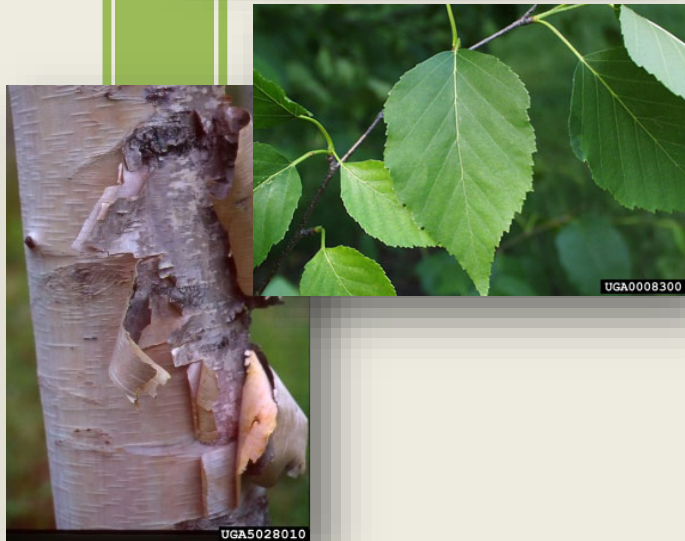


Paper birch

Betula papyrifera



The **volume of paper birch has decreased** significantly since 1983. This is a result of both natural succession and increased mortality. The number of poles has also decreased suggesting that paper birch will play a less prominent role in the future. Models suggest that volume of this species will decrease by over 70% by midcentury.

In the last three decades, growth rates have decreased and are currently negative (mortality exceeds growth). Paper birch has one of the lowest ratios of growth to volume of all species in the state. Whereas paper birch makes up about 2.0% of all volume of trees in Wisconsin, it accounts for 6.5% of total mortality.

Paper birch roundwood production made up 6% of the statewide product in 2009. Because biomass of birch is decreasing so rapidly, it is not likely to be a major source of biofuel.

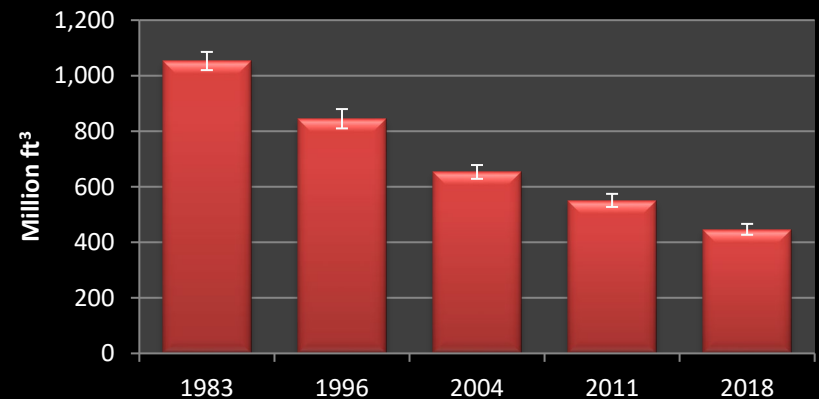
- [How has the paper birch resource changed?](#)
Volume and diameter class distribution:
- [Where is paper birch found in Wisconsin?](#)
Growing stock volume by region with map
- [What kind of sites does paper birch grow on?](#)
Habitat type and site index distribution
- [How fast is paper birch growing?](#)
Average annual net growth: trends and ratio of growth to volume
- [How healthy is paper birch in Wisconsin?](#)
Average annual mortality: trends and ratio of mortality to volume
- [How much paper birch do we harvest?](#)
Roundwood production by product and ratio of growth to removals
- [How much paper birch biomass do we have?](#)
Tons of aboveground biomass by region of the state
- [Can we predict the future of paper birch?](#)
Modelling future volumes

"How has the paper birch resource changed?"
Growing stock volume and diameter class distribution

The [growing stock volume](#) of paper birch (chart on right) was about 447 million cubic feet or about 2.0% of total statewide volume. Volume of paper birch has decreased 58% since 1983 and 47% since 1996.

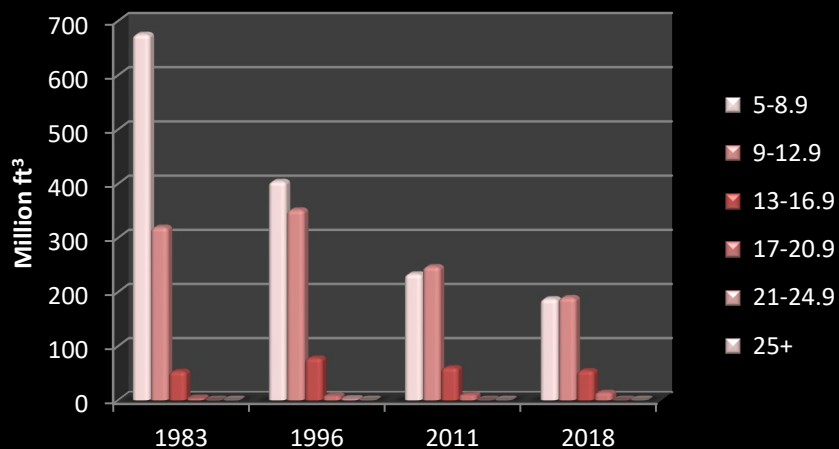
The volume and number of trees is decreasing in all size classes (charts below). [Pole-sized](#) trees have decreased in number by 30% and [sawtimber](#) trees by 22% since 2004. [Saplings](#) increased, but only by 3%, suggesting that paper birch will play a less prominent role in the future.

Growing stock volume of paper birch



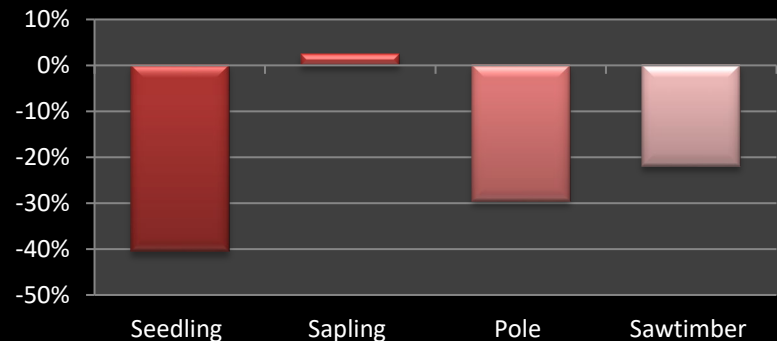
Growing stock volume (million cubic feet) by inventory year.
 Source: USDA Forest Inventory and Analysis data

Volume of paper birch by diameter class



Growing stock volume (trees over 5 inches dbh) by diameter class (inches).
 Source: USDA Forest Inventory and Analysis data

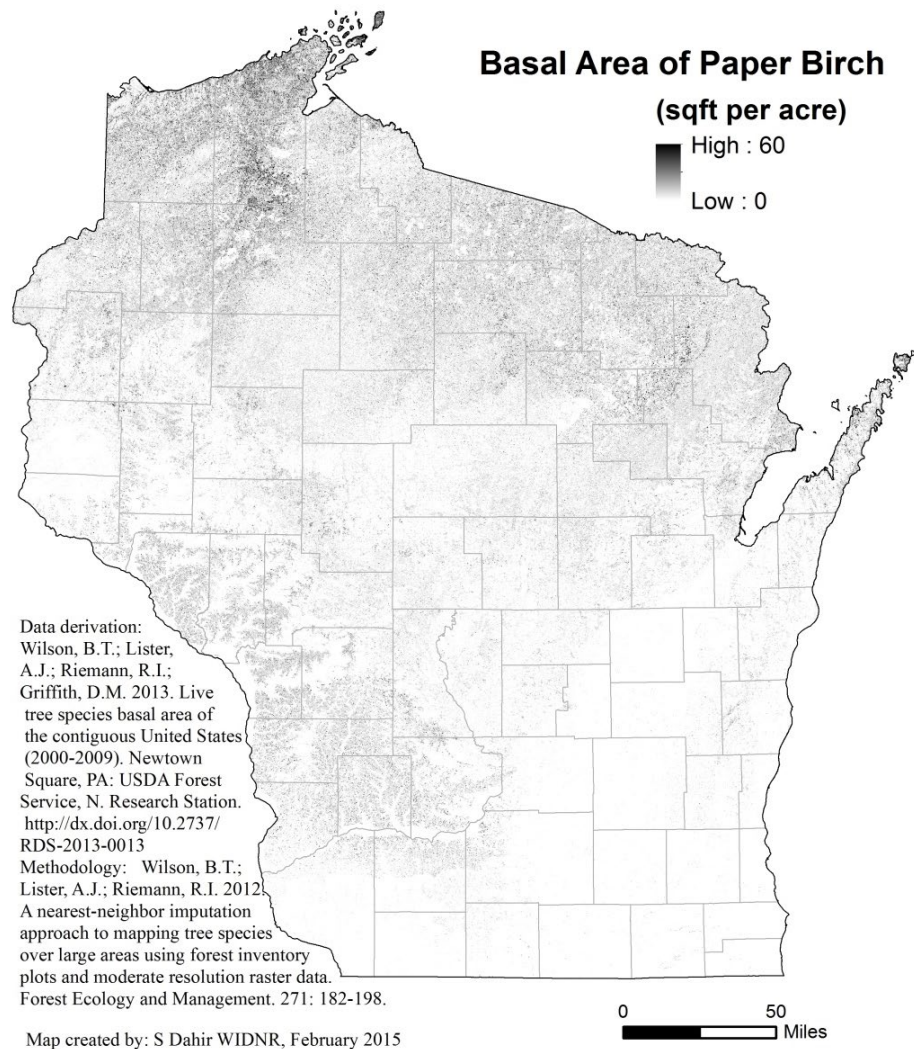
Percentage change in tree numbers: Paper birch



Percentage change in the number of live trees by size class between 2004 and 2018.
 Source: USDA Forest Inventory and Analysis data: 2004 and 2018.

"Where does paper birch grow in Wisconsin?"

Growing stock volume by region with map



The largest volume of paper birch, 70%, is located in northern Wisconsin with lesser amounts in the southwest and central parts of the state.

Most paper birch is part of the aspen / birch [forest type](#) and, to a lesser extent, the maple / basswood type. In southern and central Wisconsin, it's also a part of the oak / hickory forest type.

Table 1. Growing stock volume (million ft³) by species and region of the state.

Species	Central	North east	North west	South east	South west	Total
Paper Birch	46	142	169	27	63	447
Percent of total	10%	32%	38%	6%	14%	100%

Source: USDA Forest Service, Forest Inventory and Analysis

For a table of **Volume by County** go to:

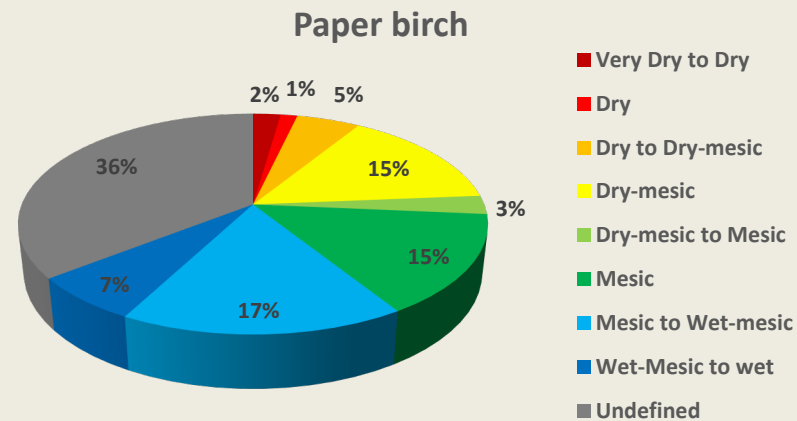
<http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/VolumeCountySpecies.pdf>



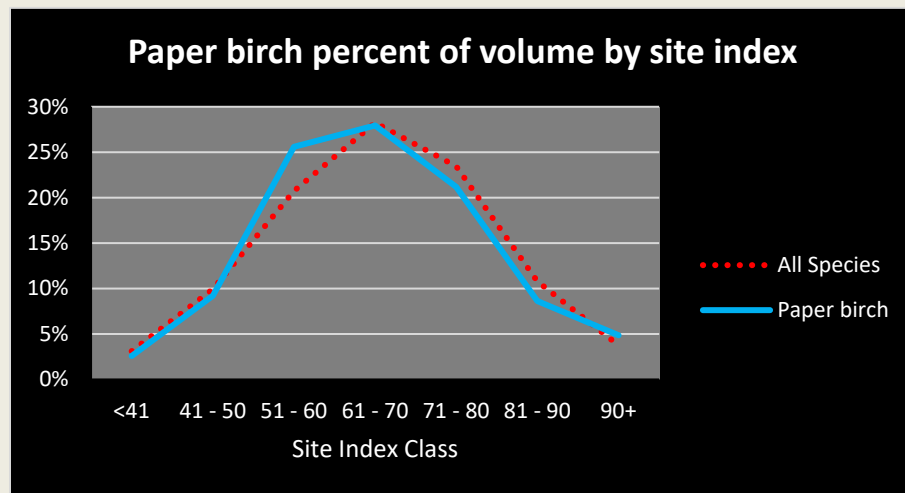
"What kind of sites does paper birch grow on?"

Habitat type¹ and site index distribution

Paper birch occurs on a wide variety of habitat types (chart below). Paper birch is well distributed across wet, mesic, and dry habitat types, but is most common on wet and mesic sites.



Percent distribution of growing stock volume by habitat type group¹ (USDA Forest Inventory & Analysis data).



Percent distribution of growing stock volume by site index class (USDA Forest Inventory & Analysis data).

The majority of paper birch growing stock volume (63%) is found in stands with site indices over 60 (chart on left).

The average site index by volume for paper birch is 65.7 slightly lower than the average for all species.

¹ For more information on habitat types see Schmidt, Thomas L. 1997. Wisconsin forest statistics, 1996. Resource Bulletin NC-183. St. Paul, MN: U.S. Dept. of Agriculture, Forest Service, North Central



"How fast is paper birch growing?"

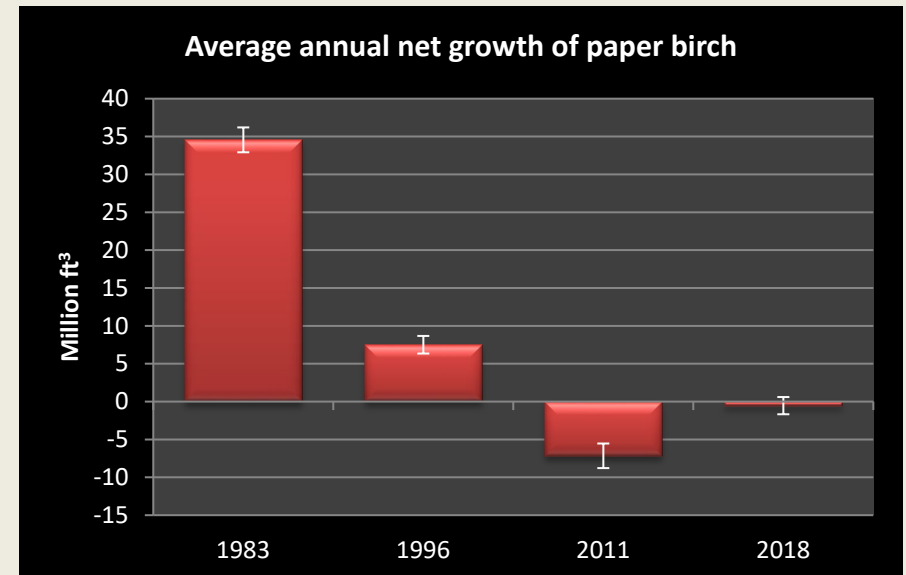
Average annual net growth: trends and ratio of growth to volume

The [average annual net growth](#) of paper birch (chart on right) has been negative for more than a decade, indicating that mortality exceeded growth during this period. Growth decreased by 78% between 1983 and 1996.

Table 2. Average annual net growth (million ft³/year) of growing stock and the ratio of growth to volume by region of the state

Region	Net growth	Ratio of growth to volume
Northeast	0.7	0.5%
Northwest	-1.4	-0.8%
Central	0.7	1.5%
Southwest	-0.4	-0.6%
Southeast	-0.2	-0.7%
Statewide	-0.5	-0.1%

Source: USDA Forest Inventory and Analysis



Average annual net growth (million cubic feet).
Source: USDA Forest Inventory & Analysis data

Growth rates for paper birch are negative throughout the state except in central and northeast Wisconsin meaning that mortality exceeded growth in these regions (Table 2). The statewide ratio of growth to volume for all species is 2.7%, much higher than the negative growth rate of paper birch.

For a table of **Average annual growth, mortality and removals by region** go to:

<http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf>

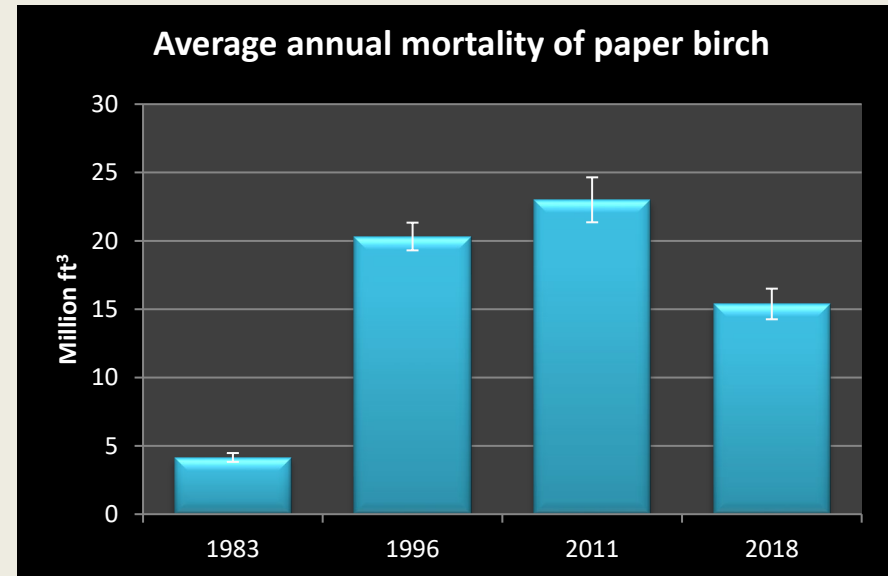


"How healthy is paper birch in Wisconsin?"

Average annual mortality and the ratio of mortality to volume

Average annual mortality of paper birch, about 15.4 million cubic feet per year, is more than triple what it was in 1983 (chart on right) but decreased slightly since 2011.

The ratio of mortality to volume is 3.4% for paper birch, much higher than the statewide average of 1.1%, is among the highest of all species (Table 3). Whereas paper birch accounts for 2.0% of total growing stock volume in the state, this species makes up over 6.5% of total mortality.



Average annual mortality (million cubic feet) by inventory year.
Source: USDA Forest Inventory & Analysis data

Table 3. Mortality, volume and the ratio of mortality to volume.

Species	Average annual mortality (ft³)	Growing stock volume (ft³)	Mortality / volume
Paper Birch	15,381,214	446,765,411	3.4%

Source: USDA Forest Inventory & Analysis data

For a table of **Average annual growth, mortality and removals by region** go to:
<http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf>

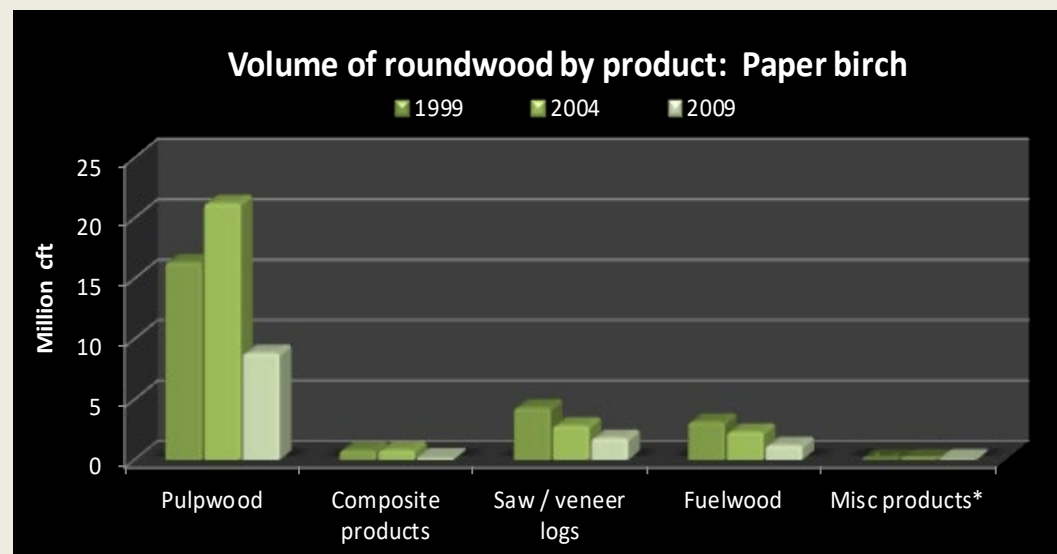


"How much paper birch do we harvest?"

Roundwood production by product and the ratio of growth to removals

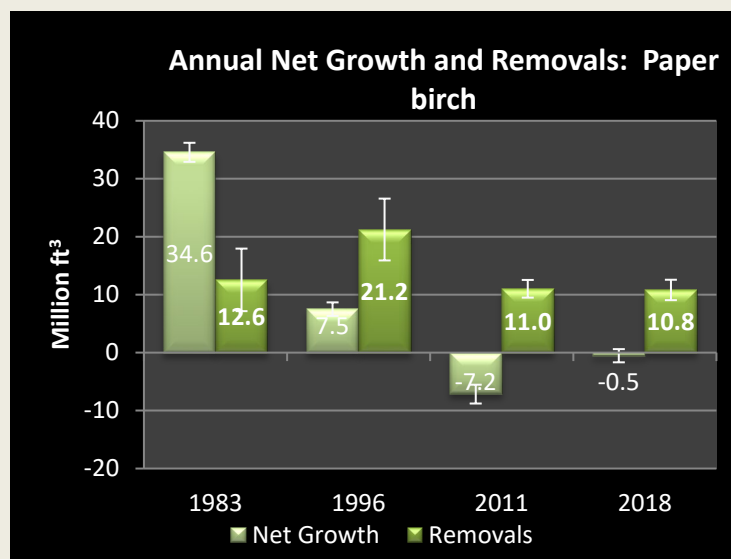
In 2009, paper birch accounted for 18.6 million cubic feet or 4.9% of Wisconsin's total [roundwood](#) production (chart on right). Over 60% of this was used for pulpwood. Birch pulpwood accounts for almost 7% of total production.

Between 2004 and 2009-2012, paper birch roundwood production fell 32% and pulpwood



Volume of roundwood. Most recent figures for pulpwood and composite products are from 2012 while other product volumes are from 2009. * Miscellaneous products include poles, posts and pilings.

Source: Ronald Piva, USDA Forest Service, Northern Research Station, St. Paul MN



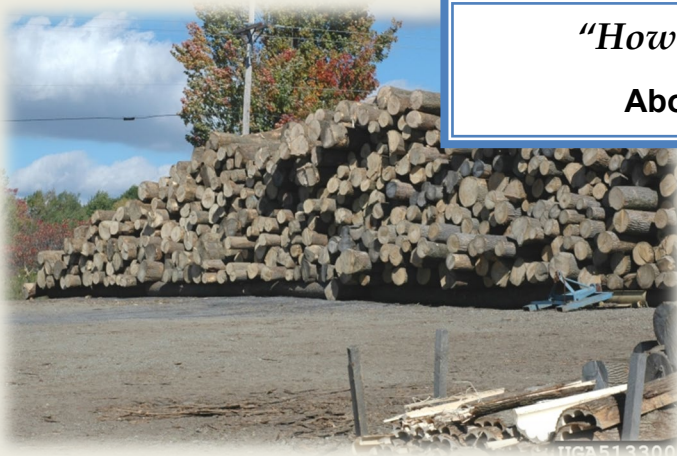
Source: USDA Forest Inventory & Analysis data

Removals of paper birch totaled 10.8 million cubic feet per year from 2012 to 2018. This is equal to 3.7% of total removals in the state.

The average annual net growth of paper birch has been negative since before 2011 (chart of left). Although net growth is nearly positive again, removals still outpace net growth by a wide margin.

For a table of **Average annual growth, mortality and removals by region** go to:

<http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf>

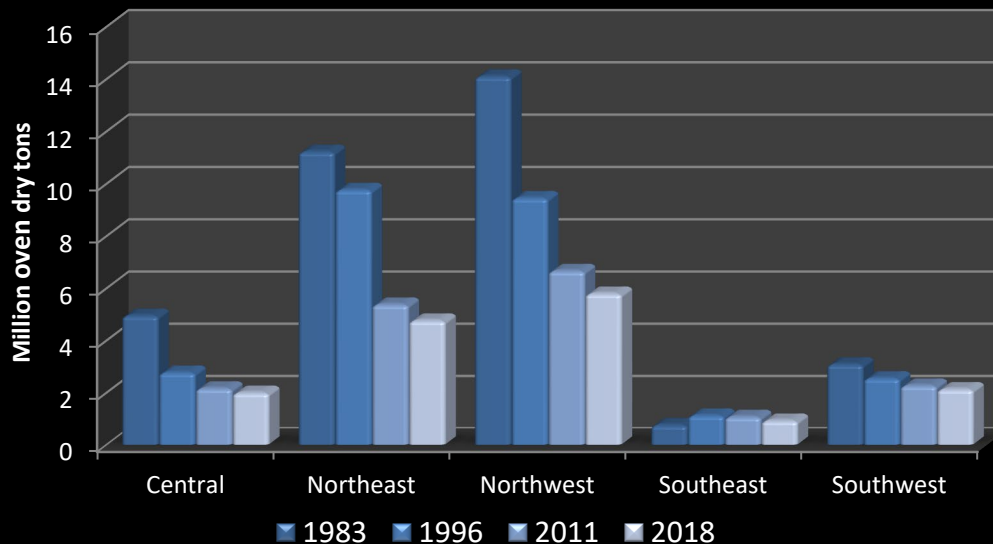


"How much paper birch biomass do we have?"

Aboveground biomass by region of the state

There are currently 15.6 million tons of aboveground biomass in live paper birch trees, a decrease of 54% from 1983. This is equivalent to approximately 7.8 million tons of carbon and represents 2.4% of all biomass statewide. As with volume, most paper birch is located in northern Wisconsin (chart below).

Biomass of all live trees: Paper birch



Biomass (above ground dry weight of live trees >1 in dbh, short tons) by year and region of the state.
Source: USDA Forest Inventory & Analysis data

Paper birch wood is of about average density for hardwoods, with a ratio of biomass to volume of 34 oven-dry lbs. per cubic foot (ODP/ft³). The average for all trees is about 33 ODP/cubic feet and for hardwoods, 36 ODP/cubic feet. Approximately 61% of all biomass is located in the main stem, 16% in saplings, 4% in stumps, and 20% in the branches.

For a table of **Biomass by County** go to:

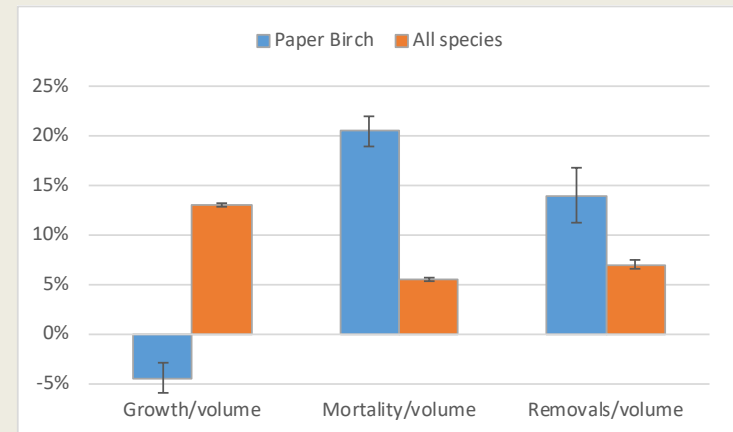
<http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/BiomassByCounty.pdf>

"Can we predict the future of paper birch?"

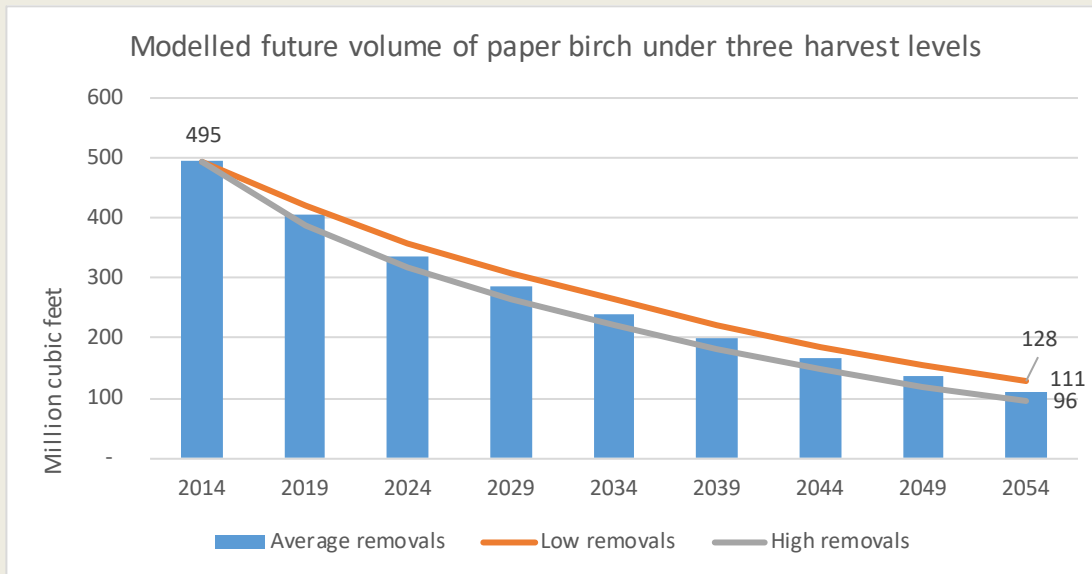
Predicted volumes based on current rates of mortality and harvest

The 5-year ratios of mortality to volume and removals to volume are significantly higher for paper birch and growth to volume is significantly lower for compared to all species in the state (chart on right). All of these trends would tend to decrease future volumes.

The Forest Vegetation Simulator (FVS¹) was used to predict future volumes of basswood through 2054. Three scenarios are forecast. One with current rates of mortality and removals (i.e. average annual mortality and removals for 2009 to 2014). Another with current mortality rates and the lower 67% confidence interval for current removals and another with the upper 67% confidence interval for removals.



Five-year ratios of mortality, removals and growth to volume.
Source: USDA Forest Inventory & Analysis data



By 2054, volume of paper birch decreases substantially in all three scenarios, 78% for current average removal levels, 74% for low removals and 81% for high removals. Without more regeneration, paper birch may be a scarce species in 50 years.