Knowledge gaps assessment of fire effects on reptiles and amphibians in the Lake States region

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How does fire affect reptiles and amphibians in the Lake States region? What research has been done on this subject?

- The important role of fire as a natural disturbance is becoming increasingly recognized in ecosystem management and species conservation.
- Most research on fire ecology has been focused in the western United States where the frequency of catastrophic fires has increased.
- The effects of fire (prescribed and wild) on ecosystems surrounding the Lake States region have not been thoroughly examined, even though fire is a natural disturbance in many of these ecosystems such as pine forests, prairies, and savannas.
- Some known effects of fire include (Smith 2000):
  - Setting back succession (may increase predation)
  - Increasing or decreasing food availability
  - Direct mortality
- Understanding fire's effect on wildlife is essential to effective management and conservation of species and ecosystems where fire is a naturally occurring disturbance.
- A number of herpetofauna are included in the Michigan Natural Features Inventory list of endangered species (16 total), including (MNFI, 2009):
  - Marlbled salamander (Ambystoma opacum)
  - Eastern box turtle (Terrapene carolina carolina)
  - Eastern massasauga rattlesnake (Sistrurus catenatus catenatus)
- Negative effects of fire on herpetofauna can cascade across trophic levels to predator species that depend on herpetofauna as prey (Keyser et al. 2004).
- Knowledge of fire effects on reptiles and amphibians could aid in more effective enforcement of the Endangered Species Act of Michigan and other states within the Lake States region.
- I performed a quantitative literature review to evaluate the state of information on the relationship between fire and herpetofauna in the Lake States region as part of an ongoing project by the Lake States Fire Science Consortium.
- A review of two species of interest, native to the Great Lakes region, is intended to provide insight into knowledge on a species specific level.

Four Publications within the Lake States Region Were Located:

- Prescribed fires are more frequently studied than wildfire.
- Prairie and forest habitats are most frequently studied.

Species of Interest:

- Red - backed salamander (Plethodon cinerius)
  - Red-backed salamanders are terrestrial salamanders that live in hardwood forested habitat. Their diet mostly consists of small insects (WI DNR web 2012).
  - The red-backed salamander is an abundant species of interest in the Lake States region but is still experiencing habitat loss nationally (Unknown 2009).

- Eastern massasauga rattlesnake (Sistrurus catenatus catenatus)
  - Massasauga’s habitat consists of open prairies, preferable wetlands and early successional communities (Johnson 1998).
  - The Massasauga is of special concern in Michigan and a candidate species for federal protection (MNFI 2012).

Discussion

Publications within the Great Lakes region:

- The small number of publications (4) found on fire effects on herpetofauna show that there is a lack of existing knowledge on this subject.
- So few publications made it unrealistic to perform statistical analysis on the quantity of different types of information presented in the body of information.
- The majority of the publications report on fire effects on reptiles. This reveals a gap in knowledge on fire effects on amphibians. This may be due to the terrestrial-bound habitat of reptiles (rather than salamanders, who can retreat to aquatic environments), making them easier to observe.
- The majority of studies reporting on prescribed fire effects make sense, as wildfires are unpredictable and prescribed fires can easily be implemented and controlled. Still, this reveals a gap in knowledge on wildfire effects.
- So few studies reporting long term data collection reveal a gap in knowledge on long-term effects of fire.

Publications on species of interest:

- More studies reported impacts on the red-backed salamander than on the massasauga, contrary to a majority of reptiles studied in the Lake States region.
- No publications occur within the Lake States region on the massasauga, even though the massasauga is in need of effective conservation efforts (MNFI 2012).

Management implications:

- Prescribed burns in the spring and summer should be withheld until snakes emerging from hibernation recover from “gragging” (Carlisle et al. 2008).
- The study on the massasauga rattlesnake advises managers to avoid moving (before burning) as a means of controlling woody vegetation, as it causes direct mortality to snakes (Durban 2006).

Future research:

- The variety of reported response types suggest a complex relationship between fire and herps, requiring further study on variables such as time since fire, fire intensity, age of individuals, wildfire effects, season of fire, ecosystem type, and species with the habitat.
- Further research on the massasauga’s response to fire in the Lake States region should be a priority, for conservation purposes.

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<th>Species of Interest</th>
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<td>Population size, season of fire, ecosystem type</td>
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References

- American Midland Naturalist.
- Mitchell (2000)
- Durbian (2006)
- Pitt (2001)
- Reference for federal protection (MNFI 2012).
- Wisconsin Old-Field Prairie Habitat Prescribed Northern prairie skink Population size, season of fire, ecosystem type, and species with the habitat.
- Prescribed fire effects. The study on the massasauga rattlesnake advises managers to avoid moving (before burning) as a means of controlling woody vegetation, as it causes direct mortality to snakes (Durban 2006).