Summer Burns in Michigan

Jack McGowan-Stinski
Senior Project Scientist

Cardno JFNew
Shaping the Future

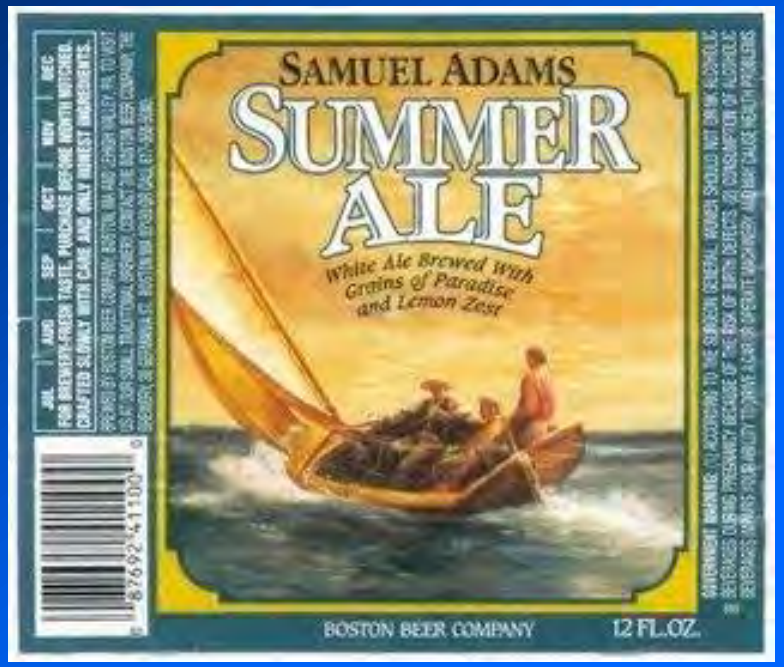
A lot of prescribed fire in MI is done in dormant season....

Why?

What is a “Summer” Burn?

- Webster’s: the season between spring and autumn comprising in the northern hemisphere usually the months of June, July, August; as reckoned astronomically extending from the June solstice to the September equinox....
- “Growing Season” equals “Summer”: phenologically, when “trees and shrubs are leafed out”...

Comparing Summer Burning to other seasons....

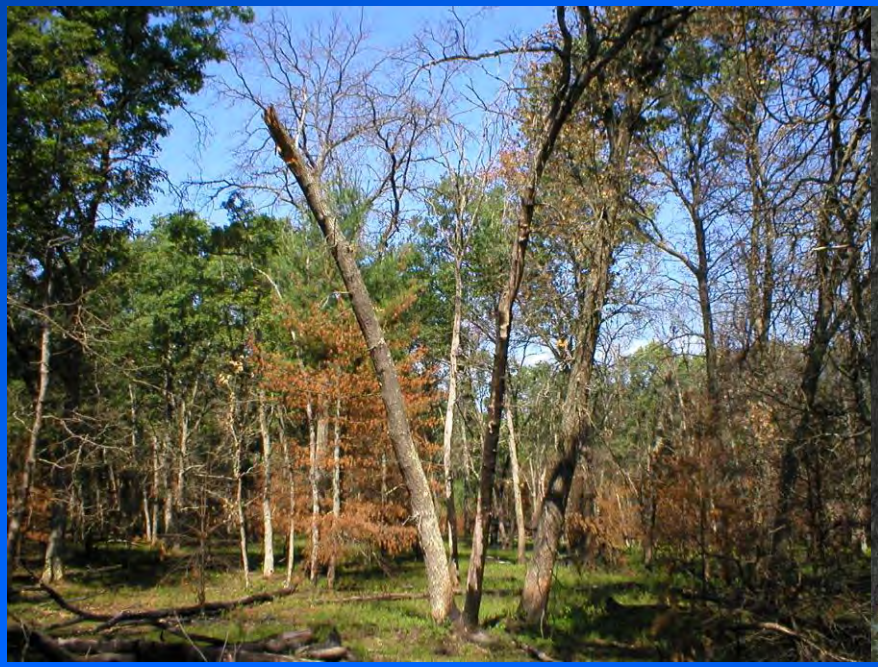


Is like comparing Samuel Adams Beers....

there are seasonal beers...the tastes are different....

....just like ***prescriptions***, fire behavior, and fire effects are different for different seasons of burning

Oak Savanna and Oak Barrens Restoration Burns…



Landscape Gradients

Prairies and savannas occur across a wide range of moisture and landscape conditions

Hillside prairie

Oak barrens, etc.

prairie fen

Shifting Mosaic

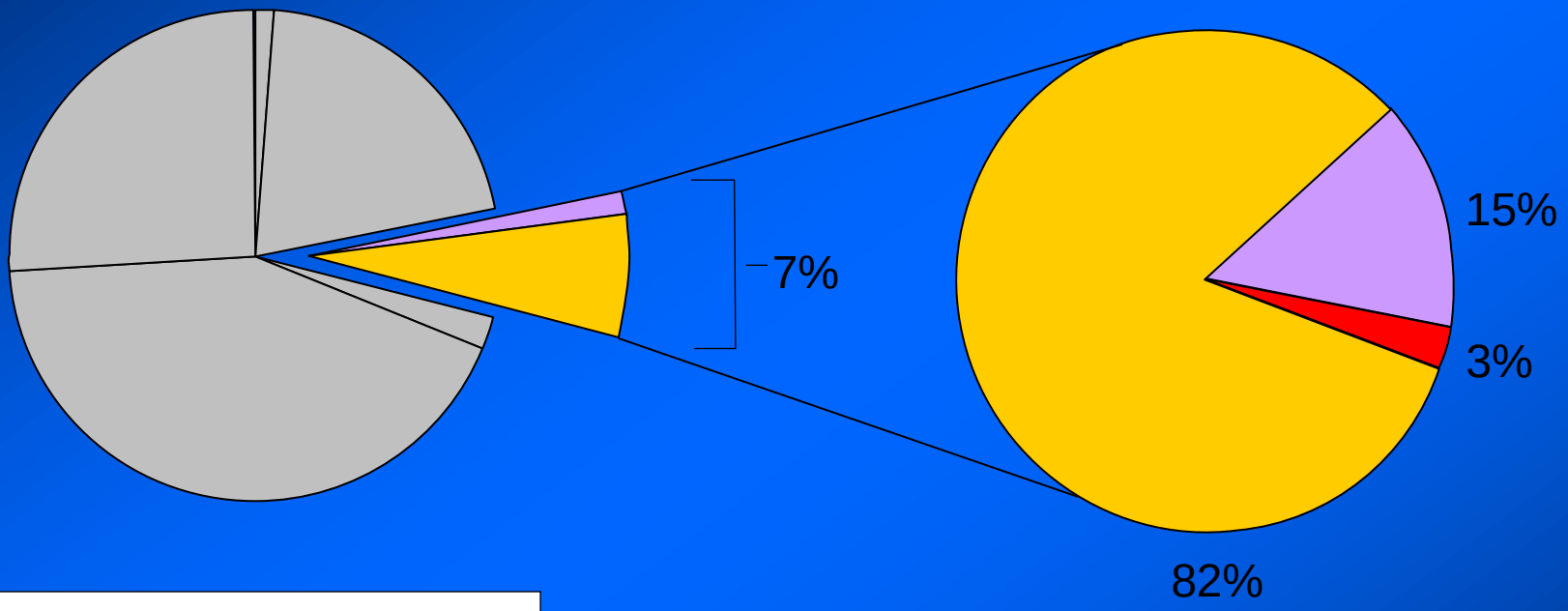
Occur in a shifting landscape mosaic with a pyric geography

oak forests

oak savanna

dry sand prairie

Circa 1800s Vegetation, Southern MI



Portion of vegetation in prairie or savanna

- wet prairie
- upland prairie
- savanna

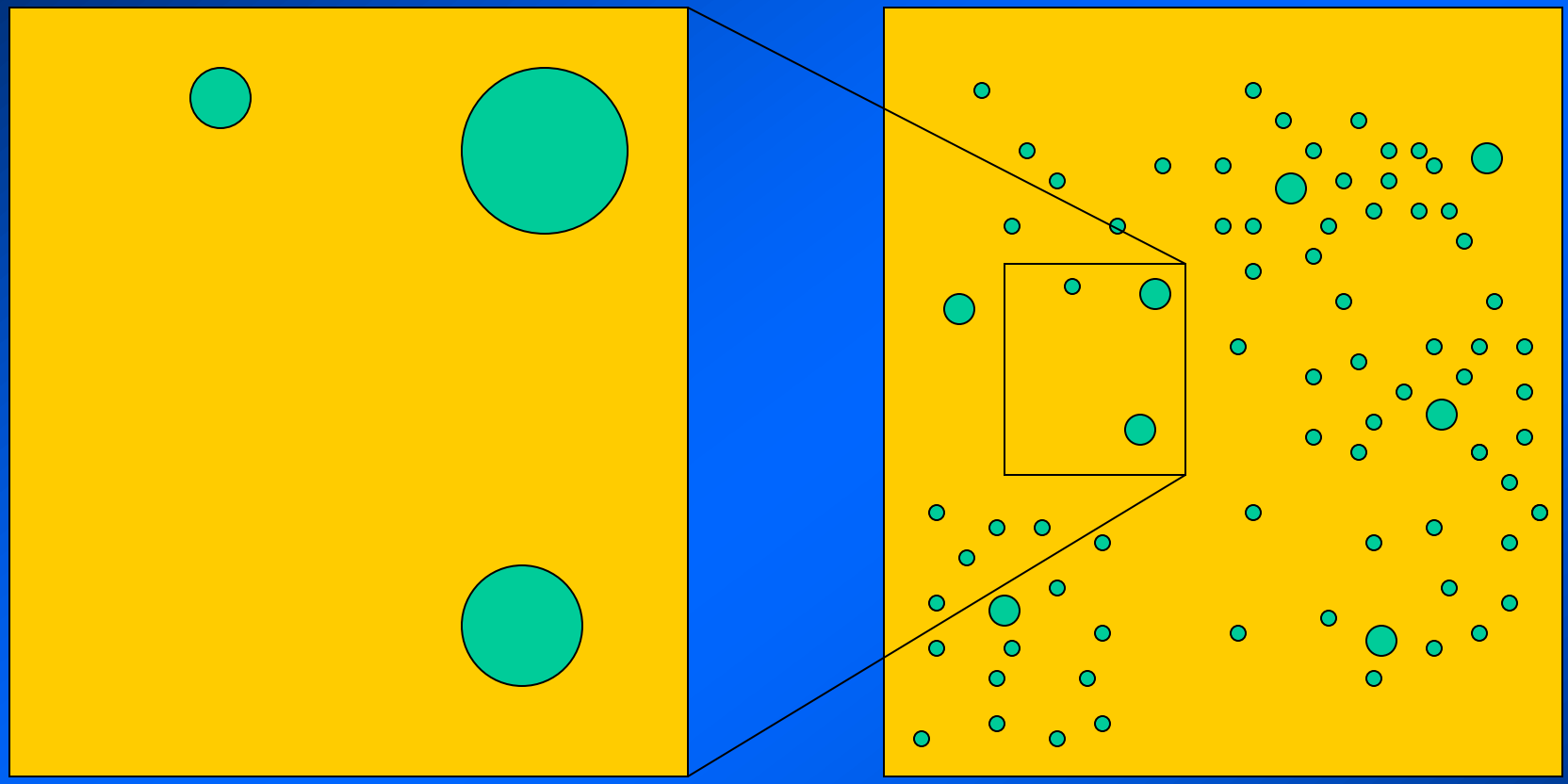
Other

- forests and wetlands

Historically ~2 million acres of savanna....**or MORE?**

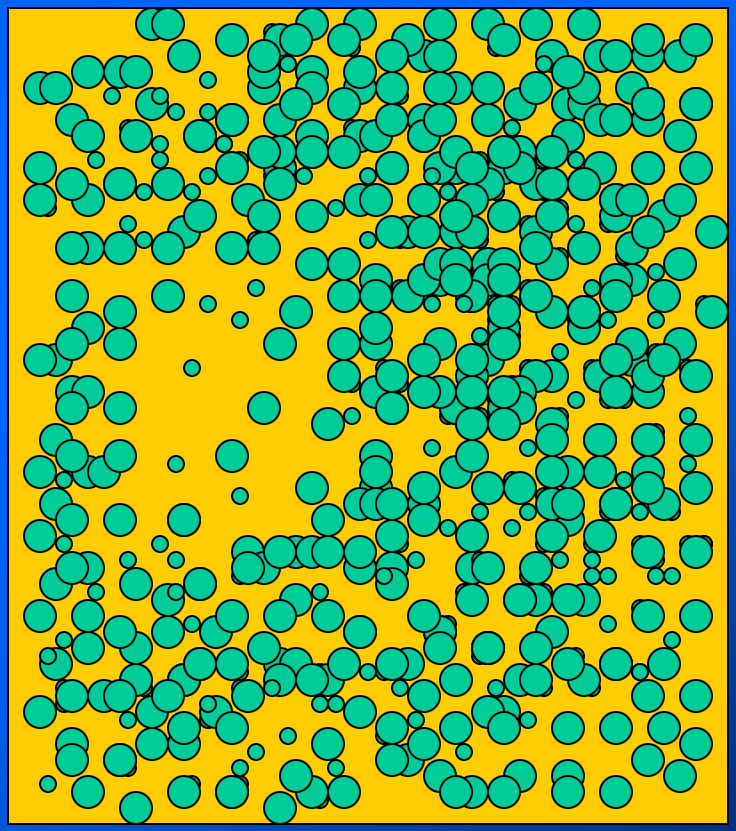
Source: Comer et al. 1995

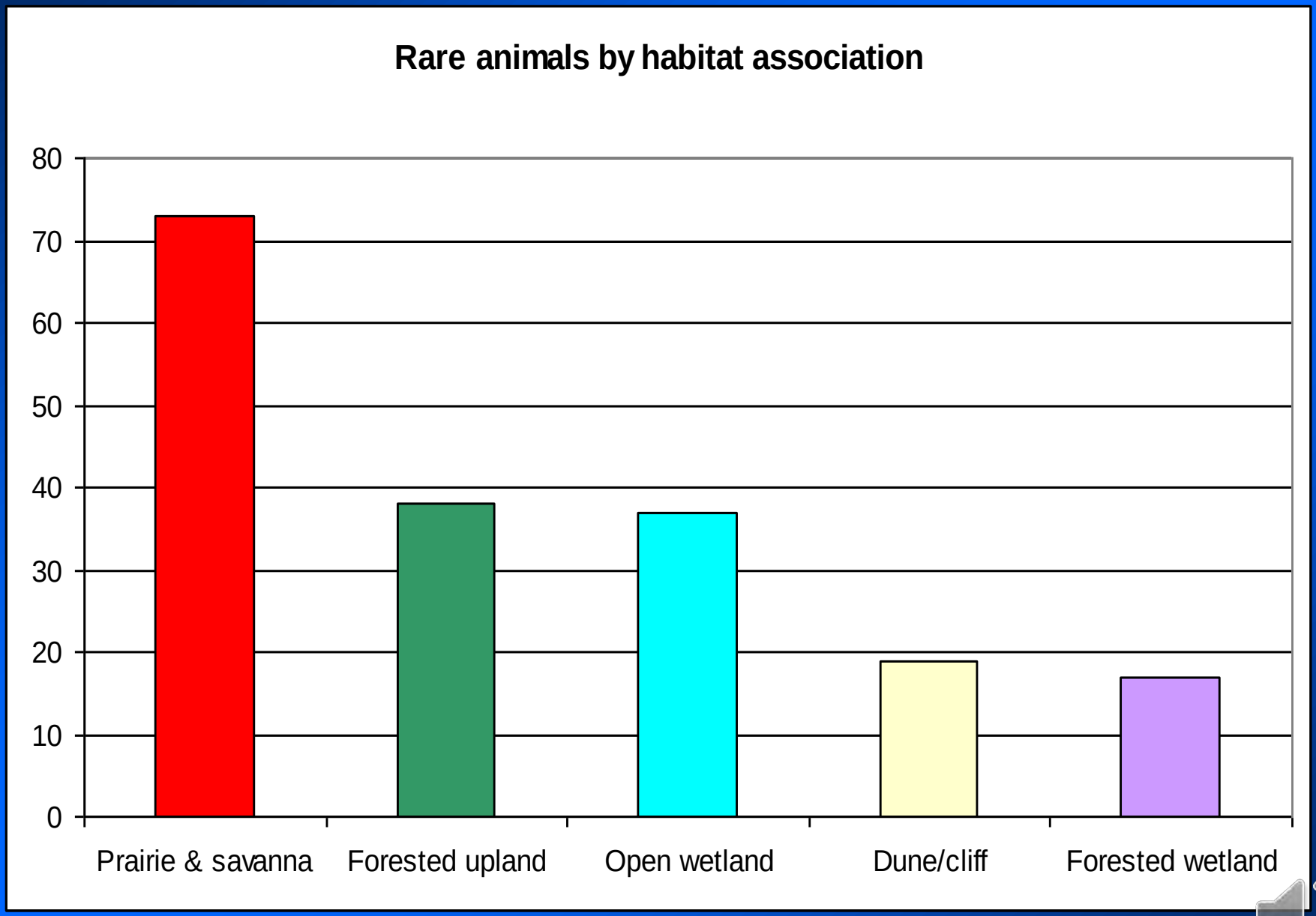
Prairie or Savanna? A Matter of Scale



Prairie = less than 1 tree per acre; > 5% canopy
Prairie pockets within savanna landscape

Many MI oak forests are actually former savannas



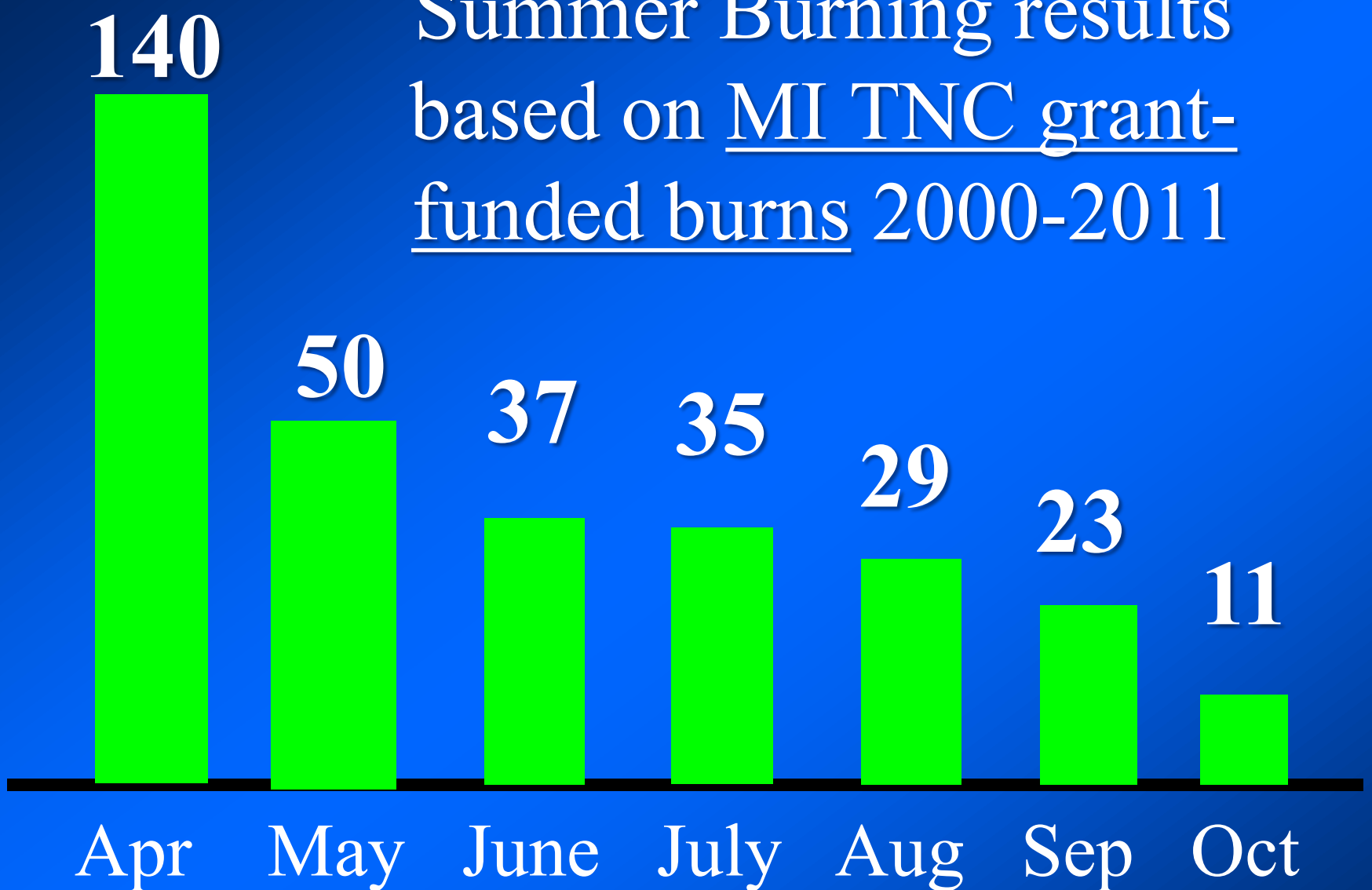

Rare animals by habitat association
80
70
60
50
40
30
20
10
0
Prairie & savanna
Forested upland
Open wetland
Dune/cliff
Forested wetland





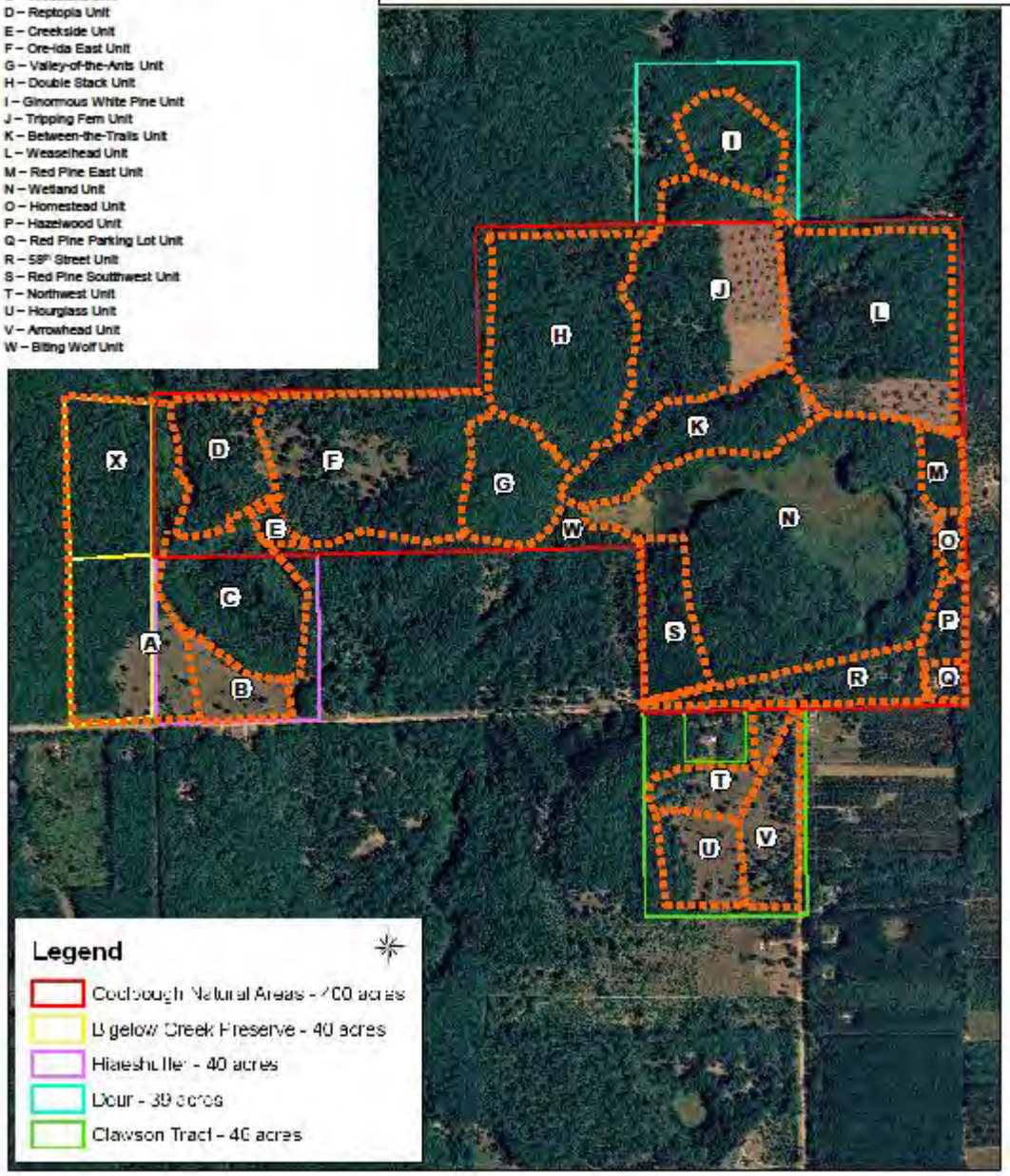

Natural communities	Rare plant and animal species	Invasive species
Dry sand prairie/oak and pine barrens, oak savanna	Prairie smoke White or Prairie False Indigo Rattlesnake-master Prairie Dropseed Sand Grass Karner Blue Butterfly frosted elfin persius duskywing dusted skipper blazing-star borer moth Great Plains spittlebug red-legged spittlebug Eastern Box Turtle	Spotted Knapweed Common St. Johnswort leafy spurge soapwort Sweet Clover's Bouncing Bet glossy buckthorn Garlic Mustard Scotch Pine Black Locust

Summer Burning results based on MI TNC grant-funded burns 2000-2011



"Newaygo" Burn Unit Locations 2010

A - Bigelow Creek (includes Hiaeshutter's West Field) Unit
B - Field Unit
C – Woodland Unit
D – Reptopia Unit
E – Creekside Unit
F – Ore-ida East Unit
G – Valley-of-the-Ants Unit
H – Double Stack Unit
I – Ginormous White Pine Unit
J – Tripping Fern Unit
K – Between-the-Trails Unit
L – Weaselhead Unit
M – Red Pine East Unit
N – Wetland Unit
O – Homestead Unit
P – Hazelwood Unit
Q – Red Pine Parking Lot Unit
R – 58th Street Unit
S – Red Pine Southwest Unit
T – Northwest Unit
U – Hourglass Unit
V – Arrowhead Unit
W – Biting Wolf Unit



0 370 740 1,180 2,220 2,960 Feet

Map created by L Reichert, The Nature Conservancy, 2010

Monitoring…

- Photomonitoring
- Vegetation transects
- Rare butterfly surveys
- Modified Brown's transects
- Oak Barrens Coarse–level Metrics

What is your Management Goal?

- To make it black?
- Reduce shrubs?
- Thin canopy?
- Enhance grasses?
- Enhance forbs?
- Enhance habitat for a certain animal species?
- Achieve full range of variability in the fire-dependent community?


"Goal is not
the flames,


but what the
flames do...

Land Management

GOALS

Resource Management

OBJECTIVES

(second-order fire effects)

Treatment *OBJECTIVES*

(first-order fire effects)

Constraints

(Control *OBJECTIVES)*

(first-order fire effects)

Fire Prescriptions

Warm-season Grass dominance

- Spring burns remove thatch and blacken ground, resulting in increased soil temperature
- Favors dominance of warm season grasses (big bluestem, little bluestem, Indian grass, switch grass)
- Repeated spring burning leads to an over-abundance of grasses and a decline of early and mid-season forbs

Ecological communities often are dominated by a few species that may monopolize up to 95% of available space (Howe 1994)

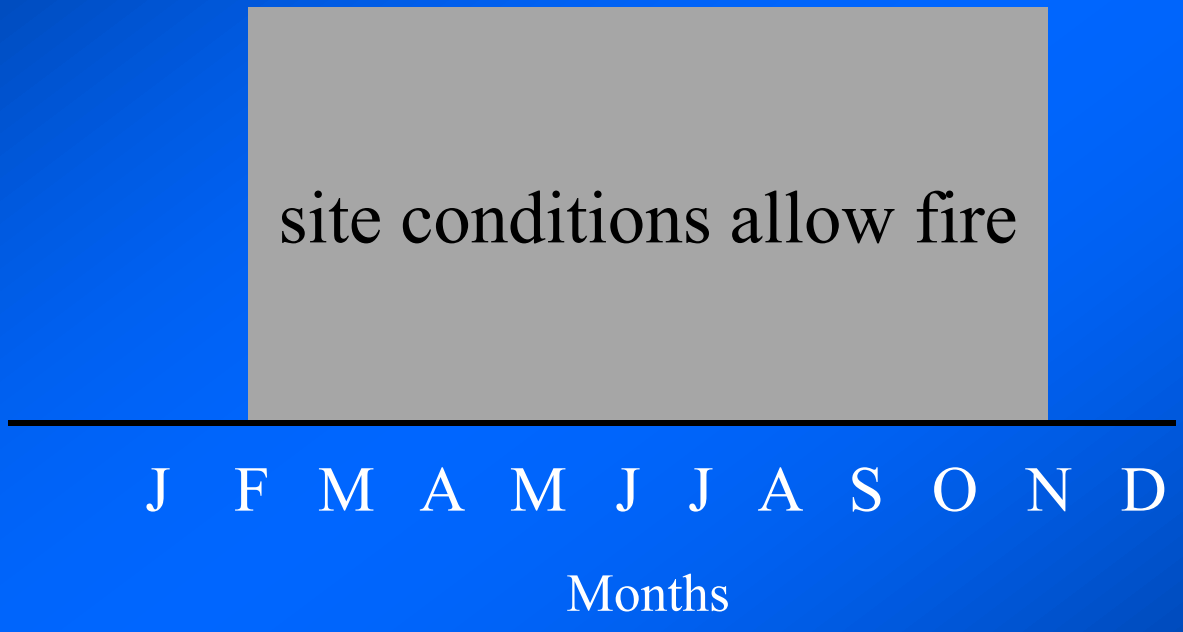
Practices that suppress dominant species increase diversity through competitive release of sub-dominants (Collins and Gibson 1990, Howe 1994 &1999, Engle 2000)

What are some practices that can suppress dominant species?

Growing season fires suppress dominant late-flowering grasses and forbs, making light and resources available for the sub-dominant species that make up the majority of the diversity.

Species richness and frequency of sub-dominants can be improved without compromising vigor of warm-season grasses.

Michigan's "General Burn Window"



Will vary dependent on where you are in the State!

Ignition source(s) for fire?

Native Americans

Likely burned whenever conditions were favorable, in spring and fall but also during growing season

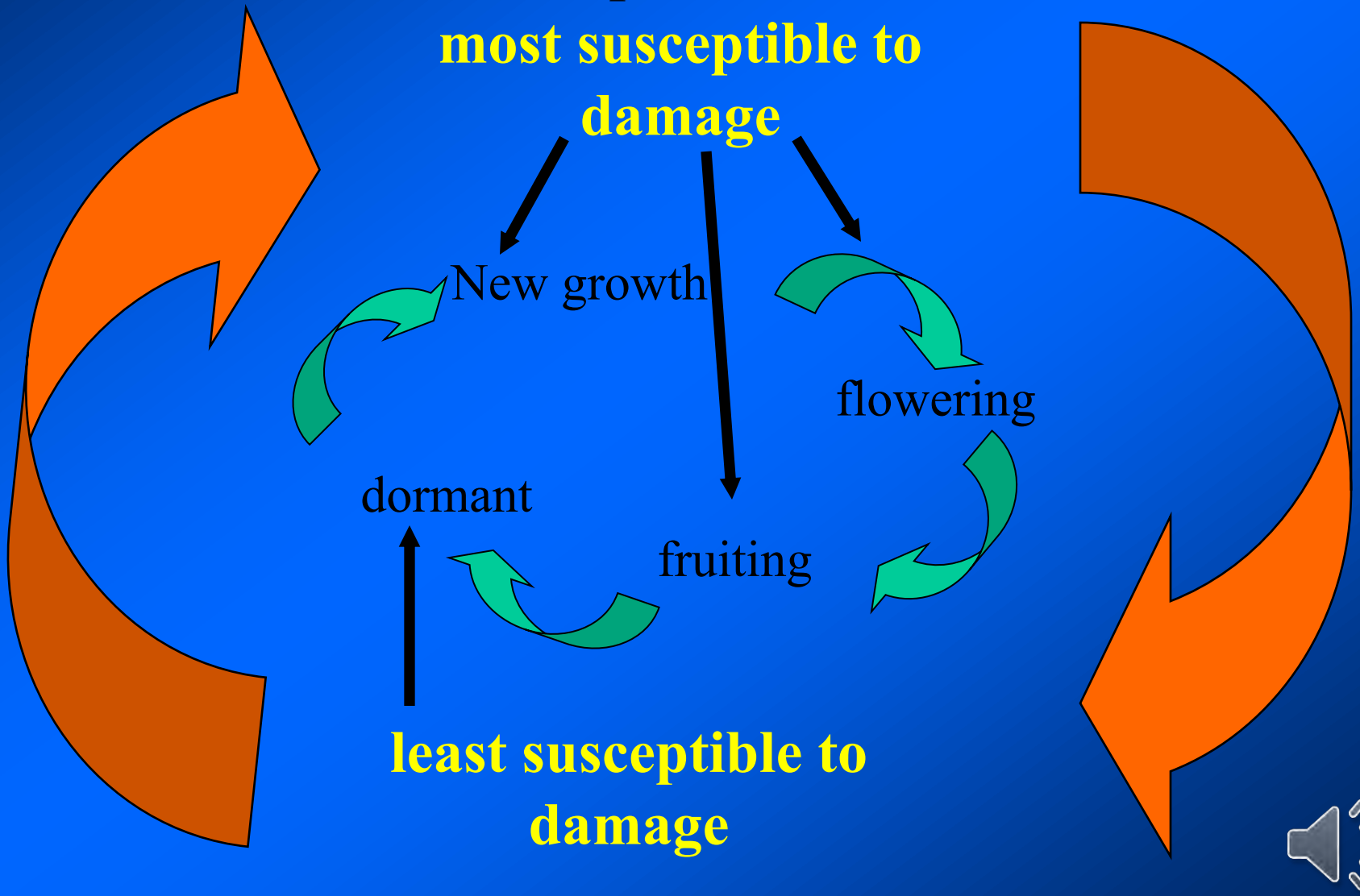
And now “us”

Lightning strikes

(Petersen and Drewa 2006)

- Fires most likely to start when thunderstorms occur at end of long dry spell
- Lightning frequency peaks in mid-to-late summer
- Lightning-caused fires most common June-August

Phenology – at what stage are plants least and most susceptible to fire?



Plant tissue that is metabolically inactive or dehydrated can withstand greater heating than tissue that is metabolically active or hydrated.

Burning during a plant's active growing season often results in the highest mortality rates

Carbohydrate Cycle

- Carbohydrates are starches and sugars manufactured by plants and used to provide energy for metabolism, and structural compounds for growth
- There is a seasonal depletion and restoration of carbohydrates in plants = Total Available Carbohydrates (TAC)
- Carbohydrate reserves used by plant for shoot and flower production
- Greatest point of depletion is usually during green up in spring or during flower production
- If fire hits at lowest point of reserves, reduced resprouting and productivity may result
- Repeated depletion in one growing season can cause harm (Spot-and-swath-burning with propane…)

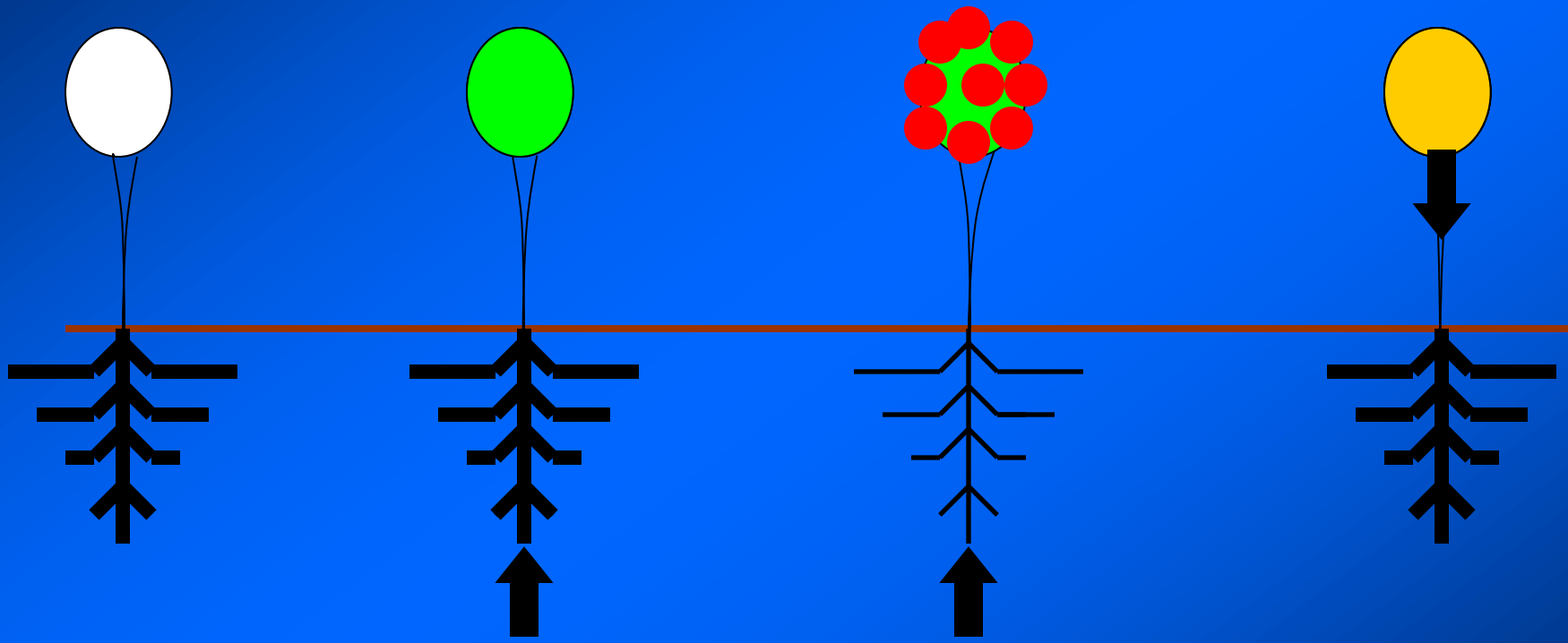
Changes in dominance of different groups of grasses and forbs in response to fire seasonality

	April-May	June-Aug	Sept	Oct-Nov
Grasses and sedges				
Warm season	↑	↓	↔	↑
Cool season	↓	↑	↑	↓ ?
Forbs				
Early-flowering forbs	↓	↑	↑	↓ ?
Mid-flowering forbs	↓	↑	↑	↑ ?
Late-flowering forbs	↑	↓	↑	↑ ?
Legumes (Fabaceae)	↑	↑	↑	↑

Ryan O'Connor
Michigan Natural Features Inventory

Howe 1994, 1995; Coppedge et al. 1998; Sparks et al. 1998; Copeland et al. 2002

Woody shrub phenology



Dormancy (Oct-March)

Leafout (mid-late April)

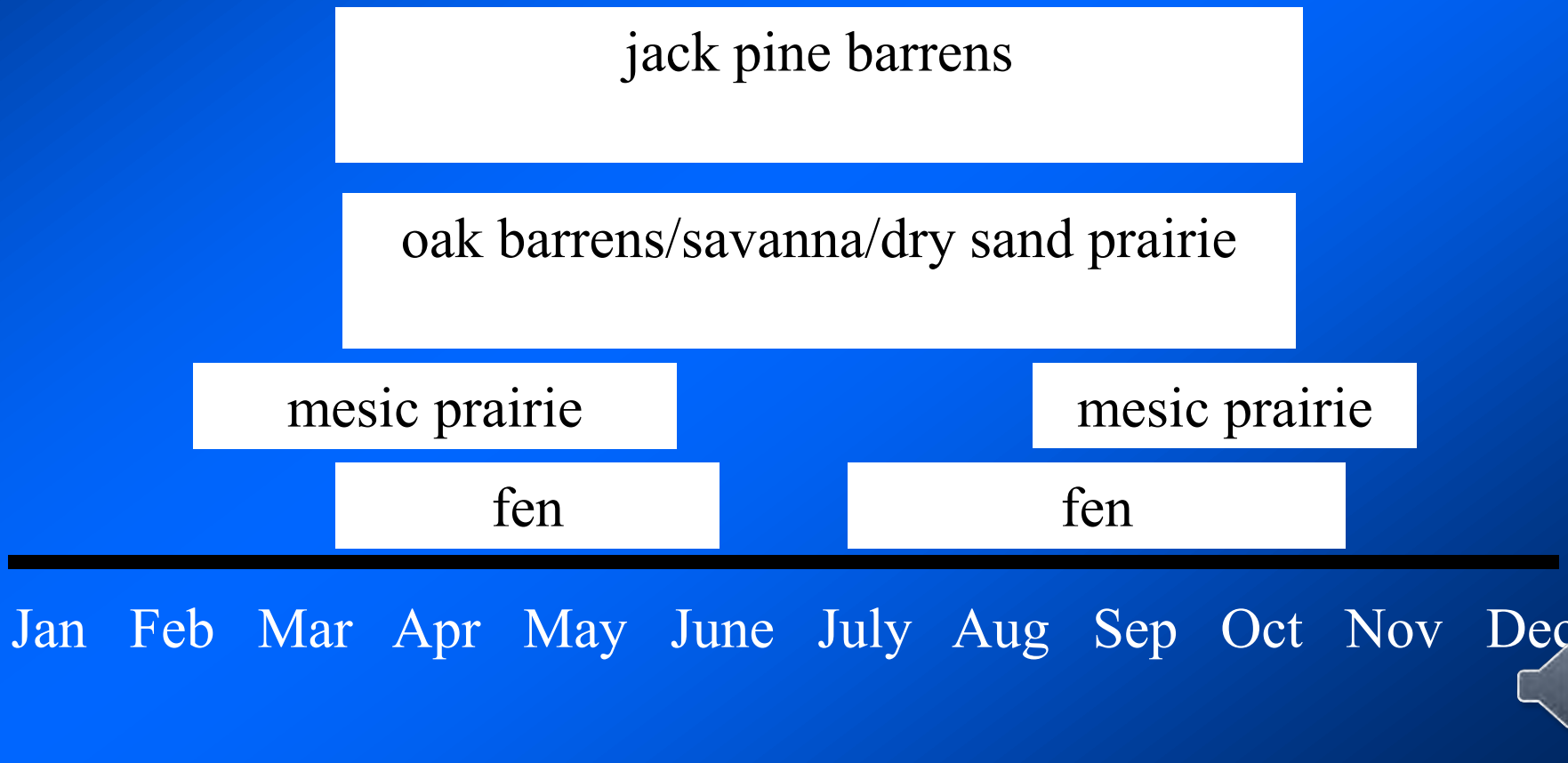
Flowering/Fruiting (May-Aug)

Senescence (Sept-Oct)

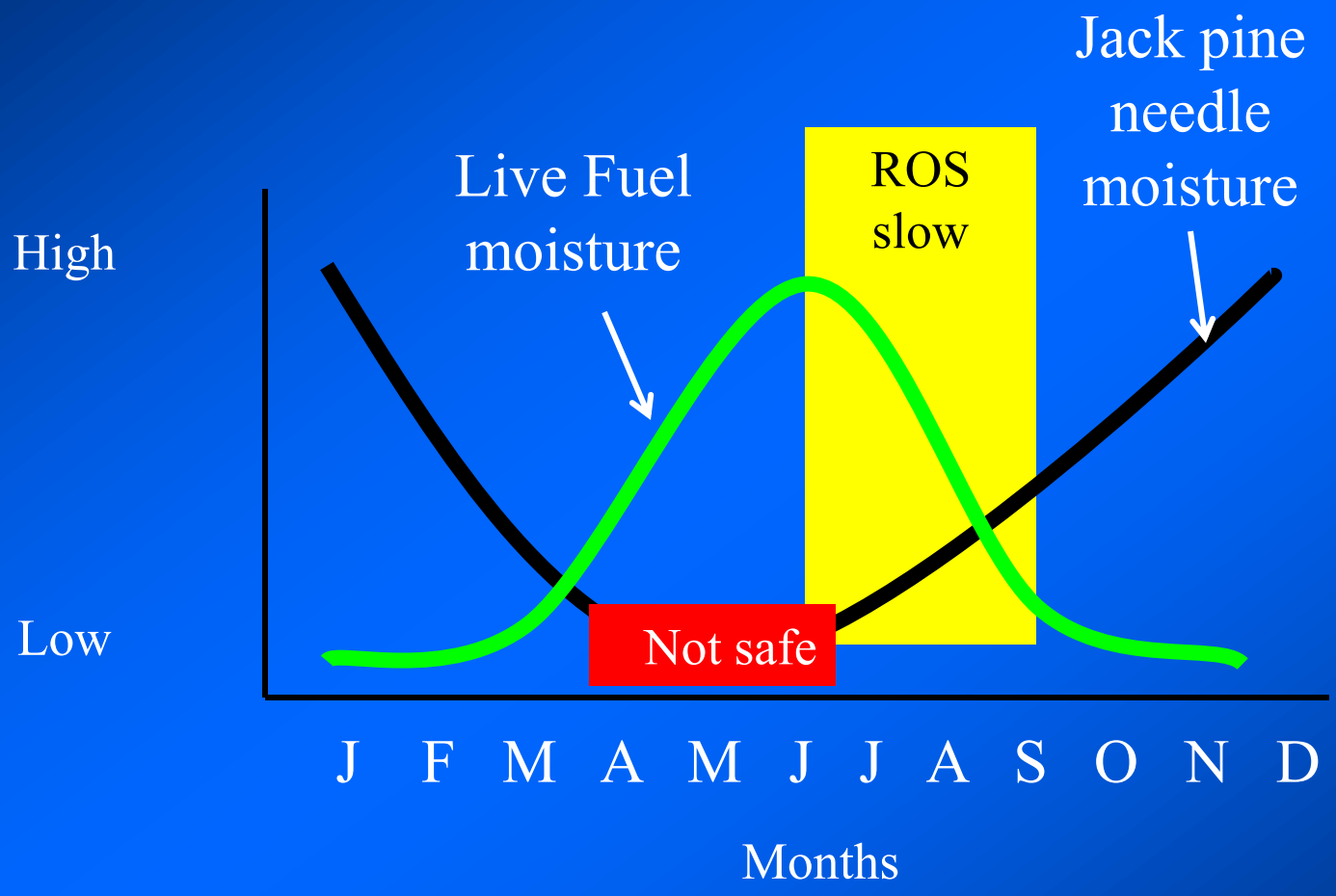
Fire Seasonality and Woody Shrubs

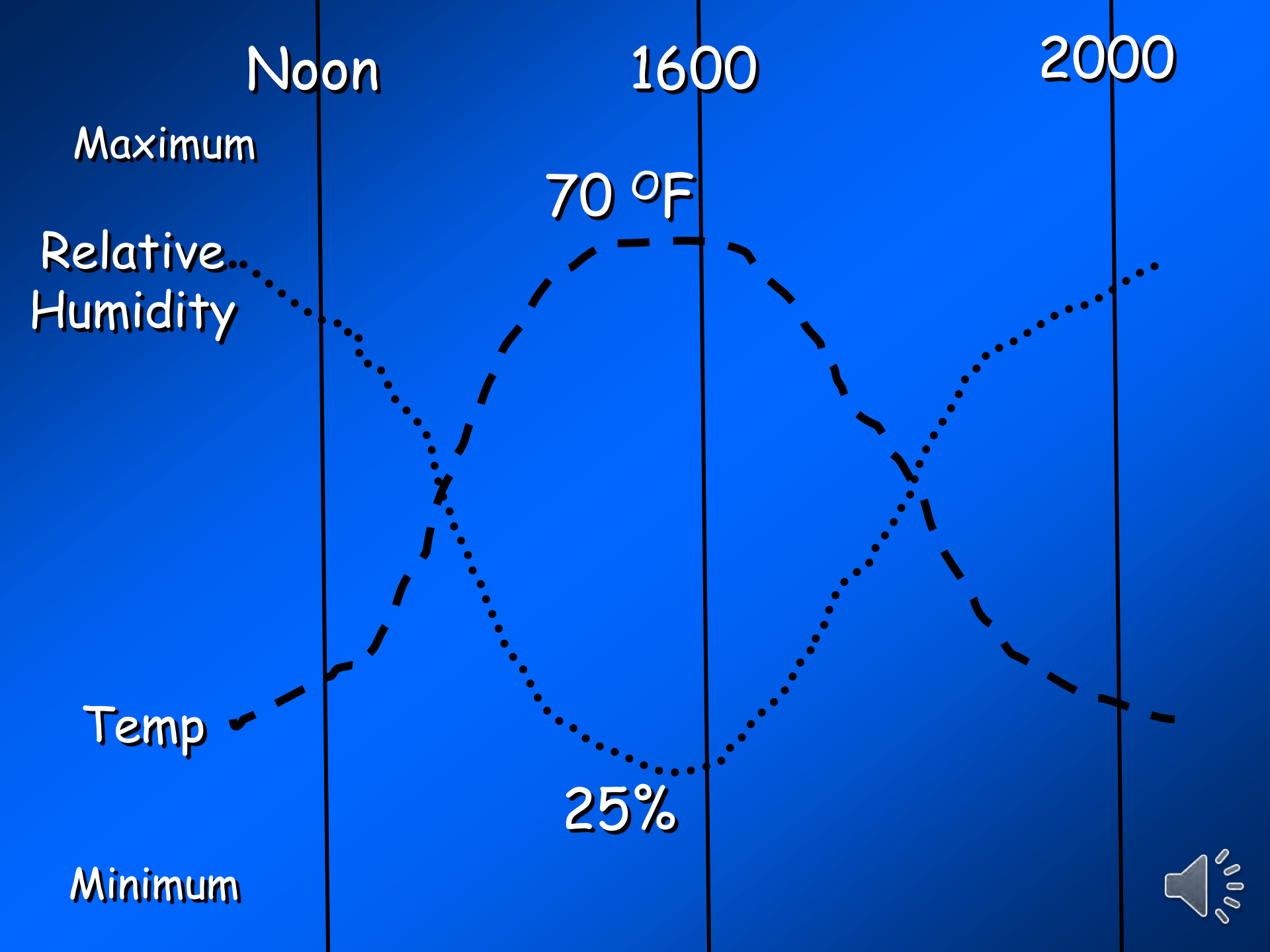
- Dormant season burns can increase density of woody stems
  - Especially clonal shrubs (blackberries, hazelnut, sassafrass, dogwoods, etc.)
- Growing season burns are more effective in reducing sprouting

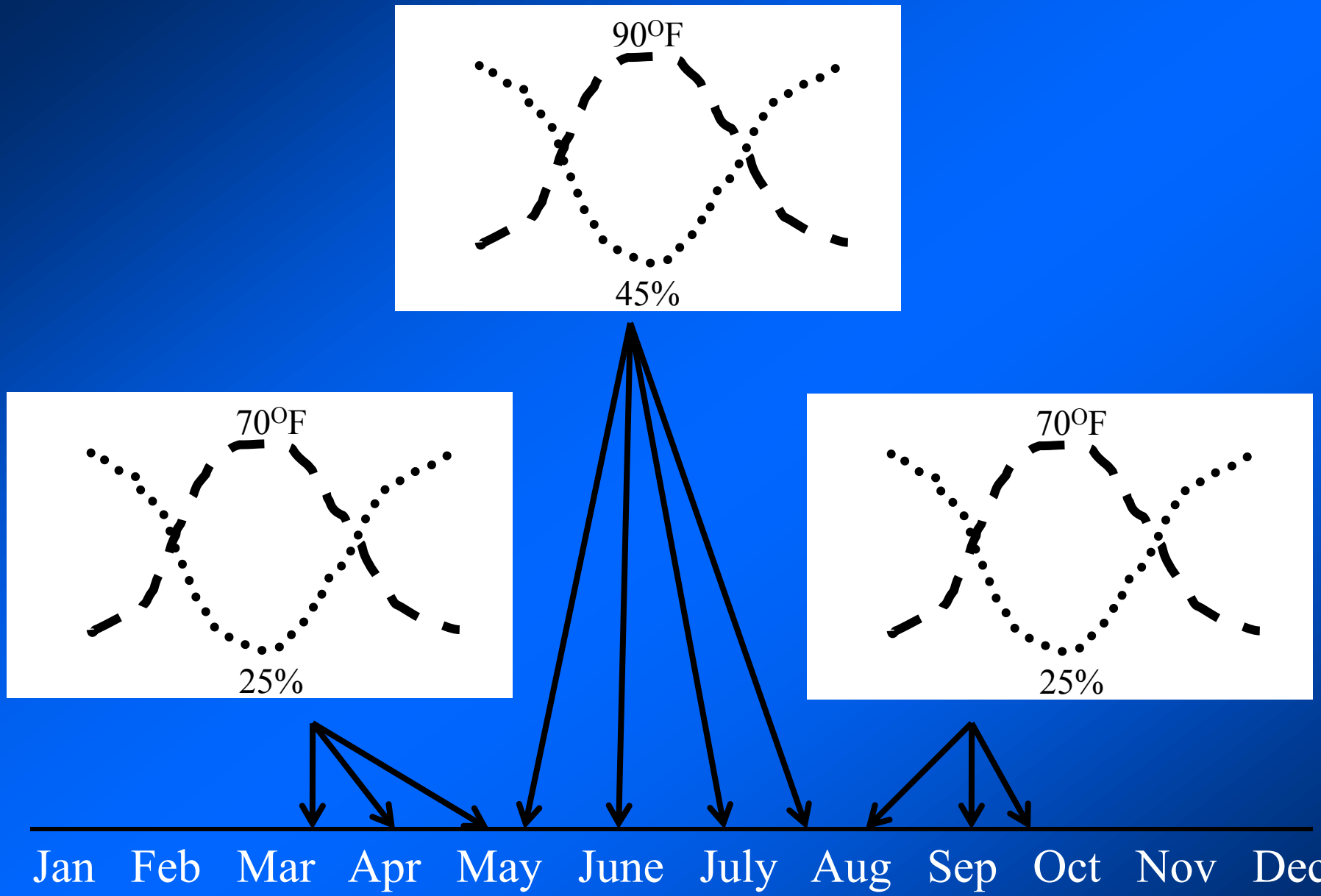
General Burn Windows by Natural Community



Treatment Objective:
Finding some "safer" times to burn in jack pine




Noon
1600
2000
Maximum
70 ºF
Relative Humidity
Temp
25%
Minimum


90°F
45%
70°F
25%
70°F
25%
Jan
Feb
Mar
Apr
May
June
July
Aug
Sep
Oct
Nov
Dec

May…









5 1999


6 2007


7 2010


8 2010


June 2003


September 2009


May 2006


August 2010

after 1st burn:
Burn May 07
photo Sept 07

after 2nd burn:
Burn June 09
photo Sept 09

June…

July…



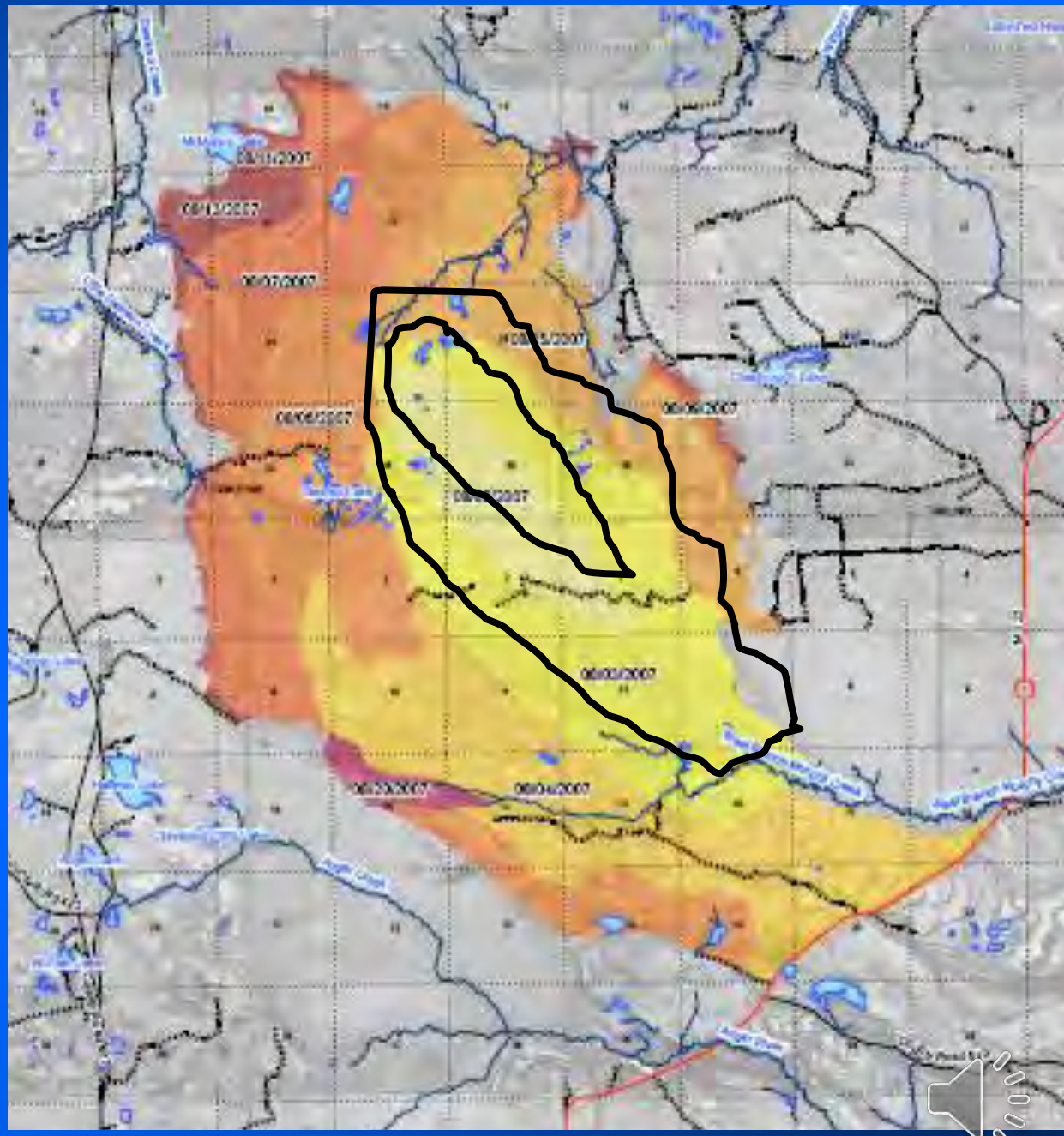


August

Sept..


Sleeper Lake
Wildfire
August-Sept 2007

Date	Acres Burned
8-2-2007	1187
8-3-2007	4969
8-4-2007	8778
8-5-2007	11259
8-6-2007	14872
8-7-2007	17174
8-9-2007	17432
8-11-2007	17613
8-13-2007	18020
8-20-2007	18185
9-13-2007 100% contained	18185



Wind, Rate-of-Spread, Residence time, Duration time

...with wind...helps increase ROS, maybe less internal ignition, may or may not help with smoke dispersal, can decrease residence time, decrease scorch

..."low" or no wind...generally requires more internal ignition, ROS is SLOW, residence time long, scorch height increased, smoke dispersal generally poor unless ignition pattern can generate lift

Range in RH (%) when summer burning by community

Not Safe | Good fire effects | Will not burn

Oak/Pine Savanna/Barrens

10 15 20 25 30 35 40 45 50 55 60 65 70 75

Dry Sand Prairie

10 15 20 25 30 35 40 45 50 55 60 65 70 75

Mesic prairie/prairie plantings

10 15 20 25 30 35 40 45 50 55 60 65 70 75

Jack Pine barrens

10 15 20 25 30 35 40 45 50 55 60 65 70 75

closed-canopy oak

10 15 20 25 30 35 40 45 50 55 60 65 70 75

Days since rain plays a large role

In general, first couple of burns….the higher the RH, and the more canopy cover…the more internal ignition will be needed, the ROS will be slower, and the burn will be more of a mosaic

Invasives as component of Fuel and RH (%) ranges for Summer Burning

Not Safe

Good fire effects

Will not burn

"Low" number or density of invasives

10 15 20 25 30 35 40 45 50 55 60 65 70 75

"Medium" number or density of invasives

10 15 20 25 30 35 40 45 50 55 60 65 70 75

"High" number or density of invasives

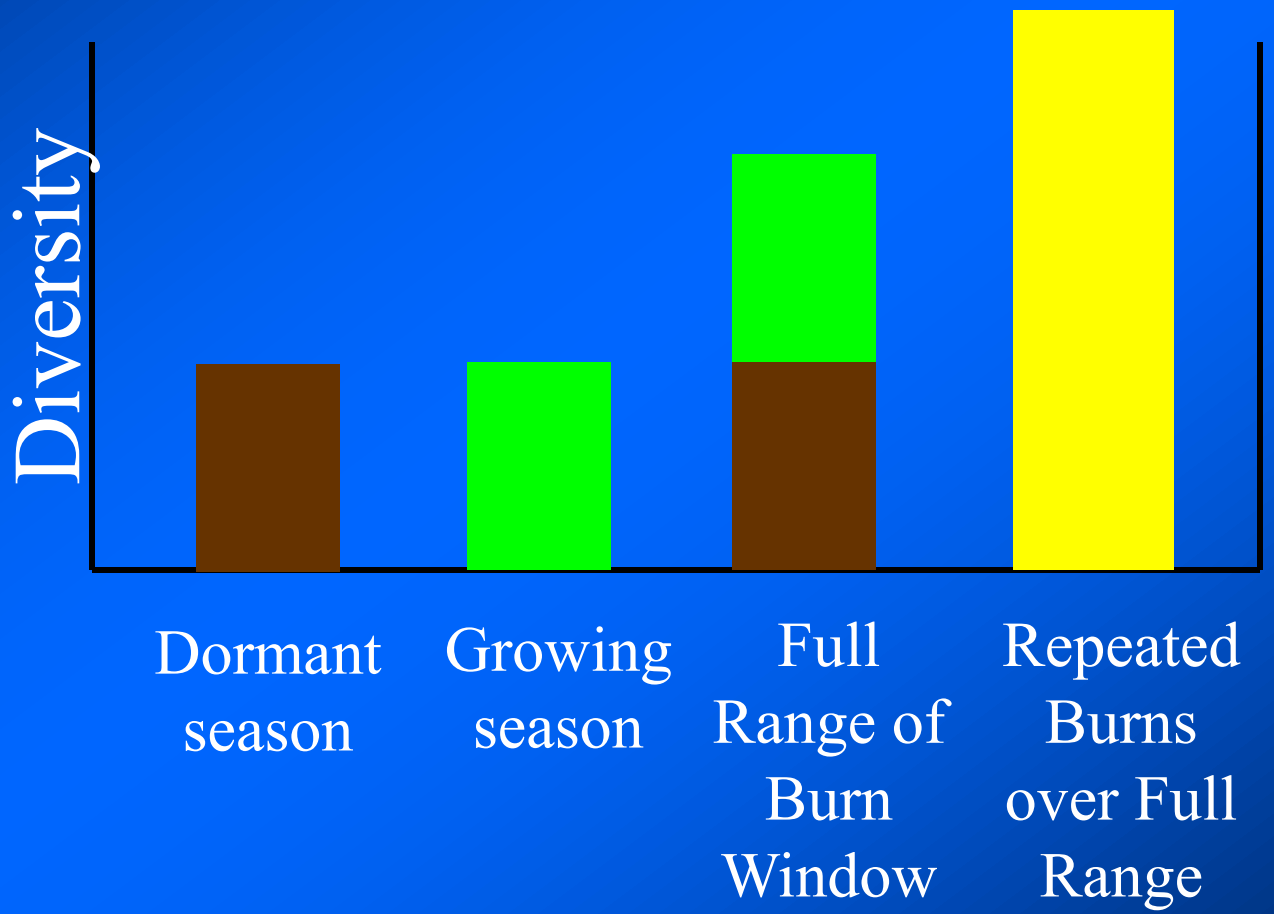
10 15 20 25 30 35 40 45 50 55 60 65 70 75

This is due to many MI invasives NOT providing "fuel" in summer

Take home thoughts....

In general, summer fires *extend* the growing season for many species

Early fires allow late flowering/seeding species to monopolize a growing season, while late fires give early flowering and seeding species a chance in next season


Diversity
Dormant season
Growing season
Full Range of Burn Window
Repeated Burns over Full Range

Repetitive dormant-season fire regimes, rarely experienced in nature, probably do not resemble the forces that shaped communities before European intervention.

Should fire management be directed towards a wider set of ecological conditions that would favor far higher species diversity?

"Value System within constraints"….

Questions?