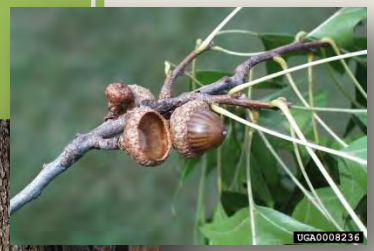
Nonselect red oaks

Black oak, *Querqus velutina*
Northern pin oak, *Querqus ellipsoidalis*



The volume in nonselect red oaks has increased since 1983 especially in larger size classes. However, there are significant differences between the species. The number of black oak trees has declined in all size classes while the number of northern pin oak has increased. Over half of all volume is located in central Wisconsin.

Growth rates have decreased and mortality has increased especially for black oak. Whereas nonselect red oak species make up about 3.8% of all volume of trees in Wisconsin, they account for only 1.5% of growth and 7.5% of mortality.

Nonselect red oaks are important timber species, comprising over 4.8% of removals. The ratio of removals to growth is 167% indicating we remove much more wood than is replaced by new growth. Due to the high density of red oak wood, it may be a valuable source of woody biomass for biofuel production.

- *How has the nonselect red oak resource changed?*
  Growing stock volume and diameter class distribution
- *Where do nonselect red oaks grow in Wisconsin?*
  Growing stock volume by region with map
- *How fast are nonselect red oaks growing?*
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- *How much nonselect red oak do we harvest?*
  Roundwood production by product and ratio of removals to growth
- *How much is nonselect red oak selling for?*
  Prices for cordwood and sawtimber: trends
- *How much nonselect red oak biomass do we have?*
  Aboveground biomass by region of the state

Division of Forestry
WI Dept of Natural Resources
12/2014

"How has the nonselect red oak resource changed?"

Growing stock volume and diameter class distribution

The growing stock volume of nonselect red oaks in 2013 was about 819 million cubic feet or 3.8% of total statewide volume (Chart 1). This represents an increase of 31% since 1983 and 19% since 1996.

The red oak resource is maturing; the total volume in small growing stock (5-12.9 inches dbh) has decreased by 11% since 1983 while the volume in large trees (13+ inches dbh) has increased by 82% (Chart 2).

There is a significant difference in the percentage change in tree numbers between the two species (Chart 3). The number of northern pin oak trees has increased in all size classes while the number of black oak has decreased.

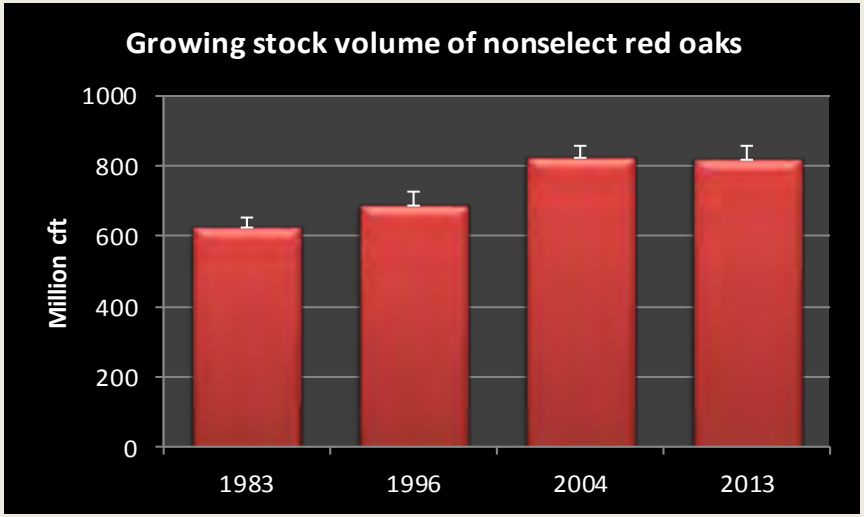


Chart 1. Growing stock volume (million cubic feet) by inventory year.
Source: USDA Forest Inventory and Analysis data

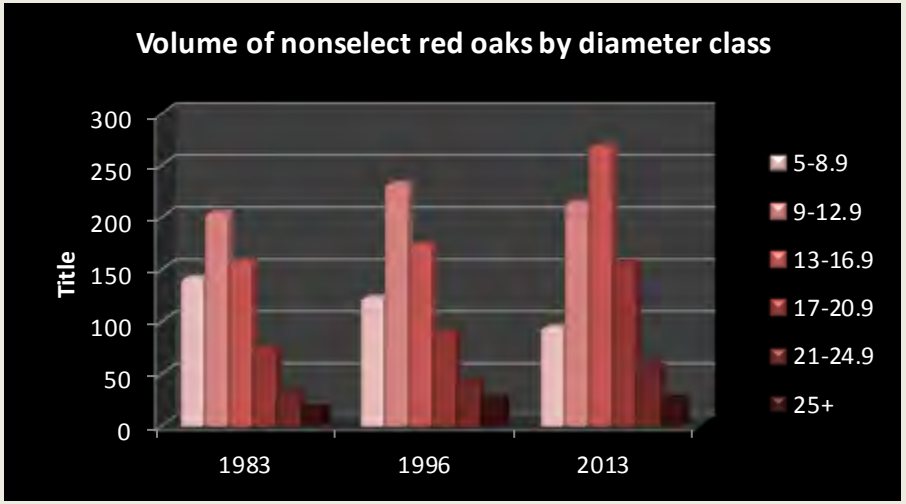


Chart 2. Growing stock volume (million cubic feet) by diameter class (inches).
Source: USDA Forest Inventory and Analysis data

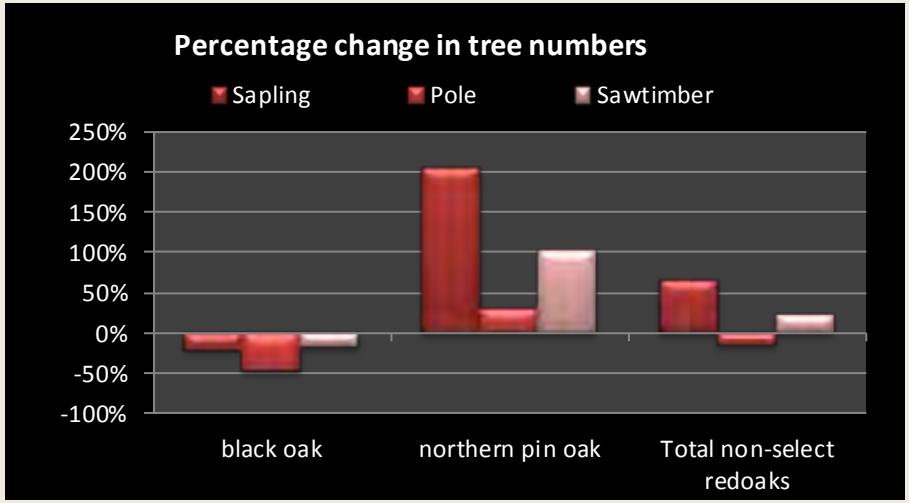
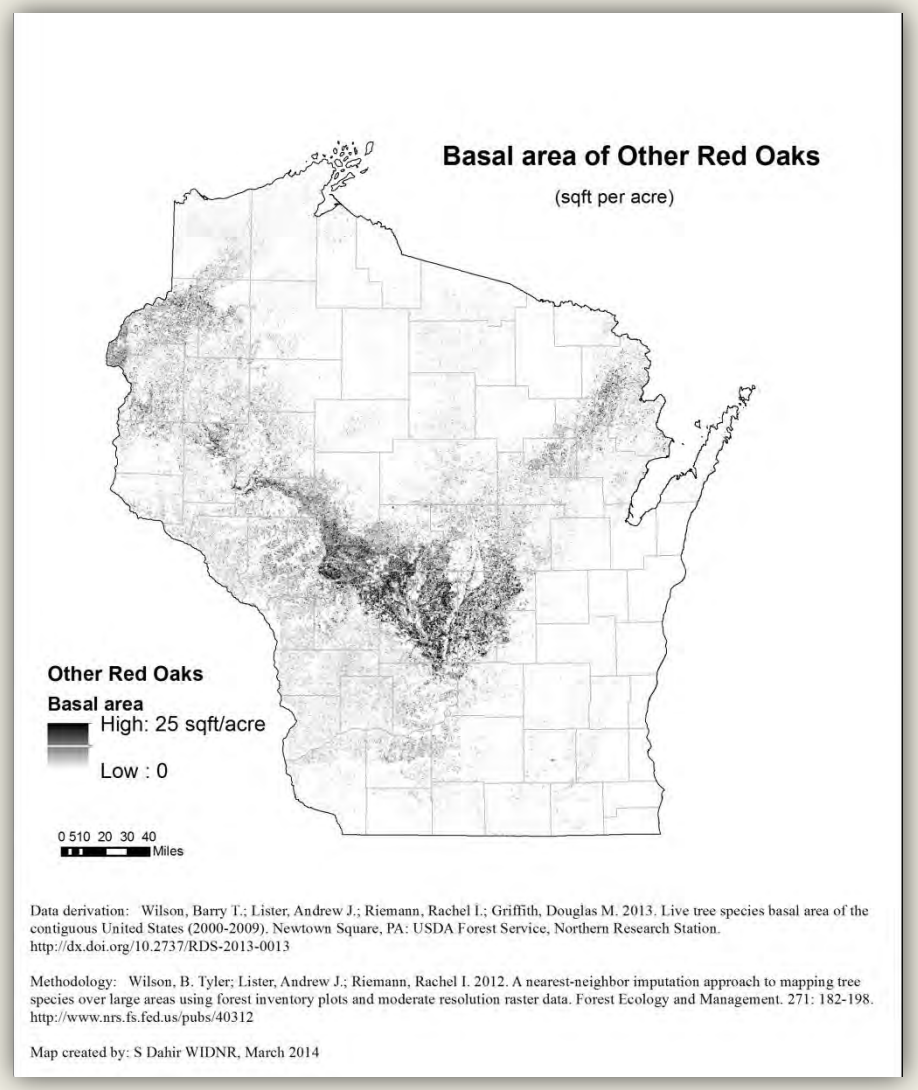


Chart 3. Percentage change in the number of live trees by size class between 1996 and 2013.
Source: USDA Forest Inventory and Analysis data 1996 and 2013.

"Where do nonselect red oaks grow in Wisconsin?"

Growing stock volume by region with map



Data derivation: Wilson, Barry T.; Lister, Andrew J.; Riemann, Rachel I.; Griffith, Douglas M. 2013. Live tree species basal area of the contiguous United States (2000-2009). Newtown Square, PA: USDA Forest Service, Northern Research Station. http://dx.doi.org/10.2737/RDS-2013-0013

Methodology: Wilson, B. Tyler; Lister, Andrew J.; Riemann, Rachel I. 2012. A nearest-neighbor imputation approach to mapping tree species over large areas using forest inventory plots and moderate resolution raster data. Forest Ecology and Management. 271: 182-198. http://www.nrs.fs.fed.us/pubs/40312

Map created by: S Dahir WIDNR, March 2014

Over half of nonselect red oak volume occurs in central Wisconsin (Table 1).

The majority of volume is found on the white oak / red oak / hickory forest type with lesser amounts on aspen and red pine types. Over half of all volume occurs on very dry to dry and dry-mesic habitat types.

Table 1. Growing stock volume (million cubic feet) by species and region of the state.

Species	Central	North east	North west	South east	South west	Total	Percent of total
Black oak	233	-	-	33	85	**351**	**43%**
N pin oak	188	103	110	20	46	**467**	**57%**
Total	**421**	**103**	**110**	**53**	**131**	**819**	**100%**
Percent of total	**51%**	**13%**	**13%**	**6%**	**16%**	**100%**	

Source: USDA Forest Service, Forest Inventory and Analysis 2013

For a table on **Volume by County for 2013** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/VolumeCountySpecies.pdf

"How fast are nonselect red oaks growing?"

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

The average annual net growth of nonselect red oaks was about 8.4 million cubic feet/year from 2009 to 2013, representing 1.5% of statewide volume growth (Chart 4). Growth rates have decreased 48 %since 1983.

The highest volume growth for nonselect red oaks occurs in central Wisconsin (Table 2) but the highest growth to volume ratio occurs in the southeast.

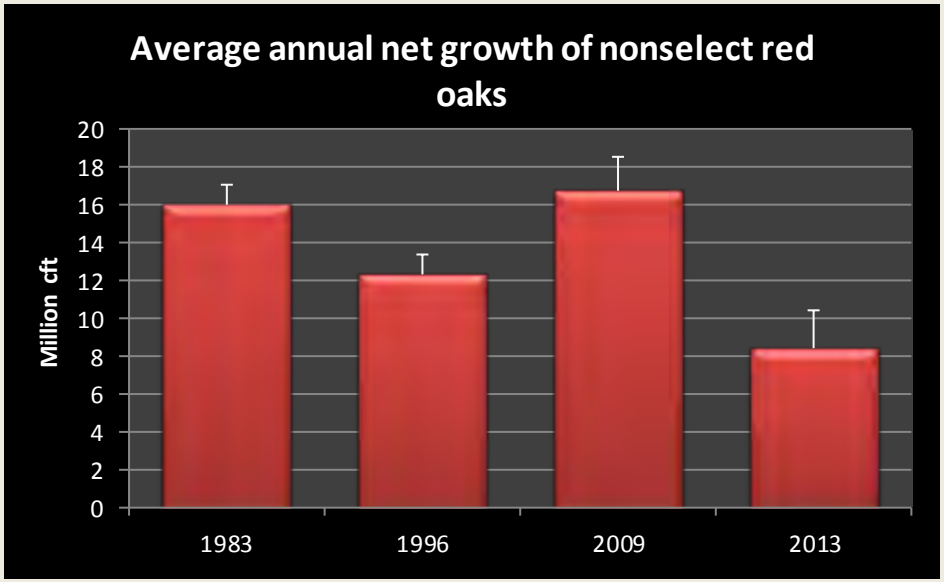


Chart 4. Average annual net growth (million cubic feet).
Source: USDA Forest Inventory & Analysis data

Table 2. Average annual net growth (million cubic feet/year) of growing stock and the ratio of growth to volume by region of the state.

Region	Net growth	Percent of Total	Ratio of growth to volume
Northeast	1.2	14%	**1.1%**
Northwest	0.0	0%	**0.0%**
Central	4.7	56%	**1.1%**
Southwest	1.3	15%	**1.0%**
Southeast	1.2	14%	**2.2%**
Statewide	**8.4**	**100%**	**1.0%**

Source: USDA Forest Inventory and Analysis 2013

The ratio of growth to volume for nonselect red oaks is 1.0%, much lower than the statewide average of 2.6% for all species.

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

"How healthy are nonselect red oaks in Wisconsin?"

Average annual mortality and the ratio of mortality to growth

The average annual mortality of nonselect red oaks, about 17.6 million cubic feet per year from 2009 to 2013, has more than doubled since 1996 (Chart 5). The percent of statewide mortality, 7.5%, is double the percent of total volume in the state, 3.8%.

The ratio of mortality to gross growth is 67.7% for nonselect red oak species, over twice as high as the statewide average of 29.6% (Table 3). Almost 70% of the growth of nonselect red oaks is lost to mortality.

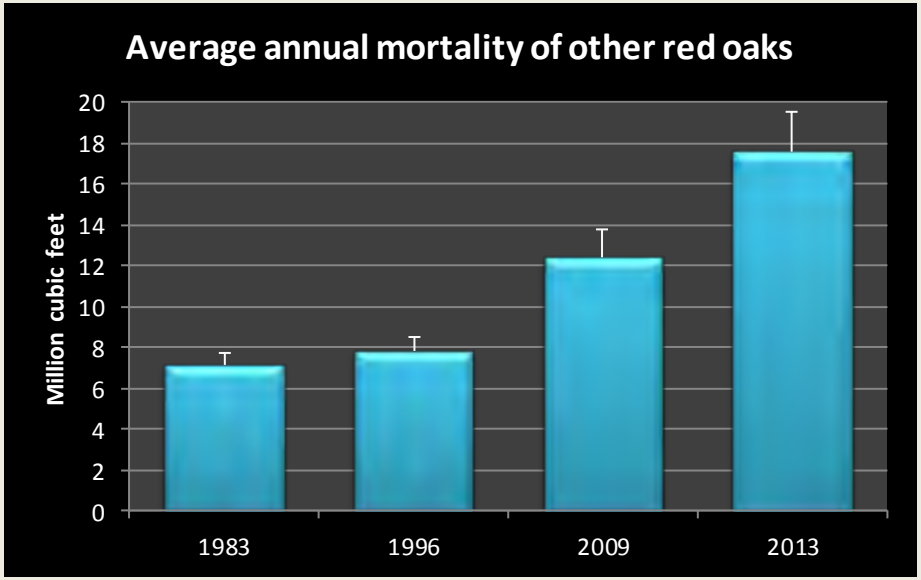


Chart 5. Average annual mortality (million cubic feet) by inventory year.
Source: USDA Forest Inventory & Analysis data:

Table 3. Mortality, gross growth, and the ratio of mortality to gross growth.

Species	Average annual mortality (cft)	Average annual gross growth (cft)	Mortality / growth
Black oak	7,699,231	11,087,973	**69.4%**
Northern pin oak	9,882,779	14,876,957	**66.4%**
Total nonselect red oaks	**17,582,010**	**25,964,929**	**67.7%**

Source: USDA Forest Inventory & Analysis data: 2013

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

"How much nonselect red oak do we harvest?"

Roundwood production by product and the ratio of removals to growth

In 2009, Wisconsin produced 15.8 million cubic feet of red oak roundwood or about 4.3% of the state's total volume (Chart 6). Nonselect red oaks account for about 2.3% of all pulpwood, 5% of sawlogs and 9.5% of all residential fuelwood.

Between 2002 and 2009, pulpwood and fuelwood production increased but sawlog production decreased by 42%.

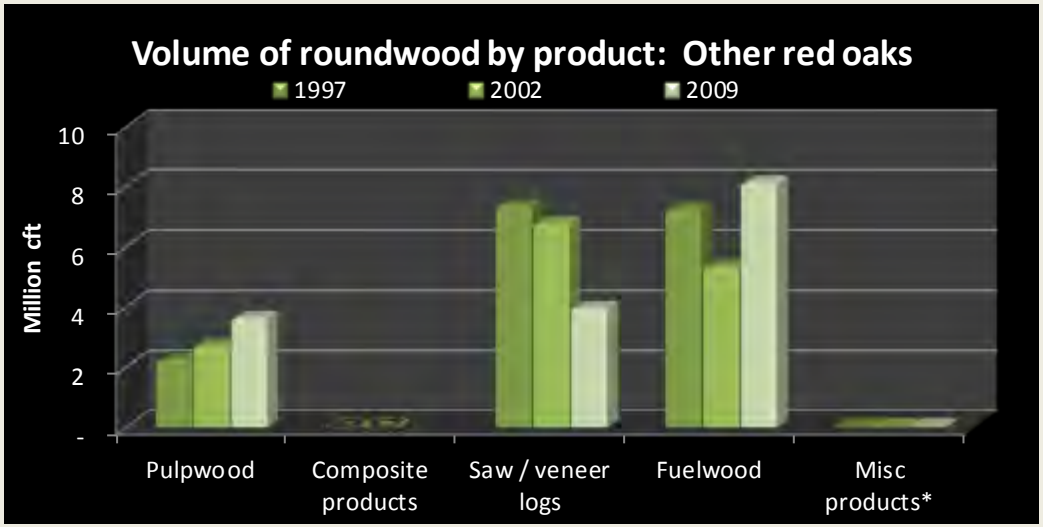


Chart 6. Volume of roundwood products. * Miscellaneous products include poles, posts, and pilings.
Source: Ronald Piva, USDA Forest Service, Northern Research Station, St. Paul MN

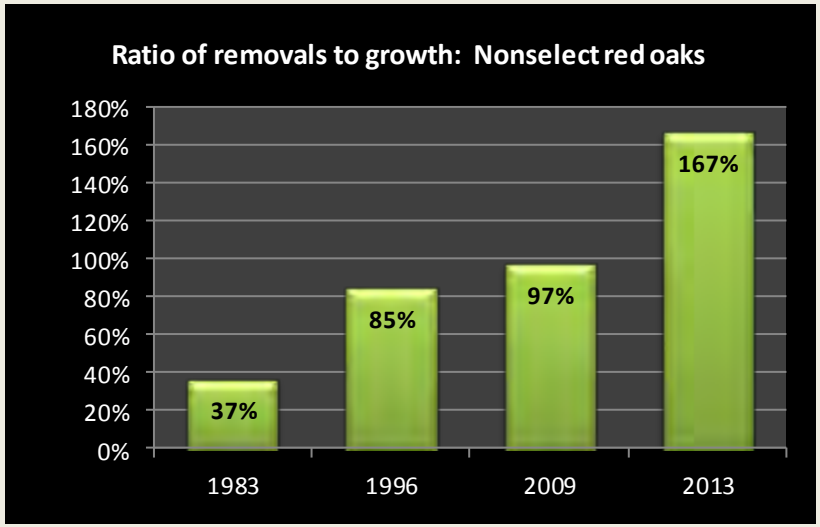


Chart 7. Ratio of volume harvested annually to net growth.
Source: USDA Forest Inventory & Analysis data

Removals of nonselect red oaks averaged 14 million cubic feet per year between 2009 and 2013.

The ratio of removals to growth is currently 167% (Chart 7) which means that we are removing much more wood than is being replaced by growth. Much of this is due to high mortality which reduces net growth significantly. The removal to growth ratio for nonselect red oaks is three times higher than the average of 56.3% for all species in the state.

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

"How much is nonselect red oak selling for?"

Prices for cordwood & sawtimber: trends

Due to the variability of timber prices from year to year and region to region, two methods of reporting prices are presented here: Timber Mart North and weighted average stumpage prices from Wisconsin Administrative Code Chapter NR 46.

Prices for nonselect red oak stumpage pulpwood and sawtimber, as reported in the Timber Mart North (Chart 8), have been increasing recently.

Average weighted stumpage values for red oak cordwood and logs as reported in NR46 (Table 4), have fallen from a peak in 2004. Log prices are currently lower than the average price for hardwood logs.

Chart 8. Chart 8. Average prices for cordwood ($/cord) and logs ($/MBF scribner) reported for Illinois (adjusted for inflation).
Source: http://web.extension.illinois.edu/forestry/il_timber_prices/index.cfm

Table 4. Average weighted stumpage prices (adjusted for inflation to 2014 dollars) by year for Wisconsin.

Product	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average for all hardwoods
Cordwood (per cord)	$17	$42	$31	$71	$61	$31	$20	$16	$20	$20	**$18**	$18
Logs (per MBF scribner)	$205	$683	$320	$570	$333	NA	$166	$160	$166	NA	**$162**	$211

Source: Wisconsin Administrative Code Chapter NR46, 2003 to 2013. The stumpage values calculated each year are for the sole purpose of assessing MFL yield and FCL severance taxes, not for determining the price that should be received for timber.

"How much nonselect red oak biomass do we have?"

Aboveground biomass by region of the state

There were 34.3 million short tons of aboveground biomass in live trees in the nonselect red oak group in 2013, an increase of 18% from 1983. This is equivalent to approximately 17.2 million tons of carbon and represents 5.5% of all aboveground carbon statewide. As with volume, most nonselect red oak is located in central Wisconsin (Chart 9).

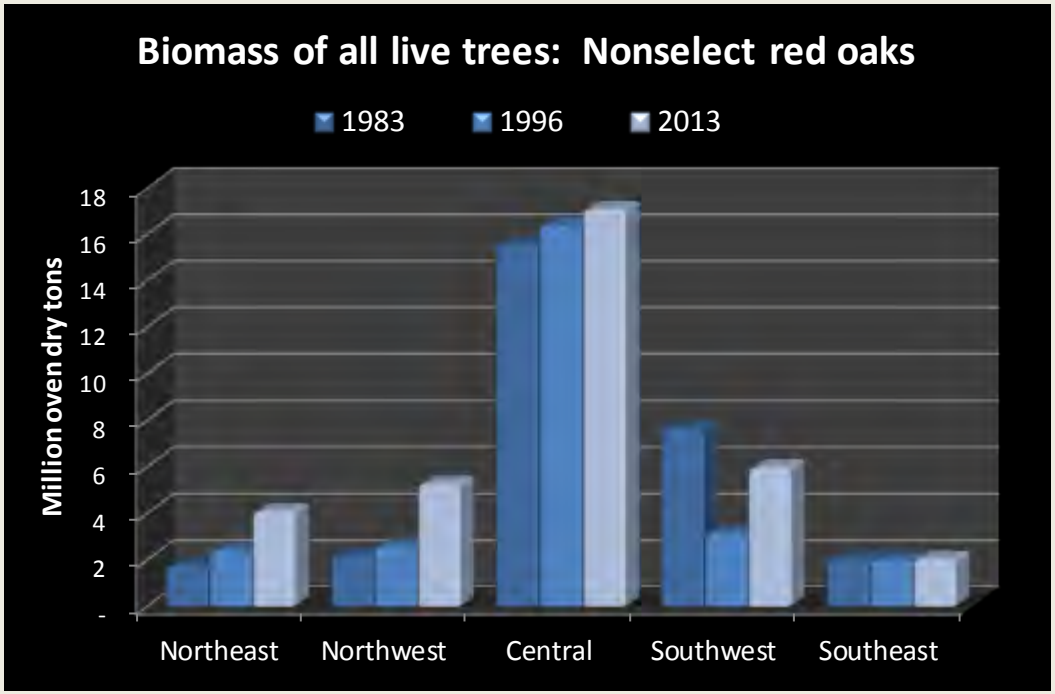


Chart 9. Biomass (above ground dry weight of live trees >1 in dbh, short tons) by year and region of the state.
Source: USDA Forest Inventory & Analysis data

The density of nonselect red oak wood is one of the highest of all species with a ratio of biomass to volume of 42 oven-dry lbs. per cubic foot (ODP/cubic feet). The average for all hardwoods is about 36 ODP/cubic feet and for all species is 33 ODP/cubic feet. Approximately, 73% of all red oak biomass is located in the main stem and 18% in the top branches.

The high volume of nonselect red oaks combined with the high density of red oak wood may make it a valuable species for biomass production.

For a table of **Biomass by County** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/BiomassByCounty.pdf