

American basswood

Tilia americana



American basswood is a fast-growing species and an important component of the maple beech / birch forest type in Wisconsin. The volume of basswood has increased steadily since 1938. Currently, basswood accounts for 5.4% of all volume in Wisconsin, but only 3.9% of total mortality and 4.0% of growth.

Basswood makes up 4.6% of growing stock removals and 3.1% of roundwood production. Currently, we harvest about half of total growth. The density of basswood is one of the lowest of all commercial species which makes it less desirable for biofuel production.

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

"How has the basswood resource changed?"

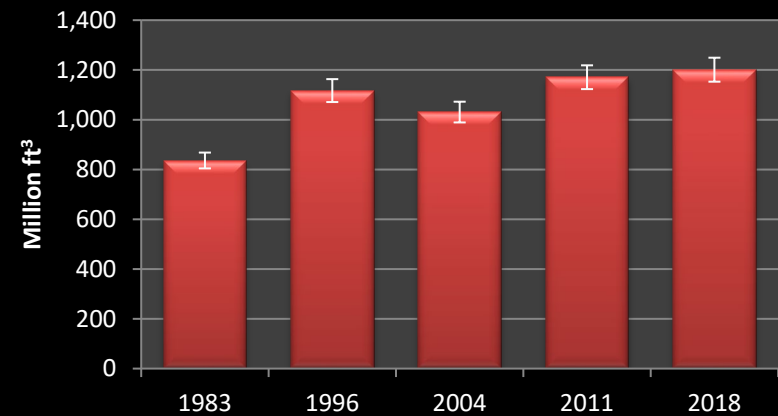
Growing stock volume and diameter class distribution

The [growing stock volume](#) of American basswood in 2016 was about 1.2 billion cubic feet or 5.4% of total statewide volume (chart on right). Volume has continued to increase for decades as pioneer species like aspen were replaced by more shade tolerant species like American basswood. Volume has increased 44% since 1983 and 8% since 1996.

The basswood resource has aged since 1983. For instance, the volume in large trees (over 13 inches in diameter) has more than doubled in this time (chart on left below).

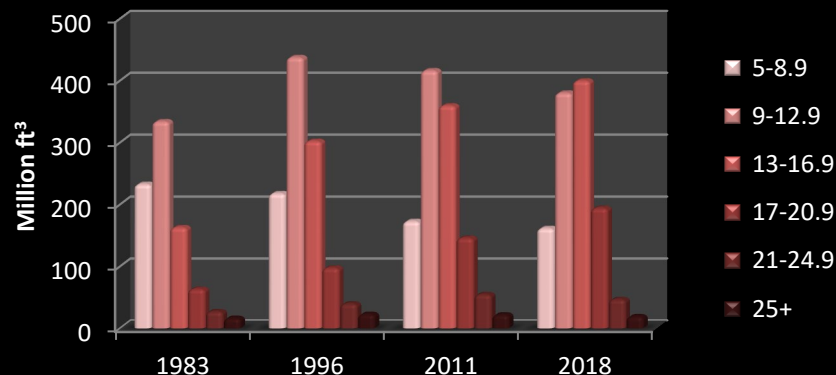
Since 2004 the number of [saplings](#) and [poles](#) has decreased (chart on right below) while the number of sawtimber trees has increased, suggesting a possible decrease in future populations of basswood.

Growing stock volume of basswood



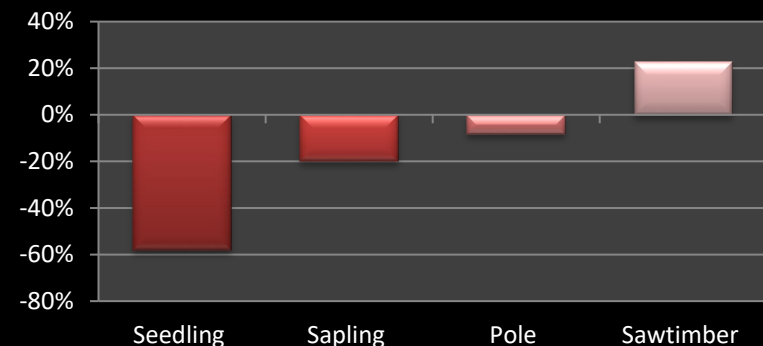
Growing stock volume (million cubic feet) by inventory year.
Source: USDA Forest Inventory and Analysis data.

Volume of basswood by diameter class



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

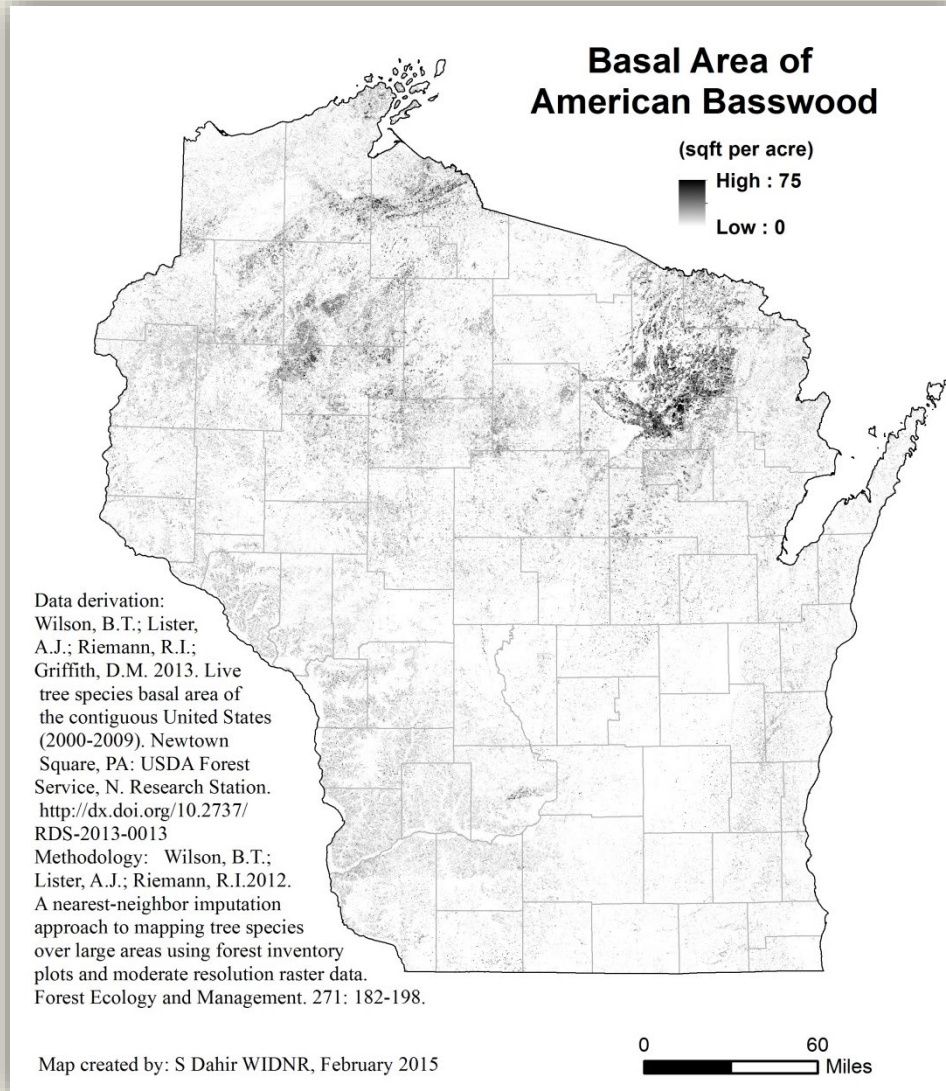
Percentage change in tree numbers: Basswood



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 is basswood found in Wisconsin?"

Growing stock volume by region with map



About 65% of all basswood volume is located in northern Wisconsin with another one quarter in the central and southwest parts of the state.

66% of basswood is found in the maple / beech / birch forest type and 27% is found in the oak / hickory type.

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

Species	Central	North east	North west	South east	South west	Total
Basswood	127	394	387	109	185	1,201
% of total	11%	33%	32%	9%	15%	100%

Source: USDA Forest Service, Forest Inventory and Analysis 2018

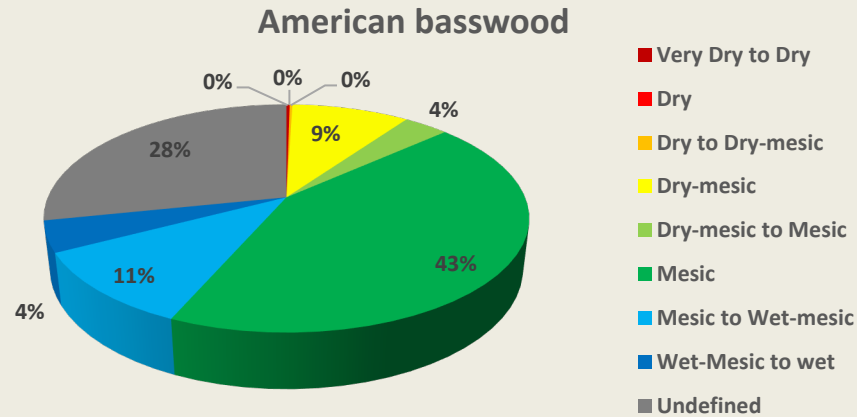
For a table of **Volume by County** go to:

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

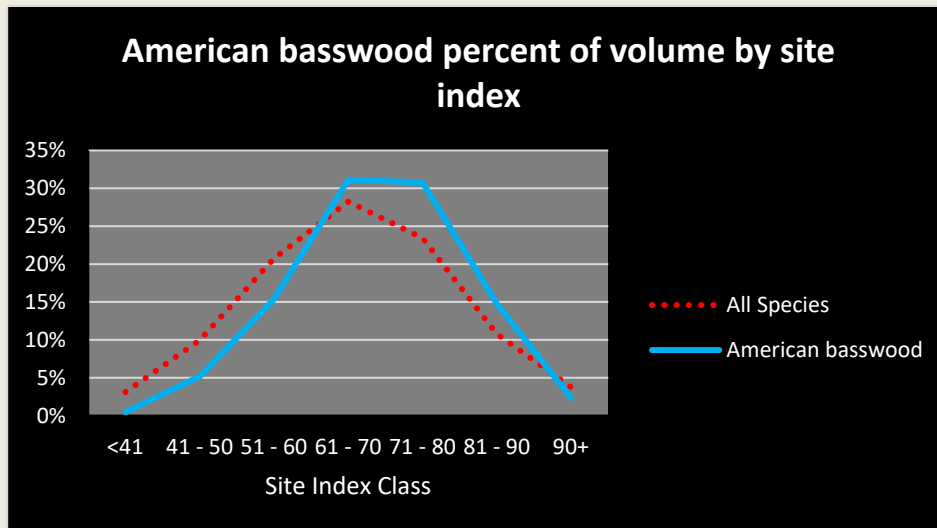
"What kind of sites does basswood grow on?"

Habitat type and site index distribution

The majority of basswood volume occurs on mesic and wetter habitat types. Only about 10% of volume occurs on dry or dry-mesic sites.



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 basswood volume occurs on richer sites.

Almost 80% is in stands with site indices over 60. As stated, basswood occurs mainly on the maple / beech / birch forest type which is more prevalent on higher site indices.

The average site index by volume for basswood is 69 compared to 66 for all species.



"How fast is basswood growing?"

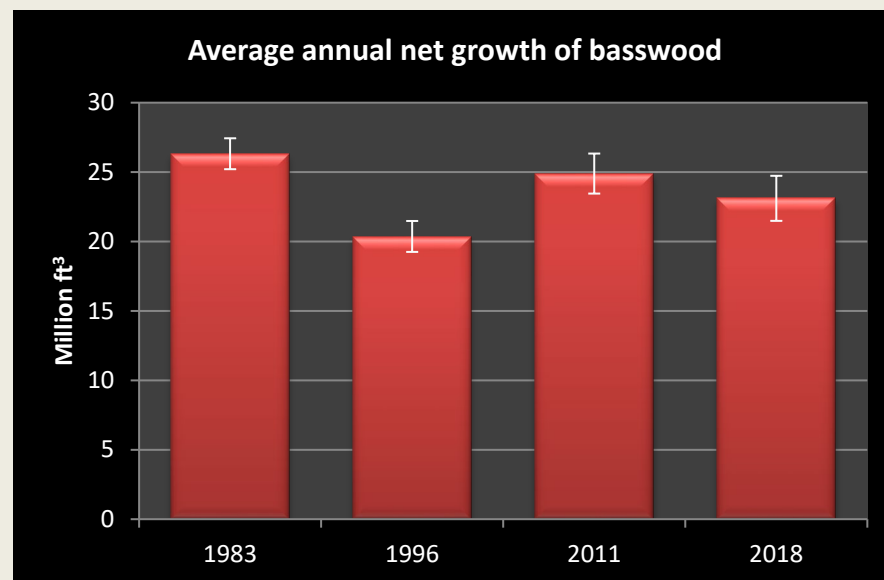
Average annual net growth: trends and ratio of growth to volume

Average annual net growth, about 23.1 million cubic feet per year from 2012 to 2018, accounts for 4.0% of total statewide growth (chart on right). The growth rate has increased by 13.5% since 1996.

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

Region	Net growth	Percent of total	Ratio of growth to volume
Northeast	7.2	31%	1.8%
Northwest	7.2	31%	1.9%
Central	2.6	11%	2.0%
Southwest	3.6	16%	2.0%
Southeast	2.5	11%	2.3%
Statewide	23.1	100%	1.9%

Source: USDA Forest Inventory and Analysis



Average annual net growth (million cubic feet).

Source: USDA Forest Inventory & Analysis data

The highest volume growth for basswood is in the northern part of the state but the highest rates of growth to volume are in southern and central Wisconsin.

The average ratio of net growth to volume for basswood is 1.9%, lower than the statewide average of 2.6% for all species.

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

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

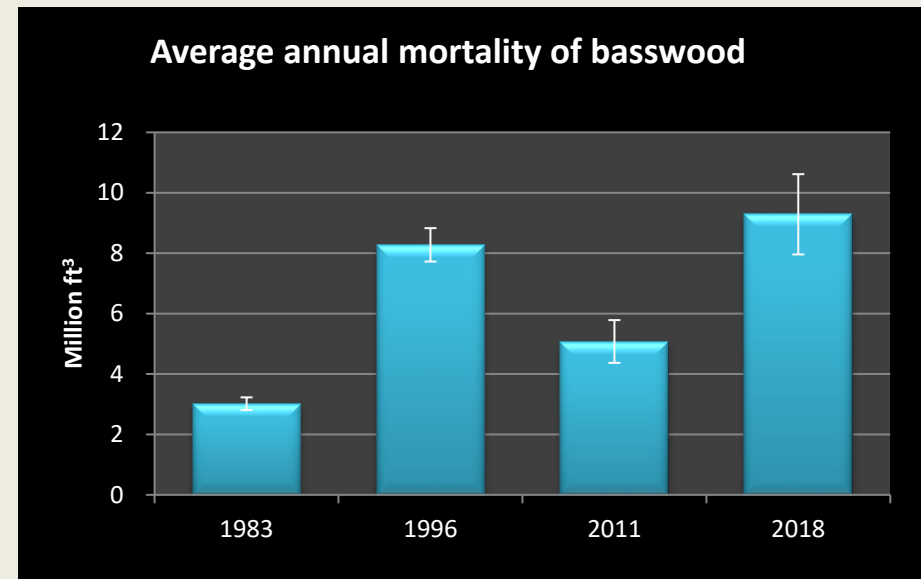


"How healthy is basswood in Wisconsin?"

Average annual mortality: trends and ratio of mortality to growth

Average annual mortality of basswood from 2012 to 2018 was about 9.3 million cubic feet, or 3.9% of statewide mortality (chart on right). Mortality has nearly doubled since 2011.

The ratio of mortality to volume is about 0.8% for basswood. This is lower than the average for all species in Wisconsin which is 1.1%.



Average annual mortality (million cubic feet) by inventory year. Bars represent the 67% confidence interval. Source: USDA Forest Inventory & Analysis data

Mortality, volume and the ratio of mortality to volume.

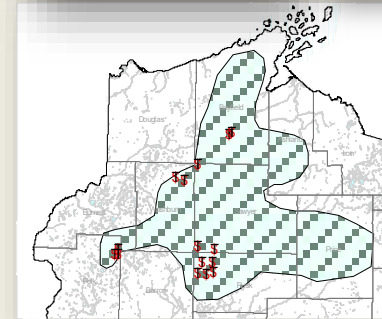
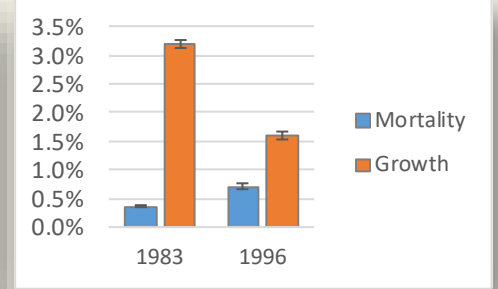
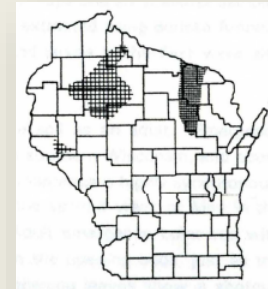
Species	Average annual mortality (ft ³)	Volume of growing stock (ft ³)	Ratio of mortality to volume
American Basswood	9,286,561	1,201,058,251	0.8%

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

“Does basswood have any major disease or pest issues?”
Introduced basswood thrips: biology, symptoms and impact

The introduced basswood thrips, *Thrips calcaratus*, is a defoliator of American basswood in the Lake States. First observed in Wisconsin in 1980, basswood stands experienced significant defoliation in the 1980s and 1990s. From 1983 to 1990, about 1.1 million acres were defoliated in northern Wisconsin (figure upper left). Between 1983 and 1996, basswood mortality doubled and growth rates decreased by half (upper right). Radial growth can be severely reduced by heavy defoliation which predisposes trees to mortality from secondary causes.

Defoliation events due to basswood thrips have dramatically decreased since 2000. 8,000 acres of defoliation were reported in northern Wisconsin in 2004 and 7,000 acres in 2010 (figure lower left), resulting in increased crown dieback in both 2005 and 2011 (lower right). The reason for reduced thrips outbreaks is unknown, but may be related to natural enemies and environmental conditions.



Upper left. Map of thrips defoliation in 1988. Upper right. Mortality and growth rate of basswood in northern Wisconsin between 1983 and 1996.
 Lower left. Map of defoliation by introduced basswood thrips in 2010. Lower right. Percentage of basswood trees with crown dieback over 10% in northern Wisconsin.



Upper left. Feeding damage in new leaves. Upper right. Feeding damage in expanded leaves. Lower left. Adult female. Lower right. Defoliated trees.

Damage to basswood from the basswood thrips is characterized by a stunted, shredded appearance of expanding leaves in early spring (image upper left). On fully expanded leaves, feeding damage appears as a silvering of the leaf cuticle (upper right).

Adult females (lower left) emerge from overwintering sites in the soil in early spring, feed on the newly opened leaves, and lay eggs in the veins of expanding leaves. Larvae appear in late spring and feed on leaf tissue throughout their development. Fully developed larvae drop from the foliage, move into the litter and soil, and pupate. Adults emerge from pupae later in the summer, move into the soil, and diapause until the following spring.



"How much basswood do we harvest?"

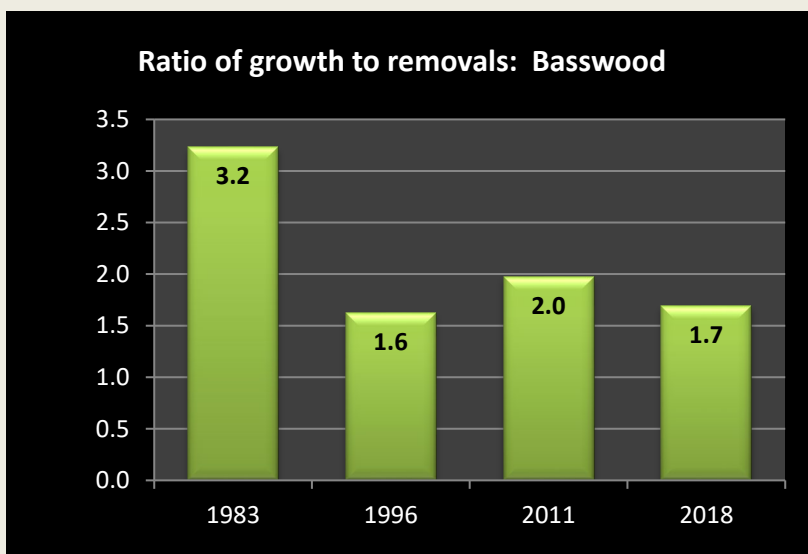
Roundwood production by product and ratio of removals to growth

In 2013, Wisconsin produced about 9.9 million cubic feet of basswood roundwood, or about 3.1% of the total statewide (chart on right). Composite products and sawlogs and veneer accounted for over 80%.

Basswood composite products made up 11.1% of statewide production and sawlogs and veneer accounted for 4.1%.



Volume of roundwood. * 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 basswood totaled 13.6 million cubic feet per year from 2012 to 2018. Basswood accounts for 5.4% of growing stock volume but only 4.6% of removals.

The ratio of average annual net growth to removals is 1.7 for basswood, slightly lower than the statewide average ratio of 1.9 for all species (chart on left).

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

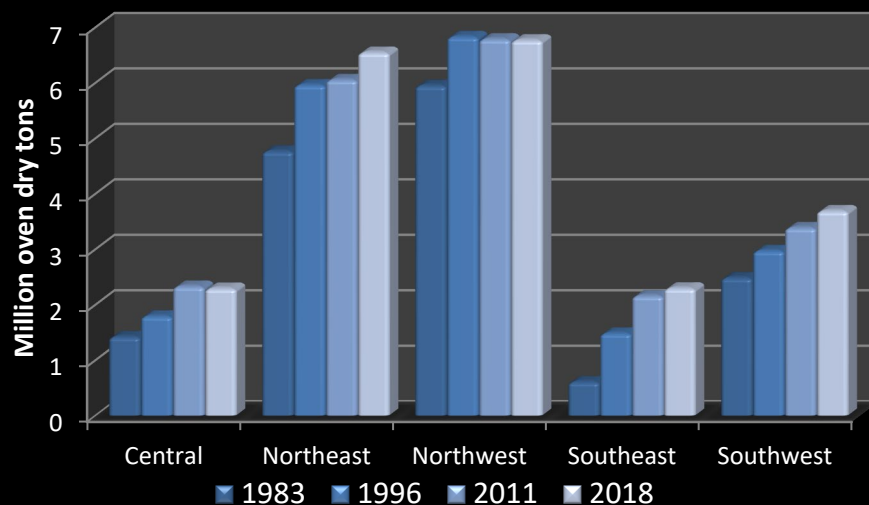


"How much basswood biomass do we have?"

Tons of aboveground biomass by region of the state

There were 21.6 million short tons of aboveground [biomass](#) in live basswood trees in 2018, up from about 15.2 million tons in 1983, an increase of 42%. This is equivalent to approximately 10.8 million tons of carbon and represents 3.3% of all aboveground biomass statewide. As with volume, most basswood is located in northern Wisconsin (chart below).

Biomass of all live trees: Basswood



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

Basswood has one of the lowest densities of any of the commercial species in Wisconsin, with a specific gravity of 0.37 and an average oven-dry weight of 23 pounds per cubic foot. The average specific gravity for all hardwoods is about 0.56 with an average weight of 34 lbs/cft. Approximately 72% of all biomass is located in the bole, 6% in saplings, 3% in stumps, and 19% in tops and limbs.

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

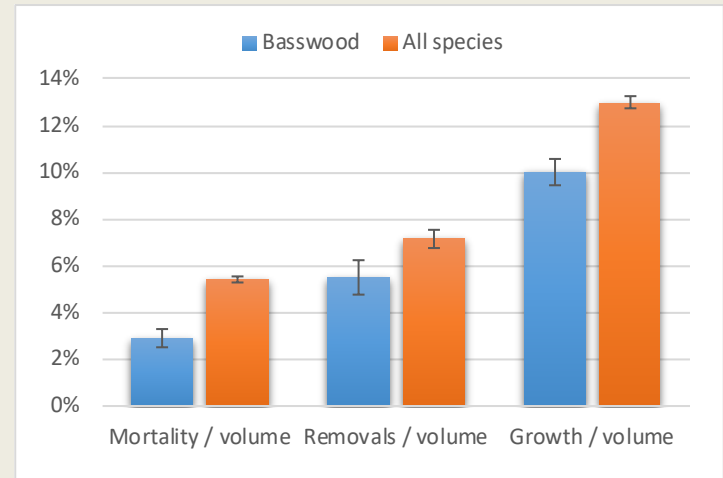
<http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/BiomassByCounty.pdf>

"Can we predict the future of basswood?"

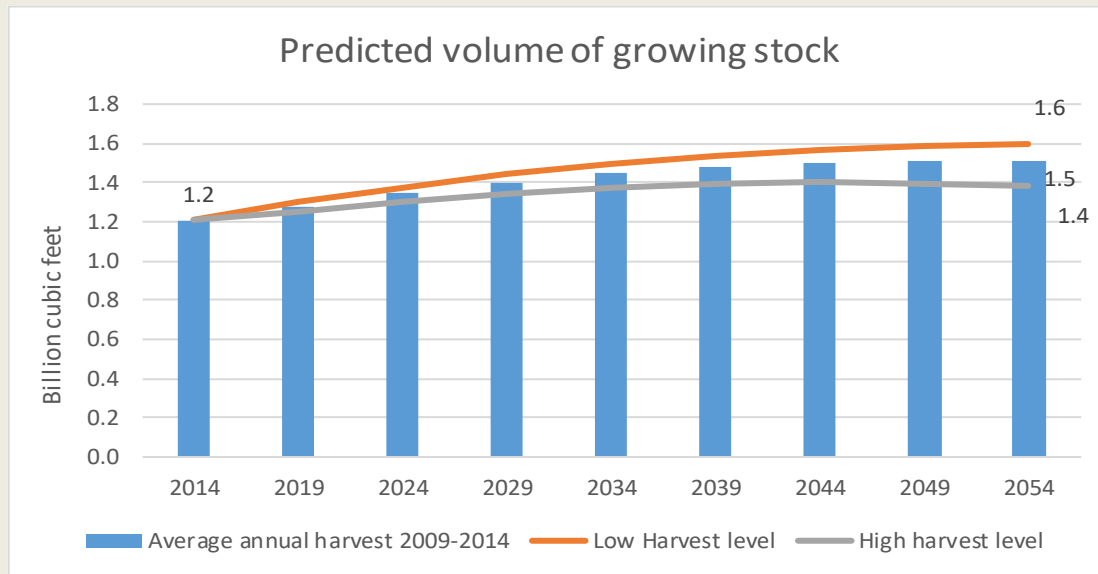
Predicted volumes based on current rates of mortality and harvest

The 5-year ratios of mortality to volume, removals to volume and growth to volume are significantly lower for basswood compared to all species in the state (chart on right).

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



Volume increases in all three scenarios, 25% by 2054 for current removal levels, 32% for low removals and 15% for high removals. Volume peaks in 2049 using current levels of harvest, never peaks for low harvest levels and peaks in 2044 for high levels of harvest.