2013-2014 Webinar Series

February 13, 2014

Multi-scale Responses of Eastern Massasauga Rattlesnakes (Sistrurus catenatus) to Prescribed Fire

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Multi-scale Responses of Eastern massasauga Rattlesnakes (*Sistrurus catenatus*) to Prescribed Fire

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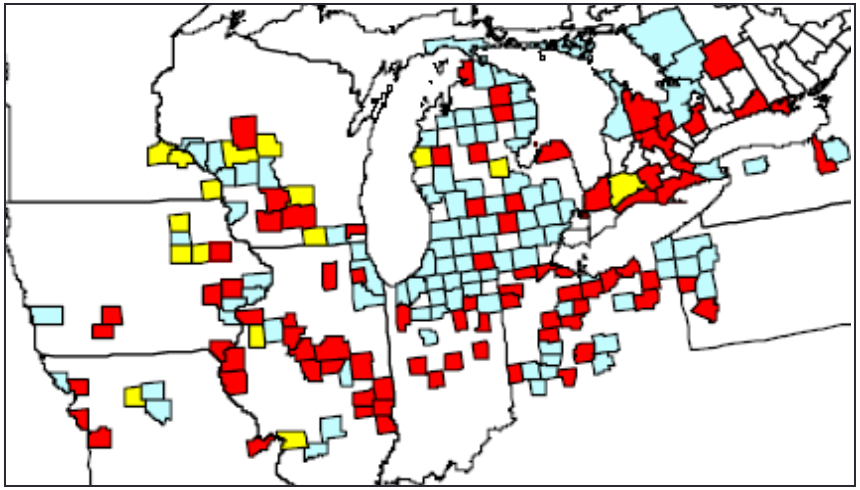
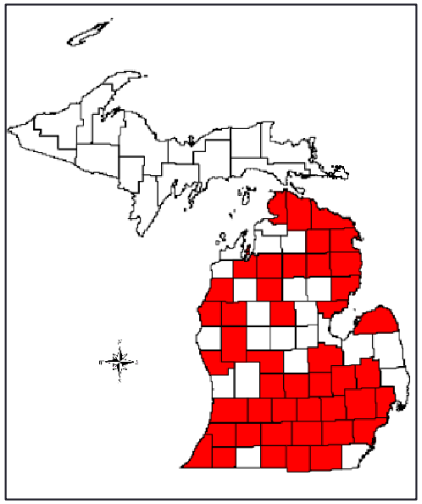
Photo courtesy of Jeff Scofield

Massasauga Distribution

- Current range extends from Iowa/Missouri to Canada and NY.
- Threatened, endangered or species of special concern
- Has been extirpated from most areas with Michigan being the last stronghold.
- Typically found in open wetlands
  - Prairie fens
  - Spring/Fall = wetlands
  - Summer = upland sites



Szymanski 1998



Lee & Legge 2000

Threats and Reasons for Decline

- Habitat loss
- Fragmentation
- Road Mortality
  - Shepard et al. 2008
- Persecution
- Collection
  - Bounty until 1975
  - Scientific
    - Keenlyne 1968
- Disease?
- Management?
  - Fires

Fire Background

- Fire as an effective management tool
  - Ecological process and tool
  - Used to prevent woody encroachment & invasive spread
  - Eliminate potentially dangerous fuel loads
  - Cost & time effective
- Mortality reported (Durbian 2006; Moore and Gillingham 2006)
  - Little knowledge on what happens post-fire

Photo courtesy of J. McGowan-Stinski

Benefits of Fire

- Habitat improvement
  - Succession creates unfavorable vegetative structures
  - Snakes & prey
    - Means & Campbell 1981
- Thermoregulation
  - Ground temp & surface radiation increase
    - Norton & De Lange 2001
- Reportedly improves herp diversity
  - Mushinsky 1985
- More found after fires
  - Seigel et al. 1998; J. Moore pers comm.

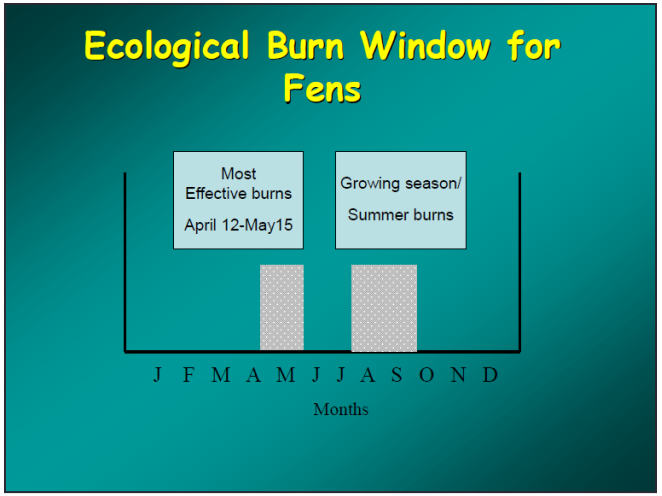
Disadvantages of Fire

- Mortality
- Reduction of cover
  - Increased predation
  - Could create unfavorable surface temperatures
- Change prey abundance/availability

Photo by R. Seigel

Current Recommendations

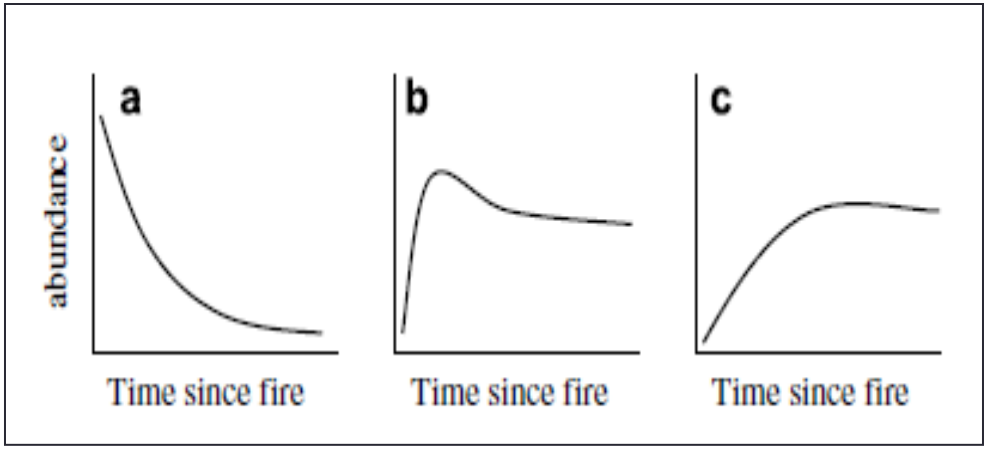
- Burn before spring emergence
- Burning after April not recommended
  - May 15th for wetlands
- Soil temps. should not exceed 20˚C (64˚F)
- Ambient temps. should not exceed 10˚C (50˚F)
- However, these conditions/dates do not always meet management objectives



Mauger and Wilson 1998, Johnson et al. 2000, Kingsbury 2002

Fire Response Models

- Caughley (1985)
  - Three predictive models of reptile responses following fires
- Driscoll & Henderson (2008)
  - Half to two thirds of reptile species showed unexpected responses
- Lindenmayer et al. (2008)
  - Management best guided by setting objectives to meet particular reptile conservation goals



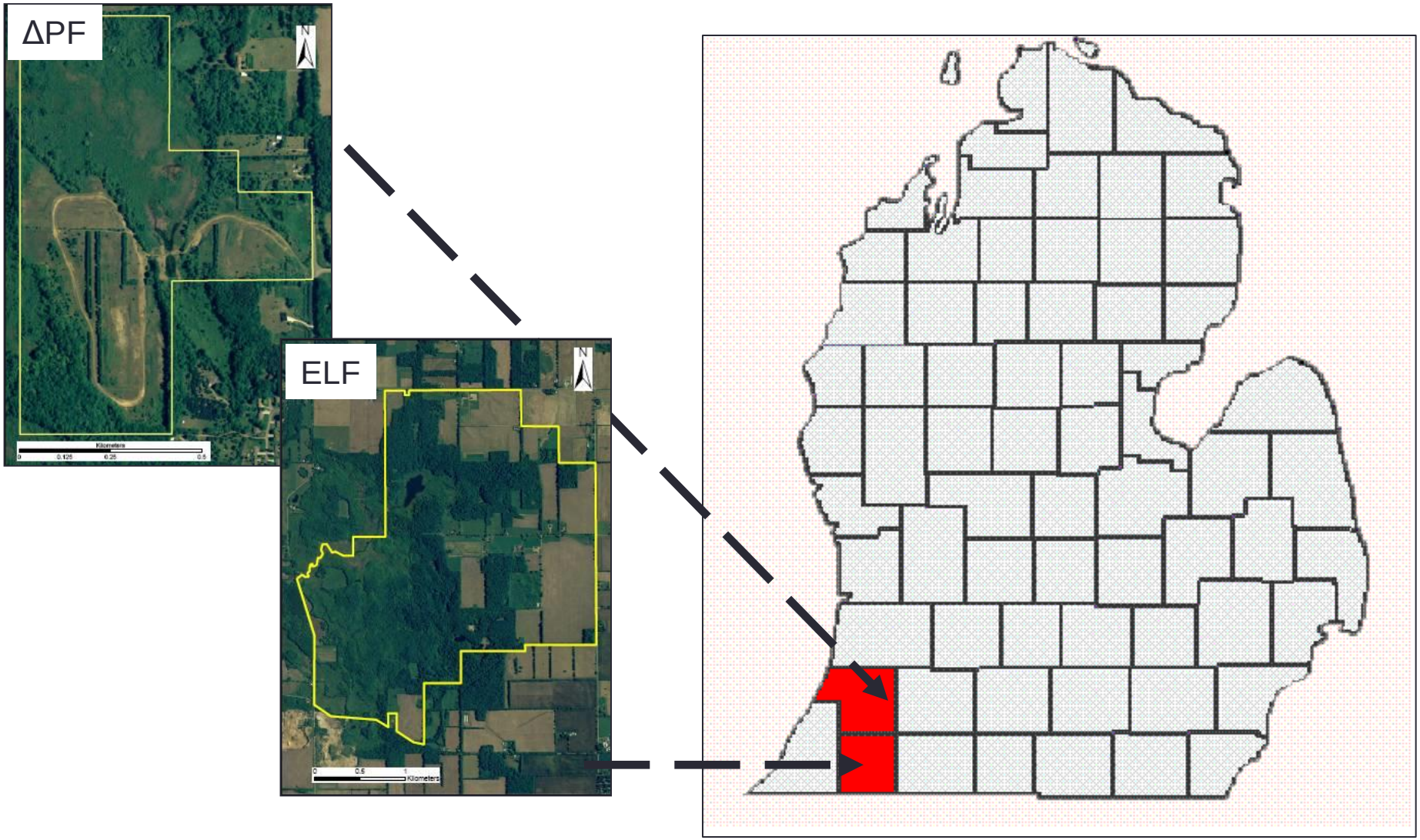
Why Important?

- Candidate for listing under U.S. Endangered Species Act since 1999
- Loss of a few individuals could lead to drastic population reduction
  - Seigel & Sheil 1999
- CCAA (Candidate Conservation Agreement with Assurances)
- Management of remaining populations

Objectives

- 1) Determine direct & indirect effects of fire on EMRs
  - 1.1) Mortality
  - 1.2) Benefits:
    - Are more found after a fire?
    - Do snakes move onto the burn unit after a fire?
  - 1.3) Behavioral responses
    - Daily movement
    - Home range size
    - Habitat use
- 2) Evaluating substrate & burrows as fire refugia
- 3) Collect detailed fire data

Study Sites



Paw Paw Prairie Fen

Mission: to restore and maintain habitat for ALL species

Paw Paw Prairie Fen

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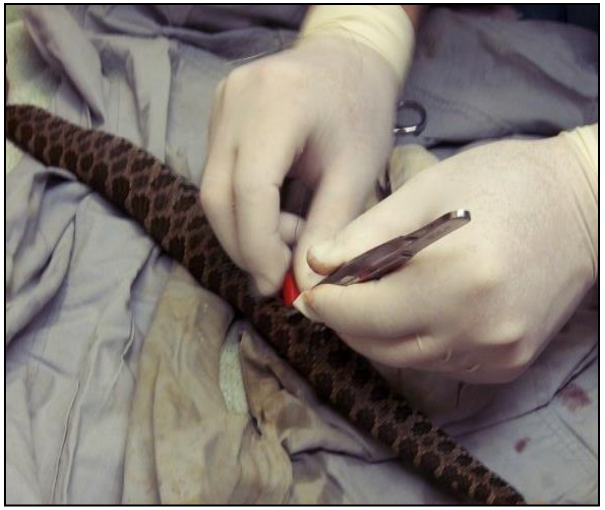
Methods

- Search for snakes
  - Late April-early June
- Snakes weighing >100g taken to Dr. Mehne, DVM for transmitter implantation
- Allowed to recover for 2-3 days before release at capture site



Telemetry

- Establish Movement pattern
  - 13 in 2007 (5♂8♀)
  - 13 in 2008 (4♂9♀)
- Tracked every 1-4 days
  - Snakes were tracked before, during & after burns
  - Body temps during fires
  - Weigh/measure at end of season
- Assigned to treatment groups on day of burn
  - Burn (5), non-burn (3) & control (5/3)

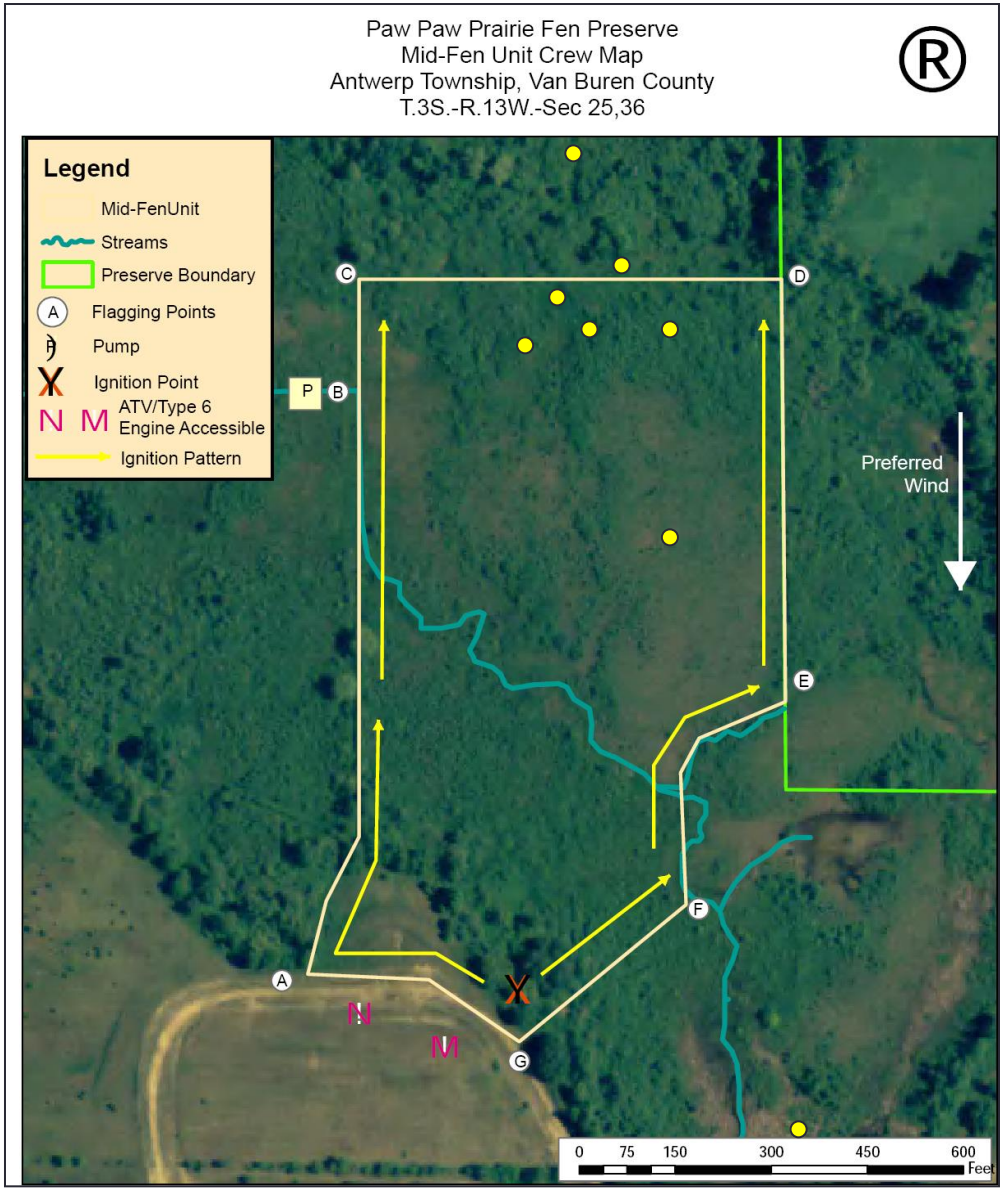
Massasauga Speed Tests

- Carried out speed tests in 2007
  - Seven individuals (3♂4♀)
- Average speed: 0.234 m/s (0.768 ft/s)
- Caveats!
  - Rarely went farther than 6’ before stopping
  - Movement decreased in 3rd trial
  - Not tested in natural habitat

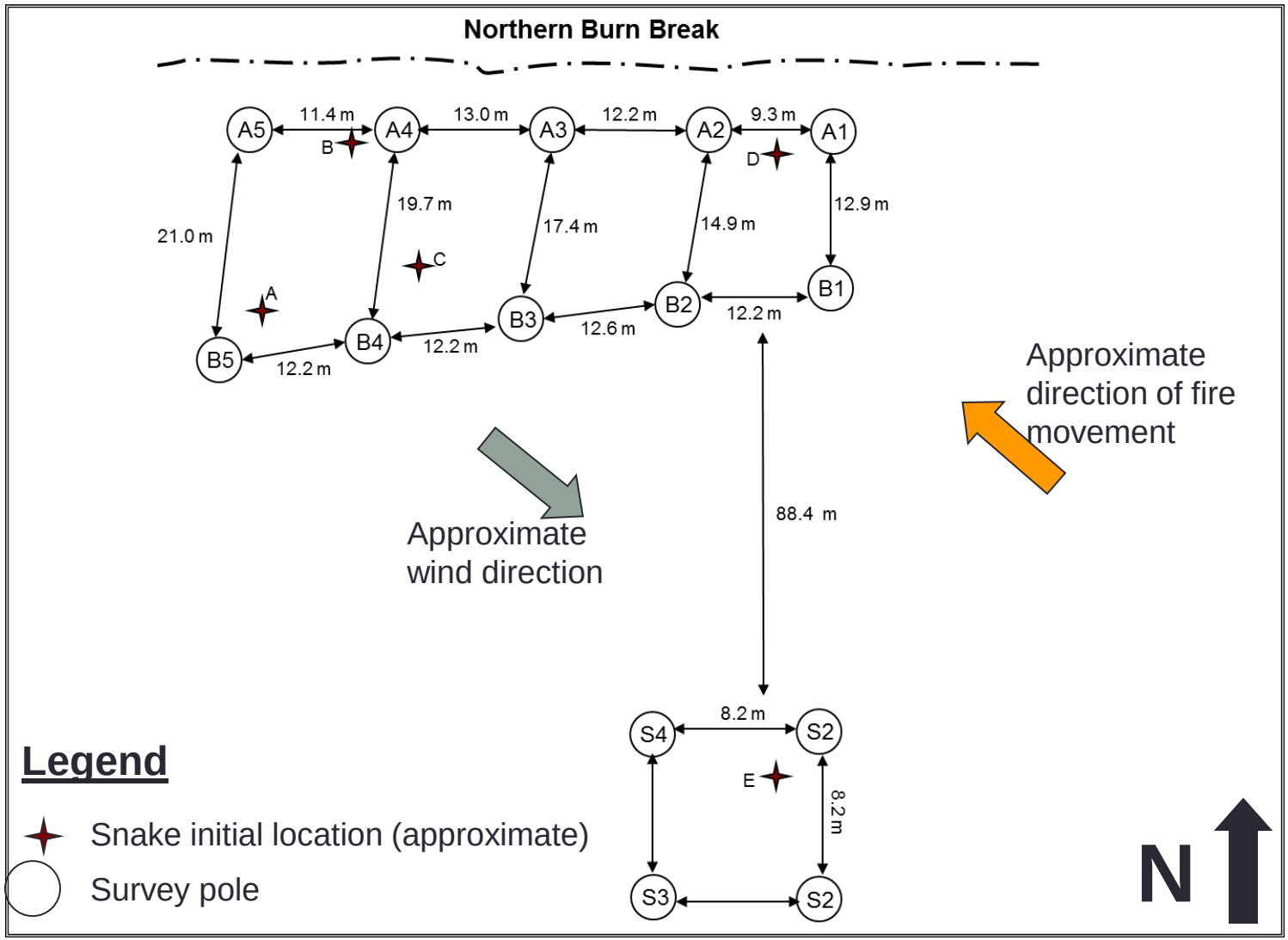
Fire Prescription and Data Collection

- Fire R_x
  - Backing fire with low R.O.S.
  - Site prep
    - Brush pile creation (35)
    - Burn breaks
- Data Collection
  - Substrate and Surface temps
    - Data Loggers
      - In refugia
    - Temperature-sensitive paint
      - 93-649°C
  - Fire speed, height, intensity, etc.

The Burn

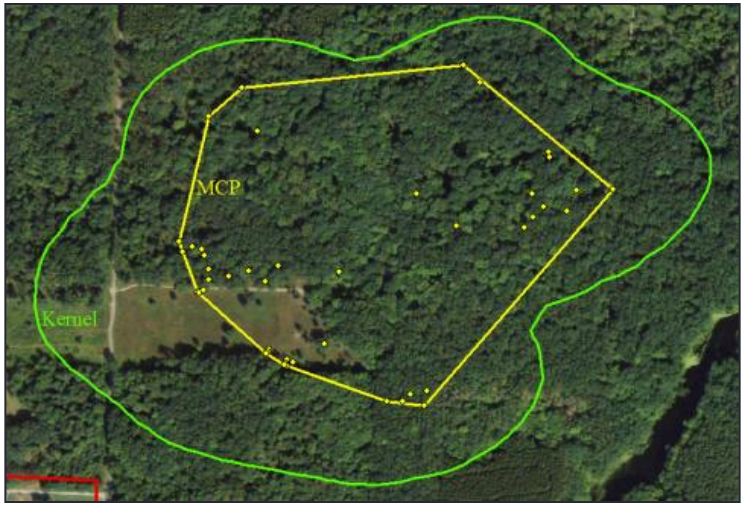

Paw Paw Prairie Fen Preserve
Mid-Fen Unit Crew Map
Antwerp Township, Van Buren County
T.3S.-R.13W.-Sec 25,36
Legend
Mid-FenUnit
Streams
Preserve Boundary
Flagging Points
Pump
Ignition Point
ATV/Type 6 Engine Accessible
Ignition Pattern
Preferred Wind
A
B
C
D
E
F
G
P
N
M
0 75 150 300 450 600
Feet

Schematic diagram of fire behavior survey posts in blocks 1-4, along northern burn break of the Mid-Fen burn unit, May 5, 2008. Numbers between posts indicate distance, in feet.



Methods Continued

- Data points into ArcGIS 10.1
  - Movement & home range
    - Minimum convex polygon (MCP)
    - Kernels
    - Followed procedures outlined by Row and Blouin-Demers (2006)
  - Microhabitat = at points
  - Macrohabitat = use within home range
  - Landscape scale – use within larger area (i.e. the park)



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Results: Objective 1.1 & 1.2

- Direct Effects:
  - Mortality (2)
    - No others found
  - Elimination of cover
- Collecting Success:
  - Six new neonates and juveniles found 1-2 weeks after burn
    - Probably present at time of burn
  - No adults
- Move on/off burn unit:
  - No immediate movement either way
    - Even snakes near burn break

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Results: Objective 1.3

- Behavioral Responses:
  - Spend more time in burrows post-burn
  - No significant differences in
    - Daily movement (p=0.837)
    - Home range size (p=0.561)

- Snake weights:

Treatment	Snake	Beginning (g)	End (g)	Total
Burn	2	132	184	+52
Burn	21	160	128	-32
Burn	23	252	180	-72
No Burn	11	148	148	0
No Burn	14	240	200	-40
Control	8	208	170	-38
Control	10	174	44	+44
Control	16	179	51	+51

Results: Microhabitat Selection

Unit	Model[b]	AIC_c	ΔAIC_c	w_i	R^2
Burn	ts+ls+dw+dos	29.089	0.000	0.243	0.776
	ts+sv+he+dw	29.157	0.068	0.235	0.775
	ts+ls+dw	29.177	0.088	0.233	0.739
	ts+dw+dos	29.790	0.701	0.171	0.738
	ts+sv+dw+dos	30.553	1.464	0.117	0.754
Non burn	ts+ld+dw	31.512	0.000	0.299	0.746
	ls+ld+dw	31.918	0.406	0.244	0.741
	ls+db+dw	32.717	1.205	0.164	0.730
	ts+ls+ld+dw	32.850	1.338	0.153	0.761
	ts+ld+db+dw	33.050	1.538	0.139	0.768
Control	ls+sv+he+db+dw+dos	19.558	0.000	0.525	0.873
	ls+ld_sv+he+db+dw+dos	21.917	2.359	0.162	0.872
	ls+hs+sv+he+db+dw+dos	22.076	2.518	0.149	0.957
	ls+he+db+dw	23.253	3.694	0.083	0.960
	ts+ls+db+dw	23.298	3.739	0.081	0.962

Results: Macrohabitat and Landscape-scale Selection

Macrohabitat			
Habitat	Burn Unit[a]	Off Unit[a]	Control[a]
Grassland	A	A	P
Forest	A	A	A
Wetland	P	P	A

Landscape			
Habitat	Burn Unit[a]	Off Unit[a]	Control[a]
Grassland	A	A	P
Forest	A	A	A
Wetland	P	P	A

[a] A “P” indicates significantly more of the habitat was used than available (i.e. selection for the habitat). An “A” indicates significantly less habitat was used than was available (i.e., avoidance)

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Results: Objectives 2 & 3

2) Refugia temperatures:

- Both hummocks and burrows stayed below Critical Thermal Maximum
  - ~40˚C+

3) Fire data

- Followed R_x and met treatment objectives
- Surface temperatures:
  - ~200 ˚C
- Fire effects:
  - Rate of Spread = 2.63-4.88 ft/min (0.013-0.025 m/s)
  - Flame length = 1.5-2.5 ft (0.46-0.72 m)
  - 95% of the area burned
  - Change in wind caused temporary shift to head fire as it passed over a snake

Conclusions

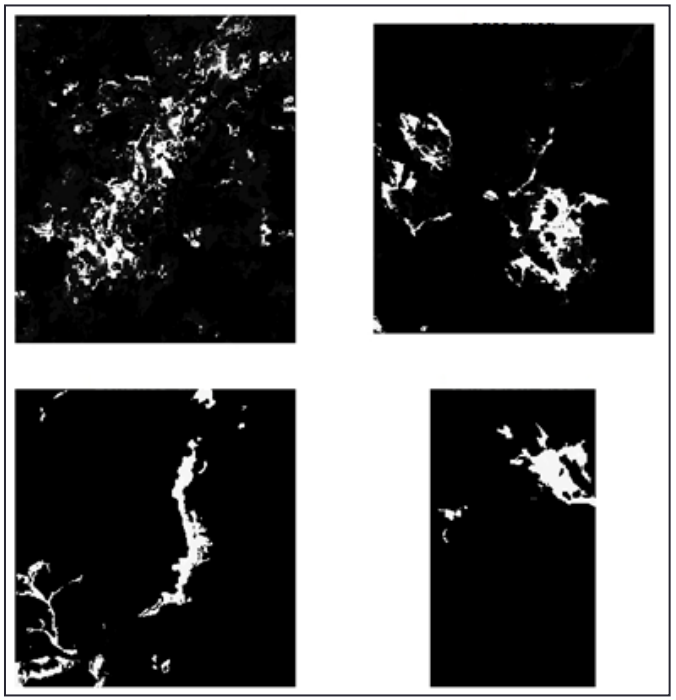
- Fire effects on EMR
  - Mortality (2)
    - Is this sustainable?
  - No change in habitat utilization
    - More time underground
  - Weights inconclusive
  - Refugia appear abundant in this type of habitat
- Fire something…..

Management Recommendations

- Burn smaller plots.
  - Limit fire's impact on population
  - Patchy burns
- Brush piles:
  - One-time or limited event
  - Move off burn unit; costly
  - Avoid construction near overwintering sites
- Overwintering sites:
  - Managers should attempt to identify prior to management
  - Plan management accordingly

Future Research

- Long-term monitoring
  - Delayed structural response
- Different fire types
- Burn at different times of year
- Cues
- Locate overwintering areas



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Prairie Biotic Research

James Ritsema

Colin Vestrand

Jessie & Matt

Zeke

Aaron

Jeff Schofield

Steph

Kile

Clay

Ray Clark

Pat Cain

Root Lab

Questions?


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

Next Webinar:

February 20 , 2014 at 2 PM Eastern (1 PM Central)

Assessing the Drivers of the 'Spring Dip' in Foliar Moisture Content and their Potential Impact on Forest Fire Behavior

W. Matt Jolly, PhD
Research Ecologist
USFS, RMRS, Fire Sciences Laboratory
Fire, Fuel and Smoke Science Program