Forest characteristics of the **Coulee Experimental Forest**

WisCFI data 2007 - 2012

Summary of the Coulee Experimental Forest

Because this forest is so small, sampling errors for almost every measure reported here are high. For this reason, **caution must be used in evaluating the data in this report**.

There are approximately 2,513 (± 11.3% sampling error or SE) acres of timberland on the Coulee Experimental Forest. The major forest types are oak and northern hardwoods. These two types account for almost 60% of all timberland. There was no acreage reported in the seedling or sapling size classes or in the less than 20 year age class. The average site index on the forest is 70.2 which is the highest of all the state forests which have a combined site index of 56.8. The six plots surveyed for habitat type, were classified as either dry mesic or dry mesic to mesic.

There are 1.6 million trees (± 14.4% SE), 4.6 million cubic feet of growing stock volume (± 18.1% SE) and 16.1 million board feet of sawtimber (± 23.5% SE) on the Coulee Experimental Forest. The most numerous growing stock species are American basswood, American elm, northern red oak and quaking aspen. Northern red oak, bigtooth aspen and American basswood account for over half of all growing stock volume on the Coulee Experimental Forest. Northern red oak accounts for 38% of all sawtimber volume. Overall the Coulee Experimental Forest has a high average volume of sawtimber per acre, 6.4 MBF/acre, compared to 4.2 MBF/acre for all properties.

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.

It is especially difficult to assess forest health on the Coulee Experimental Forest because it's a relatively small property with few trees and with only a fifth of the plots re-measured for growth and mortality, sampling errors are very high. We can look at each of the major species and report which ones have values for several of the forest health indicators that may indicate a problem, such as a below average growth rate, an above average mortality ratio, an above average volume of standing dead trees and above average percentage crown dieback.

- 4 indicators: paper birch
- 3 indicators: American basswood
- 2 indicators: black oak, white oak, quaking aspen

For all species combined, growth rates are much lower on the Coulee Experimental Forest compared to all state forests (0.7% vs. 1.4%), the mortality to growth ratio is over twice as high (0.61 vs. 0.25), the percent volume of standing dead trees is also over twice as high (24.1% vs. 8.7%), but the average percentage of crown dieback is lower (1.2% vs. 1.8%).

Together these indicators suggest there **ma**y be some problems with forest sustainability on the Coulee Experimental Forest especially for species like paper birch and American basswood.

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 located 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 acreage of timberland 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 this data.

Stand Characteristics

Acres by forest type and stand size

Acreage is so low on the Coulee Experimental Forest that only the oak forest type has a sampling error under 50%. There were no plots in seedling/sapling stands. The remaining acreage was evenly divided into pole, small sawtimber and large sawtimber-sized stands.

Acres of timberland by WisDNR forest type and size class

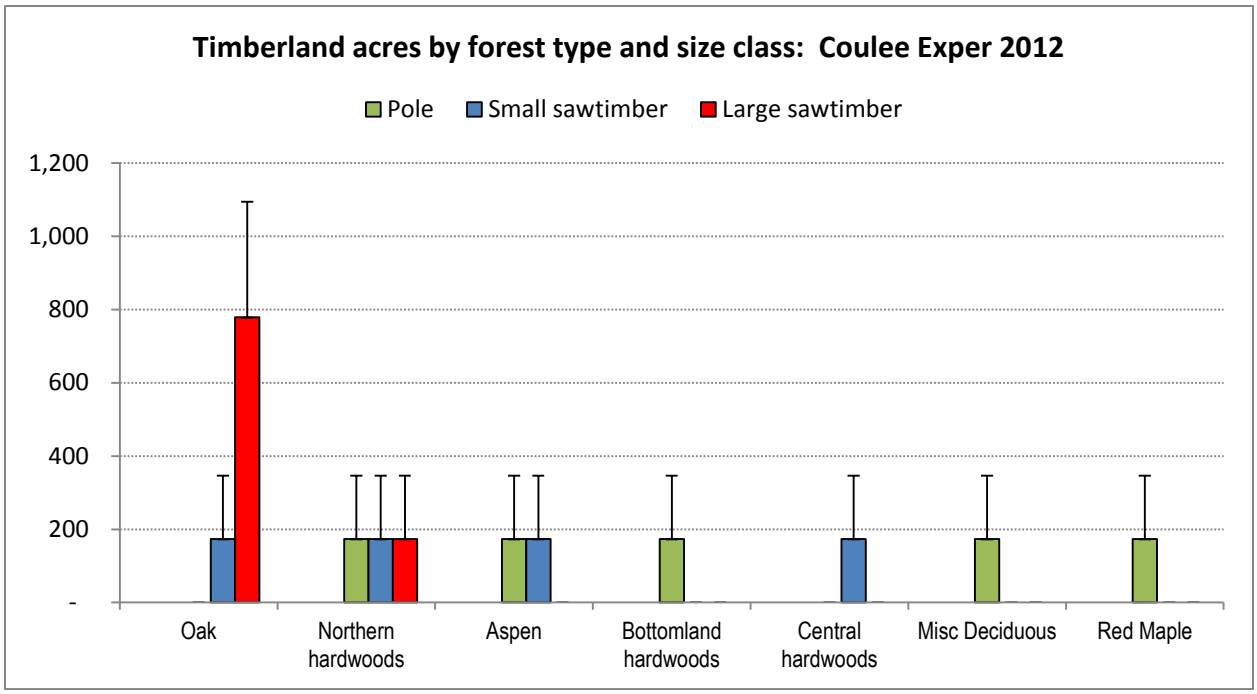
Forest type	Seedling	Sapling	Pole*	Small sawtimber*	Large sawtimber*	Total WisCFI**	Total WISFIRS
Oak	-	-	-	173	779	**953**	1,454
Northern hardwoods	-	-	173	173	173	**520**	80
Aspen	-	-	173	173	-	**346**	590
Bottomland hardwoods	-	-	173	-	-	**173**	
Central hardwoods	-	-	-	173	-	**173**	417
Misc Deciduous	-	-	173	-	-	**173**	112
Red Maple	-	-	173	-	-	**173**	
White birch	-	-	2	-	-	**2**	132
All forest types	**-**	**-**	**867**	**693**	**953**	**2,513**	2,785

*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. Some WISFIRS types have been combined.

*** Misc Deciduous is mostly bigtooth aspen and elm.

Figures under 660 acres (in red) have a sampling error of at least 50% and should be used with caution



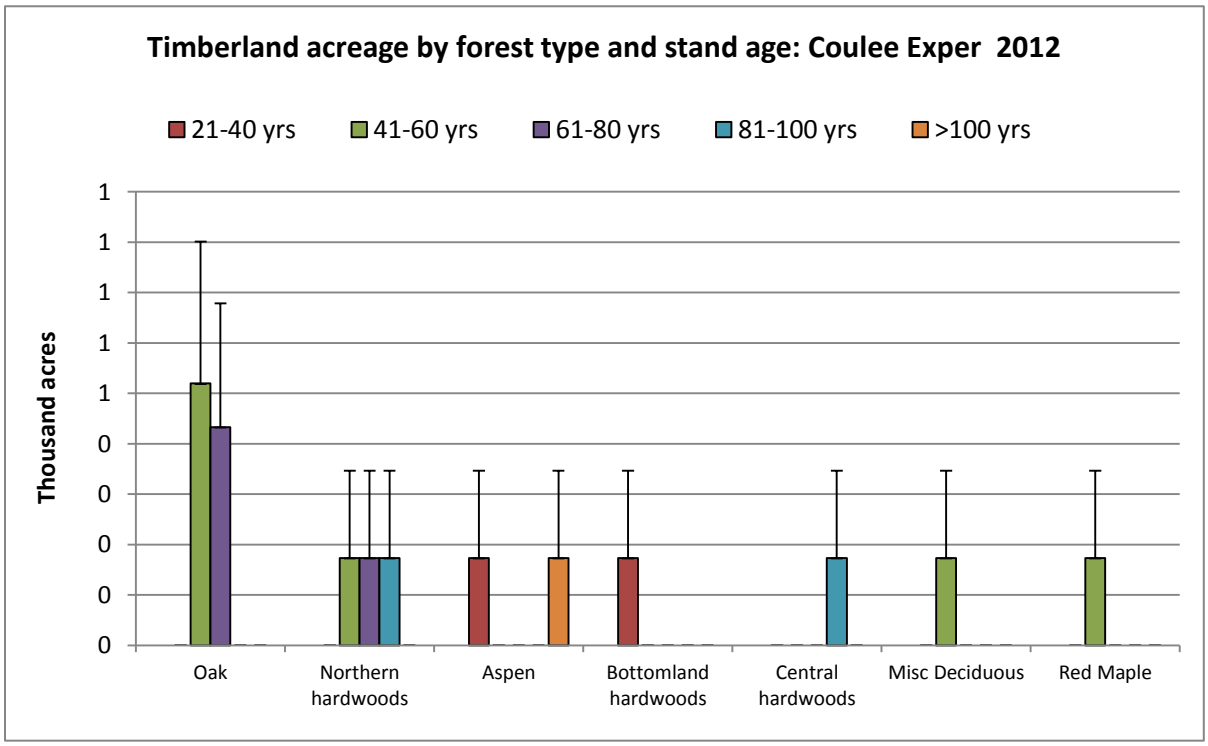
Acres by forest type and stand age

Again the sampling errors are very high but it seems that about ⅔ of acreage on the Coulee Experimental Forest is between 41 and 80 years old. There were only 16 plots with a recorded age.

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
Oak	-	-	520	433	-	-	**953**
Northern hardwoods	-	-	173	173	173	-	**520**
Aspen	-	173	-	-	-	173	**346**
Bottomland hardwoods	-	173	-	-	-	-	**173**
Central hardwoods	-	-	-	-	173	-	**173**
Misc Deciduous	-	-	173	-	-	-	**173**
Red Maple	-	-	173	-	-	-	**173**
Total WisCFI*	**0**	**348**	**1,039**	**606**	**346**	**173**	**2,513**
Total WISFIRS	**150**	**281**	**632**	**307**	**480**	**882**	**2,785**

*Lowland brush and unsurveyed acreage have been omitted.
Numbers under c. 660 acres (in red) have a sampling error of at least 50% and should be used with caution.



Acres by site index and forest type

Due to high sampling error (16 plots), the following statements are only estimates. For instance, the entry of 173 acres in the table has an error of 100%.

The average site index on the Coulee Experimental Forest is 70.2, the highest site index on any of the state forests which together have an average site index of 56.8.

Acres of timberland by forest type and site index

Forest type*	31 - 40	41 - 50	51 - 60	61 - 70	71 - 80	81 - 90	>90	Average SI
Oak			173	173	173	173	260	**77**
Northern hardwoods	173	173					173	**58**
Aspen			173		173			**65**
Bottomland hardwoods							173	**95**
Central hardwoods		173						**45**
Misc Deciduous						173		**85**
Red Maple				173				**65**
Total	**173**	**346**	**348**	**346**	**346**	**346**	**606**	**70**

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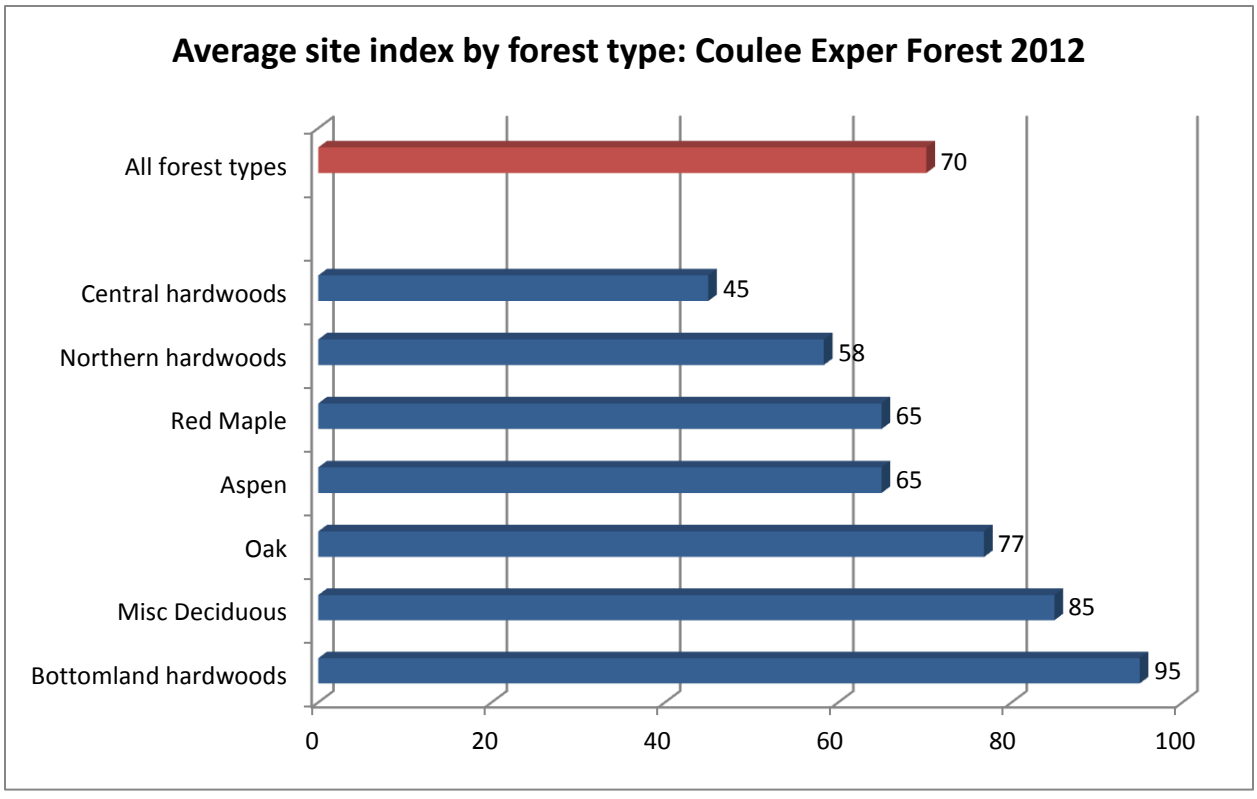
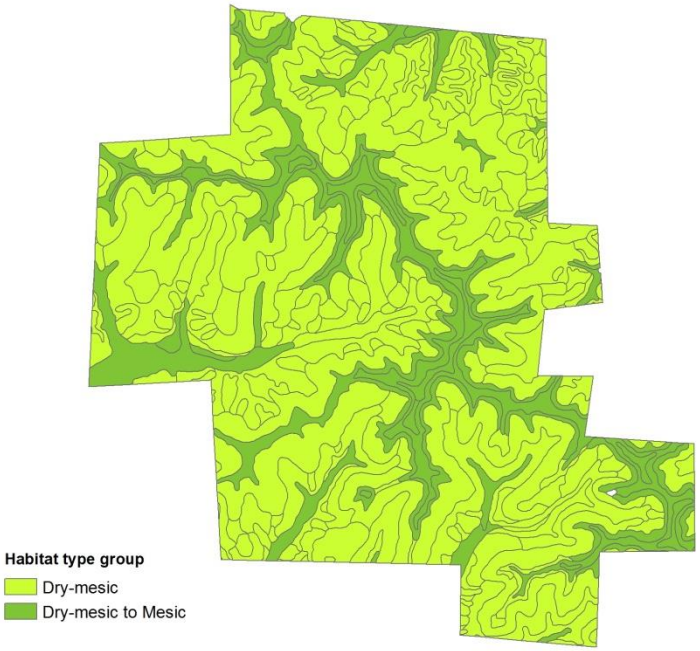
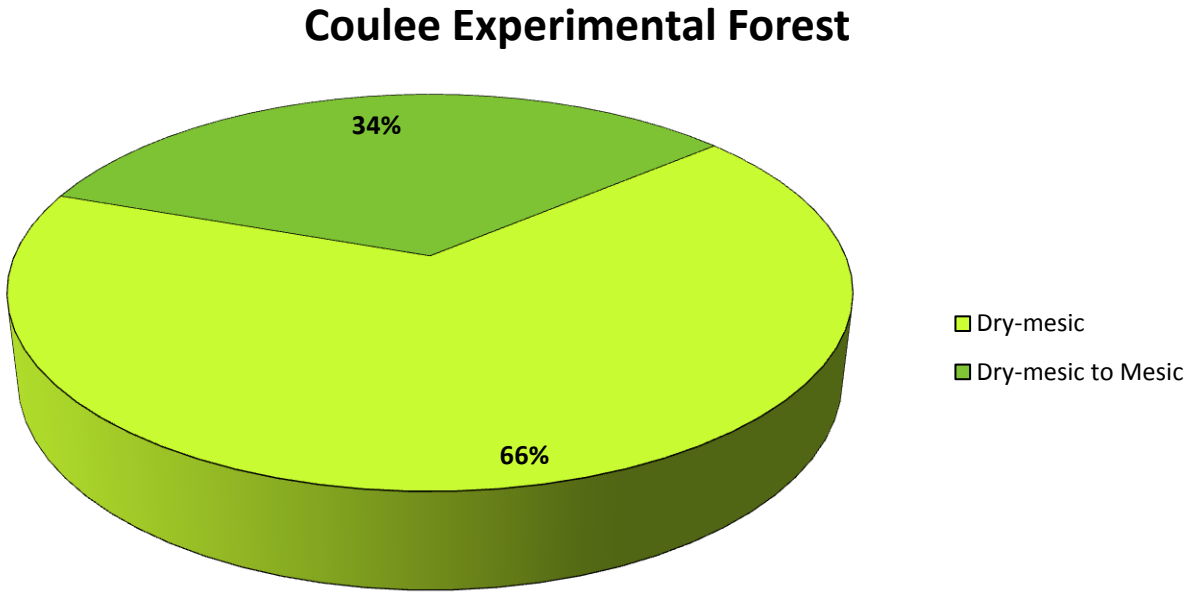


Habitat types

The habitat type system is a method of site classification that uses the floristic composition of a forest community (understory herbs and shrubs as well as 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 six plots on the Coulee Experimental Forest were sampled for habitat type and sampling errors are very high. Four plots were classified as dry mesic and two were typed as dry to dry mesic. The map on the right is based on soil drainage conditions.





Tree Numbers and Volume

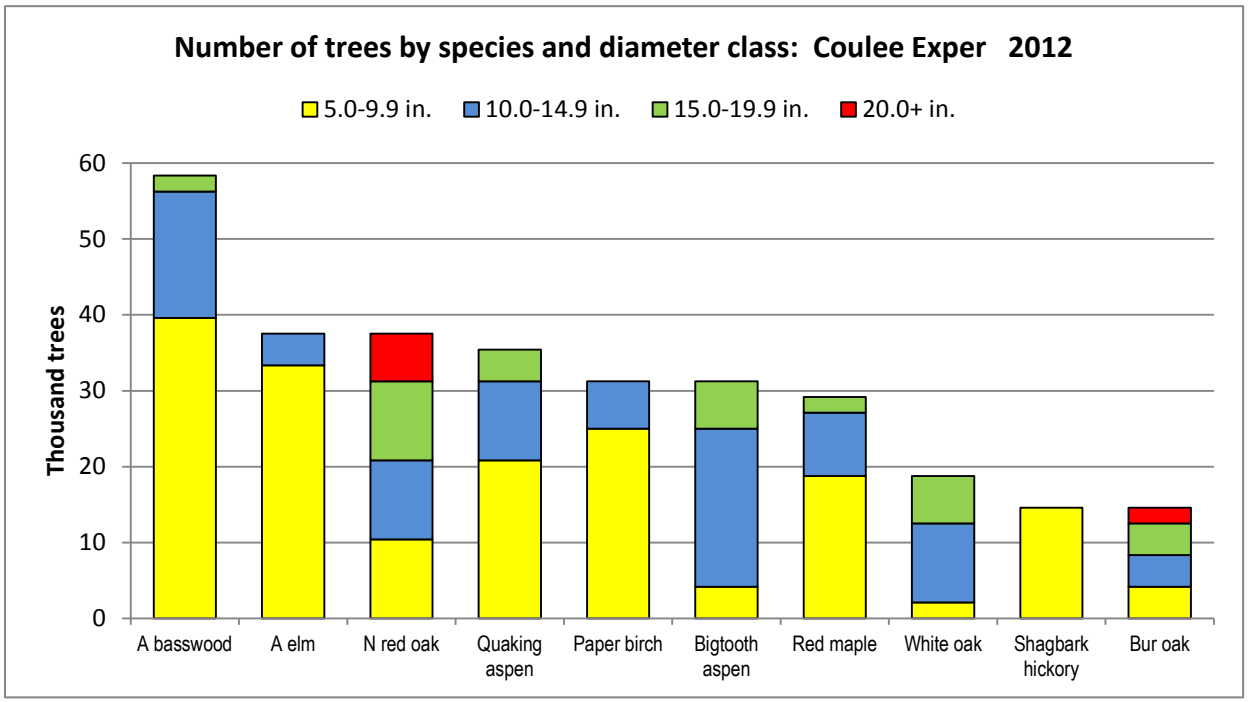
Number of trees by species and diameter

Due to high sampling error, the following statements are only estimates.

American basswood and American elm account for about half of all trees on the Coulee Experimental Forest but only 26% of trees over 5 inches dbh. The most numerous growing stock trees are American basswood, American elm, northern red oak and quaking aspen. Northern red oak accounts for over ⅓ of trees over 15 inches dbh.

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
A elm	441	33	4			479	10%	30%
A basswood	234	40	17	2		292	16%	18%
Boxelder	130	4				134	1%	8%
Red maple	104	19	8	2		133	8%	8%
Shagbark hickory	52	15				67	4%	4%
N red oak	26	10	10	10	6	63	10%	4%
Bitternut hickory	52	8				60	2%	4%
Bur oak	26	4	4	4	2	41	4%	3%
Quaking aspen		21	10	4		35	10%	2%
Paper birch		25	6			31	9%	2%
Bigtooth aspen		4	21	6		31	9%	2%
Slippery elm	26	2	2			30	1%	2%
White oak		2	10	6		19	5%	1%
Species	**1,220**	**225**	**96**	**38**	**8**	**1,587**		

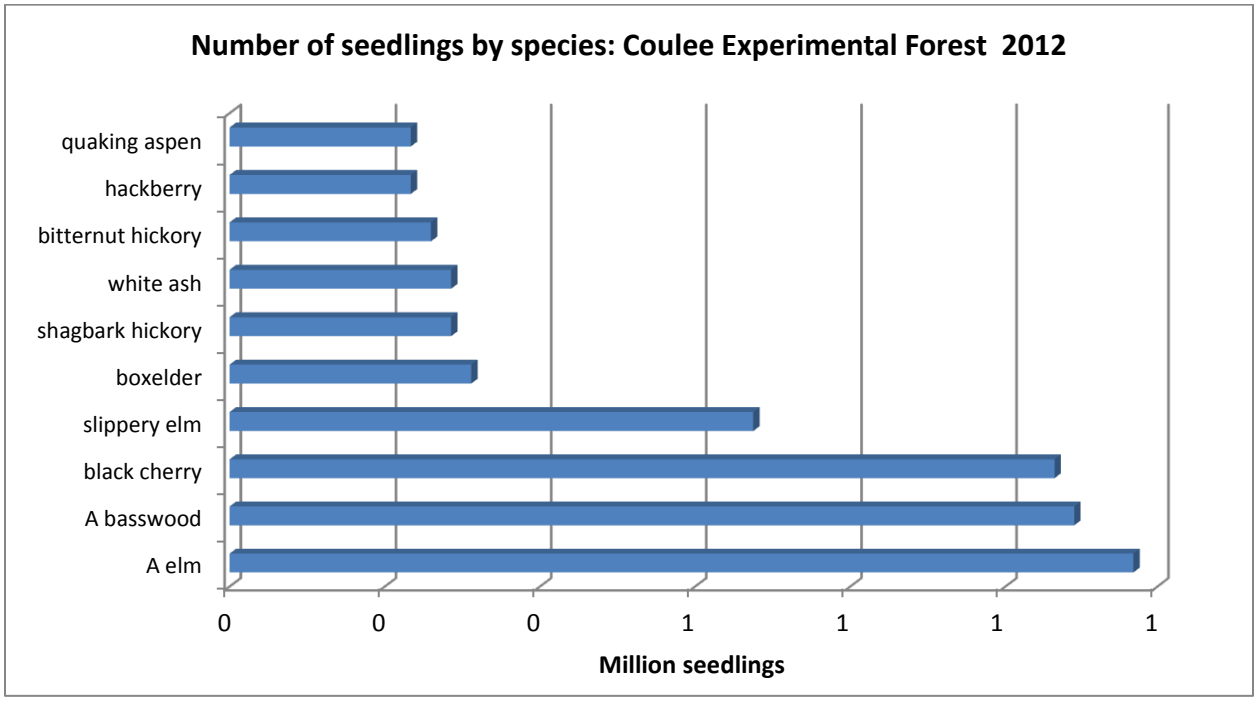

Number of trees by species and diameter class: Coulee Exper 2012
5.0-9.9 in.
10.0-14.9 in.
15.0-19.9 in.
20.0+ in.
Thousand trees
60
50
40
30
20
10
0
A basswood
A elm
N red oak
Quaking aspen
Paper birch
Bigtooth aspen
Red maple
White oak
Shagbark hickory
Bur oak

Number of seedlings by species and forest type group

Due to high sampling error, the following statements are only estimates.

The most numerous species of seedlngs are American elm, American basswood and black cherry. Over ¾ of all seedlings are found on the maple/beech/birch and oak/hickory forest type groups.

Species	Aspen / birch	Elm / ash / cottonwood	Maple / beech / birch	Oak / hickory	Total	Percent of total
A elm	26	182	467	493	**1,168**	14%
A basswood	-	-	779	312	**1,091**	13%
black cherry	441	-	130	493	**1,065**	13%
slippery elm	-	-	675	-	**675**	8%
boxelder	286	-	-	26	**312**	4%
shagbark hickory	104	26	78	78	**286**	4%
white ash	26	-	234	26	**286**	4%
bitternut hickory	-	26	130	104	**260**	3%
hackberry	-	-	78	156	**234**	3%
quaking aspen	208	-	-	26	**234**	3%
red maple	104	-	26	-	**130**	2%
Total	**1,584**	**312**	**3,401**	**2,830**	**8,127**	
Percent of total	**19%**	**4%**	**42%**	**35%**		



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

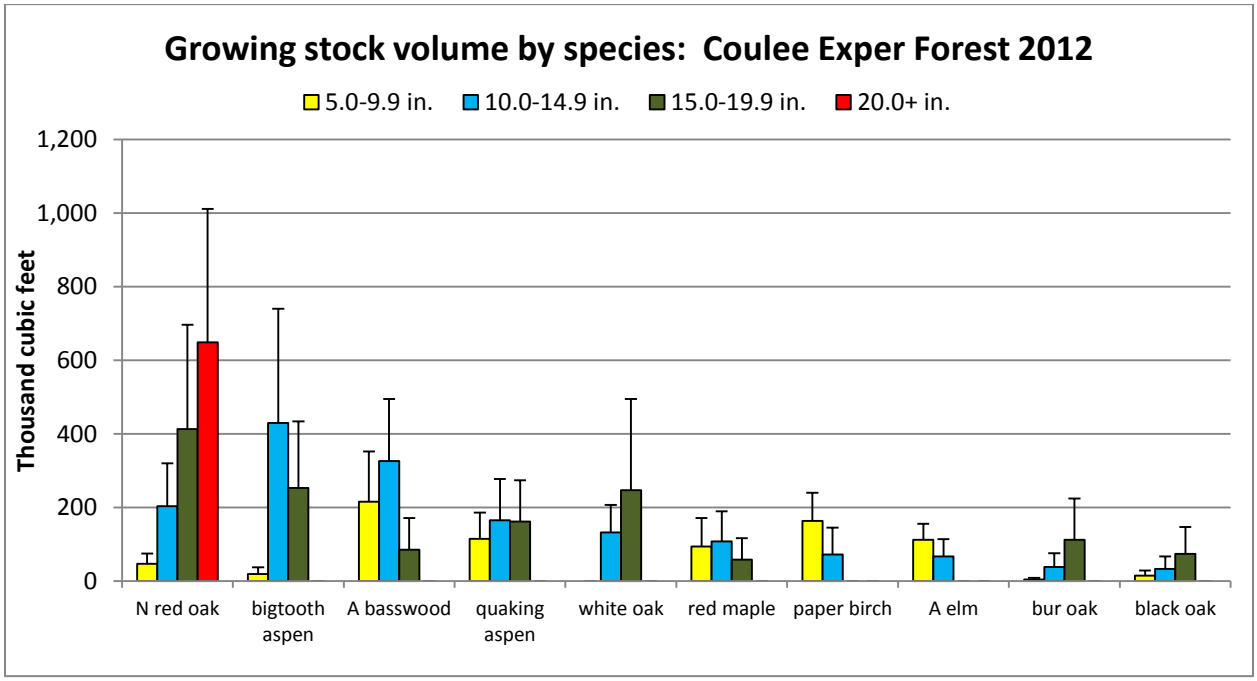
Due to high sampling error, the following statements are only estimates.

Three species account for over half of all growing stock volume on the Coulee Experimental Forest: northern red oak, bigtooth aspen and American basswood. This state forest has the highest percent of volume in trees over 15 inches, 44%, compared to an average of 34% for all forests. Note that only three species have estimated total volumes with a sampling error less than 50%.

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	% volume
N red oak	47	204	413	649	1,312	28%
bigtooth aspen	18	430	253		701	15%
A basswood	215	326	85		626	14%
quaking aspen	115	165	161		441	10%
white oak		132	247		379	8%
red maple	94	108	58		259	6%
paper birch	163	72			236	5%
A elm	112	67			179	4%
bur oak	4	38	112		154	3%
black oak	14	33	73		121	3%
Total	**978**	**1,596**	**1,403**	**649**	**4,626**	**100%**
% of total	**21%**	**35%**	**30%**	**14%**	**100%**	

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



Volume of sawtimber by species and diameter class

Due to high sampling error, the following statements are only estimates.

Northern red oak accounts for 38% of all sawtimber volume on the Coulee Experimental Forest. Bigtooth aspen, American basswood and white oak together account for another 38%. The Coulee Experimental Forest has the lowest percentage of volume of sawtimber in trees under 13 inches dbh, 19% compared to 28% for all state forests combined.

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
N red oak	297	1,489	991	3,338	6,115	38%
bigtooth aspen	551	1,778	447		2,776	17%
A basswood	610	829	424		1,862	12%
white oak	275	447	899		1,622	10%
quaking aspen	264	978			1,242	8%
bur oak		682			682	4%
red maple	345	270			615	4%
black oak		149	362		511	3%
paper birch	304				304	2%
A elm	274				274	2%
Total	**3,011**	**6,622**	**3,122**	**3,338**	**16,093**	**100%**
Percent total	**19%**	**41%**	**19%**	**21%**	**100%**	

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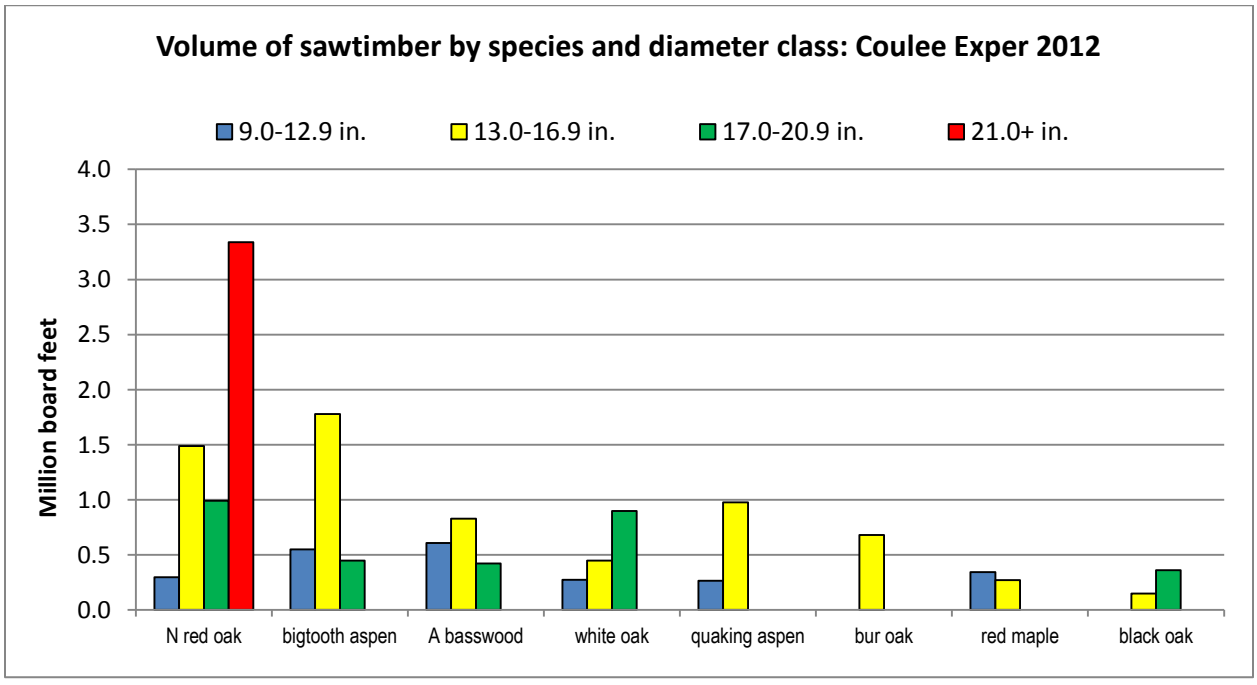


Volume of sawtimber by tree grade and species

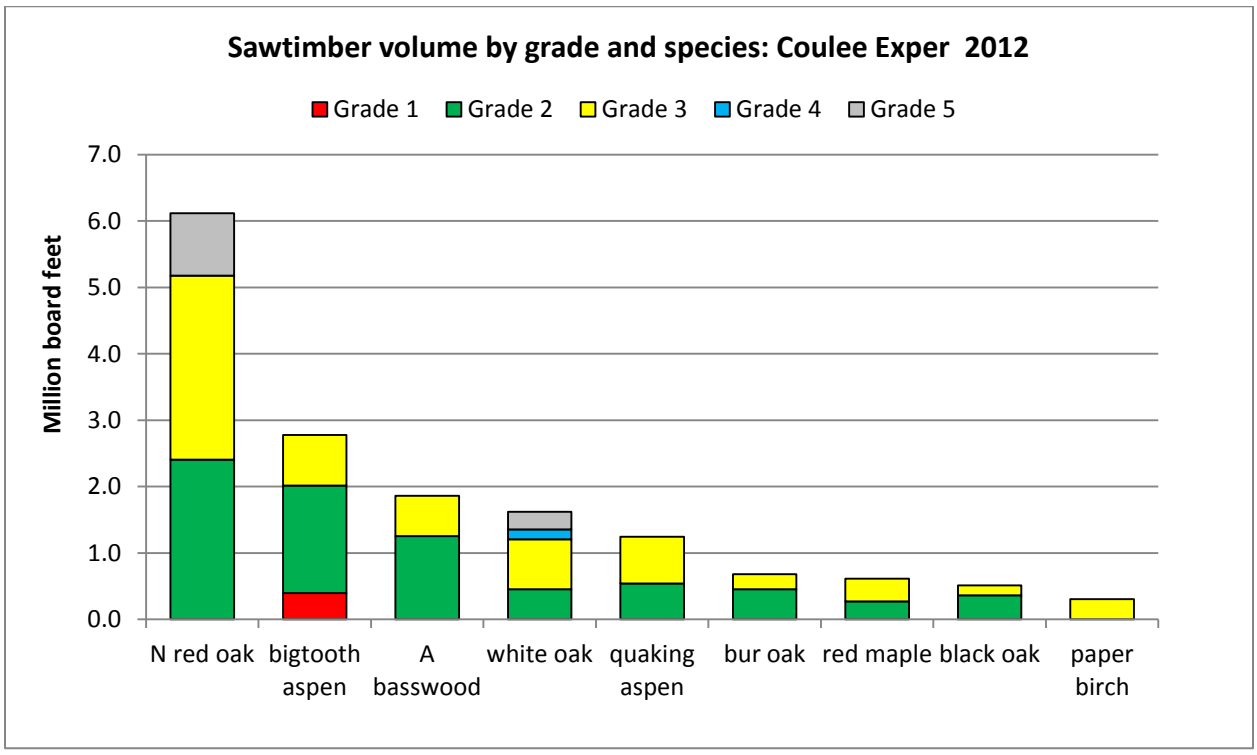
Due to high sampling error, the following statements are only estimates.

Coulee Experimental Forest has the least amount of grade 1 sawtimber, 2%, compared to an average of 21% for all state forests. Although northern red oak is the species which produces the most sawtimber volume, only 39% is in grade 1 or grade 2 sawlogs.

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 & 2
N red oak		2,406	2,773		937	6,115	39%
bigtooth aspen	398	1,618	760			2,776	73%
A basswood		1,252	610			1,862	67%
white oak		453	752	151	266	1,622	28%
quaking aspen		540	703			1,242	43%
bur oak		452	229			682	66%
red maple		270	345			615	44%
black oak		362	149			511	71%
paper birch			304			304	
American elm			274			274	
Total	**398**	**7,353**	**6,988**	**151**	**1,203**	**16,093**	**48%**
Percent total	**2%**	**46%**	**43%**	**1%**	**7%**		

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



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

Due to high sampling error, the following statements are only estimates.

The majority of volume growth on the Coulee Experimental Forest is accounted for by northern red oak and bigtooth aspen. Both have a higher than average growth to volume ratio.

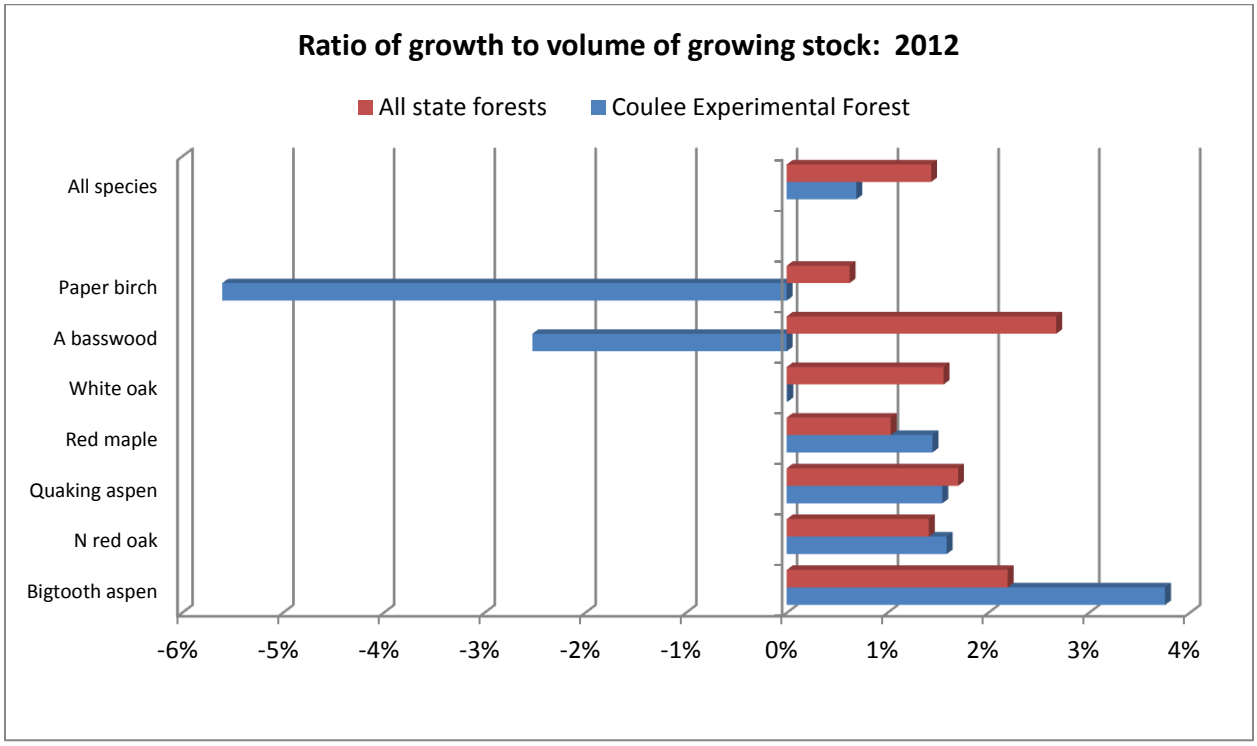
Species with growth to volume ratios that are lower than the average for all state forests include American basswood, white oak, paper birch, black oak and shagbark hickory.

The average growth rate on the Coulee Experimental Forest, 0.7% is half the average for all state forest properties, 1.4%.

Annual net growth and growth/ volume ratio for the Coulee Experimental Forest and all state forests combined.

		Growth / volume ratio	
Species*	**Average annual net growth**	**Coulee Experimental Forest**	**All state forests**
N red oak	20,818	1.6%	1.4%
Bigtooth aspen	26,309	3.8%	2.2%
A basswood	-15,802	-2.5%	2.7%
Quaking aspen	6,812	1.5%	1.7%
White oak	-23	0.0%	1.6%
Red maple	3,751	1.4%	1.0%
Paper birch	-13,207	-5.6%	0.6%
Black oak	466	0.4%	2.3%
Shagbark hickory	640	1.0%	2.7%
All species	**31,946**	**0.7%**	**1.4%**

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



Ratio of mortality to gross growth

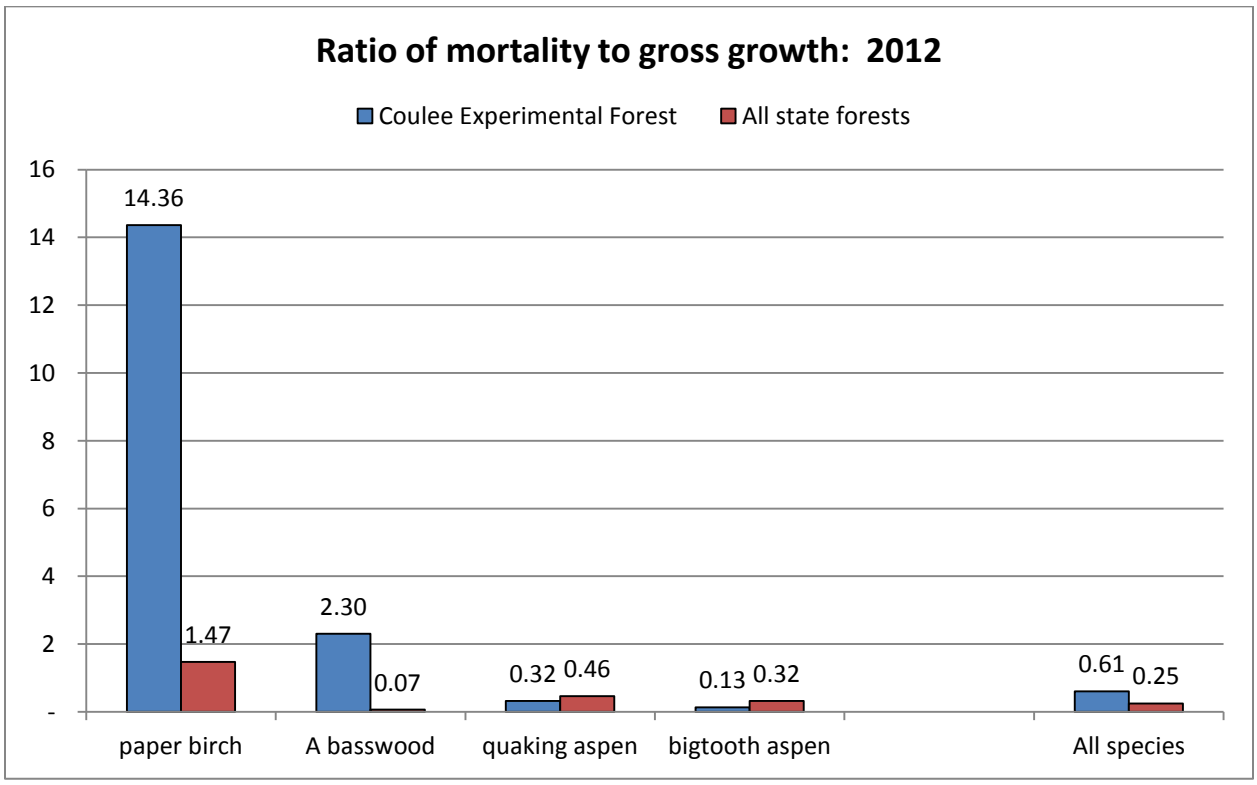
Due to high sampling error, the following statements are only estimates.

Two species had higher than average mortality to gross growth ratios on the Coulee Experimental Forest: paper birch and American basswood. The mortality ratio for both aspen species was lower than the average for all state forests. Overall the mortality ratio on the Coulee Experimental Forest was much higher than the average for all state forests as was the percent of trees which died each year.

Mortality to gross growth ratio of growing stock on the Northern Highland American Legion and for all state forests combined.

	Coulee Experimental Forest				All state forests			
Species	**Mortality of growing stock (cft)**	**Gross growth (cft)**	**Mortality / gross growth**	**Percent trees dying per year***	**Mortality of growing stock (cft)**	**Gross growth (cft)**	**Mortality / gross growth**	**Percent trees dying per year***
paper birch	14,195	988	14.36	8.35%	303,493	206,027	1.47	0.93%
A basswood	27,913	12,112	2.30	0.51%	31,922	454,393	0.07	0.14%
quaking aspen	3,233	10,045	0.32	3.42%	761,316	1,647,117	0.46	0.43%
bigtooth aspen	3,973	30,281	0.13	6.62%	171,043	529,353	0.32	0.54%
All species	**49,314**	**81,260**	**0.61**	**0.62%**	**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.



Percent standing dead trees and volume by species

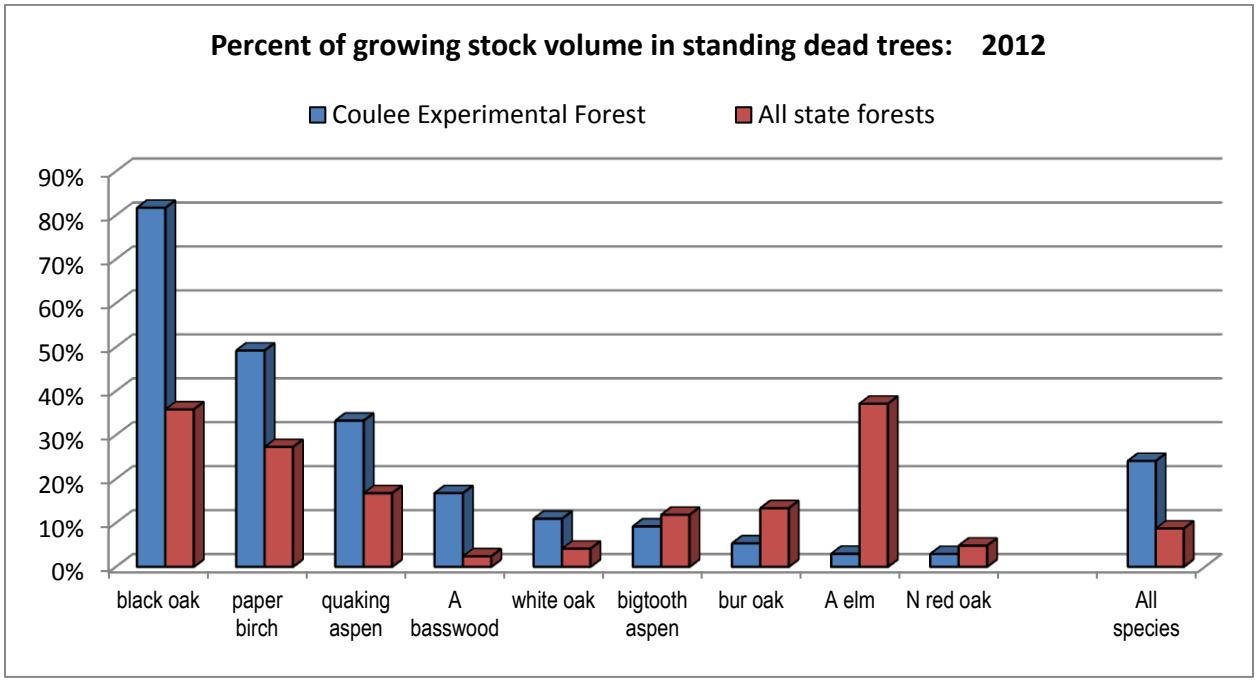
Due to high sampling error, the following statements are only estimates.

Both the percentage of standing dead trees and volume in dead trees over 5 inches dbh is over twice as high on the Coulee Experimental Forest compared to all state forests combined. Several major species have a much higher percentage than average including paper birch, quaking aspen, American basswood and white oak. Again most sampling errors are over 50%.

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

	Percent of trees that are standing dead		Percent of volume in standing dead trees	
Species	**Coulee Experimental Forest**	**All state forests**	**Coulee Experimental Forest**	**All state forests**
black oak	71.4%	4.8%	81.7%	35.8%
paper birch	57.1%	9.9%	49.2%	27.3%
quaking aspen	28.6%	4.8%	33.3%	16.8%
A basswood	0.0%	1.1%	16.8%	2.4%
white oak	14.3%	4.8%	11.0%	4.1%
bigtooth aspen	25.0%	2.6%	9.2%	11.8%
bur oak	5.7%	3.0%	5.4%	13.4%
A elm	1.1%	5.3%	3.0%	37.1%
N red oak	21.4%	2.1%	2.9%	4.8%
red maple	0.0%	1.2%	0.0%	6.1%
All species	**6.4%**	**2.8%**	**24.1%**	**8.7%**

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



Crown dieback and transparency

Due to high sampling error, the following statements are only estimates.

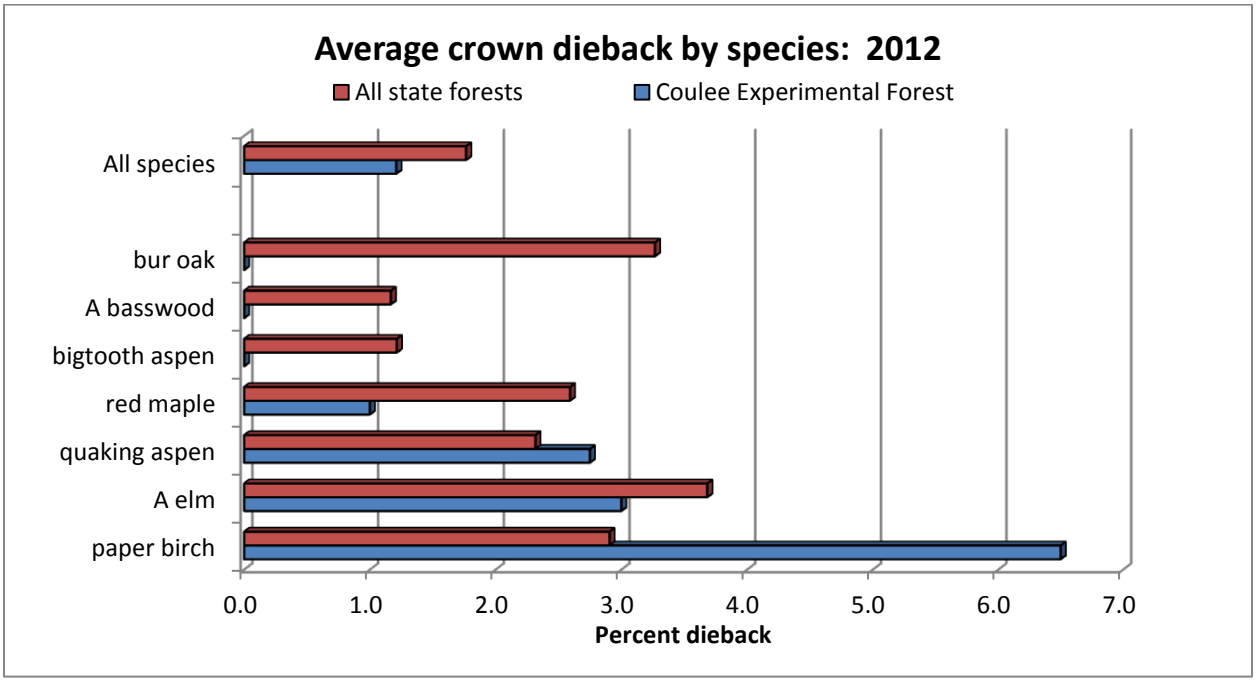
The only major species with higher than average values for both crown dieback and transparency on the Coulee Experimental Forest are paper birch and quaking aspen.

In general, dieback is lower and transparency is higher on the Coulee Experimental Forest than on all state forests combined.

Average crown dieback and transparency for the Coulee Experimental Forest compared to all state forests combined.

	Average crown dieback		Average crown transparency	
Species*	**Coulee Experimental Forest**	**All state forests**	**Coulee Experimental Forest**	**All state forests**
paper birch	6.5	2.9	21.8	18.8
quaking aspen	2.8	2.3	21.7	20.1
red maple	1.0	2.6	16.3	17.8
bigtooth aspen	0.0	1.2	18.4	19.3
A elm	3.0	3.7	18.0	20.4
A basswood	0.0	1.2	16.7	16.5
bur oak	0.0	3.3	18.0	20.3
shagbark hickory	0.0	0.4	13.0	13.8
white ash	0.0	2.8	18.0	21.7
N red oak	0.0	1.9	18.0	16.2
slippery elm	0.0	1.9	23.0	20.5
All Species	**1.2**	**1.8**	**18.5**	**17.1**

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



Trends

Growing stock volume

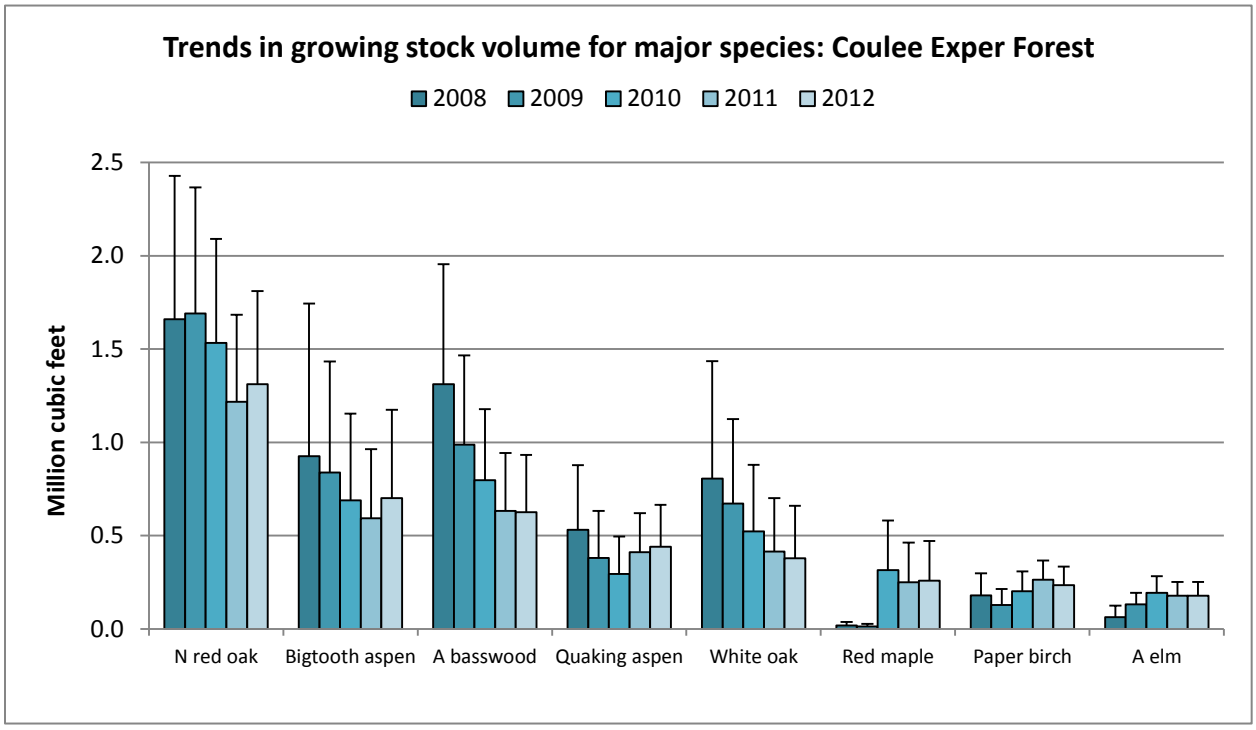
There appear to be trends in species volume which cannot be verified statistically since the data is highly auto-correlated. Future re-measurements may help to reduce this correlation and high sampling error.

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

Species	2008*	2009	2010	2011	2012	Change 2008 to 2012
N red oak	1,660	1,691	1,533	1,218	1,312	-21%
Bigtooth aspen	926	839	690	593	701	-24%
A basswood	1,311	988	797	633	626	-52%
Quaking aspen	532	380	296	412	441	-17%
White oak	806	672	523	415	379	-53%
Red maple	19	13	315	250	259	1291%
Paper birch	180	129	203	264	236	31%
A elm	63	132	194	179	179	184%
All species	**6,001**	**5,452**	**5,121**	**4,452**	**4,626**	**-23%**

***** Each year contains previous years' data, i.e. 2010 includes 2008, 2009 and 2010 data.

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



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 $\leq$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 --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.

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 **crown 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/WisCFIvolumeIversion3.pdf, pp 219-229.

References

Kotar, J., and T.L. Burger. 1996. *A guide to forest communities and habitat types of central and southern Wisconsin.* University of Wisconsin-Madison, Department of Forestry and Wildlife Ecology, Madison. 377 pp.

Kotar, J., and T. Burger. 2002. *A guide to forest communities and habitat types of northern Wisconsin*. Second edition. University of Wisconsin-Madison, Department of Forest Ecology and Management, Madison. 478 pp.

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/WisCFIvolumeIversion3.pdf

Wisconsin Dept of Natural Resources Division of Forestry. October 2007. Wisconsin State Forest Continuous Forest Inventory Volume II: Field Data Collection Procedures for Phase 3 Indicators - Version 2.0, http://dnr.wi.gov/topic/ForestPlanning/documents/WisCFIvolumeIIversion2.pdf

Wisconsin Dept of Natural Resources Division of Forestry. 2013. The State Forests of Wisconsin - Continous Forest Inventory Baseline Report 2007 - 2011, http://dnr.wi.gov/topic/ForestPlanning/documents/CFIBaselineReport-07-11.pdf

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