

Sugar maple

Acer saccharum

Sugar maple is a slow-growing, shade-tolerant species with more volume than any other tree species in Wisconsin. The volume of sugar maple has increased steadily since the middle of the twentieth century. It is the most important species making up the maple-basswood forest type of northern Wisconsin.

Ratios of growth to volume, mortality to volume and removals to volume are lower for sugar maple than the statewide average for all species. Sugar maple accounts for about 11% of all volume of trees in Wisconsin, but only 3% of total mortality.

Sugar maple is an important timber species, accounting for 13% of roundwood production. Because of the high density of its wood and the large volume in the state, sugar maple may be a valuable species for woody biomass production.



UGA1480023



UGA0008109



UGA0008380



UGA0008228

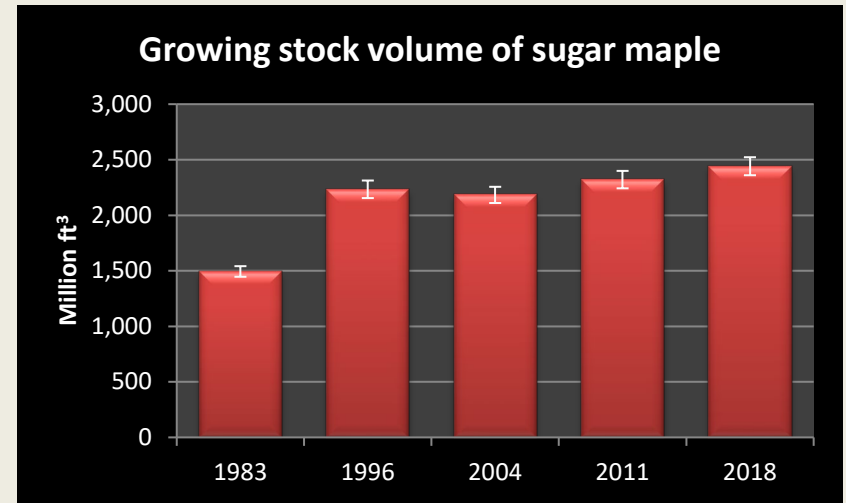
- [*How has the sugar maple resource changed?*](#)
Volume and diameter class distribution:
- [*Where is sugar maple found in Wisconsin?*](#)
Growing stock volume by region with map
- [*What kind of sites does sugar maple grow on?*](#)
Habitat type and site index distribution
- [*How fast is sugar maple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

“How has the sugar maple resource changed?”
Growing stock volume and diameter class distribution by year

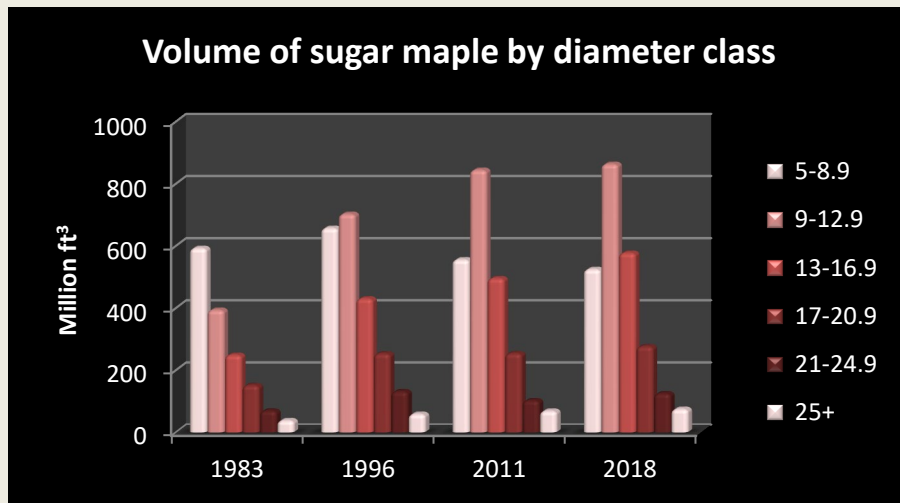
Sugar maple has the highest [growing stock volume](#) of any species in Wisconsin, 2.4 billion cubic feet or 11% of the state total (chart on right). Volume has risen steadily, increasing 63% since 1983 but only 9% since 1996.

Sugar maple has matured since 1983 with a greater increase in the volume of large sawtimber compared to smaller trees (chart lower left). Volume in large trees (13+ inches dbh) has more than doubled since 1983.

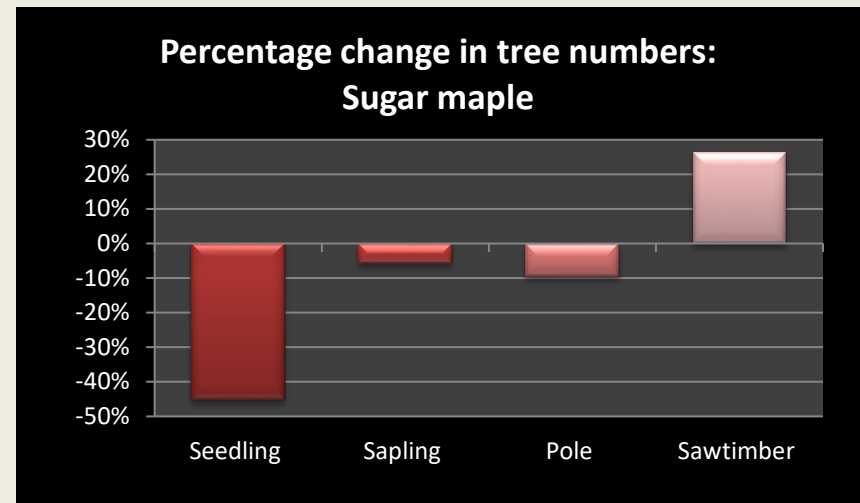
The number of [sawtimber](#) trees has increased 26% since 2004 but the numbers of [saplings](#) and [poles](#) have decreased (chart lower right).



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



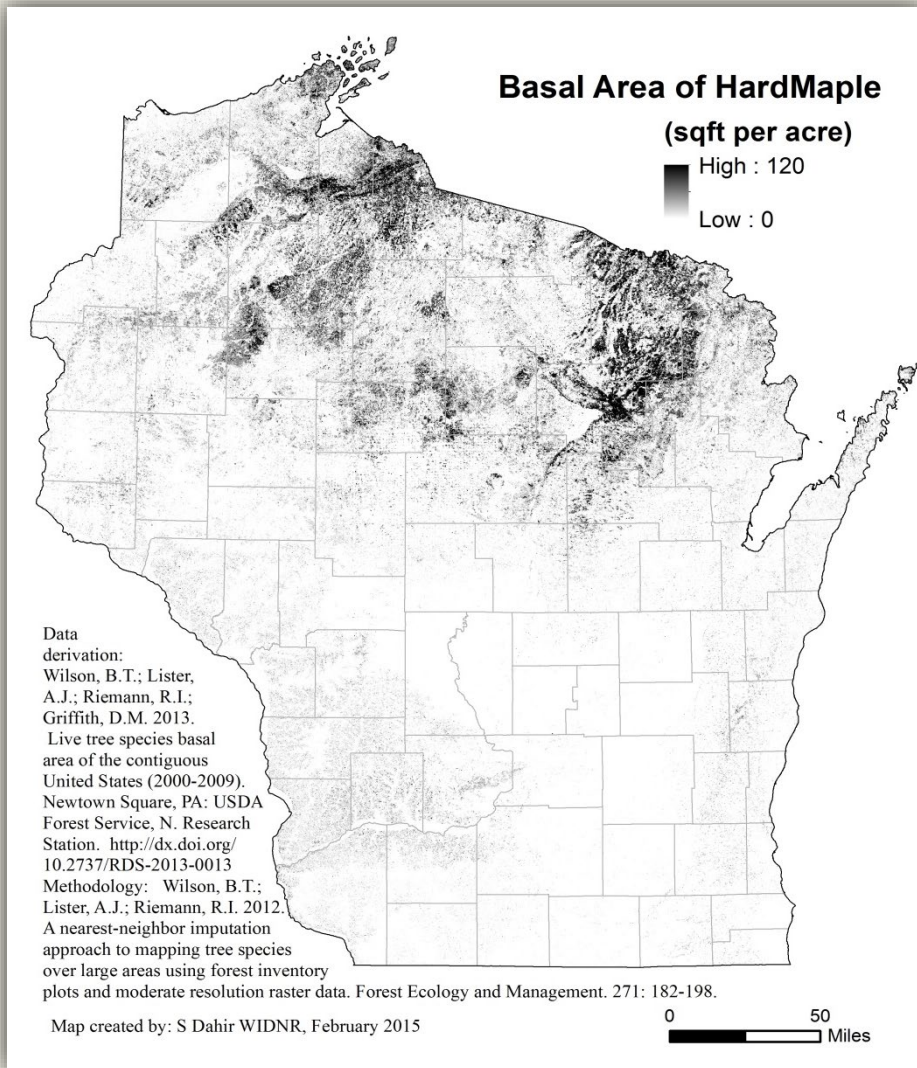
Growing stock volume (million cubic feet) by diameter class (inches).
 Source: USDA Forest Inventory and Analysis data



Percentage change in the number of live trees by size class between 1996 and 2015.
 Source: USDA Forest Inventory and Analysis data 2004 and 2018.

"Where is sugar maple found in Wisconsin?"

Growing stock volume by region with map



About 81% of sugar maple volume is located in northern Wisconsin with another 13% in the south (Table 1). It is a major component of the maple / beech / birch [forest type](#) and a minor component of oak / hickory and aspen / birch types.

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 |
|-------------------------|-----------|------------|------------|------------|------------|--------------|
| Sugar Maple | 171 | 1,120 | 850 | 111 | 190 | 2,441 |
| Percent of total | 7% | 46% | 35% | 5% | 8% | 100% |

Source: USDA Forest Service, Forest Inventory and Analysis

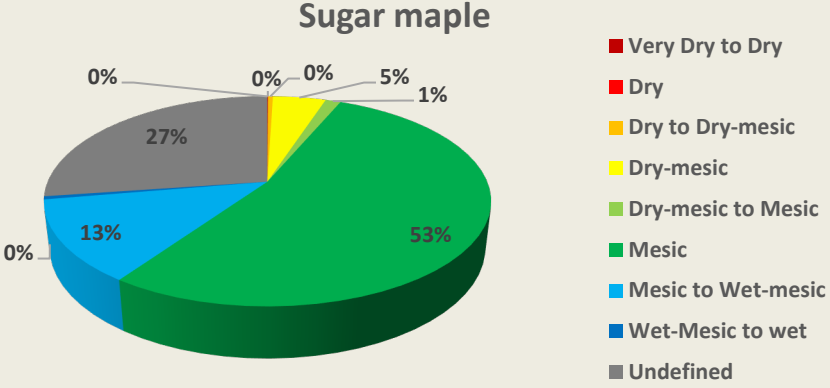
For a table on **Volume by County** go to:

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

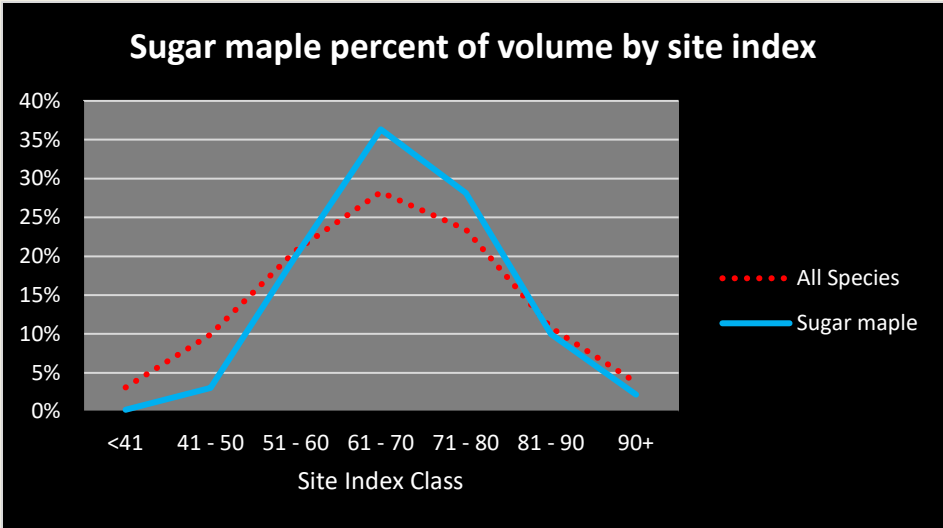


“What kind of sites does sugar maple grow on?”
Habitat type¹ and site index distribution

The majority of sugar maple growing stock volume is found on mesic habitat types with slightly wetter types (chart below) being the next most common. Sugar maple isn't very common on drier sites.



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



Almost two thirds of sugar maple growing stock volume is found in stands with site indices between 60 and 80 (chart on left). Over 75% of volume is located on sites with site index greater than 60.

The average site index by volume for sugar maple is 68 slightly higher than the average for all species, 66. There is much less volume on sites with indices below 51, 3% compared to 13% on average. Sugar maple is restricted to richer sites in general.

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

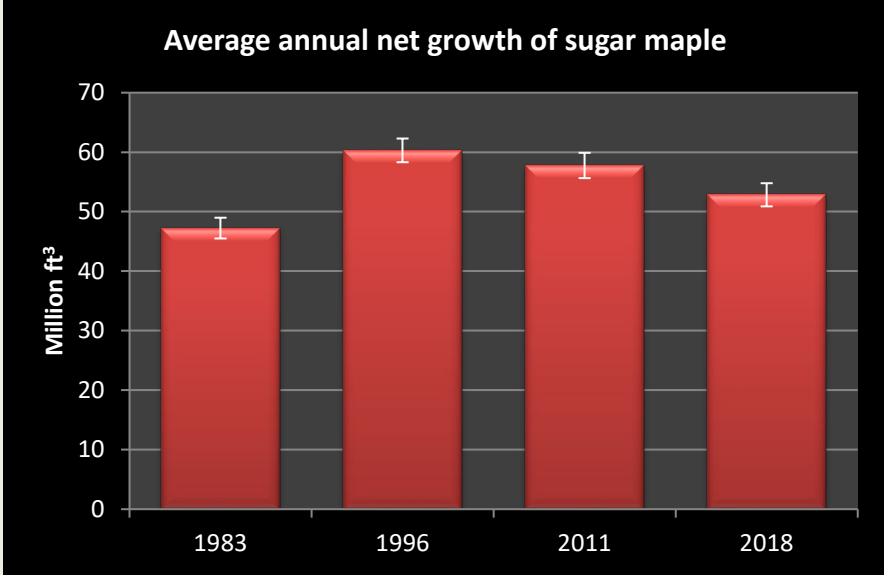
¹ For more information on habitat types see Schmidt, Thomas L. 1997. Wisconsin forest statistics, 1996. Resource Bulletin NC-183. St. Paul, MN: U.S. Dept. of Agriculture, Forest Service, North Central



“How fast is sugar maple growing?”

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

The [average annual net growth rate](#) of sugar maple was about 52.8 million cubic feet/year between 2012 and 2018, or 9.2% of total volume growth in the state (chart on right). Growth has increased 12% since 1983 but decreased 12% since 1996.



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

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 | Percent of Total | Ratio of growth to volume |
|------------------|-------------|------------------|---------------------------|
| Northeast | 21.9 | 41% | 2.0% |
| Northwest | 18.2 | 34% | 2.1% |
| Central | 4.8 | 9% | 2.8% |
| Southwest | 5.3 | 10% | 2.8% |
| Southeast | 2.7 | 5% | 2.4% |
| Statewide | 52.8 | 100% | 2.2% |

Source: USDA Forest Inventory and Analysis

Although northern Wisconsin has the highest percentage of volume growth in sugar maple, the ratio of growth to volume is highest in the central and southwest (Table 2). The average statewide ratio for sugar maple is 2.2%, slightly lower than the percentage for all species in the state, 2.6%. Sugar maple is a shade tolerant, slow-growing species.

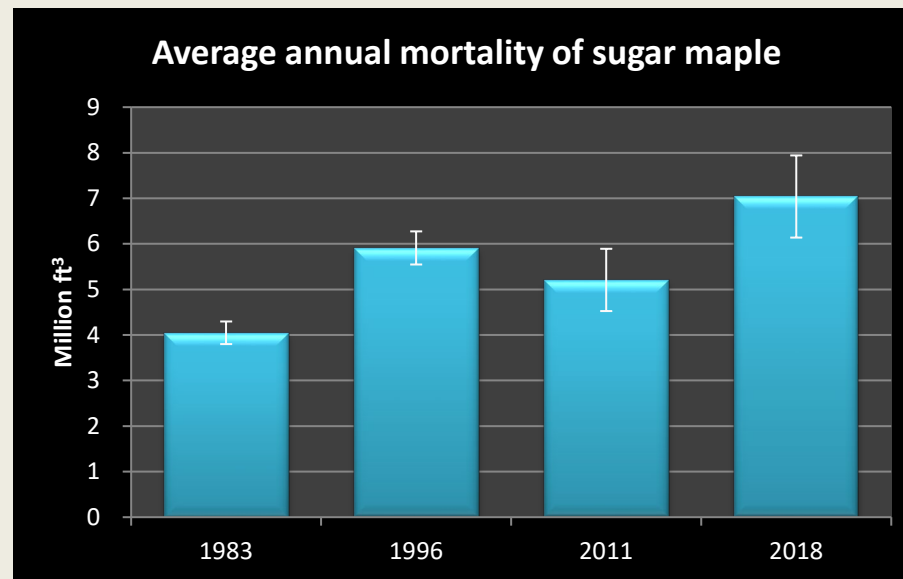
For a table of **Average annual growth, mortality and removals by region** go to:
<http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf>



“How healthy is sugar maple in Wisconsin?”
Average annual mortality: trends and ratio of mortality to volume

Average annual mortality of sugar maple, about 7.0 million cubic feet per year between 2012 and 2018, has increased 74% since 1983 (chart on right).

The ratio of mortality to volume is only 0.3% for sugar maple (Table 3). This is much lower than the statewide average of 1.1% and lower than any other major timber species except red pine and northern red oak. Whereas sugar maple accounts for 11% of total growing stock volume in the state, it makes up only 3% of total mortality.



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

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

| Species | Average annual mortality (ft ³) | Growing stock volume (ft ³) | Mortality / volume |
|-------------|---|---|--------------------|
| Sugar Maple | 7,039,180 | 2,441,408,514 | 0.3% |

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>

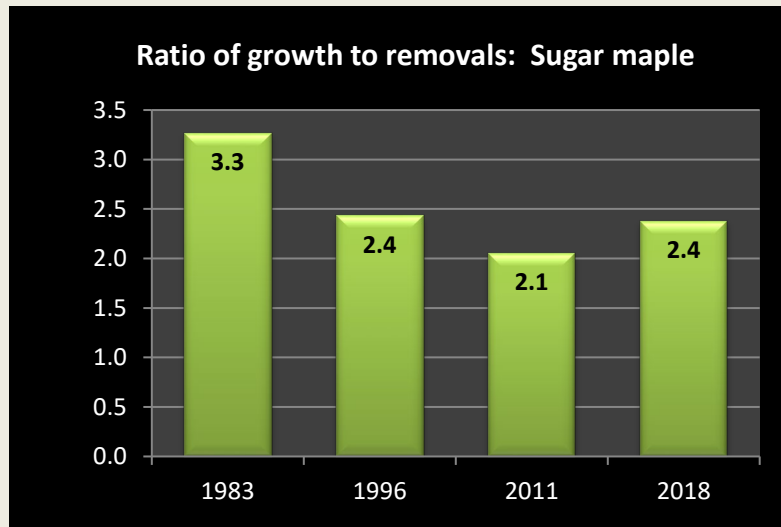


"How much sugar maple do we harvest?"

Roundwood production by product and ratio of growth to removals

Sugar maple is an important timber species in Wisconsin. In 2009-2012, the state produced about 53.3 million cubic feet of sugar maple or 14% of total [roundwood product](#) (chart on right).

In 2009-2012, 55% of sugar maple roundwood was used for pulpwood and 28% for sawlogs and veneer. Sugar maple accounted for 17.2% of all pulpwood and 18.2% of sawlog/veneer production.



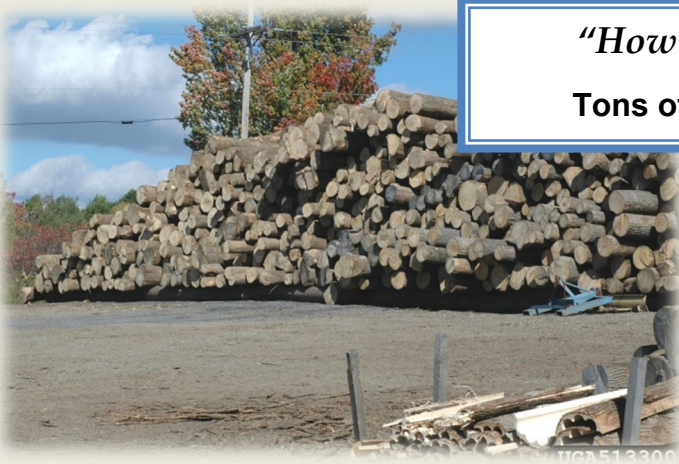
Source: USDA Forest Inventory & Analysis data

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

Removals of sugar maple totaled 22.2 million cubic feet per year from 2012 to 2018. This is equal to 7.5% of total removals in the state. Removals are 54% higher than in 1983, but 10% lower than in 1996.

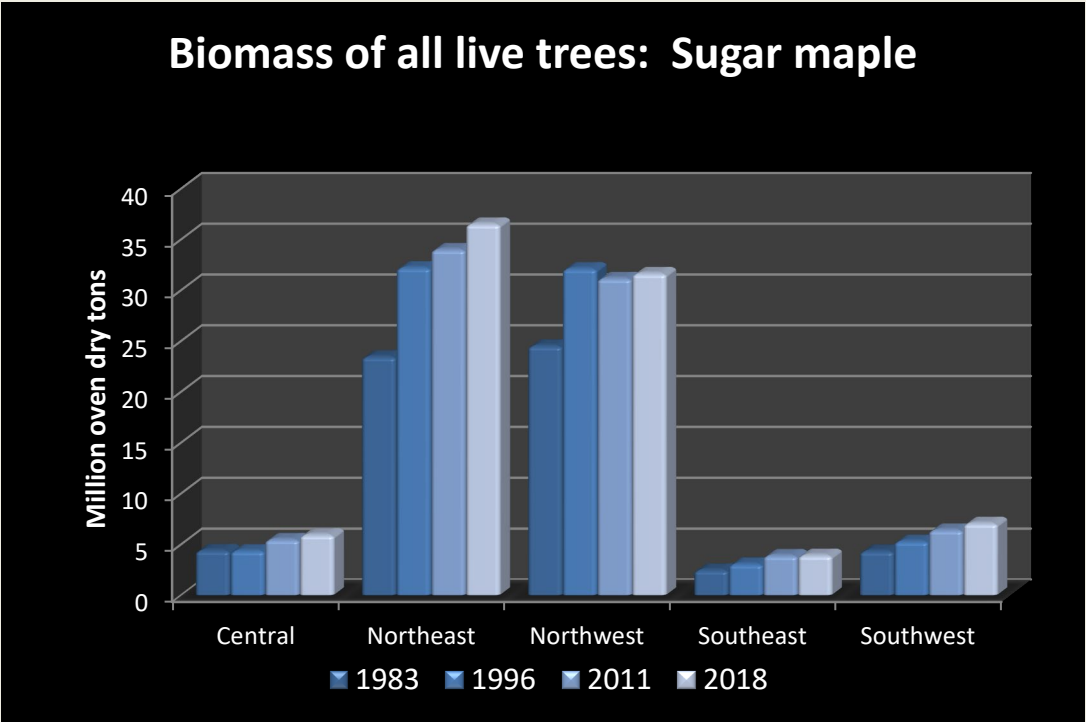
The ratio of average annual net growth to removals for sugar maple is 2.4, lower than the statewide average of 1.9 for all species. Whereas sugar maple accounts for 11.0% of growing stock volume for the state, it only makes up 7.5% of removals.

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 sugar maple biomass do we have?”
Tons of aboveground biomass by region of the state

There were 85.1 million short tons of aboveground biomass in live sugar maple trees, a 44% increase since 1983. This is equivalent to approximately 42.5 million tons of carbon and represents 13.1% of all biomass statewide. As with volume, most sugar maple is located in northern Wisconsin (chart below).



Sugar maple has a much higher density than other commercial hardwood species in Wisconsin. The specific gravity is 0.63 compared to 0.51 for all species and the oven-dry weight is 39.3 pounds per cubic foot compared to 31.4 lbs/ft³ for all species.

Approximately 69% of biomass is in the merchantable bole, 8% in saplings, 4% in stumps, and 18% in tops and limbs.

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

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 sugar maple?”

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 sugar maple compared to all species in the state (chart on right). Growth minus removals is 7% over 5 years which indicates that volume should increase significantly in the future.

The Forest Vegetation Simulator (FVS¹) was used to predict future volumes 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.

Volume increases in all three scenarios, 37% by 2054 for current removal levels, 44% for low removals and 30% for high removals.

Volume continues to increase for all three scenarios through 2054.