The Effects of Fire on Arthropods in the Lake States Region

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Background

- Both wildfires and prescribed fires occur in the Lake States Region
- **Prescribed fire** is a fire ignited by management for a specific purpose and must have a written and approved plan (JFSP 2012).
- **Wildfires** are an unplanned, unwanted fire, which can be caused by extreme weather or humans where the main objective is the put the fire out (JFSP 2012).
- Many arthropod groups significantly decline immediately after fire. The intensity of decline is related to the degree of exposure to the flames and the organism’s mobility (DeSantis & Storer 2007, Panzer 2002, Swengel 2001).
- Intermediate-term effects are quite varied. Some arthropod populations will be lower, some similar to the initial and some will actually become higher. Examples of arthropods whose populations get higher are grasshoppers and ground beetles.
- Several dozen insect species in a variety of families worldwide have attractions to fire or smoke, or ovipositor in freshly burned wood. Many of these species are highly adapted to fire conditions through sense organs sensitive to infrared wavelengths of fire and through wax glands protecting against dryness (Swengel 2001).

- Fire can affect arthropod groups in many ways, both positive and negative:
  - **Direct mortality**: Immediately after a fire, the population will usually decrease dramatically.
  - **Loss of shelter**: Many arthropods will lose their shelter in the event of a fire. This can cause many arthropods to leave the area to find new shelter.
  - **Loss of food**: Fire can destroy the areas vegetation, leaving the animals in the area with little to no food to eat. Arthropods can become the victims of animals that would usually eat something else, but that are now available.
  - **Increase in reproduction**: The effects of a fire can actually make an area more suitable for reproduction in some cases.
  - Most federal funding for fire research has been directed towards ecosystems in the western United States that are characterized by catastrophic wildfires, rather than in the Lake States Region (JFSP 2012).
  - The Lake States Fire Science Consortium’s main goals are to:
    - Accelerate the awareness, understanding, and adoption of wildland fire science information
    - Provide the best available information on fire, fuels and fire-dependent ecosystems
    - Link managers, scientists, policymakers, and disciplines by providing information and tools to support management of fire-dependent ecosystems in the Lake States region

The objective of this study was to assess the current status of fire science information addressing fire effects on arthropods in the Lake States region.

Species of interest

- There are many arthropods that are of special concern within the Lake States Region, including the Karner blue butterfly, the six-banded longhorn beetle, and the regal fritillary.

Methods

- Several lists of keywords relating to fire, arthropods, study location, and habitat keywords were used in a literature search.
- A literature search was performed to identify all publications relating to the effects wildfire and prescribed fire have on arthropods in the Lake States Region.
- The results from the literature search were organized into categories based on study location, ecosystem type, fire type, arthropod order, and variables studied.
- These results were put into pivot tables, which allowed trends to be found easily by calculating percentages.
- That information was used to create figures showing the percentage of studies that addressed each category.
- We used chi-squared analysis to identify statistically significant differences in the frequency of studies occurring in each category.

Results

- In what areas of the Lake States region have studies been conducted?
  - The majority of the studies were concentrated in Wisconsin and Minnesota.
  - Few studies address wildfire effects on arthropods; the majority address prescribed fire.
  - Lepidoptera and Coleoptera were the most frequently studied Orders.

- In what ecosystem types have studies been conducted?
  - Previous research has concentrated on prairie, savanna and forest ecosystems.
  - Information exists for seven response variables. Most studies report fire effects on arthropod population size.

Discussion

- Studies of prescribed fire effects were more common than studies of wildfire effects. This is most likely because it is much easier to study a fire when you have control over when it starts and stops versus a wildfire that cannot be predicted.
- Lepidoptera (butterflies and moths) and Coleoptera (beetles) were the most common orders studied. The large number of studies done on the order Lepidoptera may be because there are a large number of species in this order that are currently endangered or threatened within the Lake States Region; therefore, they get a lot of attention from researchers.
- Most studies were conducted in prairie, savanna or forest ecosystems, and few studies in alvar or pine barrens exist. This can be attributed to the study area that we are focusing on. In the Lake States Region it is more likely to find these types of ecosystem types versus others such as alvar.
- Ninety percent of studies reported fire effects on arthropod population, whereas few studies address other factors that influence population, such as recovery rates and survival or mortality. Effective conservation and management efforts will require that future researchers reach beyond the population variable and investigate additional variables such as reproduction rate. With so many arthropod species on the threatened and endangered list in the Lake States Region, understanding fire effects on reproduction could be very valuable.

References

Relevant publications located by this study:


Additional Citations:

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