# Conducting Prescribed Burns in Species at Risk Habitats

## Best Management Practices for Tallgrass Prairie, Oak Savanna, and Oak Woodland

Prepared for:

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We hope that this document serves as a useful tool for land stewards, restoration practitioners and conservation biologists.

*Cover photos (from top to bottom): Courtesy of Tallgrass Ontario (#1,2,5-7) and Jessica Linton (#3,4)*

*Alderville Black Oak Savanna (Photo: Gillian Di Petta)*

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## 1.0 PURPOSE

The purpose of this document is to provide Best Management Practices (BMP) for conducting prescribed burns in tallgrass habitats occupied by species at risk. It has been developed with input from a range of relevant stakeholders including land managers/stewards, Indigenous Communities, Community Members and Community Organizations, Ministry of Natural Resources and Forestry (MNRF) staff, Ministry of Environment Conservation and Parks (MECP) staff, restoration practitioners, species at risk biologists, non-profit organizations, consulting firms that regularly conduct prescribed burns and conservation authority staff. The intent of the BMP is to maximize protection for species at risk that depend on early or mid-successional tallgrass communities while recognizing that maintaining, enhancing and expanding their habitat using prescribed fire is a critical component of long-term ecosystem-based protection, recovery, and restoration.

*A prescribed fire is lit in a tallgrass prairie with a drip torch (Photo: Tallgrass Ontario)*

The term 'species at risk' is used generally throughout this document to refer to species listed as extirpated, endangered, threatened, or special concern on Schedule 1 of the Federal *Species at Risk Act* and/or the Species at Risk in Ontario List identified in Section 7 of the *Endangered Species Act* (2007). These laws and their applicable considerations for various species listing categorizations and prescribed burning are discussed further in Section 4.3.4.

## 2.0 SPECIES AT RISK IN ONTARIO

The original *Endangered Species Act* (ESA), written in 1971, underwent a year-long review which resulted in a number of changes which came into force in 2007. There is now a much stronger emphasis on science-based review and assessment of species which is completed by an independent body named The Committee on the Status of Species at Risk in Ontario (COSSARO). The ESA lays out timelines for producing strategies and plans to recover species at risk, tools to help reduce the impact of human activity on species and their habitats, and tools to encourage protection and recovery activities (Government of Ontario 2023).

Species designated as endangered, threatened or extirpated (see sidebar) automatically receive legal protection under the ESA and their general habitats are protected under the ESA (i.e., areas essential for carrying out life processes such as breeding, feeding, hibernation, and migration). Species listed as special concern do not receive legal protection under the ESA. The MECP is the provincial agency responsible for administering the ESA. Following the listing of a species at risk, they engage individuals and agencies with expertise on the species to write recovery strategies (threatened and endangered status) and management plans (special concern status). Recovery strategies must be completed within one year of listing for endangered species and within two years for threatened species. Similar plans, called management plans, must be completed within five years for special concern species, unless a recovery strategy or management plan is required for the species under the federal *Species at Risk Act* (Government of Ontario 2023).

In Ontario, there are over 200 species at risk and as of December 2022, published recovery strategies exist for 163 of these species (Government of Canada 2023). A review of published recovery strategies reveals that prescribed fire is a habitat management approach that should be considered necessary, beneficial, or likely beneficial for over one third of Ontario's species at risk (see Tables in Section 4.1). However, the need to balance the direct threat of fire to individuals and the need for fire to create and maintain suitable habitat, is a recurring theme within Ontario's recovery strategy documents.

### CATEGORIES OF AT RISK STATUS IN ONTARIO

Extirpated: lives somewhere in the world, and at one time lived in the wild in Ontario, but no longer lives in the wild in Ontario

Endangered: lives in the wild in Ontario but is facing imminent extinction or extirpation

Threatened: lives in the wild in Ontario, is not endangered, but is likely to become endangered if steps are not taken to address factors threatening it

Special concern: lives in the wild in Ontario, is not endangered or threatened, but may become threatened or endangered due to a combination of biological characteristics and identified threats

Source: Government of Ontario 2023

## 3.0 TALLGRASS COMMUNITIES

Native prairie, savanna and oak woodland habitats once covered more than 11,000,000 hectares of North America, but are now among the most endangered habitat types in Canada. It is estimated that up to 200,000 hectares of these vegetation community types existed in the southern Ontario landscape before European settlement and subsequent land conversion (Rodger 1998). Now these habitats occupy less than 3% of their former range in Ontario and what remains is fragmented and under constant threat due to fire suppression and inadequate management (Bakowsky and Riley 1994; Taylor et al. 2014). Native tallgrass communities are adapted to fire. Many grass and forb species respond well to burning and fire-tolerant tree species persist after fire which maintains an open or semi-open canopy. In Ontario, these communities are primarily associated with oak (*Quercus* spp.), especially Black Oak (*Quercus velutina*). Of all the plant communities that make up the eastern hardwood biome of North America, the Oak-dominated ecosystems are viewed as perhaps the most important because of their geographical extent, diversity, and many ecological values (Smith 2006).

One of the primary reasons for protecting and promoting tallgrass communities in Ontario is the diversity of native plant and wildlife species they support. Oaks in particular are known to support a high diversity of insects, birds, and mammals. In one study, 534 native lepidoptera (moths and butterflies) were documented to consume oak leaves (Tallamy and Shropshire 2009). These lepidoptera serve as an important food source for other insects, birds and small mammals (Brose et. al. 2013). More than 100 vertebrate species regularly consume acorns in the hardwood forest biome, which have become an even more important food source since the decline of American Chestnut (*Castanea dentata*) and American Beech (*Fagus grandifolia*) (Brose et al. 2013). The rough bark of many oaks also provides refugia for insect species during fire events (Brose et al. 2013).

Tallgrass communities in Ontario are characterized by prairie, savanna, or woodland (Lee et al. 1998) and these habitats are often interspersed. Figure 1 provides visual representations of these communities. High-quality tallgrass prairies have few trees (<25% canopy cover) and are dominated by native grasses and herbs. Indicator species include Big Bluestem (*Andropogon gerardi*), Little Bluestem (*Schizachyrium scoparium*), Yellow Prairie Grass (*Sorghastrum nutans*), and Switch Grass (*Panicum virgatum*). Communities with 25 to 35% tree canopy closure are classified as tallgrass savannas, while those with 35 to 60% tree canopy coverage are classified as tallgrass woodlands (Lee et al. 1998).

Historically, savannas often occurred along the edges of prairies, representing a compositional and structural transition from prairie to woodland and forest (Brose et al. 2013). Based on historical descriptions and original land survey notes from Ontario, savannas occurred as a homogenous vegetation type over fairly large areas (W. Bakowsky pers. comm. 2023). The trees in these communities are usually oaks (primarily Black Oak in southwestern Ontario) and hickories, with pine

associations. Some understory plant species that are dominant in savanna communities, or are indicators of savanna habitat include; Big Bluestem, Yellow Pimpernel (*Taenidia integerrima*), Wild Bergamot (*Monarda fistulosa*), Woodland Sunflower (*Helianthus divaricatus*), Smooth-leaved Aster (*Symphyotrichum laeve*), and Wild Blue (Sundial) Lupine (*Lupinus perennis*) (Rodger 1998). The application of prescribed fire to these communities at differing intervals reduces woody vegetation encroachment, encourages native tallgrass plant regeneration, and helps control (some) invasive species. A widely accepted rule of thumb for maintaining healthy habitat is to burn prairie every 5-7 years and savanna every 10-15 years, while woodland only requires periodic fire, every 15 years or more (J. Chapman pers. comm. 2022). When actively restoring or creating habitat (more common than maintenance in most of Ontario), burning more frequently may be required until a healthy prairie community is established.

In Ontario, a large proportion of species at risk and rare species are associated with, or are completely dependent on, tallgrass habitats. These species include a diversity of plants, reptiles, birds, mammals, and insects (see Section 4.1.1 to 4.1.6). Their populations are generally geographically isolated to remnant tallgrass habitats where they face the same general threats, including the loss of suitable habitat due to natural succession of woody vegetation/canopy closure, fire suppression, invasive species, trampling caused by ATV use and hiking, and the expansion of agricultural land uses.

Black Oak Savanna at the Ojibway Prairie Complex in Windsor, ON. The complex protects one of the largest remnants of tallgrass prairie and oak savanna in Ontario and supports an impressive number of species at risk, including the Eastern Foxsnake (*Pantherophis gloydi*).

*Photos: Jessica Linton (Oak Savanna) and Ryan Wolfe (Eastern Foxsnake).*

*A created tallgrass prairie in Norfolk County. Characterized by a mix of tallgrasses, native herbaceous species, and less than 25% shrub/tree cover. Photo: Jessica Linton*

*Alderville Black Oak Savanna. Characterized by scattered Black Oak tree canopy (25-35%) and a mix of tallgrasses and native herbaceous species. Photo: Jessica Linton*

*Oak Woodland at Pinery Provincial Park. Characterized by a semi-open (35-60%) canopy of oaks providing diffuse shade and diverse native herbaceous species. Photo: Jessica Linton*

**Figure 1. Tallgrass Communities in Ontario: Prairie (top), Savanna (middle), and Woodland (bottom).**

## 3.1 THE HISTORICAL ROLE OF FIRE IN ONTARIO

Little is known to western science about fire ecology prior to written records. Some informative pre-colonial information is available from Elders within Ontario's First Nation communities (Traditional Knowledge), paleoecology studies that create coarse-scale chronologies of fire occurrence by examining the charcoal accumulations in soils, and dendrochronology studies that examine tree fire scars over time.

Before European contact, there were many communities throughout southern Ontario that formed diverse and distinct nations. The Ojibway, Odawa and Pottawatomi Nations formed the Confederacy of Three Fires. From their original homeland on the east coast, they travelled into the Great Lakes Region (and further west) (Beaver 2020). The Pottawatomi moved south and settled between Lake Michigan and Lake Huron, the Odawa moved to Manitoulin Island, and the Ojibway settled along the north shore of Lake Huron (Beaver 2020). Today, Ontario's "First Nations" constitute many different nations, with the largest ethnic groups represented by Anishinaabe, Haudenosaunee, and the Cree. Each Nation has its own unique history, cultural practices, languages, traditions, and oral history. It is beyond the scope of this document to describe the individual relationship with fire that each Nation had/has; however, it is respectfully acknowledged that tallgrass communities in Ontario were stewarded by communities prior to European settlement, and as a result, were far more wide spread on the landscape then they became post-contact.

Most ecologists did not consider fire to be a factor in the ecology of the eastern hardwood biome for most of the 20th century (Brose et al. 2013). However, early writings by European explorers, missionaries, and settlers described that many First Nation communities they encountered routinely used fire for a variety of reasons (Dey 2000, Denevan 1992, Hough 1926, Maxwell 1910). These are traditions that continue to be practiced today. In general, fires of low to moderate intensity are ignited in winter, spring or fall to promote the production of the grasses and forbs that provided habitat and forage for large game and fowl (Dey and Guyette 2000). Because burning the land is at the centre of many communities' way of life, fire is considered to be a culturally important element for the survival of First Nation communities across the world (Pyne 2001, 2007). Many First Nations within the Great Lakes Basin intentionally moved villages, changed hunting grounds in rotation or were transient through specific territories and in this regard, fire-free periods were often intentional (J. Henry pers. comm. 2022).

On Walpole Island, fire is used to promote harvesting of medicinal plants, to attract wildlife for hunting, and to control encroachment of woody vegetation (C. Jacobs, Walpole Island First Nation, pers. comm. 2022). In the Rice Lake Plains, "Lake of the burning plains" in an ancient Ojibway dialect, land was burned to prepare for planting corn, squash, and beans (R. Beaver, Alderville First Nation,

2012). This Mississauga name for Rice Lake is Pamitaashkodeyong (Williams 2018) (or Pamadusgodayong) which is derived from the fact that when the Mississauga's first came to the area, the southern shore of Rice Lake appeared to be flat since it had been cleared of forest and planted in corn fields by the Mohawks (Burnham 1904). Oral traditions also describe that caribou were hunted around Rice Lake (Williams 2018). Today, many community members still regularly burn land within the Alderville First Nation (D. Mowat pers. comm. 2022). This is done for a variety of reasons including cultural practice, removing fuels, to remove invasive species, and to 'tidy up' around properties (D. Mowat pers. comm. 2022).

Although some applications of fire within southern Ontario gathered from Traditional Knowledge are noted here, this is by no means a complete account and it is reasonable to assume the extent of natural and community-maintained prairie and savanna in Ontario is more widespread than is documented in the written record (Bakowsky 1998).

Following European contact, the First Nation's cultures of the Lower Great Lakes Region were forever changed. As they suffered from the loss of their cultural identities, languages, traditional ways of life, and displacement from their traditional territories, anthropogenic fire application largely disappeared from southern Ontario. It is not a coincidence that systematic repression of First Nation peoples resulted in an absence of fire, and thus a reduction in the extent and robustness of tallgrass communities (J. Henry pers. comm. 2022). In First Nation communities where tallgrass habitats are still stewarded and fire is still a regular practice, we see the healthiest and best examples of prairies and savannas in Ontario. These areas also have a high proportion of species at risk, which have been protected and sustained through community care of the land.

What we have learned from Traditional Knowledge is also supported by western science. Brose et al. 2013, reviews and summarizes evidence of fire history from reviewing fire scar and charcoal studies in North America, including the Great Lakes Region. From this review they concluded:

- Fire has been a part of upland ecosystems throughout eastern North America, including the Great Lakes Region, since the end of the last ice age.
- Fires increased in frequency as First Nations populations increased and developed agricultural practices.
- The frequency of pre-European settlement fires varied but appears to be strongly linked to First Nation's settlements (more so than natural wildfire in some areas). This is evidenced by the fact that the majority of fires in North America occurred consistently during the dormant season (i.e., late fall to early spring during leaf-off), possibly in association with hunting, gathering, pest control and/or regeneration of food source plants. However, in the Great

Lakes Region specifically, a larger majority of fires (50%) occurred in the growing season (i.e., between the last frost of winter and first frost of fall when vegetation is leafed out), which is thought to reflect the abundance of pines as a fuel source.

- Fire-free periods were also common before European settlement, which favored Oak and Pine regeneration and promoted tree recruitment.
- In all areas, including the Great Lakes Region, fire frequency decreased with the arrival of Europeans.

The construction of railroads, sparking of rail cars, and use of fire to maintain vegetation along these corridors between the 1960s and 1980s resulted in fires along the rail corridor which provided beneficial disturbance to tallgrass communities along these corridors. The use of controlled fire has largely been replaced by woody vegetation grubbing and herbicide application but remnant tallgrass habitats can be found along several old rail lines in Ontario.

Historically, it is likely that fire would not have posed a great direct threat to species because of the extent of available habitat on the landscape (i.e., habitat was not limiting). The extent of habitat would have provided refugia areas for wildlife to move to during burns. Today, tallgrass habitats in Ontario exist as isolated patches with limited refugia areas for species at risk to take cover in during a fire. This puts the need for prescribed fire to maintain habitat, and the direct threat of fire itself on species at risk, in direct conflict with each other. This is complicated by the fact that species-specific responses can be positive, negative, or neutral and vary across time and spatial scales.

**Wild Lupine at the Alderville Black Oak Savanna following a burn.**
***Photo: Jessica Linton***

## 3.2 CURRENT THREATS TO TALLGRASS COMMUNITIES

### FIRE SUPPRESSION

Fire suppression is considered a high threat to tallgrass communities and prescribed fire is one tool land mangers use to create, restore, and manage these early successional communities. Long-term fire suppression has consequences to ecosystems, including a reduction in early successional vegetation community stages (i.e., increased canopy closure), excessive fuel accumulation, poor forest regeneration, and degradation of wildlife habitat (Van Sleeuwen 2006).

In early successional tallgrass communities, fire suppression leads to an increased growth of woody plants that would normally be controlled or excluded from these sites by wildfire or by fires set by First Nation communities. The increased shade created by tree and/or shrub canopy, as well as changes in leaf-litter composition, leads to an exclusion of prairie and savanna plants and their associated fauna. Species like oaks have leaves that burn well, whereas early and aggressive colonizing species like poplar have leaves that can inhibit fire because they do not burn well (R. Odolczyk pers. comm. 2022).

A decrease in warm season grass cover as a result of shading and changes in leaf litter composition can lead to an insufficient fuel load to carry a flame through the habitat. In Ontario, a combination of fire suppression and extensive planting of trees, accelerated detrimental tallgrass habitat alterations between 1950 and 1970 (Catling 2013). During this period, extensive tree planting also led to widespread loss of open tallgrass habitats in Ontario, which at the time was viewed as wasteland that could be improved through planting pine trees (Catling 2013). These collective impacts of increased canopy cover led to the loss of many prairie and savanna species, including three specialist butterfly species dependent on Wild Blue Lupine (see side bar).

> The Karner Blue, Frosted Elfin and Eastern Persius Duskywing butterflies have similar habitat needs and shared similar geographic ranges in Canada. All three butterflies typically inhabit early successional habitats such as pine-oak barrens, sand dunes, savannas, prairies, dry oak woodlands, and other open habitats which support populations of Wild Blue Lupine. All three of these butterflies are now extirpated from Ontario (and therefore Canada). The primary reasons for the extirpation of these species has been attributed to habitat loss or degradation (including fire suppression), habitat fragmentation and prevalence of exotic and invasive flora species. These factors have led to reduced populations sizes that were not able to withstand a severe drought that occurred in the late 1980s.

### OAK REGENERATION

There is extensive literature describing widespread oak regeneration failures and the replacement of oaks by mesophytic hardwood species (Abrams and Downs 1990; Aldrich et al. 2005; Healy et al. 1997, Schuler and Gillespie 2000; Woodall et al. 2008; Nowacki and Abrams 2008). These large-scale changes

in habitat structure have resulted in oak-pine dominated woodlands and forests being replaced with fire-resistant hardwood forests. One study in Norfolk County, Ontario (Backus Woods), demonstrated a significant decline in White Oak (*Quercus alba*) over the last 30 years, while native species, such as Red Maple (*Acer rubrum*) significantly increased (Kirk et al. 2020). This has a direct impact not only on the vegetation assemblage, but also the diversity of wildlife, as birch (*Betula* spp.) and maple (*Acer* spp.), common oak-replacement trees, support considerably fewer native lepidopteran and bird species (Brose et al. 2013).

## INVASIVE SPECIES

Oak Wilt (*Bretziella fagacearum*) is a fungal pathogen that kills thousands of oak trees in North America each year and is spread by underground roots, sap beetles, and bark-feeding beetles (Ontario Invasive Species Awareness Program 2012). Sap beetles are attracted to the sweet smell of fungal mats found primarily on Red Oak (*Quercus rubra*) infected with Oak Wilt. After contact, they can then carry fungal spores to other healthy trees by unknowingly depositing those spores into the fresh wounds on the trees that they are feeding on (DiGasparro 2022). Trees in the Red Oak group (Red Oak, Black Oak, and Northern Pin Oak (*Quercus ellipsoidalis*) and Pin Oak (*Q. palustris*)) are more susceptible to the disease and can die very quickly. Members of the white oak group (White Oak, Bur Oak (*Q. macrocarpa*) and Dwarf Chinquapin Oak (*Q. prinoides*)) are less susceptible and show a slower decline (DiGasparro 2022). This pathogen has not been recorded in Canada; however, it has been documented in Detroit USA, in close proximity to the border at Windsor, Ontario (DiGasparro 2022). Land managers should be diligent about watching for and reporting signs of Oak Wilt to the Canadian Food Inspection Agency (CFIA). Avoiding Oak pruning between April 15 – July 15 can reduce the chance of Oak Wilt infection and spread (Sakalidis 2020).

Invasive species threaten many native plant communities in Ontario, and tallgrass communities are no exception. Some of the main invasive woody plants of Ontario tallgrass ecosystems are Scot's Pine (*Pinus sylvestris*), Black Locust (*Robinia pseudoacacia*), honeysuckles (*Lonicera* spp.), Common Buckthorn (*Rhamnus cathartica*), Autumn Olive (*Elaeagnus umbellata*), and Russian Olive (*Elaeagnus angustifolia*) (Tallgrass Ontario 2012). These aggressive invasive species out-compete native tallgrass species for resources and can quickly take over entire habitats, displacing species at risk that depend on them. Although prescribed burning can control many invasive plants once a tallgrass ecosystem has become well established, a few of the most invasive species are tolerant of fire, such as Sweet White Clover (*Melilotus albus*) (Tallgrass Ontario 2012), Spotted Knapweed (*Centaurea stoebe*) and Dog-Strangling Vine (*Vincetoxicum rossicum* and *V. nigrum*) (R. Odolczyk pers. comm. 2022). The threat of invasive species at a given site should be carefully considered and may require successive burning, mowing, hand-pulling, or application of herbicides to control and/or eliminate this threat.

Non-native Spongy Moth (*Lymantria dispar*) populations occasionally reach outbreak levels and continue to expand their geographic range in southern Ontario. Spongy Moth larvae are not host specific and can cause extensive defoliation, especially on oak species. In extreme cases of tree defoliation, they will move onto woody understorey vegetation as well (J. Linton pers. observation). Defoliation of oak trees can cause habitat loss for species dependent on tallgrass habitats and competition with species dependent on the leaves they are defoliating.

In some instances, it appears that tree canopy defoliation by Spongy Moths has played a positive role for understory tallgrass plants, by increasing light penetration and resulting flower blooming (A. MacKenzie pers. comm. 2022; M. Gartshore pers. comm. 2022).

*Bacillus thuringiensis* var. *kurstaki (Btk*) is a broad-spectrum insecticide that is used to control Spongy Moth outbreaks in Ontario woodlands and treed urban areas but is lethal to all lepidopteran larvae (Rastall et al. 2003). In Ontario, spraying of *Btk* to control Spongy Moth began shortly after this species' introduction in 1969. Aerial spraying of *Btk* is still the most commonly used control method by municipalities and conservation authorities in southern Ontario which could pose a significant threat to rare lepidoptera in tallgrass communities exposed to this pesticide. *Bt* commercial corn is enhanced through biotechnology to protect against insect pests which also selectively targets butterfly and moth caterpillars (USDA 2016). Pollen and debris from harvesting this corn can expose insects in adjacent natural area to these pesticides, however the extent of this exposure has not been well-studied.

## 4.0 IMPACTS OF FIRE AS A MANAGEMENT TOOL ON SPECIES AT RISK

Fire and its use as a conservation tool are increasingly being recognized as an important factor in biodiversity conservation and natural resource management (Driscoll et al. 2010). Although in some cases, knowledge of animal responses to fire is adequate to inform prescribed burning (e.g., Briani et al. 2004; Hutto et al. 2008), to meet conservation goals aimed at maintaining all species that occupy an ecosystem, accurate knowledge about a broader range of species and their responses to fire is needed (Clarke 2008; DellaSala et al. 2004; Keith et al. 2002). At a species level one must consider dispersal ability (mobility), habitat types, adequacy of available refugia, and phenology. It is becoming increasingly clear that protection and rehabilitation of entire ecosystems is required and is generally a more effective approach than focusing on individual species; however, some small, highly vulnerable populations of some species must be a consideration. Tallgrass habitats, and therefore the species that inhabit them, are dependent on a disturbance regime that maintains some level of canopy openness and fire is the most effective conservation tool for achieving this. The following sections identify potential direct and indirect impacts of prescribed fire to species at risk based on general biology and life history information for broad taxonomic groups.

### 4.1 POTENTIAL DIRECT AND INDIRECT IMPACTS ON SPECIES AT RISK

Fire may affect wildlife indirectly by impacting habitat structure, cover, movement, and food resources, and directly by causing injury or death (Smith 2000). The indirect effects of fire on habitats can be influenced substantially by the total area burned, pattern of burning, frequency, season, and intensity of the fire (Lashley et al. 2015). It is thought that the direct effects of fire on wildlife are much less common than one might believe but support for this is poorly documented (Harper et al. 2016). In fact, based on consultation completed to inform the development of this document, observed direct mortality of wildlife, including species at risk, in Ontario by well-planned prescribed fire is anecdotally described as very rare.

Many plants that occur in tallgrass habitats have evolved to withstand or respond favourably to fire. Because plants are immobile, mitigating the impacts of prescribed fire is relatively straight forward. Wildlife are most vulnerable to mortality or injury from fire during nesting, brood-rearing, fawning seasons, and soon after emerging from hibernacula (Harper et al. 2016). For most species, few individuals in a population are affected by any given prescribed burn unless the area burned is relatively large and intense (Brennan et al. 1998) or entire populations are congregated in small geographic areas. This may be the case for small, locally occurring insect or gastropod populations or at times of the year when populations of animals seasonally congregate (e.g., reptile hibernacula).

There are four primary factors regarding prescribed fire that affect plants and wildlife directly and indirectly: 1) fire frequency, 2) fire intensity, 3) season (or timing) of burning, and 4) burn area and pattern of burning (Harper et al. 2016). These are all important considerations to make when developing the goals and objectives of a burn plan (see Section 4.2).

### 4.1.1 PLANTS, MOSSES AND LICHENS

Many grasses and forbs that occur in tallgrass habitat are adapted to fire and respond positively to it. Fire can be critically important to successful reproduction in some prairie plants, encouraging synchronized flowering, increasing pollination and seed production. In isolated tallgrass remnants alarmingly high rates of local plant extinction have been documented and attributed to fire suppression (Leach and Givnish 1996; Alstad et al. 2016). This is most often connected to encroachment of woody species and overall changes in community structure. Often, the encroachment of fire intolerant species will result in the senescence of perennial prairie forbs and graminoids. These species may persist as vegetative (non-flowering) plants for a number of years before succumbing to the unsuitable conditions and disappearing from the site. Fire can reverse the effects of encroachment on prairie vegetation and can stimulate the seed bank which may contain long-dormant conservative species[1]. Although many tallgrass plants are adapted to fire, species at risk plants still require careful consideration when developing burn plans. Many of Ontario's plant species at risk exist in small, isolated populations and may not be tolerant to the direct impact of fire or may be more vulnerable during certain times of the year. In some instances, species at risk plants may occur along trails where light levels are increased and the discing of burn breaks in preparation for a prescribed burn can present a threat to these occurrences[2].

Species at risk vascular plants known to occur in Ontario's tallgrass habitats are summarized in Table 1 along with details on their current status and specific recommendations regarding prescribed fire that are described in the species' recovery strategy, management plan, and/or status assessment documents. In general, the exact response to fire is unknown for the majority of these species at risk plants; however, prescribed fire is recognized as critical in maintaining the habitat they depend on. At this time, there are no mosses or lichen species at risk known to occur in tallgrass habitats but they are included here for future reference.

[1] A species that is considered "fragile", require stable natural habitat, and exhibits high site fidelity.

[2] It is also acknowledged that disturbance along trails from pedestrians and ATVs in some areas is what maintains the open areas to support these plants.

**Table 1. Vascular plant species at risk known to occur in tallgrass habitats**

| Common Name | Species Name | SARA | ESA | COSEWIC | Considerations for Prescribed Fire in Species Recovery Strategy and/or Status Assessment |
|---|---|---|---|---|---|
| American Columbo | *Frasera caroliniensis* | END | END | END | Prescribed burn appears to have a positive effect on recovery, however further research is necessary (Bickerton 2013a). Anecdotal observations in Brant County noted an increase in the number of plants immediately following a prescribed burn. Even when plants had emerged and were singed, they did not show any long term effects (perhaps because they emerge as a tight whorl of leaves it is somewhat protected from fire) (G.Buck, pers.comm. 2023). |
| Bird's-foot Violet | *Viola pedata* | END | END | END | Prescribed burning (Bickerton 2013b) |
| Climbing Prairie Rose | *Rosa setigera* | SC | SC | SC | Depends on areas being kept open by periodic fire, but prescribed burns are not explicitly recommended (EC 2014a) |
| Colicroot | *Aletris farinosa* | THR | END | END | Prescribed burning (MNRF 2017) |
| Dense Blazing Star | *Liatris spicata* | THR | THR | THR | Prescribed burning (MNRF 2016a) |
| Downy Yellow False Foxglove | *Aureolaria virginica* | N/A | END | END | Fire suppression has a medium impact on this species, but prescribed burning has not been explicitly recommended (COSEWIC 2018) |
| Dwarf Hackberry | *Celtis tenuifolia* | THR | THR | THR | Fire ecology for this species is unknown, but oak savannas are known to require it, further research is needed (OMNR 2013a) |
| Eastern Flowering Dogwood | *Cornus florida* | END | END | END | Fire may lessen the threats of dogwood anthracnose by opening up the forest to provide drier conditions unsuitable for fungal growth (Holzmueller et al. 2008) |
| Eastern Prairie Fringed Orchid | *Platanthera leucophaea* | END | END | END | Fire ecology unknown, further research required (EPFRT 2010). |
| Fern-leaved Yellow False Foxglove | *Aureolaria pedicularia* | N/A | THR | THR | Fire suppression has a negative impact because it results in shading and competition from other species COSEWIC 2018) |

| Common Name | Species Name | SARA | ESA | COSEWIC | Considerations for Prescribed Fire in Species Recovery Strategy and/or Status Assessment |
|---|---|---|---|---|---|
| Gattinger's Agalinis | *Agalinis gattingeri* | END | END | END | Effects of prescribed burn on this species unknown, need further research (Jones 2015b) |
| Hill's Thistle | *Cirsium pumilum* var. *hillii* | THR | THR | THR | Fire is likely required to create habitat for this species, but further research is required (OMNR 2013b) |
| Hoary Mountain Mint | *Pycnanthemum incanum* | END | END | END | Fire is required for habitat maintenance and creation, but the effects of prescribed burning on this species must be investigated (HMRT 2011). |
| Illinois Tick-trefoil | *Desmodium illinoense* | EXP | EXP | EXP | Periodic fires help to create habitat for this species and reduce competition from other species, but has not explicitly been recommended (ECCC 2017b). |
| Pale Showy Goldenrod | *Solidago pallida* | END | END | END | Prescribed burns are not critical for this species, but may have potential to contribute to the future supply of critical habitat (ECCC 2021) |
| Pink Milkwort | *Polygala incarnata* | END | END | END | Prescribed burning recommended (MNRF 2016b) |
| Purple Twayblade | *Liparis liliifolia* | THR | THR | THR | Prescribed burning recommended (MECP 2019b) |
| Riddell's Goldenrod | *Solidago riddellii* | SC | SC | SC | Prescribed burning recommended (EC 2014b) |
| Skinner's Agalinis | *Agalinis skinneriana* | END | END | END | Prescribed burns could be effective in reducing encroachment of woody species and controlling some invasives (Bowles 2016a) |
| Slender Bush Clover | *Lespedeza virginica* | END | END | END | Prescribed burns are likely beneficial, but further assessment is needed (Jones 2013a) |
| Small White Lady's Slipper | *Cypripedium candidum* | END | END | THR | Prescribed burns recommended (EC 2014c) |
| Spotted Wintergreen | *Chimaphila maculata* | END | END | END | Prescribed burns could have negative effects on this species (Ursic 2010) |
| Stiff-leaved Showy Goldenrod | *Solidago rigidiuscula* | END | END | END | Prescribed burns to reduce encroachment of woody species (EC 2011) |

| Common Name | Species Name | SARA | ESA | COSEWIC | Considerations for Prescribed Fire in Species Recovery Strategy and/or Status Assessment |
|---|---|---|---|---|---|
| Virginia Goat's-rue | *Tephrosia virginiana* | END | END | END | Prescribed burns recommended (ECCC 2017c) |
| Western Silvery Aster | *Symphyotrichum sericeum* | THR | END | THR | Prescribed burns benefit habitat creation (MECP 2018) |
| White Prairie Gentian | *Gentiana alba* | END | END | END | Prescribed burns would be effective in maintaining suitable habitat (Bowles 2016b) |
| Willowleaf Aster | *Symphyotrichum praealtum* | THR | THR | THR | Prescribed burning recommended (Jones 2013b) |

**EXP- Extirpated; END- Endangered; THR- Threatened; SC- Special Concern; N/A- Not Listed on Schedule 1**

*** Anecdotal evidence suggests that in prairies frequently burned on Walpole Island, this species is not negatively impacted (W. Bakowsky, pers. comm. 2023).**

**** Anecdotal evidence indicates this species has responded very positively to burning at Turkey Point Provincial Park (M. Gartshore, pers. comm. 2023).**

### 4.1.2 BIRDS

According to the Canadian Wildlife Service (CWS), the peak breeding period for birds in Southern Ontario is late March to late August, with most open country birds nesting between late April and early August (CWS 2018). Burning during the winter, early spring, or fall is therefore unlikely to impact the majority of Ontario's bird species that nest in tallgrass habitats[3]. Impacts on nesting birds, especially species at risk, is one of the primary considerations for land managers with regard to burning during the summer growing season.

The majority of studies available have shown few strong effects of burn season on direct mortality, breeding success, or survival of birds (Cox and Widener 2008; Engstrom et al. 1996; Tucker et al. 2004; 2006). Although burning during the breeding period may cause some direct mortality by destroying nests and killing young birds, many bird species will re-nest, and the indirect benefits of the resulting habitat alteration are usually far more important to the long-term persistence of the species (Engstrom et al. 2005; Robbins and Myers 1992). In general, a fire-return interval of growing-season burns of three or more years apart and rotation of areas burned is considered unlikely to impact bird populations (Knapp et al. 2009).

Species at risk birds known to nest in Ontario's tallgrass habitats are summarized in Table 2 along with details on their current status, nesting season, and specific recommendations regarding prescribed fire

[3] Spring burns can impact nests of American Woodcock. Burns in September still have the potential to impact late nesting species such as Eastern Towee and Field Sparrow.

that are described in the species' recovery strategy, management plan, and/or status assessment documents. For all bird species at risk that occur in these habitats, there is some indication that fire is known to be or is likely beneficial to long-term habitat maintenance.

**Table 2. Bird species at risk known to nest in Ontario's tallgrass habitats**

| Common Name | Species Name | SARA | ESA | COSEWIC | Nesting Season | Considerations for Prescribed Fire in Species Recovery Strategy and/or Status Assessment |
|---|---|---|---|---|---|---|
| Bobolink | *Dolichonyx oryzivorus* | N/A | THR | THR | Egg laying begins last week of May, fledge dates are early to mid-July. | Likely to benefit from periodic fire (McCracken et al. 2013). |
| Eastern Meadowlark | *Sturnella magna* | N/A | THR | THR | Egg laying typically from mid-May to early June, last fledglings leave nest by early July. | Likely to benefit from periodic fire (McCracken et al. 2013). Anecdotal evidence suggests they do not prefer restored tallgrass prairie that uses warm-season grasses (M. Gartshore, pers. comm. 2023). |
| Eastern Whip-poor-will | *Antrostomus vociferus* | THR | THR | THR | Eggs laid between late May and early July, eggs hatch 19-21 days after. | Recovery Strategy indicates natural fires could create suitable habitat; however, no specific mention of prescribed fire (MECP 2019a). |
| Grasshopper Sparrow | *Ammodramus savannarum* | N/A | NA | SC | Nest in late May/early June and fledge nest mid-June to early July. | Prescribed burns generally have a positive effect on abundance; however, in Ontario more research is needed and burns are not explicitly recommended (COSEWIC 2013). |
| Henslow's Sparrow | *Ammodramus henslowii* | END | END | END | Nest in late May/early June and fledge nest mid-June to early July. | Prescribed burns are documented to be beneficial for habitat maintenance (Kraus 2015). However, this species prefers to nest in thatch which burning consumes so breeding may not occur for several years following a burn after thatch has had the opportunity to accumulate (W. Bakowsky, pers. comm. 2023). |

| Common Name | Species Name | SARA | ESA | COSEWIC | Nesting Season | Considerations for Prescribed Fire in Species Recovery Strategy and/or Status Assessment |
|---|---|---|---|---|---|---|
| Northern Bobwhite | *Colinus virginianus* | END | END | END | Nests with eggs have been found from late May through mid-September. | Prescribed burning is considered beneficial (Wyshynski 2019). |
| Red-headed Woodpecker | *Melanerpes erythrocephalus* | END | END | END | Nests from mid-May to mid-August. | Restoration of savannahs by fire appears to benefit Red-headed Woodpeckers (ECCC 2019). |
| Short-eared Owl | *Asio flammeus* | SC | SC | SC | Breeding begins in late March and may continue until late August. | Occasional burning outside of breeding period has been suggested to maintain suitable habitat (EC 2016). |

**END- Endangered; THR- Threatened; SC- Special Concern; N/A- Not listed on Schedule 1**

**Bobolink (*Dolichonyx oryzivorus*) nests in a variety of tallgrass habitats. *Photo: Daniel Riley***

### 4.1.3 MAMMALS

Large and medium-sized mammals (e.g., deer, larger rodents, etc.) are mobile and tend to flee areas when humans are present. Despite their ability to move/flee, fire may still pose a direct risk of injury or mortality to mammals in hibernation or very young, immobile mammals. The effect of prescribed fire and seasonality of prescribed burns on small mammal populations is generally poorly studied (Knapp et al. 2009). Small rodent species can be important food sources for at-risk birds and snakes and should therefore be considered during mitigation planning. The mobility and/or subterranean habitats of these species make it unlikely that prescribed fire would be a serious direct threat. Bat species at risk may utilize tree cavities for roosting that are present within a burn block; however, the roost habitat is typically not subject to fire unless rotting trees ignite.

Species at risk mammals known to live in Ontario's tallgrass habitats are summarized in Table 3 along with details on their current status, active season, and specific recommendations regarding prescribed fire that are described in the species' recovery strategy, management plans, and/or status assessment documents.

**Table 3. Mammal species at risk known to occur in Ontario's tallgrass habitats**

| Common Name | Species Name | SARA | ESA | COSEWIC | Active Season and Overwinter Strategy | Considerations for Prescribed Fire in Species Recovery Strategy and/or Status Assessment |
|---|---|---|---|---|---|---|
| American Badger | *Taxidea taxus* | END | END | END | Most active during spring to fall. Overwinters in underground dens, but will become active and forage during suitable weather. | Fire not specifically mentioned in recovery plan (OABRT 2010). |
| Eastern Mole | *Scalopus aquaticus* | SC | SC | SC | Active all year long, but is largely subterranean. | Fire not specifically mentioned in recovery plan (ECCC 2015a). |
| Little Brown Myotis | *Myotis lucifugus* | END | END | END | Active foraging and roosting April through to the end of September. | Fire not specifically mentioned in recovery plan (ECCC 2015b). |
| Northern Myotis | *Myotis septentrionalis* | END | END | END | | |
| Tri-colored Bat. | *Perimyotis subflavus* | END | END | END | | |

**END- Endangered; SC- Special Concern**

### 4.1.4 REPTILES AND AMPHIBIANS

There are no species at risk amphibians directly associated with tallgrass habitats in Ontario. In general, direct effects of fire are not expected to be a concern for amphibians that occupy moist habitats that are less flammable than the surrounding landscape (Knapp et al. 2009).

Species at risk reptiles, especially snakes, are often top of mind for land managers when conducting prescribed burns in tallgrass habitats. Several of Ontario's snake species at risk, as well as some populations of Five-lined Skink (*Plestiodon fasciatus*), are restricted to tallgrass habitat remnants (Seburn 2010). Many of these species take several years to reach reproductive age and are in decline due to ongoing habitat degradation, human persecution and road mortality. These factors make protection of all individuals in a population a high priority. Because they are cold blooded, during cool weather (approximately end of October to late winter/early spring) they are inactive and hibernating. During hibernation, or shortly after spring emergence, many species tend to congregate in small localized areas. Several studies have compared reptile populations after dormant and growing season prescribed burns and none have found a significant difference in numbers (Floyd et al. 2002; Keyser et al. 2004). This has been attributed to the mobility of the species, incomplete consumption of coarse woody debris and duff during the burns, the presence of moist micro-environments, tunnels and cracks that provide refugia, and the relatively quick recovery of vegetation after a burn (Renken 2006). Many of the relevant species recovery strategy documents make reference to prescribed fire being a direct threat. However, during the literature review and consultation to inform the development of this BMP document, the majority of reported mortalities of snake species at risk were associated with unsanctioned fires or unplanned prescribed burns of low to moderate intensity, suggesting that mitigation strategies (as further described in this report) can be effective at minimizing impacts. There has been mortality of species at risk snakes during past prescribed burning in the late 1970s and early 1980s that were large and high intensity (S. Marks pers. comm. 2022).

**The Eastern Hog-nosed Snake (*Heterodon platirhinos*) is a threatened species at risk that prefers sandy, well-drained habitats where they can lay their eggs and hibernate. Photo: Heather Fotherby**

Species at risk reptiles known to live in Ontario's tallgrass habitats are summarized in Table 4 along with details on their current status, active season, and specific recommendations regarding prescribed fire that are described in the species' recovery strategy, management plans, and/or status assessment documents. These species are generally active between April and October and are likely at the highest risk of direct impacts associated with prescribed fire during the spring emergence period before they disperse from hibernacula/overwintering locations.

**Table 4. Reptile species at risk known to occur in Ontario's tallgrass habitats**

| Common Name | Species Name | SARA | ESA | COSEWIC | Active Season and Overwintering Strategy | Considerations for Prescribed Fire in Species Recovery Strategy and/or Status Assessment |
|---|---|---|---|---|---|---|
| Gray Ratsnake | *Pantherophis spiloides* | END | END | END (Carolinian population), THR (Great Lakes/ St. Lawrence population) | Active from mid-April to mid-October. Hibernate communally underground. | Prescribed fires are not specifically recommended for this species as they generally live in woodlands, but will bask and forage in prairies. Prescribed fires should be timed appropriately however, as they can cause mortality (Kraus et al. 2010). |
| Blue Racer | *Coluber constrictor foxii* | END | END | END | Active from mid-April to mid-October. Mating occurs in May, eggs hatch mid-August to late September. Hibernates communally underground. | Prescribed fires should be timed properly (Willson and Cunnington 2015). |
| Eastern Foxsnake | *Pantherophis gloydi* | END | END | END | Active from mid-April to September/October. Hibernate communally underground. | No specific information on prescribed fires (Eastern Foxsnake Recovery Team. 2010). |
| Eastern Hog-nosed Snake | *Heterodon platirhinos* | THR | THR | THR | Active from April to as late as November. Hibernate communally underground in sandy areas. | Prescribed fires may help with habitat availability (Kraus 2011). |
| Five-lined Skink | *Plestiodon fasciatus* | END | END | END | Emerge in early May and can be active until early October. Hibernate in small groups in rock fissures, under woody debris, holes in substrate. | Fire suppression may have a negative effect on populations (Seburn 2010). |
| Massasauga Rattlesnake | *Sistrurus catenatus* | END | END | END | Active from April to October. Hibernate alone or in small groups underground. | Prescribed fires are likely beneficial for habitat maintenance and creating new habitat (OMNR 2016b). |

**END- Endangered; THR- Threatened**

### 4.1.5 INSECTS

Overall, how fire affects different groups of arthropods varies but burning is considered potentially the most detrimental if the timing coincides with a particularly vulnerable life history stage (Robbins and Myers 1992). When at-risk insects are a concern, it is often recommended that the objectives of burning focus on maximizing patchiness to provide refugia and allow recolonization of the burned areas (Kalisz and Powell 2000; Knight and Holt 2005). Fire suppression has been identified as directly contributing to the decline and/or the ultimate extirpation of several species at risk butterflies in Ontario (ECCC 2017a; Linton 2015). However, it has also been reported that recovery time after a fire for populations of tallgrass habitat-specialist butterflies can be as along as almost six years in terms of richness and four years in terms of abundance (Vogel et al. 2010). Although most insect species at risk are mobile, they often have small home ranges and more immobile juvenile life stages (e.g., larvae, pupae, egg). Many of these species are also highly dependent on early successional communities supporting one or a few specific host plants that have associations with fire disturbance. Recovery rates for different species can differ substantially, so research on species-specific responses should be examined when planning prescribed fires (Vogel et al. 2010).

Species at risk insects known to live in Ontario's tallgrass habitats are summarized in Table 5 along with details on their current status, active season, and specific recommendations regarding prescribed fire that are described in the species' recovery strategy, management plans, and/or status assessment documents. These species are active between April and October and are likely at the highest risk associated with prescribed fire during their juvenile life stages.

**The Mottled Duskywing (*Erynnis martialis*), Norther Barrens Tiger Beetle (*Cicindela patruela*) and Reversed Haploa larvae (*Haploa reversa*) are all habitat-specialist insects with limited mobility. *Photos (from left to right): Jessica Linton, Colin Jones, Tom Preney***

**Table 5. Insect species at risk known to occur in Ontario's tallgrass habitats**

| Common Name | Species Name | SARA | ESA | COSEWIC | Active Season | Considerations for Prescribed Fire in Species Recovery Strategy and/or Status Assessment |
|---|---|---|---|---|---|---|
| Aweme Borer Moth | *Papaipema aweme* | END | END | END | Larvae active from late May to early June/mid-July, then pupate for a month (in ground or inside host plant). Adults nocturnal, fly from mid-August to mid-September. | The host plant for this species is unknown; however, the recovery strategy acknowledges that prescribed burning may be required for its host (Jones 2015a). |
| Eastern Persius Duskywing | *Erynnis persius persius* | EXP | EXP | END | Adults fly May to early June. | Prescribed burning beneficial (COSSARO 2016). |
| False-foxglove Sun Moth | *Pyrrhia aurantiago* | END | END | END | Adults fly August to September. | Fire is beneficial for host plant (false foxgloves), but more research is needed to understand benefits to moth (COSEWIC 2018). |
| Frosted Elfin | *Callophrys irus* | EXP | EXP | EXP | Adults fly early May to mid-June. | Prescribed burning beneficial for habitat (COSEWIC 2000; ECCC 2017a). |
| Karner Blue | *Plebejus samuelis* | EXP | EXP | EXP | Two generations over the summer, adults live on average 5 days. | Prescribed burning beneficial for habitat (ECCC 2017a). |
| Mottled Duskywing | *Erynnis martialis* | NS | END | END | Adults fly from mid-May to late June, with a second brood on the wing from mid-July to late August in extreme southern Ontario. | Prescribed burning beneficial for habitat (Linton 2015). |
| Nine-spotted Lady Beetle | *Coccinella novemnotata* | NS | END | END | Adults most commonly encountered between late June and August. | Not restricted to tallgrass habitats. No specific information on prescribed fires (Linton and McCorquodale. 2018). |
| Northern Barrens Tiger Beetle | *Cicindela patruela* | NS | END | END | Adults active from April to September. | Maintain use of prescribed burning as a management tool to prevent succession of and to restore and maintain occupied and potential habitats; still not enough data on whether or |

| Common Name | Species Name | SARA | ESA | COSEWIC | Active Season | Considerations for Prescribed Fire in Species Recovery Strategy and/or Status Assessment |
|---|---|---|---|---|---|---|
| | | | | | | not prescribed burns are effective for the recovery of this species though (Farrell et al. 2011). |
| Reversed Haploa | *Haploa reversa* | N/A | NA | END | Adults fly from late June to late July and peak in mid-July. Eggs, larvae, and pupae present year round. | Burning which is too frequent, severe, extensive, or occurs outside the natural wildfire season may negatively affect Reversed Haploa Moth. Eggs, larvae and pupae are particularly vulnerable to fires due to their limited mobility (COSEWIC 2019a). |
| Rusty-patched Bumble Bee | *Bombus affinis* | NS | END | END | Queen emerges in Spring and workers will fly into October. | Prescribed burns have improved habitat (Colla and Taylor-Pindar 2011). |
| Transverse Lady Beetle | *Coccinella transversoguttata* | NS | END | SC | Active from Spring to Fall, two to three generations per year. | Not restricted to tallgrass habitats. No specific information on prescribed fires (Linton and McCorquodale. 2019) |
| Yellow-banded Bumble Bee | *Bombus terricola* | NS | SC | SC | Queen emerges in Spring and workers will fly into October. | Impacts of fire are unknown (COSEWIC 2015). |

**END- Endangered; THR- Threatened; SC- Special Concern; NA- Not Assessed**

### 4.1.6 GASTROPODS

Burning directly and indirectly affects survival of ground dwelling animals, including snails (Nekola 2002), by reducing and modifying organic substrates used as shelters, increasing soil evaporation and destroying the upper part of the soil and leaf litter habitat, which are important for the survival of litter-soil organisms (Bellido 1987; Knapp et al. 2009). Direct impacts from fire on snail populations are reduced when available habitat is widespread and recolonization from nearby areas is possible (Pivar et al. 2022). However, when habitat areas are small, large fires are considered detrimental to subpopulations (COSEWIC 2019b). It appears that the minerals on the soil surface that accumulate after burning are favorable for snail development (A. Nicolai pers. comm. 2022).

There are currently no species at risk gastropods in tallgrass habitats in Ontario, however there are in other habitat types subject to prescribed burning such as alvar on Pelee Island (Pivar et al. 2022).

## 4.2 IDENTIFYING GOALS AND OBJECTIVES

The most effective applications of prescribed fire require a solid understanding of the ecological characteristics of a site, particularly those that pertain to the ecology of fire (Tegler 2003). Prescribed fire is an environmental management strategy used to either *restore* or *maintain* fire dependent ecosystems. These two prescribed fire strategies are defined below.

**Restoration burns** refer to the re-introduction of prescribed fire in environments where it is has been excluded for a long period of time (e.g. greater than 10 years) (Tegler 2003). These types of burns occur at sites with at least some remnant prairie indicator species and usually require multiple burns to bring back the prairie naturally. These types of sites have a high component of woody vegetation and other non-native vegetation such as cool season grasses that have established in the absence of fire (J. Chapman pers. comm. 2022). Wildlife that are associated with native tallgrass habitats are typically absent or present in small numbers (J. Chapman pers. comm. 2022). Restoration is often characterized by pre-engineering activities to prepare a site for the re-introduction of fire and special fire management methods related to the timing, frequency and intensity of prescribed fires (Tegler 2003).

**Maintenance burns** refers to the use of fire at sites dominated by tallgrass indicator species and little to no invasion of woody vegetation or other non-native vegetation (J. Chapman pers. comm. 2022). Usually, high numbers of wildlife that are associated with native tallgrass habitats are present. Maintenance refers to the regular application of prescribed fire using methods (pre-engineering, timing, frequency, intensity) tailored to a site necessary for the long-term health and integrity of the ecosystem (Tegler 2003).

The goal of a prescribed fire should describe the purpose for a program and identify the ideal habitat condition, which does not necessarily have to be achieved (Tegler 2003). Objectives, should also be outlined which are measurable and achievable and provide a method of evaluating the success of a program. Typically, the most common objectives of prescribed burns in Ontario are to reduce encroachment of woody vegetation, blacken the soil surface to promote the growth of prairie plants, and/or to kill fire-intolerant cold-season grasses and invasive plants that are directly competing with native tallgrass species.

## 4.3 PLANNING A PRESCRIBED BURN

After identifying an overall goal and specific objectives, a comprehensive burn plan is required. Before conducting a prescribed burn, careful planning is necessary and qualified fire management technical staff should be involved throughout the planning process (Tegler 2003). Safety is the central focus when planning all prescribed burn operations. The MNRF Prescribed Burn Manual (2019) provides direction for development of burn plans in Ontario and a complexity key to inform the a burn plan. The complexity key considers the anticipated duration of the burn, burn objectives, project size, resource requirements, ignition type, potential for social disruption, negative environmental values, and potential for fire escape. This determines whether a burn project is classified as high or low complexity. In the tallgrass habitats of southern Ontario today, all prescribed burns being implemented are low complexity. This is primarily due to a lack of trained individuals and resources available to execute high complexity burns (A. MacKenzie pers. comm. 2022). The Tallgrass Prairie and Savannah Prescribed Fire Decision Support System is distributed at no charge by MNRF[4].

The prescribed burn plan is as a communication tool for all of those involved in the planning and execution of a controlled burn. Species at risk should be a consideration at the early planning stages of burn plan development and may be based on known occurrences at the site or the potential for occurrences based on habitat suitability and/or historical records. A screening exercise should be undertaken that identifies what species at risk are known to occur at a proposed prescribed burn site or have the potential (low, medium or high) to occur (Appendix I). Appendix I also provides a list of recommended resources to consider when screening an area for species at risk. Specific mitigation strategies should then be included in the development of the burn plan (see Section 5). The Fire Effects Information System (https://www.feis-crs.org/feis/) is a valuable resource for species-specific information. Consultation with individuals with extensive knowledge of the local flora and fauna is important. Experts may include local First Nation Community members, local naturalists, staff of the Natural Heritage Information Centre, or ecologists with experience working in the area. These experts should be asked to provide any information for a given site as it relates to the occurrence of extant or historic species at risk populations.

Executing a prescribed burn within the prescriptions laid out in an approved burn plan generally only provides for a very narrow window of opportunity. Balancing negative smoke impacts, weather, protected values (including species at risk) and fire intensity can be a challenge (J. Chapman pers. comm. 2022, B. Burnett pers. comm. 2022). Usually, one or more of these considerations will conflict

[4] A CD with a copy of the software may be obtained by contacting Dave Heaman, Fire Science and Planning Specialist with the Ontario Ministry of Natural Resources (dave.heaman@mnr.gov.on.ca) or Brent Tegler, the developer of the software with North-South Environmental Inc. (btegler@nsenvironmental.com).

with the other, and sacrifices and risk need to be examined. When multiple species at risk occur in an area, the appropriate fire regime for one species may conflict with another. In these situations, managers should first prioritize their objectives and, if a conflict still exists, follow recommendations for fire frequency over those for fire intensity or seasonality (Harper et al. 2016).

### 4.2.1 TIMING OF BURNS

The time of year selected to conduct a prescribed burn will depend on several factors, including ecological considerations and burn objectives, and will influence the intensity and the behaviour of the fire because of weather and fuel conditions (Tegler 2013). This in turn has implications for the ecological effect of fire on plants and animals (Tegler 2013). In southern Ontario, most prescribed burns are conducted in mid-March to late April; further north, the spring burn window may range from late April to mid-May. Prescribed burns that occur during this period are effective at controlling fire-intolerant woody species and many non-native species including cool season forage grasses, prior to the emergence of native vegetation and dormant wildlife (Tallgrass Ontario 2012). The timing of funding allocations can be severely limiting for practitioners. Proposal calls for conservation funds are often released in the fall and decisions are not announced until after the spring window for prescribed burning. This limits opportunities for using these funds unless multi-year projects/restoration work is an option.

The outcomes of a prescribed burn can vary greatly based on timing and each season presents benefits and challenges to burning as summarized in Table 6. Spring burning is effective at blackening the soil, removing thatch and therefore increasing soil temperature which and assists in the establishment of native prairie plants. Typically, however the encroachment or establishment of woody vegetation is the determining factor that dictates the time of year when a burn is required in a tallgrass habitat and burning later in the summer, after leaf-out, is most effective for eliminating problematic woody shrubs (J. Chapman pers. comm. 2022). The impact of fire on woody vegetation is highest when the buds are starting to burst or when the buds have flushed. Burning prior to bud emergence will not have a high impact on woody vegetation as it will only top-kill plants (J. Chapman pers. comm. 2022). It should be noted that fuel accumulation under woody shrubs can be problematic (W. Bacosky, pers. comm. 2023). In general however, spring prescribed burns are most effective for habitat maintenance and usually impact the least number of wildlife groups. Summer and early fall burns are more effective at achieving restoration goals, especially when woody vegetation encroachment is a key factor to consider. Burning a site in the spring across multiple successive years may also achieve the same result (J. Chapman pers. comm. 2022; R. Odolczyk pers. comm. 2022).

**Table 6. Benefits and challenges to prescribed burning in different seasons**

| Season | Benefits | Challenges |
|---|---|---|
| **Spring**<br>(before or just at leaf out) | • lower risk to reptiles, amphibians, and birds<br>• grasses are dormant and serve as good fuel<br>• leaf litter burned off allowing sunlight to penetrate ground<br>• vegetation regenerates quickly<br>• burning close to spring green-up improves forage quality<br>• controls cool-season grasses<br>• favours growth of grasses | • narrow burn prescription windows<br>• less effective at eliminating woody vegetation |
| **Summer**<br>(active growing season) | • killing woody vegetation often most effective<br>• growing season burns can be important for some plants to regenerate<br>• favours wildflower growth | • relative humidity often too high for burning<br>• greened vegetation makes burning challenging and produces more smoke<br>• greater risk to active reptiles, terrestrial amphibians, and nesting birds |
| **Fall**<br>(dormancy beginning, plants putting resources to roots) | • controls warm season grasses<br>• killing woody vegetation often still effective early in season<br>• adds vital nutrients to the soil and blackens soil to promote spring germination<br>• favours wildflower growth | • weather conditions (wind/humidity) tend to be less stable<br>• small burn prescription windows |
| **Winter**<br>(plants are dormant) | • lowest risk to most wildlife<br>• if aligns with objectives- generally results in patchy burn pattern | • soil will remain blackened until spring which may promote erosion during spring runoff<br>• snow cover/ground moisture dampen fuels<br>• if does not align with objectives- generally results in patchy burn pattern |

### 4.2.2 FREQUENCY OF BURNS

Fire frequency is generally regarded as the most influential factor related to fire effects at local and landscape scales (Frost 1998; Nowacki and Abrams 2008). The frequency of prescribed burns (the fire-return interval) depends on the target community type and the degree to which invasive woody vegetation and non-native species have colonized a site. The frequency of burns needs to reflect the site goals which often includes the restoration or maintenance of species at risk habitat. Newly created tallgrass prairie can be burned annually for the first several years once sufficient fuel has accumulated. Established prairies can be maintained with a fire-return interval of 5-7 years, savannas require fire every 10-15 years, and woodland communities benefit from fire periodically at intervals of 15 years or more (Tallgrass Ontario 2012). In some areas of southwestern Ontario, where woody growth is more rampant due to precipitation, humidity, and/or perched water tables, it may be better to burn more frequently (e.g. every 3 years for prairie and every 5-7 years for savanna) (A. Woodliffe, pers. comm. 2023).

Fire-return interval should also be carefully considered for species at risk habitats. Different taxonomic groups and individual species may respond differently (either positively or negatively) to the frequency of fire.

### 4.2.3 FIRE INTENSITY AND BEVAVIOUR

The factors that will influence the intensity and behaviour of a prescribed fire include:

- Weather;
- Fuel load and moisture;
- Wind speed and direction;
- Topography and the ignition pattern.

Fire intensity is the amount of heat released from the fire, with the length of the flame being the greatest visual indicator of intensity (MNR 2017). The specific parameters for prescribed burn prescriptions will be determined on a site-by-site basis; however, there are considerations for species at risk when it comes to fire intensity and behaviour. Providing escape routes and refugia areas can be important considerations during the planning phase and are often influenced by the ignition pattern of a prescribed fire (Table 7).

**Table 7. Ignition Pattern Considerations for Species at Risk**

| Ignition Pattern | Pros | Cons |
|---|---|---|
| Back Burn[1] | • typically spreads very slowly and provides maximum opportunity for wildlife in the burn area to flee<br>• burns longer and deeper which may have greater impacts on immobile species/seeds at, or just beneath the soil surface | • dangerous if the wind changes suddenly and adequate burn breaks (control lines) are not in place<br>• requires a high fuel load to carry out the burn. |
| Head Fire[2] | • more opportunities for refugia in damp areas or areas with little fuel to be left untouched<br>• If intensity is high enough (cambium of woody stems must be 160°C to kill a tree/shrub) may kill desirable plants unintentionally<br>• burns shallow which may be better for immobile species/seeds at, or just beneath the soil surface | • may move through an area too quickly, not consuming desired fuels or allowing wildlife to flee. |
| Flank Fire[3] | • produces a more medium intensity burn with some opportunities for wildlife to flee<br>• depending on prescriptions, may not be intense enough to kill desirable woody species | • depending on prescriptions and site objectives, may not be intense enough to kill problematic trees or woody vegetation |
| Perimeter Fire[4] | • often used to maximize safety and consumption of fuels in a burn area (all four sides are ignited and burn toward the middle) | • does not provide opportunities for wildlife to escape a burn area |

[1]Ignition line set to burn/spread against the wind

[2]Ignition line set to burn/spread with the wind

[3]Ignition line set along control line parallel to the wind

[4]Ignition lines set along all sides of a burn area

**Head fire ignition at Pinery Provincial Park. *Photo: Alistair MacKenzie***

### 4.2.4 PERMITTING AND AUTHORIZATIONS

Depending on who is involved in planning and implementing a prescribed burn and where and when a burn is being done, there are a number of permit and authorization considerations related to wildlife and species at risk (Table 8). Notwithstanding these considerations, the local fire authority must be contacted to determine their requirements in Ontario (MNRF 2019).

A prescribed burn is an activity that has the potential to adversely impact species at risk. Certain species at risk in Ontario, and their habitat, are protected by the *Endangered Species Act, 2007* (ESA) through listing on the Species at Risk in Ontario (SARO) List under Ontario Regulation 230/08. The ESA has two key protection provisions that apply to species on the SARO List:

- Section 9 (https://www.ontario.ca/laws/statute/07e06#BK14) prohibits the following for species listed as extirpated, endangered, or threatened on the SARO List: killing, harming, harassing, capturing, or taking live members of a species; and possessing, transporting, collecting, buying, selling, leasing, trading or offering to do any of these things for any member of a species whether dead or alive.

- Section 10 (https://www.ontario.ca/laws/statute/07e06#BK15) prohibits the damage or destruction of the habitat of species listed as extirpated, endangered or threatened on the SARO List.

The persons proposing to carry out a prescribed burn are responsible to determine if the activity will have adverse impacts on SAR and/or SAR habitat that is protected under the ESA and will contravene either of the two ESA prohibitions noted above. Proponents are expected to complete an appropriate level of site assessment by a qualified professional to determine the presence of SAR and/or their habitats and whether they will be adversely impacted by the proposed prescribed burns. Where the activities have unavoidable impacts to SAR and/or their habitat in a manner that would contravene sections 9 or 10 of the ESA, the persons responsible can seek a permit or agreement under the ESA or use an applicable conditional exemption. Please refer to Species at risk | ontario.ca for more information about SAR, the ESA and options for permits, agreements and conditional exemptions.

To register the activity; file a Notice of Activity (NoA), there are requirements to develop a mitigation plan, minimize adverse impacts to species at risk, and monitor the outcome of the work. If a prescribed burn is authorized under Section 23.11, Section 9 (protection of individuals) also does not apply. This provision ensures that if there is an accidental mortality of an individual species at risk while carrying out ecosystem protection work, while mitigating to the greatest extent possible, the practitioner(s) are legally protected from prosecution under the ESA. There may still be scenarios in which this exemption would not apply and a permit or authorization from the Minister is required to

conduct a prescribed burn in species at risk habitat (e.g., activities are proposed in an exempt habitat type, mitigation requires transporting species at risk, etc.). If you are unsure if your project is eligible for registration under Section 23.11, contact the MECP in the early stages of planning to determine if an ESA permit is required.

**Table 8. Relevant Legislation and Legal Requirements for Conducting Prescribed Burns in Species at Risk Habitat*.**

| Relevant Legislation | Administering Agency | Authorization Type(s) | Activities that apply | Activities that do not apply | Resources |
|---|---|---|---|---|---|
| **Provincial** | | | | | |
| *Endangered Species Act* | Ministry of the Environment, Conservation and Parks | • Notice of Activity Filing: s. 23.11 O. Reg. 242/08 - Ecosystem Protection | • Prescribed burns with the purpose of protecting, maintaining, enhancing or restoring an ecosystem native to Ontario, if carried out by:<br>• a conservation authority<br>• a municipality.<br>• the Ministry.<br>• a band as defined in the *Indian Act*<br>• A post-secondary institution<br>• a Not-for-Profit, registered charity, or trustee of a charitable foundation if the corporation has among its primary objectives: natural heritage conservation, ecological conservation or a similar objective | • Prescribed burns that do not have ecosystem protection has their primary objective<br>• Prescribed burns in a fen, bog, sand barren or dune, beach bar, alvar, cliff, or talus<br>• In some circumstances, possession or transport of a species at risk as part of a burn plan | Section 23.11 of On. Reg. 242/08 https://www.ontario.ca/laws/regulation/080242#BK35<br><br>Information on how to file a Notice of Activity: https://www.ontario.ca/page/natural-resources-registration-guide#section-2<br><br>Contact ESAReg@ontario.ca to discuss eligibility |

| Relevant Legislation | Administering Agency | Authorization Type(s) | Activities that apply | Activities that do not apply | Resources |
|---|---|---|---|---|---|
| *Endangered Species Act* | Ministry of the Environment, Conservation and Parks | • Stewardship Agreement (if the specific purpose of the prescribed burn is to assist in the protection or recovery of the species) | • Prescribed burns in a fen, bog, sand barren or dune, beach bar, alvar, cliff, or talus<br>• Prescribed burns carried out by a person or entity not described in s. 23.11(1) of O. Reg. 242/08 (see above)<br>• In some circumstances, possession or transport of a species as part of a prescribed burn | • S 17.1 O. Reg. 242/08 – Stewardship Activities. Certain activities carried out as part of a stewardship activity funded by the Species at Risk in Ontario Stewardship Program (as outlined in the final Transfer Payment Agreement) do not require authorization under the ESA to kill, harm, harass, capture, take, possess, collect, or transport a member of the species that is the subject of the stewardship activity, or damage or destroy its habitat, provided that the conditions are met.<br>• There are a number of restrictions to this exemption (e.g it can only apply to species to which the activities have been funded. Any other species impacted will require proper authorization). | Information on Stewardship Program exemption under 17.1:<br>https://www.ontario.ca/laws/regulation/0802425<br><br>Visit:<br>https://www.ontario.ca/page/how-get-endangered-species-act-permit-or-authorization |

| Relevant Legislation | Administering Agency | Authorization Type(s) | Activities that apply | Activities that do not apply | Resources |
|---|---|---|---|---|---|
| *Endangered Species Act* | Ministry of the Environment, Conservation and Parks | • Permit (if the specific purpose of the prescribed burn is *not* to assist in the protection or recovery of the species) | • Prescribed burns in a fen, bog, sand barren or dune, beach bar, alvar, cliff, or talus<br>• Prescribed burns carried out by a person or entity not described in s. 23.11(1) of O. Reg. 242/08 (see above)<br>• In some circumstances, possession or transport of a species as part of a prescribed burn | • Activities that would otherwise be except under s. 23.11(1) of O. Reg. 242/08 or can be achieved through a Stewardship Agreement | Contact the MECP at SAROntario@ontario.ca to discuss your specific project and applicable SAR species<br><br>Sections 16-20 of the ESA: https://www.ontario.ca/laws/statute/07e06#BK14 |
| *Fish and Wildlife Conservation Act* | Ministry of Northern Development, Mines, Natural Resources and Forestry | • Wildlife Scientific Collector's Authorization (WSCA) | • Typically, activities that involve capture of any kind require a WSCA | • WSCA are not required for Crown (MNRF/MECP) employees in the execution of their duties. However, this does not apply if they are volunteering in an unofficial capacity. | Contact the applicable MNRF district office of the jurisdiction in which the prescribed burn will occur to determine if a WSCA is required for the activities proposed: https://www.ontario.ca/page/ministry-natural-resources-and-forestry-regional-and-district-offices |
| | | • Approved Wildlife Animal Care Protocol | • Trapping wildlife prior to a prescribed burn | • Hand-capture and immediate relocation to a refuge area prior to a prescribed burn | Animal care protocols are reviewed and approved by the MNRS's Wildlife Monitoring and Research Branch (https://www.infogo.gov.on.ca/infogo/#orgProfile/1313/en) |

| Relevant Legislation | Administering Agency | Authorization Type(s) | Activities that apply | Activities that do not apply | Resources |
|---|---|---|---|---|---|
| | | | • Keeping wildlife in captivity for any period of time | | |
| **Federal** | | | | | |
| *Migratory Birds Convention Act* | Canadian Wildlife Service (Environment and Climate Change Canada) | • Since prescribed burns themselves are not prohibited under the MBCA, and any harm to migratory birds would be incidental, a permit would likely not be possible. | • Harm to migratory birds<br>• Disturbance or damage to migratory bird nests or eggs | • Conducting a prescribed burn | MBCA: https://laws-lois.justice.gc.ca/eng/acts/m-7.01/<br><br>Associated Regulations: https://laws.justice.gc.ca/eng/regulations/SOR-2022-105/index.html#docCont. Note: Schedule 1 of MBR 2022 provides year-round nest protection for 18 species.<br><br>If burns must occur during the breeding season then thorough sweeps must be conducted to check for breeding birds in the area. If breeding/nesting birds are seen, activities should cease and proper buffer zones must be implemented (information on buffer zones can be found at the links above). |
| *Species at Risk Act* | Canadian Wildlife Service (Environment and Climate Change Canada) | • Permit<br>• Exemption<br>• Agreement | • Activities that may affect species listed on Schedule 1 of SARA, as extirpated, endangered, or threatened and which contravene the | • Activities that do not affect species listed on Schedule 1 of SARA.<br>• Activities on private or provincial lands where SARA does not apply | Critical habitat is identified in species' Recovery Strategies, which are available on the public registry: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html |

| Relevant Legislation | Administering Agency | Authorization Type(s) | Activities that apply | Activities that do not apply | Resources |
|---|---|---|---|---|---|
| | | | Act's general or criti cal habitat prohibitions.<br><br>• Under SARA, prohibitions regarding individuals and residences for migratory birds and aquatic species at risk apply wherever they occur in Canada. For terrestrial species at risk, these prohibitions apply on federal lands. | • Activities that have been authorized through other means (e.g. EA process). | More detail on responsibilities under SARA can be found here: https://www.canada.ca/en/environment-climate-change/services/species-risk-education-centre/your-responsibility/your-responsability-guide.html |
| Impact Assessment Act | Impact Assessment Agency (IAA) of Canada | • IAA Approval | • Prescribed Burn Plan for federally regulated parks. | Activities determined not likely to cause significant adverse environmental effects | Guide to the Parks Canada Process under the Impact Assessment Act: https://parks.canada.ca/nature/eie-eia/processus-process/projet-project/itm1b-2 |

*This table provides a high-level overview of relevant legislation but these must be read and understood in their entirety using the resources provided. Individuals and organizations conducting prescribed burns are responsible for ensuring compliance with relevant legislation.

# 5.0 AVOIDING AND MINIMIZING ADVERSE EFFECTS TO SPECIES AT RISK

## 5.1 SITE PREPARATION

A large proportion of the work involved with conducting a safe, effective prescribed burn occurs in the planning stages. Planning a prescribed burn should typically be initiated months in advance of the desire burn date(s) to provide adequate time for expert consultation, receipt of applicable permits/authorizations, a thorough species at risk screening, a well thought out burn plan, and proper site preparation. The following recommendations for species at risk and their habitats should be considered during site preparation:

- Sensitive species at risk habitats should not be burned in their entirety during any given year, but divided into manageable sections on a rotating basis. In general, a standard rule of thumb is that no more than ¼ of a habitat should be burned at a time to ensure adequate refugia for wildlife and to protect populations at a high level of risk from stochastic events (e.g., small insect or plant populations);

- All equipment used should be cleaned in accordance with the Clean Equipment Protocol for Industry (Halloran et al. 2013) prior to entering the area to reduce the spread of invasive species;

- Avoid creating burn breaks through areas with species at risk plants or known habitat features of importance;

- Where species at risk plants or important habitat features occur in close proximity to burn breaks, demarcate these in the field and advise workers/burn crew of their location and significance. Do this during the growing season to ensure individuals are not overlooked;

- If possible, prepare burn breaks with equipment between November 30 and March 1 when reptiles are inactive, open country birds are not breeding, and insects and plants are dormant. If burn breaks must be prepared outside this timing window, conduct pre-mowing/cutting wildlife sweeps to relocate wildlife (e.g., snakes) or identify unforeseen areas for avoidance (e.g., active bird nests);

- Prior to the burn, remove fuels from sensitive areas or microhabitats you wish to preserve (e.g., hollowed out trees, area around sensitive plant species at risk, etc.). This can be done using rakes, leaf blowers, etc.;

- If there are high-value areas/features within a burn block, consider running sprinklers for 12-24 hours leading up to the burn, if possible.

## 5.2 PLANTS, MOSSES, AND LICHENS

To mitigate impacts to plant, mosses and/or lichen species at risk within the burn area the following mitigation strategies are recommended prior to burn ignition:

- Demarcate plants in the field using flagging tape affixed high above the surface of the ground for visibility and advise the burn crew of their location and significance;
- Remove fuels from 1-2 metres around the base of plants including woody debris and accumulated leaf litter;
- Wet down areas around the plants, and the plants themselves, with water using a backpack pump or pump hose; and
- To ensure compliance with the ESA in some instances, translocation may be required (see Section 23.11(12) of Ontario Regulation 24/08.

## 5.3 BIRDS

The most effective way to mitigate impacts to bird species at risk is burning outside of the breeding and nesting season. However, even when implementing timing windows, there is always the potential for early/late migrants or early nesting species to be present. Many raptors nest in the winter months as well. To mitigate impacts to bird species at risk when the burn plan is scheduled to occur within the breeding bird window, the following mitigation strategies are recommended prior to burn ignition:

- During the active breeding season, the area should be surveyed and swept by a qualified biologist to flush out birds that may be present among the vegetation;
- Early morning surveys should be carried out prior to the burn date to identify any evidence of nesting. If signs of nesting or breeding are detected, Environment and Climate Change Canada (ECCC) recommends:
    - halting all disruptive activities,
    - avoidance of disturbing surrounding vegetation,
    - protecting the nest with a buffer zone,
    - avoiding the immediate area until the young have left the vicinity of the nest, and
    - avoiding, adapting, rescheduling or relocating planned activities.
- Additional information on avoiding harm to migratory birds is available on ECCC's website[5]. Specifically, the following pages provide useful information:
    - Published general nesting periods[6] support planning activities;

[5] https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/reduce-risk-migratory-birds.html#toc3

[6] https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods.html

- The nesting calendar query tool[7]; and,
- Technical information for how to determine the presence of a nest[8].

## 5.4 MAMMALS

Mammals tend to be highly mobile and often have a flee response when humans are present. Many mammals in the rodent or weasel families also can escape or hide underground. To mitigate impacts to mammal species at risk within the burn area, the following mitigation strategies are recommended prior to burn ignition:

- Conduct a thorough search prior to the burn of any habitat features that may be used by mammal species at risk (e.g., dens, cavity trees, etc.);
- If a den location is discovered that could be used by a species at risk, this area should be excluded from the burn area or surveyed to determine use.
    - During the very early spring, winter, and late fall, burrowing mammals are likely to be less active and/or in a state of hibernation or torpor.
    - During the late spring, summer and early fall, it may be possible to flush mammals from the area temporarily while the burn occurs or, subject to appropriate permitting, temporarily capture and hold mammals.
    - If the den is active, the MECP should be contacted to determine if the burn should proceed.
- If a potential roost site for bat species at risk is found in the burn area (i.e., Oak tree with cavity), this feature should be excluded from the burn between April 1 and September 30 or surveyed to determine use (MECP 2022);
- Hibernacula for Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), and Tri-colored Bat (*Perimyotis subflavus*) are very unlikely to occur in proposed tallgrass burn areas (generally underground openings, including caves, abandoned mines, wells, and tunnels), therefore conducting burns around potential summer roosting habitats between November 1 and March 31 is considered sufficient mitigation. The ignition of dead standing or hollow trees (chicots) often results in a prolonged 'mop-up[9]' period following

[7] https://naturecounts.ca/apps/rnest/index.jsp. Note that some species breed very early in the spring or later in the fall.

[8] https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/reduce-risk-migratory-birds.html#toc3

[9] 'mop-up' refers to physical labour to **extinguish "hot-spots" and residual flames where needed.**

the burn and as a result, most burn bosses[10] will aim to avoid these trees through preparation activities prior to ignition;

- Habitat features can be protected by removing fuels from the area and wetting down the area.

## 5.4 REPTILES

When it comes to planning a prescribed burn, reptiles, in particular snakes, tend to be the species at risk prioritized for mitigation. They often will take cover among vegetation or under other objects instead of fleeing an area when there is a threat. Because they are ectothermic, they are also inactive during cool, overcast, and/or rainy weather. Most prescribed burns are planned in early spring before emergence from hibernation sites; however, even in early spring (April/May) snakes are likely to come out of their hibernacula for brief periods of time to bask on sunny days. Conducting low-intensity, slow, patchy burns is an effective way to reduce risk to snakes if this approach aligns with the burn objectives.

To mitigate impacts to reptile species at risk within the burn area, the following mitigation strategies are recommended prior to burn ignition:

- An experienced biologist should conduct a thorough review of the burn area immediately prior to the burn to locate any reptiles or any habitat features that may be used by resptile species at risk (e.g., decaying logs or other cover objects, rocky areas, potential or known hibernacula, etc.);
- Snakes found within the burn area should be carefully captured by an experienced biologist and relocated outside the burn breaks or held temporarily in accordance with an approved Animal Care Protocol;
- Biologists should remain on site during the burn in case additional snakes are located and need to be moved.

## 5.5 INSECTS

The majority of species at risk insects occupy their habitats year round. Many tallgrass habitat specialists have specific plant associations, small population sizes, and geographically isolated home ranges. Many species, like butterflies, have immobile life stages and/or overwinter at or just below the ground surface. Because flushing, wildlife sweeps, and relocations are not possible for insects, mitigation measures should focus on identifying and protecting important habitat features. To mitigate impacts to insect species at risk within the burn area, the following mitigation strategies are recommended prior to burn ignition:

[10] The person responsible for supervising a prescribed burn from ignition to mop-up (MNRF 2019).

- Conduct targeted survey work to define the known range of species within an area. This could be inferred from habitat characteristics in some cases (e.g., a host-specific butterfly that spends its entire lifecycle in association with that plant);
- Ensure that the burn area does not overlap with more than 25% of the known area occupied by the species (or at all for very rare or restricted species);
- Focus on burning nearby overgrown habitats that they can spread into in due course.
- If important refugia or microhabitat areas are identified that should be protected, remove fuels from 1-2 metres around these areas and wet them down with water;
- Considerations for ignition pattern and fire-return-interval may be particularly important for insects. Patchy burns that leave abundant refugia (at least 50% of area, M.Gartshore, pers. comm. 2023) are more desirable for protecting small insect populations.
- Rotating burn areas, keeping them small in size, and extending the fire-return-interval to at least 5 years is a cautious approach;
- Some very small tallgrass sites harbour small numbers of significant insects or entire populations of a species and should not be burned at all. Management of these sites should rely on alternative methods (see Section 5.7).

## 5.6 GASTROPODS

Similar to insects, gastropods like snails and slugs occupy their habitats year round and have small population sizes and geographically isolated home ranges. Mitigation measures should also focus on identifying and protecting important habitat features. To mitigate impacts to gastropod species at risk within the burn area the following mitigation strategies are recommended prior to burn ignition:

- Conduct targeted survey work to define the known range of species within an area. Ensure that the burn area does not overlap with more than 25% of the known area occupied by the species;
- If possible, burn when temperatures are cold and gastropods are in hibernation;
- If important refugia or microhabitat areas are identified that should be protected, remove fuels from 1-2 metres around these areas.
    - Do NOT wet these areas down with water which may cause increased activity and emergence from sheltered areas (A. Nicolai pers. comm. 2022).
- Considerations for fire-return-interval may be particularly important for gastropods. Patchy burns that leave abundant refugia are more desirable for protecting populations (A. Nicolai pers. comm. 2022);

- Rotating burn areas, keeping them small in size, and extending the fire-return-interval to at least 3 years is a cautious approach (A. Nicolai pers. comm. 2022);
- Temporary capture and release may be an effective approach if there is confidence in being able to release individuals back to suitable habitat patches after a burn.

## 5.6 PRESCRIBED BURN ALTERNATIVES

If there are a high number of sensitive species at risk and other values to protect from the threats associated with fire, other methods for maintaining or restoring habitat should be considered. The following alternative approaches are recommended in these cases:

- Fire intolerant trees and shrubs that occur within sensitive areas may be controlled using mechanical means (chainsaws, brush saws) or chemical means (herbicide application). In many cases (e.g Common Buckthorn), mechanical cutting should be followed up with herbicide application, as the cut stems will resprout. Large accumulations of woody material should be bucked-up or chipped and removed from the site;

- The harvest of fire intolerant tree species as part of a timber harvest operation can help to restore semi-open canopy conditions and may promote the growth of fine fuels and Oak saplings which will facilitate future prescribed burns;

- The open structure of tallgrass prairie can be maintained by mowing the site with a bushhog mower during the dormant season. Similar to the protocols for creating burn breaks, any equipment used should adhere to The Clean Equipment Protocol for Industry (Halloran et al. 2013). This should be planned carefully and executed with extreme consideration for invasive species introduction.

## 5.7 POST-BURN ASSESSMENT

### SHORT-TERM MONITORING

Conducting targeted species at risk surveys prior to a burn can provide useful data to inform burn planning such as presence/absence, area of occupancy and/or territory size, and estimates of abundance. The methods employed will vary based on resources and the target species; however, the most important consideration is that the surveys provide useful data to inform mitigation strategies and are repeatable. Ideally, the same surveys should be repeated following the implementation of a prescribed burn.

Conducting assessments after a fire is critical to understanding if the burn objectives were achieved and if there were any unintended impacts to species at risk or their habitats. An initial assessment should be conducted immediately after the burn, but if time and resources allow, also after vegetation has re-established. In general, there is a lack of post-burn standardized monitoring or assessments in Ontario. The following are recommended for consideration when completing post-burn assessments:

- The details of the burn (location/extent, who was involved, when the burn occurred, weather, etc.);
- Description of how the objectives of the burn were met (or not met);
- Description of any unanticipated impacts to species at risk or their habitats and/or lessons learned;
- An indication of whether mitigation measures implemented were effective;
- Identification of additional management (fire or other) needs;
- Recommendations on what to do differently next time.

In cases where there is Sweet White Clover, a site visit 7-10 days after the burn is required, as seedlings of this species will spring up by the thousands. A light application of herbicides will remove this generation from the site, especially if they are only at the cotyledon stage[11] (W. Bacowsky, pers. comm. 2023).

## LONG-TERM MONITORING

Historically, there has been a general lack of systematic, long-term monitoring data related to prescribed burning in Ontario. This is mainly due to limited funding and resource constraints and often the successful completion of a burn can be challenging in itself. Increasingly though, there are some excellent examples of projects focused on long-term monitoring of species at risk and their habitats and their response to prescribed burning. This includes projects on Pelee Island (S. Sukumar, pers. comm. 2022**),** in the Long Point Walsingham Forest Priority Place (NRSI 2021), and at Alderville Black Oak Savanna (R. Norris pers. comm. 2022). NRSI has developed pre-post burn standardized survey methods for pollinating insects, breeding birds, and vegetation communities (NRSI 2021). There are also many examples in the United States of long-term studies.

Land managers are encouraged to design and implement long-term monitoring programs to complement their prescribed burn programs whenever possible. Ideally this would include more than one year of pre-burn data collection and multiple years of post-burn data collection. Again, the approach to surveying will differ based on the habitat objectives, the species at risk being considered, and the resources available, but the most important thing is to ensure the program is set up in a way that is systematic, repeatable, and comparable from year to year. This data collection will not only fill in important knowledge gaps identified in species at risk recovery strategies, it will directly inform our understanding of mitigation strategies and their effectiveness.

[11] first visible signs a plant has germinated

# 6.0 OTHER CONSIDERATIONS FOR IMPLEMENTATION

## 6.1 HUMAN SAFETY

Safety is a central focus of the RX100 Low Complexity Prescribed Burn Worker training (MNR 2017) and will form an important part of any prescribed burn plan. Fire is not the only danger to consider when conducting a prescribed burn. There are many more considerations such as smoke inhalation, working in areas with specific risks like Lyme disease, toxic plants, or dangerous wildlife, heat stroke or exhaustion, dehydration and lifting heavy equipment. Ensure you are familiar with the individual safety procedures developed for each and every burn you participate in and that the burn boss goes over these with all participants.

## 6.2 LANDOWNER AND PUBLIC OUTREACH

Conducting community outreach prior to executing a burn can contribute significantly to its overall success (B. Burnett, pers. comm. 2022). Generally, when the public is educated and aware of activities like prescribed fire, they are less likely to take issue with it. In this regard, it is considered best practice to:

- Communicate directly with landowners living near areas that will be burned. If possible, establish a good relationship with these individuals and take time to answer their questions;
- Develop outreach materials that describe the purpose and benefits of burning in language that is easily understood by a lay audience. Ensure that specific information about protecting values is included;
- Communicate the intent to burn, timing of burning, etc. through social media, local newspapers, local radio, or other relevant medias;
- On the day of a burn have designated, knowledgeable people available to answer questions from the public and direct traffic if needed.
- Include large signage along affected roads that a prescribed burn is underway, and that smoke is a temporary outcome.

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## APPENDIX I
## SPECIES AT RISK SCREENING

**Resources to inform species at risk screening:**

- Natural Heritage Information Centre (NHIC) database- https://www.ontario.ca/page/get-natural-heritage-information
- Local MNRF offices
- Ministry of Environment, Conservation and Parks- https://www.infogo.gov.on.ca/infogo/#orgProfile/169487/en
- Local Conservation Authorities- https://conservationontario.ca/conservation-authorities/find-a-conservation-authority
- Ontario Breeding Bird Atlas- https://www.birdsontario.org/
- Ontario Reptile and Amphibian Atlas- https://www.ontarioinsects.org/herp/
- Mammal Atlas of Ontario- https://view.publitas.com/on-nature/mammal_atlas-38jjdao7azjw/page/1
- Ontario Butterfly Atlas Online- https://www.ontarioinsects.org/atlas/
- Ontario Odonata Atlas (contact NHIC)
- iNaturalist- https://www.inaturalist.org/
- eBird- https://ebird.org/home
- Local relevant technical reports or subwatershed studies
- Relevant researchers, conservation organizations, etc.

| Scientific Name | Common Name | S-RANK1 | SARO1 | COSEWIC2 | SARA2 | SARA Schedule2 | Habitat Requirements | Potential to occur in burn site (check all that apply) |
|---|---|---|---|---|---|---|---|---|
| **Birds** | | | | | | | | |
| *Ammodramus savannarum* | Grasshopper Sparrow | S4B | SC | SC | SC | Schedule 1 | Well-drained grassland or prairie with low cover of grasses, taller weeds or sandy soil; hayfields or weedy fallow fields; uplands with ground vegetation of various densities. Requires perches for singing and tracts of grassland generally >5ha.[3,4] | |
| *Antrostomus vociferus* | Eastern Whip-poor-will | S4B | THR | T | T | Schedule 1 | Areas with a mix of open and forested areas, such as open woodlands, savannas, pine plantations, woodland edges, or openings in more mature deciduous, coniferous and mixed forests. Forages in open areas and uses forested areas for roosting and nesting.[3,4] | |
| *Asio flammeus* | Short-eared Owl | S4?B, S2S3N | SC | T | SC | Schedule 1 | Grasslands, open areas or meadows that are grassy or bushy; marshes, bogs or tundra. Nests on the ground and requires 75-100 ha of contiguous open habitat.[3,4] | |
| *Centronyx henslowii* | Henslow's Sparrow | S1B | END | E | E | Schedule 1 | Large, fallow, grassy area with ground mat of dead vegetation, dense herbaceous vegetation, ground litter and some song perches; neglected weedy fields; wet meadows; | |

| Scientific Name | Common Name | S-RANK1 | SARO1 | COSEWIC2 | SARA2 | SARA Schedule2 | Habitat Requirements | Potential to occur in burn site (check all that apply) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | cultivated uplands. Requires a minimum tract of grassland of 40 ha, but usually in areas >100 ha.[3,4] | |
| *Chordeiles minor* | Common Nighthawk | S4B | SC | SC | T | Schedule 1 | Open ground; clearings in dense forests (including burns and logged areas); rock barrens; peat bogs; ploughed fields; gravel beaches or barren areas with rocky soils; open woodlands; flat gravel roofs.[3,4] | |
| *Colinus virginianus* | Northern Bobwhite | S1?B | END | E | E | Schedule 1 | Grassland, prairie or hay fields with woody cover in form of thickets, tangles of vines, shrubs; fence rows or woodland edges; cropland growing corn, soybeans or small grains and clover or grass; well-drained sandy or loamy soil; pond edges.[3,4] | |
| *Dolichonyx oryzivorus* | Bobolink | S4B | THR | T | T | Schedule 1 | Large (>10 ha), open expansive grasslands, pastures, hayfields, meadows or fallow fields with dense ground cover. Occasionally nest in large (>50 ha) fields of winter wheat and rye in southwestern Ontario. [3,4] | |

| Scientific Name | Common Name | S-RANK1 | SARO1 | COSEWIC2 | SARA2 | SARA Schedule2 | Habitat Requirements | Potential to occur in burn site (check all that apply) |
|---|---|---|---|---|---|---|---|---|
| *Melanerpes erythrocephalus* | Red-headed Woodpecker | S3 | SC | E | E | Schedule 1 | Open, deciduous forest with little understory; fields, parks or pasture lands with scattered large trees; wooded swamps; orchards, small woodlots or forest edges; groves of dead or dying trees. Requires cavity trees with at least 40 cm dbh.[3,4] | |
| *Sturnella magna* | Eastern Meadowlark | S4B, S3N | THR | T | T | Schedule 1 | Open pastures, hayfields, grasslands or grassy meadows with elevated singing perches (small trees, shrubs or fence posts). Also found in weedy borders of croplands, roadsides, orchards, airports, shrubby overgrown fields or other open areas. Generally prefers larger tracts of habitat >10 ha, but will sometimes use smaller tracts.[3,4] | |
| **Herpetofauna** | | | | | | | | |
| **Lizards** | | | | | | | | |
| *Plestiodon fasciatus* pop.1 | Common Five-lined Skink (Carolinian population) | S2 | END | E | E | Schedule 1 | Open woods, savannah, with sandy substrates, stabilized dune habitats near the shorelines of Lake Erie, St Clair, and Lake Huron. Must have abundant cover objects such as logs, woody debris, stumps, or vegetation piles. Nests under cover or in | |

| Scientific Name | Common Name | S-RANK1 | SARO1 | COSEWIC2 | SARA2 | SARA Schedule2 | Habitat Requirements | Potential to occur in burn site (check all that apply) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | decaying logs or vegetation debris. Overwintering habitat not well understood.[9] | |
| **Snakes** | | | | | | | | |
| *Coluber constrictor foxii* | Blue Racer | S1 | END | E | E | Schedule 1 | Dry, open to semi-open habitats such as alvar, thicket, savannah, and woodland on Pelee Island. Requires shelter habitats, such as rocks, rock piles, rubbish, vegetation piles, logs or stumps, for thermoregulation and shedding. Nests in decaying logs, under large rocks, or in mounds of decaying vegetation.[10] | |
| *Heterodon platirhinos* | Eastern Hog-nosed Snake | S3 | THR | T | T | Schedule 1 | Open habitats, such as open woods, brushland or forest edges, with well-drained loose or sandy soils, well-drained substrates. Specializes in hunting and eating toads; occurs in habitats near or adjacent to wetland habitats where toads are present. Rocks, logs, stumps, etc. are used for shelter. Use snout to dig nests as well as to dig burrows for overwintering.[11] | |

| Scientific Name | Common Name | S-RANK1 | SARO1 | COSEWIC2 | SARA2 | SARA Schedule2 | Habitat Requirements | Potential to occur in burn site (check all that apply) |
|---|---|---|---|---|---|---|---|---|
| *Pantherophis gloydi* pop. 2 | Eastern Foxsnake (Carolinian population) | S2 | END | E | E | Schedule 1 | Open natural and semi-natural upland habitats, such as meadows, fields, restored prairies, and marshes and creeks. Root wads and logs provide cover and shelter. Nests in rotten logs, stumps, dune slopes, decaying piles of vegetation. Hibernates communally underground in animal burrows, or in old wells or foundations.[12] | |
| *Pantherophis spiloides* pop. 2 | Gray Ratsnake (Carolinian population) | S1 | END | E | E | Schedule 1 | Found in a mix of agricultural land and deciduous forest, preferring habitat where forest meets more open environments. Nests in cavities of large deciduous trees, stumps, logs or compost piles. Overwinters in underground cracks and crevices.[13] | |
| *Sistrurus catenatus* pop. 2 | Massasauga (Carolinian population) | S1 | END | E | E | Schedule 1 | Semi-open or open habitats such as meadows, clearings, tall grass prairie, as well as bogs, marshes, forests, and forest edges. Require open areas to warm themselves in the sun. Foraging occurs in lowland habitats such as grasslands, wetlands, and bogs. Hibernate underground in mammal or crayfish | |

| Scientific Name | Common Name | S-RANK1 | SARO1 | COSEWIC2 | SARA2 | SARA Schedule2 | Habitat Requirements | Potential to occur in burn site (check all that apply) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | burrows, root systems in shrub or forest communities.[15] | |
| *Thamnophis butleri* | Butler's Gartersnake | S2 | END | E | E | Schedule 1 | Open, moist habitats, such as cultural meadows, grasslands, old fields, tallgrass prairie, in close proximity to wetlands where it can feed on leeches and earthworms. Dense grass cover and thatch is important for shelter. Small mammal or crayfish burrows, rock or log piles, draings, stone walls, or foundations are used for hibernation.[16] | |
| **Mammals** | | | | | | | | |
| *Taxidea taxus jacksoni* | American Badger (Southwestern Ontario population) | S2 | END | E | E | Schedule 1 | Open grasslands, oak savannahs, sand barrens and farmland.[3,4] | |
| **Butterflies** | | | | | | | | |
| *Lycaeides melissa samuelis* | Karner Blue | SX | EXP | EXP | EXP | Schedule 1 | Dry, sandy oak savanna and woodland habitats with presence of adequate Wild Lupine. | |
| *Callophrys irus* | Frosted Elfin | SX | EXP | EXP | EXP | Schedule 1 | Dry, sandy oak savanna and woodland habitats with presence of adequate Wild Lupine. | |
| *Erynnis **persius*** | Eastern Persius Duskywing | SX | EXP | END | END | Schedule 1 | Dry, sandy oak savanna and woodland habitats with | |

| Scientific Name | Common Name | S-RANK1 | SARO1 | COSEWIC2 | SARA2 | SARA Schedule2 | Habitat Requirements | Potential to occur in burn site (check all that apply) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | presence of adequate Wild Lupine. | |
| *Erynnis martialis* | Mottled Duskywing | S2 | END | E | NS | No Schedule | Dry habitats with sparse vegetation, including open barrens, sandy patches among woodlands, and alvars. In Ontario, eggs are deposited only on New Jersey Tea (*Ceanothus americanus*) and Prairie Redroot (*Ceanothus herbaceus*).[3] | |
| **Plants** | | | | | | | | |
| *Agalinis gattingeri* | Gattinger's Agalinis | S2S3 | END | E | E | Schedule 1 | Open sandy places, such as higher ground near marshes and in old borrow pits.[23] In Ontario, most abundant on Manitoulin alvars. Also in moist-fresh tallgrass prairies on Walpole.[25] | |
| *Agalinis skinneriana* | Skinner's Agalinis | S1 | END | E | E | Schedule 1 | Prairies and dry, open ground.[4] | |
| *Aletris farinosa* | Colicroot | S2 | END | E | E | Schedule 1 | Moist or sometimes dry, usually sandy soil in swales, meadows, prairies, and other sandy openings. Flowering in late spring to mid summer.[23,24] | |
| *Aristida basiramea* | Forked Triple-awned Grass | S2 | END | E | E | Schedule 1 | Dry sandy open ground. Generally in barrens with leached acidic soil.[23] | |

| Scientific Name | Common Name | S-RANK1 | SARO1 | COSEWIC2 | SARA2 | SARA Schedule2 | Habitat Requirements | Potential to occur in burn site (check all that apply) |
|---|---|---|---|---|---|---|---|---|
| *Arnoglossum plantagineum* | Tuberous Indian-plantain | S2 | SC | SC | SC | Schedule 1 | Fens, moist prairies, sedge meadows, and calcareous shores. Flowering in summer.[23.24] | |
| *Asclepias quadrifolia* | Four-leaved Milkweed | S1 | END | E | E | | Dry calcareous woods.[1] In Ontario, south-facing rocky slopes in mature oak-hickory woods and dry scrubby fields on shallow soil over limestone. [25] | |
| *Buchnera americana* | Blue-hearts | S1 | END | E | E | Schedule 1 | Sandy open savannah and prairies.[23] In Ontario, calcareous interdunal meadows only.[25] | |
| *Castanea dentata* | American Chestnut | S1S2 | END | E | E | Schedule 1 | Rich deciduous and mixed forests, particularly with oak. Flowering in summer.[24] | |
| *Celtis tenuifolia* | Dwarf Hackberry | S2 | THR | T | T | Schedule 1 | Borders of forests, fields and fencerows, and open dryish sandy forests. Flowering in spring.[23,24] In Ontario, dry black oak-pine savanna and woodland and sand dunes. Also borders of prairie openings (Trent River).[25] | |

| Scientific Name | Common Name | S-RANK1 | SARO1 | COSEWIC2 | SARA2 | SARA Schedule2 | Habitat Requirements | Potential to occur in burn site (check all that apply) |
|---|---|---|---|---|---|---|---|---|
| *Chimaphila maculata* | Spotted Wintergreen | S2 | THR | T | E | Schedule 1 | Deciduous forests of several kinds, often with some conifers, but especially under oaks on sandy soils, as on forested dunes. Flowering in summer.[23,24] Mixed oak pine forest in Ontario. [25] | |
| *Cornus florida* | Eastern Flowering Dogwood | S2? | END | E | E | Schedule 1 | Dry (usually oak) to rich deciduous forests, especially on hillsides and river banks; rarely recorded with tamaracks. Flowering in spring. Fruiting in summer to fall.[23,24] Sandy woods and wood edges in Ontario. [25] | |
| *Cypripedium candidum* | Small White Lady's Slipper | S1 | END | T | T | Schedule 1 | In essentially full sun, in fens, wet, calcareous meadows, usually with tamarack and shrubby cinquefoil, wet prairies, rarely in slightly drier prairie habitats. Flowering in spring to summer.[23,24] | |
| *Frasera caroliniensis* | American Columbo | S2 | END | E | E | Schedule 1 | Dry (oak, hickory, sassafras) or sometimes moist forests and openings.[23] | |

| Scientific Name | Common Name | S-RANK1 | SARO1 | COSEWIC2 | SARA2 | SARA Schedule2 | Habitat Requirements | Potential to occur in burn site (check all that apply) |
|---|---|---|---|---|---|---|---|---|
| *Gentiana alba* | Yellowish Gentian | S1 | END | E | E | Schedule 1 | Dry or moist prairies and open oak savannah. Flowering in summer.[23] | |
| *Lespedeza virginica* | Slender Bush-clover | S1 | END | E | E | Schedule 1 | Dry savannah (especially oak), in Ontario.[25] | |
| *Liatris spicata* | Spiked Blazing Star | S2 | THR | T | T | Schedule 1 | Moist sandy plains and shores, marshy meadows, wet prairies, marly shores, roadsides and fields in Ontario. [25] | |
| *Liparis liliifolia* | Lily-leaved Twayblade | S2S3 | THR | T | T | Schedule 1 | Brushy second-growth thickets and mixed forests, pine plantations. Flowering in spring to summer.[23,24] | |
| *Platanthera leucophaea* | Prairie White-fringed Orchid | S2 | END | E | E | Schedule 1 | Open fens (even on floating sedge mats), wet prairies and other wet open sites. Flowering in late spring to summer.[23,24] | |
| *Polygala incarnata* | Pink Milkwort | S1 | END | E | E | Schedule 1 | In Ontario, moist to fresh tallgrass prairies. Never in dry prairies.[25] | |
| *Pycnanthemum incanum var. incanum* | Hoary Mountain-mint | S1 | END | E | E | Schedule 1 | Dry oak woods and openings.[1] | |

| Scientific Name | Common Name | S-RANK1 | SARO1 | COSEWIC2 | SARA2 | SARA Schedule2 | Habitat Requirements | Potential to occur in burn site (check all that apply) |
|---|---|---|---|---|---|---|---|---|
| *Rosa setigera* | Climbing Prairie Rose | S2S3 | SC | SC | SC | Schedule 1 | Open forests and thickets, and savannahs. Flowering in spring to summer.[23,24] Also, woodland edges and roadsides. [25] | |
| *Solidago riddellii* | Riddell's Goldenrod | S3 | SC | SC | SC | Schedule 1 | Fens, wet prairies, shore meadows, moist ground around lakes and along rivers. Flowering in fall.[23,24] | |
| *Solidago rigidiuscula* | Stiff-leaved Showy Goldenrod | S1 | END | E | E | Schedule 1 | Tallgrass prairie and oak savannah.[1] | |
| *Symphyotrichum praealtum var. praealtum* | Willow-leaved Aster | S2 | THR | T | T | Schedule 1 | Moist fields (including recent clearings) and prairies, and openings of oak savannahs. Also found in open woods or thickets, abandoned farm fields, and along lake and stream shores, railways, and roadsides. Flowering in late summer to fall.[23,24] | |
| *Symphyotrichum sericeum* | Western Silvery Aster | S1 | END | T | T | Schedule 1 | Prairies, dry banks and fields. Flowering in late summer to fall.[23,24] Also, shallow osils over bedrock and on steep slopes in northwestern Ontario. [25] | |
| *Tephrosia virginiana* | Virginia Goat's-rue | S1 | END | E | E | Schedule 1 | Sandy barrens, fields, prairie-like areas, and oak-pine savannahs.[23] | |

| Scientific Name | Common Name | S-RANK1 | SARO1 | COSEWIC2 | SARA2 | SARA Schedule2 | Habitat Requirements | Potential to occur in burn site (check all that apply) |
|---|---|---|---|---|---|---|---|---|
| *Vaccinium stamineum* | Deerberry | S1 | THR | T | T | Schedule 1 | Sandy, well-drained soil, xeric communities such as dry oak woods, pine barrens, savannahs, dry pine ridges, sparsely wooded bluffs, sand hills, thickets and clearings. Flowering in spring.[24] rock barrens[25] | |
| *Viola pedata var. pedata* | Bird's-foot Violet | S1 | END | E | E | Schedule 1 | Sandy open plains, slopes, and oak savannas in Ontario.[23] | |

[1] Ministry of Natural Resources and Forestry (MNRF). 2021. Natural Heritage Information Centre (NHIC): Species List for Ontario. Published: 2014-06-23. All Species List Updated: 2021-03-18. Available: https://www.ontario.ca/page/get-natural-heritage-information

[2] Government of Canada. 2021. Species at Risk Public Registry: Species Search. Updated: 2021-02-02. Available: https://species-registry.canada.ca/index-en.html#/species?sortBy=commonNameSort&sortDirection=asc&pageSize=10

[3] Ministry of the Environment, Conservation, and Parks (MECP). 2020. Species at Risk in Ontario. Published: 12-07-2018. Updated: 09-11-2020. Available: https://www.ontario.ca/page/species-risk-ontario

[4] Ontario Ministry of Natural Resources (OMNR). 2000. Significant Wildlife Habitat Technical Guide. Appendix G: Wildlife Habitat Matrices and Habitat Descriptions for Rare Vascular Plants. October 2000.

[9] Seburn, D.C. 2010. Recovery strategy for the Common Five-lined Skink (*Plestiodon fasciatus*) – Carolinian and Southern Shield populations in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi + 22 pp. https://www.ontario.ca/page/common-five-lined-skink-recovery-strategy

[10] Willson, R.J. and G.M. Cunnington. 2015. Recovery Strategy for the Blue Racer (Coluber constrictor foxii) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources and Forestry, Peterborough, Ontario. vi + 35 pp. https://www.ontario.ca/page/blue-racer-recovery-strategy#section-1

[11] Kraus, T. 2011. Recovery Strategy for the Eastern Hog-nosed Snake (*Heterodon platirhinos*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. i + 6 pp + Appendix vi + 24 pp. Adoption of

the Recovery Strategy for the Eastern Hog–nosed Snake (*Heterodon platirhinos*) in Canada (Seburn, 2009). https://www.ontario.ca/page/eastern-hog-nosed-snake-recovery-strategy#section-1

[12] Eastern Foxsnake Recovery Team. 2010. Recovery strategy for the Eastern Foxsnake (*Pantherophis gloydi*) – Carolinian and Georgian Bay populations in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi + 39 pp. https://www.ontario.ca/page/eastern-foxsnake-recovery-strategy#section-1

[13] Kraus, T., B. Hutchinson, S. Thompson and K. Prior. 2010. Recovery Strategy for the Gray Ratsnake (*Pantherophis spiloides*) – Carolinian and Frontenac Axis populations in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi + 23 pp. https://www.ontario.ca/page/gray-ratsnake-recovery-strategy#section-1

[15] Ministry of the Environment, Conservation and Parks (MECP). 2018. Massasauga Rattlesnake General Habitat Description. Updated: July 9, 2021 Published: December 19, 2018. https://www.ontario.ca/page/massasauga-rattlesnake-general-habitat-description

[16] Ministry of the Environment, Conservation and Parks. 2019. Recovery Strategy for the Butler's Gartersnake (*Thamnophis butleri*) in Ontario. Ontario Recovery Strategy Series. Prepared by the Ministry of the Environment, Conservation and Parks, Peterborough, Ontario. iv + 6 pp. + Appendix. Adoption of the Recovery Strategy for the Butler's Gartersnake (*Thamnophis butleri*) in Canada (Environment Canada 2018). https://www.ontario.ca/page/butlers-gartersnake-recovery-strategy#section-1

[23] A. A. Reznicek, E. G. Voss, & B. S. Walters. Michigan Flora Online. University of Michigan. Published: February 2011. Available: https://michiganflora.net/genus.aspx?id=Sium.

[24] Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico [Online]. 22+ vols. New York and Oxford. Available: http://beta.floranorthamerica.org.

[25] W. Bakowsky, Community Ecologist, Natural Heritage Information Centre, Ministry of Natural Resources and Forestry.

## APPENDIX II
## FIELD BMP CHECKLIST

| General BMP | Check all that apply | Notes on implementation |
|---|---|---|
| Area burned on rotating basis | | |
| No more than 1/4 of suitable SAR habitat burned in a given year | | |
| Clean Equipment Protocol implemented | | |
| Burn breaks avoid SAR plants or important habitat features | | |
| Burn breaks prepared between Nov. 30 and Mar. 1 | | |
| Burn breaks prepared between Mar. 2 and Nov. 29 included wildlife sweeps | | |
| SAR Plants flagged in advance | | |
| Fuels removed from important habitat features | | |
| Sprinklers run prior to burn | | |

| Scientific Name | Common Name | Present | Potentially Present | Absent | Recommended BMPs | BMP's Implemented |
|---|---|---|---|---|---|---|
| | | Check all that apply | | | | Check all that apply |
| **Birds** | | | | | **Bird BMPs** | |
| *Ammodramus savannarum* | Grasshopper Sparrow | | | | Early morning surveys prior to burn date | |
| *Antrostomus vociferus* | Eastern Whip-poor-will | | | | During the active breeding season- pre burn sweep to flush birds & identify nests | |
| *Asio flammeus* | Short-eared Owl | | | | **Notes on implementation:** | |
| *Centronyx henslowii* | Henslow's Sparrow | | | | | |
| *Chordeiles minor* | Common Nighthawk | | | | | |
| *Colinus virginianus* | Northern Bobwhite | | | | | |
| *Dolichonyx oryzivorus* | Bobolink | | | | | |
| *Melanerpes erythrocephalus* | Red-headed Woodpecker | | | | | |
| *Sturnella magna* | Eastern Meadowlark | | | | | |
| **Herpetofauna** | | | | | **Herpetofauna BMPs** | |
| *Plestiodon fasciatus* pop.1 | Common Five-lined Skink (Carolinian population) | | | | Pre-burn sweep and relocation of all herps | |
| *Coluber constrictor foxii* | Blue Racer | | | | Biologist remain on site during burn | |
| *Heterodon platirhinos* | Eastern Hog-nosed Snake | | | | Habitat features can be protected by removing fuels from the area and wetting down the area | |

| Scientific Name | Common Name | Present | Potentially Present | Absent | Recommended BMPs | BMP's Implemented |
|---|---|---|---|---|---|---|
| | | Check all that apply | | | | Check all that apply |
| *Pantherophis gloydi* pop. 2 | Eastern Foxsnake (Carolinian population) | | | | **Notes on implementation:** | |
| *Pantherophis spiloides* pop. 2 | Gray Ratsnake (Carolinian population) | | | | | |
| *Sistrurus catenatus* pop. 2 | Massasauga (Carolinian population) | | | | | |
| *Thamnophis butleri* | Butler's Gartersnake | | | | | |
| *Thamnophis butleri* | Butler's Gartersnake | | | | | |
| **Mammals** | | | | | **Mammal BMPs** | |
| *Taxidea taxus jacksoni* | American Badger (Southwestern Ontario population) | | | | Pre-burn review to identify any dens, cavity trees, etc. | |
| *Myotis lucifugus* | Little Brown Myotis | | | | Exclusion of any potential SAR dens until use can be confirmed. | |
| *Myotis septentrionalis* | Northern Myotis | | | | If a potential roost site for bat species at risk is found in the burn area- exclude from the burn between April 1 and September 30 or surveyed to determine use | |

| Scientific Name | Common Name | Present | Potentially Present | Absent | Recommended BMPs | BMP's Implemented |
|---|---|---|---|---|---|---|
| | | Check all that apply | | | | Check all that apply |
| *Perimyotis subflavus* | Tri-colored Bat. | | | | Habitat features can be protected by removing fuels from the area and wetting down the area | |
| **Notes on implementation:** | | | | | | |
| **Butterflies** | | | | | **Insect BMPs** | |
| *Lycaeides melissa samuelis* | Karner Blue | | | | Pre-burn survey work to identify habitat extent of SAR | |
| *Callophrys irus* | Frosted Elfin | | | | Burn area restricted to no more than 25% of the known area occupied by the species | |
| *Erynnis* ***persius*** | Eastern Persius Duskywing | | | | Fuels removed 1-2 metres around important refugia | |
| *Erynnis martialis* | Mottled Duskywing | | | | Refugia wetted down with water | |

| Scientific Name | Common Name | Present | Potentially Present | Absent | Recommended BMPs | BMP's Implemented |
|---|---|---|---|---|---|---|
| | | Check all that apply | | | | Check all that apply |
| Notes on implementation: | | | | | Ignition patter and/or patchiness targeted outcome | |
| | | | | | Fire-return-interval at least 5 years from last burn | |
| | | | | | | |
| **Plants** | | | | | **Plant BMPS** | |
| *Agalinis gattingeri* | Gattinger's Agalinis | | | | Demarcate plants in the field using flagging tape affixed high above the surface of the ground for visibility and advise the burn crew of their location and significance | |
| *Agalinis skinneriana* | Skinner's Agalinis | | | | Remove fuels from 1-2 metres around the base of plants including woody debris and accumulated leaf litter; | |
| *Aletris farinosa* | Colicroot | | | | Wet down areas around the plants, and the plants themselves, with water using a backpack pump or pump hose | |

| Scientific Name | Common Name | Present | Potentially Present | Absent | Recommended BMPs | BMP's Implemented |
|---|---|---|---|---|---|---|
| | | Check all that apply | | | | Check all that apply |
| *Aristida basiramea* | Forked Triple-awned Grass | | | | To ensure compliance with the ESA in some instances, translocation may be required (see Section 23.11(12) of Ontario Regulation 24/08 | |
| *Arnoglossum plantagineum* | Tuberous Indian-plantain | | | | **Notes on implementation:** | |
| *Asclepias quadrifolia* | Four-leaved Milkweed | | | | | |
| *Buchnera americana* | Blue-hearts | | | | | |
| *Castanea dentata* | American Chestnut | | | | | |
| *Celtis tenuifolia* | Dwarf Hackberry | | | | | |
| *Chimaphila maculata* | Spotted Wintergreen | | | | | |
| *Cornus florida* | Eastern Flowering Dogwood | | | | | |
| *Cypripedium candidum* | Small White Lady's Slipper | | | | | |
| *Frasera caroliniensis* | American Columbo | | | | | |
| *Gentiana alba* | Yellowish Gentian | | | | | |
| *Lespedeza virginica* | Slender Bush-clover | | | | | |
| *Liatris spicata* | Spiked Blazing Star | | | | | |
| *Liparis liliifolia* | Lily-leaved Twayblade | | | | | |

| Scientific Name | Common Name | Present | Potentially Present | Absent | Recommended BMPs | BMP's Implemented |
|---|---|---|---|---|---|---|
| | | Check all that apply | | | | Check all that apply |
| *Platanthera leucophaea* | Prairie White-fringed Orchid | | | | | |
| *Polygala incarnata* | Pink Milkwort | | | | | |
| *Pycnanthemum incanum var. incanum* | Hoary Mountain-mint | | | | | |
| *Rosa setigera* | Climbing Prairie Rose | | | | | |
| *Solidago riddellii* | Riddell's Goldenrod | | | | | |
| *Solidago rigidiuscula* | Stiff-leaved Showy Goldenrod | | | | | |
| *Symphyotrichum praealtum var. praealtum* | Willow-leaved Aster | | | | | |
| *Symphyotrichum sericeum* | Western Silvery Aster | | | | | |
| *Tephrosia virginiana* | Virginia Goat's-rue | | | | | |
| *Vaccinium stamineum* | Deerberry | | | | | |
| *Viola pedata var. pedata* | Bird's-foot Violet | | | | | |