



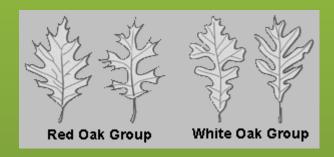


No may now protect the east their fig. (Morehand, etc.) for the Color of the Color

Oaks in Wisconsin

- Flower in May wind borne pollen
- 2 distinct groups
 - Red (pointed leaf lobes):
 - Black Oak, Red Oak, N. Pin Oak
 - Acorns 2 years to mature from flowers
 - Germinate in spring

- White (rounded leaf lobes):
 - White Oak, Bur Oak, Swamp White Oak, Chinquapin Oak
 - Acorns 1 year to mature (annual acorn production)
 - Germinate in fall, developed root system by spring
- Lots of hybridization between species within groups



Red Oak Group

Driest sites, poorest soils

• Hill's Oak

Black Oak

Red Oak



More moisture, richer soils







Black Oak - Quercus velutina

- Oval acorns with loose scales
- Leaves shiny, deeply lobed
- Bark black, broken into patches
- Fairly intolerant of shade, but can grow under other oaks (dappled shade)
- Scrub/grub former





Red Oak - Quercus rubra

- Most mesic (moderately moist soil) of WI oaks
- Large acorns in flat saucer cups
- Bark with long continuous vertical strips
- Best on deep, well drained soils, rich in nutrients
- Most tolerant of shade, can replace other oaks
- Trunks susceptible to fire damage relative to white/bur oaks



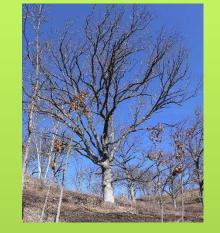
White Oak Group

Driest sites, poorest soils

- Chinquapin Oak
- Bur Oak*
- White Oak
- Bur Oak*
- Swamp White Oak

Wetter sites, richer soils











Bur Oak - Quercus macrocarpa

- Acorn cups with heavy fringe of coarse hairs
- Thick leaves with single deep indentation towards base
- Bark and twigs with thick cork
- Wide range of conditions from moist to very dry
- Intolerant of shade
- Most fire tolerant oak
 - Thick bark
 - o Re-sprouter





White Oak - Quercus alba

- Acorns oval in deep cups with scales
- Variable leaves, roundly lobed
- Bark light grey, scaly
- Ecology/range similar to Bur, without driest and wettest sites
- More shade tolerant than Bur
- Red Oak < Fire Tolerance < Bur Oak



Oak Growth Strategies and Fire Adaptations

	Oak	Hickory	Maple/Basswood/others
Growth Strategy	Below Ground Storage Root Builders	Root Builders	Above Ground – Outcompete, over top and out shade Shoot Builders
Bark	Thick	Thin	Thin
Wound Resistance	Resistant Compartmentalization	Easily Wounded	Easily Wounded
Leaf Litter	High Lignin Content Leaves curl Dry, loose fuel Slow Decomposition Builds up over time Flammable	Flammable Slow Decomp.	Lays flat, compact fuel Decomposes Readily Inflammable
Leaf Shade	Dappled	Moderate	Dense

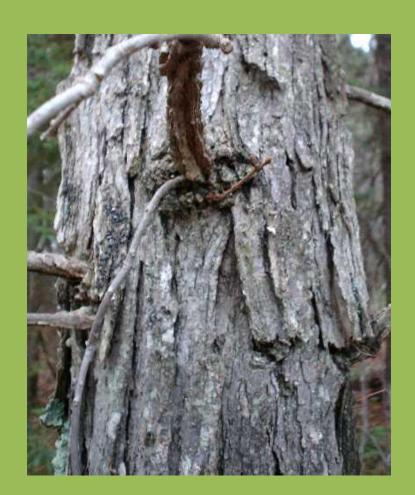






"Have you ever wondered why a thick crust of corky bark covers the whole tree, even to the smallest twigs? This cork is armor. Bur oaks were the shock troops sent by the invading forest to storm the prairie; fire is what they had to fight..."

Aldo Leopold
A Sand County Almanac



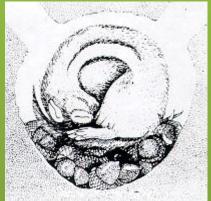


Acorns / Mast Production

- Acorns ripen and drop late summer
- Many species of wildlife have evolved around this large mast event
- Acorns provide high calorie food source for winter survival strategies:
 - Fatten prior to mating season and winter (deer)
 - Feed prior to and during migration (wood ducks)
 - Fatten prior to hibernation (bears)
 - Cache or bury for use during winter (small mammals, red headed woodpeckers)









Acorns / Mast Production

- Red Group Acorns 2 years to mature
- White Group Acorns 1 year to mature
- All Oaks great fluctuation in annual acorn production year to year
 - Variations in climate
 - Flowers damaged from late frost

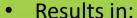
Table 10

Annual variation in size of acorn crop in a black oak-white oak (Q. velutina-Q. alba) forest in University of Wisconsin Arboretum

Year	No. of acorns per acre*	Year	No. of acorns per acre*
1949	157,000	1954	93,800
1950	23,000	1955	119,600
1951	40,000	1956	10,700
1952	69,000	1957	170,600
1953	63,000	1958	37,700

Acorns / Mast Production

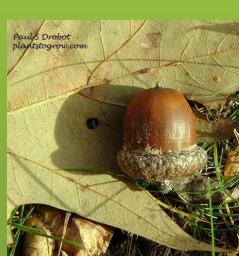
- 3 5 years between heavy acorn crops in any 1 species
- Cycles of different oak species can coincide:
 - Years of very few acorns and
 - Years of very heavy acorn production



- pulses of oak reproduction, when heavy acorn production is greater than consumption by insects and wildlife
- ecological cascades from heavy mast years, resulting in high reproduction in some wildlife species







Example ecological cascade from high mast years:

- 1) Large acorn crop
- ⇒ 2) Increase in small mammal population
- \Rightarrow 3) Good foraging next summer for rattlesnakes
- \Rightarrow 4) Followed by a year of high snake reproduction

Big mast crop in 2009



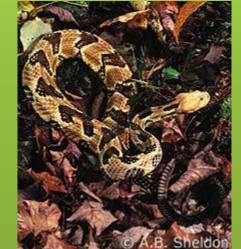
Increase in small mammals 2010





2010: Good foraging on small mammals

2011: timber rattlesnake snake reproduction very high



Females in WI usually produce young only once every three to four years



Oak Importance to Butterflies and Moths



W.A. Smith, WDNR



U.S. Fish and Wildlife Service

Common Name	Plant Genus	Butterfly/moth species supported
Oak	Quercus	534
Cherry	Prunus	456
Willow	Salix	455
Birch	Betula	413
Poplar	Populus	368
Maple	Acer	285
Elm	Ulmus	213
Pine	Pinus	203
Hickory	Carya	200
Basswood	Tilia	150
Ash	Fraxinus	150
Walnut	Juglans	130
Beech	Fagus	126
Chestnut	Castanea	125
Goldenrod	Solidago	115
Asters	Aster	112
Sunflower	Helianthus	73
Sedges	Carex	36
Milkweed	Asclepias	12



Thomas Meyer, WDNR



U.S. Fish and Wildlife Service

Data from US mid-Atlantic region

Hooded Warbler (Wilsonia citrina), - Threatened in Wisconsin

Found in large upland forest tracts in southern Wisconsin, in pockets of dense understory near small canopy openings





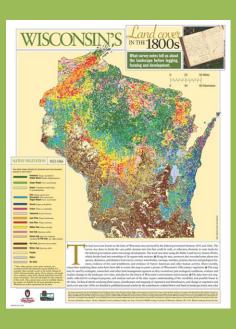
U.S. Fish and Wildlife Service

Hooded Warblers are primarily insectivorous, and prefer adult and larval forms (caterpillars) of butterflies and moths

Oak Dominated Natural Communities in Wisconsin







Oak Woodland





Feldkirchner

Southern Dry Forest

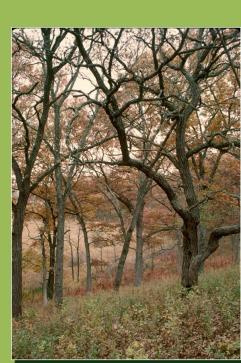
Oak Woodland

- Canopy closure from 50% to 95%
- Between more open oak savannas and the oak forests
- Subjected to frequent (annual) low-intensity ground fires, lack dense woody understory
- Dominant trees included white oak, bur oak, and black oak
- This type is extraordinarily rare today (Critically Imperiled in Wisconsin).









Oak Woodland

The herb layer is diverse, including plants from prairie, oak savanna, and oak forest

Features grasses, legumes, asters and other forbs that are best adapted to light conditions of highly filtered shade

Typical herbs include upland boneset, rough-leaved sunflower, shooting-star, Short's aster, yellow-pimpernel, bottlebrush grass, silky wild-rye, and tick-trefoil

Savannas and Open Woodlands are the preferred habitat for some plants (purple milkweed) and animals (red-headed woodpecker, orchard oriole, eastern bluebird)



Purple Milkweed





Oak Woodland

Example Rare Species Associated with Oak Woodlands

- Nests on the ground in an open understory
- Declining across its range due to loss of open woodland habitat

Whip-poor-will





Red-headed Woodpecker

- Favor open upland sites with scattered trees
- Prefer to nest in oak trees
- Cavity nester, key habitat elements include large snags and dead limbs
- Stores caches of nuts and insects in shallow tree cavities



Diverse understory features robust plants

- Large flowers (pollinators, insects)
- Soft mast, berries, seeds, beans
- Plentiful, high calorie critter food









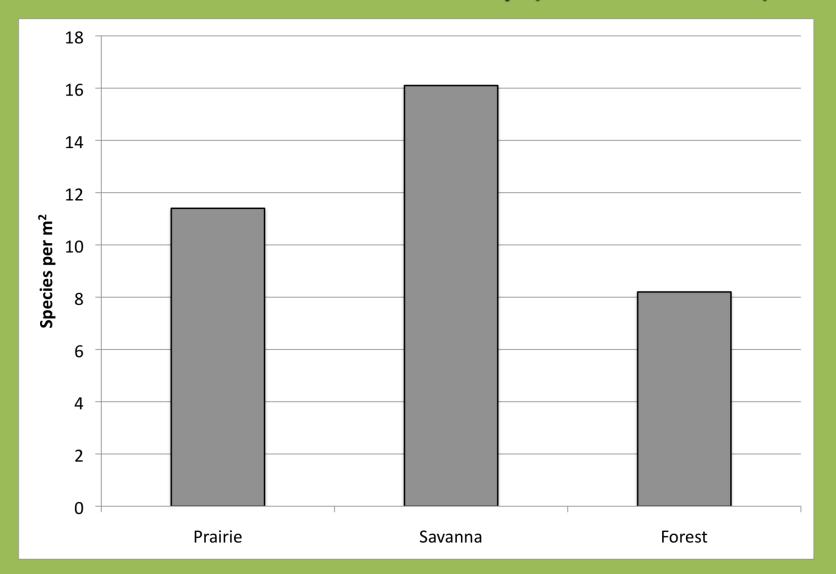


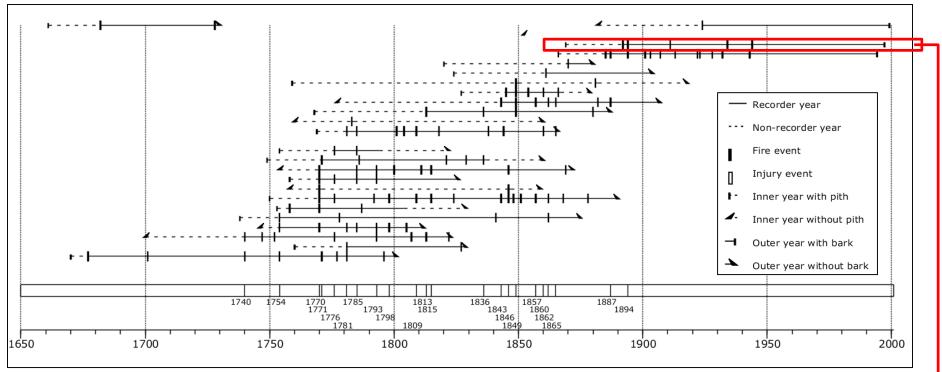




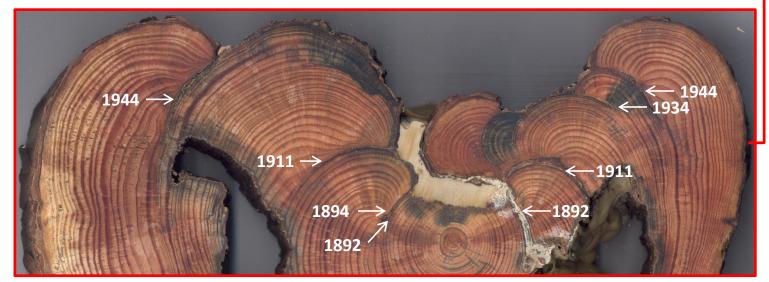


Succession and Biodiversity (Southern WI)

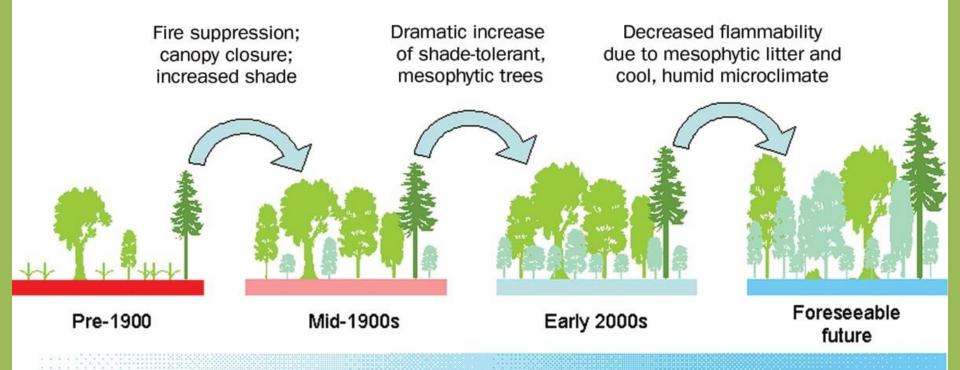




Mean Fire Interval: 2 – 6 years!

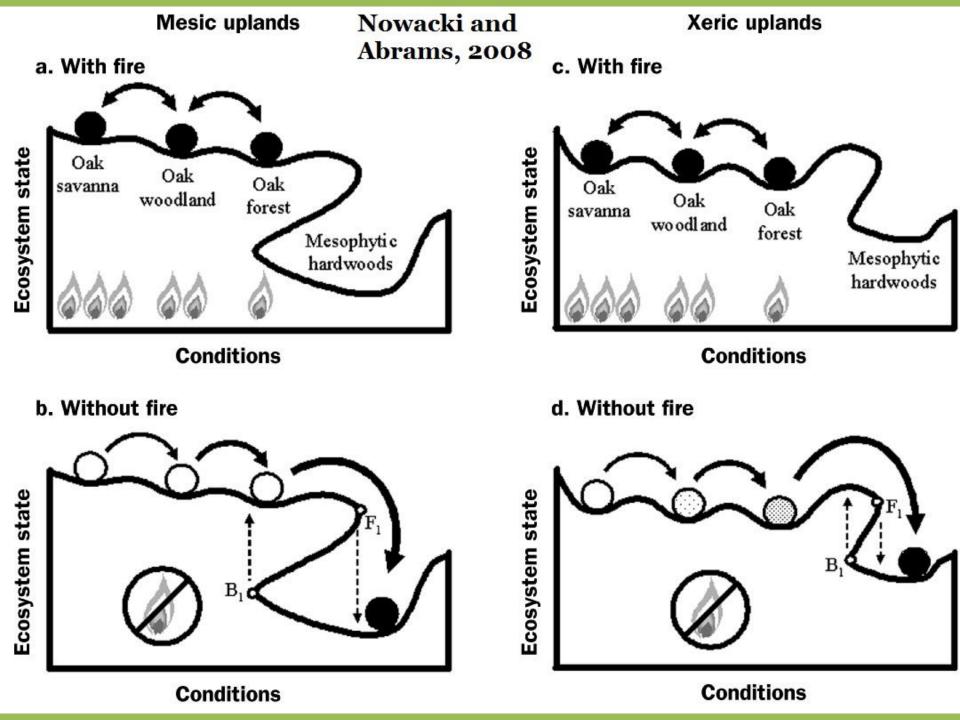


Fire importance



Mesophication

Nowacki and Abrams, 2008





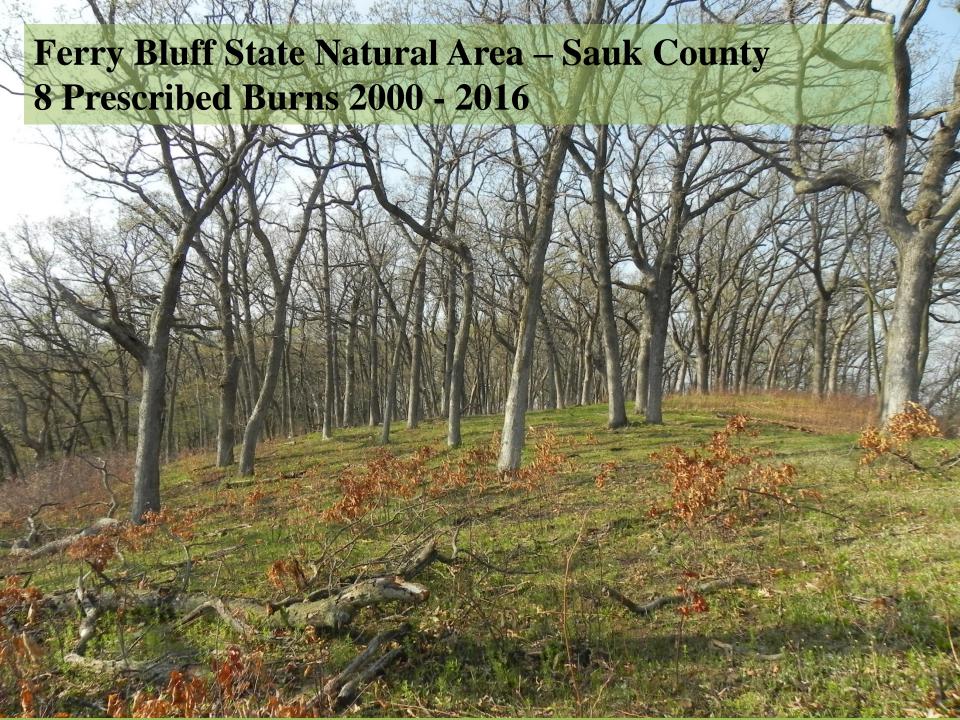
















Acknowledgements

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