

Forest characteristics of the Black River State Forest



WisCFI data 2007 – 2012

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Summary of the Black River State Forest

There are approximately 58,288 ($\pm 1.9\%$ sampling error or SE) acres of [timberland](#) on the Black River State Forest. The major [forest types](#) are white pine and red pine which account for almost half of all acreage. About 44% of timberland acreage is in sawtimber-sized stands and 12% is in seedling and sapling stands. Eighty percent of acreage is less than 60 years of age. The Black River State Forest has the lowest percent of acreage, 1%, in stands over 100 years of age compared to 5% for all state forests. It also has one of the highest percentages of timberland in young stands, 23%, compared to 15% for all state forests.

Average site index on the forest is 53 compared to an average of 56.8 for all state forests. The forest types with the lowest average site index are tamarack and scrub oak. About half of all timberland in the Black River State Forest is classified as having a very dry to dry habitat type and the other half is either mesic to wet mesic or wet mesic to wet.

There are 42.6 million trees ($\pm 5.3\%$ SE), 63 million cubic feet of growing stock volume ($\pm 5.3\%$ SE) and 227.5 million board feet of sawtimber ($\pm 7.0\%$ SE) on the Black River State Forest. The most numerous [growing stock](#) species are eastern white pine, red pine and jack pine. These three species plus northern pin oak account for the majority of growing stock and sawtimber volume. Eighty percent of sawtimber volume is eastern white pine and red pine. Most pine sawtimber is in grade 2 and 3 with grade 3 accounting for over half of sawlog production. This forest has a fairly low per acre volume relative to the other state forests. The Black River State Forest has about 3.9 MBF/acre of sawtimber volume compared to 4.2 MBF/acre for all state forests combined.

Several measures are reported which assess forest health and species sustainability. All are approximations, either based on only one year of data, such as growth and mortality, or peripheral measures of health, such as crown characteristics and the number and volume of standing dead trees. Caution should be used in drawing firm conclusions from this data.

Trees on the Black River State Forest seem to be healthy and most species have sustainable volume and growth. A number of measures show higher values for forest health on the Black River State Forest compared to all state forests combined. For instance, the ratio of growth to volume is 21% higher on the Black River State Forest. The overall ratio of mortality to gross growth is 42% lower on the Black River State Forest and the percent of trees dying per year is 50% lower compared to all state forests. The percent of trees and of tree volume in standing dead trees over 5 inches dbh is much lower on the Black River State Forest. Finally, trees crowns have lower levels of dieback and transparency on the Black River State Forest compared to all state forests combined.

However, certain species score relatively poorly on several of these health measures. Jack pine, for instance, has a lower than average growth to volume ratio, a higher than average mortality to growth ratio and a higher percentage of trees and volume in standing dead trees. Both aspen species also have a slower than average growth rate, a higher than average volume in standing dead trees and a higher than average percentage of crown dieback.

There were no significant trends in growing stock volume on the Black River State Forest from 2008 to 2012.

Forward

There has always been a strong demand for timely, consistent, and reliable forest inventory and monitoring information for State Forests. Recently, the demand for timely and relevant information has been growing. Partners interested in State Forests want more recent information, covering a broader scope of forest attributes with more analysis and reporting capabilities. In response, the Wisconsin Department of Natural Resources implemented a State Forest Continuous Forest Inventory (WisCFI) program that will increase our capacity to collect, analyze and publish data on an annual basis for each State Forest individually and as a group (over 500,000 acres of forest and nonforest land).

The primary purpose of the Wisconsin CFI is to collect and report on the condition of the forest in a statistically sound manner on an annual basis for each State Forest. The information will be used to track the status and trends in forest extent, cover, growth, mortality, habitat, and overall health. The continuous forest inventory will provide unbiased, reliable information at the property level with the ability to incorporate regional trends. The inventory will assist in planning, management and monitoring.

Inventory goals:

- Provide information on the condition and health of the forest and track changes over time.
- Integrate effectively data, methods and tools in the planning and decision making processes.
- Develop and maintain data input models and methods for forestry analysis and planning.
- Develop up-to-date and easy-to-use information products and services for property managers and our public and partners.

Difference between WISFIRS (forest reconnaissance data) and WisCFI data

The WISFIRS (Wisconsin Forest Inventory and Reporting System or Recon) and the WisCFI (Wisconsin Continuous Forest Inventory) datasets are used to describe the same forests but their purpose, methodology and results are very different.

WISFIRS is a stand-based dataset and is used to **manage individual stands**. A stand is defined as having a fairly uniform composition of trees with a common management objective. The emphasis is on management. Since forests are never consistent throughout, data on cover type and tree composition must be generalized in order to describe the stand as a whole. Generalizing by stand is crucial for scheduling management activities but not for determining accurate forest-wide statistics such as volume by species, growth or mortality rates. In addition, since forest reconnaissance is performed at different intervals for different stands, tracking forest-wide trends such as changes in acreage by forest type, size class or other stand descriptors, is difficult.

WisCFI data is an analytical tool which can provide **statistically consistent and accurate** information as well as trends in this data. It is based on systematically randomized plots (each plot represents c. 200 acres of forest) which are re-measured every five years. There are many stands defined by forest reconnaissance which will not have even one WisCFI plot and many stands which will have more than one. Many WisCFI plots will be assigned a cover type, size class or stand age which may be quite

different from the forest reconnaissance typing of the stand in which they are located. As previously stated, stands may be very inconsistent from one location to the next. The important thing is that the data is measured very consistently from plot to plot and from inventory to inventory and that each plot is located in a systematic and random manner. This allows a statistical determination of the amount of error attached to each measure. The more plots, the lower the sampling error. Knowing the amount of error means we can determine the accuracy of the measurement. For instance, for the NHAL an area of c. 2,500 acres yields a sampling error of about 25%. This means that there is a 2/3 probability that the actual value will be between 1,900 and 3,100.

WisCFI data cannot be used to describe small areas because of the large amount of error associated with small samples but it can be used to describe acreage by stand age, size class, forest type, soil type, habitat type, site index, and productivity for an entire state forest. It can be used to determine volume or number of trees by tree size class, crown class, stocking class, site index, etc. With the addition of P3 data, many other measures such as crown dieback or transparency, area of compacted or bare soil, quantity of coarse woody debris, or cover of invasive species can be estimated. These measures will initially have a large sampling error but as the plots are re-measured, the amount of error will diminish and trends will emerge from the data. Again, all of these measures have an associated sampling error and therefore their accuracy can be gauged. This allows us to say whether there is or is not, for instance, a significant change in the acreage of a forest type or the volume of a species.

As plots are re-measured for the first time in 2012, changes in these measures will emerge. For instance, as trees are re-inventoried, mortality or removals will be recorded. Growth rates will emerge as will changes in acreage by size class or forest type. As the definitions become clearer, the WisCFI data will become more and more useful as a tool to describe the effects of management forest-wide, including whether a State Forest is meeting the management goals set out in its Master Plan.

Sampling Error

The process of sampling (selecting a random subset of a population and calculating estimates from this subset) causes estimates to contain error they would not have if every member of the population (e.g., every tree in had been observed and included in the sample). The WisCFI inventory is based on a sample of 3,908 selected plots with an average sampling rate of about one plot for every 135 acres of state forest land.

Along with every estimate is an associated sampling error that is typically expressed as a percentage of the estimated value (the estimated value plus or minus the sampling error). This sampling error is the primary measure of the reliability of an estimate. We use a sampling error based on one standard error, that is, the chances are two in three that the results would have been within the limits indicated had a 100-percent inventory been conducted using these methods.

For instance, the Brule River State Forest has an estimated timberland acreage of 35,704 acres with a sampling error of 2.14%. This means that there is a 67% probability that the actual value is between 34,940 and 36,468 acres. The smaller the value being measured, the larger the sampling error. For instance the sampling error for seedling acreage is 22% and the error for seedling aspen acreage is 48%.

Sampling error must be considered when making assumptions about from data.

Stand Characteristics

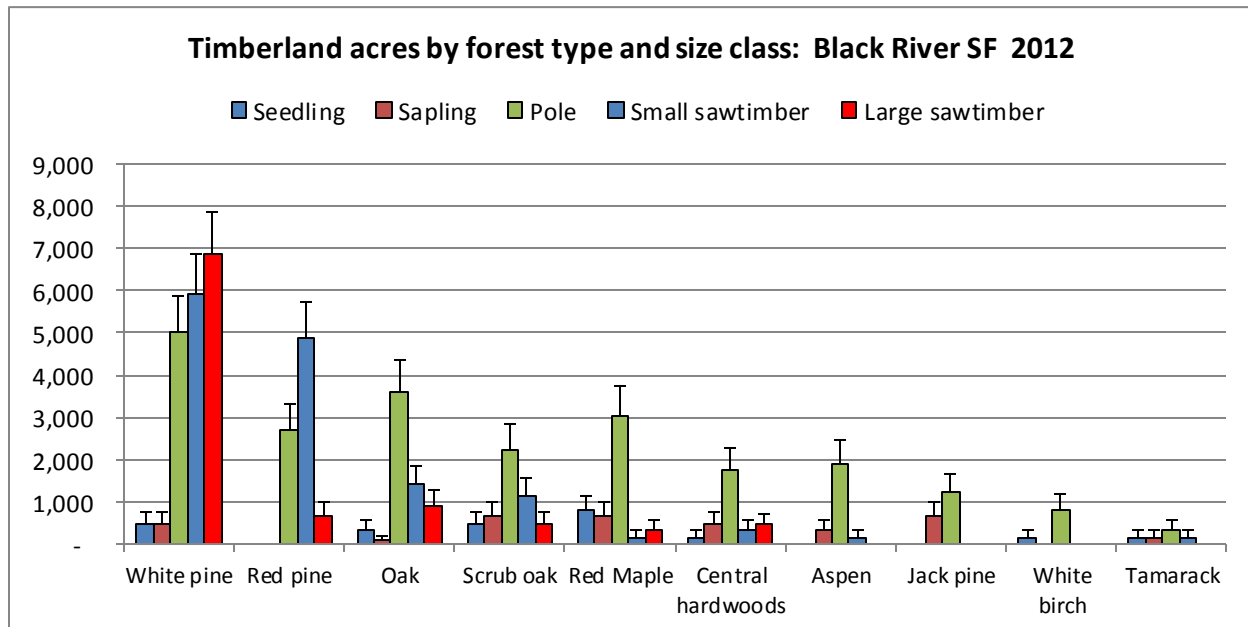
Acres by forest type and stand size

Almost half of the timberland acreage and 75% of all sawtimber stands on the Black River State Forest are in the red pine, white pine or jack pine forest type. Seedling and sapling stands occupy only 12% of timberland acreage whereas sawtimber stands occupy 44%.

Acres of timberland by WisDNR forest type and size class on the Black River State Forest (2012).

Forest type**	Seedling	Sapling	Pole*	Small sawtimber*	Large sawtimber*	Total WisCFI	Total WISFIRS
White pine	494	577	5,047	6,580	6,492	19,189	15,857
Red pine	-	-	2,526	4,981	577	8,083	6,543
Oak	329	90	3,780	1,400	835	6,434	9,024
Red Maple	856	741	2,965	165	329	5,056	2,549
Scrub oak	617	659	2,127	1,153	412	4,967	2,279
Central hardwoods@	165	494	1,839	329	464	3,290	
Aspen	-	329	1,967	47	-	2,343	5,171
Jack Pine	-	659	1,092	-	-	1,751	12,276
White birch	72	-	824	-	-	895	
Tamarack	165	82	587	14	-	849	1,017
Northern hardwoods	-	-	165	329	72	567	
Blackspruce	-	-	494	-	-	494	411
Bottomland hardwoods	-	-	247	-	165	412	1,150
Misc Deciduous***	-	-	329	-	-	329	
Swamp hardwoods	-	-	165	-	-	165	65
All forest types	2,697	3,631	24,153	14,998	9,345	58,288	56,342
Percent of total	5%	7%	44%	27%	17%	100%	

*Pole: 5-9" softwood, 5-11" hardwoods Small sawtimber: 9-15" softwoods, 11-15" hardwoods Large sawtimber: 15+"
 Lowland brush and unsurveyed acreage have been omitted. * Misc Deciduous is mostly jack pine and black locust.
 @ Central hardwoods is a combination of eastern white pine, black oak, red maple and jack pine.
 Figures in red have a sampling error of at least 50% and should be used with caution.



Acres by forest type and stand age

About 80% of acreage on the Black River State Forest is 60 years of age or less. Most of this is white pine, red maple and red pine forest types. Only 1% is over 100 years old and most of this is white pine with some scrub oak. The Black River State Forest has the lowest percentage of stands in the 100+ age class of all the state forests.

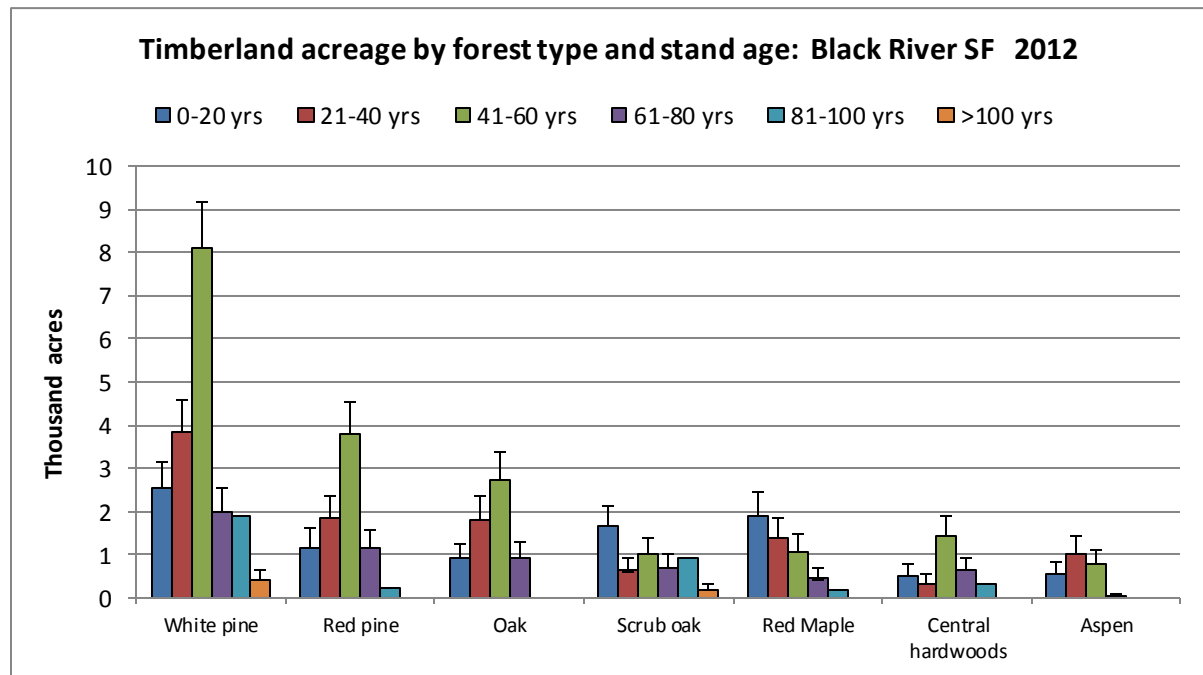
Acres of timberland by forest type and stand age

Forest type	0-20 yrs	21-40 yrs	41-60 yrs	61-80 yrs	81-100 yrs	>100 yrs	Total
White pine	2,550	3,851	8,107	1,976	1,901	412	18,797
Red pine	1,179	1,833	3,792	1,153	247	-	8,204
Oak	913	1,812	2,729	906	-	-	6,359
Scrub oak	1,647	626	1,007	692	906	165	5,042
Red Maple	1,908	1,400	1,071	441	165	-	4,984
Central hardwoods	494	329	1,427	628	329	-	3,208
Aspen	563	1,026	777	47	-	-	2,413
Jack pine	494	1,071	329	-	-	-	1,894
White birch	72	329	587	-	-	-	988
Tamarack	329	247	82	165	-	-	824
Northern hardwoods	-	-	-	402	165	-	567
Black spruce	-	-	165	329	-	-	494
Bottomland hardwoods	-	82	-	165	165	-	412
Misc Deciduous	-	-	329	-	-	-	329
Swamp hardwoods	-	-	-	-	165	-	165
Total WisCFI*	13,139	13,081	20,547	6,903	4,042	577	58,288
Total WISFIRS**	13,874	14,931	9,748	6,998	5,662	5,129	56,342

*Lowland brush and unsurveyed acreage have been omitted.

**27,730 acres were not recorded as to age.

Numbers under c. 680 acres have an error of at least 50% and should be used with caution.



Acres by [site index](#) and forest type

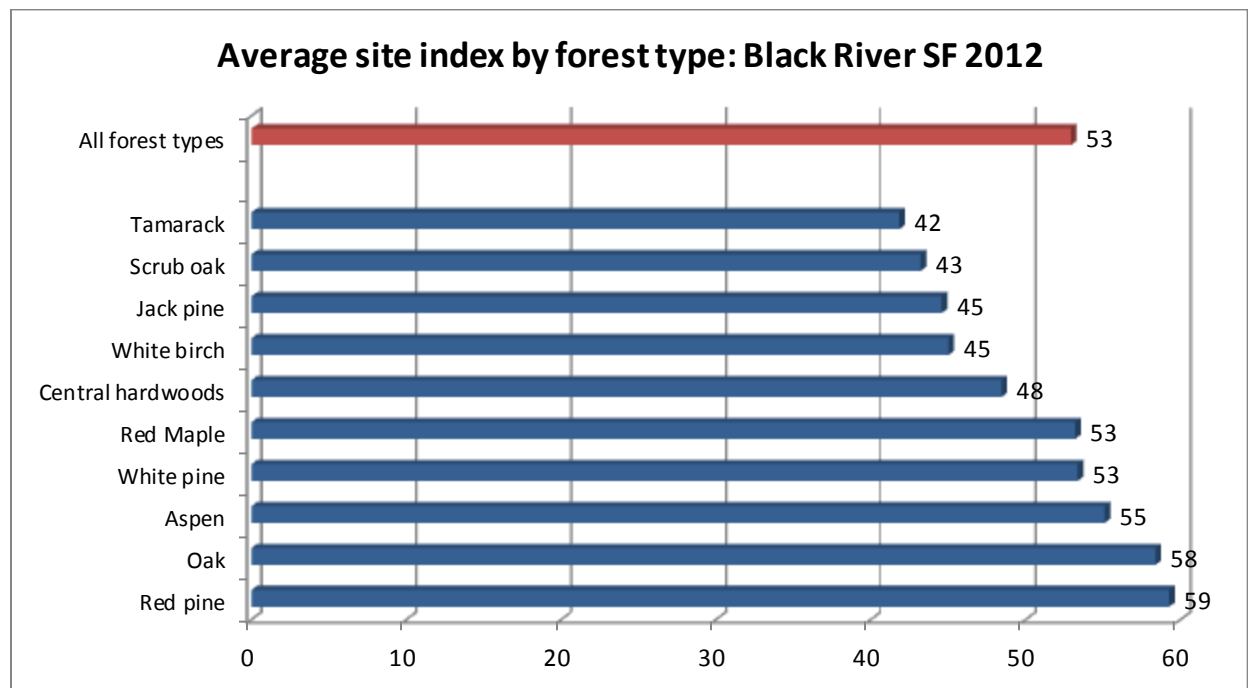
The average site index on the Black River State Forest is 53 which is below the average for all state forests combined, 56.8. Excluding forest types with low acreage (and high errors) the types with the highest average site index are red pine and oak, and the types with the lowest site index are tamarack, scrub oak, jack pine, and white birch.

Acres of timberland by forest type and site index

Forest type*	<=30	31 - 40	41 - 50	51 - 60	61 - 70	71 - 80	81 - 90	>90	Total acres
White pine	329	1,281	5,725	7,565	2,211	1,270	252	165	18,797
Red pine	329	1,617	2,141	2,635	1,318	165			8,204
Oak			4,465	1,647	247				6,359
Scrub oak		1,153	3,807			82			5,042
Red Maple	329	1,894	1,443	1,153			165		4,984
Central hardwoods	659	1,452	603	329	165				3,208
Aspen	107	870	494	777	165				2,413
Jack pine	494	988	412						1,894
White birch		165	659	165					988
Tamarack	247		344	233					824
Northern hardwoods			165	329	72				567
Black spruce		329		165					494
Bottomland hardwoods			165				82	165	412
Misc Deciduous			165		165				329
Swamp hardwoods				165					165
Total	577	5,340	19,191	19,497	9,347	3,260	746	329	58,288

*Lowland brush and unsurveyed acreage have been omitted.

Numbers under c. 680 acres have an error of at least 50% and should be used with caution.

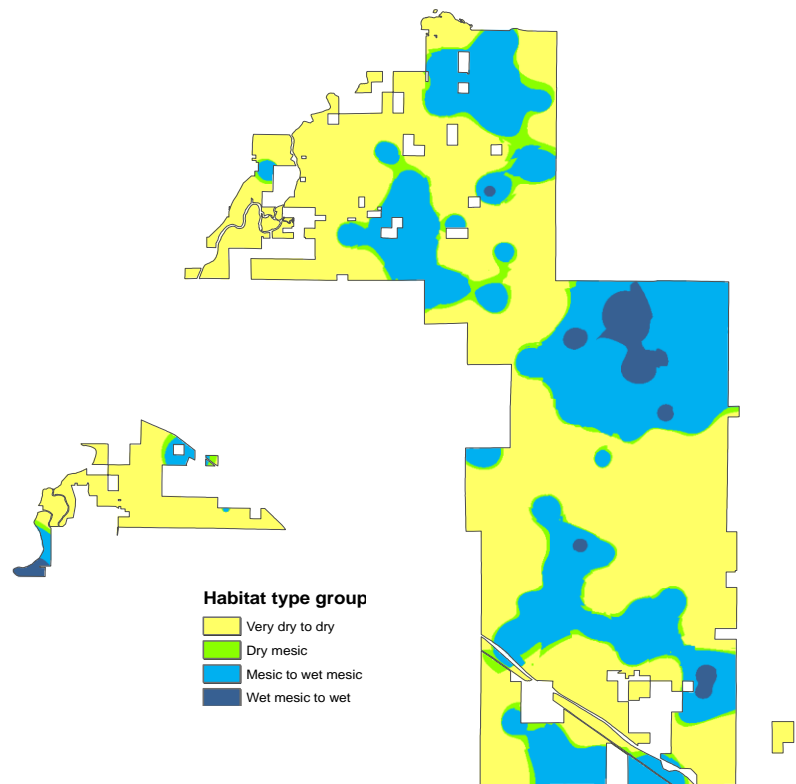


Habitat types

The habitat type system is a method of site classification that uses the floristic composition of a forest community (understory herbs, shrubs and trees) as an indicator of site capability along a moisture/nutrient gradient ranging from very dry to wet and nutrient poor to nutrient rich (Kotar et al. 1999).

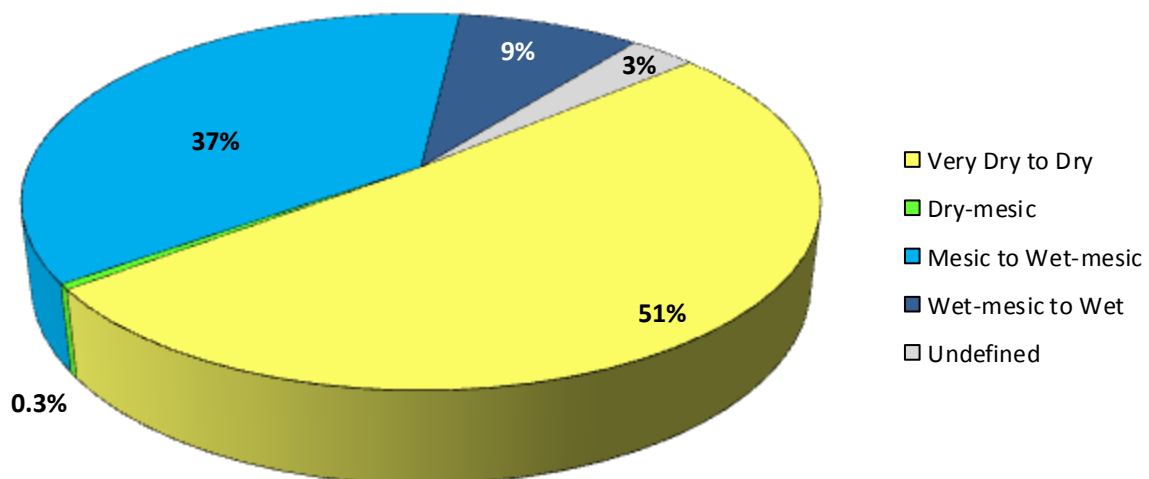
Only 25% of the acreage on the Black River State Forest was sampled for habitat type and sampling errors may be high. For this reason percentages rather than acres are reported.

Over half of all timberland on the Black River State Forest is classified as very dry to dry and 46% as mesic to wet mesic or wetter. Eastern white pine dominates both dry and wet habitat types groups.



The above map is based on the approximate location of habitat types within the forest and may not reflect the percentages in the chart below.

Black River State Forest



Tree numbers and volume

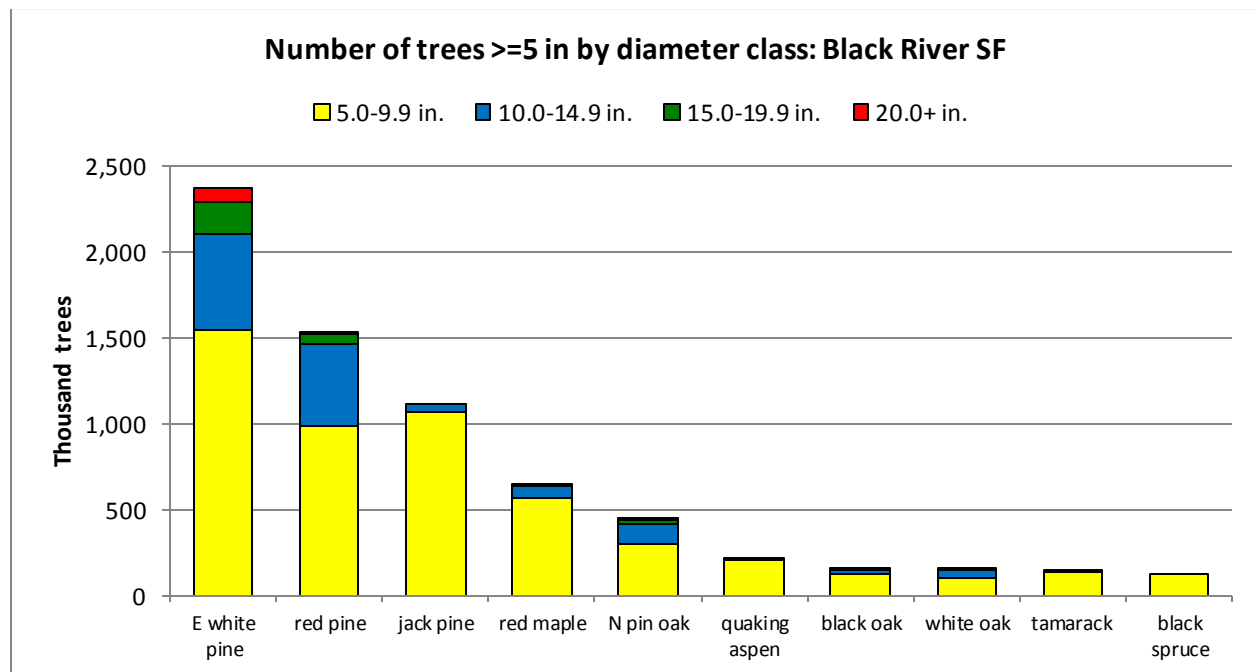
Number of trees by species and diameter

Of the over 42 million trees on the Black River State Forest, eastern white pine and red maple, account for over half. The majority (81%) of trees are saplings. Pines, eastern white pine, red pine and jack pine, account for 65% of trees over 5 inches dbh. Only 1% of trees are over 15 inches and these are mostly eastern white pine.

Number (thousands) of trees by species and diameter class.

Species	1.0-4.9 in.	5.0-9.9 in.	10.0-14.9 in.	15.0-19.9 in.	20.0+ in.	Total	% of trees > 5 in dbh	% of all trees
E white pine	9,751	1,677	575	194	89	12,287	31%	29%
Red pine	568	1,015	480	59	4	2,126	19%	5%
Jack pine	3,654	1,156	54			4,863	15%	11%
Red maple	9,208	698	95	14		10,015	10%	24%
N pin oak	4,024	452	147	36	4	4,662	8%	11%
Quaking aspen	1,950	212	4	2		2,168	3%	5%
Black oak	1,457	202	56	16		1,730	3%	4%
Tamarack	815	141	2			957	2%	2%
White oak	420	131	50	10		610	2%	1%
Paper birch	568	81	6			655	1%	2%
Bigtooth aspen	543	95	14			652	1%	2%
Black spruce	272	121				392	1%	1%
A basswood	99	24	28	6		156	1%	0%
N red oak		46	38	16		99	1%	0%
Total	34,340	6,191	1,576	365	99	42,570		

Figures in red have a sampling error over 50% and should be used with caution.

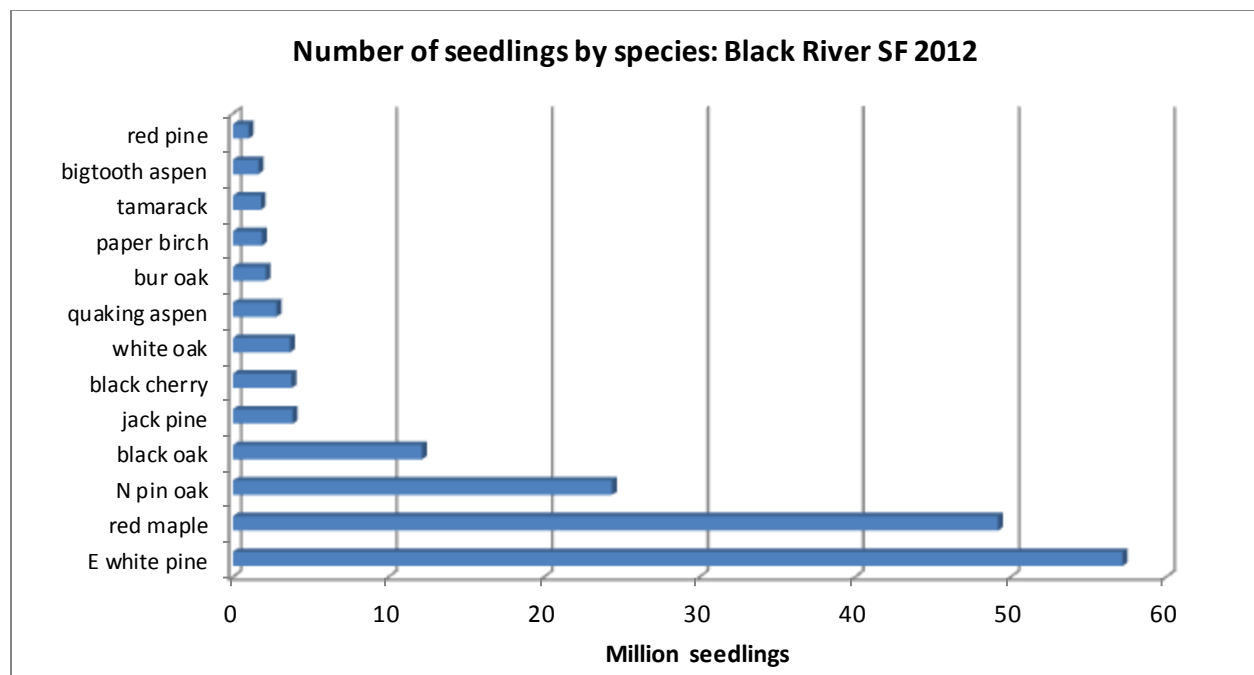


Number of seedlings by species and forest type group

Eastern white pine, red maple and northern pin oak account for $\frac{3}{4}$ of all seedlings. Over half are found on the white / red / jack pine forest type group.

Number (thousands) of live seedlings on timberland by forest type group and species

Species	Aspen / birch	Elm / ash / cottonwood	Spruce / fir	Maple / beech / birch	White / red / jack pine	Oak / hickory	Total	Percent of total
White pine	2,098	25	864	3,826	41,894	8,270	57,200	34%
red maple	3,012	25	617	8,443	18,515	14,788	49,201	29%
N pin oak	2,345	74	0	4,320	10,196	6,073	24,391	14%
black oak	568	0	0	2,592	8,245	444	12,171	7%
jack pine	592	0	0	568	1,160	420	3,851	2%
black cherry	370	0	0	938	1,185	864	3,777	2%
white oak	74	0	0	370	1,950	987	3,678	2%
quaking aspen	99	0	0	321	123	197	2,814	2%
bur oak	0	0	0	49	518	1,506	2,123	1%
paper birch	469	0	25	272	568	197	1,876	1%
tamarack	0	0	444	25	913	25	1,802	1%
bigtooth aspen	99	0	0	74	667	25	1,654	1%
red pine	123	0	0	25	741	99	1,012	1%
black spruce	0	0	889	0	0	0	889	1%
N red oak	0	0	0	25	123	518	667	0.4%
slippery elm	0	0	0	642	0	0	642	0.4%
Total	9,850	123	2,839	22,959	87,071	34,438	168,514	
% total	6%	<1%	2%	14%	52%	20%		



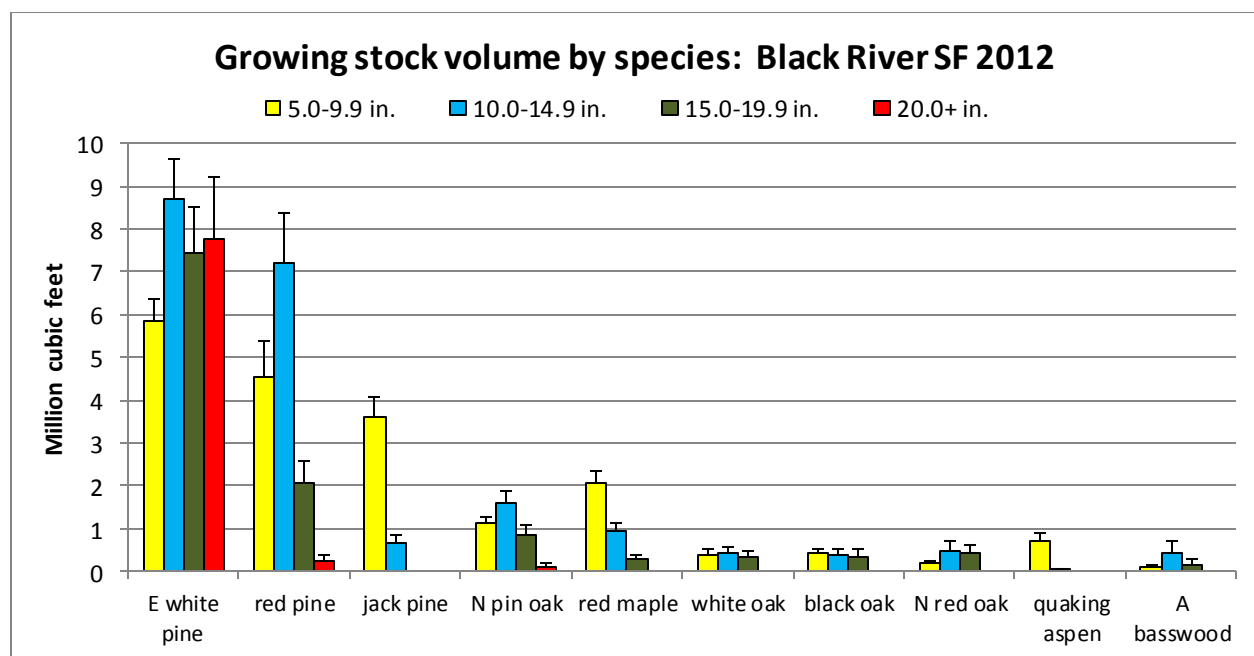
Volume of growing stock (>4.9in dbh) by species and diameter

Eastern white and red pine account for 69% of all growing stock volume on the Black River State Forest. About 1/3 of all trees are less than 10 inches dbh and 13% are over 20 inches dbh. About 95% of volume in trees over 20 inches is in eastern white pine.

Volume of growing stock (thousand cubic feet) by species and diameter class.

Species	5.0-9.9 in.	10.0-14.9 in.	15.0-19.9 in.	20.0+ in.	Total Volume	% of all volume
E white pine	5,846	8,718	7,426	7,767	29,757	47%
red pine	4,563	7,184	2,084	224	14,055	22%
jack pine	3,625	657			4,282	7%
N pin oak	1,119	1,589	844	93	3,645	6%
red maple	2,082	945	280		3,308	5%
white oak	403	450	320		1,174	2%
black oak	412	394	346		1,152	2%
N red oak	191	479	437		1,107	2%
quaking aspen	706	25			731	1%
A basswood	85	427	157		668	1%
tamarack	551	29			580	1%
silver maple	18	38	301	122	478	1%
bigtooth aspen	311	165			476	1%
black spruce	353				353	1%
paper birch	183	87			270	<1%
hackberry	27	160			187	<1%
Total	20,842	21,633	12,307	8,206	62,989	100%
% of total	33%	34%	20%	13%	100%	

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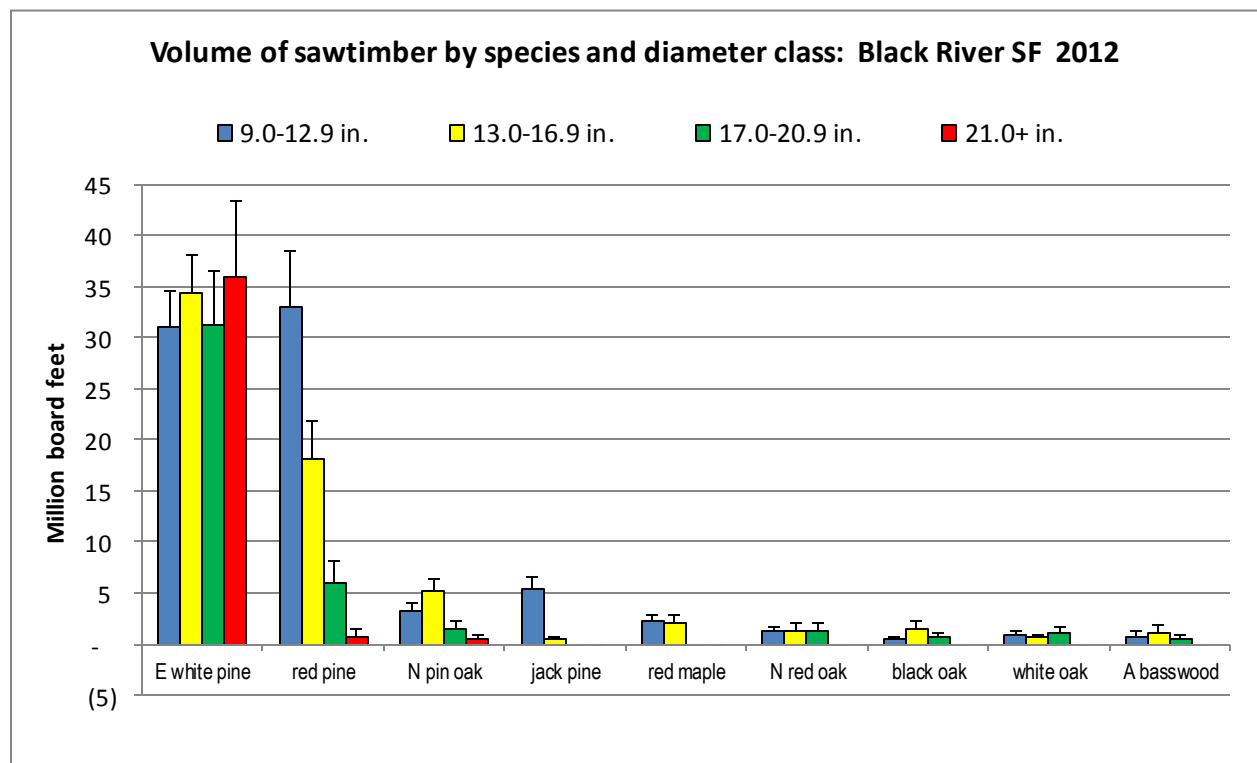
Volume of sawtimber by species and diameter class

Two species, eastern white pine and red pine, account for 83% of all sawtimber. Eastern white pine makes up 97% of trees over 21 inches dbh.

Volume of sawtimber (thousand board feet) by species and diameter class

Species	9.0-12.9 in.	13.0-16.9 in.	17.0-20.9 in.	21.0+ in.	Total	Percent total
E white pine	30,966	34,306	31,254	35,907	132,433	58%
red pine	32,986	18,113	5,922	700	57,721	25%
N pin oak	3,338	5,124	1,521	469	10,452	5%
jack pine	5,460	407			5,867	3%
red maple	2,332	2,040			4,372	2%
N red oak	1,208	1,368	1,377		3,953	2%
black oak	518	1,464	662		2,644	1%
white oak	909	602	1,076		2,588	1%
A basswood	788	1,113	474		2,374	1%
silver maple	151	1,383	591		2,126	1%
hackberry	113	569			682	<1%
Total	79,879	67,649	42,877	37,077	227,481	100%
Percent total	35%	30%	19%	16%	100%	

Figures in red have a sampling error over 50% and should be used with caution.

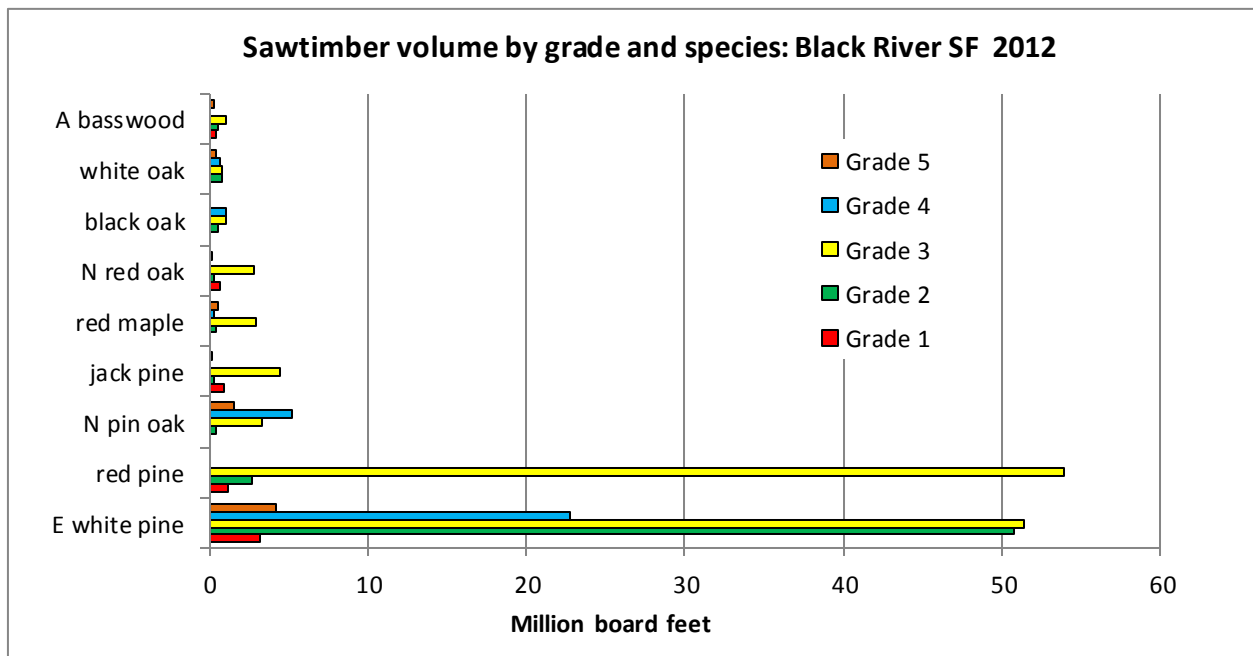


Volume of sawtimber by tree grade ¹ and species

The Black River State Forest has one of the lowest percentages of grade 1 sawlogs, 3%, of all the state forests which average 21%. This is probably due to the predominance of softwood sawtimber.

Volume of sawtimber (thousand boardfeet) on timberland by species and tree grade

Species	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Total	% Grade 1
E white pine	3,235	50,777	51,363	22,817	4,242	132,433	2.4%
red pine	1,159	2,691	53,870			57,721	2.0%
N pin oak		378	3,296	5,257	1,521	10,452	
jack pine	967	365	4,460		75	5,867	16.5%
red maple		439	2,992	325	616	4,372	
N red oak	680	336	2,813		124	3,953	17.2%
black oak		504	1,084	1,056		2,644	
white oak		779	750	636	423	2,588	
A basswood	474	611	999		290	2,374	20.0%
silver maple	591	285	883		366	2,126	27.8%
hackberry		569	113			682	
slippery elm	264	190				455	58.1%
bigtooth aspen			334	114		448	
American elm			358			358	
river birch			262			262	
tamarack	253					253	100%
Total	7,623	57,925	123,823	30,309	7,802	227,481	
Percent total	3%	25%	54%	13%	3%		



^{1 1} To find specifics on log grading see Wisconsin State Forest Continuous Forest Inventory Volume I: Field Data Collection Procedures for Phase 2 Plots- Version 3.0, pp 222-226.

Forest Health and Sustainability

There are several measures that serve as indicators of forest health and sustainability. These include the ratio of average annual net growth to volume, the ratio of mortality to gross growth, the number and volume of standing dead trees and the percentage of crown dieback and transparency. These measures assess very different aspects of forest health and have varying degrees of precision and statistical reliability. Since growth and mortality are based on only one year of data, sampling errors are high. For this reason and in order to normalize between site variability, ratios are presented as well as absolute values.

The ratio of growth to volume and the ratio of mortality to gross growth are measures of sustainability of species. So long as the growth rate is positive and maintained over time and so long as mortality does not surpass growth for long periods, a species should continue to play a sustainable role in the forest.

Mortality may be caused by insects, disease, adverse weather, succession, competition, fire, old age or human and animal activity and is often the result of a combination of these factors. The ratio of mortality to gross growth (growth plus mortality) indicates whether a species is declining or maintaining its current position in a particular forest. By normalizing mortality by growth rate, the ratio allows comparisons across diverse landscapes.

The number and volume of standing dead trees is much less precise as there is little indication of when trees died and some species will remain vertical for a longer period. But numbers are larger and the sampling error will be lower. Standing dead trees serve as an indicator of forest health and diversity in several ways, functioning as indicators of past mortality events, as habitat for many species and as carbon storage.

The condition of tree crowns within a stand reflects the overall health of a forest. Crown indicators can also vary by species and are often temporary. Dieback is the percentage of dead branch tips in the crown. Crown transparency is a measure of the proportion of the crown through which the sky is visible. A forest suffering from a disease epidemic or insect infestation will have obvious dieback and high transparency.

Because these measures are all approximations with a certain degree of error, taken together they can give a general accounting of forest health and sustainability.

Ratio of annual net growth to volume

Eastern white pine and red pine make up $\frac{2}{3}$ of annual net growth.

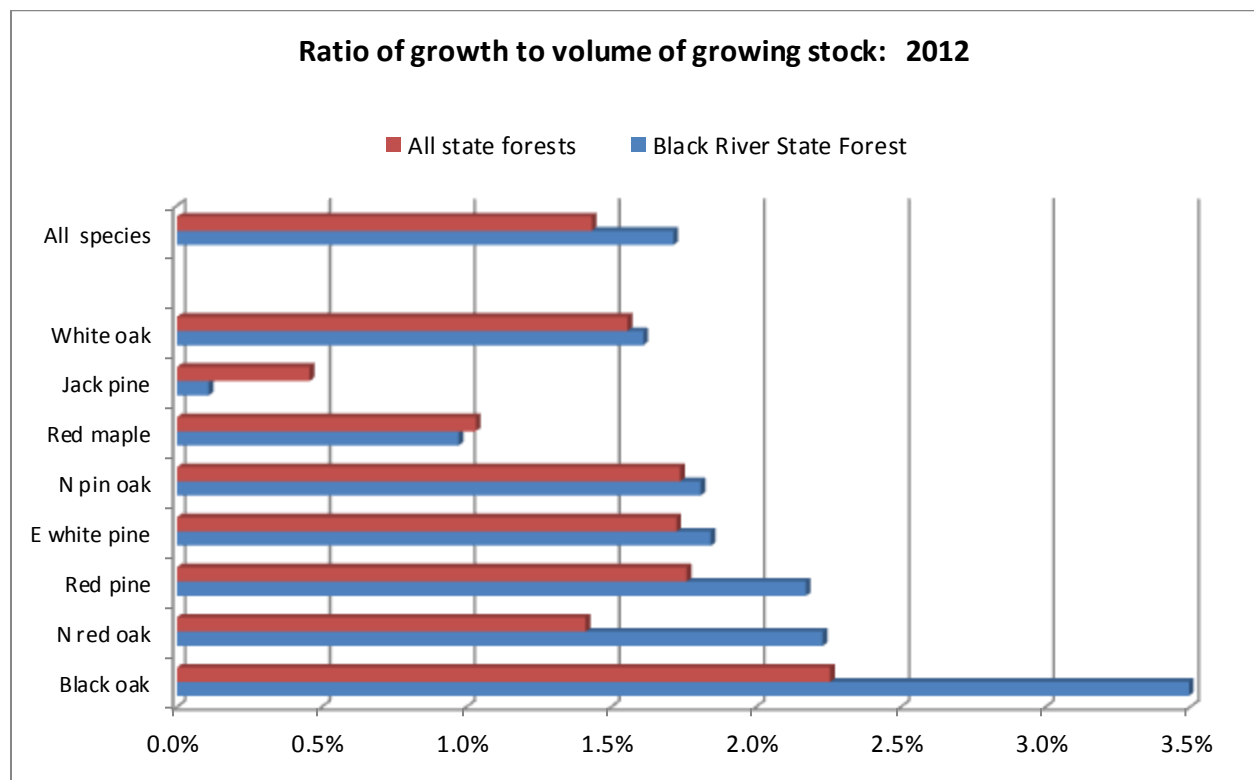
Eastern white pine, red pine, northern pin oak and black oak all have a higher than average growth to volume ratio. Jack pine and the aspens have a lower than average growth rate although sampling error is high.

The average growth rate on the Black River State Forest for all species, 1.7%, is higher than for all state forests combined, 1.4%.

Annual net growth (cubic feet per year) and growth to volume ratio.

Species*	Average annual net growth	Growth / volume ratio	
		Black River State Forest	All state forests
E white pine	548,694	1.8%	1.7%
Red pine	305,376	2.2%	1.8%
N pin oak	65,931	1.8%	1.7%
Black oak	40,252	3.5%	2.3%
White oak	18,907	1.6%	1.6%
Red maple	32,172	1.0%	1.0%
N red oak	24,680	2.2%	1.4%
Quaking aspen	9,600	1.3%	1.7%
Bigtooth aspen	8,051	1.7%	2.2%
Jack pine	4,715	0.1%	0.5%
All species	1,080,292	1.7%	1.4%

* Figures in red have a sampling error over 50% and should be used with caution .



Ratio of mortality to gross growth

The species with the highest mortality to gross growth ratio for the Black River State Forest are jack pine, red maple and northern pin oak. Jack pine and red maple have ratios over 50% which means that over half of all growth is lost to mortality. The ratio for all species on the Black River State Forest, 0.14, is much lower than for all state forest properties combined, 0.25

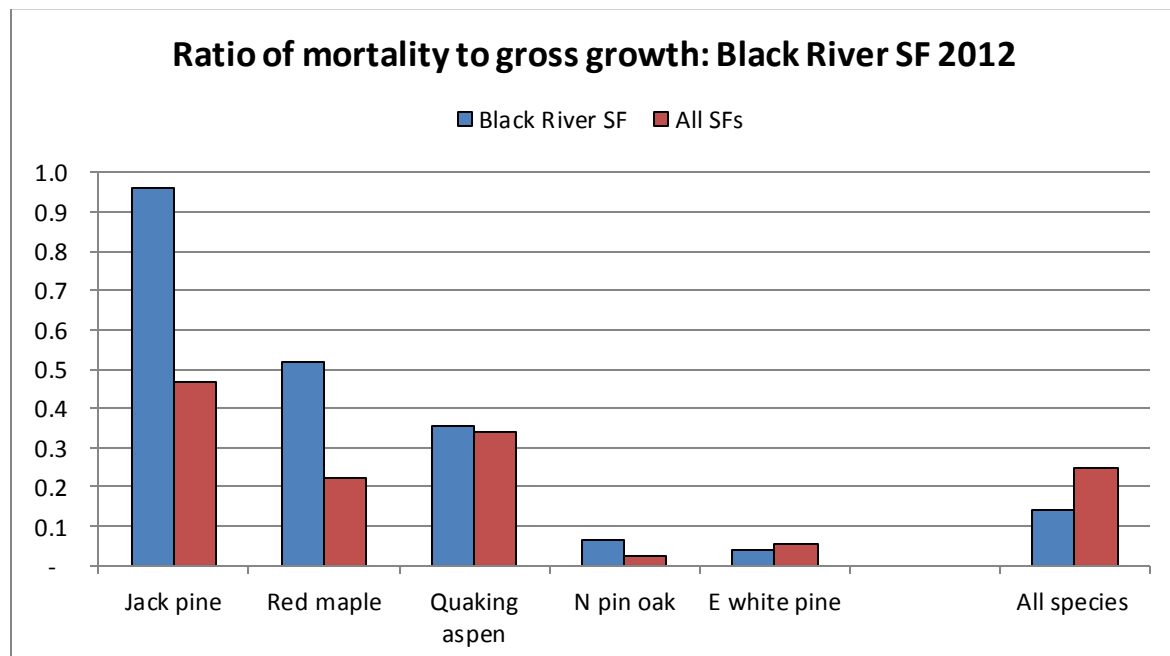
The percentage of trees dying in one year on the Black River State Forest, 0.1% is half that for all properties, 0.2%. Both measures are approximations based on one year of data.

Mortality to gross growth ratio for the Black River State Forest and for all state forests combined.

Species**	Black River State Forest				Statewide			
	Mortality (cft/yr)	Gross growth (cft/yr)	Mortality / gross growth	Percent of trees dying per year *	Mortality (cft/yr)	Gross growth (cft/yr)	Mortality / gross growth	Percent of trees dying per year*
Jack pine	112,998	117,713	0.96	0.50%	194,865	237,779	0.82	0.44%
Red maple	34,548	66,719	0.52	0.07%	162,805	621,649	0.26	0.10%
Quaking aspen	5,306	14,906	0.36	0.13%	761,316	1,647,117	0.46	0.43%
N pin oak	4,511	70,442	0.06	0.03%	4,511	202,293	0.02	0.06%
E white pine	24,235	572,929	0.04	0.04%	105,319	1,880,658	0.06	0.07%
All species	181,598	1,261,890	0.14	0.10%	2,767,937	11,082,704	0.25	0.20%

* Number of trees (at least 1 inch dbh) that died in one year divided by number of all trees, live and dead.

** Figures in red have a sampling error over 50% and should be used with caution.



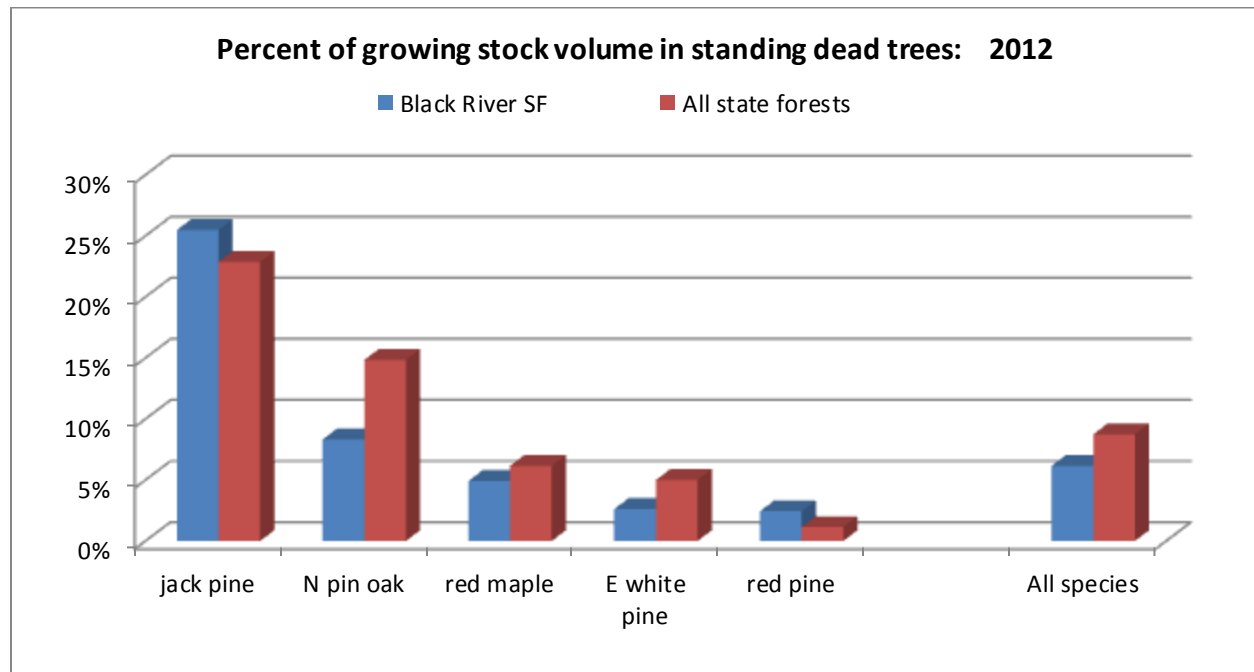
Numbers and volume of standing dead trees

As with average annual mortality, the number and volume of standing dead trees (>5 inches dbh) is lower on the Black River State Forest than on all state forests combined. The percent of volume of dead trees is higher than average for jack pine and red pine but lower for northern pin oak, red maple and eastern white pine.

Percent of all trees and all volume in trees >5 inches dbh that are standing dead by species.

Species	Percent of trees that are standing dead		Percent of volume in standing dead trees	
	Black River SF	All state forests	Black River SF	All state forests
jack pine	6.4%	5.9%	25.5%	22.9%
N pin oak	1.3%	3.3%	8.3%	14.8%
red maple	0.4%	1.2%	4.9%	6.1%
E white pine	0.9%	1.8%	2.6%	5.0%
red pine	1.0%	1.4%	2.4%	1.1%
bigtooth aspen	3.9%	2.6%	29.9%	11.8%
quaking aspen	3.7%	4.8%	26.6%	16.8%
black oak	3.1%	4.8%	20.7%	35.8%
silver maple	16.4%	8.1%	8.3%	3.1%
N red oak	6.5%	2.1%	6.2%	4.8%
tamarack	0.4%	2.1%	2.8%	11.8%
white oak	0.7%	4.8%	0.4%	4.1%
All species	1.8%	2.8%	6.2%	8.7%

** Red indicates species which make up less than 3% of total volume and have a high sampling error.



Crown dieback and transparency

The major species with the highest values for dieback on the Black River State Forest are bigtooth aspen, quaking aspen, northern pin oak, American elm and black oak.

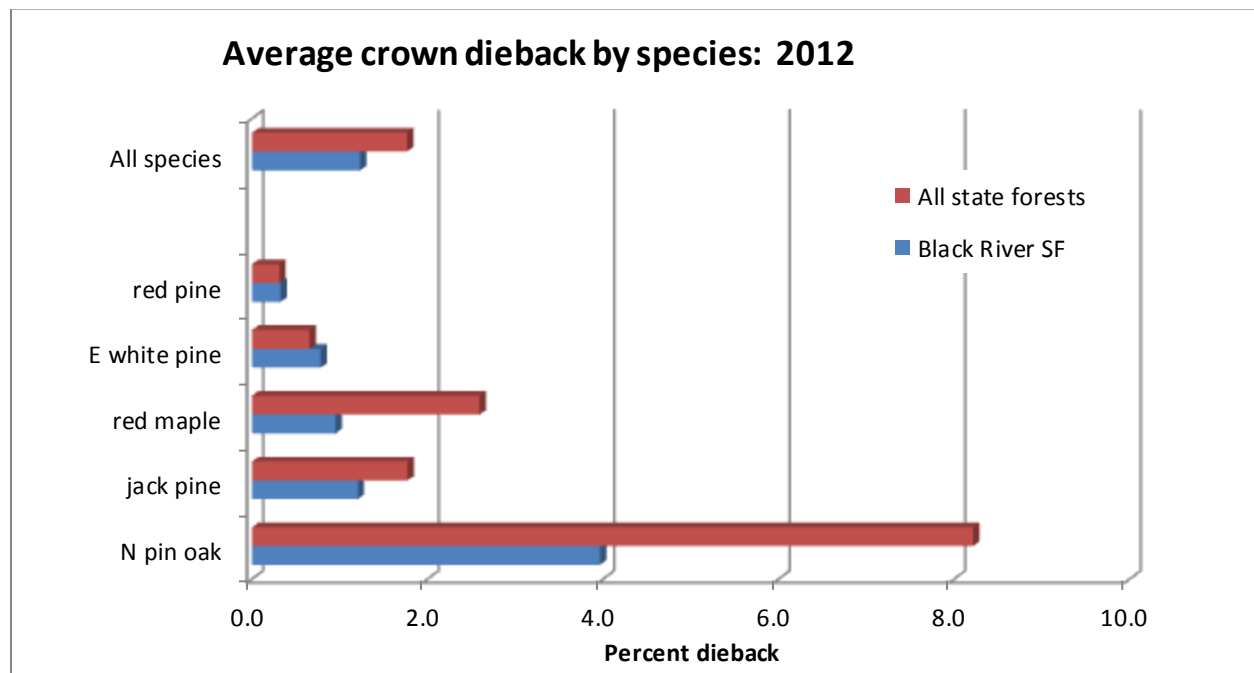
The major species with lower values for crown dieback compared to all state forests combined include jack pine, northern pin oak, red maple, white oak and northern red oak.

Overall, both crown dieback and transparency are lower on the Black River State Forest than on all state forests combined.

Average crown dieback and transparency on the Black River State Forest and all state forests.

Species*	Average crown dieback		Average crown transparency	
	Black River SF	All state forests	Black River SF	All state forests
N pin oak	4.0	8.2	17.1	21.4
jack pine	1.2	1.8	18.9	17.9
red maple	1.0	2.6	15.5	17.8
E white pine	0.8	0.7	18.7	17.0
red pine	0.3	0.3	13.7	13.6
A elm	3.0	3.7	18.0	18.0
bigtooth aspen	12.9	1.2	25.0	19.3
bitternut hickory	4.3	3.6	18.0	18.0
quaking aspen	4.3	2.3	19.7	20.1
black oak	2.1	1.8	19.2	19.2
hackberry	1.5	1.5	20.5	20.4
paper birch	1.2	2.9	16.0	18.8
tamarack	0.8	1.5	17.1	16.9
N red oak	0.7	1.9	17.6	16.2
black spruce	0.7	0.9	14.2	13.0
white oak	0.6	1.9	16.9	18.3
All Species	1.2	1.8	17.0	17.1

*Red indicates species which make up less than 3% of total volume and have a high sampling error.



Trends

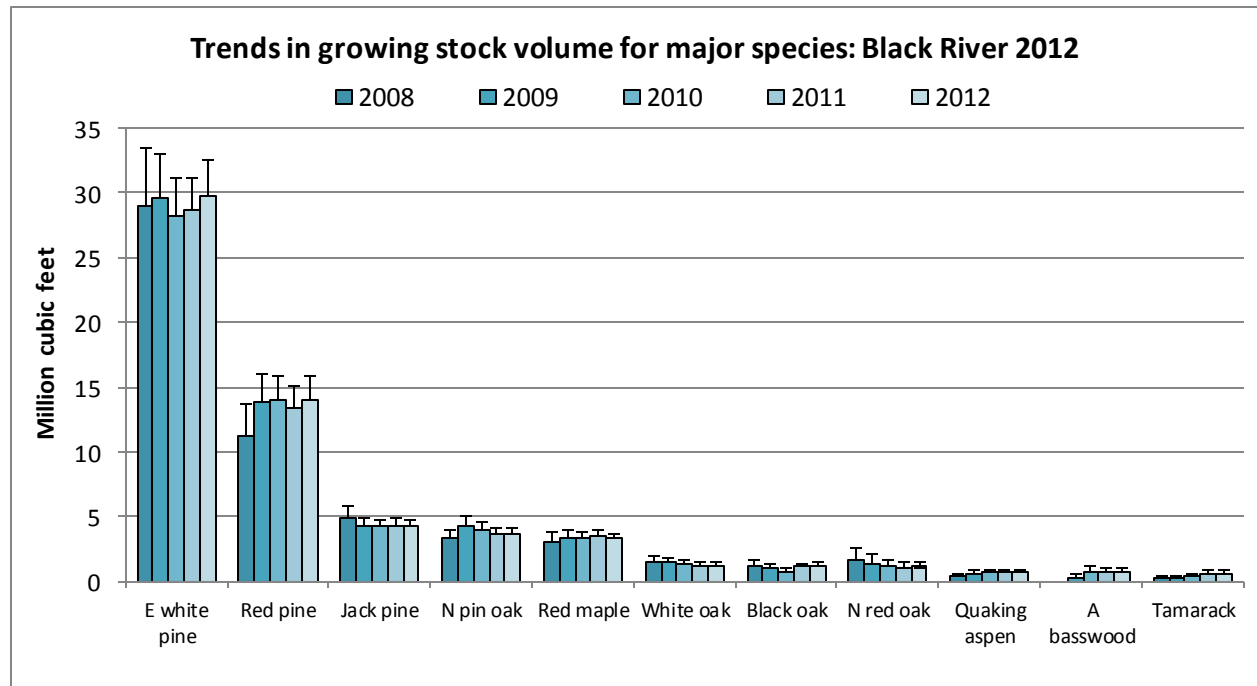
Growing stock volume

There may appear to be trends in species volume but they cannot be substantiated statistically since the data is highly auto-correlated and sampling errors are high. Future re-measurements may help to reduce both the correlation and error.

Growing stock volume (thousand cubic feet) by major species and year

Species	2008*	2009	2010	2011	2012	Change 2008 to 2012
E white pine	29,033	29,560	28,276	28,664	29,757	2%
Red pine	11,241	13,871	13,958	13,370	14,055	25%
Jack pine	4,954	4,260	4,202	4,313	4,282	-14%
N pin oak	3,309	4,265	3,984	3,636	3,645	10%
Red maple	3,086	3,412	3,357	3,466	3,308	7%
White oak	1,489	1,441	1,274	1,179	1,174	-21%
Black oak	1,240	1,055	793	1,120	1,152	-7%
N red oak	1,677	1,389	1,178	1,087	1,107	-34%
Quaking aspen	398	612	715	714	731	84%
A basswood	0	307	770	670	668	
Tamarack	206	234	391	581	580	182%
All species	59,115	63,133	61,558	61,326	62,989	7%

* Each year contains previous years' data, i.e. 2010 includes 2008, 2009 and 2010 data. *Red indicates species which make up less than 3% of total volume and have a high sampling error.



Definition of Terms

Average net annual growth of growing stock --The annual change in cubic foot volume of sound wood in live sawtimber and poletimber trees, and the total volume of trees entering these classes through ingrowth, less volume losses resulting from natural causes. Average net annual growing stock is the average for the years between inventories.

Forest type-WisCFI. - A tract of forest land characterized by the predominance of one or more key species which make up 50 percent or more of the basal area of saw-timber and pole-timber stands, or of the number of trees in seedling and sapling stands. Forest land less than 10 percent stocked with commercial tree species is classified as upland brush, grass or lowland brush.

Aspen--Aspen comprises 50% or more of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in sapling and seedling stands.

Bottomland hardwoods --Any combination of silver maple, green ash, swamp white oak, American elm, river birch, and cottonwood comprises 50% or more of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in sapling and seedling stands. Hardwood dominated forests occurring on floodplains and some terraces.

White birch --White Birch comprises 50% or more of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in sapling and seedling stands.

White cedar --White cedar comprises 50% or more of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in sapling and seedling stands. In mixed swamp conifer stands, white cedar is predominant.

Central hardwoods --Any combination of oaks, hickories, elms, black cherry, hackberry, red maple, white ash, green ash, basswood, and sugar maple, which does not satisfy the defining criteria for NH, MR, or O cover types. The CH type occurs only on uplands within and south of the Tension Zone (southern Wisconsin).

Balsam Fir --Balsam fir comprises 50% or more of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in sapling and seedling stands. In mixed swamp conifer stands, balsam fir is predominant.

Hemlock --Hemlock comprises 50% or more of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in sapling and seedling stands.

Miscellaneous Conifers --Conifer forests dominated by uncommon or exotic species; e.g. Eastern red cedar, Scotch pine, Norway spruce, European Larch.

Miscellaneous Deciduous --Hardwood forests dominated by uncommon or exotic species; e.g. box elder, honey locust, black locust, Norway maple.

Red Maple --Red Maple comprises 50% or more of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in sapling and seedling stands. If soil is poorly drained, then swamp hardwood.

Northern hardwoods --Any combination of sugar maple, beech, basswood, white ash, and yellow birch comprises 50% or more of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in sapling and seedling stands.

Oak --Oak comprises 50% or more of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in saplings and seedling stands.

Scrub oak --More than 50% of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in sapling and seedling stands is comprised of oak with site indices ≤ 50 . Typical forest products include only fuelwood and fiber.

Red pine --Red pine comprises 50% or more of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in sapling and seedling stands. In mixed pine stands, red pine is predominant.

White pine --Eastern white pine comprises 50% or more of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in sapling and seedling stands. In mixed pine stands, eastern white pine is predominant.

Jack pine --Jack pine comprises 50% or more of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in sapling and seedling stands. In mixed pine stands, jack pine is predominant.

Black spruce --Black spruce comprises 50% or more of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in sapling and seedling stands. In mixed swamp conifer stands, black spruce is predominant.

Swamp hardwoods --Any combination of black ash, green ash, red maple, silver maple, swamp white oak, and American elm that comprises 50% or more of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in sapling and seedling stands. This type occurs on wetlands characterized by periodic inundation (fluctuating water table near or above the soil surface) and nearly permanent subsurface water flow.

White Spruce --White spruce comprises 50% or more of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in sapling and seedling stands.

Tamarack --Tamarack comprises 50% or more of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in sapling and seedling stands. In mixed swamp conifer stands, tamarack is predominant.

Black Walnut --Black walnut comprises 50% or more of the basal area in saw-timber and pole-timber stands, or 50% or more of the stems in sapling and seedling stands.

Gross growth - Net growth plus volume losses due to mortality

Growing-stock tree.--A live timberland tree of commercial species that meets specified standards of size, quality, and merchantability. (Note: Excludes rough, rotten, and dead trees.)

Growing-stock volume.--Net volume in cubic feet of growing-stock trees 5.0 inches d.b.h. and over, from 1 foot above the ground to a minimum 4.0- inch top diameter outside bark of the central stem or to the point where the central stem breaks into limbs.

Habitat types and habitat type groups – An aggregation of units of land capable of producing similar plant communities at climax and having similar potential productivity. Habitat type groups are groupings of habitat types with similar soil moisture and nutrient regimes and potential productivity.

Sawtimber tree.--A live tree of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs 8 feet or longer, and meeting regional specifications for freedom from defect. Softwoods must be at least 9.0 inches d. b. h. Hardwoods must be at least 11.0 inches d.b.h.

Sawtimber volume.--Net volume of the saw-log portion of live sawtimber in board feet, International 1/4-inch rule (unless specified otherwise), from stump to a minimum 7.0 inches top d. o. b, for softwoods and a minimum 9.0 inches top d. o. b, for hardwoods.

Site index.--An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Stand-size class.--A classification of stocked (see Stocking) forest land based on the size class of live trees on the area; that is, sawtimber, poletimber, or seedlings and saplings.

Nonstocked - Meeting the definition of accessible forest land, and one of the following applies: (a) less than 10 percent stocked by trees of any size, and not classified as cover trees (see code 6), or (b) for several woodland species where stocking standards are not available, less than 5 percent **crow**n cover of trees of any size.

Large saw-timber stands (15+) - Saw-timber stands typed as large saw-timber within the primary cover type based on the basal area size class distribution of saw timber trees 15.0 inches d.b.h. and larger.

Small saw-timber stands (Softwoods 9-14.9", Hardwoods 11-14.9") - Saw-timber stands typed as small saw-timber within the primary cover type based on the basal area size class distribution of saw-timber trees less than 15.0 inches d.b.h.

Pole-timber stands (Softwoods 5-8.9", Hardwoods 5-10.9") - Stands typed as pole-timber within the primary cover type having a minimum net basal area of 10 sq. ft./acre.

Sapling stands (1-4.9") - Forest stands typed as saplings within the primary cover type having a minimum of 200 seedlings per acre.

Seedling stands (<1") - Forest stands typed as seedlings within the primary cover type having a minimum of 200 seedlings per acre.

Stand-age class.--A classification based on age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Timberland.--Forest land that is producing, or is capable of producing, more than 20 cubic feet per acre per year of industrial wood crops under natural conditions, that is not withdrawn from timber utilization, and that is not associated with urban or rural development. Currently inaccessible and inoperable areas are included. (Timberland was formerly called commercial forest land.)

Tree grade.--A classification of the lower 16 feet of the bole of standing trees based on external characteristics as indicators of the quality and quantity of lumber that could be produced from the tree. Tree grade was assigned to a sample of hardwood sawtimber trees during the 1996 inventory. See Wisconsin Dept of Natural Resources Division of Forestry. October 2011. Wisconsin State Forest Continuous Forest Inventory Volume I: Field Data Collection Procedures for Phase 2 Plots- Version 3.0, <http://dnr.wi.gov/topic/ForestPlanning/documents/WisCFIvolumelversion3.pdf>, pp 219-229.

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For more information on the WisCFI database including background, reports, tables and access to the data, please go to the WIDNR Wisconsin's Continuous Forest Inventory website at: <http://dnr.wi.gov/topic/ForestPlanning/forestInventory.html>