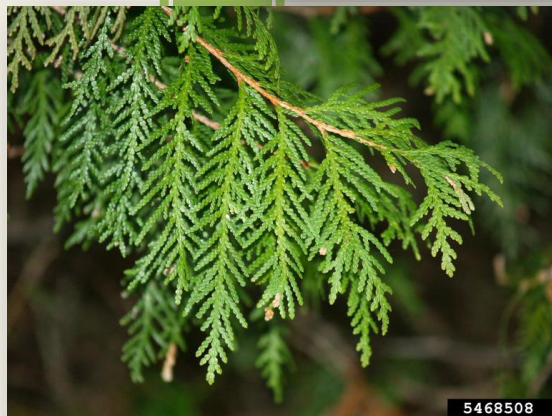


Northern white-cedar

Thuja occidentalis



Northern white-cedar is a slow-growing species found mainly on wetter sites in northern Wisconsin. The volume of white-cedar has increased 50% since 1983. This species is maturing with an increase in the number of sawtimber trees and a decrease in the number of saplings and poles. Mortality and removal rates are relatively low for this species and volumes are predicted to increase in the next 40 years.

Northern white-cedar is not an important timber species, accounting for only 0.1% of roundwood production. Currently, we harvest only 6% of total growth. The density of northern white-cedar wood is the lowest of all tree species which makes it less desirable for biofuel production.

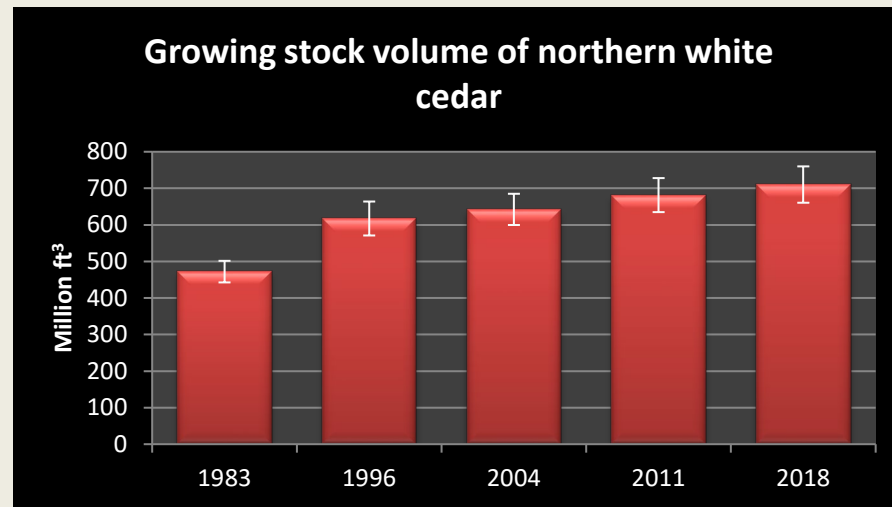
- [How has the northern white-cedar resource changed?](#)
Volume and diameter class distribution:
- [Where is northern white-cedar found in Wisconsin?](#)
Growing stock volume by region with map
- [What kind of sites does northern white-cedar grow on?](#)
Habitat type and site index distribution
- [How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

“How has the northern white-cedar resource changed?”
Growing stock volume and diameter class distribution

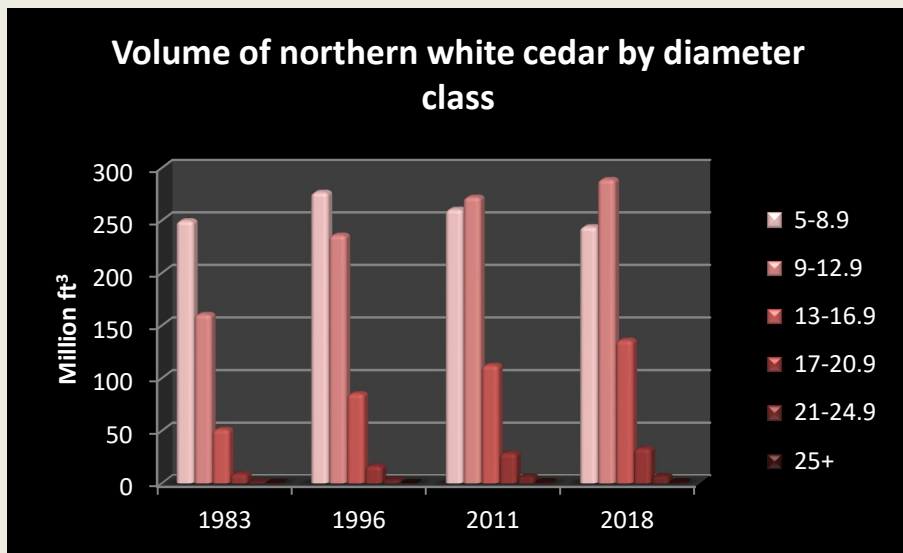
The [growing stock volume](#) of northern white-cedar in 2018 was about 710 million cubic feet or 3.2% of total statewide volume (chart on right). Volume has risen steadily, increasing 50% since 1983.

The northern white-cedar resource has aged. For instance, the volume in small trees (5-12.9 inches in diameter) has increased 30% whereas the volume in large trees (13+ inches) has nearly tripled since 1983 (chart below left).

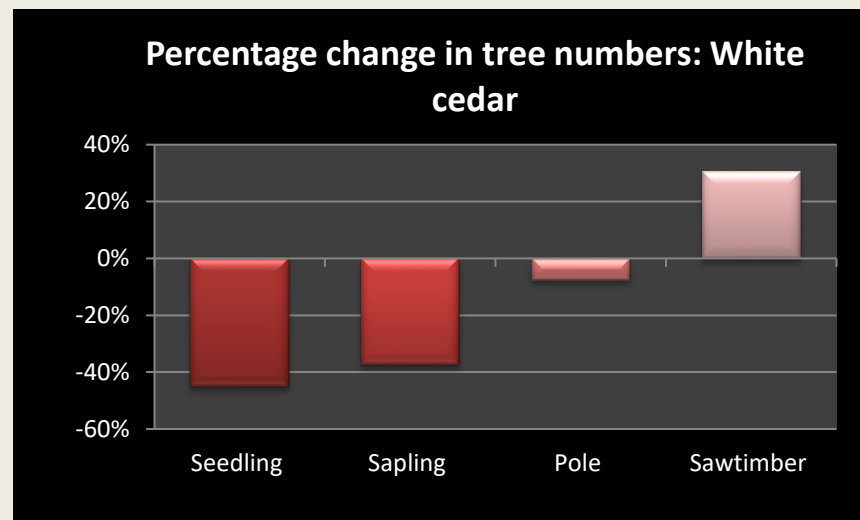
This aging is also reflected in the number of trees by size class (chart below right). The number of [sawtimber-sized](#) trees has increased significantly since 2004 while the number of seedlings, saplings and poles has decreased. This may suggest a decrease in future populations.



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



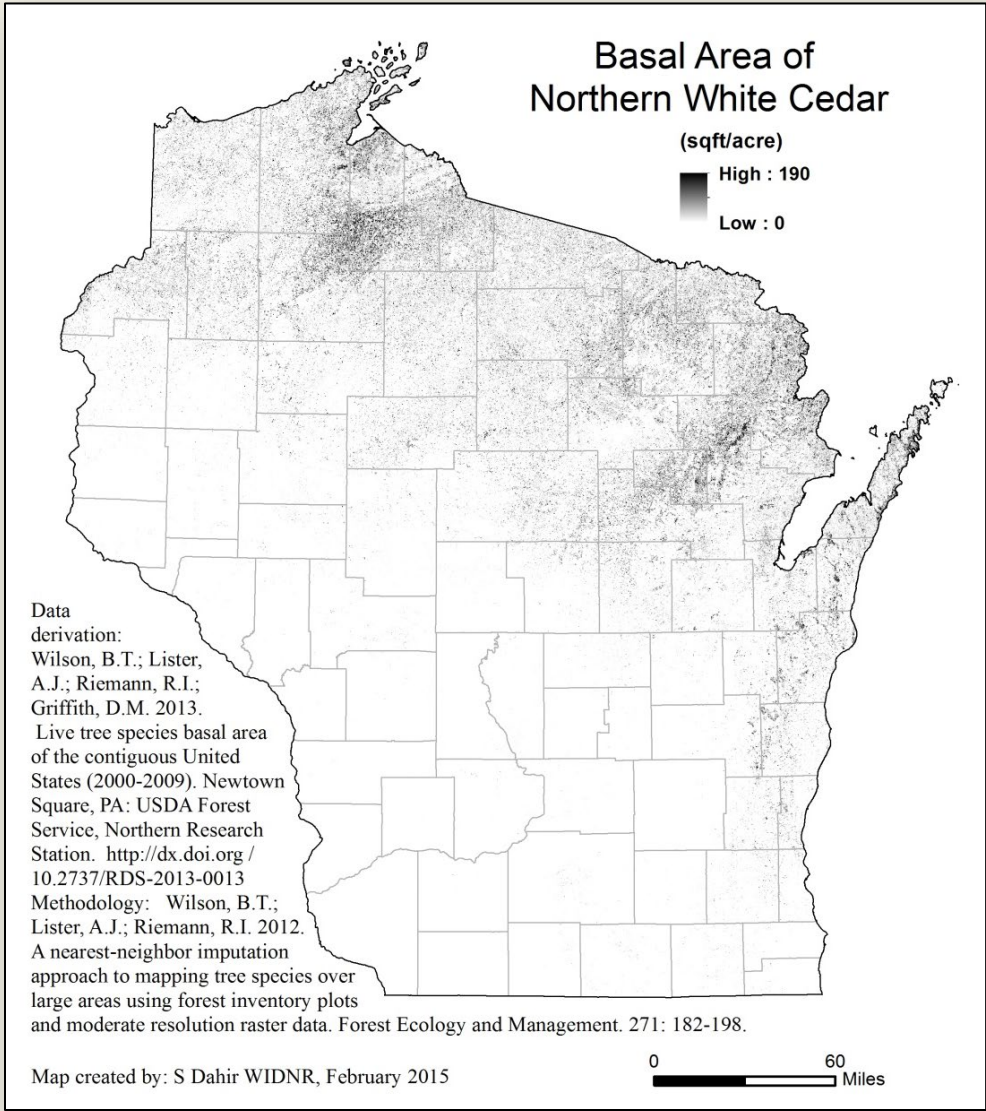
Growing stock volume (trees over 5 inches dbh) by diameter class (inches).
 Source: USDA Forest Inventory and Analysis data



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

“Where does northern white-cedar grow in Wisconsin?”

Growing stock volume by region with map



Three quarters of northern white-cedar volume is located in northern Wisconsin with 19% in the southeast.

Nearly two-thirds of volume is located on the spruce / fir forest type with another 19% on the elm / ash / cottonwood type.

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

Species	Central	North east	North west	South east	South west	Total
N white-cedar	38	366	170	137	0	710
% of total	5%	52%	24%	19%	0%	100%

Source: USDA Forest Service, Forest Inventory and Analysis

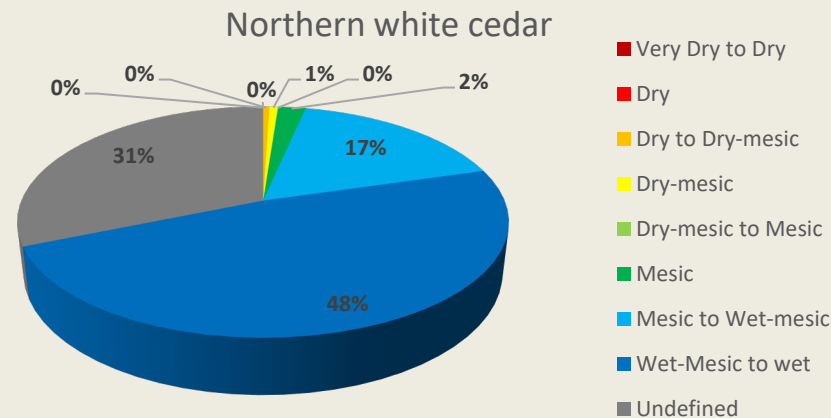
For a table of **Volume by County** go to:
<http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/VolumeCountySpecies.pdf>



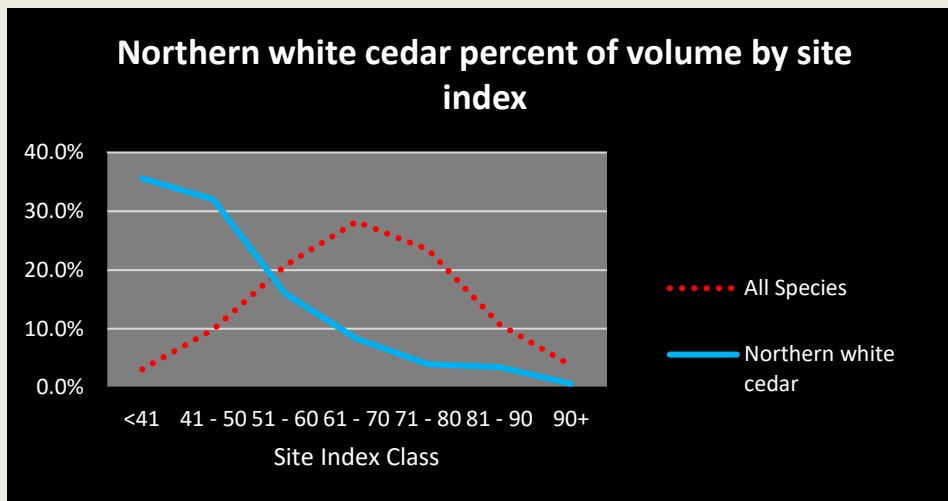
“What kind of sites does northern white-cedar grow on?”

Habitat type and site index distribution

The vast majority of northern white-cedar growing stock volume is found on wet habitat types (chart below) with the rest on 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).

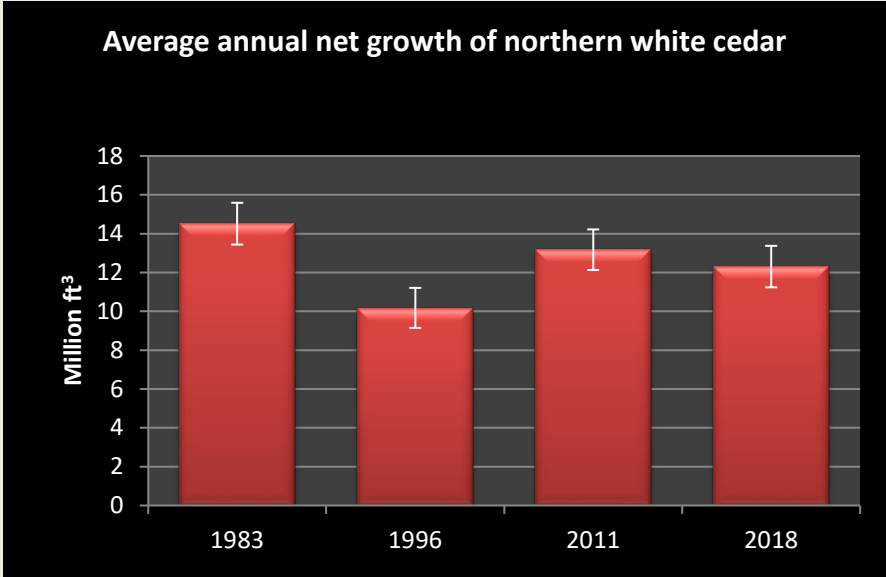
Northern lowlands where the majority of northern white-cedar growing stock volume is found have some of the lowest site indices of all forestland (chart on left). Over 80% of volume is located on sites with a site index below 60.

The average site index by volume for white-cedar is 47, much lower than the average for all species, 66. White-cedar grows on some of the poorest soils in the state.



“How fast is northern white-cedar growing?”
Average annual net growth and ratio of growth to volume

Average annual net growth of northern white cedar was about 12.3 million cubic feet per year from 2012 to 2018 and accounts for 2.2% of total statewide growth (chart on right). The growth rate has decreased by 15% since 1983 but has increased by 21% since 1996.



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

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

Region	Net growth	Percent of Total	Ratio of growth to volume
Northeast	5.9	48%	1.6%
Northwest	3.0	24%	1.7%
Central	0.9	7%	2.4%
Southwest	0.0	0%	.
Southeast	2.5	20%	1.7%
Statewide	12.3	100%	1.7%

Source: USDA Forest Inventory and Analysis 2018.

The highest volume growth for northern white-cedar is in the northeast region of the state but the highest rate of growth to volume is in central Wisconsin.

The average ratio of net growth to volume for northern white-cedar is 1.7%, lower than the statewide average of 2.6% for all species.

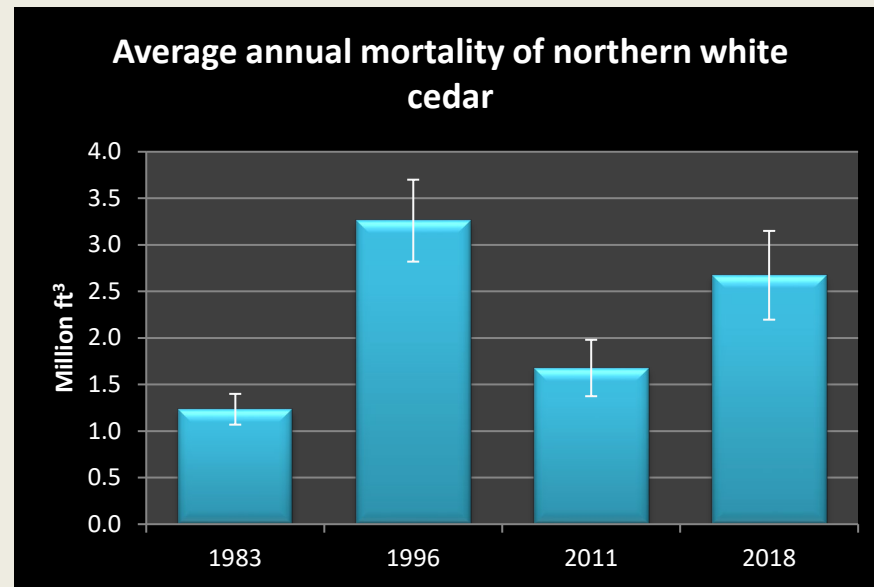
For a table of **Average annual growth, mortality and removals by region** go to:
<http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf>



“How healthy is northern white-cedar in Wisconsin?”
Average annual mortality and the ratio of mortality to volume

Average annual mortality of northern white-cedar from 2012 to 2018 was about 2.6 million cubic feet, or 1.1% of statewide mortality (chart on right). Mortality has decreased since 1996 but increased since 2011.

The ratio of mortality to volume is about 0.4% for northern white-cedar. This is much lower than the average for all species in Wisconsin which is 1.1%.



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

Mortality, volume and the ratio of mortality to volume.

Species	Average annual mortality (ft ³)	Growing stock volume (ft ³)	Mortality / volume
Northern white-cedar	2,673,199	710,248,270	0.4%

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



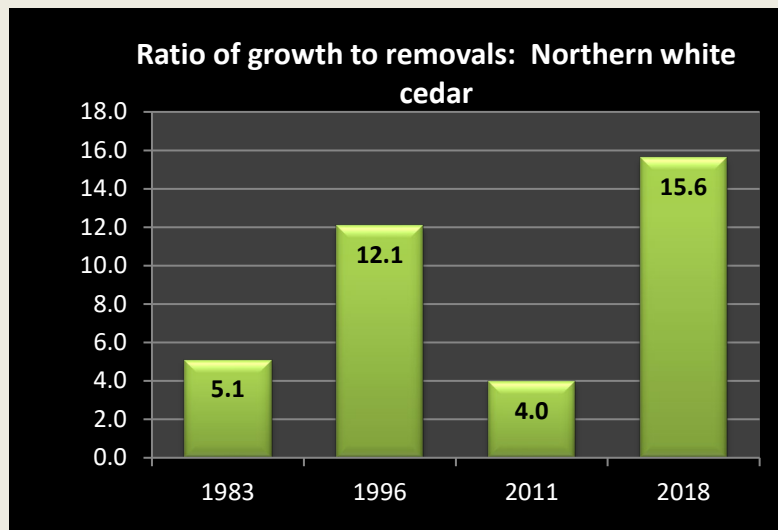
"How much northern white-cedar do we harvest?"

Roundwood production and the ratio of growth to removals

In 2009-2012, Wisconsin produced about 470,000 cubic feet of cedar [roundwood](#), or about 0.12% of the total harvest (chart on right). About one third is used for pulpwood, a third for fuelwood and one third for miscellaneous products.

Roundwood production for northern white-cedar has decreased significantly in the last decade.

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 northern white-cedar were 0.8 million cubic feet per year from 2012 to 2018 or 0.3% of total removals. Removals are about the same as in 1996 but are only a quarter of what they were in 2011.

The ratio of average annual net growth to removals is 15.6 for northern white-cedar, much higher than the statewide average ratio of 1.9 (chart on left). Whereas northern white-cedar accounts for 3.2% of growing stock volume in the state, it makes up only 0.3% of removals.

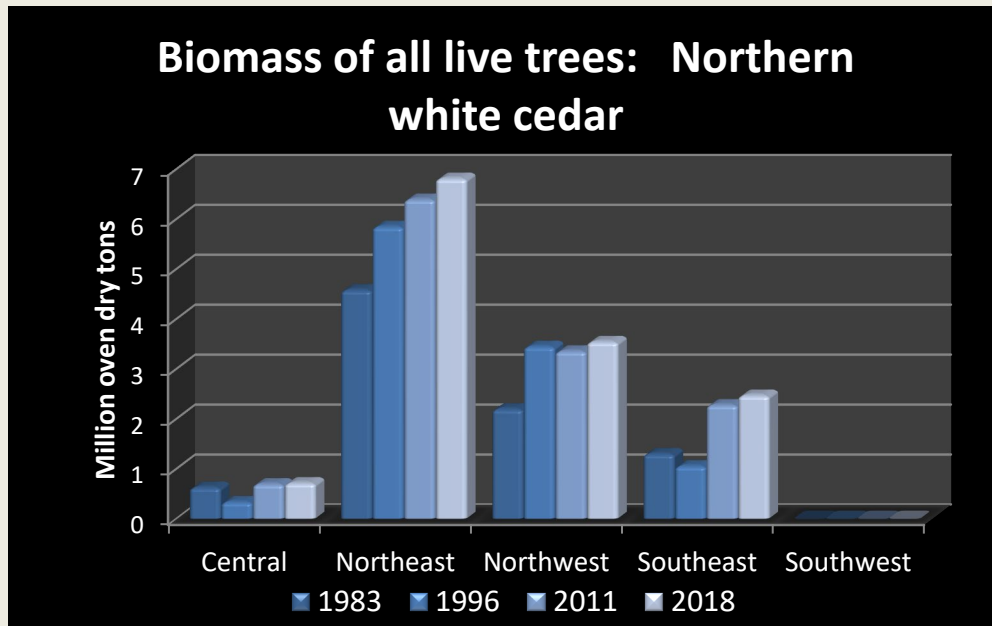
For a table of **Average annual growth, mortality and removals by region** go to:
<http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf>



“How much northern white-cedar biomass do we have?”

Tons of aboveground biomass by region of the state

There were 13.6 million short tons of aboveground [biomass](#) in live northern white-cedar trees in 2018, an increase of 56% since 1983. This is equivalent to approximately 6.8 million tons of carbon and represents 2.1% of all aboveground biomass statewide. As with volume, most northern white-cedar is located in northern Wisconsin (chart lower left).



Northern white-cedar has the lowest density of any of the commercial tree species in Wisconsin, with a ratio of biomass to volume of 22 oven-dry lbs. per cubic foot. The average for all softwoods is about 26 ODP/cubic feet and for all species is 33 ODP/cubic feet. Approximately 75% of biomass is located in the bole, 7% in saplings, 4% in stumps, and 13% in the top branches.

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 northern white cedar?”

Modelled future volumes based on current mortality & harvest

The ratios of growth, mortality and removals to volume are lower for northern white cedar compared to all species in the state (chart on right). The ratio of mortality and removals is about 80% lower. The fact that growth is so high relative to removals indicates that volume should increase over time.

FVS (Forest Vegetation Simulator¹) was used to predict future volumes through 2054 based on these rates of mortality and removals.

Ratio of growth, mortality and removals to volume of growing stock.
Source: USDA Forest Inventory & Analysis

As predicted from the growth to removals ratio, volume increases for the next 40 years, 48% by 2054.