

Candidate Conservation Agreement with Assurances -- Agreement Number:

Candidate Conservation Agreement with Assurances for the Eastern Massasauga Rattlesnake in Michigan



This Agreement, effective and binding on the date of the last signature below, is between the Michigan Department of Natural Resources (DNR), the Michigan Department of Military and Veterans Affairs (DMVA) and the U.S. Fish and Wildlife Service (Service). Participating property owners and oil, gas and mineral development companies may also be included under the Agreement by signing a Certificate of Inclusion (CI Participants).

Participating Landowners: Michigan Department of Natural Resources and
Michigan Department of Military and Veterans Affairs

Permit Holder: Michigan Department of Natural Resources

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1) Introduction

The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA) requires that the U.S. Fish and Wildlife Service (hereafter “the Service”) list species of wildlife and plants that are endangered or threatened based on the best available scientific and commercial information. The Service identifies species as “candidates” for listing when there is sufficient information on biological vulnerability and threats to support a proposal to list, but preparation of a proposal is precluded by higher-priority listing actions.

If and when a species becomes listed under the ESA that action triggers both a regulatory and a conservation responsibility for Federal, State, and private landowners. These responsibilities stem from section 9 of the ESA that prohibits “take” (i.e., harass, harm, pursue, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct) of listed species. Along with the section 9 prohibitions, Federal agencies must ensure that their actions will not jeopardize the continued existence of the listed species and carry out programs for the conservation of listed species.

Candidate species offer unique challenges and opportunities to non-federal landowners. The challenge is that the Eastern Massasauga Rattlesnake (*Sistrurus catenatus*) (EMR) was proposed for listing in September 2015, which means if the species is listed the “take” prohibitions and the accompanying restrictions may apply. This introduces uncertainty to land planning and makes long-term planning especially difficult. However, candidate species also open an opportunity to address threats to the species, especially if the species is concentrated on the lands of one or a few landowners. If those threats are addressed, the species might never need to be listed under the ESA.

The concept behind a Candidate Conservation Agreement with Assurances (CCAA) is to simultaneously capitalize on the opportunity to conserve the candidate species while reducing the uncertainty that landowners face in managing lands with candidate species. The Service and the landowner(s) voluntarily agree to a conservation program for the candidate species, which may include management restrictions, mitigation, education, other conservation tools, or some combination. In return the Service provides formal assurances that the landowner will not face new restrictions or prohibitions as a result of listing. Thus, a CCAA provides a species with a conservation program and relieves the landowner of uncertainty in land management.

The ESA (subsections 7(a)(1) and (a)(2)) obligates Federal agencies to affirmatively conserve listed species; and therefore, Federal landowners and actions are not eligible for the assurances provided through a CCAA. Although assurances cannot be conveyed to Federal agencies, because the conservation measures of a CCAA must “preclude or remove any need to list the species covered by the agreement” (50 CFR 17.22(d)(8)), the CCAA can inform and significantly streamline the section 7 consultation process. Therefore, even though actions with a federal nexus on lands enrolled in a CCAA must undergo section 7 consultation, such actions that fully comply with the terms of the CCAA are unlikely to require additional conservation measures.

Thus there is a high level of certainty for non-Federal cooperators that their management activities funded by Federal agencies are unlikely to be disrupted if listing occurs, provided the agreed-upon actions are being properly implemented. However, if actions with a federal nexus are not adequately addressed by the CCAA, or unanticipated and unusual circumstances develop, there may be a need for additional conservation measures and/or a Biological Opinion that may include reasonable and prudent measures to minimize the impacts(s) of such action(s).

Finally, when a CCAA is programmatic (designed to allow for multiple landowners), other non-Federal cooperators may participate through Certificates of Inclusion (Appendix A) by agreeing to implement the conservation measures and other requirements of the CCAA. The participation of other cooperators is encouraged, but their participation is voluntary and must be approved by the holder of the ESA permit associated with the CCAA.

Most viable populations of EMR occur on land managed by the Michigan Department of Natural Resources (hereafter “DNR”) and the Michigan Department of Military and Veterans Affairs (hereafter “DMVA”), who are together the “Participating Landowners.” This document is an agreement between the DNR, the DMVA and the Service, to which additional landowners and oil, gas and mineral development companies in Michigan will later be invited to participate through Certificates of Inclusion (hereafter “CI Participants”). EMR was listed as a candidate species in 1999. The urgency of listing was upgraded in 2011. In July 2011, the Service entered into an agreement with the non-for-profit Center for Biological Diversity to make final decisions on most currently- listed Candidate species by 2018. The EMR was proposed for listing as a threatened species on September 30, 2015. The DNR and Service have less than 1 year for CCAA review by the Service, DNR signing on CI Participants, and Service review of the species status in light of the CCAA.

2) Purpose

The purpose of this Agreement is to encourage non-Federal landowners in Michigan to manage their properties in ways that are consistent with the long-term sustainability and persistence of EMR. Because the management of DNR lands to provide habitat for wildlife, to restore natural communities, to manage healthy forests, and to provide recreational opportunities has resulted in the persistence of populations of EMR on those lands, this Agreement does not require significant changes in DNR land management. However, management techniques are constantly changing, and this document provides guidelines and strategies to ensure that those changes are consistent with the persistence of this species on DNR lands in the future.

The ESA’s take provisions can affect implementation of conservation measures intended to benefit a listed species. For example, the take prohibitions have indirectly led to the degradation of some Karner blue butterfly habitat in Michigan. The butterfly needs oak savanna, a habitat that was created by fires set largely by Native Americans, then early settlers, and more recently by managers of state game areas and private land owners.

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When the Karner blue butterfly was listed under the ESA, burning, mowing, and forest harvest (which had maintained savanna) ceased because the activities could have harmed individual butterflies. Savanna habitat began converting to forest through the process of ecological succession. Through a statewide HCP with associated Incidental Take Permit, the DNR can again manage oak savannas for many wildlife species, from Karner Blue butterflies to wild turkeys. Regulatory tools such as HCPs and CCAAs are valuable to ensure that species recovery can occur, even when management of occupied habitat is necessary.

Across its range, EMR demonstrates considerable plasticity in preferred habitat. It relies on vegetation structure that is found in open or shrubby wetlands, savannas and early successional forests. In the event that the EMR is listed, a cessation of mowing, burning, and forest harvest will likely result in ecological succession and habitat degradation in areas with EMR. As with Karner Blue butterfly habitat, tree canopies would close together and shade the ground, threatening EMR habitat in the one state where this species persists in many viable populations. This Agreement seeks to avoid that outcome. The general management strategy is to identify and minimize threats in management areas or properties at which EMR have either been known to occur or where extensive habitat occurs. Education and outreach efforts are proposed to raise awareness and increase understanding about the species for all stakeholders, reduce persecution or indiscriminate killing, and promote conservation of the species. The conservation goal of this Agreement on the part of the Service, the DNR, the DMVA and other cooperators is to maintain viable populations of EMR by managing and restoring habitat for EMR. This goal is consistent with the Service's "Candidate Conservation Agreement with Assurances Final Policy" (64 FR 32726, June 17, 1999), revisions to that policy (69 FR 24084: May 3, 2004) and the regulations that implement the policy (69 FR 24084, May 3, 2004).

3) Authority

Sections 2, 7, and 10 of the ESA allow the Service to enter into this CCAA with other cooperating partners. Section 2 of the ESA states that encouraging interested parties, through Federal financial assistance and a system of incentives, to develop and maintain conservation programs is a key to safeguarding the Nation's heritage in fish, wildlife, and plants.

Section 7 of the ESA requires the Service to review programs it administers and utilize such programs in furtherance of the purposes of the ESA. By entering into this CCAA, the Service is utilizing its authority to enter into this type of agreement to further the conservation of the Nation's fish and wildlife resources.

Section 10(a)(1)(A) of the ESA authorizes the issuance of permits to "enhance the survival" of a listed species. Section 10(a)(1)(A) of the ESA allows the Service to issue permits for acts that would otherwise be prohibited by section 9 if such acts are expected to enhance the propagation or survival of the affected species.

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Application and issuance criteria for Enhancement of Survival Permits for CCAAs are found in the Code of Regulations (CFR) at 50 CFR 17.22(d) and 17.32 (d), respectively. See also the Services joint policy on CCAAs, which was published in the *Federal Register* with the Department of Commerce's National Oceanic and Atmospheric Administration, National Marine Fisheries Service (64 FR 32726; June 17, 1999), as well as revisions to that policy (69 FR 24084; May 3, 2004).

4) Background and Status

4.1 Life History

4.1.1 Phenology and Movement

In Michigan, EMR are typically active from late April to late September (Harding 1997, Szymanski 1998, Mauger and Wilson 1999, Kingsbury pers. comm.). Spring emergence may begin in late March, but typically continues throughout April as groundwater levels rise and ground temperature approaches air temperature. Emergence may shift as much as two weeks from north to south within the state, and depends on local weather conditions. EMR typically stay near their hibernacula for one to two weeks, basking on elevated sites such as sedge or grass hummocks, muskrat or beaver lodges, or dikes and other embankments, before moving to their summer habitats (Johnson 1995, King 1997, Parent 1997). They then gradually disperse. Similarly, at the end of the active season, EMR are often observed above ground in the vicinity of their overwintering location for several weeks before finally entering hibernation (Johnson *et al.* 2000). Given the above, a generally safe rule of thumb in Michigan would be that EMR are underground or in the vicinity of their hibernacula from October 15 to April 15, though annual variation must be considered.

Temporal shifts in habitat selection during the active season have been documented in some studies (Reinert and Kodrich 1982, Seigel 1986, Bissell 2006, and Harvey and Weatherhead 2006a) and not in others (Weatherhead and Prior 1992). Although habitat use appears to vary regionally and among populations (Szymanski 1998), use of both upland and wetland habitat types is described throughout the literature for Michigan populations (Bissell 2006, Marshall *et al.* 2006, Moore and Gillingham 2006, Sage *et al.* 2006, Bailey *et al.* 2012). Distribution of use among these habitat types varies between these studies. Differences in habitat use between populations may result from local adaptation to habitat conditions such as resource availability, landscape context and habitat fragmentation or isolation; discrepancies may also result from differences, not related to habitat, in study designs and sampling methods among researchers (Bailey *et al.* 2012).

Studies conducted in Michigan have all indicated that vegetation types in early seral stages and an open canopy were preferred by EMR (Bissell 2006, Marshall *et al.* 2006, Moore and Gillingham 2006, Sage *et al.* 2006, Bailey *et al.* 2012).

Regardless of whether individuals stay in wetlands throughout the year, or disperse to uplands during the summer, the association with wetlands is consistent. EMR are almost never more than 500 meters from a wetland.

4.1.2 Reproduction

Female EMR usually attain sexual maturity and mate during their second or third full active season following birth and typically give birth the following year at an age of three or four years (Wright 1941, Keenlyne 1978, Seigel 1986, Faust *et al.* 2011), although it may be later in some populations (C. Parent unpubl. data in Johnson *et al.* 2000). Mating occurs in the spring, summer and fall (Reinert 1981, Vogt 1981, Harding 1997). Like many other snakes, reproductive females are thought to produce pheromone trails to attract potential mates (Johnson *et al.* 2000). During the mating season, males often make direct and long distance movements to locate females (Johnson 1995, C. Parent unpubl. data in Johnson *et al.* 2000).

Females may reproduce annually or biennially (every 2 years) in different parts of their range (Reinert 1981, Seigel 1986, Harding 1997). In Michigan, researchers have found females tend to reproduce biennially (Bissell 2006, Bailey 2010), as in most populations (Johnson *et al.* 2000).

Gestation sites vary across the species' range although all tend to have very open or below average canopy cover (Reinert and Kodrich 1982, Johnson 1995, King 1997, Foster *et al.* 2009). Reinert and Kodrich (1982) also found that these areas maintain significantly higher maximum daily temperatures than the areas used by males and nongravid females. Foster *et al.* (2009) found that gravid females maintained a mean body temperature of 11.67 °C above the ambient temperature and they are more constrained by metabolic and thermoregulatory needs of their embryos. Although it is clear that open canopy and early successional vegetation structure are consistent characteristics of selected gestation sites, Shoemaker and Gibbs (2010) warn that both warmth and crypsis potential (potential to remain undetected or cryptic within the environment) are important determinants of basking-site quality.

EMR give birth to live young generally from mid-July through early September (Wright 1941, Keenlyne 1978, Reinert 1981 and 1985, Seigel 1986, Johnson 1995, Harding 1997); Bissell (2006) found a mean parturition date of 17 August at a study site in southwestern Michigan. The number of young or brood size may vary from 3 to 20 snakes (Seigel 1986, Harding 1997). The mean viable litter size was estimated to be 9 by Bissell (2006) and 7 by Bailey (2010), at a site in southwestern Michigan. Females and young typically remain at the gestation site for several days after birth, but the neonates or young snakes receive no direct parental care (Johnson *et al.* 2000).

The young snakes shed their skin for the first time in about a week after birth and then gradually disperse (Johnson 1995, King 1997, C. Parent unpubl. data in Johnson *et al.* 2000).

4.1.3 Population Ecology

The cryptic coloration of this species makes detection in large enough numbers to estimate population size time consuming and expensive. A population size of 35 individuals (1.97 per ha) was estimated for a site in northeastern Ohio by Maple and Orr (1968). Reinert (1978) reported densities of 0.59 and 3.78 individuals per ha at an 8.1 ha (20 acre) site in Pennsylvania. Johnson (1995) estimated densities between 0.56 and 2.53 individuals per ha, at 37 ha (91.4 acre) site in New York. Most existing estimates indicate a range of 0.5-2.5 snakes per ha (Szymanski 1998).

Seigel and Sheil (1999) developed a Population Viability Analysis (PVA) model for EMR populations in Missouri, which suggested that adult survival rates of 80 percent per year and neonate survival rates of 20 percent per year would be needed to maintain stable populations in Missouri. The PVA model was highly sensitive to even small changes in adult and juvenile mortality rates (Seigel and Sheil 1999). Although this model is specific to populations in Missouri, it is likely that most EMR populations will have similar demographic constraints (Johnson *et al.* 2000).

Bailey *et al.* (2011) developed a PVA for an EMR population in southwest Michigan. The site appears to have a robust population even though the wetlands and uplands are actively managed for a variety of species. Habitat management is explicitly tailored to benefit rare reptiles, including EMR. Annual active season survival estimates were exceptionally high (0.95) at this site, and the only mortality was due to predation.

Faust *et al.* (2011) developed PVA models comparing status across states throughout the range and the effect on viability of changing habitat management to reduce impact on snakes. A majority of populations in every state were not viable, although Michigan had more viable populations than any other state.

4.1.4 Food habits

Rodents and other snakes are the major prey items of EMR (Keenlyne and Beer 1973, Seigel 1986, Hallock 1991, Johnson 1995). Rodents seem to be the preferred prey for adults, (Hallock 1991, Johnson 1992) while juveniles eat both rodents and snakes (Keenlyne and Beer 1973, Seigel 1986, Shepard *et al.* 2004). Voles, moles, jumping mice, and shrews are consumed as well as other snakes and occasionally birds, lizards, frogs, insects and crayfish (Gloyd 1940, Wright and Wright 1957, Klauber 1972, Fromm 1980, Vogt 1981, Hallock 1991, Shepard *et al.* 2004). EMR appear to be sit-and-wait foragers (Reinert *et al.* 1984 in Prior 1991).

4.1.5 Behavior

When threatened, EMR will typically remain motionless, relying on their cryptic coloration to blend into their surroundings. The characteristic rattle is sounded when the snake is alarmed. This species is considered nonaggressive.

Most documented strikes occur when the snake is directly disturbed, as when picked up or stepped on (Johnson and Menzies 1993). Although the venom is highly toxic, fatalities are very uncommon because the species' short fangs can inject only a small volume (Klauber 1972). Dogs, small children, the elderly and people in poor health are thought to be at greatest risk, but no recent mortalities have occurred.

4.1.6 Hibernation

Hibernation sites (hibernacula) are usually in transition zones between uplands and wetlands, where the snakes enter the ground via crayfish or small mammal burrows. Subterranean spaces caused by tree roots, rock crevices, or submerged trash have been used, as well as sphagnum hummocks, barn floors, and basements (Seigel 1986, Johnson and Menzies 1993, Johnson 1995). Hibernation sites are located below the frost line, and typically in association with groundwater that does not freeze (Johnson and Menzies 1993). Superficial characteristics are not likely sufficient to identify suitability of hibernacula, however, as there are many factors affecting hibernacula suitability (Sage *et al.* 2006, Harvey and Weatherhead 2006a).

4.1.7 Home Range

Home range sizes may vary substantially within and among populations in Michigan. In southern Michigan, average home range size varies from 5 ha (Sage 2005), to 2.8 ha (Bissell 2006), to 1.3 ha (Moore and Gillingham 2006). However, Bailey (2010) found a distinct difference among mean home range size for males (7.42 ha), non-gravid females (3.15 ha), and gravid females (0.71 ha). Further north in Michigan, near Grayling, home range sizes averaged 16.7 ha (Degregorio *et al.* 2011). These home range sizes are intermediate between very small home ranges in Pennsylvania (Reinert and Kodrich 1982) and very large home range sizes (25-26 ha) in Ontario (Weatherhead and Prior 1992) and New York (Johnson 2000).

4.2 Population Status in Great Lakes Region

The EMR was once considered common from western New York, western Pennsylvania and southern Ontario to southeastern Minnesota, eastern and southern Iowa and northern Missouri (Szymanski 1998). EMR currently occupy a similar range, but population distribution and sizes across its range have declined. The results of a recent status assessment suggest that EMR only occur in 60% of the counties where they were historically known to occur (Szymanski 1998). Most states or provinces within the species' range have reported losing over 50% of their historical populations, and less than one-third of extant populations are considered secure (Szymanski 1998).

As a result of these declines, the EMR has been afforded some level of legal protection in every state and province within its range. In 1982, the EMR was listed as a Category 2 species by the US Fish and Wildlife Service. In 1991, the species was designated a threatened species in Canada, and in 2015, it was proposed for federal listing in the United States.

When considered in the context of the rest of its range, populations of EMR in Michigan are doing better than in surrounding states and Ontario. Faust *et al.* (2011) completed population viability analyses for a subset of populations across the range. Only Michigan had more than one viable population; fully 1/3 of populations assessed had quasi-extinction probability less than 1.0. While this would indicate that the status in Michigan is better than other jurisdictions, fully 2/3 of Michigan populations were estimated to face extinction in the next 25 years. Changes in management improved status at many of the sites with larger populations, suggesting that management guidelines like those in this CCAA could have a significant positive impact on the status of EMR in Michigan. One site in southwestern Michigan managed for EMR had a survival probability of 0.95, considerably higher than other studies (Bailey *et al.* 2011.)

4.3 Population Status in Michigan

In Michigan, the decline of EMR has been less severe than in other states. Michigan has the greatest number of extant EMR populations and the greatest amount of suitable habitat (Szymanski 1998). Thus, conservation and recovery efforts in Michigan are particularly crucial for ensuring the long-term viability of this species.

Historically, EMR occurred throughout Michigan's Lower Peninsula with occurrences in 50 of the 68 Lower Peninsula counties. EMR also occur on Bois Blanc Island in Lake Huron. Bois Blanc Island is part of Mackinac County and considered part of the Upper Peninsula, but lies less than four miles north of the Lower Peninsula shoreline. EMR are not known to occur on the mainland of the Upper Peninsula.

Michigan has many populations of EMR, and they persist throughout most of the species' historical range in Michigan. However, the number of populations has declined (Legge 1996). As of 1996, there were 204 known occurrences in the state, including historical locations (Legge 1996). Of this total, 141 (70%) had been observed in the past 10 years, and 117 (57%) had been observed in the past five years (Legge 1996). Of the 204 historical localities, 50 populations (~25%) were considered extirpated (Legge 1996, Szymanski 1998). Of the remaining 154 possibly extant populations, 40 were considered secure or presumed secure, 78 were considered vulnerable or declining, and 36 were unknown (Szymanski 1998).

Since 1996, limited surveys for the EMR have been conducted and incidental observations have continued to be compiled. Targeted field surveys on public or other protected lands were conducted from 2001-2003.

In 2003, surveys also were conducted on some private properties at which EMR had been reported. In addition, several radio-telemetry projects have been completed in Michigan. The Michigan DNR continues to request and gather EMR reports from resource managers and the general public.

According to the Michigan Natural Features Inventory (MNFI), as of 2011, there were 258 known occurrences of EMR in 50 counties throughout the Lower Peninsula of Michigan. However, EMR were last documented or reported from only 172 of these occurrences since 1991 (i.e., within the last 20 years), and only 98 of these occurrences since 2000. Of the 98 occurrences that have been confirmed since 2000, 79 occur primarily on public or protected lands or on public and adjacent private lands, while the remaining 19 occurrences occur exclusively on private lands. These occurrences are located in 32 counties.

Although the general distribution of populations in the state has been well documented, less is known about population size, demographics and long-term viability. Given the highly cryptic nature and potentially low abundance of EMR, it is difficult to estimate population size for this species (Szymanski 1998). Other factors can be used to assess population status and viability including changes in geographic range, habitat quantity and quality, or poaching reports.

4.4 Habitat Characteristics

EMR have been found in a variety of wetland habitat types across their range, including bogs, fens, shrub swamps, wet meadows, marshes, moist grasslands, wet prairies, peatlands, coniferous forests and floodplain forests (Minton 1972, Seigel 1986, Hallock 1991, Weatherhead and Prior 1992, Johnson 1995, Kingsbury 1996, Harding 1997, Sage 2005). At many locations, EMR also move from wetlands to drier upland sites during certain parts of the year to forage, disperse, gestate, and even hibernate in some cases (Reinert and Kodrich 1982, Seigel 1986, Weatherhead and Prior 1992, Johnson 1995, King 1997, Bissell 2006, Kingsbury pers. comm.). Suitable upland habitat types range from forest edges and openings, savannahs and prairies to meadows, old fields and some agricultural lands.

Analysis of the various habitat types utilized by EMR across its range indicates that structural characteristics of a site appear to be more important for determining habitat suitability than vegetative characteristics (Beltz 1992). In southern Michigan, all known sites appear to have the following three components: (1) open, sunny areas intermixed with shaded areas, and (2) areas in the vicinity where the water table is at or near the surface, and (3) variable elevations between adjoining lowland and upland habitats (Beltz 1992). In northern Michigan, the tie to shallow groundwater is less important. Over most of their range, EMR tend to avoid heavily wooded areas (Wright 1941, Bielema 1973, Reinert and Kodrich 1982, Seigel 1986, Kingsbury 1996 and 1999, Bailey *et al.* 2012), although they can utilize forest openings or gaps (Weatherhead and Prior 1992, Johnson 1995, King 1997, Kingsbury pers. comm.) preferred habitats are generally open (e.g., less than 50% canopy cover), typically with an open woody vegetation layer, with trees and shrubs thinly distributed (Johnson *et al.* 2000). This vegetative structure likely provides a thermoregulatory mosaic and increases prey densities for the snakes (Johnson *et al.* 2000). Within relatively open habitat, EMR often utilize areas near isolated trees or shrubs, potentially for thermoregulation and protection from predators (Bielema 1973, Johnson 1995, Johnson *et al.* 2000).

EMR also appear to prefer a sedge and grass ground cover, often with a significant sphagnum component (Johnson *et al.* 2000). At a microhabitat scale, EMR showed preference for sites closer to retreat sites and shrubs (Harvey and Weatherhead 2006b).

In many ways, Michigan contains a relatively complete assemblage of potential EMR habitat (Kingsbury 2002). Populations are distributed throughout the Lower Peninsula, and climatic, soil and vegetation features are widely variable across the state. EMR habitat use in Michigan appears to vary regionally. Populations in southern Michigan are typically associated with open wetlands, often prairie fens and wet meadows along rivers and around lakes (Legge and Rabe 1999, Kingsbury 2002). Populations in northern Michigan are associated with similar open wetlands as well as lowland coniferous forests such as cedar swamps (Legge and Rabe 1999, Kingsbury 2002). Upland habitat types utilized in Michigan include savannas, old fields, grassy fields or openings, managed wildlife openings, pine barrens, edges of dry upland forests, such as jack and red pine forests, and openings associated with oil and gas wells (Legge and Rabe 1999, Kingsbury 2002, DeGregorio *et al.* 2011). In general, understanding of EMR habitat in the northern Lower Peninsula is less extensive and requires further clarification.

Although significant habitat loss has occurred in Michigan, suitable habitat for the EMR may be extensive (Kingsbury 2002). Many of the sites where EMR were not documented during recent surveys still appeared to contain suitable habitat and potential for the species. Also, there are numerous and extensive tracts of seemingly suitable habitat in the state in which EMR have not been documented and/or that have not been surveyed.

4.5 Threats

Section 4(a)(1) of the ESA lists five factors that must be considered when determining if a species should be listed as threatened or endangered. A species may be listed due to one or more of these factors. These include:

- (A) present or threatened destruction, modification, or curtailment of its habitat or range;
- (B) over-utilization for commercial, recreational, scientific, or educational purposes;
- (C) disease or predation;
- (D) inadequacy of existing regulatory mechanisms; and
- (E) other natural or manmade factors affecting its continued existence.

The Service's *Species Assessment and Listing Priority Assignment Form* for the EMR describes the status and threats that the Service evaluated in order to determine that the species qualifies as a candidate for listing under the ESA. The species assessment form includes detailed information and references on the EMR's range, status, habitat needs, and listing priority assignment. This section summarizes the threats assessment information from the EMR's assessment form.

4.5.1 Threat (A): The present or threatened destruction, modification, or curtailment of its habitat or range. As noted previously, habitat loss is an important factor in the decline of EMR. The effects of past, widespread wetland loss continue to impact EMR populations. Development and agricultural practices continue to cause habitat loss, although to a lesser degree than in the past. Habitat loss increases the distance between populations and can isolate seasonally used habitats within individual populations, can restrict gene flow and other effects of small population dynamics, as well as increase exposure to sources of mortality. Destruction or modification of habitat is affecting at least 50 populations range-wide (Szymanski 1998).

In addition, urban encroachment has disrupted the natural disturbance processes (such as hydrological cycles and fire frequency), and subsequently, changes in habitat structure and vegetative composition have occurred. Prolonged flood conditions may make wetlands too deep for use by EMR, while prolonged drought conditions may affect crayfish populations and thus reduce the number of suitable hibernacula available for EMR.

Woody succession, especially by introduced species such as Eurasian buckthorn, that results in habitat becoming too shaded may reduce or eliminate these sites as suitable places for EMR to bask and thermoregulate. For example, in New York, EMR relate spatially with areas where woody stems are in low density (Johnson 1995). In Pennsylvania increasing woody vegetation was cited as a threat at 75 percent of the EMR sites surveyed (Reinert and Buskar 1993).

The Service, partner organizations and species experts from throughout the range of the species completed a range-wide extinction risk model for the EMR (Faust *et al.* 2011). Based on expert inputs, vegetative succession and habitat fragmentation were found to be the two of the three most commonly occurring detrimental factors (with the third being late season prescribed burns) occurring at sites with active EMR populations (Faust *et al.* 2011, pp. 12-15, 56-62).

4.5.2 Threat (B): Overutilization for commercial, recreational, scientific, or educational purposes. Persecution, and the over-collection and overutilization of EMR are documented threats, with several populations having been collected beyond a recoverable threshold.

In Wisconsin, illegal collecting has been documented despite many years of legal protection (Christiansen 1993, Wisconsin Department of Natural Resources 2011). An Indiana Department of Natural Resources law enforcement investigation in 1998 uncovered a well-organized, multi-state effort to launder State-protected reptile species (including EMR). The investigation concluded with the indictment of 40 defendants.

In 2009, a similar joint investigation by law enforcement agents in the United States and Canada uncovered at least 33 EMR poached from a Canadian population, and then smuggled into the United States (New York Department of Environmental Conservation, 2009).

4.5.3 Threat (C): Disease or predation.

Snake fungal disease (SFD) is an emerging and significant threat to EMR populations (Allender *et al.* 2011). Recently, a growing number of snakes have been found in the U.S. with severe and often fatal fungal infections. The number of species of snakes with documented or suspected cases of the disease, and the geographic area the disease has been found, continues to increase annually. A causative agent, *Ophidiomyces ophidiicola* (formerly *Chrysosporium ophidiicola*) was first described from an Eastern Rat Snake (*Pantherophis obsoletus*) in Georgia (Rajeev *et al.* 2009). The pathogen has now been confirmed in at least two EMR specimens from Michigan and observed annually at the only known remaining population in Illinois. In the wake of the devastating impacts on amphibians due to Chytrid beginning in 1996 (caused by the fungus *Batrachochytrium dendrobatidis*) (Longcore *et al.* 1999), and White Nose Syndrome (caused by the fungus *Pseudogymnoascus destructans*) on bats beginning in 2005 (Gargas *et al.* 2009), there may be genuine cause for concern that the emerging fungal disease in snakes could have a significant impact on EMR populations.

The loss of suitable habitat can force EMRs to utilize and traverse areas that increase their vulnerability to predation. At a site in Wisconsin, for example, owl predation appears to be significant. Of the nine individuals being tracked at that site, three were taken as prey (Hay, 1996, pers. communication). Upland habitat for that site is limited to railroad embankments. Although these areas provide the open habitat structure necessary for the female's thermoregulatory needs, they also provide easy EMR foraging for owls.

4.5.4 Threat (D): The inadequacy of existing regulatory mechanisms.

The EMR is listed as endangered in the states of Illinois, Indiana, Iowa, Minnesota, Missouri, New York, Ohio, Pennsylvania, and Wisconsin; as threatened in the Canadian province of Ontario; and as special concern in the state of Michigan. Although the species is afforded some level of state protection across its range, protection of its habitat is generally limited to lands protected for other conservation purposes. Given the significance and pervasiveness of habitat loss, the threats facing the EMR range-wide are likely to continue without additional regulatory protections.

4.5.5 Threat (E): Other natural or manmade factors affecting its continued existence.

Range-wide many EMR populations have declined to critical levels, increasing susceptibility to low birth rates and small population dynamics. EMR females do not bear their first litter until three years of age, or older, and then do so only once every other year. This low biological replacement rate means that EMR populations occurring at low densities are particularly sensitive to losses, both natural (e.g., predation) and human (e.g.,

collection or mortality due to land use practices). Given the species' low biological replacement rate, even small increases in adult mortality can lead to irreversible declines. These biological traits and the threat factors identified above interact synergistically, which exacerbates the effect of individual factors and can accelerate declines and the extirpation of populations affected by one or more factors. Similarly, the range-wide extinction risk (Faust *et al.* 2011) found that many extant populations across the range of the species may also be very small, and subject to effects of small population size and small population dynamics.

Climate change is one of several factors believed to be actively leading to declines in reptile populations (Gibbons *et al.* 2000). The EMR scored Highly Vulnerable to climate change in an analysis using the NatureServe Climate Change Vulnerability Index tool (Hoving *et al.* 2013). Poor dispersal ability, landscape barriers, and drought sensitivity all contributed to the highly vulnerable score (Hoving, unpublished). Another assessment modeled demographic rates under past and future climate scenarios. They found that past climate change explained the observed recent range contraction, and suggested that the range contraction would continue. Only populations in northern Michigan and Ontario were likely to persist to mid-century (Pomara *et al.* 2014). While these studies suggest that EMR populations in southern Michigan are not viable, there is some uncertainty about this prediction. The ability of species to evolve responses in situ to a changing climate is largely unknown and unknowable, and this species' sensitivities to climate change are predicated on projections of future precipitation that are highly uncertain. Although more models suggest drying in southern Michigan, nearly as many models suggest a wetter climate.

5) Conservation Goals

The Cooperators will conserve and enhance EMR on enrolled lands in Michigan during the life of this Agreement. This agreement implements a strategy that addresses EMR conservation from a landscape perspective, promotes the management of suitable habitat, and allows land managers the flexibility to actively manage suitable habitat while integrating specific guidance to minimize the loss of individual snakes. The primary conservation goal of this agreement on the part of the Service and the other cooperators is to conserve EMR by managing and restoring habitat for EMR on enrolled lands.

The DNR is committed to the conservation, protection, management, use and enjoyment of the state's natural and cultural resources for current and future generations. To implement and achieve this mission the DNR has identified five goals:

1. Protect natural and cultural resources.
2. Ensure sustainable recreation use and enjoyment.
3. Enable strong natural resource-based economies.
4. Improve and build strong relationships and partnerships.
5. Foster effective business practices and good governance.

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The DNR must consider the above listed five goals on DNR enrolled lands while simultaneously managing habitat for EMR. Specifically the conservation and sustainability of EMR on DNR enrolled lands will be met by their staff following the Management Strategies identified in Section 7.1. By implementing these strategies the DNR will ensure that suitable habitat will be available for EMR while minimizing impacts to individual snakes. There are 3 primary types of DNR administered lands and a description of the EMR conservation goals and their relationship to EMR conservation, are discussed below.

The Camp Grayling National Guard Training Center exists on State of Michigan lands that are a mosaic of DNR and DMVA administrative responsibility. All Camp Grayling lands are included as enrolled lands. Camp Grayling is a multidisciplinary military training ground on which the DNR performs natural resource management as long as the management activity is deemed compatible with training. On these lands military training has precedence over resource management activities. Natural resource management activities strive to sustainably produce various forest products, enhance game and non-game wildlife habitat, including habitat for EMR, and protect areas of unique character while accommodating military training.

5.1 Game and Wildlife Areas

In southern Michigan, most EMR populations found on State lands occur either on state game areas or on state parks. Game areas were purchased with funds provided by hunters and hunting license fees continue to fund the on-going management of these properties. As in other states, the primary goal in managing lands purchased with Pittman-Robertson funds must be the conservation of wild birds and mammals. Game and Wildlife Area management focuses on providing habitat for sustainable populations of game species, such as deer, turkey, and waterfowl. This management often creates or maintains forest openings, preserves or restores non-forested wetlands, maintains or establishes open grassland/savanna complexes, and discourages land use not oriented to wildlife habitat. Game management increasingly emphasizes native vegetation, natural ecological processes (like fire), and restoring natural communities. Management on these areas has resulted in and will continue to create vegetation structure amenable to EMR.

5.2 Parks and Recreation Areas

Although state parks and recreation areas were purchased with a variety of funds, the on-going management of these properties is funded largely or entirely by visitors who pay an entrance or use fee. The primary conservation goals on these properties are two-fold: to protect natural features and to allow people to use and enjoy the areas. The management of these lands has focused on the maintenance or restoration of natural communities, such as savannas, prairies, and non-forested wetlands. This management for ecological communities has benefited many specific species, including the EMR, but the management goal remains at the system or community level.

5.3 Forest Lands

State forests are co-managed by wildlife biologists and foresters for many uses, including forest products, wildlife, fisheries, natural communities, and forest health. This active management has resulted in a forest of diverse age structures, with temporary non-forested openings being created and reverting to forest continually. Furthermore, in northern Michigan, many forest lands are managed as barrens. These sandy, nutrient poor soils support grasslands used by upland sandpiper, elk, and EMR. Although they lack trees, these barrens are managed as part of the forest ecosystem. EMR are not restricted to barrens however. They benefit from timber harvest adjacent to non-forested wetlands and riparian areas as well. Although the primary goal on these lands is for the long-term sustainability of the forest ecosystem (broadly defined), the management of these forests has created and will continue to create valuable habitat for the EMR.

5.4 Expected Benefits to EMR, Rare Plants, and Rare Animals

This Agreement encourages cooperative habitat management efforts between the Service and other cooperators. The expected benefit from the enrolled landowners, including Participating Landowners and CI Participants with enrolled lands, implementing the management strategies identified in this Agreement (Section 7.1) is the continued maintenance and improvement of existing EMR habitat. The continued maintenance and management of EMR habitat should benefit the long-term sustainability of EMR populations in Michigan. In addition, the conservation, protection and management of suitable habitat for EMR will have widespread ecosystem-based benefits. For example, EMR are typically affiliated with several rare natural communities such as prairie fens, prairies, and savannas. EMR are also associated with numerous imperiled species, such as the federally and state endangered Mitchell's satyr butterfly (*Neonympha mitchellii*), the state threatened spotted turtle (*Clemmys guttata*) and many other listed or rare species (Appendix B). When actively managing properties and following the Agreement's management strategies, the enrolled landowners will conserve, manage and protect numerous rare plants, animals and natural communities.

6) Enrolled Lands

6.1 Michigan Department of Natural Resources

DNR administered enrolled lands include lands where the DNR holds title to both surface and sub-surface rights and lands where the DNR holds title to surface rights but no subsurface rights. Lands for which the DNR holds title to subsurface rights, but no surface rights are specifically not enrolled. It is important to note that the DNR will exclude all private land in-holdings from the EMR CCAA. However, private landowners interested in EMR conservation can sign onto the Agreement and receive the same assurances via a Certificate of Inclusion. The total DNR acreage enrolled is 2,524,000 acres.

The majority of DNR lands are not suitable habitat for EMR. Because EMR distribution is not fully known, we choose to enroll all lands. Most enrolled land that harbors EMR has been and will continue to be managed in ways compatible with and often beneficial to EMR. However, a minority of enrolled lands known to have EMR are dedicated to uses that are not compatible with EMR. These include parking lots, buildings, road and trail surfaces, and cropland. For this reason, enrolled lands have been separated into two categories: managed land and unmanaged land.

6.2 Department of Military and Veterans Affairs

DMVA lands that are enrolled in this agreement include only the 147,000 acres of Camp Grayling. These acres are used for military training under a number of different ownership, grant and lease agreements. Wildlife and forest management of all these lands is primarily the responsibility of the DNR. DMVA and Camp Grayling have responsibility for management of military construction and training as it impacts threatened, endangered, proposed and candidate species.

6.3 Managed Lands

The total DNR lands enrolled as Managed Land is 136,311 acres (Table 1). Managed Land is considered most important to the long-term sustainability of EMR and was identified using Michigan's natural heritage database, expertise from DNR staff, and through conversations with EMR experts. Managed Land will be managed according to management strategies identified in Section 7.1. The management strategies will be implemented as necessary to reduce and/or eliminate a particular threat (Appendix C). Map of enrolled lands (Appendix D) delineate boundaries of Managed and Unmanaged land for all enrolled lands.

6.4 Unmanaged Lands

Unmanaged land is all other enrolled land owned and administered by the DNR and not included as Managed Land. The total DNR lands enrolled as Unmanaged Land is 2,387,689 acres. While mostly unsuitable for EMR, unmanaged land included some occupied habitat that occurs on lands that are incompatible with EMR management, such as campgrounds or regularly mowed right-of-way on roads and some trails.

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Table 1. List of DNR and DMVA properties enrolled as EMR Managed Lands. DMVA properties are included in the State Forest estimates since their land is managed as part of the State Forest system.

State Forest Areas	Acres
Au Gres River	925
AuSable Canoe Camp	581
AuSable River	753
Big Cannon Creek	1,588
Bois Blanc Island	5,423
Deward Road	698
Green Swamp	6,439
Hartwick Pines SF	763
Ishaword Forest	752
Manistee River	2,796
Muskegon River Oxbows	3,632
Portage Creek-Lake Margrethe	4,532
Rainy River Flooding	4,247
Roy and McDonald Creeks	3,164
Seven Mile Swamp	2,304
Skegemog Lake Swamp	2,615
Ward Road Wetlands	2,168
Wide Waters Road North	3,186
Wide Waters Road South	7,788
Wolf River Swamp	1,773
SUB-TOTAL	56,127

State Parks and Recreation Areas	Acres
Bald Mountain SRA	1,513
Brighton SRA East Unit	2,374
Brighton SRA West Unit	1,339
Hartwick Pines SP	2,131
Highland SRA	1,736
Holly SRA East Unit	180
Holly SRA West Unit	1,743
Island Lake SRA	2,107
Pinckney SRA	6,855
Proud Lake SRA	1,680
Seven Lakes SP	1,368
Thompsons Harbor SP	5,387
Waterloo SRA Eastside	6,929
Waterloo SRA Westside	943
Yankee Springs SRA	2,654
SUB-TOTAL	38,939

State Game and Wildlife Areas	
Allegan SGA	6,416
Augusta Creek SWA	389
Barry SGA	7,494
Crane Pond SGA	2,207
Gourdneck SGA	2,157
Gregory SGA	1,826
Horseshoe Lake SGA	398
Muskegon SWRA	13,370
Oak Grove SGA	1,412
Onsted SGA	302
Rose Lake SWA	2,846
Somerset SGA	294
Three Rivers SGA	2,125
SUB-TOTAL	41,236
TOTAL DNR	136,311

7) Conservation Measures

7.1 Management Strategies for Managed Lands

These habitat management guidelines were developed to provide land managers with a framework to protect EMR populations while creating and/or restoring suitable habitat needed to sustain EMR populations on enrolled lands. These guidelines reflect current knowledge of researchers and resource managers in Michigan. However, we also recognize that our understanding of the factors, including management actions, influencing EMR population dynamics are limited. There are varying degrees of support for the efficacy for the conservation measures currently available for EMR (e.g., informed judgment of experienced land managers, well-documented research across multiple types of sites, etc.). Therefore as resources allow, an adaptive management approach that targets key assumptions and uncertainties related to management actions is critical to meeting the CCAA standard over the life of this agreement (Section 10). These guidelines will be followed on enrolled lands identified as 'Managed Land' and may be modified if population levels decline due to changed circumstances (see Section 12.2.1).

When deviations from these guidelines are necessary, a written request to the Service must be submitted as described in "Modifications of the CCAA" on page 25 of the CCAA. If a non-DNR Enrolled Landowner is requesting the modification, the DNR must be notified as well. In cases where a quick review is necessary (i.e. short burn windows in the spring, urgent situations), approval must be obtained from the Service. In emergency human health and safety situations (to be decided by the land manager) when pre-approval to deviate from these guidelines is impractical, descriptions of the actions taken will be carefully documented and provided to the DNR and the Service after the fact. Development activities, such as new buildings, parking lots or transportation infrastructure, in enrolled lands designated as managed habitat will require modifications to the CCAA. Development activities in Unmanaged Land will not require modifications; however, they will be subject to Section 7 reviews if a federal nexus exists.

7.1.1 Wetland Protection

The primary threat to the EMR is habitat loss, in particular the effects of past, widespread wetland loss. While the DNR lands may have been intended for recreation, forestry, game species, or other purposes they have nonetheless played an important role in conserving EMR by providing places where wetlands have been conserved. The effectiveness of DNR lands as part of conservation landscape for the EMR is demonstrated by the number of remaining EMR populations they support. Conserving wetlands is one of the most significant EMR conservation measures provided by the DNR lands.

7.1.2 Prescribed Fire

Fire is a natural process that occurs in many natural communities, including fens and other vegetation types occupied by EMR (Spieles *et al.* 1999). Fire in fens and savannas serves to keep the vegetation open, reduce shrub and tree cover, reduce surface cover and encourage germination and reproduction of many plant species.

Prescribed fire will be allowed in managed habitat even though it has the potential to kill individual snakes. At some managed sites, prescribed fire may be the preferred or only effective management treatment for invasive species or discouraging woody growth for the purpose of maintaining important habitat. The following guidelines will allow managers to enhance or increase suitability of EMR habitat while minimizing the potential loss of individual snakes. Heat from prescribed fire does not reach far into the soil. Therefore, burning during the inactive season is not expected to harm hibernating EMR. Smith *et al.* (2001) observed that snakes exposed to low intensity fire were more likely to survive than those exposed to high intensity fires. Mortality from prescribed fire is possible, even when steps are taken to reduce that mortality (Durbian 2006, Cross 2009), but the impacts of fires likely vary with other threats, snake population size, fire intensity, and fire frequency. Snakes and other reptiles may move from the burn unit, but in order to provide them more time and potential refuges these guidelines include recommendations to decrease rate of spread and intensity. Rattlesnakes have been known to seek subterranean refuges and may survive less intense fires (Smith *et al.* 2001).

Prescribed fire promotes dynamic changes in the landscape that set back succession, improve EMR habitat, and may be beneficial to EMR populations in the long run. The impacts from prescribed fire on EMR populations are uncertain and, therefore, will be evaluated for its positive and negative effects to EMR populations and habitat (See Section 10). The following guidelines will be observed when using prescribed fire to increase habitat suitability for rattlesnakes.

1. Burning in managed EMR habitat when snakes are inactive or not emergent is unrestricted except when current conditions could possibly result in snake emergence. If available, use a Snake Emergence Prediction Model (SEPM). If the model predicts that snakes may be emergent, burning will be conducted according to the protocols described below. If the model predicts snakes are not active, then burning is unrestricted.
2. Land managers will leave unburned areas adjacent to prescribed burns to serve as snake refugia whenever possible.
3. Prescribed burn plans will use 'back burning' as the primary ignition strategy. This approach will minimize entrapping snakes between flame fronts. However, the burn manager may make the judgment, during a burn treatment, that encirclement ignition or strip firing is necessary to protect human safety or property.

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4. A scientific fire behavior model, such as the United States burn model, the Canadian burn model or equivalent will be used to formulate a burn prescription for a maximum rate of spread no faster than 16 chains per hour (17.6 feet per minute) with an average targeted rate of 10 chains per hour or less (11 feet per minute), except in known hibernacula areas. A slower rate of spread may allow snakes within the burn unit adequate time to find refugia.
5. Where hibernacula are known to be dense (greater than 5 hibernacula per acre), no burning is allowed from March 15 to May 15, unless the Snake Emergence Prediction model predict snakes to be inactive and not yet emerged. Where hibernacula are known to be diffuse (less than 5 hibernacula per acre) across the landscape, burns between March 15 and May 15 can move at no faster than 8 chains per hour (8.8 feet per minute).
6. Fire breaks will be established following existing fuel breaks (roads, rivers, trails...) to the greatest extent possible. Cultivation (disking or roto-tilling) of burn breaks will be minimized to the extent that human health and safety are not jeopardized. Cultivation and mowing fire breaks will be established during the inactive season to the extent possible (See 7.1.2 & 7.1.3).

7.1.3 Mowing and Hydro-axing

In Michigan, mowing has been used to set back succession, control invasive species or establish fire breaks. Mowing is also used to maintain dikes, trails, and other areas designated for human use. While mechanical treatments are an important wildlife management tool, they have been identified to cause direct snake mortality. Mechanical treatments are intensive management techniques that may threaten the long-term survival of localized EMR populations.

The following guidelines will be observed when mechanical treatments are used in managed habitat to increase habitat suitability for rattlesnakes and minimize mortalities:

1. Set mower deck heights to maintain turf grass at <15 cm (6 inches) at all times.
2. In areas with known hibernacula, mowing and hydro-axing are not allowed at any time of year.
3. Management will follow the most recent rutting guidelines for the DNR.
4. Mowing or hydro-axing of grasses over 6 inches will occur only during the inactive season, except to control non-native vegetation in degraded habitats.

After snakes have emerged, mowing and hydro-axing will only be allowed when land managers are trying to improve EMR habitat in highly degraded sites (>90% canopy closure or >75% nonnative invasive species). For example, a land manager may want to control invasive species or convert agricultural fields to native grasslands.

7.1.4 Cultivation

In Michigan, cultivation has been used to establish new habitat plantings, set back succession, and establish fire breaks. Cultivation is strongly discouraged in managed habitat regardless of snake activity.

However, the following cultivation practices will be considered acceptable in managed habitat:

1. Areas that are to be treated with mechanical soil disturbance will be mowed during the inactive season to less than 15 cm (6 in) in height so that they are unattractive to snakes the following spring.
2. Areas may be continuously maintained as row-cropped agriculture.
3. Narrow strips of land may be cultivated for the establishment of fire breaks, as outlined in the prescribed fire guidelines.
4. Cultivation may be used when necessary to protect human or natural resource health and safety (e.g., wildfire suppression.)

7.1.5 Water Level Manipulation

Maintaining the natural hydrology is critical for maintaining viable populations of amphibians and reptiles. In some wetland complexes, the natural fluctuations in water levels help maintain open landscapes. The groundwater or saturated soils protect hibernating snakes from freezing during winter. Draining removes the heat sink capabilities of the water and weakens the thermal link to warmer areas farther underground. Therefore, alterations to wetland hydrology may have negative impacts on amphibian and reptile populations. EMR, like other wetland snakes, have been shown to tolerate submersion for short periods (about 2 weeks) of time when water temperatures are near freezing. They then rely on cutaneous gas exchange. Individuals will be able to respond to flooding during the active season by moving. Flooding will not kill the snakes during the active season, but may force them out of suitable habitat. Extended flooding may destroy elements of the habitat. Beavers promote dynamic changes in the landscape, and may be beneficial to the snake population in the long run. Beaver activity should be evaluated for its positive and negative effects on EMR habitat and also on human interests.

The following guidelines will be observed when manipulating water levels in managed habitat:

1. Water levels in managed habitat will not be drawn down during the inactive season, except for human health and safety reasons.
2. Water levels may not be raised for more than two continuous weeks during a single inactive season, except for health and safety concerns.
3. Permanent flooding or drainage that results in loss of EMR habitat is prohibited.

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4. Water levels may be raised during the active season.
5. This agreement does not obligate the DNR to manage beaver to maintain water levels.
6. Temporary flooding to mimic the restorative effects of beaver activity for one to five years will need written pre-approval from the Service.

7.1.6 Forest Management

Most forestry activities that are conducted in accordance with sustainable forest management principles are not expected to negatively impact EMR populations. In most cases forest management practices will benefit EMR, especially when the following guidelines are observed on Managed Lands.

1. Conduct timber harvesting operations when substrate is firm and dry in mid to late summer or when the ground is adequately frozen so that rutting and compaction is minimized.
2. Reforest stands through natural regeneration or tree planting (including appropriate site preparation, such as trenching and scarification). Planting densities should be at levels that assure a similar cover type pattern, or retain or mimic more open forest communities (e.g., pine barren or savanna). Savanna and pine barren restorations are encouraged.
3. Consider increasing fine and coarse woody debris retention, creating brush piles and favoring other habitat elements. Slash burning will occur only during the inactive season.

7.1.7 Chemical Control

Chemicals have been used by many natural resource professionals to achieve specific habitat management goals and objectives. Currently, many land managers use herbicides because of their effectiveness, ease of use and because herbicides can be relatively inexpensive. Although herbicide use may be an effective habitat management tool, a paucity of research exists on the effects of chemicals on reptiles and, specifically, to EMR. Therefore, it is strongly recommended that land managers consider specific biological factors and utilize a cautious approach when choosing an herbicide, application method, application rate, time of application, and time between applications.

Due to the unknown impacts of herbicides to EMR, broadcast applications in Managed Land is prohibited except when land managers are re-establishing suitable habitat at highly degraded sites (e.g. converting row crops to native grasslands or to control monocultures of invasive species). Land managers may use other herbicide treatments such as spot spraying or wicking to control invasive plant species in Managed Land.

7.1.8 Collection, Release, Relocation and Persecution

Collection of EMR for personal pets and commercial trade is an ongoing problem. Poachers have posed as researchers or collaborators of researchers to obtain information on where to find EMR. Pet EMR held in captivity will not be released into the wild because the potential for introducing diseases into an area is significant. Mixing stocks could also have undesirable genetic effects.

The following guidelines will be observed to minimize the potential negative impacts from the collection, release, relocation and persecution of rattlesnakes:

1. Details on specific locations of snakes or hibernacula will be treated with the same sensitivity as location of state or federally listed species because collection or killing at hibernacula could devastate a population.
2. EMR legally maintained in captivity will not be released back into the wild. Those snakes that have been held temporarily for research purposes may be released where they were captured if they are in good health and have been held in isolation from other reptiles.
3. EMR will only be moved to protect the snake or people. EMR that must be moved should be moved less than 500 m and into the same wetland system, but not across barriers (e.g., roads). If a snake is moved across property lines, permission will be obtained from the landowner. EMR lacking knowledge of their surroundings have elevated levels of mortality.
4. Staff will be routinely educated about EMR because they are in an excellent position to provide public education.
5. Priority will be given to placing snakes that cannot be released or are confiscated into the EMR Species Survival Plan population maintained by the Association of Zoos and Aquariums where they may have both an education benefit and contribute to the captive population and possible future assurance breeding.

7.1.9 Trails and Pathways

Trails and pathways are an important component of managing DNR administered land. For human safety, use and enjoyment of trails and pathways, it is necessary to perform maintenance on the trails, including grading, tree-trimming and other activities.

The following guidelines will be observed when performing trail and pathway maintenance:

1. Set mower deck heights to maintain turf grass at <15 cm (6 inches) at all times.
2. In areas with known hibernacula, mowing and hydro-axing are not allowed at any time of year.
3. Management will follow the most recent rutting guidelines for the DNR.

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4. Outside areas of known hibernacula, mowing or hydro-axing of grasses over 6 inches will occur only during the inactive season, except to control non-native vegetation in degraded habitats.
5. Development of new trails/pathways or substantive changes to existing trails/pathways within Managed Land must include consultation with the DNR Endangered Species Coordinator prior to initiation of construction.
6. Trail/pathway construction will be complete during the inactive season.

7.2 Management Strategies for Unmanaged Lands

On Unmanaged Lands other goals and mandates require that the management strategies outlined in Section 7.1 will not apply. The Enrolled Landowners will use the following guidelines on Unmanaged Land:

1. Possession of EMR will continue to be prohibited. This will be accomplished by maintaining the Director's Order (No. DFI-166.98, Regulations on the Take of Reptiles and Amphibians; Act 165 of the Public Acts of 1929, as amended, Sec. 302.1c(1) and 302.1c(2) of the Michigan Compiled Laws) which prohibits take of "special concern" reptiles and amphibians without a permit from the DNR.
2. Upon documentation of more than one individual, evidence of reproduction, and availability of suitable habitat on enrolled lands previously designated as Unmanaged Land, signatories may re-classify enrolled areas as Managed Land, but are not required to do so. Consideration will be given to whether the EMRs found are associated with a known and viable population nearby.
3. Management of Unmanaged Land where EMR are unwelcome will focus on management techniques that discourage EMR use. For example, grassy areas around buildings or campsites will be frequently mowed because tall vegetation could attract EMR.
4. Avoid or minimize the potential for actions on the Unmanaged Lands that may restrict EMR dispersal between Managed Lands that are separated by less than 1 km. Activities that may limit dispersal may include new or expanded paved roads or motorized vehicle trails. In order to provide incidental take coverage for these types of activities pursuant to the CCAA the DNR and the Service must first confirm the action proposed is consistent with the CCAA standard.
5. The following guidelines will be observed to minimize the potential negative impacts from the collection, release, relocation and persecution of rattlesnakes:
 - a) Details on specific locations of snakes or hibernacula will be treated with the same sensitivity as location of state or federally listed species because collection or killing at hibernacula could devastate a population.

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- b) EMR legally maintained in captivity will not be released back into the wild. Those snakes that have been held temporarily for research purposes may be released where they were captured if they are in good health and have been held in isolation from other reptiles.
- c) EMR will only be moved to protect the snake or people. EMR that must be moved should be moved less than 500 m and into the same wetland system but not across barriers (e.g., roads). If a snake is moved across property lines, permission will be obtained from the landowner. EMR lacking knowledge of their surroundings have elevated levels of mortality.
- d) Staff will be routinely educated about EMR because they are in an excellent position to provide public education.
- e) Priority will be given to placing snakes that cannot be released or are confiscated into the EMR Species Survival Plan population maintained by the Association of Zoos and Aquariums where they may have both an education benefit and contribute to the captive population and possible future assurance breeding.

7.3 Management Strategies for Oil, Gas and Mineral Development

Should the EMR be listed as threatened or endangered under the ESA, authorization for incidental take under the Section 10(a)(1)(A) Enhancement of Survival Permit will be applicable when it is determined that the measures proposed for the lease collectively meet the CCAA standards. Oil, gas and mineral development activities within EMR managed areas may be authorized as a form of incidental take if the DNR determines that the activities proposed for that lease will result in a clear conservation benefit for the EMR.

The goal for an oil, gas, or mineral Certificate of Inclusion is for leaseholders to avoid and minimize negative impacts to EMR and to voluntarily contribute funding or in-kind actions to benefit the EMR. The intent is to provide options that would ensure measurable benefits to EMR conservation consistent with the purposes of the CCAA standard (i.e., preclusion or removal of the need to list). This will include compensating for any of the potential biological impacts associated with habitat loss or fragmentation for EMR as well as costs for EMR management in a more complex landscape (e.g., reduced ability to use prescribed fire or increased law enforcement costs).

Conservation measures will be site specific, but fall into general categories of habitat enhancement or avoidance of negative habitat impacts, implementing conservation measures, and addressing critical research needs. These activities will be assessed through leasing or the land use permitting processes and will consider well density, well location, access road surface, length and width, voluntary contributions to EMR conservation, and ongoing and future reclamation activities.

It is the responsibility of the oil, gas, and mineral developer to contact the DNR and develop a plan for DNR review, and to sign a Certificate of Inclusion for incidental take coverage authorized under the CCAA when the proposed plan is determined to meet the CCAA standard. Without a signed Certificate of Inclusion the CCAA does not cover oil, gas, and mineral development activities on 'managed' lands.

7.4 Education and Outreach

Education and outreach efforts are needed to raise awareness and understanding about the species for all stakeholders, reduce persecution or indiscriminate killing and promote conservation of species. A general approach is to conduct research to identify appropriate content and delivery of education and outreach efforts, learn from other efforts, model after successful efforts such as the Ontario program, identify and recruit conservation partners and target audiences, develop and distribute materials/provide resources, evaluate effectiveness of efforts, develop a volunteer network and ultimately, develop and maintain local, long-term presence/outreach effort in communities around the state within the species' range.

8) Obligations of the Cooperators

8.1 All Enrolled Participants (DNR, DMVA and CI Participants) agree to:

1. Abide by all terms of this Agreement, including 1) the specific management strategies (Section 7.1) to minimize risk of harm to EMR on enrolled lands designated as Managed Land and 2) the management strategies (Section 7.2) to minimize risk of harm to EMR on enrolled lands designated as Unmanaged Land.
2. Oil, gas and mineral development companies must work with the DNR to ensure overall measurable benefits to EMR conservation as documented through the DNR's leasing and Land Use permitting processes.
3. Work with the DNR and Service to develop a mutually agreeable site specific plan or with applicable lease or Land Use permit for oil, gas and mineral development companies.
4. Allow the Service and DNR staff reasonable access to their enrolled property to survey and monitor EMR and their habitat.
5. Notify the DNR Wildlife Division and the Service at least 30 days in advance for activities that deviate from this Agreement;
6. Report on activities as described in Monitoring (Section 9) and any applicable activities identified in the Certificate of Inclusion.

8.2 The DNR agrees to:

1. Hold the 10(a)(1)(A) Enhancement of Survival Permit issued under the Agreement;
2. Work with interested landowners or oil, gas and mineral development company lessees in the State of Michigan who participate in this Agreement by administering a program for Certificates of Inclusion.

3. Work with potential landowners and the Service to develop mutually agreeable site specific plans with interested non-DNR landowners. The DNR will work with oil, gas and mineral development companies to avoid and minimize impacts to EMR via leasing and land use permitting process in place of a site specific plan.
4. Notify the Service if discernible declines in statewide EMR populations or occupied habitat occur.
5. Suspend, in whole or part or revoke, the Certificates of Inclusion of CI Participants found to be in non-compliance with the requirements of the Agreement or their mutually-developed site-specific plans or with applicable lease or Land Use permit for oil, gas and mineral development companies. The DNR and Service may suspend or revoke the Certificate of Inclusion for cause in accordance with the laws and regulations in force at the time of such suspension or revocation (50 CFR 13.28(a)). If DNR or the Service determines that a CI Participant is violating the terms of the site specific plan or with applicable lease or Land Use permit for oil, gas and mineral development companies, written notice shall be sent to the CI Participant advising the CI Participant of the nature of the violation and identifying corrective actions required to bring the CI Participant back into compliance with the site-specific plan or with applicable lease or Land Use permit for oil, gas and mineral development companies. Take authorization and the regulatory assurances associated with the Certificate of Inclusion may be suspended or revoked if the CI Participant does not remedy the violation within seven (7) days after receipt of the notice. Notices of compliance violations will be copied to the Service. A summary of noncompliance variances also will be included in the DNR annual report.
6. Actively seek funds to implement management practices on DNR property and on properties of enrolled landowners with site specific plans. Funds do not need to be sought or given specifically for EMR conservation. Funds for management of lands for primarily game species, recreation activities, or forest management that also benefits EMR on enrolled lands are sufficient.
7. Submit modification or addendum requests to the Service as appropriate or necessary at least 30 days in advance for activities on enrolled lands that deviate from this agreement.
8. Assemble annual reports for activities under this Agreement by January 31 for the previous calendar year. Reports will include results of monitoring, any take or natural mortality observed, and the number of landowners participating through Certificates of Inclusion and the total acres of managed and unmanaged area enrolled under this Agreement.

8.3 The Service agrees to:

1. Not require additional conservation measures beyond those of this agreement or impose additional incidental take restrictions beyond those identified in the draft Enhancement of Survival Permit (Appendix E.)
2. Issue a 10(a)1(A) Enhancement of Survival Permit simultaneously with the federal listing of EMR, in the event that the EMR is federally listed as threatened or endangered under the federal Endangered Species Act.

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3. Work with the Enrolled Landowners to develop mutually agreeable site-specific plans. Work with the DNR and oil, gas and mineral development companies to avoid and minimize impacts to EMR via leasing and land use permitting process.
4. Review and issue decisions on modification or addendum requests within 30 days of receipt.
5. Provide oversight on the issuance of Certificates of Inclusion and approval of site-specific plans. Review and reach a determination (i.e. approve or deny) on Certificate of Inclusion issuance of individual site-specific plans or with applicable lease or Land Use permit for oil, gas and mineral development companies. The Service will make these determinations within 30 days of receipt. Certificates will not be issued until the Service renders its determination.
6. Suspend, in whole or part, or revoke, the Certificates of Inclusion of CI Participants found to be in non-compliance with the requirements of the Agreement or their mutually-developed site-specific plans or with applicable lease or Land Use permit for oil, gas and mineral development companies. The DNR and Service may suspend or revoke the Certificate of Inclusion for cause in accordance with the laws and regulations in force at the time of such suspension or revocation (50 CFR 13.28(a)). If DNR or the Service determines that a CI Participant is violating the terms of the site specific plan or with applicable lease or Land Use permit for oil, gas and mineral development companies, written notice shall be sent to the CI Participant advising the CI Participant of the nature of the violation and identifying corrective actions required to bring the CI Participant back into compliance with the site-specific plan or with applicable lease or Land Use permit for oil, gas and mineral development companies. Take authorization and the regulatory assurances associated with the Certificate of Inclusion may be suspended or revoked if the CI Participant does not remedy the violation within seven (7) days after receipt of the notice. Notices of compliance violations will be copied to the Service. A summary of noncompliance variances also will be included in the DNR annual report.
7. Suspend in whole or part, or revoke the Enhancement of Survival Permit if the Permit terms are not being properly implemented.
8. Assist DNR with the compilation of information and the preparation of annual reports.

9) Duration of Agreement and Permit

The CCAA, including any commitments related to funding under Service programs, will be in effect for 25 years following its approval and signing by the Parties. CI Participants signing this Agreement under the umbrella Agreement will sign on for a minimum of five (5) years. The section 10(a)(1)(A) permit authorizing take of the species will become effective on the date of the final rule listing EMR and will expire when this CCAA expires or is otherwise suspended or terminated. The permit and CCAA may be extended beyond the specified terms prior to permit expiration through the permit renewal process and with agreement of the Parties.

9.1 Renewal

DNR will encourage all CI Participants to participate for longer periods of time, but we do not wish to exclude potential participants who may wish to initially try a short-term agreement and later, if satisfied, renew for a longer period. DNR will contact all CI Participants at least 90 days prior to expiration of their agreement; at this time the CI Participant can either request a CCAA renewal or can allow their CCAA to expire. If the CI Participant renews the CCAA before the expiration date the same commitments and assurances will be continued. If the CI Participant does not wish to renew, it may simply let the CCAA expire; then the conservation activities may cease, and the CI Participant will no longer receive the assurances provided by the Enhancement of Survival permit. If the CI Participant wishes to renew after the original agreement has expired, DNR and Service will decide whether an “as-is” renewal is acceptable or if changed circumstances merit changes in the agreement. Changed circumstances may include modifications and updates to the management guidelines contained in this CCAA. If DNR decides to terminate this Agreement or not to renew upon expiration of this Agreement, the CI Participants have the option of negotiating a new CCAA with the Service.

10) Adaptive Management

This CCAA is based on adaptive management principles. Adaptive management is a process of monitoring the implementation of conservation measures, then adjusting future conservation measures according to what was learned. Adaptive management can also include testing of alternative conservation measures, monitoring the results, and then choosing the most effective and efficient measures for long-term implementation. Inclusion of adaptive management in a CCAA allows for up-front, mutually agreed upon changes to conservation measures in response to changing conditions or new information.

We expect that the conservation measures will effectively achieve the biological goals and objectives. However, there is uncertainty associated with some management techniques under specific field conditions (e.g., how well do specific prescribed fire management prescriptions help protect EMR?). Additionally, the status of the EMR could change in unexpected ways during CCAA implementation. It is possible that additional and different management measures not identified in the CCAA will be identified and proven to be more cost-effective in achieving biological goals and objectives than those currently being implemented. Results of effectiveness monitoring may also indicate that some management measures are less effective than anticipated. To address these uncertainties, the adaptive management program will as resources allow (1) gauge the effectiveness of the proposed conservation measures and (2) propose alternative or modified management measures as the need arises consistent with existing funding. The adaptive management program incorporates four primary elements:

- Identify uncertainties and the questions that need to be addressed to resolve the uncertainties. Develop alternative strategies.

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- Evaluate pilot projects implementing alternative strategies on a small scale to determine which strategies to implement more broadly.
- Integrate a monitoring program that is able to detect the necessary information for strategy evaluation.
- Incorporate feedback loops that link implementation and monitoring to a decision-making process.

The DNR has already begun investing in a number of these primary elements. The DNR funded Michigan Natural Features Inventory to identify and delineate known extant EMR populations in Michigan and to assess the condition or estimated viability of these delineated populations. The results of this study will help with the integration of a monitoring program. In addition, the DNR was recently awarded a competitive State Wildlife Grant (October 1, 2014 to September 30, 2017) that will focus on EMR conservation through refined modeling, habitat management and snake fungal disease. This project will help to refine uncertainties and questions related to surveys, detection rates at occupied sites and occurrence of snake fungal disease, provide information about habitat suitability that will help with integration of a monitoring program, and assess alternative strategies for improving habitat suitability.

The DNR and the Service agree and recognize that implementation of the conservation measures herein must be consistent with the concepts and principles of adaptive management. The effectiveness of the conservation measures, monitoring methods, and new technologies will be reviewed by the DNR and Service on an annual basis.

Upon such evaluation, mutually agreed to modifications to the conservation measures will be incorporated to further enhance the goals of this CCAA. Additionally, research projects that are designed to determine the effectiveness of management practices will be encouraged and utilized to determine what adaptive management is necessary. A Michigan EMR Working Group, including representatives from the DNR and the Service, species experts and other conservation partners, will be established to provide a forum for discussions about adaptive management and priority needs for the four primary elements.

11) Monitoring

11.1 Population Monitoring

The DNR, Service, and other cooperators will collaborate to implement a monitoring strategy to track status and trends of EMR populations. Surveys will include quantitative data on select populations and habitat. The survey design will reflect the available funding resources and may include selecting a subset of sites that can serve as representatives for other similar situated populations (size, geographically, etc.) or help to provide a periodic benchmark for the status of the species.

As resources allow, the DNR and the Service will also seek to target population monitoring efforts on key managed lands or population monitoring to help address uncertainties related to critical management questions. The DNR and the Service will continue to seek reliable, cost-effective survey methodologies. Given the reality of limited non-game funding and the intensity of Service's currently recommended protocols if utilized, the DNR does not anticipate increasing EMR surveys beyond current levels.

Monitoring the status and trends of the EMR will take place once the CCAA is permitted and will build on existing baseline data or baseline data acquired during early implementation. For status and trends monitoring, survey protocols and schedules will be established during the initial phase of implementation (years 1 through 5). Where feasible, the DNR and the Service will draw from relevant and established monitoring protocols.

Unless the DNR and the Service agree to adopt an alternative monitoring approach the Service's Recommended Standard Survey Protocol for the Eastern Massasauga Rattlesnake (<http://www.fws.gov/midwest/endangered/reptiles/eama-survey.html>) will be used to inform cooperative and collaborative monitoring efforts. These protocols stress that surveys at each site be intensive (40 hours of searching per site) and only be done by highly trained observers. Survey results will be recorded in Michigan's natural heritage database. These surveys will be the responsibility of each Enrolled Landowner and survey intensity and frequency will likely depend on time and funding constraints of individual Enrolled Landowners. Survey data, findings, and any assessment of trends will be reported to the DNR within the calendar year of performing the surveys.

11.2 Habitat Monitoring

Habitat monitoring is a rapidly developing discipline, and will likely change during the 25 year term of this Agreement. Enrolled Landowners will monitor EMR habitat using tools that are effective and available. These might include IFMAP, photo-monitoring, coarse level metrics, Habitat Suitability Indexes or niche modeling. O'Connor (2006) discusses a variety of monitoring techniques that might be adapted to habitat monitoring for the CCAA. Enrolled Landowners may choose to evaluate and monitor EMR habitat components and vegetation structure at other sites, which may be very valuable especially if management is intense.

The DNR, experts, and other conservation partners will continue to evaluate and refine monitoring techniques and analysis and protocol will be adapted accordingly. Any new applicable information from EMR research projects will also be considered in the adaptation of a monitoring protocol.

11.3 Take Monitoring

Managed areas burned or mowed during the active season will be surveyed to identify live and dead snakes within 2 days post-treatment. All EMR observed to be killed from management activities will be reported to the Service within 30 days. In addition, reports of illegal take (i.e., unpermitted collection or persecution) on enrolled lands will be reported to the Service's Office of Law Enforcement within 48 hours.

11.4 Compliance Monitoring and Reporting

On an annual basis the DNR will provide a report to the Service for activities covered under this Agreement. The DNR will submit a final report to the Service by March 1. The report will include, but is not limited to:

1. Acres of habitat managed by year and by management technique
2. Brief description of habitat management implemented each year
3. Number of observed EMR mortalities associated with management activities
4. Number of other observed EMR mortalities, and suspected cause(s) (i.e., road mortalities)
5. Results of any population or habitat monitoring for EMR
6. Summary of new CI Participants enrolled under the Agreement over the past year, including copies of the completed Certificates of Inclusion for all CI Participants and number of acres enrolled for CI Participants with enrolled lands.

The CI Participants with enrolled lands will be responsible for monitoring and reporting specified herein related to implementation of the CCAA and fulfillment of its provisions, including implementation of agreed-upon conservation measures, and 'take' authorized by the permit. The Service, after reasonable prior notice to the CI Participant, may enter enrolled lands to ascertain compliance with the CCAA. Reports from CI Participants with enrolled lands will be submitted to the DNR annually and due on December 31. Information in the CI Participant reports will include, but is not limited to:

1. Acres of habitat managed by year and by management technique
2. Brief description of habitat management implemented each year
3. Summary of any studies pertaining to EMR
4. Number of observed EMR mortalities associated with management activities
5. Number of other observed EMR mortalities (i.e., road mortalities)
6. Results of population monitoring for EMR
7. Other information the CI Participant deems pertinent to the EMR conservation program.

12) Incidental Take, Regulatory Assurances, and Unforeseen Circumstances

12.1 Level/Type, and Impact of Incidental Take

The objective of this Agreement is to maintain, conserve and secure EMR populations across Michigan for the duration of this Agreement. However, the DNR expects that during maintenance and management of both managed habitat and unmanaged habitat some take of EMR will occur (see Section 7.1). Upon approval of this CCAA, and satisfaction of all other applicable legal requirements, the Service will issue a permit, in accordance with section 10(a)(1)(A) of the ESA to the DNR. This permit will become effective on the date of the final rule listing the EMR and will authorize incidental take of EMR that results from management within the covered area. Although management practices will be scheduled to avoid EMR to the extent possible, take from allowed activities may not be avoidable. Incidental take could occur as a result of many activities within DNR and DMVA managed and unmanaged lands, as well as any non-Federal cooperator lands covered through Certificates of Inclusion. The implementation of the CCAA is intended to avoid and minimize the sources of incidental take from these activities and reduce threats to EMR. Incidental take could occur as a result of prescribed fire, mowing and hydro-axing, cultivation, forest management and chemical control management practices. Most of these impacts are expected to be limited and sporadic in nature. Incidental take is also expected by visitors to these properties, through road-kill, and other activities. Educational and outreach efforts are expected to reduce this type of take. Incidental take on managed and unmanaged lands may also occur from occasional activities such as construction and trail maintenance, but these instances of take are expected to be rare events. Take must be incidental to otherwise lawful ongoing activities on enrolled lands in the action area and consistent with implementation of the CCAA.

Conservation benefits for EMR under the CCAA will likely accrue well beyond the duration of the conservation period especially from habitat enhancement and protection measures. This should result in long-term reduced impacts and reduced incidental take of these species. Overall, although impacts and incidental take are expected to occur, impacts are not expected to be great enough to compromise the establishment and viability of EMR within the covered area. No requirement is made in this CCAA for Participating Landowners to notify DNR or FWS prior to any expected incidental take of EMR. For purposes of this CCAA, the FWS does not believe that such a notification requirement is practicable or appropriate.

The actual level of take of individual EMR is largely unquantifiable due to secretive nature of the species, and the degree to which individuals may be able to move and avoid impacts during some treatments. As a surrogate for the number of individuals taken, areas of occupied habitat in actively managed and unmanaged areas have been quantified. The

estimates provided below are based upon the last 2-5 years of management activities within covered DNR & DMVA lands.

12.1.1 Managed Lands

Managed lands consist of state owned lands considered significant for the conservation of EMR in Michigan. These lands will be managed according to management strategies identified in Section 7.1 and will be applied to reduce and/or eliminate a particular threat. The amount of land managed by prescribed fire, mowing and hydro-axing, cultivation, forest management and chemical control is less than 1% for each of these major management strategies on managed lands (Table 2).

Table 2. Acreage estimates for each of the major management strategies on Managed Lands.

Activity Type	Prescribed Fire	Mowing & Hydro-Axing	Cultivation	Forest Management	Chemical Control	Total
Average Annual Managed Land Acres Treated	592	283	1328	638	639	3,479
Percent of Total Managed Land Treated	0.43%	0.21%	0.97%	0.47%	0.47%	2.55%

12.1.2 Unmanaged Lands with Potential EMR Habitat

The unmanaged lands category includes lands that are not considered significant to the conservation of the EMR.

The unmanaged lands are generally not suitable habitat for the species or not suitable to sustain the conservation of the species, but have been included in the CCAA to provide some basic conservation measures (e.g., management to minimize potential for human-snake interaction in areas with high recreational use, etc.) in the event an EMR may occur on those lands. Further, only a small portion of the unmanaged lands will have any actions that occur on them in any given year. The amount of land managed by prescribed fire, mowing and hydro-axing, cultivation, forest management and chemical control is less than 1% for each of these major management strategies on unmanaged lands (Table 3).

As evident from the information provided above, the percentage of potentially occupied habitat subject to treatments which may result in take, is not expected to raise above 2.6% per year for either managed or unmanaged lands with potential EMR habitat. Thus, a significant percentage of the occupied areas will not be subject to actions that may result in take covered by the agreement. Incidental take that does occur will likely occur only occasionally, and is not expected to nullify the conservation benefits anticipated under the CCAA. Completion of specific conservation actions at both the local or landscape scale afforded by this agreement is expected to result in overall net benefits, although may create a temporary risk to individual snakes.

Table 3. Acreage estimates for each of the major management strategies on Unmanaged Lands.

Treatment Type_	Prescribed Fire	Mowing & Hydro-Axing	Cultivation	Forest Management	Chemical Control	Total
Average Annual Unmanaged Land Acres Treated	178	77	158	117	40	571
Percent of Total Unmanaged Land Treated	0.64%	0.28%	0.57%	0.42%	0.15%	2.06%

The estimated anticipated level of incidental take associated with this CCAA for non-state administered lands is directly related to the number of landowners interested in obtaining coverage through a Certification of Inclusion. Accurately estimating the total number of participants is impossible at this time. However, using habitat as a substitute and based upon known locations of conservation lands in Michigan and the locations of potential EMR habitat, it is possible to estimate that these conservation lands occur in 1.13% of the non-state-administered potential EMR habitat. This percentage is likely an over estimate, since not all potential participants will enroll in our CCAA. However, all lands enrolled via a Certificate of Inclusion will follow the conservation measures identified in Section 7.1.

12.2 Assurances Provided

Through this CCAA, the Service provides the Cooperators assurances that no additional conservation measures or additional land, water, or resource use restrictions, beyond those voluntarily agreed to and described in the Conservation Measures section of this CCAA, will

be required should the EMR become listed as a threatened or endangered species in the future. Unless otherwise stated, these assurances will be authorized by the issuance of an Enhancement of Survival Permit under section 10(a)(1)(A) of the ESA, which will become effective at the time of listing.

The assurances listed below apply to the Cooperators. The assurances apply only where the Enhancement of Survival Permit associated with this CCAA and the CCAA itself are being properly implemented, and only with respect to species adequately covered by this CCAA, the Eastern massasauga rattlesnake.

12.2.1 Changed Circumstances provided for in the CCAA

If additional conservation measures are necessary to respond to changed circumstances, such as wildfire, drought, snake fungal disease or the federal listing of a species with overlap in habitat, and the measures were set forth in the CCAA's operating conservation program, the DNR or CI participant will implement those measures specified in the CCAA. Changed circumstances that may occur include:

1. Wildfire: Should wildfire occur, the DNR or CI participant will work with the USFWS to determine and implement mutually agreed upon appropriate remedial measures, if necessary. Adaptive management approaches will be applied to maximize likelihood of success.
2. Drought: Annual monitoring and conservation measures in the CCAA are expected to address minor year to year variations in precipitation amounts. Prolonged periods of drought, although uncommon in the areas covered by this CCAA, may create conditions that reduce seasonally available habitat beyond normal annual variation and cause changed circumstances on the landscape. In the event of moderate to extreme drought, as determined by National Oceanic and Atmospheric Administration (NOAA) or if annual monitoring indicates drought conditions, the USFWS will notify the DNR and within 90 days of notification, the parties will meet and evaluate the drought conditions and, if opportunities exist, employ changes to the conservation measures to address local conditions.
3. Snake fungal disease: Should instances of snake fungal disease be confirmed within areas covered by this CCAA, the DNR will notify the Service with 30 days of confirmation. The DNR will work with the Service to identify and implement mutually agreed upon response measures, if any.
4. Federal listing of a species with overlap in habitat: In the event another species, whose habitat requirements overlap those of the EMR, is listed under the ESA, the Service will notify the DNR within 30 days of listing. Within 90 days of final listing, the parties will meet to evaluate the potential conflicts between implementation of conservation measures provided for in this CCAA and the conservation of the newly listed species.

12.2.2 Changed Circumstances not provided for in the CCAA

If additional conservation measures not provided for in the CCAA's operating conservation program are necessary to respond to changed circumstances, the Service will not require any conservation measures in addition to those provided for in the CCAA without the consent of the DNR.

12.2.3 Unforeseen Circumstances

If additional conservation measures are necessary to respond to unforeseen circumstances, the Director may require additional measures of the Enrolled Participant, but only if such measures are limited to modifications within the CCAA's conservation strategy for the affected species, and only if those measures maintain the original terms of the CCAA to the maximum extent possible. Additional conservation measures will not involve the commitment of additional land, water, or financial compensation, or additional restrictions on the use of land, water, or other natural resources available for development or use under the original terms of the CCAA without the consent of the Enrolled Participant.

The Service will have the burden of demonstrating that unforeseen circumstances exist, using the best scientific and commercial data available. These findings must be clearly documented and based upon reliable technical information regarding the status and habitat requirements of the affected species. The Service will consider, but not be limited to, the following factors:

1. Size of the current range of the affected species;
2. Percentage of range adversely affected by the CCAA;
3. Percentage of range conserved by the CCAA;
4. Ecological significance of that portion of the range affected by the CCAA;
5. Level of knowledge about the affected species and the degree of specificity of the species' conservation program under the CCAA; and
6. Whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the affected species in the wild.

12.3 Notification of Take

The DNR and the Service agree that annual reports and other site specific work plans are sufficient notification for permitted take that occurs on an ongoing basis from the implementation of various conservation measures and from otherwise lawful actions described in the CCAA for both Managed and Unmanaged Lands.

By signature of the associated Certificate of Inclusions, CI Participants agree to provide the Service with an opportunity to evaluate any planned action that potentially would result in authorized take in the form of direct mortality or injury of EMR before that action is implemented and the potential for take occurs. Notification that such take may occur must be provided to the Service at least 30 days in advance of the action.

13) National Historic Preservation Act

Section 106 of the National Historic Preservation Act, as amended, requires Federal agencies to take into account the effects of their *undertakings* on historic properties, and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment. The historic preservation review process mandated by Section 106 is outlined in regulations issued by ACHP (36 CFR Part 800). An *undertaking* in 36 CFR § 800.16(y) of the NHPA's implementing regulations is defined as "a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval." A basic tenet underlying Enhancement of Survival Permits is that the Services do not authorize the applicant's activities that cause the take. Instead, the Services authorize the incidental take that results from the applicant's covered activities.

Compliance with Section 106 of the National Historic Preservation Act (NHPA) shall be addressed on a case- by-case basis by the DNR or other Enrolled Participant, as appropriate, and will be completed prior to implementation of actions with the potential to affect historic properties.

Actions pursuant to the CCAA on managed lands are unlikely to affect NHPA's resources since these actions are designed at maintaining natural landscape features and generally only include ground disturbance in areas that have been previously disturbed (e.g., re-planting former agricultural lands). Actions on managed and unmanaged lands would require additional NHPA compliance if they affect historic properties, archaeological sites and resources, and other cultural resources (e.g., historic districts, historic and prehistoric landscapes, Native American sites, etc.).

The process for NHPA compliance includes a step-wise approach of identifying and evaluating potential impacts to historic properties resulting from the implementation of actions. The DNR or other Enrolled Participant, as appropriate, shall start this process as early as feasible in the planning process so that options for siting to avoid or minimize impacts to cultural resources are not precluded. To comply with the NHPA prior to taking action that may affect historic property, the DNR or other Enrolled Participant, as appropriate, must adhere to the following process:

- A. During early planning, the DNR or Enrolled Participant will determine if the planned action authorized pursuant to the CCAA has the potential to affect historic properties. Generally, implementing actions that maintain existing natural features without additional ground disturbance or have ground disturbance that is limited only to previously disturbed areas do not have the potential to affect historic properties. For these actions, the Service has concurred that the NHPA's compliance process is complete.
- B. If the planned action has potential to affect historic properties, DNR or Enrolled Participant with Service will consult to identify historic properties in accordance with 36 C.F.R. § 800.4.

MDNR or Service will then conduct records file search in coordination with the State Historic Preservation Officer (SHPO) and/or the Tribal Historic Preservation Officer (THPO).

- C. If a records search does not reveal the presence of historic properties (i.e., no resources identified) and past surveys are considered sufficient, then DNR or Service will request concurrence of No Effect from SHPO/THPO in accordance with 36 C.F.R. § 800.4(d). If DNR or Service receives concurrence from SHPO, the compliance process is complete.
- D. If the records file search determines that historic properties are potentially present, or determines that further investigations are appropriate, then the following factors will be evaluated:
 - a. Whether or not there are historic properties, as defined by the National Register criteria (36 C.F.R. part 63), in the area of potential effect;
 - b. Whether or not the action can avoid effects to historic properties; and
 - c. Whether or not the action would adversely affect historic properties.
- E. For actions other than maintaining existing natural features or that involve ground disturbance of areas previously undisturbed, but where no historic properties are present and/or no adverse effects are anticipated, then DNR in coordination with Service will request a concurrence of No Effect or No Adverse Effect from SHPO and any other consulting parties, in accordance with 36 C.F.R. § 800.4(d) or 36 C.F.R. § 800.5(d), respectively. If DNR or Service receives concurrence from SHPO and other consulting parties, the compliance process is complete.
- F. If the Service, in consultation with the SHPO and other consulting parties, determines that historic properties will be adversely affected, then the Service in coordination with DNR or Enrolled Participant will develop a Memorandum of Agreement in accordance with 36 C.F.R. § 800.6.

14) Terms and Conditions of the Agreement

14.1 Modifications

After approval of the CCAA, the Service may not impose any new requirements or conditions on, or modify any existing requirements or conditions applicable to, an Enrolled Participant or successor in interest to the Enrolled Participant, to compensate for changes in the conditions or circumstances of any species or ecosystem, natural community, or habitat covered by the CCAA except as stipulated in 50 CFR 17.22(d)(5) and 17.32(d)(5).

14.2 Modification of the CCAA

Any party may propose modifications or amendments to this CCAA by providing written notice to, and obtaining the written concurrence of, the other Parties. Such notice shall include a statement of the proposed modification, the reason for it, and its expected results. Such notice shall be submitted to the DNR who shall submit it to the Service.

The Parties will respond to proposed modifications within 60 days of receipt of such notice. Proposed modifications will become effective upon the written concurrence of the Service. New construction or other activities within managed EMR areas that are not consistent with the CCAA will require a modification.

14.3 Amendment of the Permit

The permit may be amended to accommodate changed circumstances in accordance with all applicable legal requirements, including but not limited to the ESA, the NEPA, and the Service's permit regulations at 50 CFR 13 and 50 CFR 17. The party proposing the amendment shall provide a statement describing the proposed amendment and the reasons for it.

14.4 Termination of the CCAA

As provided for in Part 8 of the Service's CCAA Policy (64 FR 32726, June 17, 1999), the Enrolled Participant may, for good cause, terminate implementation of the CCAA's voluntary management actions prior to the CCAA's expiration date, even if the expected benefits have not been realized. If the CCAA is terminated without good cause, however, the Enrolled Participant is required to surrender the Enhancement of Survival Permit at termination, thus relinquishing his or her take authority (if the species has become listed) and the assurances granted by the permit. The Enrolled Participant is required to give 30 days written notice of its intent to terminate the CCAA, and must give the Service an opportunity to relocate affected species within 60 days of the notice.

14.5 Permit Suspension or Revocation

The Service may suspend or revoke the permit for cause in accordance with the laws and regulations in force at the time of such suspension or revocation (50 CFR 13.28(a)). The Service may also, as a last resort, revoke the permit if continuation of permitted activities would likely result in jeopardy to covered species (50 CFR 17.22/32(d)(7)). The Service will revoke because of jeopardy concerns only after first implementing all practicable measures to remedy the situation.

14.6 Remedies

Each party shall have all remedies otherwise available to enforce the terms of the CCAA and the permit. In particular, the Service may seek specific performance of appropriate mitigation measures in the event the Enrolled Participant terminates this CCAA or fails to comply with its terms. No party shall be liable in damages for any breach of this CCAA, any performance or failure to perform an obligation under this CCAA, or any other cause of action arising from this CCAA.

14.7 Dispute Resolution

The Cooperators agree to work together in good faith to resolve any disputes, using dispute resolution procedures agreed upon by all Cooperators.

14.8 Succession and Transfer of the CCAA

This CCAA shall be binding on and shall inure to the benefit of the Parties and their respective successors and transferees, (i.e., new owners) in accordance with applicable regulations (50 CFR 13.24 and 13.25).

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The rights and obligations under this CCAA shall run with the ownership of the enrolled property and are transferable to subsequent non-Federal property owners pursuant to 50 CFR 13.25. If the CCAA is transferred, the new owner(s) will have the same rights and obligations with respect to the enrolled property as the original owner. The new owner(s) also will have the option of receiving CCAA assurances by signing a new CCAA and receiving a new permit. The Enrolled Landowner shall notify the Service in writing of any transfer of ownership, so that the Service can attempt to contact the new owner, explain the baseline responsibilities applicable to the property, and seek to interest the new owner in signing the existing CCAA or a new one to benefit listed species on the property. Assignment or transfer of the permit shall be governed by Service regulations in force at the time.

14.9 Availability of Funds

Implementation of this CCAA is subject to the requirements of the Anti-Deficiency Act and the availability of appropriated funds. Nothing in this CCAA will be construed by the Parties to require the obligation, appropriation, or expenditure of any funds from the U.S. Treasury. The Parties acknowledge that the Service will not be required under this CCAA to expend any Federal agency's appropriated funds unless and until an authorized official of that agency affirmatively acts to commit to such expenditures as evidenced in writing.

14.10 No Third-Party Beneficiaries

This CCAA does not create any new right or interest in any member of the public as a third-party beneficiary, nor shall it authorize anyone not a party to this CCAA to maintain a suit for personal injuries or damages pursuant to the provisions of this CCAA. The duties, obligations, and responsibilities of the Parties to this CCAA with respect to third parties shall remain as imposed under existing law.

14.11 Succession and Transfer of the Permit and Certificates of Inclusion

This Agreement shall be binding on and shall inure to the benefit of the parties and their respective successors and assigns in accordance with applicable regulations (50 CFR 13.24 and 13.25). The 10(a)(1)(A) permit issued in association with this Agreement can be transferred in accordance with applicable regulations (50 CFR 13.25). Should any non-Federal property owner who is participating in this Agreement transfer any interest in his/her property, the non-Federal property owner will notify DNR at least 60 days prior to any transfer. The DNR, or at the request of DNR, the Service, will contact the new owner to explain the responsibilities applicable to the property to determine if there is interest in participation in the Agreement.

The DNR will notify the Service of transfer of ownership of enrolled lands and the results of contacts with new property owners.

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The responsibilities of an existing executed site-specific plan and its associated Certificate of Inclusion may be transferred to a new landowner or entity holding an interest in the land (e.g., lessee) if the proposed landowner agrees in writing to implement all the commitments of the site-specific plan or with applicable lease or Land Use permit for oil, gas and mineral development companies and to comply with the terms of the 10(a)(1)(A) permit.

14.12 Relationship to Other Agreements

Should the EMR be listed, take coverage for the implementation of conservation measures or restoration and monitoring activities not specifically described in this Agreement but subsequently implemented by DNR may require an agreement between the Service and the State of Michigan under Section 6 of the ESA.

14.13 Notices and Reports

Any notices and reports, including monitoring and annual reports, required by this CCAA shall be delivered to the persons listed below, as appropriate:

Dan Kennedy, Endangered Species
Coordinator
Wildlife Division
Michigan Department of Natural
Resources
P.O. Box 30180
Lansing, MI 48909

Larry Jacobs
Natural Resources Specialist
Environmental Office Camp Grayling,
MI 49739 (989) 344-6175

Scott Hicks, Supervisor
East Lansing Field Office
U.S. Fish and Wildlife Service
2651 Coolidge Road, Suite 101
East Lansing, MI 48823

Regional Permits Coordinator
U.S. Fish and Wildlife Service
5600 American Blvd. West, Suite 990
Bloomington, MN 55437

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IN WITNESS WHEREOF, THE PARTIES HERETO have, as of the last signature date below, executed this Candidate conservation Agreement with Assurances to be in effect as of the date that the Service issues the permit.

William Moritz, Ph.D.
Interim Director
Michigan Department of Natural Resources

Date

Gregory J. Vadnais
Major General, MI National Guard
The Adjutant General of Michigan
Director, Department of Military and Veterans Affairs

Date

Thomas Melius
Regional Director
U.S. Fish and Wildlife Service

Date

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Appendix A. Certificate of Inclusion



Michigan Department of Natural Resources – Wildlife Division

CERTIFICATE OF INCLUSION

By the authority of part 365, 1994 PA 451.

MICHIGAN EASTERN MASSASAUGA RATTLESNAKE CANDIDATE CONSERVATION AGREEMENT WITH ASSURANCES **PERMIT** **NUMBER** _____

This certifies that the Participant listed below is included within the scope of

Permit Number _____ issued on _____, under the authority of Section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended, 16 U.S.C. 1539 (a)(1)(B). Pursuant to the permit and this certificate, the participant is authorized to conduct activities in accordance with the conservation measures described in the attached Eastern Massasauga Candidate Conservation Agreement with Assurances.

Authorized Participant

Participant Project Officer

Name of DNR Rep, Wildlife
Division
Michigan Department of Natural
Resources

Date

PR2151 (Rev. 05/27/2011)

Appendix B. State Threatened and Endangered Species

The following state-listed threatened and endangered species overlapped records of Eastern Massasauga Rattlesnakes in Michigan's natural heritage database.

Invertebrate Animal

Scientific Name	Common Name	State Status	Federal Status
<i>Appalachia arcana</i>	Secretive locust	SC	
<i>Atrytonopsis hianna</i>	Dusted skipper	SC	
<i>Calephelis mutica</i>	Swamp metalmark	SC	
<i>Catocala amestris</i>	Three-staff underwing	E	
<i>Catocala dulciola</i>	Quiet underwing	SC	
<i>Discus patulus</i>	Domed disc	SC	
<i>Dorydiella kansana</i>	Leafhopper	SC	
<i>Erynnis baptisiae</i>	Wild indigo duskywing	SC	
<i>Erynnis persius persius</i>	Persius dusky wing	T	
<i>Euphyes dukesi</i>	Dukes' skipper	T	
<i>Flexamia huroni</i>	Huron River leafhopper	T	
<i>Hemileuca maia</i>	Barrens buckmoth	SC	
<i>Hesperia ottoe</i>	Ottoe skipper	T	
<i>Incisalia henrici</i>	Henry's elfin	T	
<i>Incisalia irus</i>	Frosted elfin	T	
<i>Lepyronia angulifera</i>	Angular spittlebug	SC	
<i>Lycaeides melissa samuelis</i>	Karner blue	T	LE
<i>Meropleon ambifusca</i>	Newman's brocade	SC	
<i>Mesomphix cupreus</i>	Copper button	SC	
<i>Neonympha mitchellii mitchellii</i>	Mitchell's satyr	E	LE
<i>Oarisma poweshiek</i>	Poweshiek skipperling	T	C
<i>Oecanthus laricis</i>	Tamarack tree cricket	SC	
<i>Papaipema beeriana</i>	Blazing star borer	SC	
<i>Papaipema maritima</i>	Maritime sunflower borer	SC	
<i>Papaipema sciata</i>	Culvers root borer	SC	
<i>Papaipema silphii</i>	Silphium borer moth	T	
<i>Papaipema speciosissima</i>	Regal fern borer	SC	
<i>Philomycus carolinianus</i>	Carolina mantleslug	SC	
<i>Prosapia ignipectus</i>	Red-legged spittlebug	SC	
<i>Somatochlora hineana</i>	Hine's emerald dragonfly	E	LE
<i>Spartiniphaga inops</i>	Spartina moth	SC	

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Speyeria idalia	Regal fritillary	E	
Tachopteryx thoreyi	Grey petaltail	T	

Plants

Scientific Name	Common Name	State Status	Federal Status
Amerorchis rotundifolia	Small round-leaved orchis	E	
Amorpha canescens	Leadplant	SC	
Angelica venenosa	Hairy angelica	SC	
Aristolochia serpentaria	Virginia snakeroot	T	
Asclepias hirtella	Tall green milkweed	T	
Asclepias purpurascens	Purple milkweed	T	
Baptisia lactea	White or prairie false indigo	SC	
Berula erecta	Cut-leaved water parsnip	T	
Besseya bullii	Kitten-tails	E	
Bouteloua curtipendula	Side-oats grama grass	E	
Bromus nottowayanus	Satin brome	SC	
Cacalia plantaginea	Prairie indian-plantain	SC	
Calamagrostis stricta	Narrow-leaved reedgrass	T	
Calypso bulbosa	Calypso or fairy-slipper	T	
Carex conjuncta	Sedge	T	
Carex richardsonii	Richardson's sedge	SC	
Carex scirpoidea	Bulrush sedge	T	
Carex squarrosa	Sedge	SC	
Carex trichocarpa	Hairy-fruited sedge	SC	
Castanea dentata	American chestnut	E	
Celtis tenuifolia	Dwarf hackberry	SC	
Cirsium hillii	Hill's thistle	SC	
Corydalis flavula	Yellow fumewort	T	
Cypripedium arietinum	Ram's head lady's-slipper	SC	
Cypripedium candidum	White lady slipper	T	
Dalibarda repens	False violet	T	
Diarrhena obovata	Beak grass	T	
Dichanthelium leibergii	Leiberg's panic grass	T	
Dichanthelium polyanthes	Round-seed panic-grass	E	
Dodecatheon meadia	Shooting star	E	
Drosera anglica	English sundew	SC	

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<i>Dryopteris celsa</i>	Small log fern	T	
<i>Eleocharis atropurpurea</i>	Purple spike rush	E	
<i>Eleocharis compressa</i>	Flattened spike rush	T	
<i>Eryngium yuccifolium</i>	Rattlesnake-master or button snakeroot	T	
<i>Eupatorium fistulosum</i>	Hollow-stemmed Joe-pye weed	T	
<i>Festuca scabrella</i>	Rough fescue	T	
<i>Filipendula rubra</i>	Queen-of-the-prairie	T	
<i>Fraxinus profunda</i>	Pumpkin ash	T	
<i>Galearis spectabilis</i>	Showy orchis	T	
<i>Gentiana flavida</i>	White gentian	E	
<i>Gentiana puberulenta</i>	Downy gentian	E	
<i>Gentianella quinquefolia</i>	Stiff gentian	T	
<i>Geum virginianum</i>	Pale avens	SC	
<i>Gillenia trifoliata</i>	Bowman's root	E	
<i>Gymnocarpium robertianum</i>	Limestone oak fern	T	
<i>Helianthus hirsutus</i>	Whiskered sunflower	SC	
<i>Hieracium paniculatum</i>	Panicled hawkweed	T	
<i>Hybanthus concolor</i>	Green violet	SC	
<i>Hydrastis canadensis</i>	Goldenseal	T	
<i>Iris lacustris</i>	Dwarf lake iris	T	LT
<i>Juncus vaseyi</i>	Vasey's rush	T	
<i>Kuhnia eupatorioides</i>	False boneset	SC	
<i>Liparis liliifolia</i>	Purple twayblade	SC	
<i>Lithospermum latifolium</i>	Broad-leaved puccoon	SC	
<i>Lygodium palmatum</i>	Climbing fern	E	
<i>Mertensia virginica</i>	Virginia bluebells	E	
<i>Muhlenbergia richardsonis</i>	Mat muhly	T	
<i>Myrica pensylvanica</i>	Northern bayberry	T	
<i>Panax quinquefolius</i>	Ginseng	T	
<i>Phlox maculata</i>	Wild sweet William	T	
<i>Platanthera ciliaris</i>	Orange- or yellow-fringed orchid	E	
<i>Platanthera leucophaea</i>	Prairie white-fringed orchid	E	LT
<i>Poa paludigena</i>	Bog bluegrass	T	
<i>Polemonium reptans</i>	Jacob's ladder	T	
<i>Polygala cruciata</i>	Cross-leaved milkwort	SC	
<i>Prunus alleghaniensis</i> var. <i>davisii</i>	Alleghany or Sloe plum	SC	
<i>Pterospora andromedea</i>	Pine-drops	T	

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<i>Sanguisorba canadensis</i>	Canadian burnet	E	
<i>Scirpus clintonii</i>	Clinton's bulrush	SC	
<i>Scleria triglomerata</i>	Tall nut rush	SC	
<i>Scutellaria elliptica</i>	Hairy skullcap	SC	
<i>Scutellaria ovata</i>	Forest skullcap	T	
<i>Silene stellata</i>	Starry campion	T	
<i>Silphium integrifolium</i>	Rosinweed	T	
<i>Solidago houghtonii</i>	Houghton's goldenrod	T	LT
<i>Spiranthes ovalis</i>	Lesser ladies'-tresses	T	
<i>Sporobolus heterolepis</i>	Prairie dropseed	SC	
<i>Stellaria crassifolia</i>	Fleshy stitchwort	E	
<i>Tanacetum huronense</i>	Lake Huron tansy	T	
<i>Trillium recurvatum</i>	Prairie trillium	T	
<i>Triphora trianthophora</i>	Nodding pogonia or three birds orchid	T	
<i>Valeriana edulis</i> var. <i>ciliata</i>	Edible valerian	T	
<i>Viburnum prunifolium</i>	Black haw	SC	
<i>Viola novae-angliae</i>	New England violet	T	
<i>Zizania aquatica</i> var. <i>aquatica</i>	Wild rice	T	

Vertebrate Animal

Scientific Name	Common Name	State Status	Federal Status
<i>Accipiter gentilis</i>	Northern goshawk	SC	
<i>Acris crepitans blanchardi</i>	Blanchard's cricket frog	T	
<i>Ammodramus henslowii</i>	Henslow's sparrow	E	
<i>Ammodramus savannarum</i>	Grasshopper sparrow	SC	
<i>Buteo lineatus</i>	Red-shouldered hawk	T	
<i>Clemmys guttata</i>	Spotted turtle	T	
<i>Clonophis kirtlandii</i>	Kirtland's snake	E	
<i>Cygnus buccinator</i>	Trumpeter swan	T	
<i>Dendroica cerulea</i>	Cerulean warbler	T	
<i>Dendroica discolor</i>	Prairie warbler	E	
<i>Dendroica kirtlandii</i>	Kirtland's warbler	E	LE
<i>Emydoidea blandingii</i>	Blanding's turtle	SC	
<i>Glyptemys insculpta</i>	Wood turtle	SC	
<i>Haliaeetus leucocephalus</i>	Bald eagle	SC	
<i>Microtus ochrogaster</i>	Prairie vole	E	

Candidate Conservation Agreement with Assurances -- Agreement Number:

Pandion haliaetus	Osprey	SC	
Pantherophis spiloides	Gray ratsnake	SC	
Perimyotis subflavus	Eastern pipistrelle	SC	
Sistrurus catenatus catenatus	Eastern massasauga	SC	C
Spiza americana	Dickcissel	SC	
Terrapene carolina carolina	Eastern box turtle	SC	
Wilsonia citrina	Hooded warbler	SC	

Appendix C. Connecting Threats to Conservation Measures.

Threat	Current Threat Level	Applicable Conservation Measure
Habitat Loss (e.g., conversion of wetlands to other land uses)	High	Legal mandates on the conservation purposes of lands (e.g., Pittman-Robertson land-use restrictions, State Park's and Forest's implementing legislation, etc.)
Habitat Fragmentation	High	Managed Public Land Strategy, July 1, 2013 and Section 7.1.1
Vegetative (woody)	High	Conservation Measures, Section 7
Prescribed fires (post-emergence)	High	Conservation Measure, Section 7.1.2
Disruptions to hydrology (urban encroachment, prolonged flooding, prolonged drought, etc.)	Moderate	Conservation Measure, Section 7.1.5
Small isolated populations	Moderate	Conservation Measures, Sections 7.1.1 and 7.2.4
Illegal collection	Moderate	Conservation Measure, Section 7.1.8
Persecution	Moderate	Conservation Measure, Section 7.1.8
Prescribed fire (pre-	Low-Moderate	Conservation Measure, Section 7.1.2
Conservation land management (mowing, hydro-axing, etc.)	Low-Moderate	Conservation Measure, Section 7.1.3
Disease	Low	Threats Section 4.5.3 and Adaptive Management Section 10
Climate change	Low	Threats Section 4.5.5

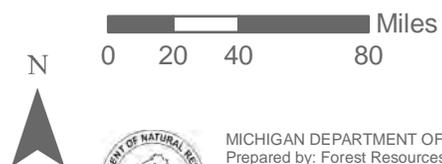
Appendix D. Map of Eastern Massasauga Managed Lands

Michigan's Eastern Massasauga Rattlesnake CCAA Managed Land



EMR CCAA Managed Land

-  Forest Resources Division
-  Parks & Recreation Division
-  Wildlife Division
-  County



MICHIGAN DEPARTMENT OF NATURAL RESOURCES
Prepared by: Forest Resources Division
Resource Assessment Unit
Data Source: DNR GDSE
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