

Prescribed Fire as a Silvicultural Tool

- I. What is sustainable forestry?
- II. The use of fire in Southern Wisconsin forest management
 - I. The oak forest resource in Wisconsin
 - II. The role of fire in Wisconsin forest ecology
 - I. The perpetuation of oak on mesic sites
- III. Considerations When Using Prescribed Fire to Achieve Forest Management Goals
 - I. Difference between prairie and woodland / forest burns
 - II. Factors determining mortality as a result of fire
- IV. Example: Mazomanie Bottoms Prescribed Fire, Spring 2010
- V. Implementing a fire management system
- VI. Research needs for silvicultural fire in Wisconsin

What is Sustainable Forestry?

Sustainable forestry is the practice of managing dynamic forest ecosystems to provide ecological, economic, social, and cultural benefits for present and future generations.

WDNR Division of Forestry



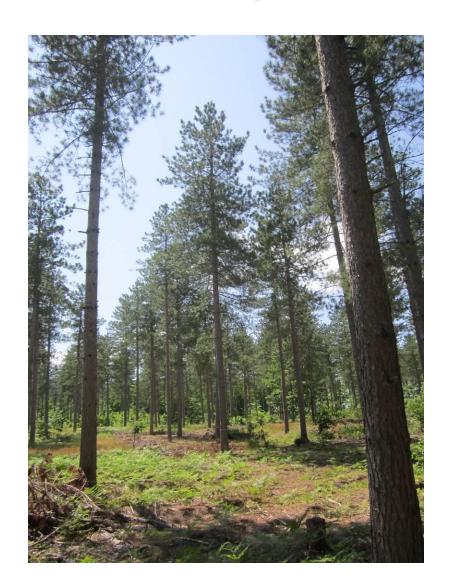




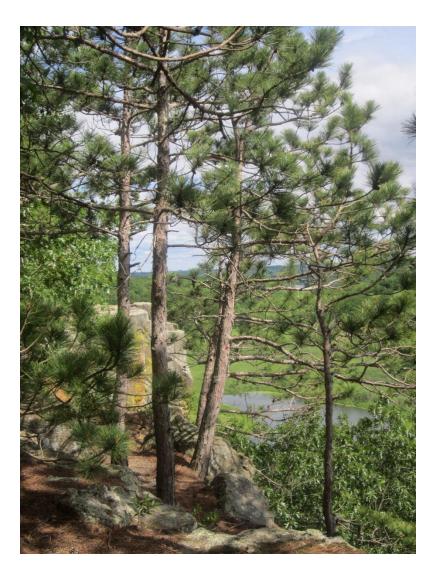
What is Sustainable Forestry?

Sustainable forestry practices must be based on:

- Compatible landowner objectives
- The capabilities of each site
- Scientifically sound silviculture
- Each of these factors is equally important

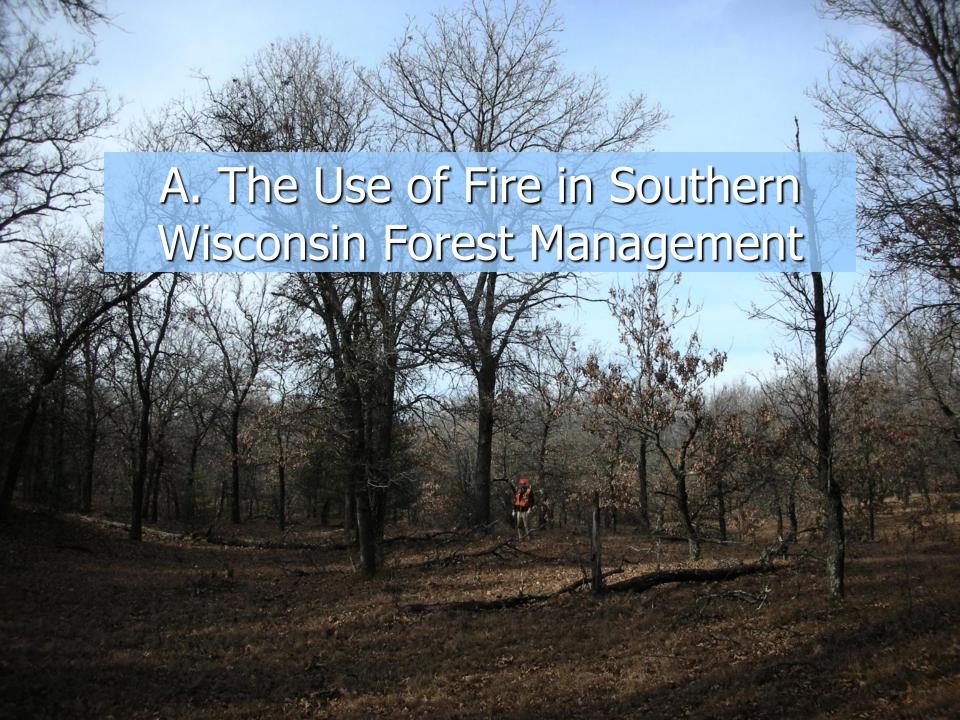


What is Sustainable Forestry?

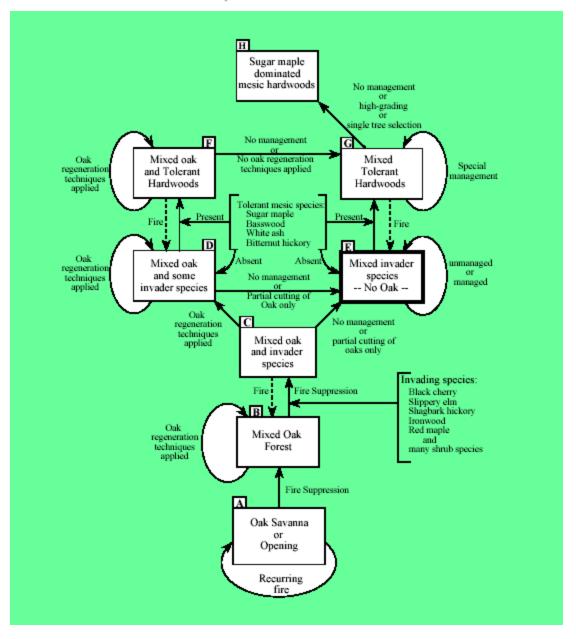


Aldo Leopold went so far as to say that the first rule of intelligent tinkering is to keep all the pieces. Today, we need another rule,

the second rule of intelligent tinkering is to know what the machine is supposed to do and how it works.



Forest Community Dynamics (with and without management) on Mesic and Dry-mesic Sites in Southern Wisconsin



Oak Forest of Wisconsin

- The oak cover type has an unbalanced age structure
 - Harvesting occurs in predominantly older stands.
 - Only 4% of oak stands are older than 100 years
 - Regeneration is not occurring as a cover type on drymesic / mesic sites
 - Only 6% in 1 to 20 year age class
 - 66% of resource in 40 to 80 year range

There is an apparent shift in Wisconsin's oak resource from good sites (mesic) to poor sites (dry).



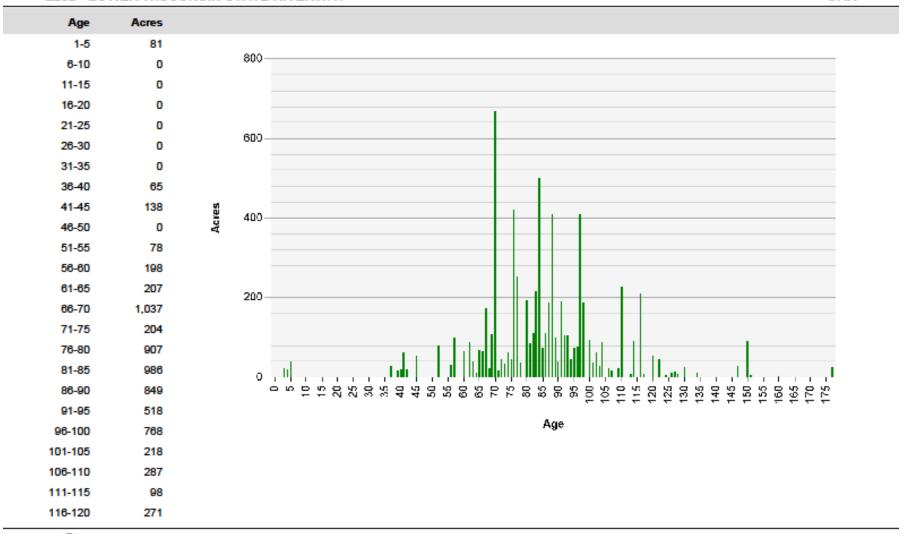
Forest Type Age Distribution

Print Date: 9/16/2010

Report 103

2232 - LOWER WISCONSIN STATE RIVERWAY

OAK





Oak Forest of Wisconsin

- Mismanagement or no management is resulting in:
 - Conversion to more shade tolerant trees and shrubs on dry mesic / mesic sites.
 - Loss of herbaceous biodiversity with implications for insect and bird populations
 - May also lead to a potential for:
 - increased soil erosion
 - loss of soil nutrients
 - Increased male pattern balding.

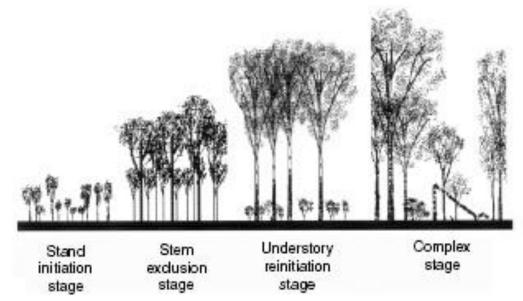


Fire may play a critical role in the perpetuation of oak on mesic sites

1. Site Maintenance

Prior to stand initiation and after understory reinitiation, fire can be used to keep less desirable species from encroaching in oak dominated stands.

- Red maple
- Exotic / Invasive Species



Fire may play a critical role in the perpetuation of oak on mesic sites

2. Establishment of Regeneration

Seedling establishment may be increased by burning due to a decrease in litter depth and exposure of mineral soil.

- Reduces soil moisture which discourages moisture loving species from becoming established
- May control insect predators of both acorns and new seedlings.

Fire may play a critical role in the perpetuation of oak on mesic sites

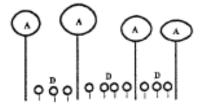
3. Competitive Advantage

Competition from other species might be reduced and the proportion of oaks in advanced reproduction might be increased with fire.

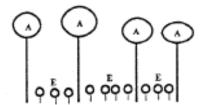
- Oak regeneration accumulates in the presence of disturbance
- Favors a large root:shoot ratio. Oak seedlings have inherently slow shoot growth and attaining a competitive rate of growth depends upon the development of a large root:shoot ratio and large root mass.



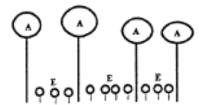
1. Typical upland mixed-hardwood stand.



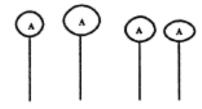
 After 3-5 years, yellow-poplar dominates the advance regeneration pool.



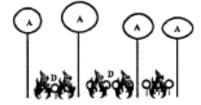
 Oak now dominates the advance regeneration pool. Three management options available.



 Overstory retained and additional fires withheld creates a two-age stand.



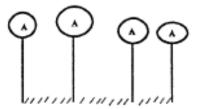
 Initial cut to a shelterwood (40 to 60% basal area reduction).



 Prescribed fire topkills the advance regeneration, forcing rootstocks to sprout. Overstory damage and mortality limited to trees with slash at their bases.



 Overstory harvested and additional fires withheld creates a new oak forest.



 Repeat burning either stockpiles oak sprouts or creates an oak savanna.

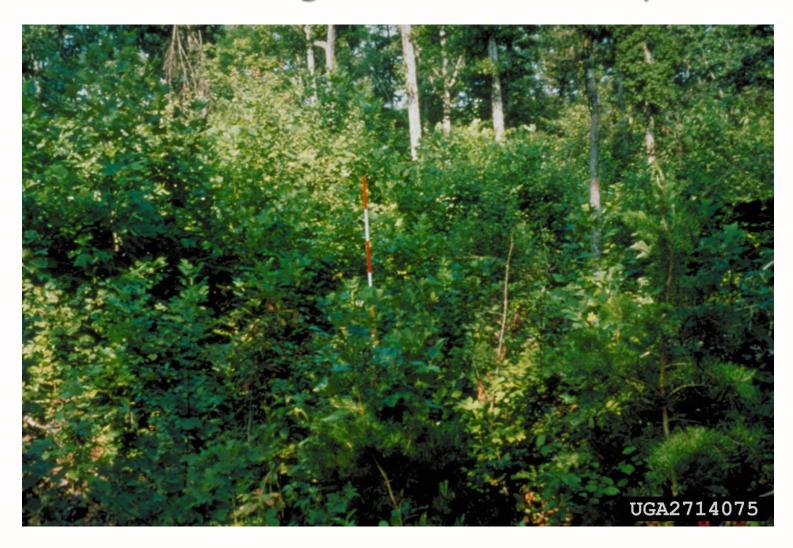
The Shelterwood - Burn Method



The Shelterwood - Burn Method: 1st Stage Shelterwood harvest

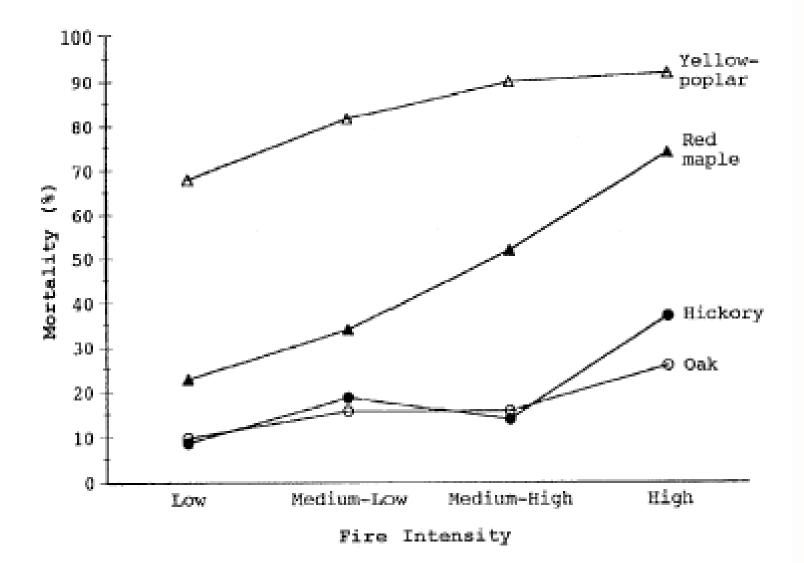


The Shelterwood - Burn Method: Advanced Regeneration Development

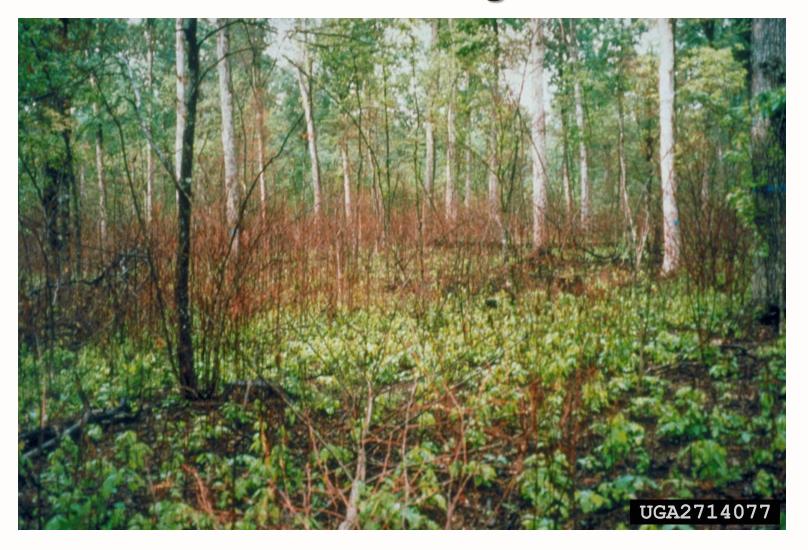


The Shelterwood - Burn Method: Relatively Hot Growing Season Prescribed Fire





The Shelterwood - Burn Method: Oak Dominates Advanced Regeneration Pool



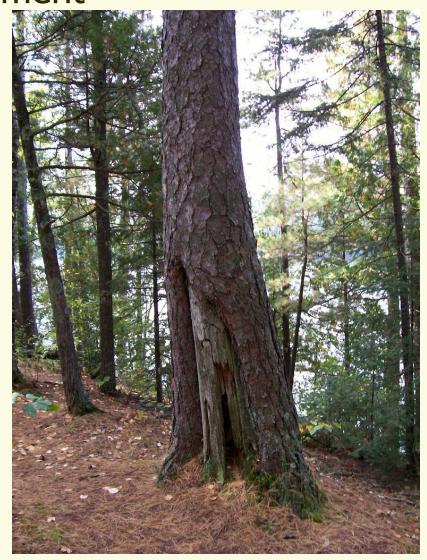
Notes to the Shelterwood - Burn Technique

- Mechanical site scarification or waiting for a bumper acorn crop are probably better management strategies for establishing new oak seedlings than prescribed burning.
- Oak reproduction will not be uniform over the entire burned area
- One burn may not be enough if oak dominance is desired in the new stand
- It is believed that oak dominance of the advanced regeneration will continually increase with repetitive spring burning at about 2-4 year intervals. Competitors cannot be allowed to outgrow the ability to be killed by fire.

Incorporating Ecological Complexity into Red Pine Management

Reintroduce fire

- Prescribed fire in older stands (>50 years old) can be an effective tool for:
 - Eliminating shrub and hardwood competition
 - Preparing mineral seedbeds
 - Incorporation of natural stand development processes into intermediate treatments

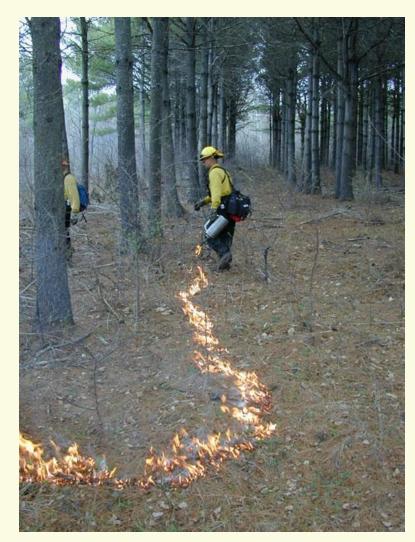




Prescribed Fire as a Silvicultural Tool for Red Pine Management

Silvicultural Trial

- A 33 acre prescribed burn was conducted on the Willow Flowage in May 2002. Burn objectives were:
- reduce shrub and hardwood competition
- reduce the duff layer & prepare seedbed for pine regeneration.



Prescribed Fire as a Silvicultural Tool for Red Pine Management



Results:

- The fire burned hot and slow
- 90% mortality of hazelnut and 20% mortality of hardwood
- less than 15% duff removed
- some existing pine regeneration mortality





Red Pine Cone Beetle

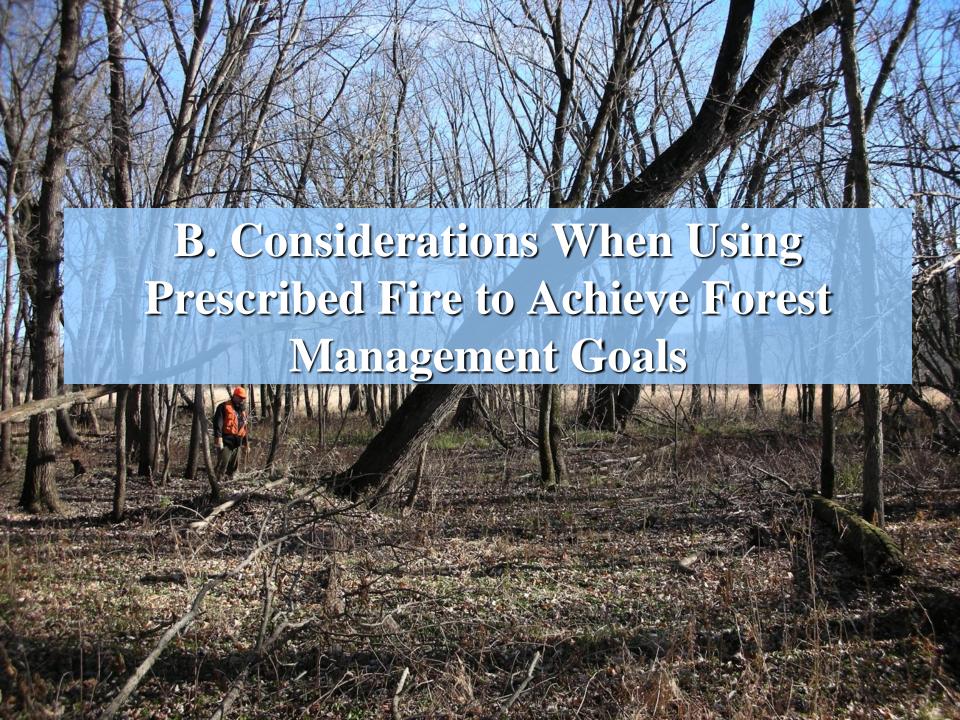
- Adults and larvae completely destroy seed in affected cones
- In September, the adult bores into current-year buds and shoots.
- Weakened shoots break off and fall to the ground, adultsoverwinter in the shoots on the ground.
- Prescribed fire can reduce the population, increase seed production.



Regeneration following shelterwood harvest. Prescribed burn to limit red pine cone beetle and prepare seed bed.

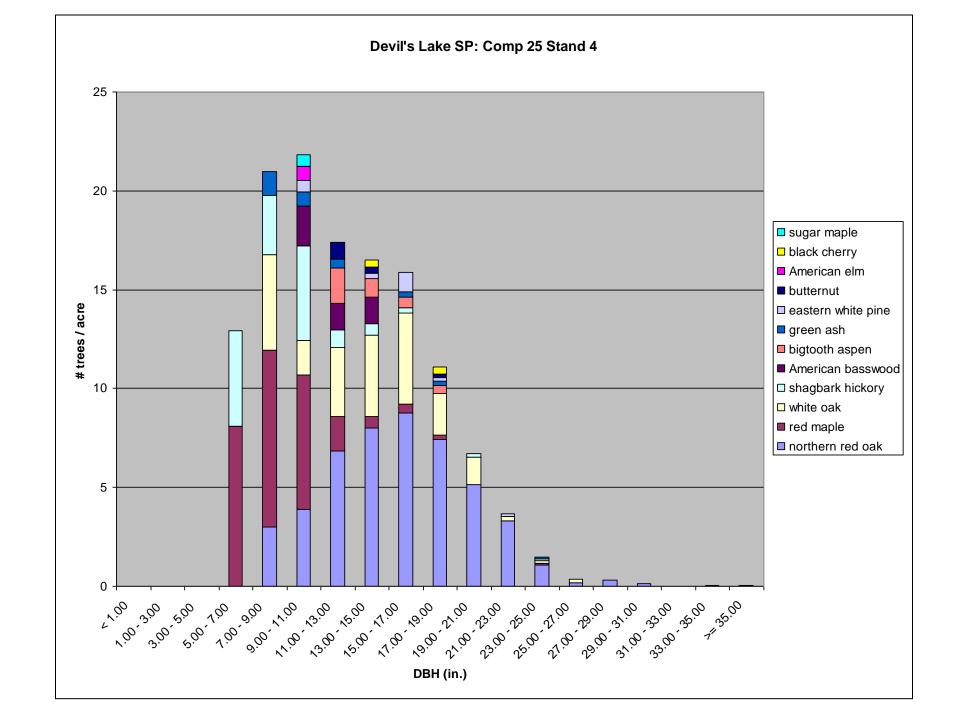
Hiawatha National Forest 2012





Considerations When Using Rx Fire to Achieve Forest Management Goals

- Differences between grass/prairie and woodland/forest burns?
- Fire as a natural disturbance force vs. fire as a management tool
 - Can fire successfully achieve management goals?
 - Fire return interval based on utility of fire
 - Longer fire potential periods (i.e. woodland fires have longer windows of utility)



Considerations When Using Rx Fire to Achieve Forest Management Goals

Differences between grass/prairie and woodland/forest burns?

- Intensity makes a difference
 - Fire is more nuanced in a forest
 - Economic implications of fire
 - Will fire limit present and future management options?



Factors determining tree mortality from fire

1. Season

During the dormant season, trees are generally less susceptible to injury by fire.

2. Bark Characteristics

The easiest bark characteristic to measure is bark thickness although this is not always a true indicator of resistance to fire.

3. Size and Vigor

Larger trees are able to survive more intense fires than smaller trees (thicker bark, larger area of cambium).

4. Form

If a tree is crooked or leaning, flames may be directly below the stem, increasing heat at the bark surface.

Factors determining tree mortality from fire

5. Fire Intensity

- When living tissue reaches 147°F, it dies almost instantaneously
- Death of plant tissue is a function of both temperature and time.
- The greater the fire intensity the more energy is directed at the tree the greater the likelihood of death or injury.
- Scorch height can be used as a rough approximation of fire intensity.

6. Stocking Level

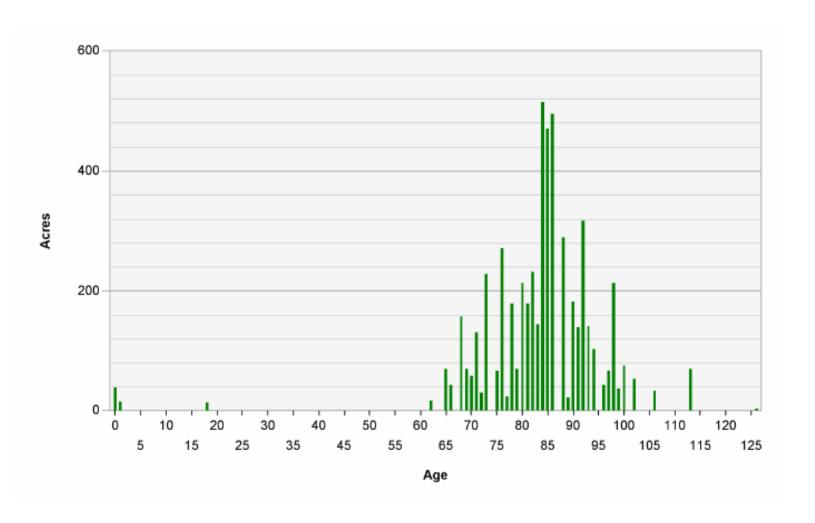
Because stems in an overstocked stand tend to be smaller in diameter and less vigorous than those in an adequately stocked stand, they are more likely to be fire-damaged.

7. Species Composition of Stand

Stand Level Considerations for Oak Management

- ✓ Is thinning part of our problem (i.e. what is the stand's rotation age?)
 - ✓ Do not thin stands past ¾ of rotation age. This may encourage a brushy understory and set up interference with future regeneration attempts
 - ✓ As a rule of thumb when thinning oak stands, approximately 75% of the cut relative stand density should be removed from below the average stand diameter (low thinning) and 25% from above (crown thinning)

Devils Lake State Park Oak Cover Type Age Distribution (acres)



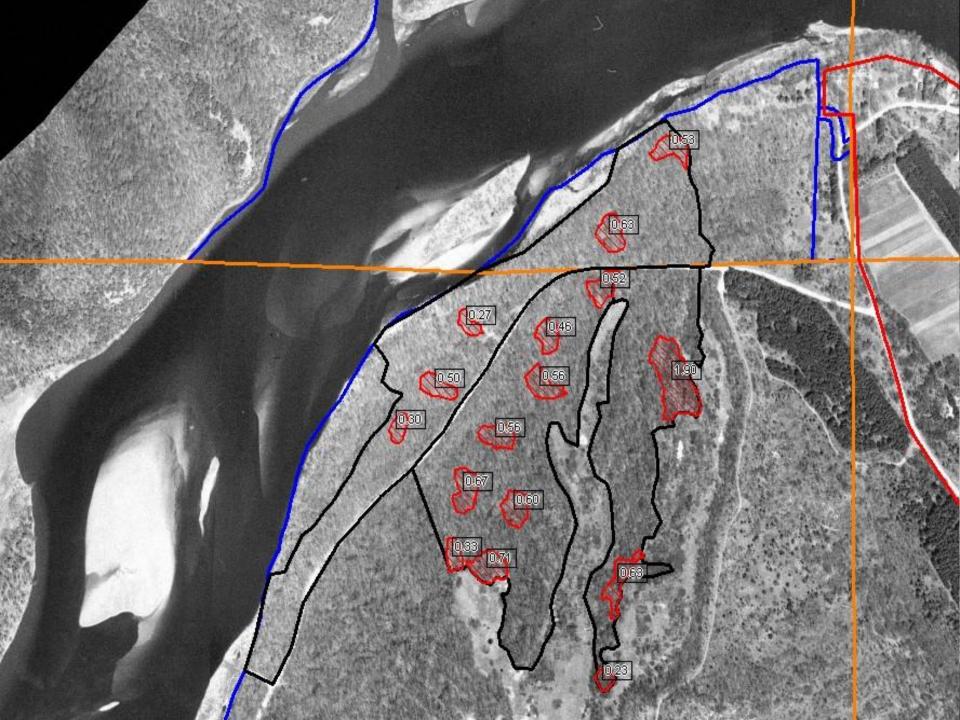
Considerations When Using Rx Fire to Achieve Forest Management Goals

Differences between grass/prairie and woodland/forest burns?

Different resource commitments

Are you ready for Day 2?



































IMPLEMENTING A FIRE MANAGEMENT PROGRAM

- ☐ Determine if fire management is needed.
 - ☐ It is important to determine, if the need to use prescribed fire to meet management goals, justifies the risks inherent in burning. Consider all available options.
 - Benefits from the chosen control option should always outweigh the overall risks and costs.

IMPLEMENTING A FIRE MANAGEMENT PROGRAM

- □ Develop a Site Fire Management Plan
 - ☐ This may be include in the Forest Stewardship Plan for your property and should include:
 - ☐ Site Background Information
 - ☐ Fire Management Justification and Goals
 - ☐ Fire Regime Proposal
 - ☐ Site Specific Fire Operations
 - ☐ Smoke Management Plan
 - Maps

IMPLEMENTING A FIRE MANAGEMENT PROGRAM

- ☐ Develop and implement a Prescribed Burn Plan
- ☐ Monitor and assess the impacts of management actions
 - ☐ If desired outcomes are not achieved with prescribed burning, consider amending the fire to achieve goals
 - ☐ Increase/Decrease residence time
 - ☐ Increase/Decrease frequency of burn
 - ☐ Increase/Decrease intensity of burn
 - ☐ Change prescription reflect fuel loading

Research Needs for Silvicultural Fire in Southern Wisconsin

- ✓ Better baseline data on fire intensity required to accomplish specific goals
 - ✓ prescribed burn evaluation and monitoring
- ✓ Better ways to accurately estimate baseline data
 - ✓ ex. flame length, ROS
- ✓ Better fuel models that incorporate exotic species
 - ✓ Live fuel moisture, garlic mustard, and Fuel Model 9
- ✓ Better understanding of fire as a tool for oak silviculture

