Seasonality of Fire:
Matching Burn Timing with Fire Effects

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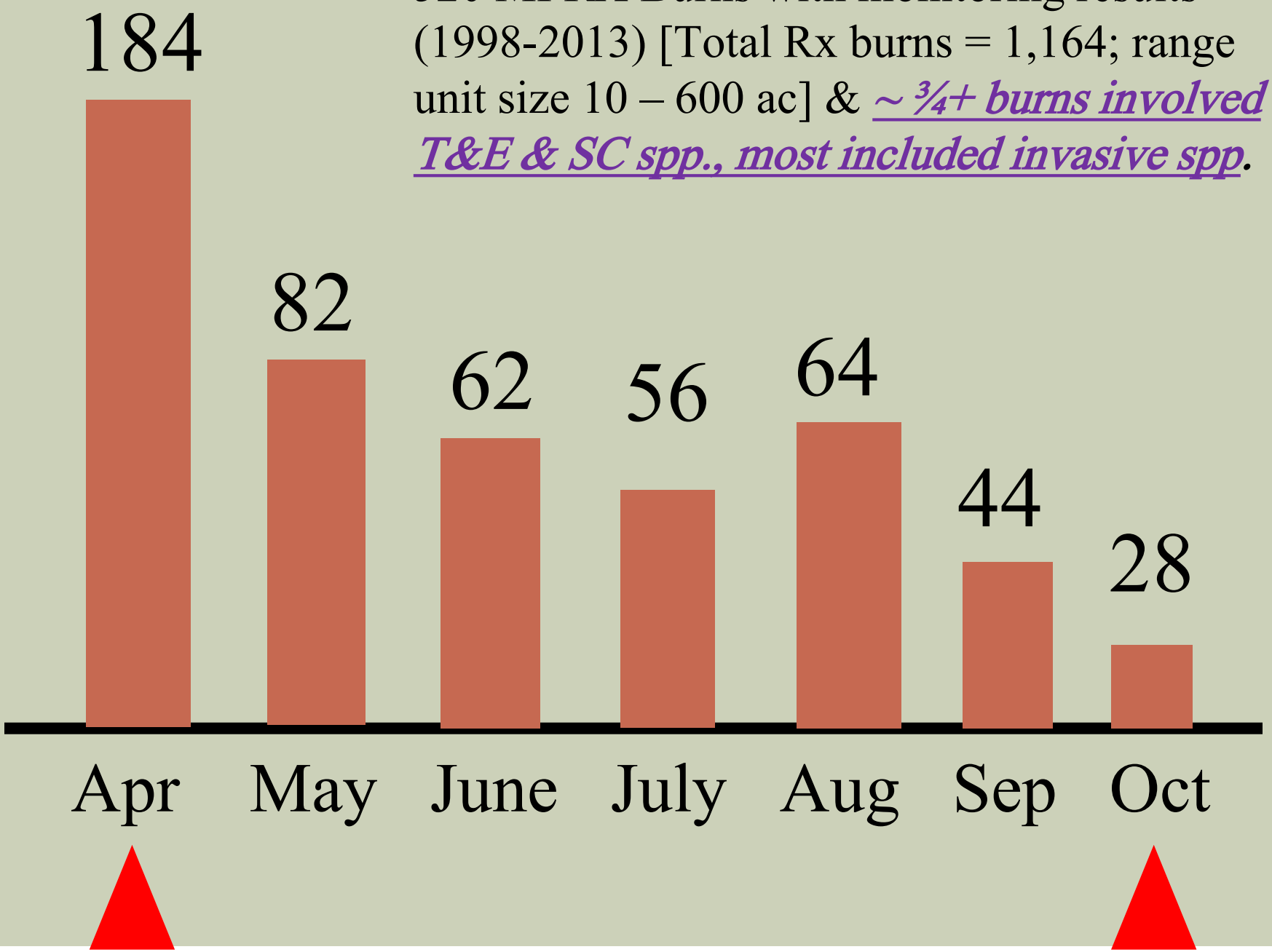
“Good Fire” versus “Bad Fire”

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

520 MI RX Burns with monitoring results (1998-2013) [Total Rx burns = 1,164; range unit size 10 – 600 ac] & ***~ ¾+ burns involved T&E & SC spp., most included invasive spp***.



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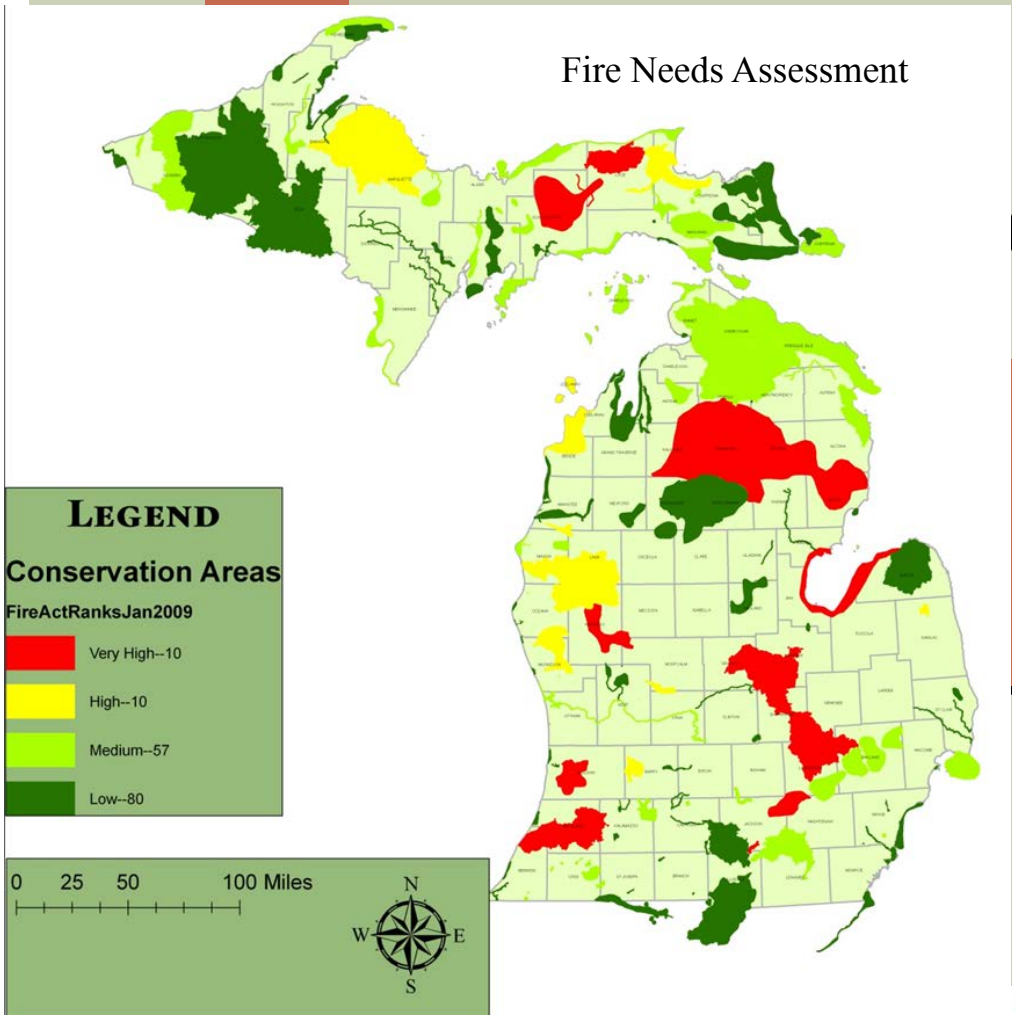
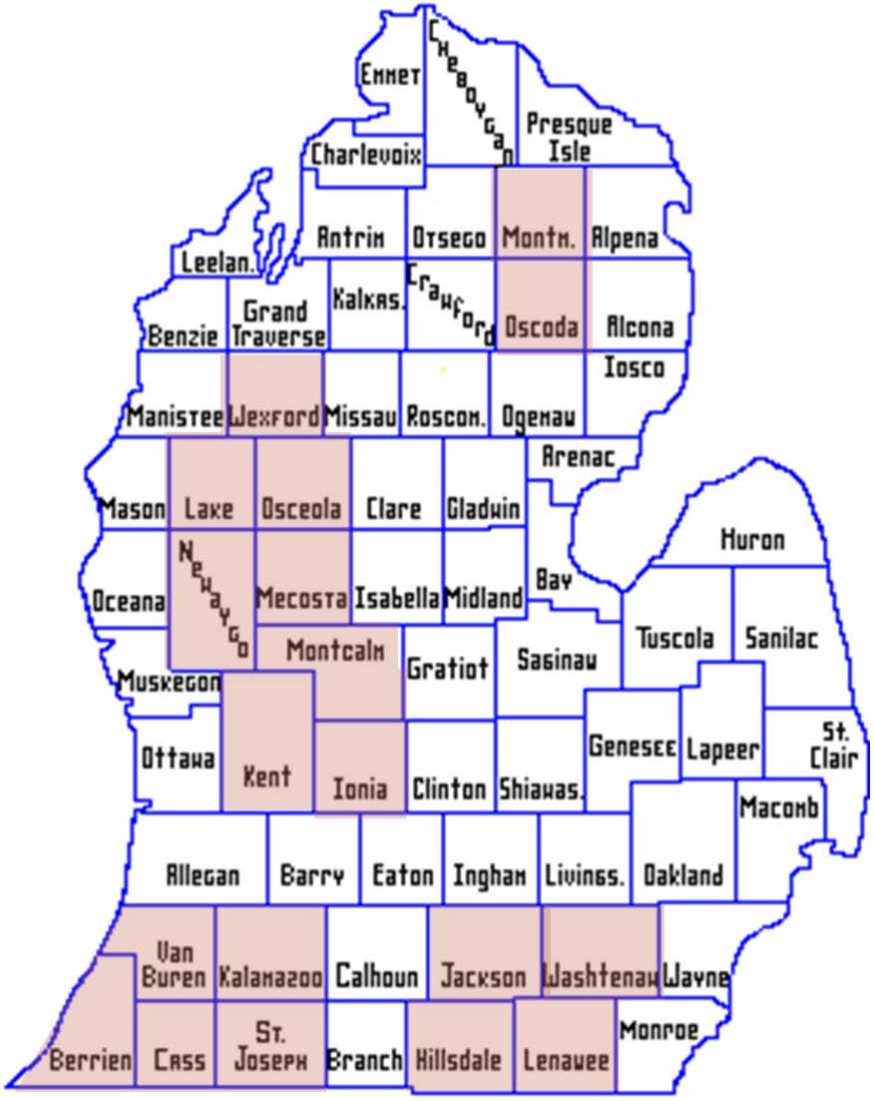




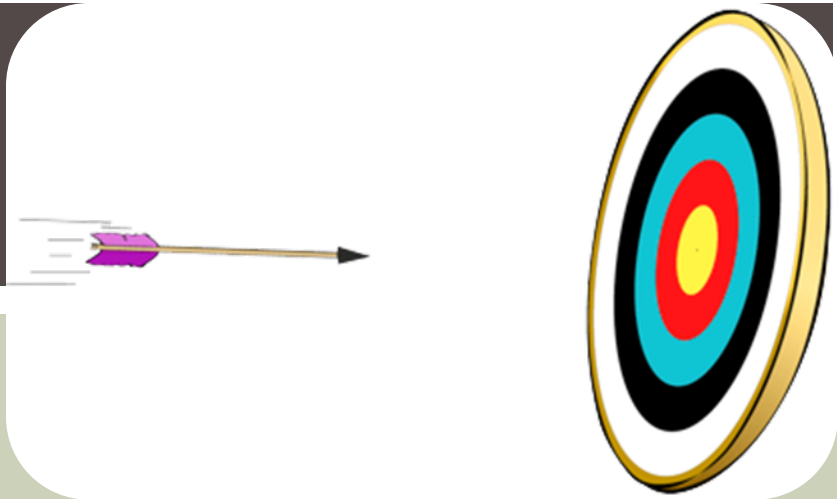
MONITORING

- Floristic Quality Assessment/ Vegetation transects/ Nectar sources/ Germination (Oaks and rare plant spp.)
- Rare Animal spp. surveys
- Modified Brown's fuel loading
- Coarse-level metrics development
- Photo-monitoring
- Invasive spp. removal efficacy

MANAGEMENT/RESTORATION OBJECTIVES

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

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”


"Goal is not the flames, but what the flames do...
... achieving desired fire effects"

FOR EACH BURN….

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

WHAT DOES SEASON OF FIRE MEAN?

SEASONALITY: "TRADITIONAL" BURN WINDOWS

Spring season

Fall season

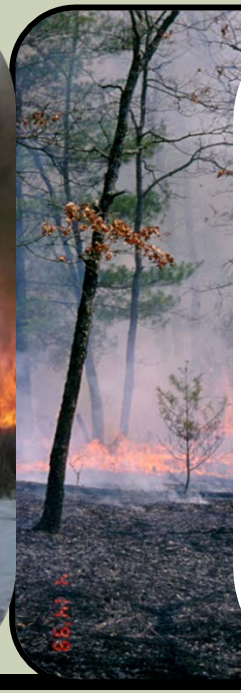
Jan Feb Mar Apr May June July Aug Sep Oct Nov Dec

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

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

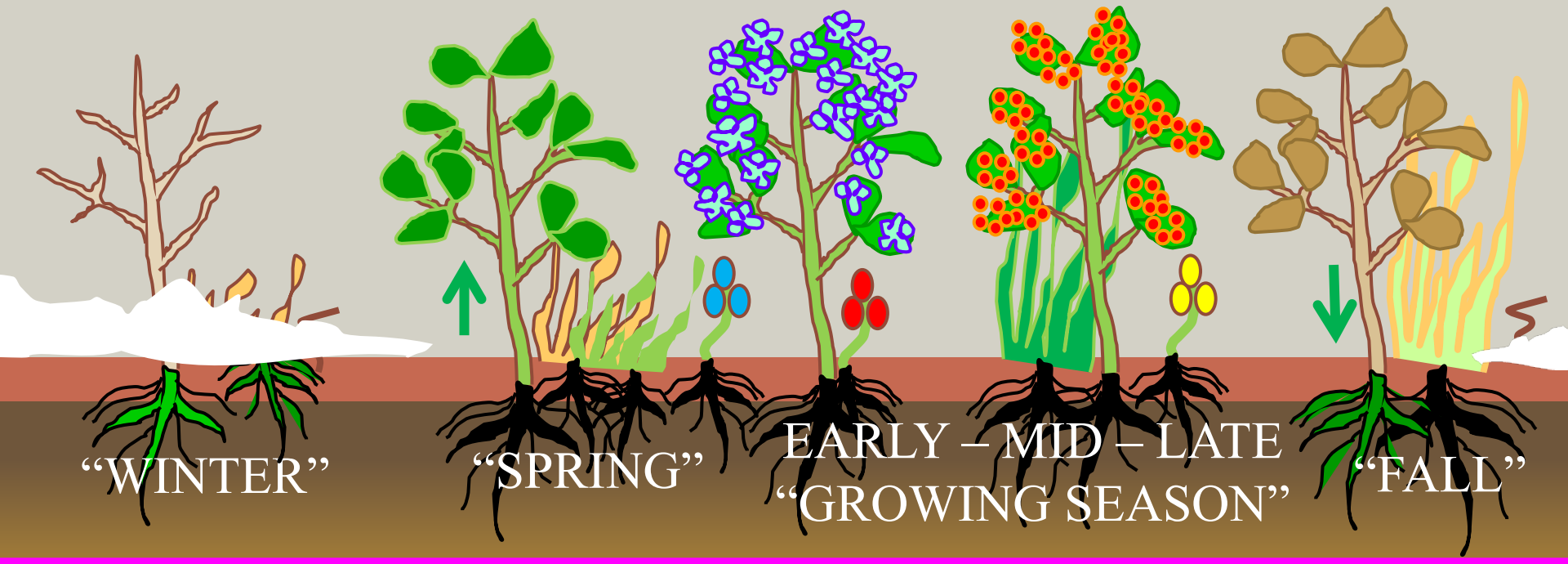
Direct and Indirect Effects on flora and fauna

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

PHENOLOGY & PHYSIOLOGY

Woody – Coniferous & Deciduous

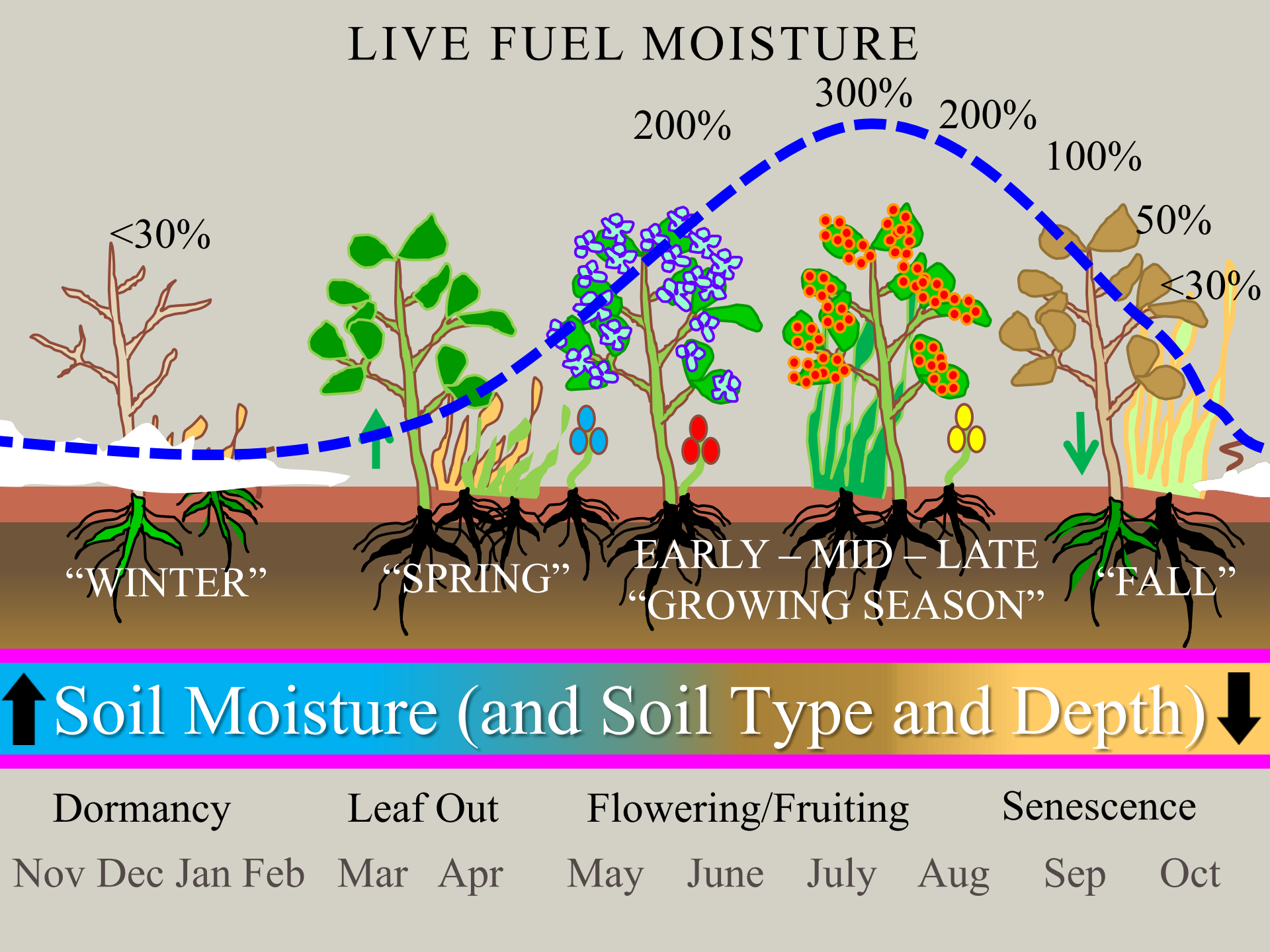
Herbaceous – Annuals & Perennials



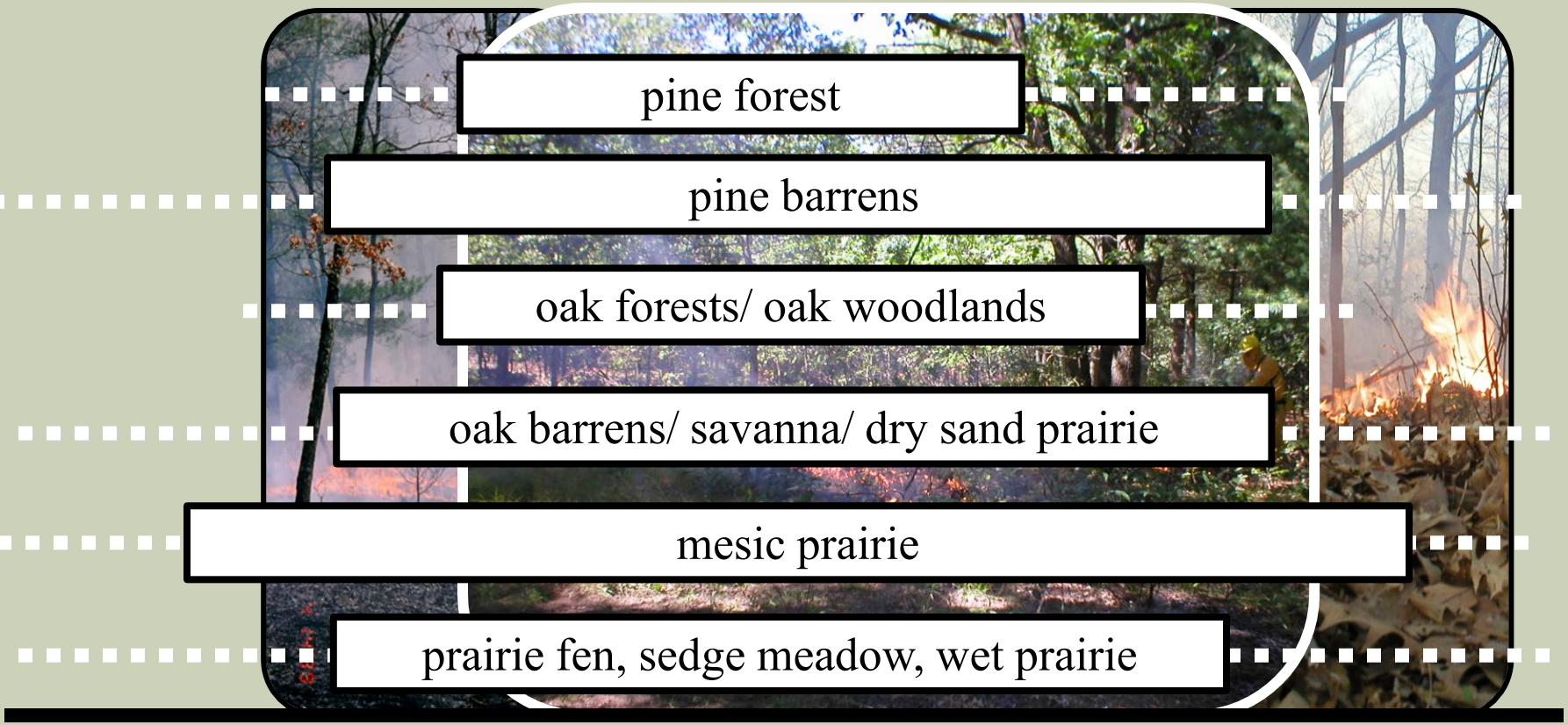
Soil Moisture (and Soil Type and Depth)

Dormancy | Leaf Out | Flowering/Fruiting | Senescence

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


LIVE FUEL MOISTURE
<30%
200%
300%
200%
100%
50%
<30%
"WINTER"
"SPRING"
EARLY – MID – LATE
"GROWING SEASON"
"FALL"
Soil Moisture (and Soil Type and Depth)
Dormancy
Leaf Out
Flowering/Fruiting
Senescence
Nov Dec Jan Feb Mar Apr May June July Aug Sep Oct

SEASONALITY:
BURN WINDOWS BY NATURAL COMMUNITY



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*)	↑	↑	↑	↑

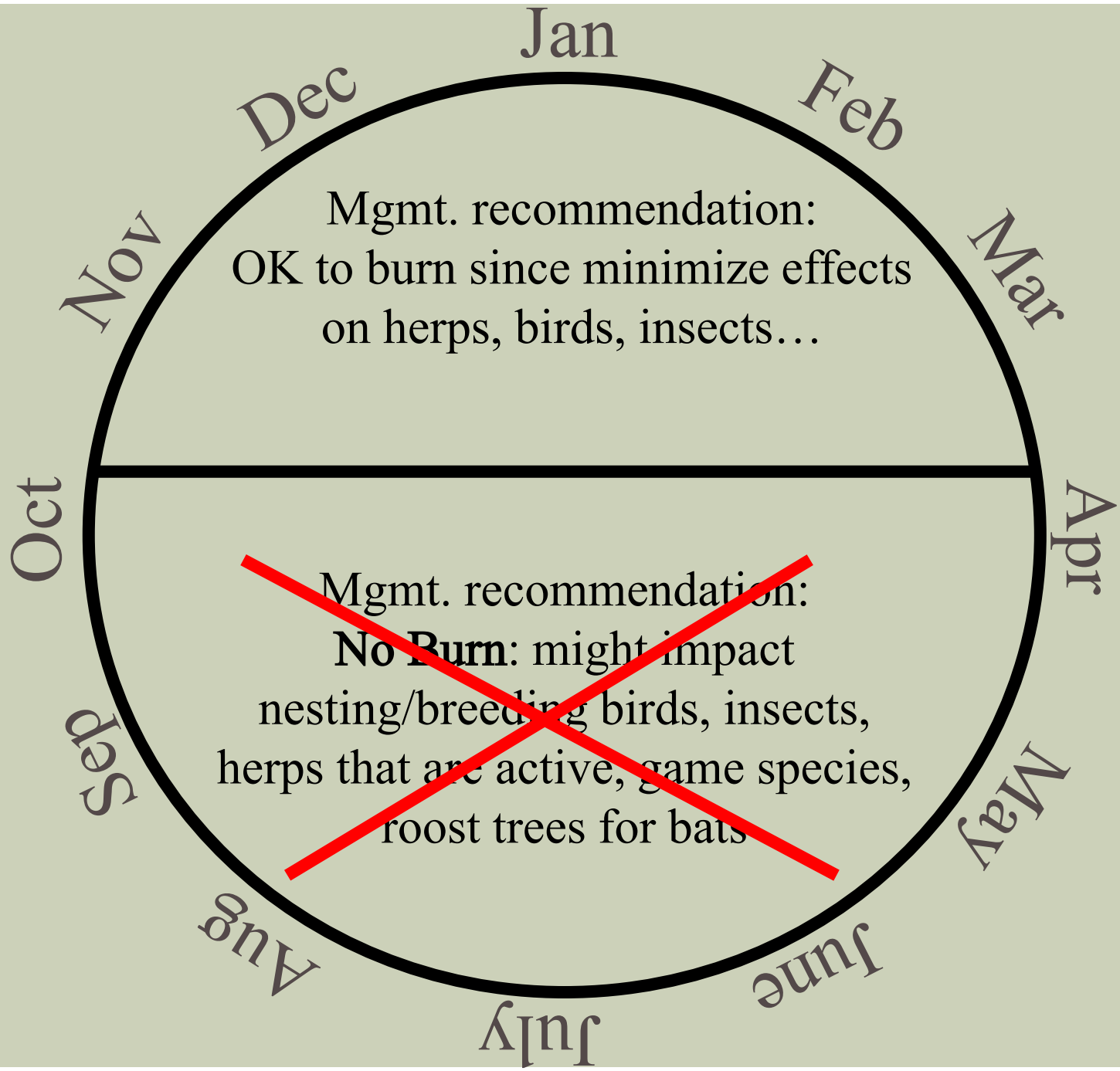
Note: it is better to use yearly Phenology, but illustrated above in general terms with calendar dates

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

The single species ***"Burn or No Burn"*** problem for using RX fire…

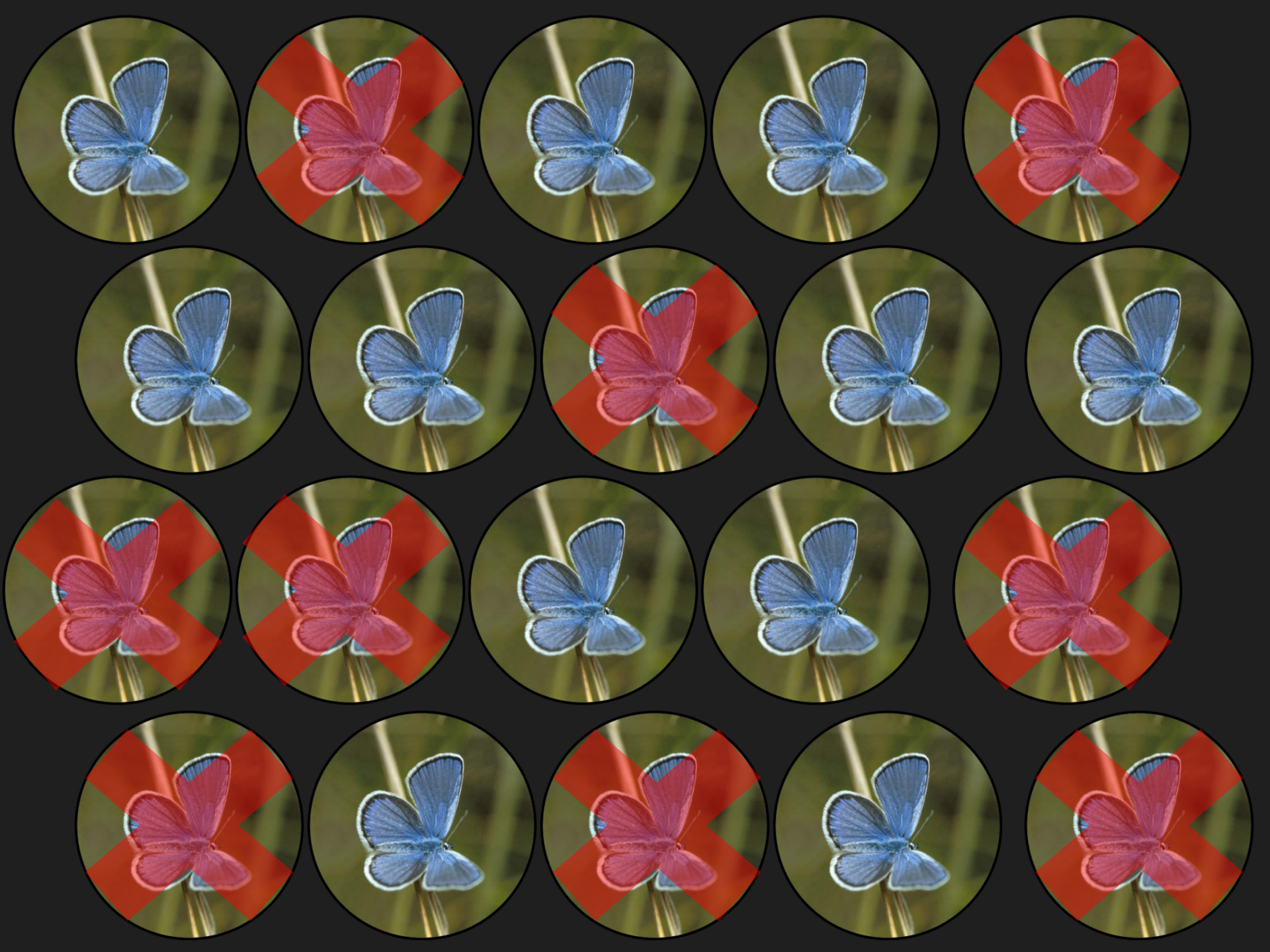


The single species *"Burn or No Burn"* problem for using RX fire…

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

Apr May June July Aug Sep Oct

Competing values = restoration **paralysis** because we will not 'accept' actions that harm animals



(OVERCOMING) IMPEDIMENTS

"You cannot burn that in the summer…."

"We tried a summer burn and it did not 'work', so we are not going to try again…."

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)

"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)

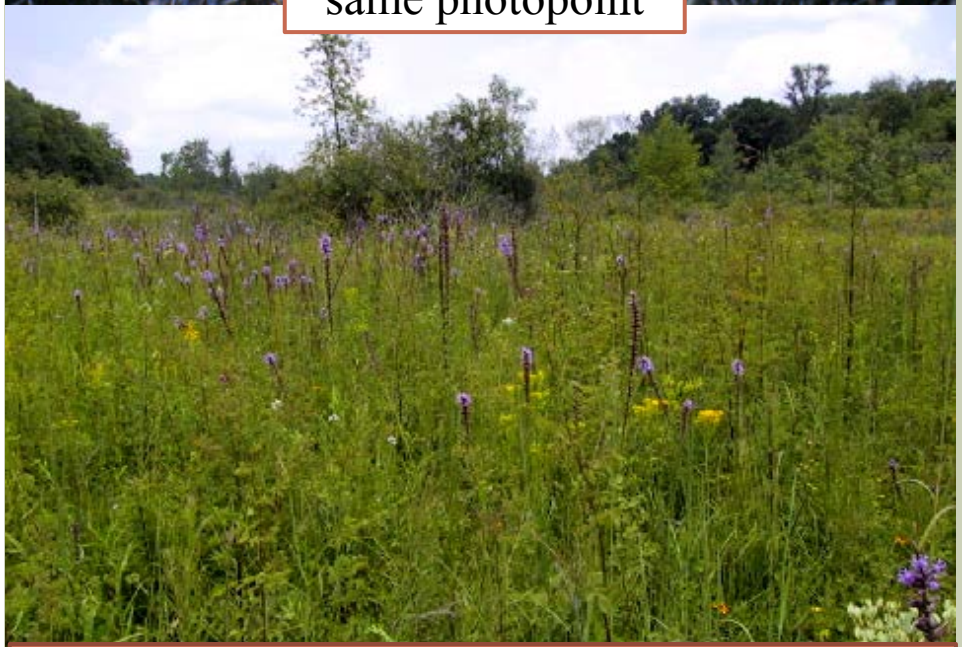
2011 priority planning example – 79 Burn Units – est. max. 114 operational days

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

1-2 operational days to multiple operational/ patrol days

1995 pre-restoration

same photopoint

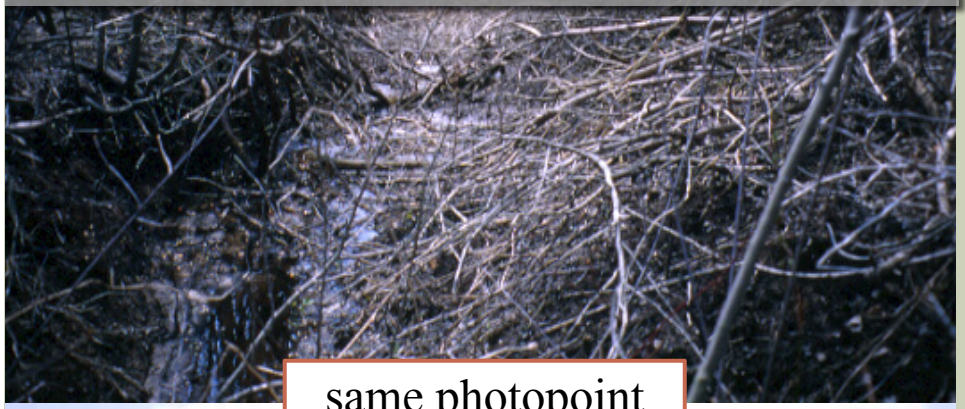


2010 post-restoration

buckthorn, other shrubs, loosestrife, reed canary grass, Phragmites, swallowwort, thistles, etc.

1995 pre-restoration

For massasauga site was rated non-viable habitat in 1995



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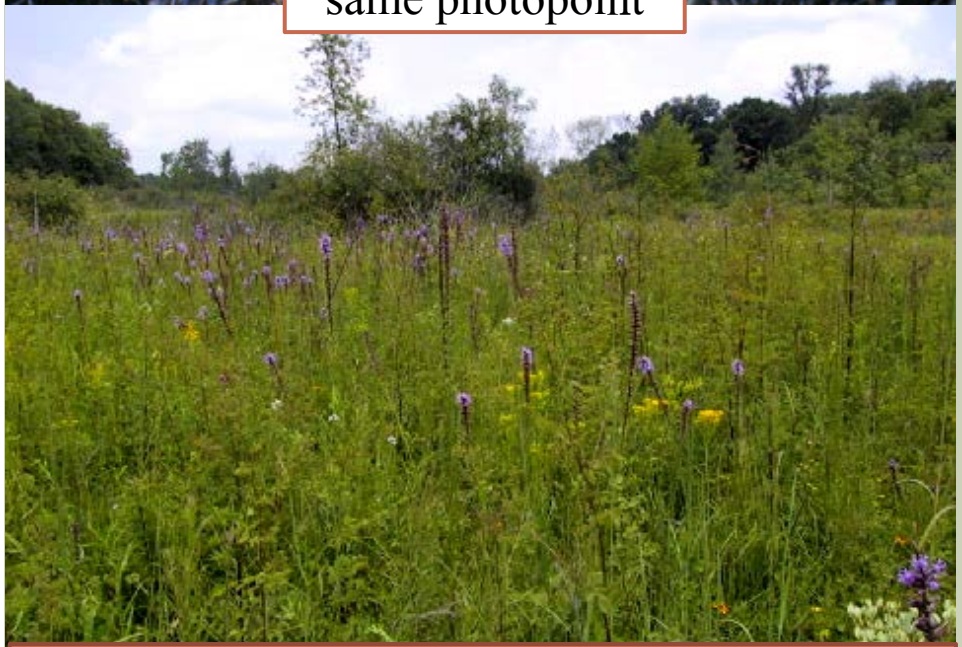
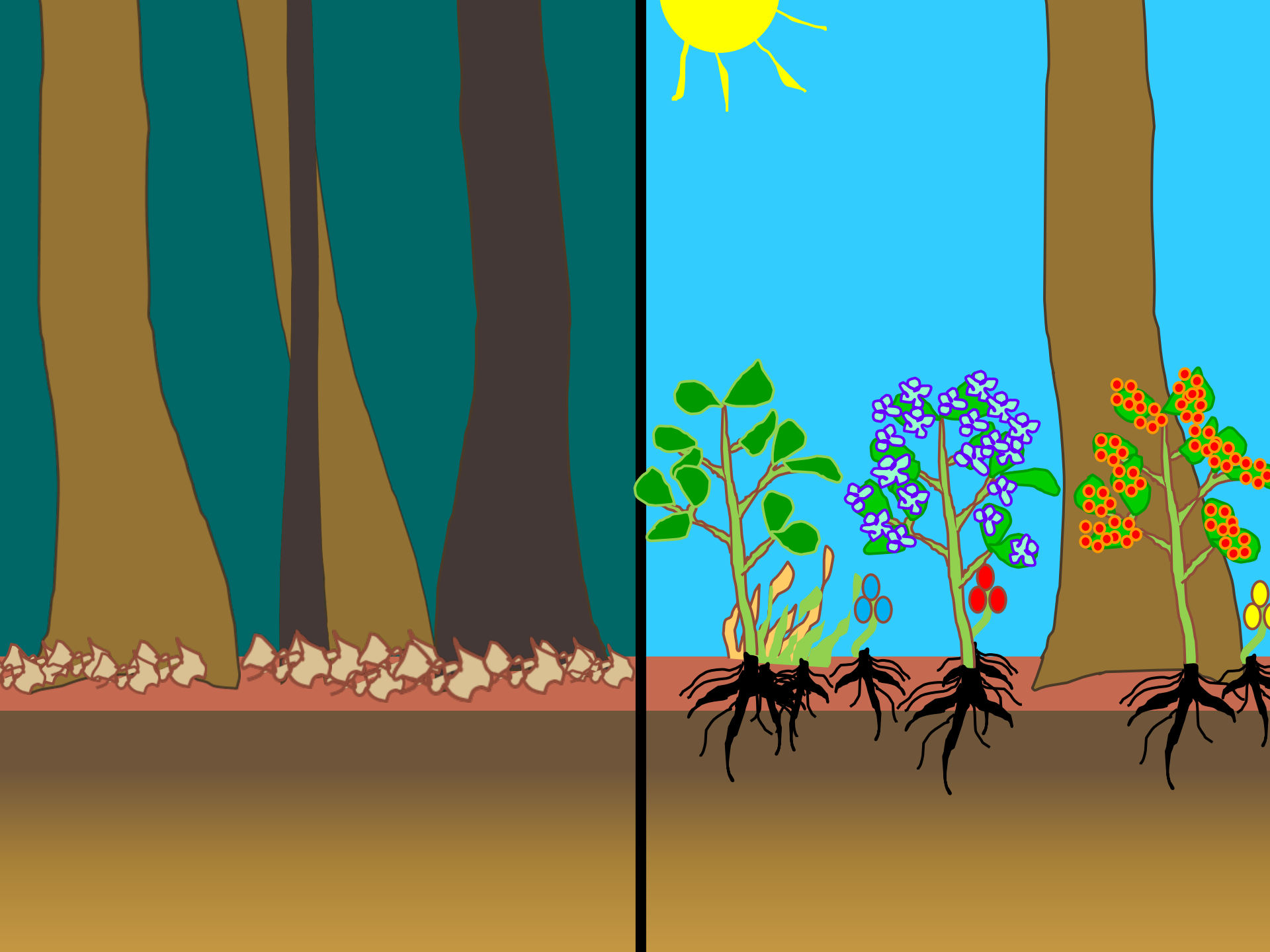


2010 post-restoration

buckthorn, other shrubs, loosestrife, reed canary grass, Phragmites, swallowwort, thistles, etc.

- Direct versus indirect fire injury/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?

- Prey base increases shortly after each burn any season
- two massasauga's (2 males) found dead after spring/ 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)
- Rarely went farther than 6’ before stopping
- Fire - maximum rate of spread 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)…




5 1999

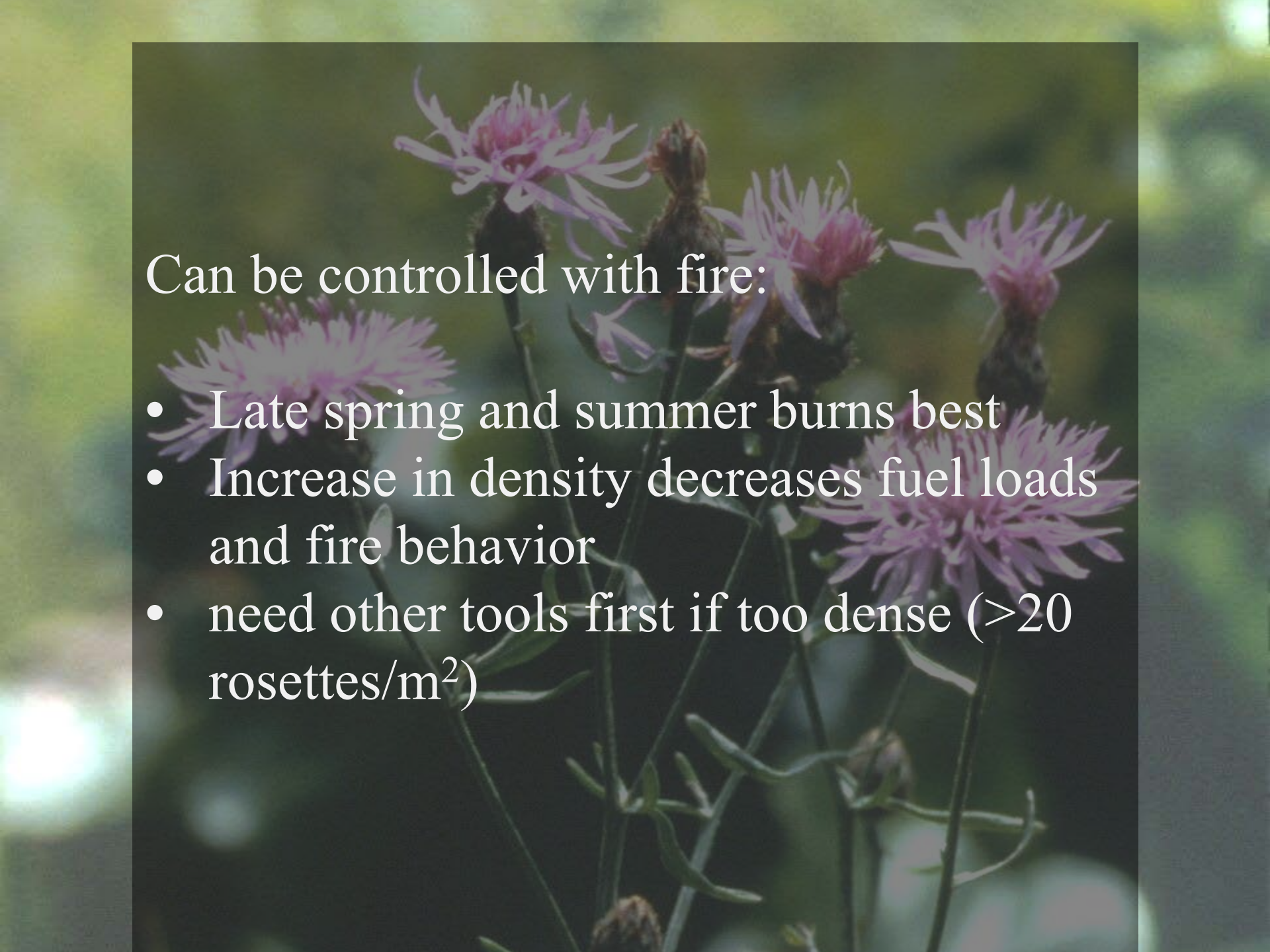

6 2007


7 2010


8 2010

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

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

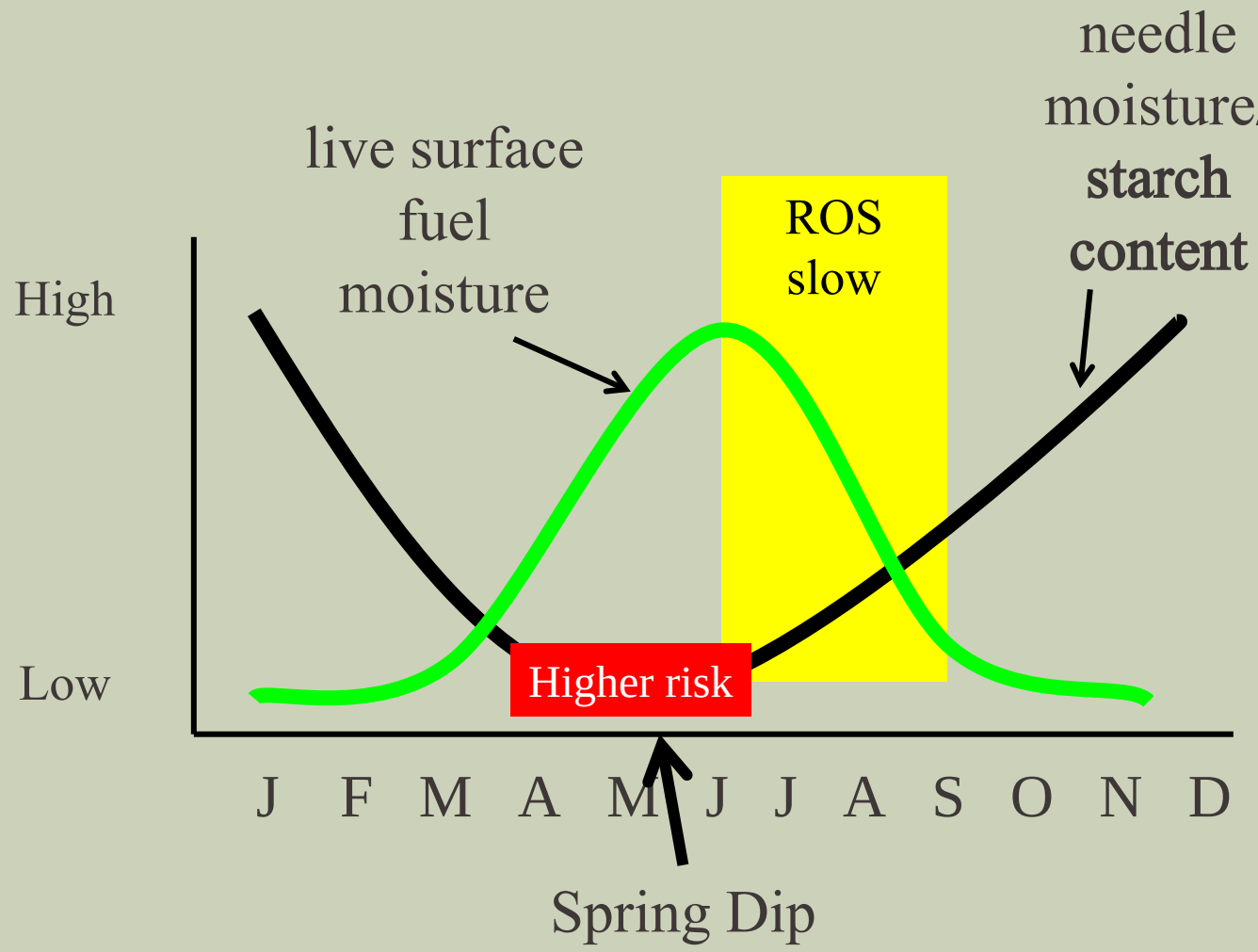


Can be controlled with fire:

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


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

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



REPEATED BURNS ACROSS THE "BURN WINDOW"

Native plant diversity

T&E species – plant and animal

Non-native plant, and competitive species

Resilience


WAP WAP WAP
CALVIN! WHAT ARE YOU DOING TO THE COFFEE TABLE?!?
IS THIS SOME SORT OF TRICK QUESTION, OR WHAT?

Questions?


Lake States
Fire Science Consortium
A JFSP KNOWLEDGE EXCHANGE CONSORTIUM
JOINT FIRE SCIENCE PROGRAM