Seasonality of Fire:
Matching Burn Timing with Fire Effects

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Fire is…

- An Ecological Process in a Fire-dependent System
- A Management Tool
- A High Risk Activity
- Physical conversion = release of energy

“Good Fire” versus “Bad Fire”

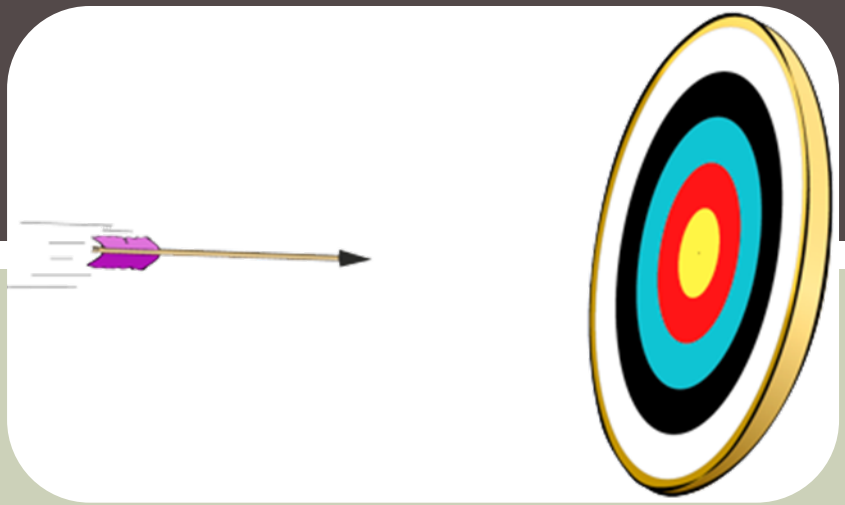
“Well, thank God we all made it out in time….
‘Course, now we’re equally screwed.”

WHAT IS YOUR MANAGEMENT/RESTORATION OBJECTIVES?

- To make unit 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?

- Mechanical
- Chemical
- Biological
- Fire
- Water

OVERALL GOAL …



- ecological resilience
- repeated burn objectives can accommodate the needs of most animal and plant species and sustain ecological resilience
- managers need to acknowledge and accept that optimizing conditions for a particular suite of species will lead to negative consequences for other species

“winners and losers”

FOR EACH BURN….

Keep fire in the “box” and keep crew and public safe


“Goal is not the flames, but what the flames do...


... Fire Effects

WHAT DOES SEASON OF FIRE MEAN?

SEASONALITY: "TRADITIONAL" BURN WINDOWS

Spring season

Fall season

Jan Feb Mar Apr May June July Aug Sep Oct Nov Dec

WINTER….

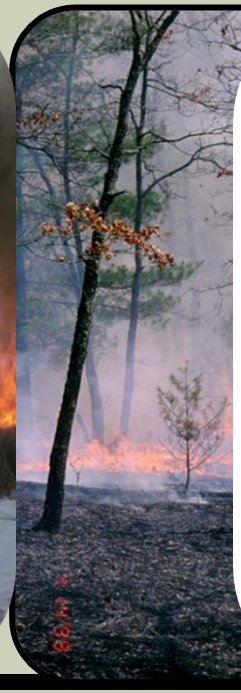
Nov Dec Jan Feb

THE FULL BURN WINDOW

Spring season

Growing season / Summer Burning

Fall season



Jan Feb Mar Apr May June July Aug Sep Oct Nov Dec

THE FULL BURN WINDOW

Spring Growing season / Fall

Jan Feb Mar Apr May June July Aug Sep Oct Nov Dec

GROWING SEASON (FIRE SCIENCE) TOP IMPEDIMENTS:

1. Lack of knowledge, or available information on seasonal fire effects

2. (unrealistic) expectations for growing season burns based only on past dormant season burn experience (fuels, weather, and prescriptions)

Energy released; flame front, ROS, residence time

Organic matter consumed (above and below ground), char & scorch height

Fire Intensity

+ / -

Fire Severity

Heat output at the "correct" time

Ecosystem Response

Direct and Indirect Effects on flora and fauna

You can have any combo of intensity and severity from any ignition pattern

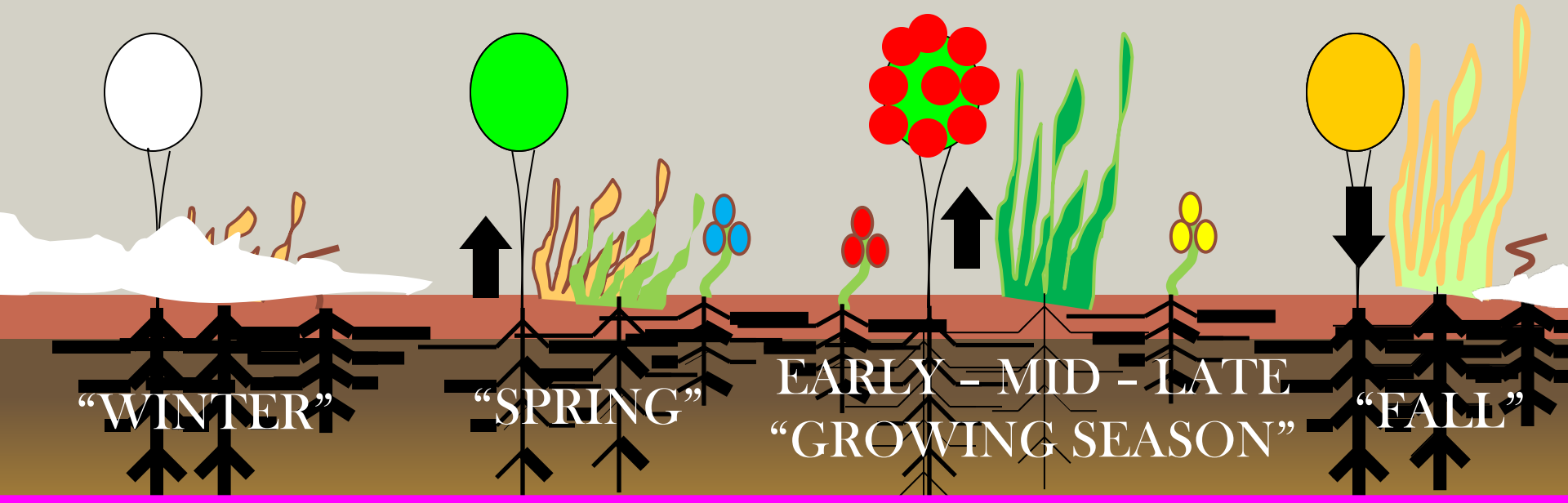
PHENOLOGY-PHYSIOLOGY-FUEL MOISTURE

Woody

- Coniferous
- Deciduous

Herbaceous

- Annuals
- Perennials

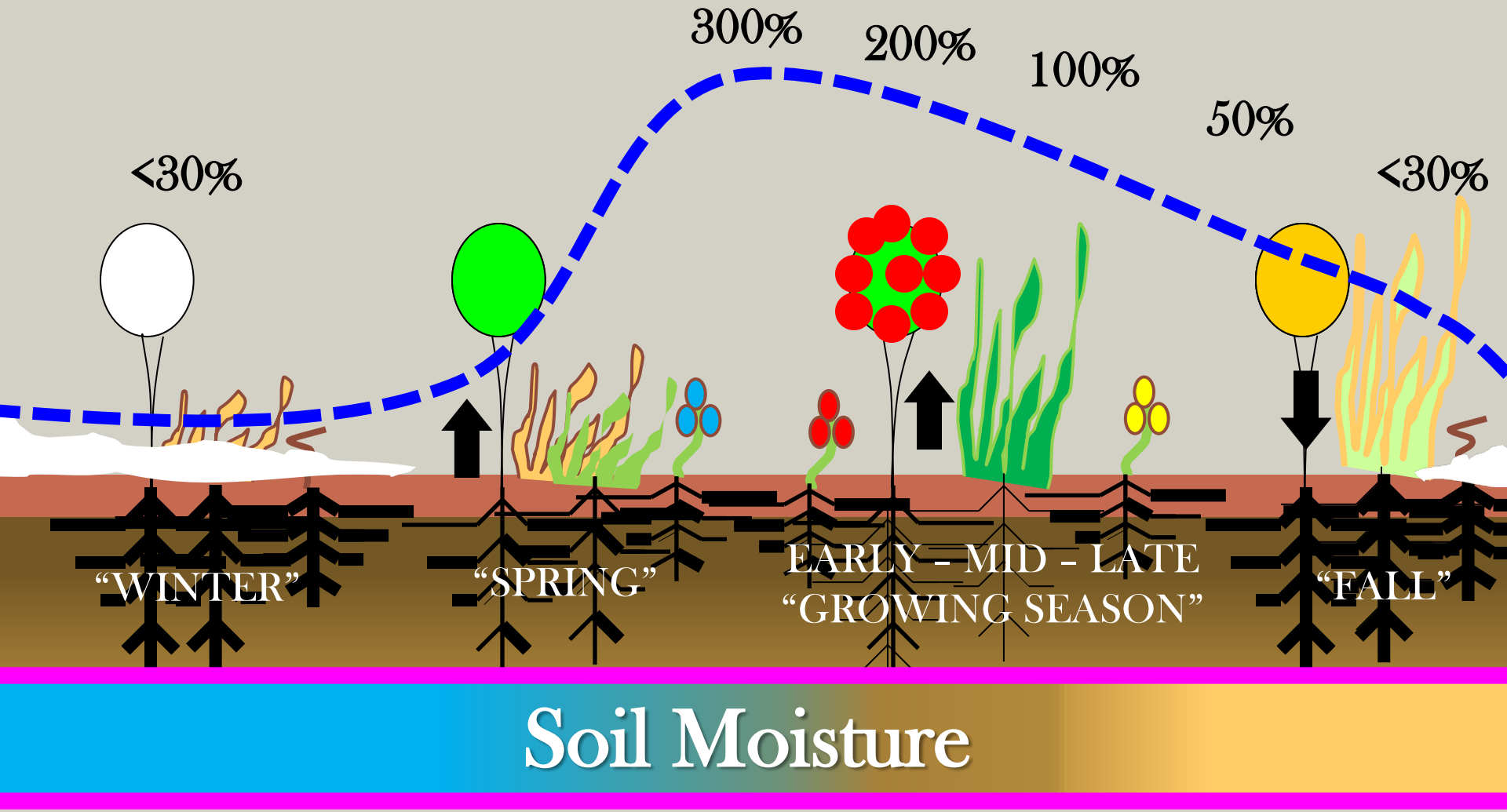


Soil Moisture

Dormancy **Leaf Out** **Flowering/Fruiting** **Senescence**

Nov Dec Jan Feb Mar Apr May June July Aug Sep Oct

LIVE FUEL MOISTURE



Dormancy | **Leaf Out** | **Flowering/Fruiting** | **Senescence**

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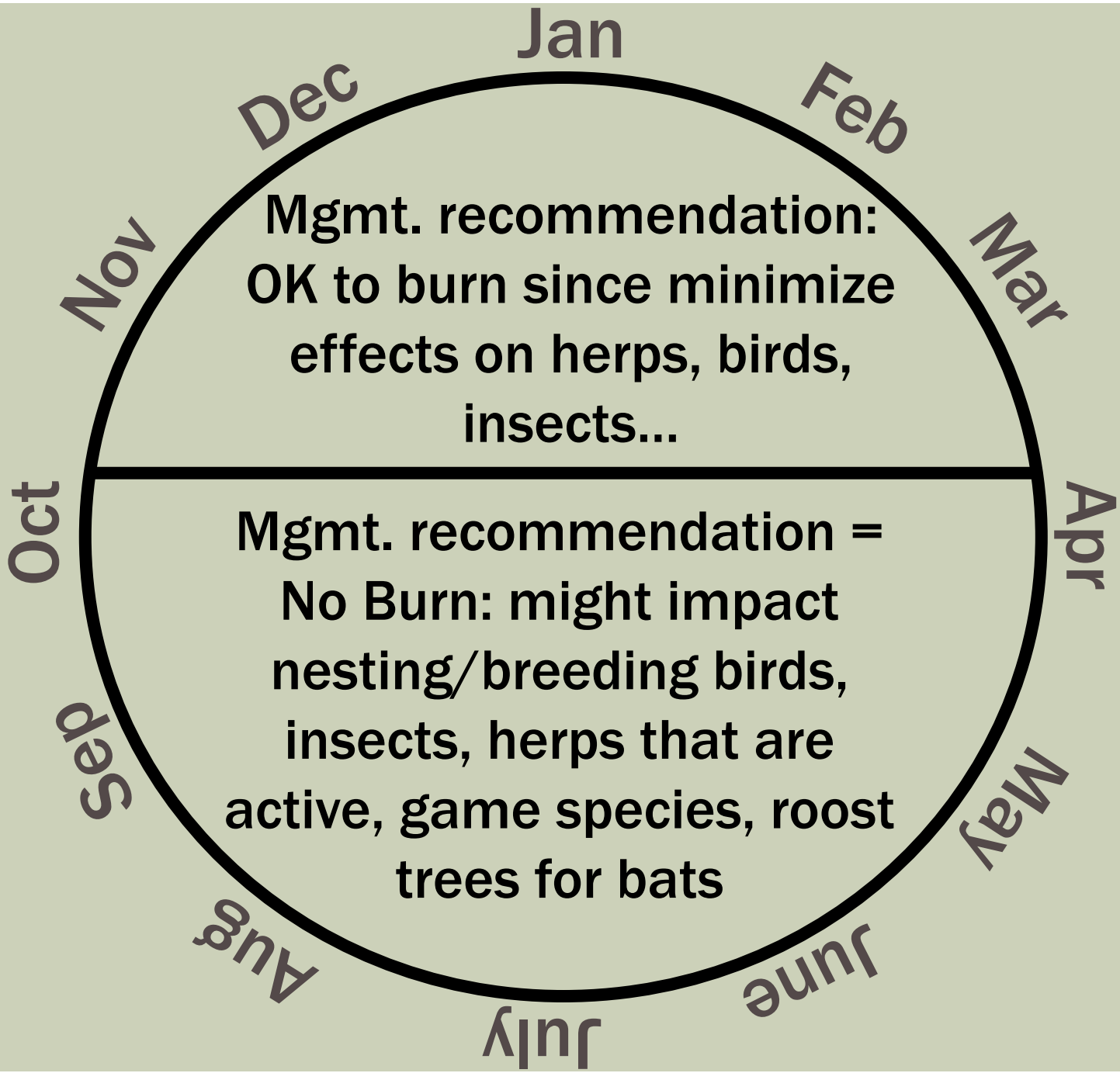
"single species view" or the "animal view"



"single species view" or the "animal view"

Jan

Apr

May

June

July

Aug

Sep

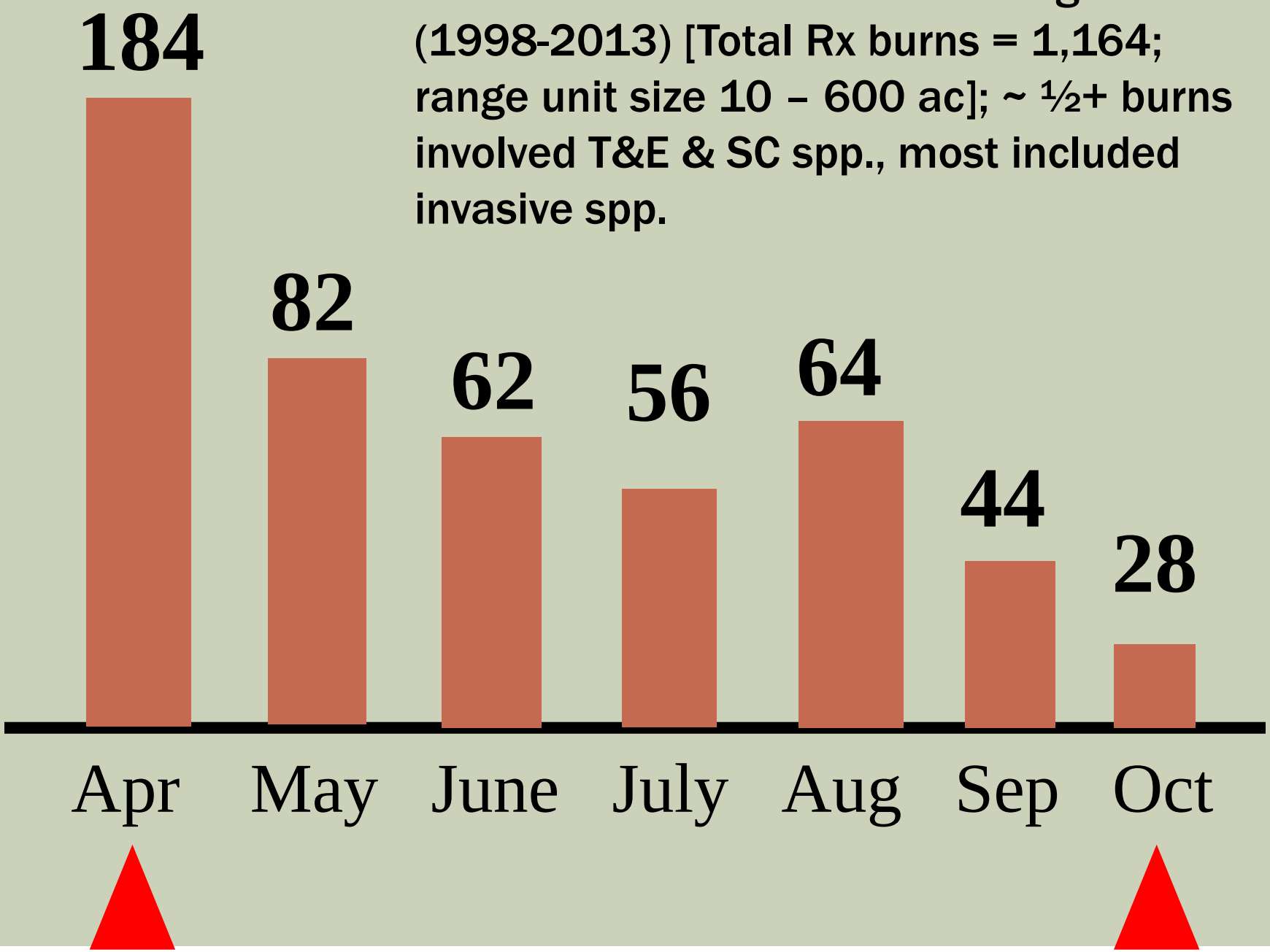
Oct

effects on herps, birds, insects…

Mgmt. recommendation – No Burn: might impact nesting/breeding birds, insects, herps that are active, game species, roost trees for bats


INSTRUC
1
PULL RING PIN.
3
AIM AT BASE OF FIRE. USE EXTINGUISHER UPRIGHT.
TRASH
WOOD
PAPER
B

520 MI RX Burns with monitoring results (1998-2013) [Total Rx burns = 1,164; range unit size 10 – 600 ac]; ~ ½+ burns involved T&E & SC spp., most included invasive spp.



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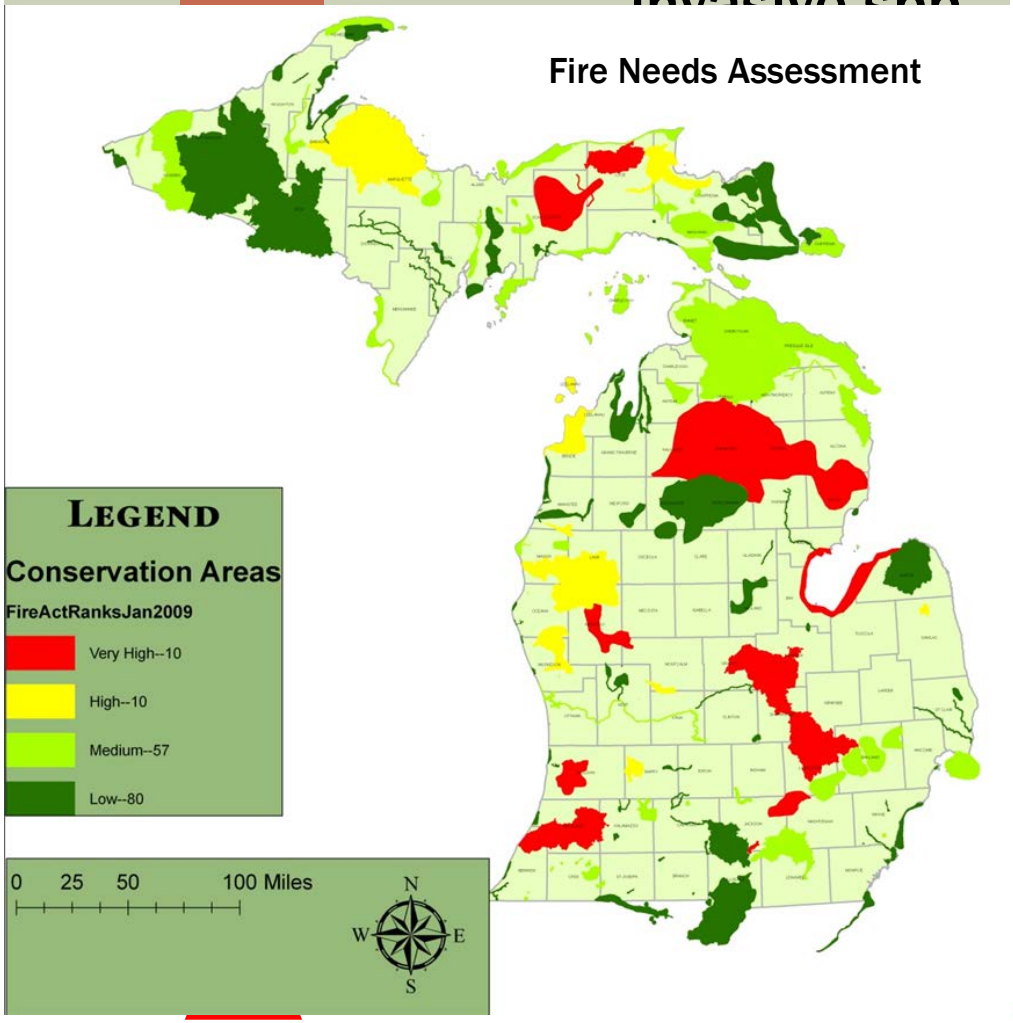
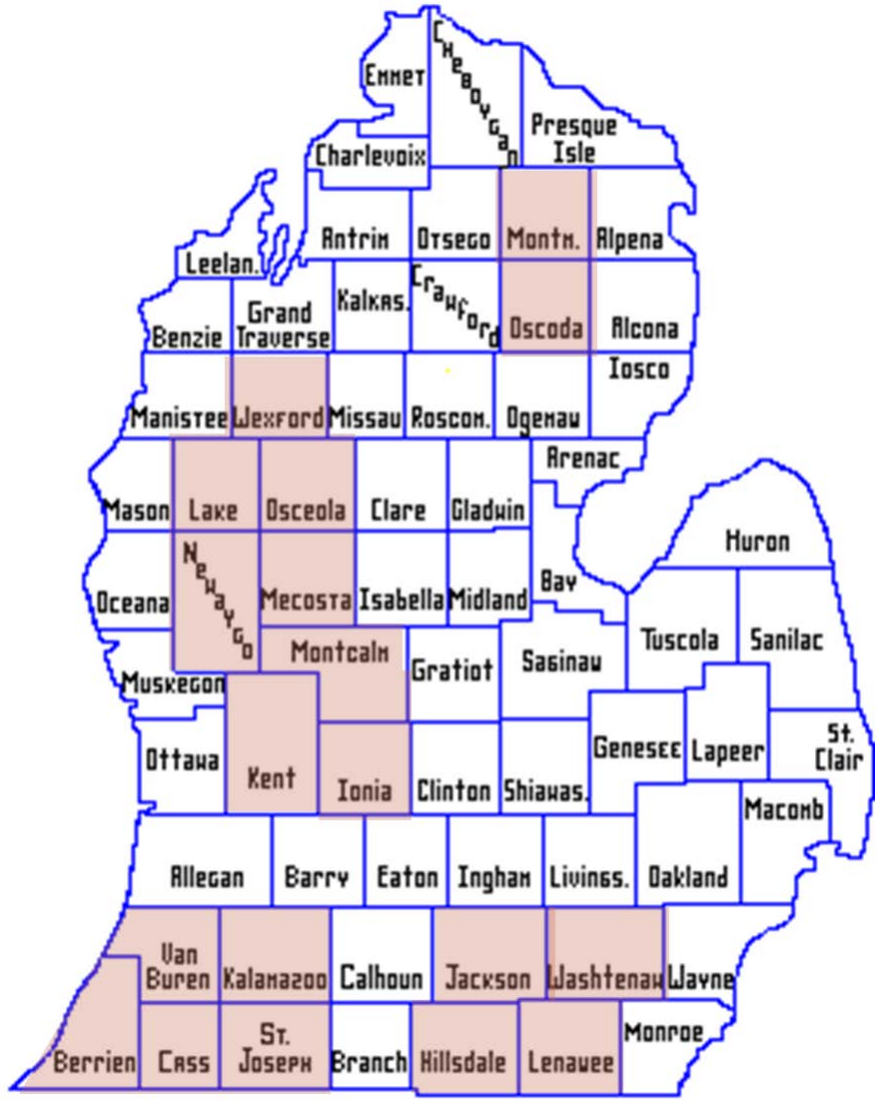




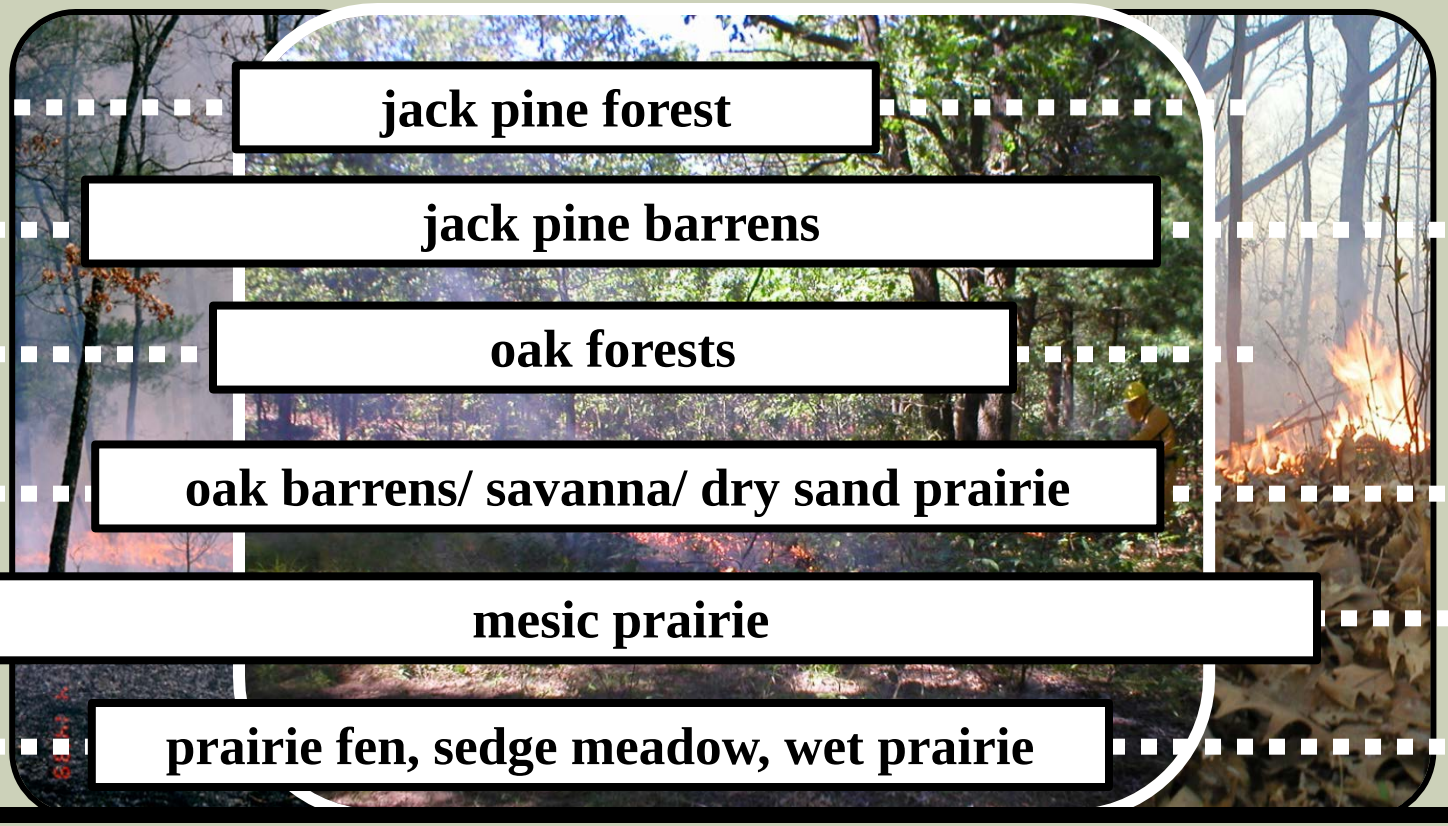
MONITORING

- Photo monitoring
- Vegetation transects
- Rare butterfly surveys
- Modified Brown's transects
- Coarse–level Metrics

COARSE-LEVEL METRICS

- canopy closure and complexity of canopy structure and percent of canopy composed of oak or pine species
- sub-canopy oak/pine and **oak/pine recruitment**
- shrub cover
- ground cover of native herbaceous species (grass, sedge, forbs) compared to non-native invasive and competitive plant species.

SEASONALITY: BURN WINDOWS BY NATURAL COMMUNITY



Jan Feb Mar Apr May June July Aug Sep Oct Nov Dec

GROWING SEASON: EARLY-MID-LATE

Apr

May

June

July

Aug

Sep

Changes in DOMINANCE of different groups of grasses and forbs in response to season of fire

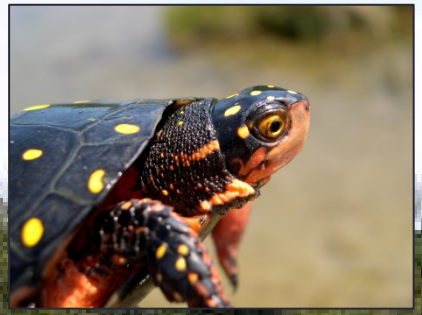
	April-May	June-Aug	Sept	Oct-Nov
Grasses and sedges				
Warm season				
Cool season				 ?
Forbs				
Early-flowering forbs				 ?
Mid-flowering forbs				 ?
Late-flowering forbs				 ?
Legumes (Fabaceae)				

Note: it is better to use yearly Phenology, but illustrated above in general terms with calendar dates

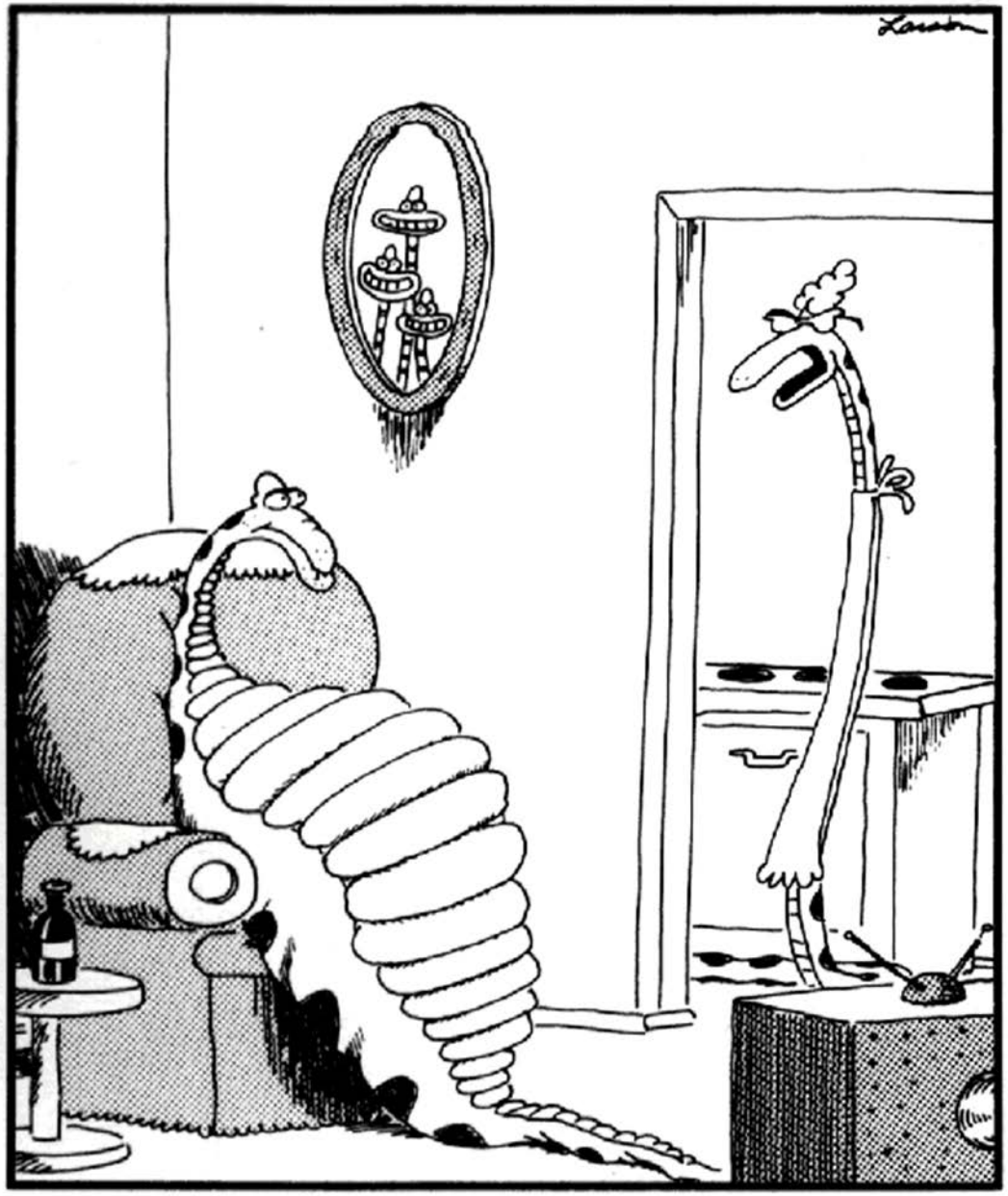
Fire Effects - Invasive's & Competitive Species - Seasonality

	March-April	May	June-Aug	Sept	Oct-Nov
knapweed					
sweet clovers					
garlic mustard					
St. Johnswort					
bouncing bet					
buckthorn					
autumn olive					
honeysuckles					
pennsylvania sedge					

Note: it is better to use yearly Phenology, but illustrated above in general terms with calendar dates

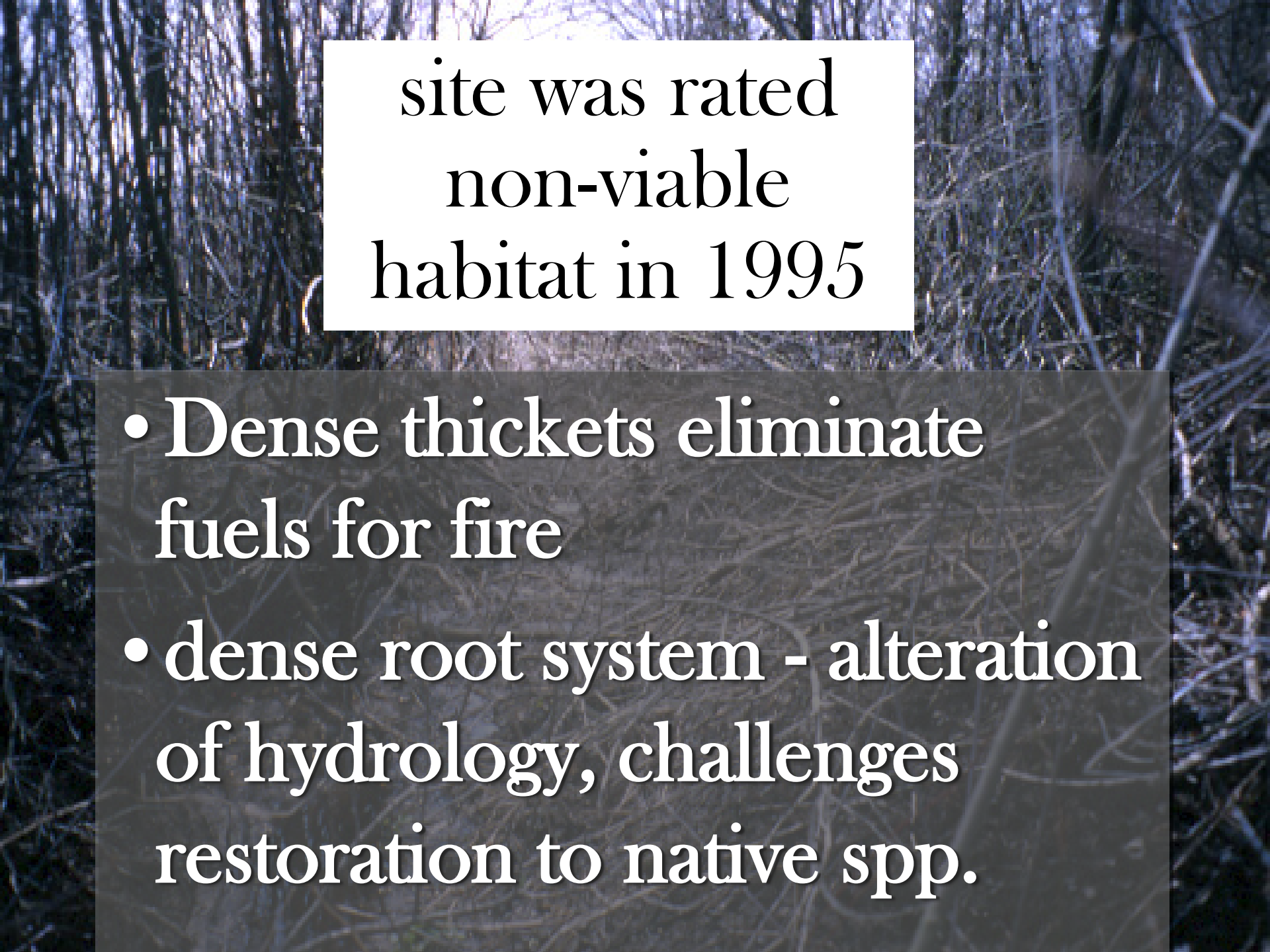



Mitchell's
Satyr



"Joe! You went and ate the pig I was going to serve this evening to the MacIntyres? ...Well you just disgorge it -- it should still be OK."

- Direct versus indirect mortality?
- What are all the other mortality factors?
- How fast and how far can a massasauga move to get to refugia?
- What are the cues to escape – visual, audio, smoke, thermal?



site was rated non-viable habitat in 1995

- Dense thickets eliminate fuels for fire
- dense root system - alteration of hydrology, challenges restoration to native spp.

- Prey base increases shortly after each burn any season
- two massasaugas (2 males) found dead after early growing season burn
- 23 Snakes (13 unmarked/ unknown) moved back into area two weeks post burn
- 69 snakes marked in first year 2005 (site was rated non-viable habitat in 1995...)
- Average speed: 0.234 m/s (46 ft/min), but rarely went farther than 6 ft before stopping
- Guidelines now are max ROS no faster than 16 chains per hour (17.6 feet per minute) with a targeted rate of 10 chains per hour or less (11 feet per minute)...


“Spot-burning”

Eliminating Buckthorn with just Fire – Seasonality and available fuel….

2004

2006

2008


Mitchell’s
Satyr

DORMANT SEASON

Cover/ Fuel Type	Description	Fuel Loading	Fuel Consumption			
			Wet Fuels	Moderate Fuels	Dry Fuels	Very Dry Fuels
			FFMC <75 DMC <15	FFMC 75-88 DMC 15-25	FFMC 89-91 DMC 25-50	FFMC 92+ DMC 50+
Fen/Wet Prairie	Sedges/graminoids on organic soils that may be seasonally dry	10-20 t/ac	<10%	60%	80%	100%

GROWING SEASON

Cover/ Fuel Type	Description	Fuel Loading	Fuel Consumption			
			Wet Fuels	Moderate Fuels	Dry Fuels	Very Dry Fuels
			FFMC <80 BUI <30 DC <200	FFMC 80-88 BUI 30-50 DC 200-300	FFMC 89-91 BUI-50-100 DC 300-400	FFMC 92+ BUI 100+ DC 400+
Fen/Wet Prairie	Sedges/graminoids on organic soils that may be seasonally dry	10-20 t/ac	<10%	35%	65%	95%

Natural community	Rare plant and animal species	Invasive species & Competitive species
dry sand prairie, oak and pine barrens, oak savanna, oak woodland, oak forest	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 Buckthorn Garlic Mustard Scotch Pine Black Locust Pennsylvania Sedge Red Maple



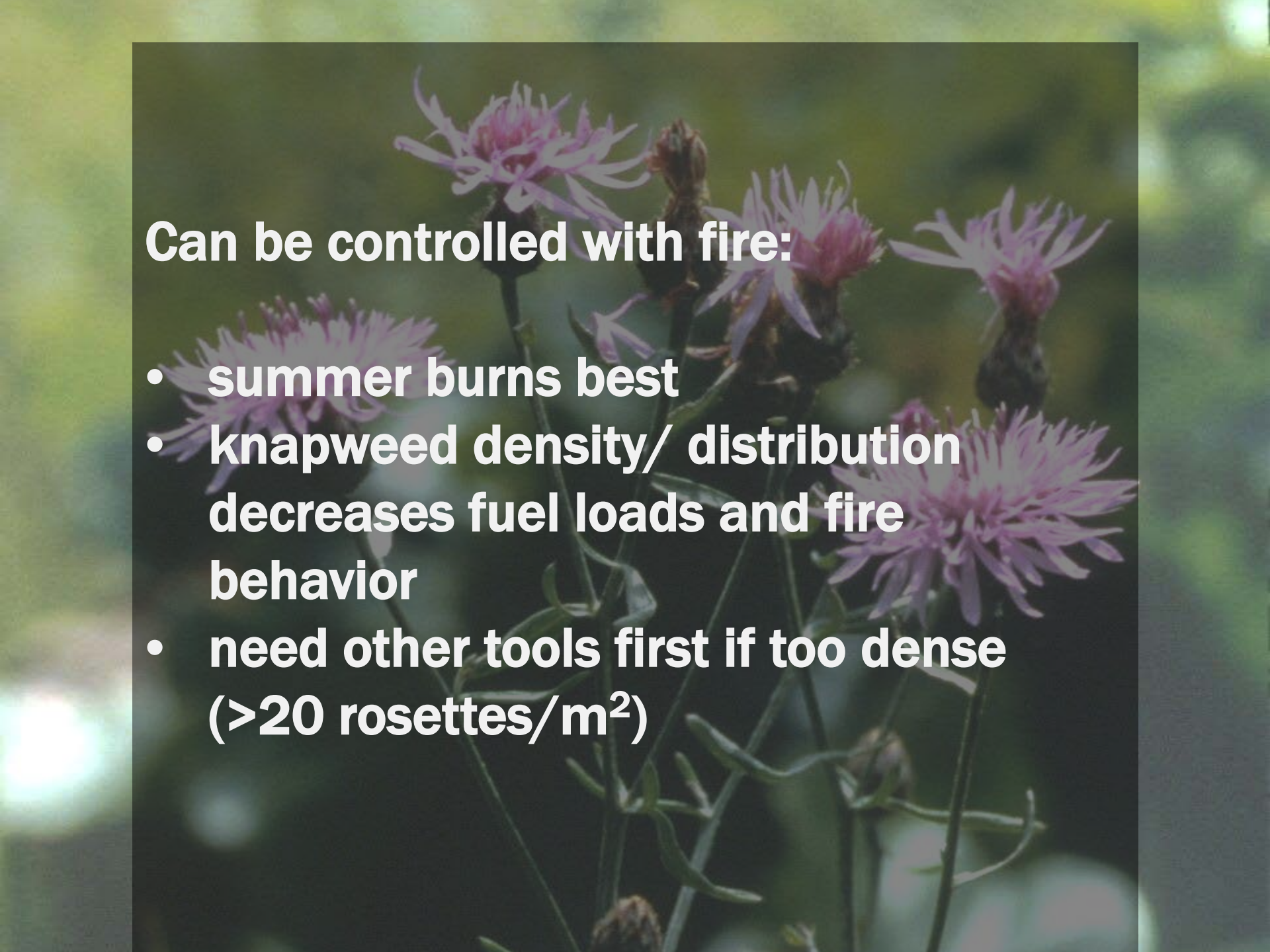






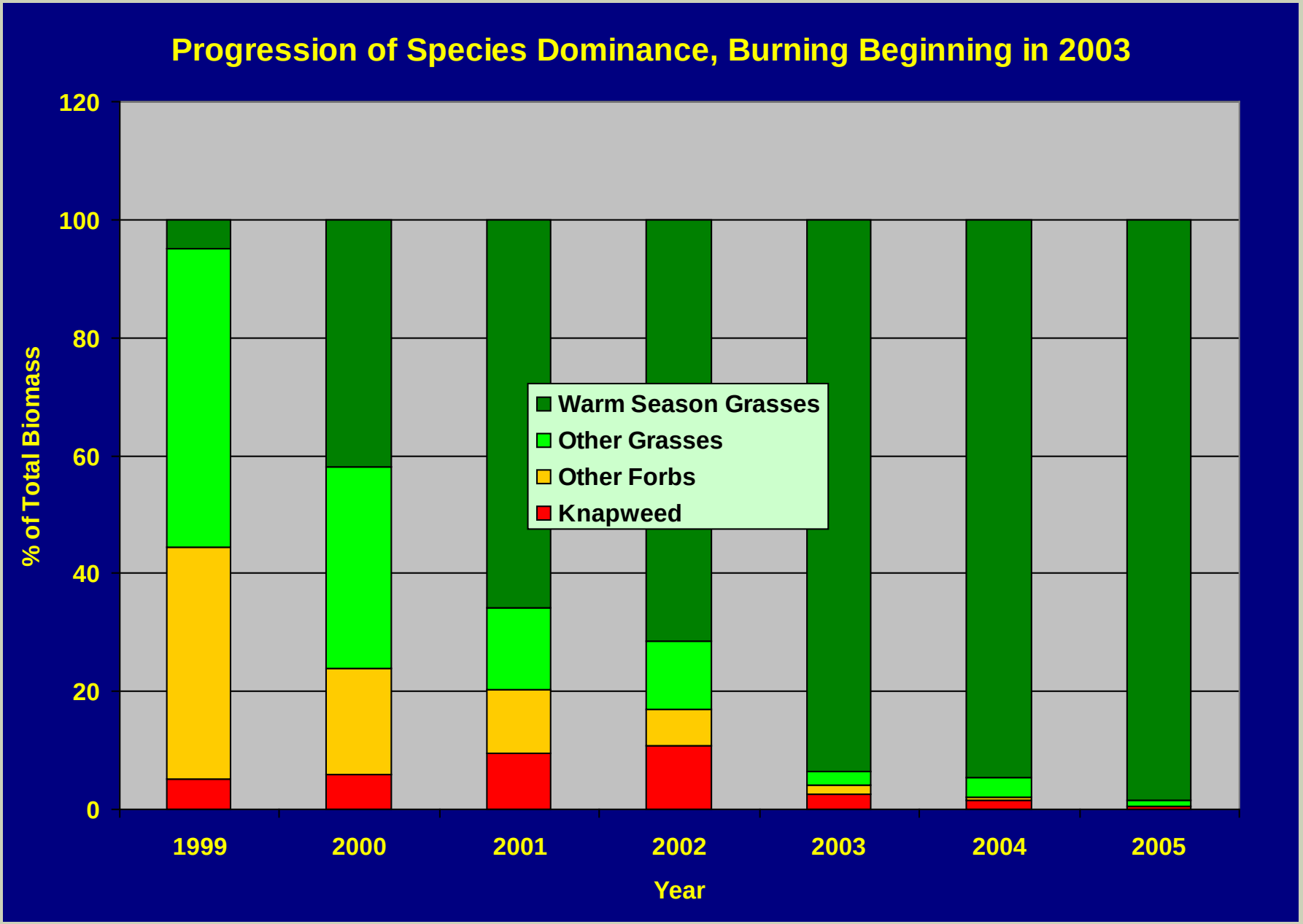






Can be controlled with fire:

- summer burns best
- knapweed density/ distribution decreases fuel loads and fire behavior
- need other tools first if too dense (>20 rosettes/m^2)



MACDONALD ET AL., 2007. RESTORATION ECOLOGY 15(1):118-128


Swath Burning....
Consider alternative uses of "fire" as a tool, and still an "ecological process"...

Pennsylvania sedge

- **Dense matt**
- **alters fuel load**
- **inhibits other species**
- **Fire in growing season will reduce**
- **Fire in dormant season increases**

10-09-S290-VG

Rx June 2, 2009
backing

Rx June 2, 2009
heading

(photos July 15, 2009)


5 1999


6 2007

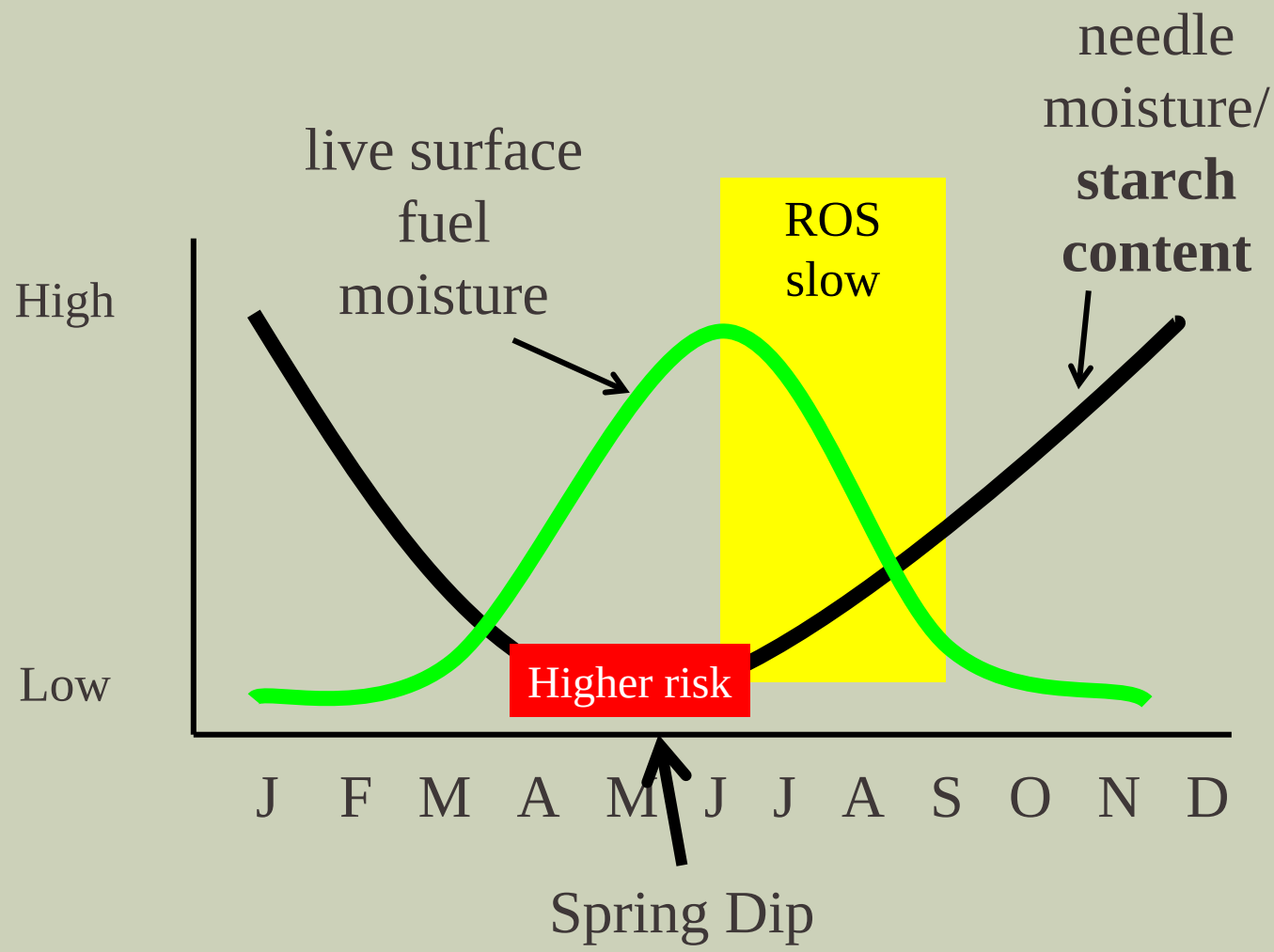

7 2010


8 2010

after 1st burn:
Burn May 31, 2007
(photo Sept 2007)

after 2nd burn
June 20, 2009
(photo Sept 2009)

TREATMENT OBJECTIVE: FINDING SOME "SAFER" TIMES TO BURN IN JACK AND RED PINE



"NARROW BURN WINDOW" NO LONGER AN IMPEDIMENT… ALSO REDUCED CAPACITY, WEATHER, AND EQUIPMENT IMPEDIMENTS"

Ave No. Days Weather met Prescription Parameters 1998-2013 all MI sites

April 1 - May 10	May 11 - June 15	June 16 - Aug 31	Sept 1 - 30
26 (40 total days)	**25** (36 total days)	**40** (77 total days)	**16** (30 total days)

2011 priority planning example – 79 Burn Units – est. max. 114 operational days

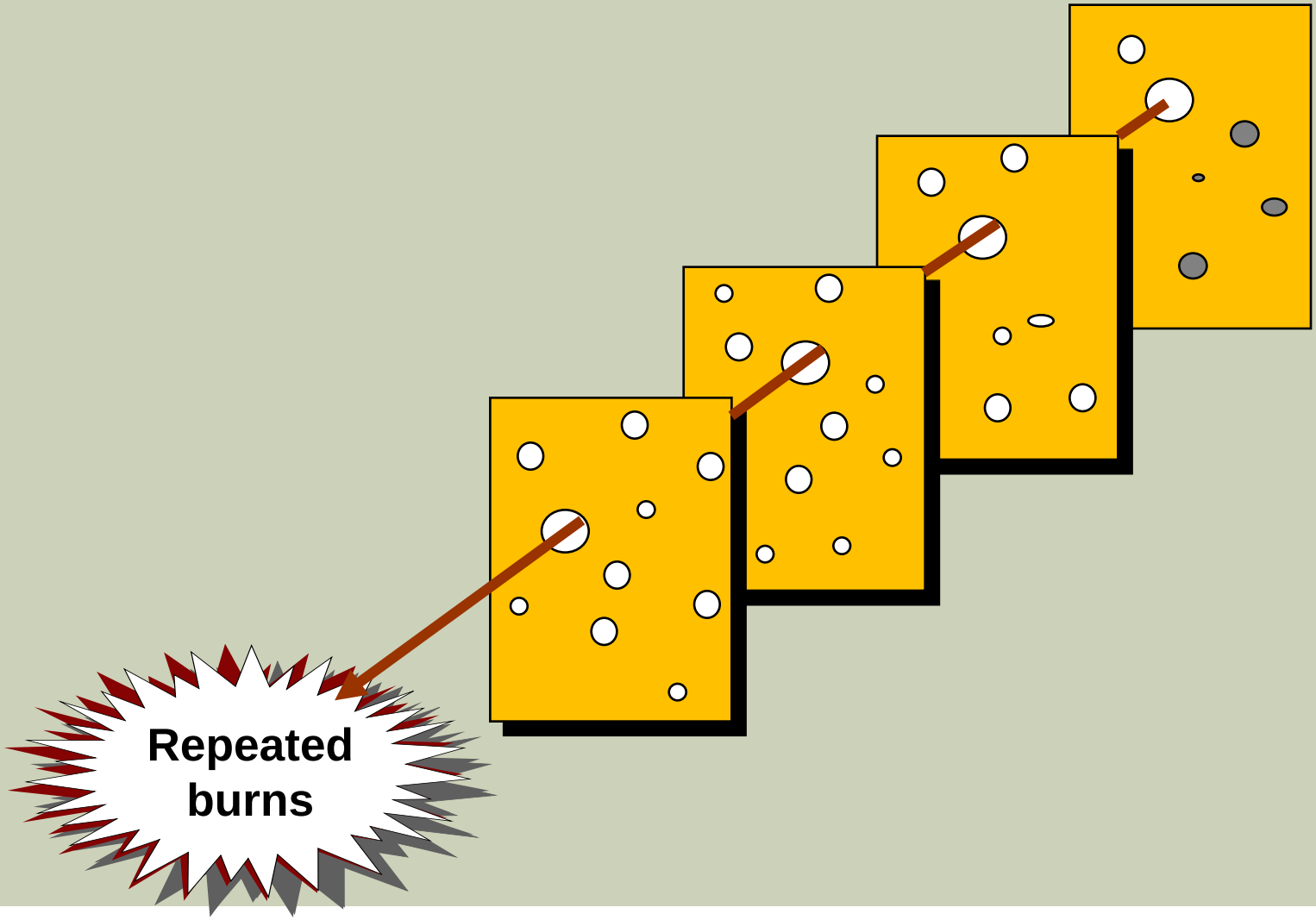
April 1-May 10			May 11 -June 15			June 16 - Aug 30			Sept. 1- 30		
Sites	Units	Days	Sites	Units	Days	Sites	Units	Days	Sites	Units	Days
11	30	12 to 29	10	18	20 to 35	7	25	30 to 40	3	6	10

moving into potential extra days of patrol

Cost per implementation/ operation = meeting fire effects/ objectives

- Example: 6 consecutive operational days in growing season versus 6 separate spring days over 6+ years
- BUT…plan for that expense in one budget year…

BARRIERS/ IMPEDIMENTS



REPEATED BURNS ACROSS THE "BURN WINDOW"

Native plant diversity

T&E species – plant and animal

Non-native plant, and competitive species

Resilience

Questions?

Lake States Fire Science Consortium

A JFSP KNOWLEDGE EXCHANGE CONSORTIUM