Wisconsin's Forest Resources

Acreage in timberland in Wisconsin stands at over 16.4 million acres, which has remained relatively study since 2010. These forests are becoming middle-aged with major increases in stands 80+ years old. However, acreage in very young stands has decreased in the last three decades. Most forest land is privately owned and located in northern and central parts of the state.

The volume of wood is steadily increasing, with 22.2 billion cubic feet of merchantable bole volume in growing-stock trees in 2018. The species with the greatest volume are red oaks, sugar maple and red maple. Since 1996, growth rates have increased at a greater pace than volume, and mortality has increased at a higher rate than growth or volume. Removals have declined slightly since 1996.

- *How have Wisconsin's forests changed?*
  Acreage by stand age class, forest type and size class
- *What are the major species and how have they changed?*
  Growing stock volume by major species
- *Who owns our forests?*
  Timberland ownership by group
- *What types of forests do we have?*
  Acreage and map of Wisconsin's timberland by forest type
- *How much wood do we have?*
  Growing stock volume by species and year
- *How fast are our forests growing?*
  Average annual net growth by species and year
- *How healthy are our forests?*
  Average annual mortality by species and year
- *How much wood do we harvest?*
  Average annual removals by species and year
- *How much biomass do our forests contain?*
  Short tons of aboveground biomass by species and year

"How have Wisconsin's forests changed?"

Acreage by stand age class, forest type and size class

There were over 16.4 million acres of **timberland** in Wisconsin in 2018. This is an increase of nearly 1.7 million acres since 1983 and more than 0.7 million acres since 1996. Most of this increase has been in central and southeast Wisconsin.

About two-thirds of all timberland is classified as either maple-beech-birch, oak-hickory or aspen-birch forest type (Figure 1). Since 1996, the acreage in maple-beech-birch and aspen-birch has decreased. The number of acres in all other forest type classes has increased, with the exception of spruce-fir, which has remained stable.

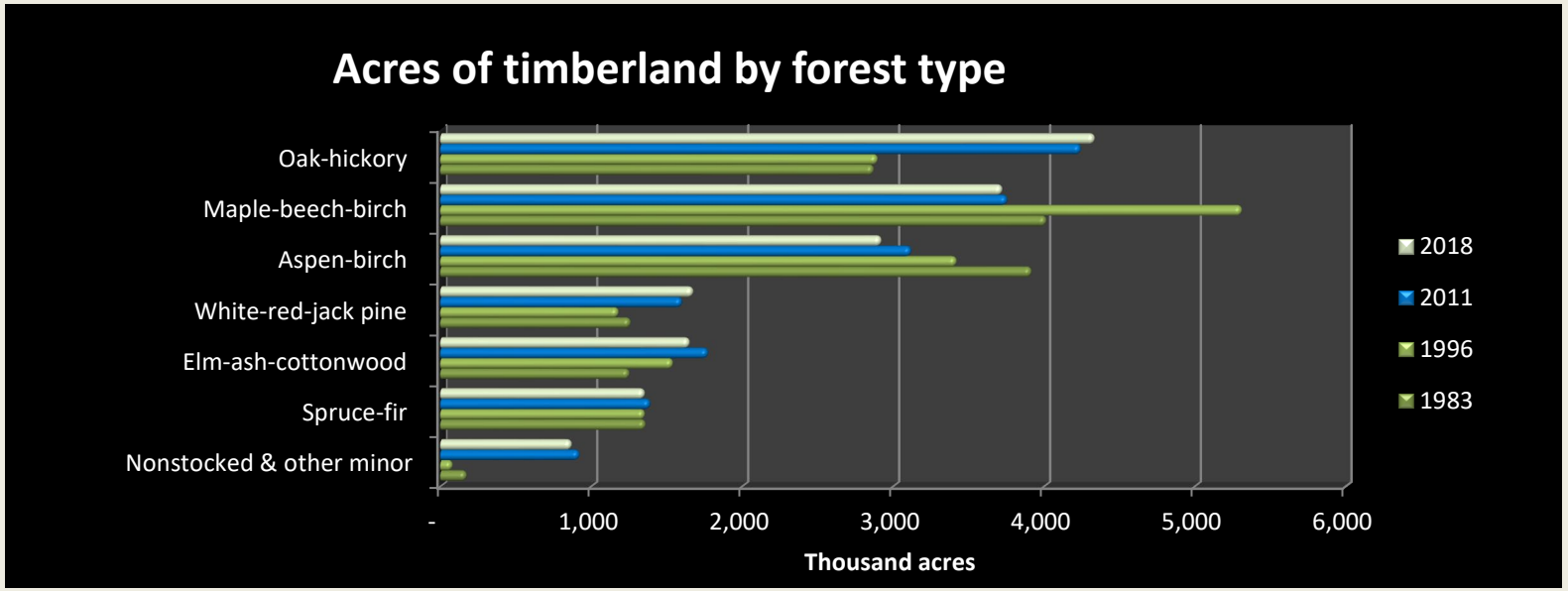


Figure 1. Acreage of timberland by forest type and inventory year (USDA Forest Service, Forest Inventory & Analysis 2018)

Additional tables:
Acreage of timberland by forest type group and county

Wisconsin's forests are becoming **middle-aged** with fewer acres in the very youngest and very oldest age classes (Figure 2). In 1983, 22% of acreage was 20 years old or less. In 2018, this has decreased to only 11%. In addition, 7.7% of acreage was at least 100 years old in 1983. This age class represents only 6% of timberland in 2018.

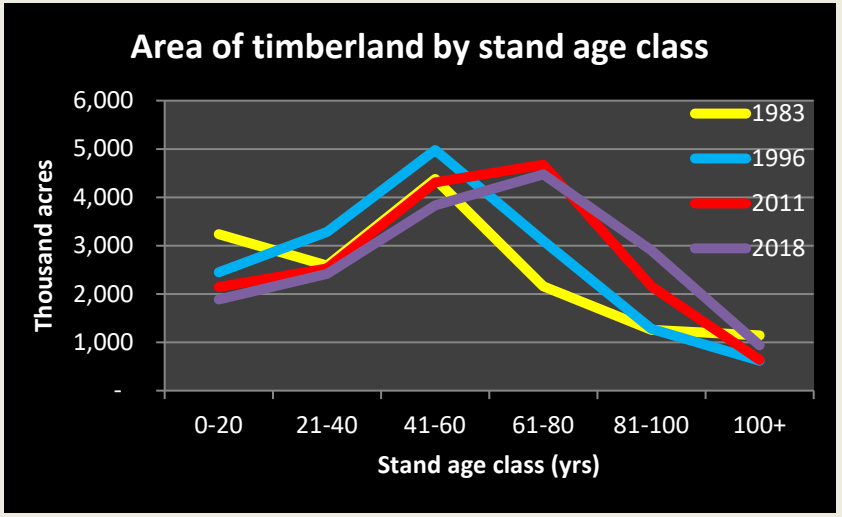


Figure 2. Acreage of timberland by stand age class and inventory year (USDA Forest Service, Forest Inventory & Analysis)

The distribution of acreage by stand size class reflects the same process of forest maturation (Figure 3). Between 1983 and 2018, the area in sawtimber stands increased by about 3.1 million acres or 66% whereas the acreage in seedling/sapling stands decreased by nearly 0.5 million acres and poletimber stands decreased by more than 0.9 million acres.

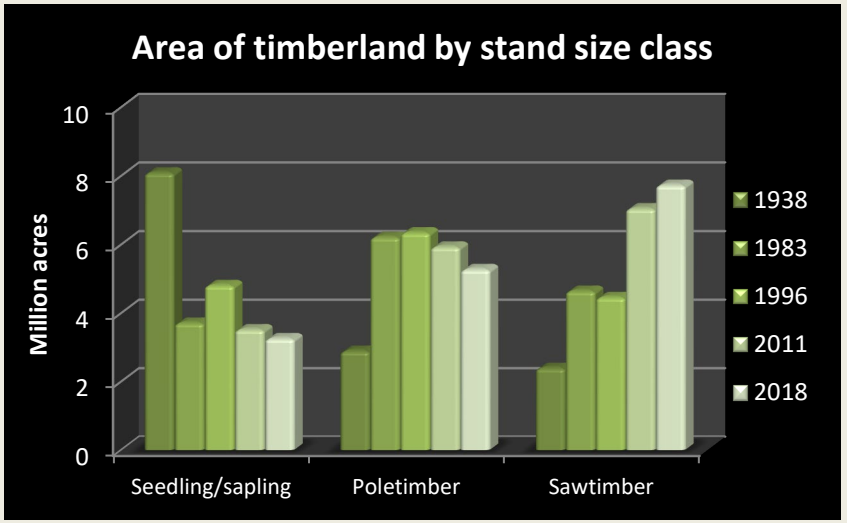


Figure 3. Acreage of timberland by stand size class and inventory year (USDA Forest Service, Forest Inventory & Analysis)

Additional tables:

Acreage of timberland by stand age class and county

Acreage of timberland by stand size class and county

"What are the major species and how have they changed?"

Growing stock volume by major species

There are 22.2 billion cubic feet of wood in Wisconsin's forests. The greatest volume of any major species in 2018 is in the **red oak group** (northern red oak, black oak, northern pin oak, Figure 4)**.** Volume in this group has increased 37% since 1983. The second highest volume is in **red maple,** where volume has doubled in the last 35 years.

The greatest percentage **volume gains** in the last 35 years have been in white pine (236%), red pine (135%), red maple (103%), ash (99%), and the white oak group (64%, white oak, bur oak, swamp white oak).

The greatest percentage **volume losses** in the last three decades have been in paper birch (58%), jack pine (57%), elm (32%), balsam fir (23%), and aspen (11%).

The growing stock volume of elm species (American elm, slippery elm, rock elm, Siberian elm) decreased between 1983 and 1996, but has increased 4% since 1996.

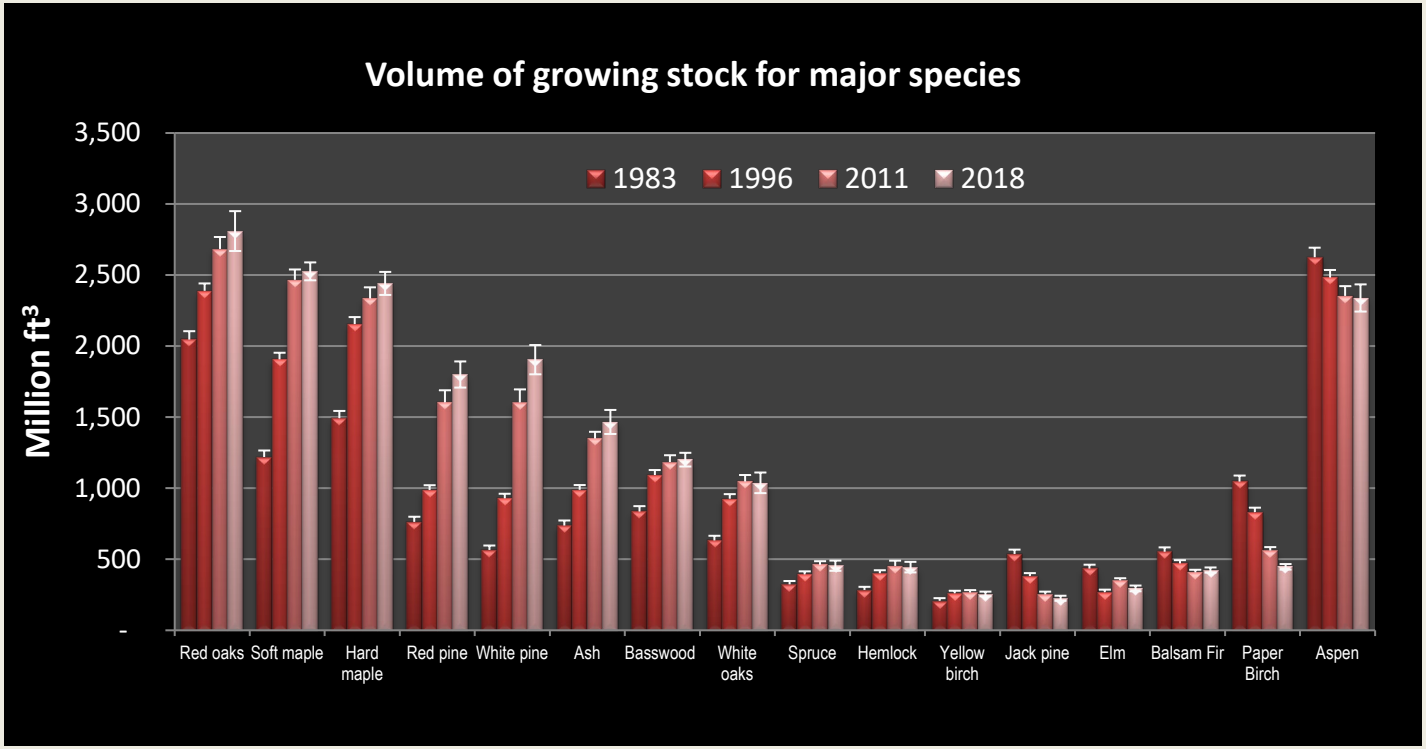


Figure 4. Volume of growing stock (million cubic feet) by species and inventory year (USDA Forest Service, Forest Inventory & Analysis 1983, 1996, 2011, and 2018).

"Who owns Wisconsin's forests?"

Timberland ownership by group

About **one third of Wisconsin's timberland is owned by the public**: federal, state, county, and municipal governments (Figure 5). Over half is owned by private individuals and 10% by corporate and other private entities.

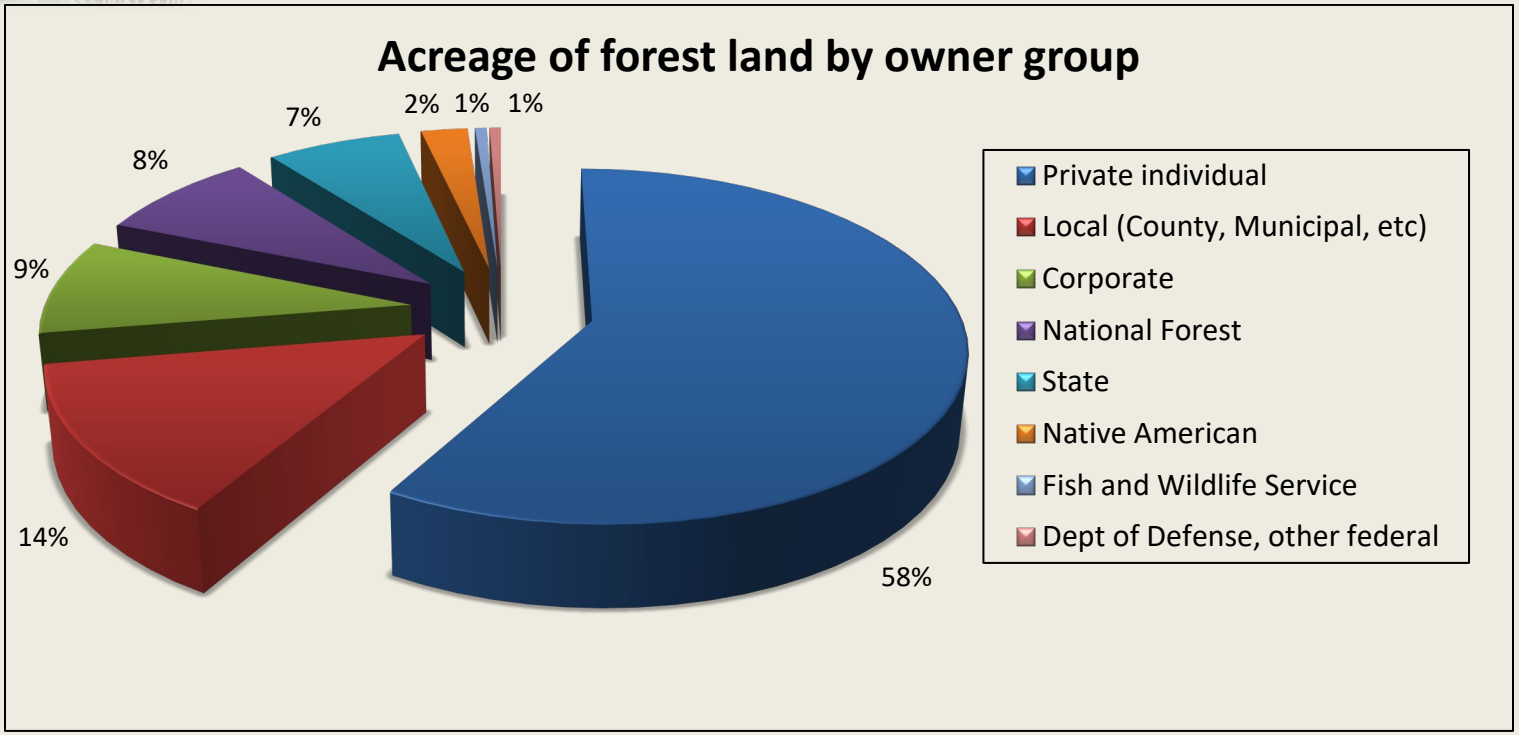


Figure 5. Acreage of timberland by owner group (USDA Forest Service, Forest Inventory & Analysis, 2017 data)

Additional tables:

Acreage of timberland by owner class and county

"What types of forests do we have?"

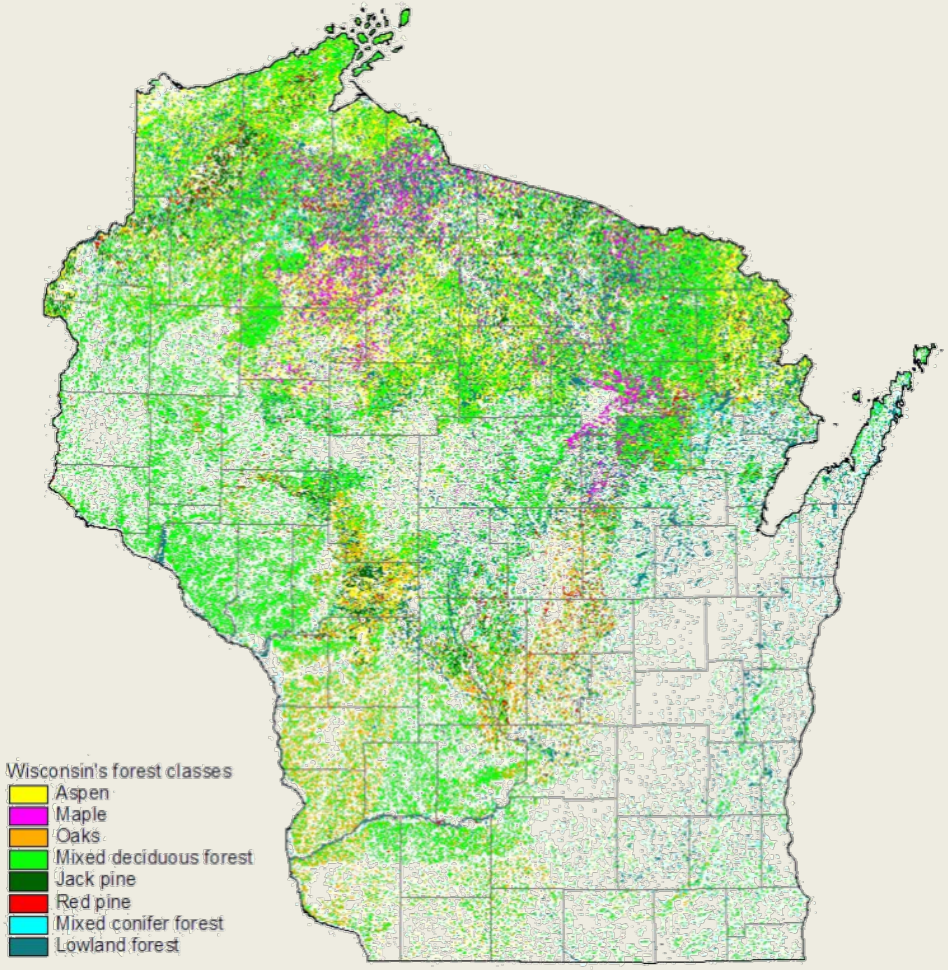
Acreage and map of Wisconsin's timberland by forest type

Wisconsin's forests are located mostly in the northern and central parts of the state (Table 1, map). Pine and oak-pine predominate in the sandy soils of central, northwest and northeast Wisconsin. Oak-hickory forest type occurs mostly in the southwest and central parts of the state. Aspen-birch, maple-basswood and spruce fir are primarily northern forest types. Bottomland hardwoods are distributed throughout the state in low-lying areas.

Table 1. Acres (1,000) of timberland by major forest type and region of the state

Forest type group	North east	North west	Central	South west	South east	Grand Total
Oak-hickory	391	949	1,191	1,306	485	4,322
Maple-beech-birch	1,402	1,421	373	327	188	3,710
Aspen-birch	930	1,468	340	117	54	2,909
Elm-ash-cottonwood	314	466	332	194	333	1,639
White, red and jack pine	469	464	569	82	78	1,663
Spruce fir	633	508	128	8	65	1,342
Oak-pine	143	150	212	29	21	556
Minor types*	36	74	91	45	57	303
Total	**4,319**	**5,501**	**3,234**	**2,109**	**1,282**	**16,445**

* Includes nonstocked land, exotic hardwoods and exotic softwoods.
Source: USDA Forest Service, Forest Inventory & Analysis 2018 data



Source: WISCLAND land cover, Wisconsin Dept. of Natural Resources, 1998

"How much wood do we have?"

Growing stock volume by species and year

Table 2. Growing stock volume in million cubic feet on timberland.

Species group	1983	1996	2011	2018	Change since 1983
Red oaks	2,050	2,533	2,625	2,810	37%
Red maple	1,132	1,834	2,147	2,302	103%
Sugar maple	1,494	2,234	2,321	2,441	63%
Aspen	2,628	2,520	2,319	2,339	-11%
White pine	567	1,073	1,557	1,905	236%
Red pine	766	1,024	1,585	1,800	135%
Ash	738	1,021	1,331	1,466	99%
Basswood	836	1,117	1,171	1,201	44%
White oaks	633	1,021	1,030	1,038	64%
Spruce	325	399	457	455	40%
Paper birch	1,053	845	551	447	-58%
Hemlock	284	439	439	445	57%
Balsam Fir	556	479	404	424	-24%
Elm	435	284	348	295	-32%
Yellow birch	208	266	258	256	23%
Jack pine	526	388	237	226	-57%
Minor species	1,286	1,869	2,191	2,363	84%
Total	15,515	19,345	20,971	22,212	43%

Source: USDA Forest Service, Forest Inventory & Analysis

Wisconsin has over 22 billion cubic feet of growing stock volume in trees over 5 inches in diameter, an increase of 43% since 1983 (Figure 6). The volume of white pine has more than tripled and the volume of red maple and red pine has doubled since 1983. Ash, white oaks, hemlock and sugar maple volume has also increased by over 50%.

Of all species, jack pine and paper birch have undergone the largest decrease in volume in the last two decades (Table 2). Balsam fir, aspen, and yellow birch also have shown declines.

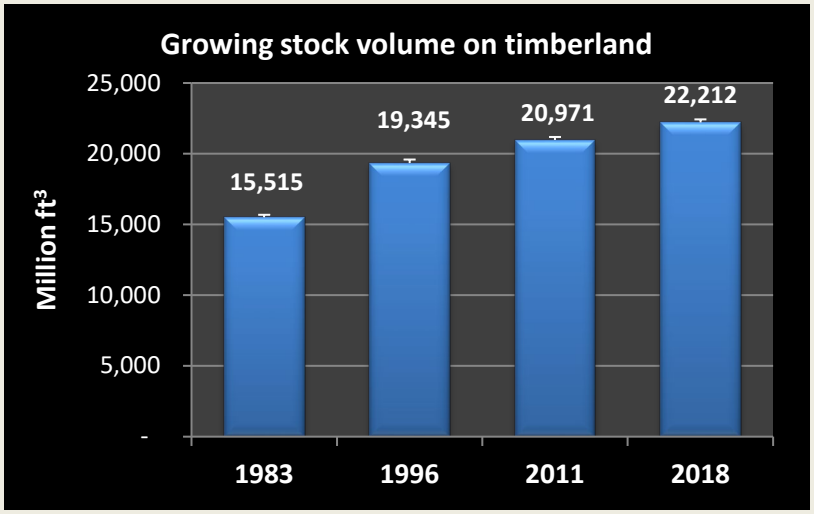


Figure 6. Volume of growing stock (million cubic feet) by inventory year (USDA Forest Service, Forest Inventory & Analysis).

"How fast are our forests growing?"

Average annual net growth by species and year

Average annual net growth has increased about 16% since 1983 (Figure 7). The average ratio of growth to volume is 2.6% statewide but some species surpass this.

Red pine, white pine, aspen, red maple, and balsam fir all have ratios over 2.6%. Paper birch, yellow birch, elm, jack pine, spruce and hemlock have growth ratios far below average. High mortality will decrease net growth significantly as is the case with aspen, elm, paper birch and balsam fir.

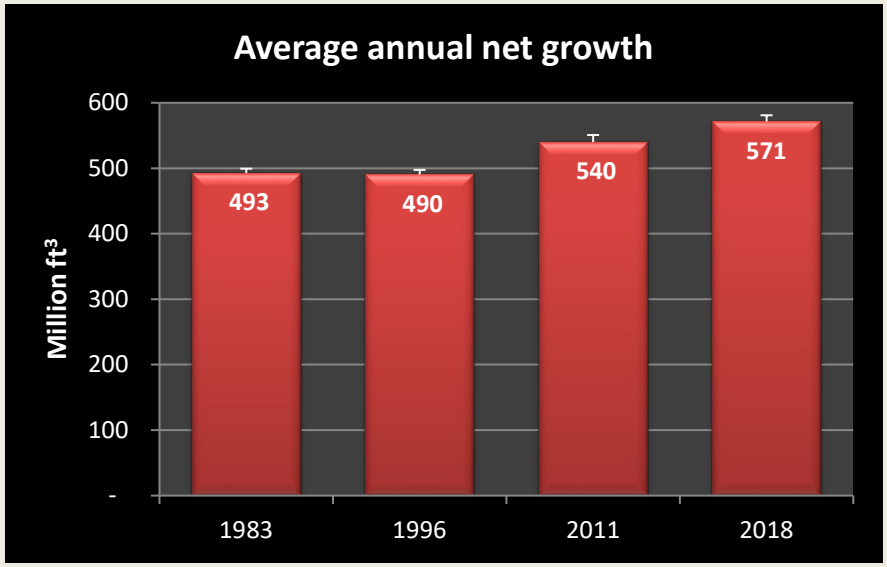


Figure 7. Average annual net growth of growing stock by inventory year (USDA Forest Service, Forest Inventory & Analysis).

Table 3. Growing stock volume, net growth and the ratio of growth to volume by species.

Species group	Growing stock volume (million cft)	Average annual net growth (million cft)	Ratio of growth to volume
Red pine	1,800	67.4	3.7%
White pine	1,905	69.5	**3.6%**
Red maple	2,302	68.6	3.0%
Ash	1,466	34.7	2.4%
Jack pine	226	4.7	2.1%
Sugar maple	2,441	52.8	2.2%
Spruce	455	6.3	1.4%
Aspen	2,339	78.3	3.3%
Basswood	1,201	23.1	1.9%
Red oaks	2,810	66.3	2.4%
White oaks	1,038	19.4	1.9%
Hemlock	445	4.9	1.1%
Balsam Fir	424	11.5	2.7%
Yellow birch	256	4.4	1.7%
Elm	241	-2.7	-1.1%
Paper Birch	447	-0.5	-0.1%
Minor species	2,416	62.8	2.6%
Total	**22,212**	**571.4**	**2.6%**

"How healthy are our forests?"

Average annual mortality by species and year

Table 4. Annual mortality and volume of growing stock and the ratio of mortality to volume by species.

Species group	Annual mortality (million cft)	Volume of growing stock (million cft)	Ratio of mortality to volume
Paper Birch	15.4	447	3.4%
Elm	23.4	295	7.9%
Balsam Fir	16.9	424	4.0%
Aspen	60.0	2,339	2.6%
Yellow birch	2.7	256	1.0%
Jack pine	6.9	226	3.1%
Spruce	10.2	455	2.2%
Red oaks	23.5	2,810	0.8%
White oaks	4.5	1,038	0.4%
Hemlock	5.3	445	1.2%
Basswood	9.3	1,201	0.8%
Ash	14.2	1,466	1.0%
Red maple	8.8	2,302	0.4%
Sugar maple	7.0	2,441	0.3%
Red pine	3.1	1,800	0.2%
White pine	7.6	1,905	0.4%
Other species	17.3	2,363	0.7%
Total	**236.0**	**22,212**	**1.1%**

Source: USDA Forest Service, Forest Inventory & Analysis 2018 data

Average annual mortality has increased at a faster pace than volume since 1996. Volume increased 14.8% but mortality increased by 24.7% (Figure 8). Over 1% of all volume is lost to mortality (Table 4). Certain species have experienced elevated mortality, especially paper birch, elm, balsam fir, aspen, yellow birch, spruce, and jack pine (Table 4).

The species with the lowest ratios of mortality to volume are red and white pine, sugar and red maple, white and red oaks, and basswood.

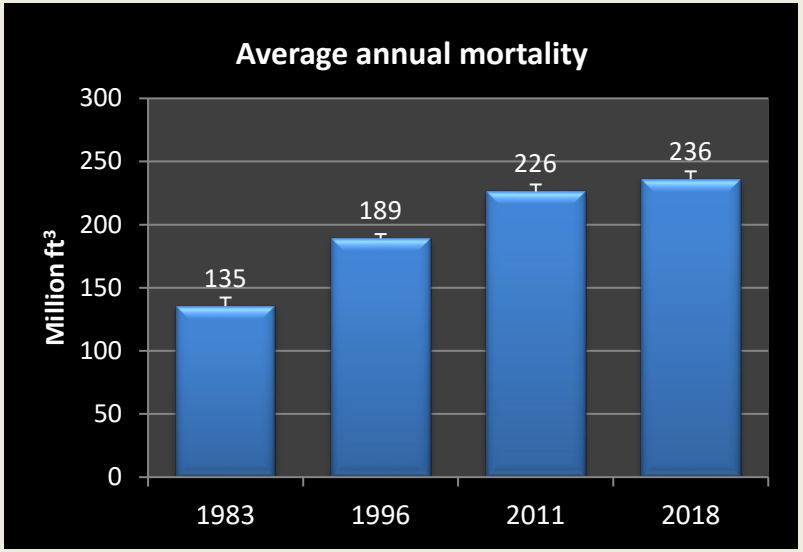


Figure 8. Average annual mortality by inventory year (USDA Forest Service, Forest Inventory & Analysis).

"How much wood do we harvest?"

Average annual removals by species and year

On average, we harvest 295 million cubic feet annually, down from 332 million cubic feet in 1996 (Figure 9). This is 52% of net annual growth, down from 68% in 1996. Average annual removals for paper birch, jack pine, and elm exceeded annual growth (Table 5). The species with the lowest harvest to growth ratios include white pine, hemlock, sugar maple, and red maple.

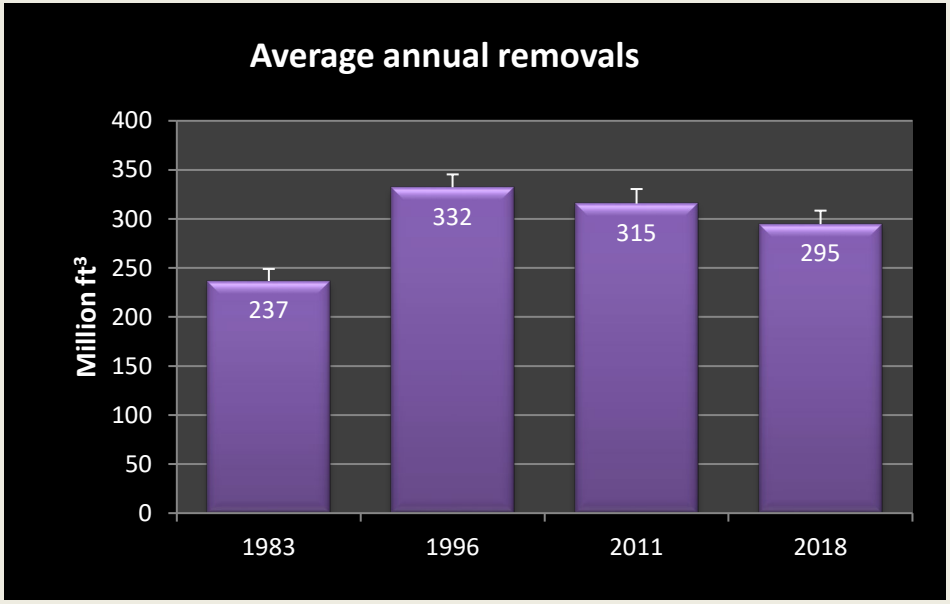


Figure 9. Average annual removals (million cubic feet) of growing stock by inventory year (USDA Forest Service, Forest Inventory & Analysis).

Table 5. Average annual removals and annual net growth, and the ratio of removals to growth.

Species group	Annual removals (million cft)	Annual net growth (million cft)	Ratio of removals to growth
Jack pine	6.9	4.7	147%
Aspen	65.3	78.3	83%
Yellow birch	2.8	4.4	64%
Balsam Fir	6.5	11.5	56%
Red oaks	32.4	66.3	49%
Elm	3.5	-2.7	-
White oaks	9.4	19.4	48%
Spruce	3.7	6.3	58%
Red pine	36.4	67.4	54%
Sugar maple	22.2	52.8	42%
Basswood	13.6	23.1	59%
Red maple	30.2	68.6	44%
Hemlock	2.4	4.9	49%
Ash	13.1	34.7	38%
White pine	16.0	69.5	23%
Paper Birch	10.8	-0.5	-
Minor species	19.5	62.8	31%
Grand Total	**295**	**571**	**52%**

Source: USDA Forest Service, Forest Inventory & Analysis, 2018 data

"How much biomass do our forests contain?"

Short tons of aboveground biomass by species and year

Table 6. Biomass (million short tons), growing stock volume (million cubic feet) and carbon (million metric tons) by tree species.

Species group	Aboveground Biomass 2018 (millions short tons)	Growing stock volume 2018 (millions ft^3)	Above- and belowground carbon (million metric tons)
Ash	47.0	1,466	28.1
Aspen	58.6	2,339	35.1
Balsam Fir	11.6	424	7.2
Basswood	21.6	1,201	12.9
Elm	12.0	241	7.2
Sugar maple	85.1	2,441	50.9
Hemlock	9.6	445	5.9
Jack pine	5.4	226	3.3
Paper Birch	15.6	447	9.3
Red oaks	98.2	2,810	58.5
Red pine	33.1	1,800	20.3
Red maple	75.4	2,302	45.1
Spruce	10.9	455	7.0
White oaks	40.9	1,038	24.4
White pine	33.6	1,905	20.6
Yellow birch	10.7	256	6.4
Other species	80.8	2,416	48.6
Total	**650**	**22,212**	**391**

Source: USDA Forest Service, Forest Inventory & Analysis, 2018 data

Wisconsin has about 650 million short tons of aboveground biomass in its forests (Figure 10), and 391 million metric tons of aboveground and belowground carbon in live trees over 1" diameter (Table 6). The amount of carbon and biomass has increased 39% since 1983 and 21% since 1996.

The species with the highest aboveground biomass are red oaks, sugar maple, and red maple (Table 6). The same three species are also greatest in total tree carbon, with aspen and ash ranking 4th and 5th.

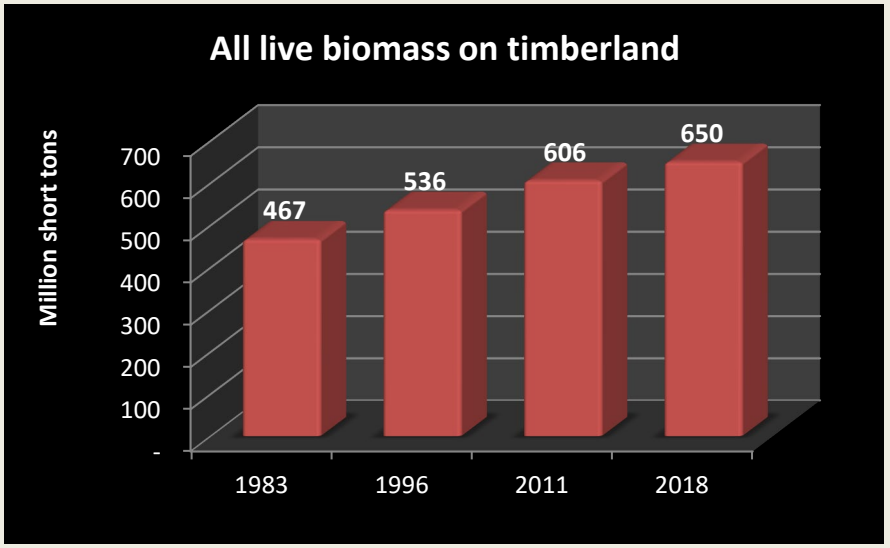


Figure 10. Aboveground biomass (million short tons) in live trees on forest land (USDA Forest Service, Forest Inventory & Analysis).