -- |
| 0.26 - 1.0 | 0.6 | 0.0 | 0.6 | -- | -- | -- |
| 1.1 - 3.0 | 1.1 | 0.0 | 1.1 | -- | -- | -- |
| 3.1 - 9.0 | 0.1 | 0.0 | 0.1 | 10 | 5 | 15 |
| 9.1 - 20.0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 |
| Total | 2.2 | 0.0 | 2.2 | 10 | 5 | 15 |

**Ottmar, Roger D.; Vihnanek, Robert E. 2002.** Stereo photo series for quantifying natural fuels. Volume IIa: hardwoods with spruce in Alaska. PMS 836. Boise, ID: National Wildfire Coordinating Group, National Interagency Fire Center. 41 p.

A series of single and stereo photographs display a range of natural conditions and fuel loadings in hardwood ecosystems undergoing succession to spruce in Alaska. Each group of photos includes inventory information summarizing vegetation composition, structure and loading, woody material loading and density by size class, forest floor depth and loading, and various site characteristics. The natural fuels photo series is designed to help land managers appraise fuel and vegetation conditions in natural settings.

Keywords: Woody material, biomass, fuel loading, natural fuels, Alaska hardwoods, quaking aspen, *Populus tremuloides*, paper birch, *Betula papyrifera*, balsam poplar, *Populus balsamifera*, white spruce, *Picea glauca*, black spruce, *Picea mariana*.