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 numbers of saplings and poles have 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 the lowest ratio of growth to volume of all species in the state. Whereas paper birch makes up about 2.2% of all volume of trees in Wisconsin, it accounts for 8.4% 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.

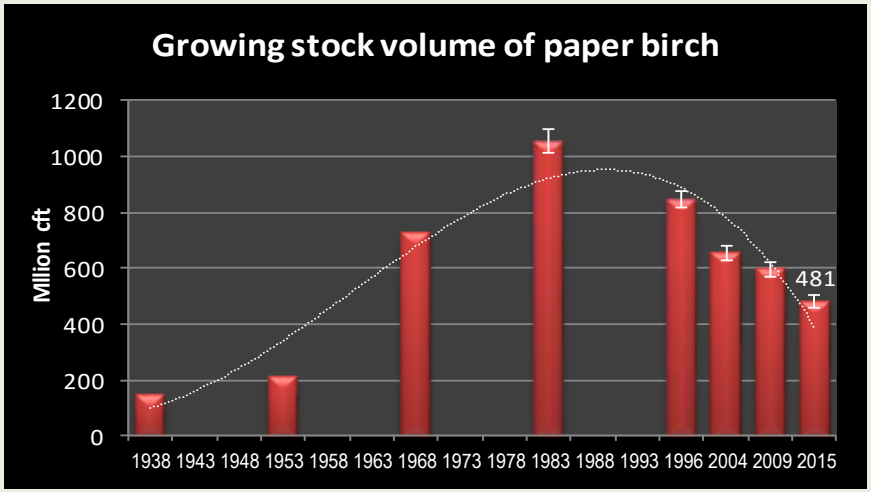
Division of Forestry
WI Dept of Natural Resources 2016

"How has the paper birch resource changed?"

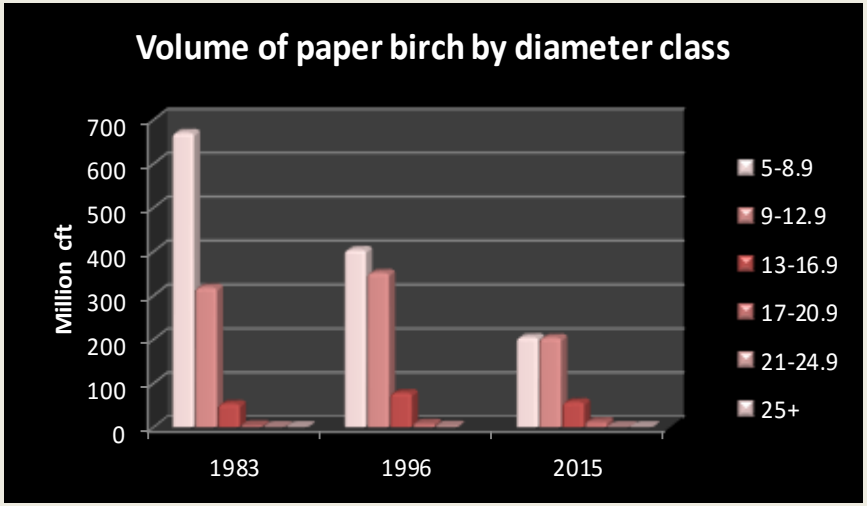
Growing stock volume and diameter class distribution

The growing stock volume of paper birch (chart on right) was about 481 million cubic feet or about 2.2% of total statewide volume. Volume of paper birch has decreased 54% since 1983 and 43% since 1996.

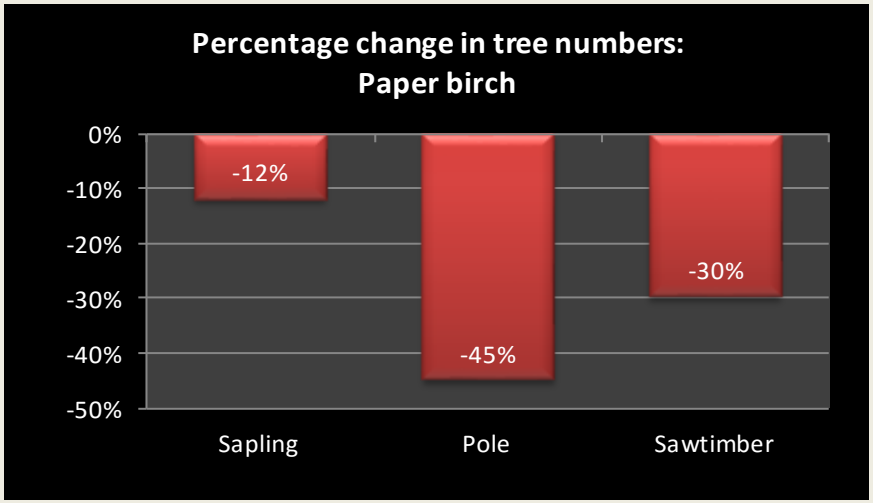
The volume and number of trees is decreasing in all size classes (charts below). Pole-sized trees have decreased in number by 45% since 1996. Saplings and sawtimber trees have decreased as well, suggesting that paper birch will play a less prominent role in the future.



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



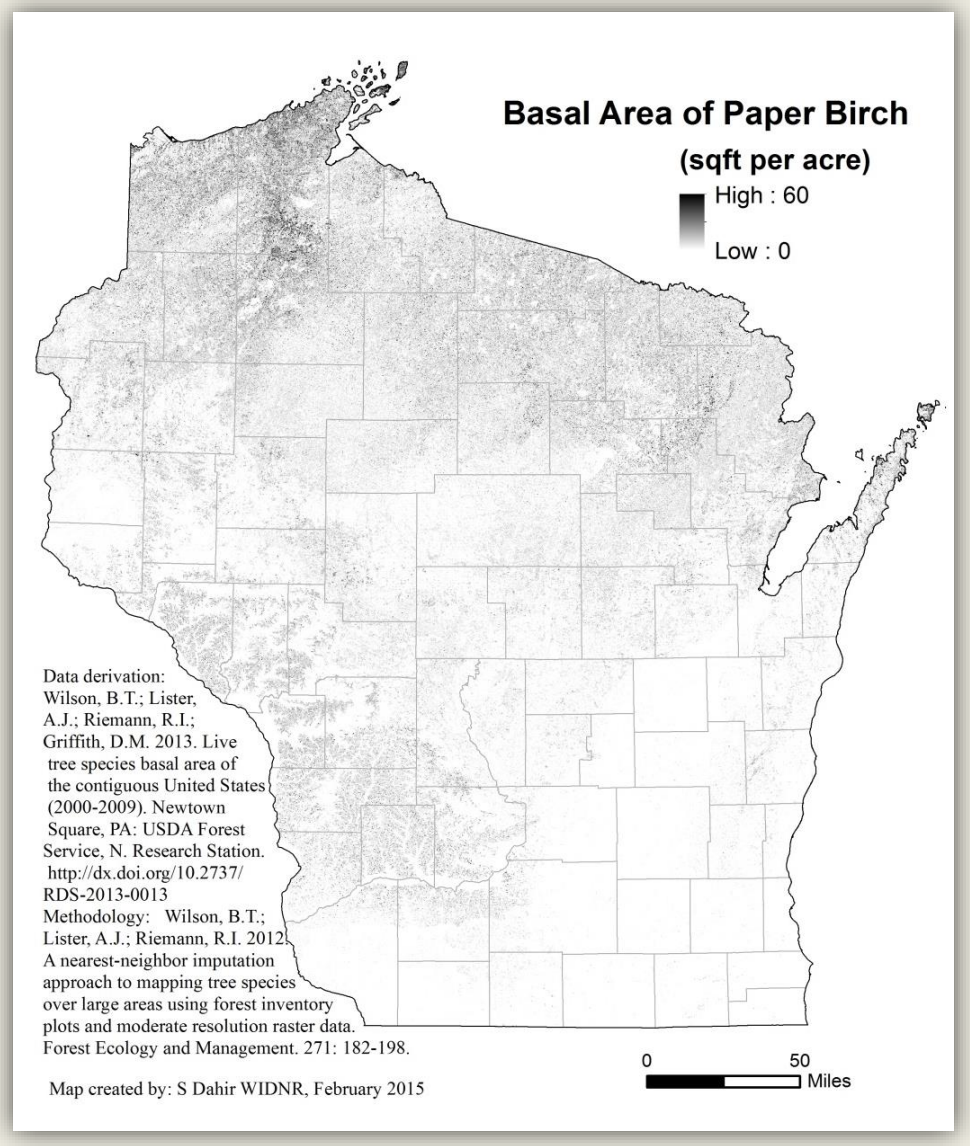
Growing stock volume (trees over 5 inches dbh) by diameter class (inches).
Source: USDA Forest Inventory and Analysis data



Percentage change in the number of live trees by size class between 1996 and 2015.
Source: USDA Forest Inventory and Analysis data: 1996 and 2015.

"Where does paper birch grow in Wisconsin?"

Growing stock volume by region with map



The largest volume of paper birch, 68%, 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 cft) by species and region of the state.

Species	Central	North east	North west	South east	South west	Total
Paper Birch	54	151	176	29	70	**481**
Percent of total	**11%**	**31%**	**37%**	**6%**	**15%**	**100%**

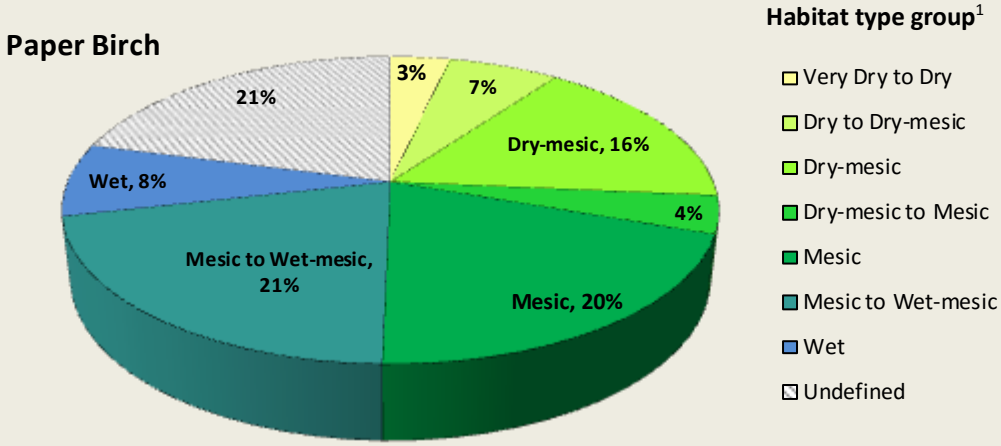
Source: USDA Forest Service, Forest Inventory and Analysis

For a table of **Volume by County** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/VolumeCountySpecies.pdf

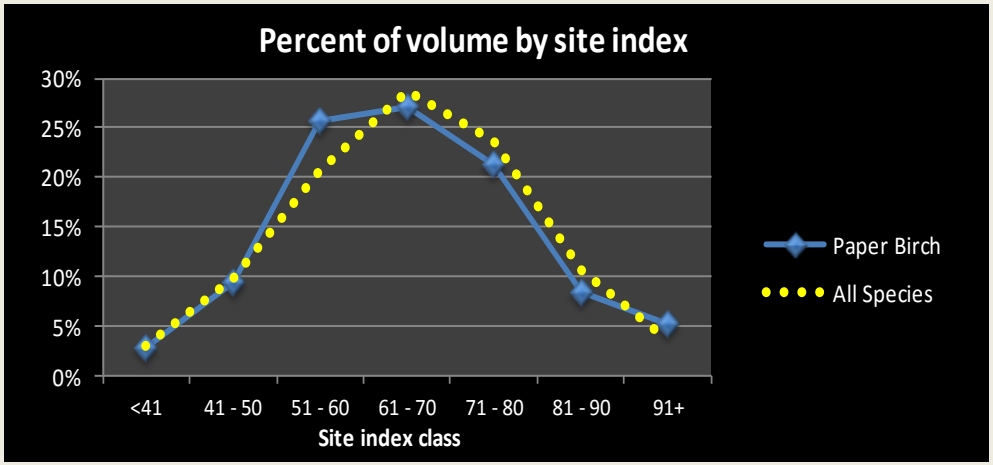
"What kind of sites does paper birch grow on?"

Habitat type[1] and site index distribution

Paper birch occurs on a wide variety of habitat types (chart below). About ¼ of volume is located on dry habitat types, another ¼ on mesic types and another 30% on mesic to wet and wet habitat types.



Percent distribution of growing stock volume by habitat type group (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 (62%) is found in stands with site indices over 60 (chart on left).

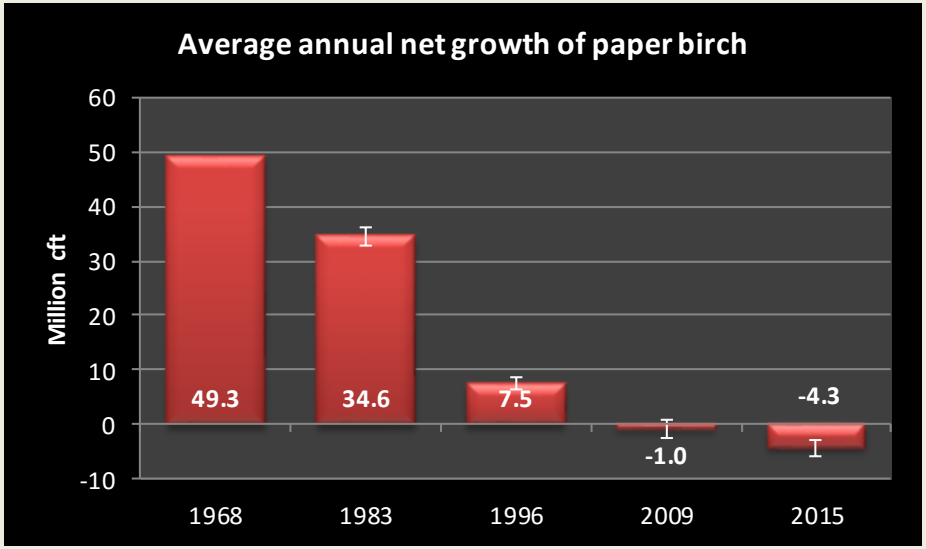
The average site index by volume for paper birch is 65.7 slightly lower than the average for all species.

[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 since 2009, indicating that mortality exceeded growth during this period. Growth decreased by 78% between 1983 and 1996.



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

Table 2. Average annual net growth (million cft/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	0.2	**0.2%**
Northwest	-3.6	**-2.1%**
Central	0.5	**0.9%**
Southwest	-0.7	**-0.9%**
Southeast	-0.8	**-2.6%**
Statewide	**-4.3**	**-0.9%**

Source: USDA Forest Inventory and Analysis

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.

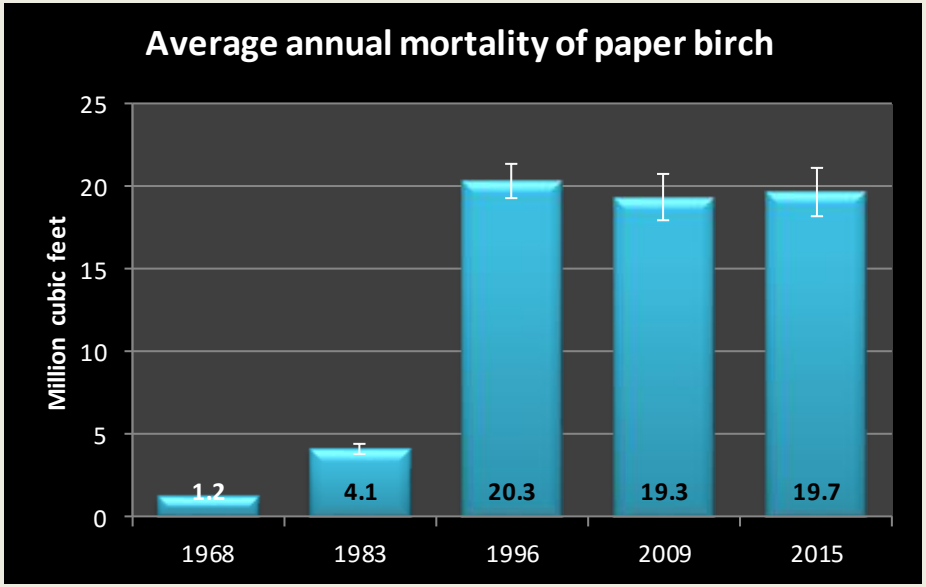
For a table of **Average annual growth, mortality and removals by region** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf

"How healthy is paper birch in Wisconsin?"

Average annual mortality and the ratio of mortality to volume

Average annual mortality of paper birch, about 19.7 million cubic feet per year, has increased over fivefold since 1983 (chart on right) but has changed little since 1996.

The ratio of mortality to volume is 4.1% 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 2.2% of total growing stock volume in the state, this species makes up over 8.4% 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 (cft)	Growing stock volume (cft)	Mortality / volume
Paper Birch	**19,700,397**	**480,657,983**	**4.1%**

Source: USDA Forest Inventory & Analysis data

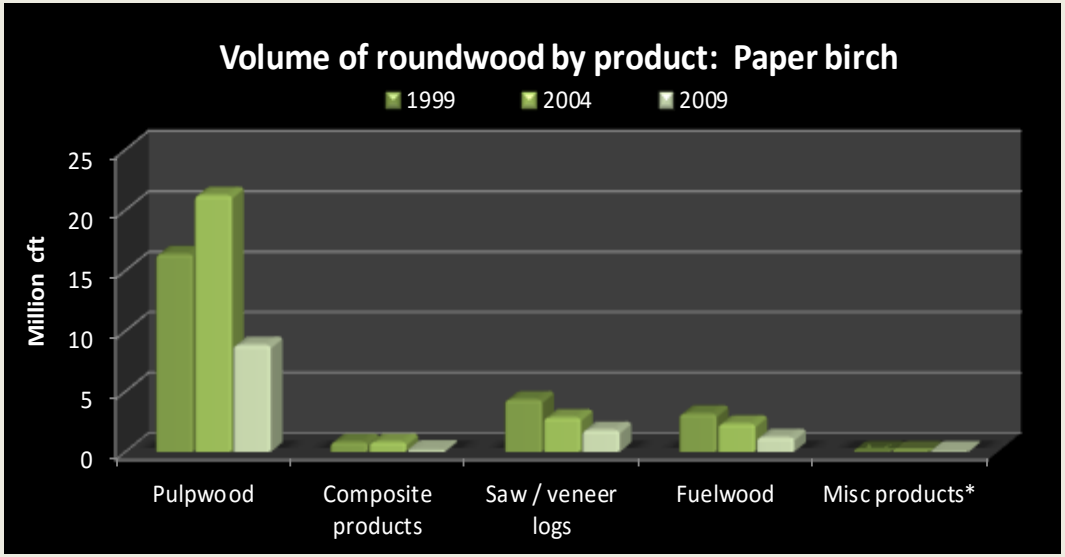
For a table of **Average annual growth, mortality and removals by region** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf

"How much paper birch do we harvest?"

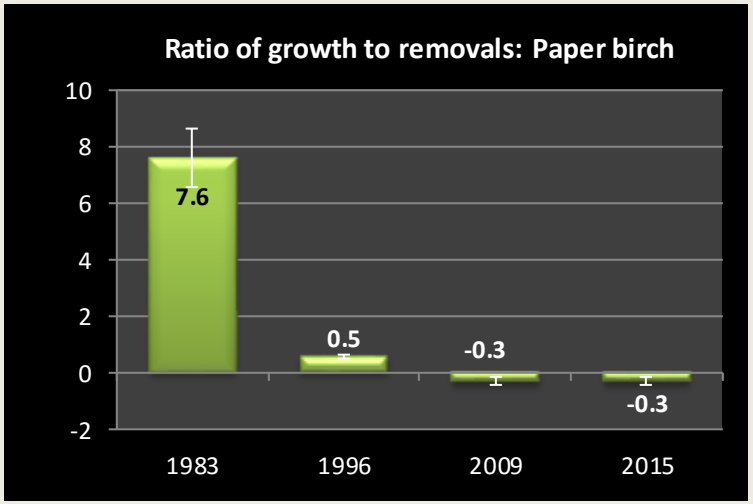
Roundwood production by product and the ratio of growth to removals

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 alone fell 45%.



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

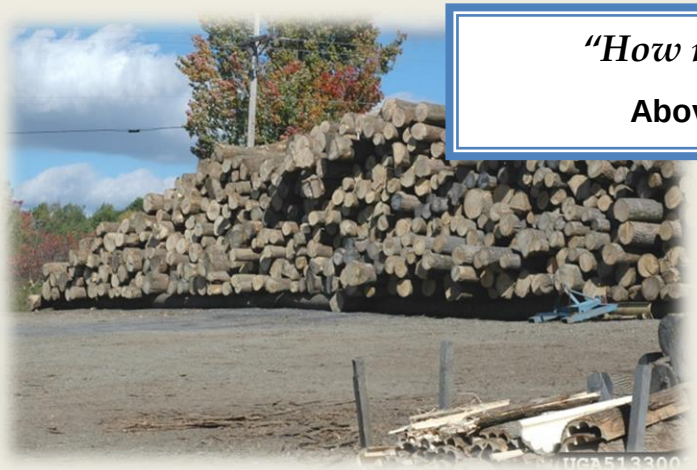


Source: USDA Forest Inventory & Analysis data

Removals of paper birch totaled 13.1 million cubic feet per year from 2010 to 2015. This is equal to 4.3% of total removals in the state.

The ratio of average annual growth to removals (chart of left) has been negative since 2009 as mortality increased and volume and growth decreased.

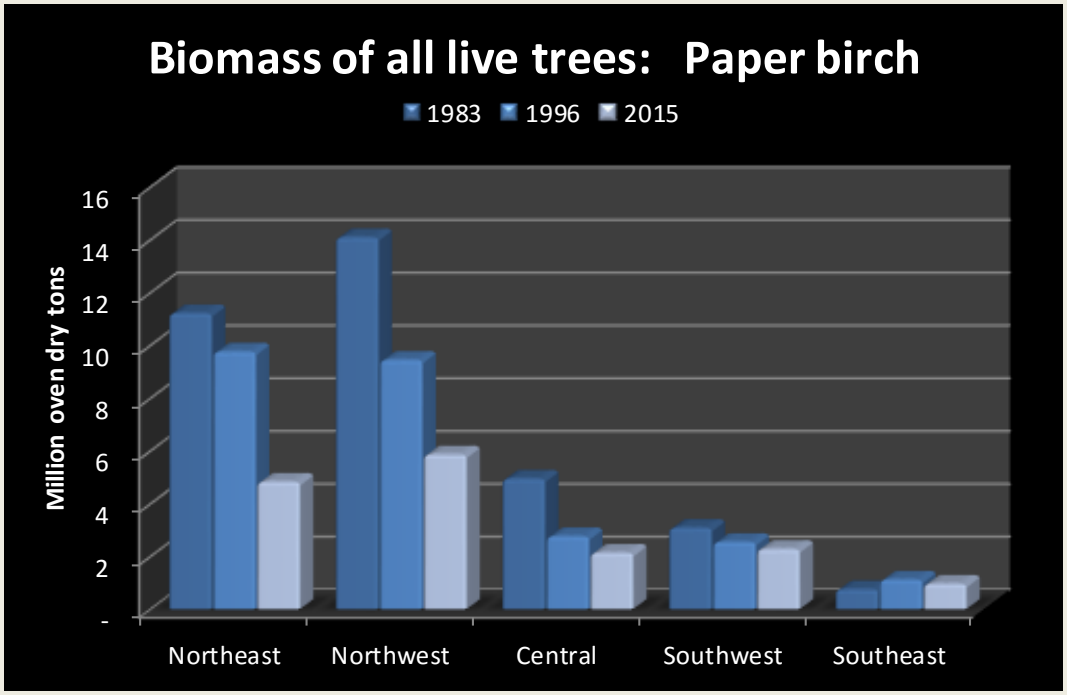
For a table of **Average annual growth, mortality and removals by region** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf



"How much paper birch biomass do we have?"

Aboveground biomass by region of the state

There are currently 16.1 million tons of aboveground biomass in live paper birch trees, a decrease of 53% from 1983. This is equivalent to approximately 8 million tons of carbon and represents 2.5% of all biomass statewide. As with volume, most paper birch is located in northern Wisconsin (chart below).



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/cft). The average for all trees is about 33 ODP/cubic feet and for hardwoods, 36 ODP/cubic feet. Approximately, 72% of all biomass is located in the main stem and 19.5% in the branches.

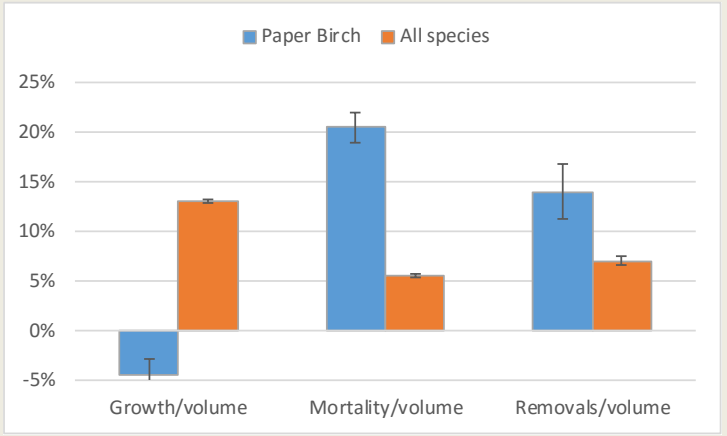
For a table of **Biomass by County** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/BiomassByCounty.pdf

"Can we predict the future of paper birch?"

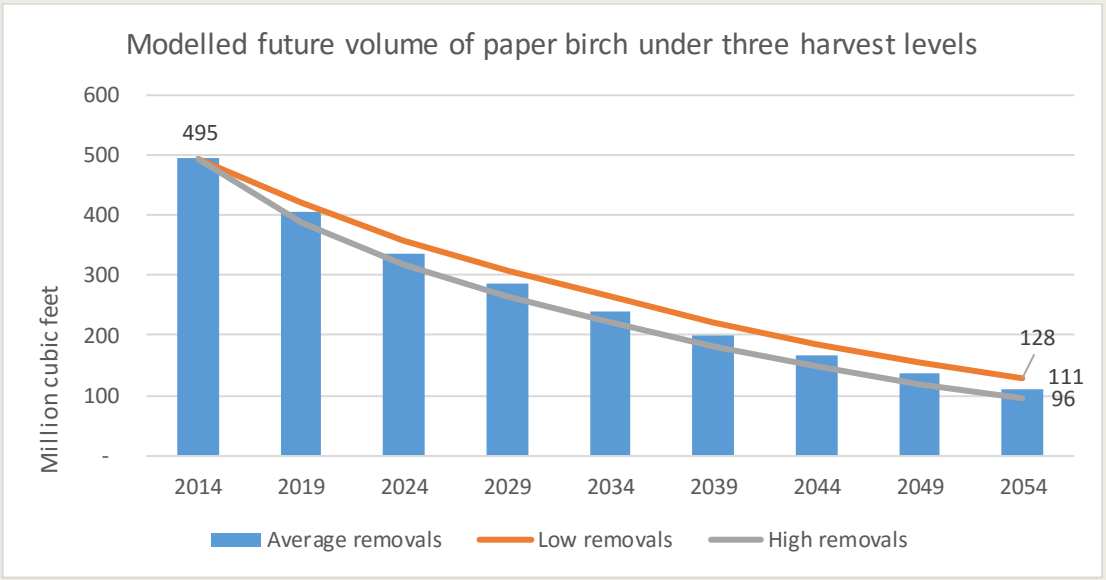
Predicted volumes based on current rates of mortality and harvest

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 (FVS[1]) 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.

The Forest Vegetation Simulator is a forest growth and yield simulation model created by the USDA Forest Service, see http://www.fs.fed.us/fmsc/fvs/.