Invertebrate Conservation Guidelines: With an Emphasis on Prairie, Savanna, and Grassland Ecosystems

Background

Growing awareness for invertebrate conservation, especially prairie butterflies and other pollinators, has sparked renewed interest for developing best management practices (BMPs) that both maintain invertebrate biodiversity and achieve land management goals. Conservation of prairie, savanna, and grassland invertebrate populations relies on careful implementation of management practices that conserve habitat while minimizing adverse effects to reproduction and survival. Currently, Minnesota's List of Endangered, Threatened, and Special Concern Species (List) includes following invertebrate groups: insects (i.e., butterflies and moths, caddisflies, and tiger beetles), arachnids (i.e., jumping spiders), and mollusks (i.e., mussels and snails). As more information becomes available, additional invertebrate groups may be incorporated into the state's List.

Given that information on imperiled invertebrate species' is sparse or completely lacking for many lands, BMPs can inform decisions on managing land that *may* support these species. Land management activities designed to improve native plant communities or habitats for vertebrate species do not necessarily conserve the invertebrates that are also present.

Following these guidelines may be difficult or costly, and we encourage managers to contact MN DNR Nongame Wildlife Program staff to adapt these guidelines in managing a specific site.

Recommended Conservation Measures

Prescribed Fire

- Plan to leave unburned refugia in prescribed burn plans. These areas are set aside from some management activities so that wildlife inhabitants of a unit or parcel will have a relatively undisturbed refuge during intensive management activities within a specified unit or parcel. While many of these species adapted to plant communities that were, and continue to be dependent on disturbance, they evolved on a far less fragmented landscape with relatively large areas from which disturbance-sensitive species could recolonize disturbed patches. This is particularly important for species of invertebrates that are poor dispersers, but also benefits many other species of wildlife. Never attempt to burn an entire habitat patch or property within any single year (i.e., avoid border to border burns).
- When larval/host associations are known for a particular invertebrate species, refugia should be selected that contain these larval host plant species and/or nectaring resources. Refugia should reflect the frequency of fire management and size of the property (see below). Designating permanent refugia within a site may be simpler than developing a rotational refugia management strategy.

- Divide lands into as many burn units as is feasible and burn no more than one unit in any single year. Units should be approximately equal in size to maximize the likelihood that they will produce enough adults to compensate for individuals killed in the burned unit.
- Refugia should rarely, if ever be placed within restored habitats. It takes many years, if ever, for the plant and invertebrate composition to be restored to levels similar to remnant native prairie. Looking at past land-use history is extremely important for selecting refugia. Historical aerial photography for the state of Minnesota is available free at: http://map.lib.umn.edu/mhapo/index.html.
- Allow *at least* 3 years to elapse without fire (i.e., minimum 4-year rotations) before re-burning any area. Allowing 4 to 5 years to elapse without fire (i.e., 5 to 6 year rotation) may be beneficial for some groups or species (Swengel 1996; Wallner *et al.* 2012). Nekola (2002) recommended fire return intervals of 15+ years supplemented with other less destructive methods of land management between fires for grassland land snail species. Natural fire likely occurred with return intervals of less than 10 years on average in many of these fire dependent systems (MN DNR 2005). Greater fire rotation will allow time for populations to recolonize from refugia located within or adjacent to the burn unit.
- Consider the use of proactive techniques to increase the patchiness of fires, especially if habitats that would serve as sources of recolonizing adults are small or not contiguous with the burn unit. Allow fires to burn in a patchy ("fingering") pattern within units. Do not make a concerted effort to burn "every square inch"; leave fire "skips" unburned. Burning under cool or damp conditions may increase survival of insects present in the litter layer within the burned unit (Panzer 2003).
- Consult the Natural Heritage Information System to familiarize yourself with what is known about the distribution of invertebrates in or near your burn units. Work with Nongame Wildlife Program staff to conduct pre-burn surveys if survey information for the site is not already available.
- In order to limit mortality of invertebrate larvae and preserve early nectar sources, conduct spring burns as early as is feasible to achieve management objectives.
- Avoid fall burns that may result in higher soil temperatures than early spring burns and greater mortality of larvae, even after they have retreated for the season to shelters at or below the ground surface. In addition, the removal of plant material by fall burns may expose larvae to greater temperature extremes during winter.
- If fires may need to be conducted in late spring to address a particular management need (e.g., control of smooth brome, *Bromus inermis*), divide rare invertebrate habitat into multiple burn units, ensure that fires stay within planned burn areas, maximize the number of years between fires, and reduce fuel loads (e.g., by haying) in units where frequent or intense fire is not necessary.
- High fuel levels increase the likelihood that fires will kill many imperiled and rare invertebrates, even during early spring burns when some larvae are still in their subsurface shelters. Therefore, consider reducing fuel levels (e.g., by haying the previous fall) before conducting burns where fuel levels seem to be high.

Haying and Native Seed Harvest

- Hay or harvest seed after mid-September to reduce the likelihood of removing or destroying eggs and nectar sources for late-flying invertebrates' (e.g., Leonard's skipper). If it is not feasible to wait until mid-September, delay haying until after the critically imperiled species' flight-period to minimize the impact to reproductive activity.
- When collecting seed, leave some seed-heads intact. Many invertebrates rely on prior-years seed-heads for shelter and nesting; especially bush clover (*Lespedeza* spp.) and beard-tongue (*Penstemon* spp.) seed-heads.
- Leave at least 20 cm (8 inches) of stubble to provide habitat for over-wintering larvae. The ideal time to mow is after larvae have entered dormancy. Dormancy times are difficult to determine, but haying or mowing after warm season grasses have senesced will help minimize larval impacts.
- As with annual burning, annual haying may reduce plant diversity in grassland habitats. Therefore, hay in alternate years or subdivide the habitat into multiple units and leave at least some of the units unhayed each year to act as refugia. Resting hay units may also reduce the impacts of any adverse effects that may occur from haying that is conducted early enough to adversely affect the most sensitive invertebrate species.

Grazing

- Limit the duration and intensity of grazing on sites with rare invertebrate species, and set up grazing paddocks/regimes to allow for retention of some nectar and host plants.
- As with haying, Skadsen (2003) also recommended that grazing never reduce stubble heights below 20 cm (8 inches) in tallgrass prairie.
- Use rotational grazing on sites with imperiled species, and mix up the grazing cycle so as not to graze a site during the same time each year.
- Use indictor plants as a way to monitor for potential grazing impacts on imperiled invertebrates. For example, declines in purple coneflower may be indicative of adverse effects to Dakota skippers.
- Adverse effects may occur at lower grazing intensities in wet-mesic prairies. For sites with Dakota skippers, it is recommended that wet-mesic habitats be managed with fall or late-summer haying. It is recommended that grazing not be used unless special consideration is given to Dakota skipper, and other imperiled invertebrate habitat needs.

Habitat Restoration

- Restoration of destroyed (e.g., plowed) or severely degraded habitat should be considered experimental. Sites adjacent to remnant prairies, occupied habitats, or connected to occupied habitats by suitable habitat corridors would be best for any restoration experiments.
- *Degraded* habitats may be recoverable, especially if the adverse management has not been especially intense or is recent. For example, good quality Dakota skipper habitat that is intensively grazed for one year may recover if more appropriate management is resumed and if a source population is nearby or if the species persisted on a portion of the site.

- Road rights-of-way containing native prairie habitat may serve as corridors for grassland butterflies (Ries & Debinski 2001). Partnering with highway managers is very important to prevent untimely mowing or spraying of these areas.

Weed/Invasive Species Control

- Avoid broadcast applications of pesticides or herbicides that may be harmful to rare invertebrates or their nectar plants.
- Ensure that field crews recognize target weeds to avoid adverse effects to important native species.
- Follow invasive species decontamination protocols (MN DNR staff see Operational Order 113).

Coordinated Management

- Conduct surveys or review available data to delineate local populations and habitat. This would facilitate coordination and management of populations that may cross one or more management units or ownerships.
- Coordinate management activities with property owners and managers of nearby habitats. For example, plan burns and other temporarily adverse management activities during years when nearby habitats will not be burned.

Maintain Genetic Diversity within Populations

- Dakota skipper populations, and likely other prairie specialist invertebrates, are showing signs of inbreeding (Britten & Glasford 2002). Manage habitat to maximize genetic diversity by minimizing habitat disturbance during the Dakota skipper flight period, connect isolated populations, expand suitable habitat patches, etc.

Summary

In our highly fragmented landscape, it is important to consider the impact of land-management practices on invertebrate species. Management activities, especially prescribed burning, should be planned to reduce significant impacts to rare invertebrate species, allow for refugia habitat, connect isolated parcels, and increase habitat diversity. Simply managing for native floristic components within a property will not guarantee the conservation of native wildlife. If planning assistance is needed for a particular species or site, consult with your Nongame Wildlife Specialist(s). Thanks for considering Minnesota's invertebrates in your management activities!

Literature Cited

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