PROPOSED

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Butler's Gartersnake (*Thamnophis butleri*) in Canada

Butler's Gartersnake

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For copies of the recovery strategy, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk (SAR) Public Registry[1].

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[1] http://www.registrelep-sararegistry.gc.ca

Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996)[2] agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress five years after the publication of the final document on the SAR Public Registry.

The Minister of the Environment is the competent minister under SARA for the Butler's Gartersnake and has prepared this strategy, as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the Province of Ontario.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of Butler's Gartersnake and Canadian society as a whole.

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment Canada and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

The recovery strategy sets the strategic direction to arrest or reverse the decline of the species, including identification of critical habitat to the extent possible. It provides all Canadians with information to help take action on species conservation. When the recovery strategy identifies critical habitat, there may be future regulatory implications, depending on where the critical habitat is identified. SARA requires that critical habitat identified within federal protected areas be described in the *Canada Gazette*, after which prohibitions against its destruction will apply. For critical habitat located on federal lands outside of federal protected areas, the Minister of the Environment must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies. For critical habitat located on non-federal lands, if the Minister of the Environment forms the opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of Parliament, and not effectively protected by the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to extend the prohibition against destruction of critical habitat to that portion. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

[2] http://registrelep-sararegistry.gc.ca/default.asp?lang=en&n=6B319869-1#2

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Executive Summary

Butler's Gartersnake is listed as Threatened on Schedule 1 of the federal *Species at Risk Act*. The species is listed as Endangered in Ontario under the provincial *Endangered Species Act, 2007* (ESA 2007). Butler's Gartersnake (*Thamnophis butleri*) is a small gartersnake with three distinct yellow to orange longitudinal stripes running from head to tail over a brown body. A dark checkered pattern is evident running alongside its stripes. Like most other small Canadian snakes, this species has not been well studied. Butler's Gartersnake is often confused with two other gartersnakes coexisting in its range, both belonging to the same genus, *Thamnophis*. These similar species are the Common Gartersnake (*T. sirtalis)* and the Eastern Ribbonsnake (*T. sauritus*). Butler's Gartersnake is shorter in total length (38 – 51 cm), more docile and has a unique pattern and position of side stripes in comparison to these species.

In Canada, Butler's Gartersnake is restricted to Ontario where it has recently been found in two regions: Windsor-Sarnia (Essex, Chatham-Kent, Lambton Counties and Walpole Island) and Luther Marsh (Dufferin and Wellington Counties). Further surveys are required to determine if it still exists in other areas including: Skunk's Misery (Lambton and Middlesex Counties), Parkhill (Middlesex County) and additional locations in the Windsor-Sarnia region. In the United States, Butler's Gartersnake is restricted to the Great Lakes Region and is found within four states: Wisconsin, Ohio, Indiana, and Michigan.

Butler's Gartersnake is found in grasslands, old fields, disturbed sites, urban and industrial sites and tallgrass prairie where a dense cover of grasses or herbs and a heavy thatch layer are present. The species is often found in close proximity to wet areas such as small marshes (seasonally dry), swales, and small bodies of water located in vacant urban lots (industrial lands), parks and tallgrass prairie remnants.

The major threats contributing to Butler's Gartersnake decline are ongoing habitat loss, degradation and fragmentation, due to urban, industrial and road development as well as agricultural expansion.

There are unknowns regarding the feasibility of recovery of the Butler's Gartersnake. The population and distribution objective for Butler's Gartersnake is to maintain the current abundance and distribution of all extant subpopulations. Where biologically and technically feasible, the distribution and abundance of extant subpopulations should be increased and habitat connectivity between local subpopulations improved. The broad strategies to be taken to address the threats to the survival and recovery of Butler's Gartersnake are presented in the section on Strategic Direction for Recovery (Section 6.2).

There are several locations that may still support Butler's Gartersnake, however these locations have not been surveyed recently or adequately and/or there is a lack of certainty in the data needed to identify critical habitat. For this reason, critical habitat for Butler's Gartersnake has only been partially identified in this recovery strategy. Critical habitat is identified for 27 extant locations in Ontario and occurs within the geographic regions of Windsor-Sarnia and Luther Marsh. The Schedule of Studies (Section 7.2) outlines the activities required to identify additional critical habitat necessary to support the population and distribution objectives for this species.
One or more action plans for Butler's Gartersnake will be completed by December 2023.

Recovery Feasibility Summary

Based on the following four criteria that Environment Canada uses to establish recovery feasibility, there are unknowns regarding the feasibility of recovery of the Butler's Gartersnake. In keeping with the precautionary principle, this recovery strategy has been prepared as per section 41(1) of SARA, as would be done when recovery is determined to be feasible.

1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.

   Yes. There are currently 27 to 38 extant[3] locations[4] of Butler's Gartersnake in Canada, which occur within four geographic regions. The species is frequently locally abundant where it does occur and may be the most common snake species at some locations. Most local subpopulations are small, though exact numbers may not be known, and may be threatened by negative genetic effects of small population size and demographic stochasticity as well as numerous other threats (COSEWIC 2010). However, there are several large subpopulations of this species in Ontario that are capable of maintaining the species in the province (COSEWIC 2010).

2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.

   Unknown. In Ontario, sufficient suitable habitat is available to support the current population. Walpole Island contains one of the largest remnant tracts of native prairie in Ontario and as much as 10% of the Canadian population is believed to occur here (Bowles 2005). This species is also found within Nature Reserves and Conservation Areas in Ontario such as Ojibway Prairie (Windsor) and Luther Marsh (north of Guelph) and it may also still exist in Skunk's Misery, Parkhill and in additional locations in the Windsor-Sarnia region (see Figure 2). It is also possible that in some urban areas, new habitat may be created as abandoned industrial sites are allowed to naturalize (COSEWIC 2010). However, its distribution, particularly for some urban subpopulations, is limited due to habitat fragmentation and confined to a limited area of Southern Ontario. This results in subpopulations being isolated from one another, which can lead to a reduction in genetic diversity and even inbreeding. Thus, maintaining connectivity between subpopulations is crucial to the recovery of Butler's Gartersnake.

[3] Population/subpopulation which is considered to be still in existence.

[4] Location: a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present. Throughout this document, the term 'subpopulation" is considered synonymous with the term "location" as used by the 2010 COSEWIC Status Report and the International Union for the Conservation of Nature (IUCN 2010) (i.e., consideration for threats, distance, geographical separation and perceived habitat connectivity between clusters of collecting sites (a collection site is defined as a specific place where a snake was seen or collected. See Appendix B for more information on locations of Butler's Gartersnake in Canada.

3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.

   Unknown. The primary threats to the species are urban, industrial and road development as well as agricultural expansion. Some current and future development and agricultural expansion in suitable Butler's Gartersnake habitat can be avoided through stewardship, co-operation with landowners, land managers and First Nations, land use management practices and policy and regulations such as the recently implemented activities for the Right Honourable Herb Gray Parkway. Snake barriers, monitoring coverboards, inspecting key habitat features and working within timing windows have reduced impacts to snakes during construction (AMEC Environment and Infrastructure, environmental consultants on behalf of the Parkway Infrastructure Constructors and Windsor Essex Mobility Group 2013). However, many local subpopulations exist in small and or isolated habitat fragments, in urban areas with established road networks where mitigation may be difficult or impossible.

4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.

   Yes. Standard techniques exist for monitoring and general habitat restoration (e.g., creation of hibernacula, habitat enhancement). Land management practices have been developed to provide agricultural, urban and industrial private land owners with the information necessary to coexist with wildlife without polluting or destroying suitable habitat (e.g., Best Management Practices such as implementing and maintaining wildlife corridors, controlling invasive species such as European Common Reed (*Phragmites australis australis)*, maintaining open-canopy, dense ground-layer vegetation and avoiding activities that allow the encroachment of woody vegetation (Tallgrass Ontario 2005; Savanta Inc. 2008; Ontario Ministry of Natural Resources 2011; Mifsud 2014; Wisconsin Department of Natural Resources 2014)). Research on many recovery techniques specific to Butler's Gartersnake was carried out to fulfill the *Endangered Species Act, 2007* permit requirements for the Right Honourable Herb Gray Parkway development including research that will involve monitoring relative to eco-passages and culverts under roads.

Table of Contents

1. COSEWIC* Species Assessment Information

Date of Assessment: November 2010

Common Name: Butler's Gartersnake

Scientific Name: *Thamnophis butleri*

COSEWIC Status: Endangered

Reason for Designation: Most populations of this species occur in small, scattered habitat remnants. Most are isolated so they are threatened by the negative genetic effects of small population size and by demographic stochasticity[5]. Recent surveys have not detected the species at several sites where they were formerly known. Road mortality, ongoing habitat loss and fragmentation are also threats to this small specialized snake.

Canadian Occurrence: Ontario

COSEWIC Status History: Designated Special Concern in April 1999. Status re-examined and designated Threatened in November 2001. Status re-examined and designated Endangered in November 2010.

*Committee on the Status of Endangered Wildlife in Canada

2. Species Status Information

The global conservation rank for Butler's Gartersnake (*Thamnophis butleri*) is Apparently Secure[6] (G4) (NatureServe 2014). In the United States, it is ranked nationally as Apparently Secure (N4), and subnationally as Critically Imperiled[7] in Indiana (S1), Vulnerable[8]/Apparently Secure in Wisconsin (S3S4), Apparently Secure in Michigan (S4), and has not been officially ranked in the state of Ohio (SNR). In Canada, Butler's Gartersnake is ranked Imperiled both nationally (N2) and provincially (S2) in Ontario (NatureServe 2014).

Butler's Gartersnake is currently listed as Threatened[9] on Schedule 1 of the federal *Species at Risk Act* (SARA) and is listed as Endangered[10] under Ontario's *Endangered Species Act, 2007* (ESA 2007). Approximately 16% of the global range occurs in Canada (COSEWIC 2010).

[5] Demographic stochasticity refers to the variability of population growth rates arising from related random events such as birth rates, death rates, sex ratio, and dispersal. It is particularly important for small populations because it increases the probability of extirpation.
[6] Uncommon but not rare; some cause for long-term concern due to declines or other factors.
[7] Extreme rarity or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from jurisdiction.
[8] Due to a restricted range, relatively few populations, recent and widespread declines, or other factors making it vulnerable to extirpation.
[9] A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
[10] Endangered: a native species facing imminent extinction or extirpation.

3. Species Information

3.1 Species Description

Butler's Gartersnake is a small snake typically ranging from 38 to 51 cm in length with a maximum recorded length of 73.7 cm (Minton 1972 as cited in Rossman et al. 1996). It has a small head only slightly broader than the neck (Rossman et al. 1996) and a tail that is generally 20 to 25% of its total length (Sandilands 2001). Bearing the characteristic striped pattern of gartersnakes, Butler's Gartersnake has three longitudinal yellow to orange stripes, one dorsal[11] and two lateral[12] (Conant and Collins 1991; Rossman et al. 1996; Ernst and Ernst 2003). The dorsal stripe may also be white to cream in colour. The lateral stripes are centred on the 3rd scale row and at least anteriorly, they extend onto scale rows 2 and 4 (Ernst and Barbour 1989; Ernst and Ernst 2003; COSEWIC 2010). In some regions, the lateral stripes may be centred on the third scale row and only encompass half of the second row. The whitish underbelly is divided from the lateral stripe by a broad chestnut coloured stripe along the first lateral scale row and the upper edges of the ventral[13] scales (COSEWIC 2010). The back may range from olive-brown or chestnut to black.

Butler's Gartersnake may be confused with two other *Thamnophis* species occurring in Ontario, the Common Gartersnake (*T. sirtalis*) and the Eastern Ribbonsnake (*T. sauritus*) which both occur in southwestern Ontario (Sandilands 2001; COSEWIC 2010). In the case of the Eastern Ribbonsnake, the lateral stripes are on rows 3 and 4, while for the Common Gartersnake they are on rows 2 and 3. The Common Gartersnake and Eastern Ribbonsnake have larger heads and more pronounced necks than the Butler's Gartersnake. The Eastern Ribbonsnake also has a distinct white crescent in front of the eye, is more slender and has a longer tail. Further, the Eastern Ribbonsnake does not occur in most of the areas in southwestern Ontario where Butler's Gartersnakes are found (Ontario Nature 2014).

Like many other snake species, Butler's Gartersnake avoids mid-day sun and becomes active in the morning and evening during midsummer (Logier 1939; Catling and Freedman 1980(a); Ernst and Ernst 2003). Butler's Gartersnakes are non-aggressive, and will quickly seek shelter in thick grass thatch if disturbed (Ernst and Barbour 1989; Ernst and Ernst 2003; COSEWIC 2010). Although Butler's Gartersnake can move quickly in grassy areas, when travelling over hard surfaces it moves much more slowly having to slither sideways, in a "side-winding" motion (Sandilands 2001; Ontario Nature 2011). Butler's Gartersnake also has a prehensile[14] tail allowing it to wrap around vegetation or other objects to avoid predation (Environment Canada 2014).

[11] The upper side or back of an animal
[12] Situated on one side or other of the body
[13] Of, on, or relating to the underside of an animal
[14] Capable of grasping.

3.2 Population and Distribution

Butler's Gartersnake is endemic to North America where its range is considered one of the most restricted of all snake species (Sandilands 2001); its range is limited to an area near the lower Great Lakes in the United States (south-eastern Wisconsin, Indiana, Ohio and the Lower Peninsula of Michigan) and Canada (southern Ontario) (Nature Serve 2013) (Figure 1). The global range is estimated to be between 20,000 and 200,000 km^2 (Nature Serve 2013). Even though Butler's Gartersnake subpopulations are somewhat disjunctive[15] within their range, in many cases this species is locally abundant (Conant 1951; Conant and Collins 1991; Rossman et al. 1996). Due to its affiliation with prairie and grassland habitat and its current disjunct distribution, it is presumed that Butler's Gartersnake's former Canadian range included previously occupied sites between currently known locations (COSEWIC 2010).

The current Canadian range of Butler's Gartersnake is restricted to four geographically isolated regions in southwestern Ontario. Two regions: Windsor-Sarnia (Essex, Chatham-Kent, and Lambton Counties) and Luther Marsh (Dufferin and Wellington Counties) contain recent occurrence observations of Butler's Gartersnake. The species is also historically known to occur in Skunk's Misery (Lambton and Middlesex Counties) and Parkhill (Middlesex County) (COSEWIC 2010), however, further surveys are needed to confirm the species' presence in these two areas. The species is considered extirpated from a fifth region near Rondeau Provincial Park.

Within these regions, 48 locations of Butler's Gartersnake have been documented (Figure 2, Appendix B). For the purposes of this report, the term 'location' is used synonymously with the term 'subpopulation'. Six are considered extirpated[16] and four are considered historical (i.e., not observed in >20 years). The number of extant subpopulations is believed to be between 27 and 38. The uncertainty in the number of extant subpopulations is due to the fact that at seven locations, which were last visited in 2009 (including Walpole Island), surveyors did not find any Butler's Gartersnakes, although suitable habitat appears to be available. An additional three locations have lost significant portions of their habitat (COSEWIC 2010, Appendix B: locations 11, 14, 40) and additional surveys are required to confirm the status at these locations.

Seven locations visited in 2009 are new locations not previously noted in the literature. New locations have not been assessed by the Natural Heritage Information Centre and in the future, the enumeration of subpopulations may better align with element occurrence information. More recently, Noble et al. (2013) suggested that Butler's Gartersnakes in Windsor, Sarnia, and Luther Marsh consist of four to five genetically distinct clusters which are subdivided into three or four subpopulations but it is not clear how the known locations are designated within those clusters.

Throughout its current distribution, Butler's Gartersnakes are mainly scattered in small, fragmented locations. No snakes have been encountered at Skunk's Misery from 1989-2009 despite several targeted searches. Only one snake is known from Parkhill (1992), and this area was

[15] Discontinuous or separated from other subpopulations or populations.
[16] Population/subpopulation which was previously known to occur (i.e., for which there is historical record), but that no longer exists.

not searched in 2009 when other surveys for Butler's Gartersnake were conducted in Ontario (COSEWIC 2010). Further surveying, particularly in the spring, is required to confirm the presence/absence of the species at Skunk's Misery, Parkhill, Walpole Island and an additional 12 locations within the Windsor-Sarnia geographic region (COSEWIC 2010; J. Choquette pers. comm. 2014).

Several effective methods for detecting this secretive species enabled reliable estimates for a few Windsor subpopulations during the Herb Gray Parkway (HGP) project.[17] Radio telemetry using specialized transmitters, passive integrated transponder (PIT) tagging, a mark-recapture program and hibernacula enclosure fences to confirm hibernacula locations and snake use were employed. Through modeling of data collected using these methods, this project produced an estimate of around 550 individuals for HGP monitored areas in 2013 (LGL 2010; AMEC Environment and Infrastructure, environmental consultants on behalf of the Parkway Infrastructure Constructors and Windsor Essex Mobility Group (AMEC) 2012, 2013, 2014).

Currently, the long term survival of Butler's Gartersnake in Ontario is uncertain. In 2010 Butler's Gartersnake was reassessed from Threatened to Endangered by COSEWIC due to its small overall distribution in Canada, ongoing habitat loss including fragmentation and proposed development at many locations, and the decline and downward trend in the number of known local subpopulations. Most local subpopulations exist in small and or isolated habitat fragments and may be threatened by negative genetic effects of small population size and demographic stochasticity (COSEWIC 2010).

[17] The Rt. Hon. Herb Gray Parkway is a major highway infrastructure project that will form part of the transportation corridor connecting Highway 401 in Ontario to Interstate 75 in Michigan.

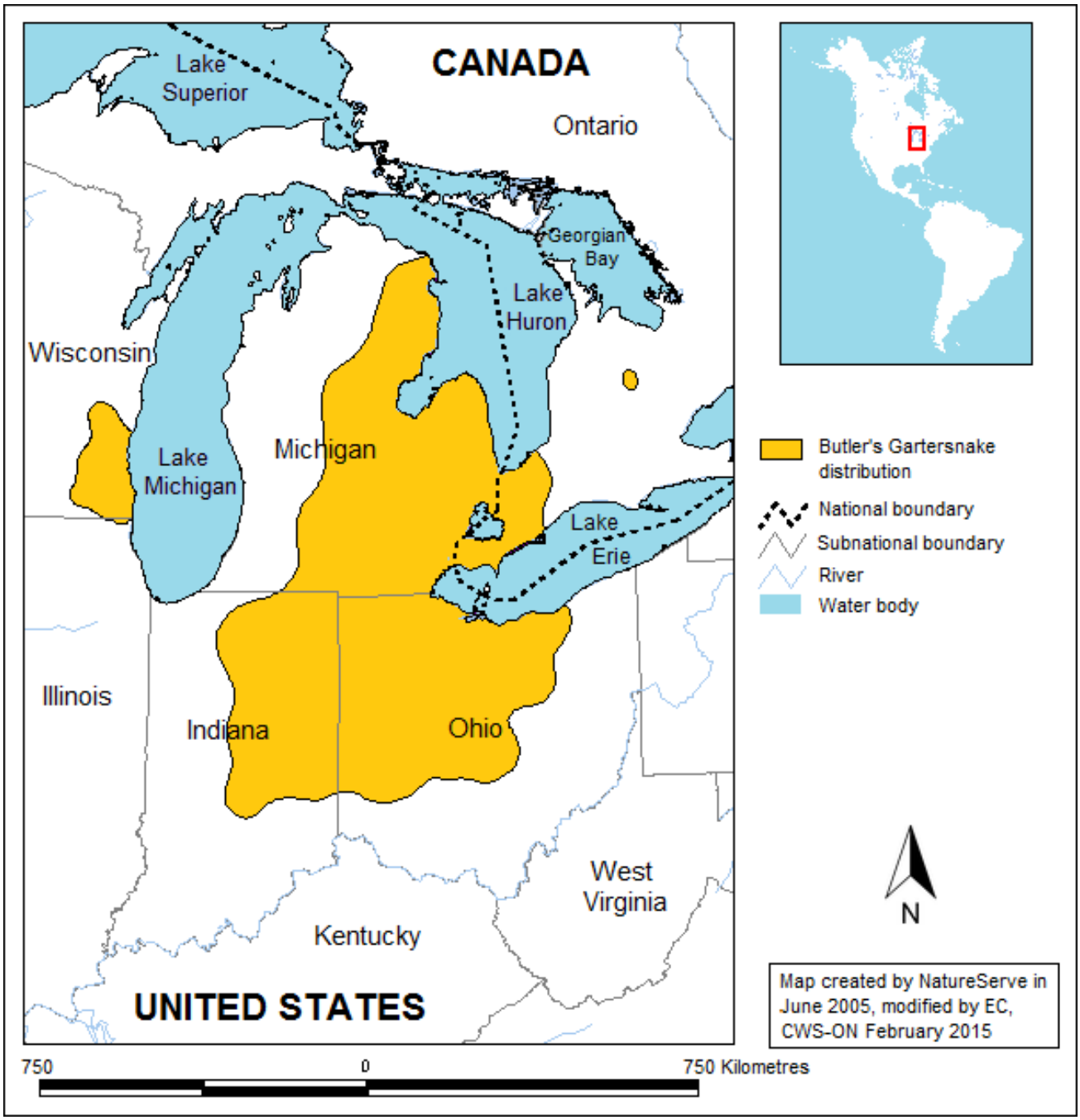

Figure 1. Global Distribution of Butler's Gartersnake (Modified from NatureServe 2014).

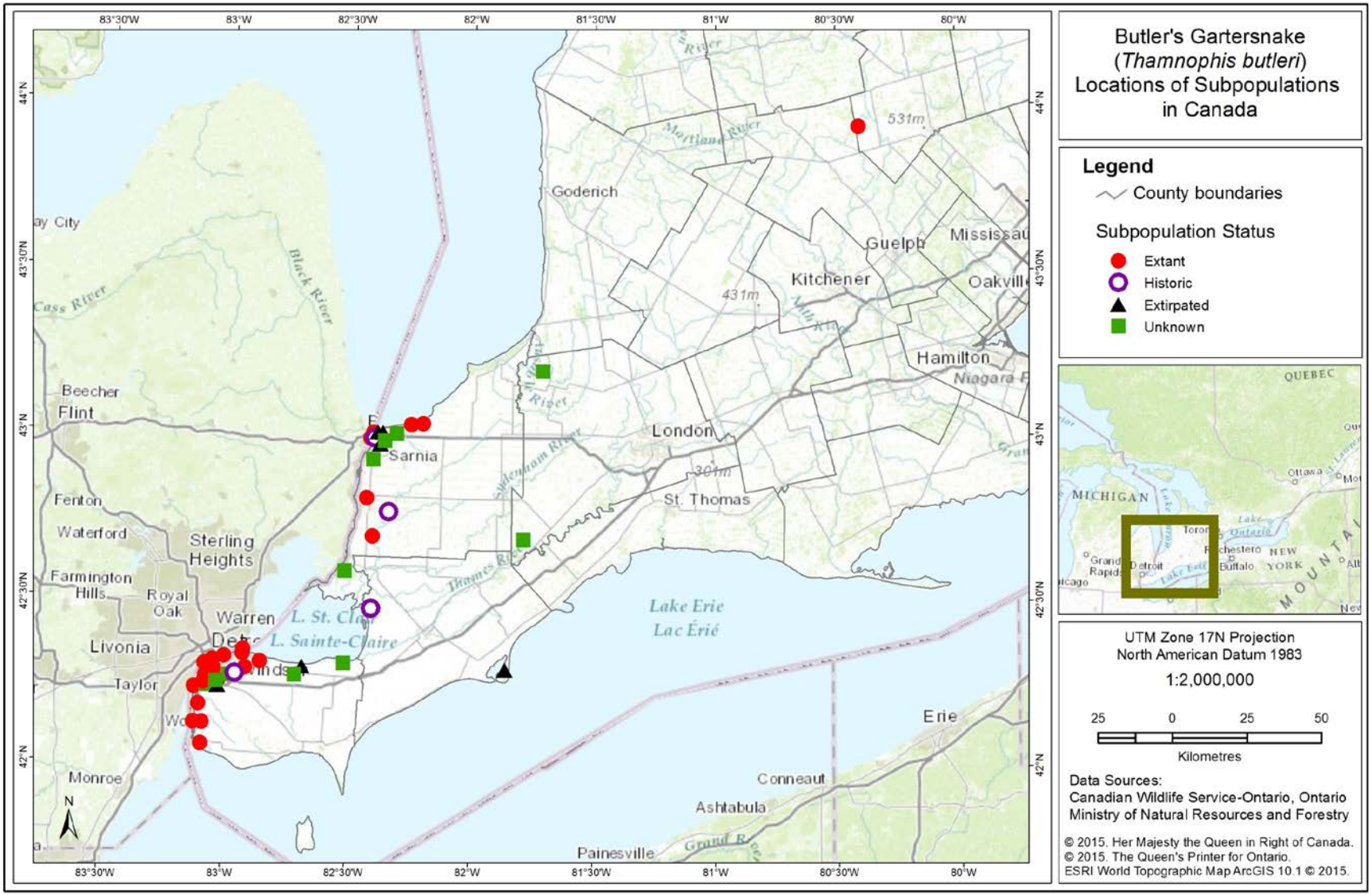

Figure 2. Location of Butler's Gartersnake subpopulations in Canada (modified from COSEWIC 2010).

3.3 Needs of the Butler's Gartersnake

Butler's Gartersnake is thought to be originally associated with post-glacial prairie in the Great Lakes region over 7,000 years ago (Schmidt 1938; Smith 1957; Bleakney 1958; Environment Canada 2014). This species has persisted in prairie remnants dominated by grasses including Big Bluestem (*Andropogon gerardii*) and Little Bluestem (*Schizachyrium. scoparium*) in southwestern Ontario (Sandilands 2001), though many populations now persist in highly altered human landscapes (e.g., fields, parklands, etc.). COSEWIC (2010) also indicates that all Butler's Gartersnake locations (with the exception of Luther Marsh) coincide with remnants of tallgrass prairie and oak savanna habitats which are critically imperiled in Ontario. Only 2.4 percent of northern tallgrass prairie remains in all of North America today (Samson et al. 2004), with less than 1 percent remaining in Ontario (Bakowsky and Riley 1994; Catling and Brownell 1999; Catling 2008).

General Habitat Needs

Butler's Gartersnake habitat in Ontario is characterized by open areas with dense grasses (e.g., cultural meadows, grasslands, old fields, tallgrass prairie communities) in close proximity to wet areas (i.e., small marshes, seasonal wet areas, small bodies of water) (Logier 1939; Planck and Planck 1977; Conant and Collins 1991; COSEWIC 2010). Dense grass cover with a heavy thatch layer is essential to its habitat, as the thatch layer allows Butler's Gartersnakes to move around in search of food under cover from predators (Planck and Planck 1977). In some areas, the species persists in early successional habitat where open grasslands are supporting shrubs and trees (Logier 1939). Butler's Gartersnake is also known to occur along treed edges and in vacant lots, small parks and abandoned sites in urban areas (Ernst and Barbour 1989; Rossman et al. 1996; Ernst and Ernst 2003; AMEC 2014).

Live Birthing Habitat

Core use areas of Butler's Gartersnake are typically associated with live birthing habitat or open basking habitat where females spend large amounts of time prior to giving birth (AMEC 2012; 2013). Butler's Gartersnakes are ovoviviparous (give birth to live young rather than lay eggs) and have between 4 and 20 young by early July to mid-September (Vogt 1981; Ernst and Ernst 2003; LGL and URS 2010). During the first two weeks of July, gravid[18] females may suddenly change behaviour and move out of previous activity areas in rapid linear movements to live birthing sites (LGL 2011; AMEC 2012, 2013, 2014); sometimes travelling over 200 m outside their activity areas (LGL 2010). Others were documented, also in multiple years, basking in habitats adjacent to live birthing sites just prior to giving birth (AMEC 2012, 2013, 2014). Live birthing habitat for Butler's Gartersnake consists of lowland areas or wet depressions surrounded by higher and drier land. Drier areas typically include shrub or tree cover along the edges of wet depressions, and may include wetland indicator plant species typically found in swamps and marshes (LGL 2011; AMEC 2012, 2013, 2014). AMEC (2012, 2013, 2014) confirmed fidelity to live birthing areas across successive years and in multiple monitoring zones, as part of the HGP monitoring, where the same live birthing areas were used by the same Butler's Gartersnake population.

[18] Internally carrying developing young or eggs.

Hibernation Habitat

Butler's Gartersnakes commonly hibernate individually through the cold winter months across their range, beginning hibernation in mid-September and not emerging until early April (Conant 1951; Wright and Wright 1957; LGL 2010). Hibernacula[19] recorded in Ontario include: Devil Crayfish *(Cambarus diogenes*; also known as Chimney Crayfish or Meadow Crayfish*)* burrows, small mammal burrows, drains, log piles, and other underground sites (LGL 2010; AMEC 2012, 2013, 2014). Radio-tracked Butler's Gartersnakes largely used crayfish burrows, often trying several burrows in the fall before settling on one for the winter (AMEC 2012, 2013, 2014). Hibernacula are usually associated with wetland habitats (open areas or more treed areas) or open water (drainage ditches), as both Chimney and Meadow Crayfish require certain water levels in areas where they create their burrows (i.e., must be able to reach ground water during periods of drought) (Bovbjerg, 1952; Hobbs 1989). To date, Butler's Gartersnakes have not yet been observed using the artificial hibernacula created to mitigate impacts to individuals captured during construction of the HGP (AMEC 2013); though several relocated Butler's Gartersnakes have found new hibernacula in the habitats to which they were moved, suggesting that adaptation to new habitats is possible for some individuals. The Wisconsin Department of Natural Resources (WDNR) identified several man-made structures as providing hibernacula for Butler's Gartersnake, such as old building foundations, sink holes, and improperly capped landfills and dumps (Freedman and Catling 1978; WDNR 2005; WDNR 2014).

Foraging Habitat

Butler's Gartersnakes spend most of their time during active months, generally April to September, foraging in long grasses found in tallgrass prairie, cultural thickets, cultural meadows, and meadow marshes (Planck and Planck 1977; LGL 2010; AMEC 2012). The species' preference for open grassland habitat with access to wetter areas may be related to its preferred prey, earthworms (Catling and Freedman 1980(a); Lyman-Henley and Burghardt 1995; W. King pers. comm. 2014).

Thermoregulation/Mating Habitat

Butler's Gartersnakes regulate their body temperature by basking and cooling throughout the day (Huey and Kingsolver 1989; Grant 1990). In order to elevate their body temperature, Butler's Gartersnakes seek out open spaces in vegetation, edges of water, the top of logs, coverboards, grass thickets, brushpiles and clusters of vegetation up to a metre above the ground (LGL 2010; AMEC 2013). The species has also been observed basking on gravel roads on cool evenings (C. Campbell and F.W. Schueler pers. comm. 2009) and along walking/bicycle trails (S. Gillingwater pers. comm. 2010). Planck and Planck (1977) observed snakes basking on top of shingles and crawling underneath to forage for earthworms. Mating often takes place at basking areas in close proximity to their hibernation sites, thus suitable habitat during this life process consists of many of the above habitat types from open spaces in vegetation to grass thickets (Harding 1997; Holman et al. 1999). In addition to basking sites, cooling sites are used by Butler's Gartersnake to lower body temperature during hot days in mid to late summer (LGL 2011). Cooling sites include shady areas such as the base of mature thickets, dogwood bushes, underground retreat sites, rock piles, large rocks, forest edges and shrubs, and various man-made

[19] Hibernacula are subterranean structures (natural or man-made) that occur where conditions provide access below the frost line and where adequate moisture exists (where snakes will not freeze or become dehydrated).

structures (Logier 1939; LGL 2010; LGL 2011). Locations along the edges of forested areas and cultural thickets are frequently used as cooling sites or cover (LGL 2010), and underground dens may also be used as shelters or dwelling places to avoid extremely hot periods in mid-summer (Logier 1939; Carpenter 1952; Catling and Freedman 1980).

Movement (commuting and dispersal[20]) Habitat

Butler's Gartersnake populations have typically shown limited movements and high site fidelity (Carpenter 1952; COSEWIC 2010; LGL 2010; AMEC 2013). In southern Michigan, Carpenter (1952) found Butler's Gartersnakes had an activity range of two acres (0.8 hectares). In southern Ontario the species' activity range has been found to be slightly larger at 1.6 hectares (AMEC 2013). Carpenter (1952) found that individual snakes did not extend their movements over the entire available habitat, but limited themselves to a smaller parcel. In mark-recapture studies Butler's Gartersnakes were frequently recaptured within 50 m of their original capture location and often under the same coverboard (recapture distance of 0 m) (AMEC 2013, 2014). LGL (2010) and AMEC (2013) found that Butler's Gartersnakes exhibited localized movements within their activity area at certain times of the year (e.g., bolting movements to and from live birthing sites and hibernacula). Recent work by AMEC also showed that range lengths (maximum distance moved in an active season) for non- relocated Butler's Gartersnakes were between 150 – 380 m (AMEC 2012, 2013, 2014). Movements across roads, through residential/landscaped areas or via linear corridors such as drains were rare, and most individuals kept to the outer boundaries of forested or wooded areas. Relocated individuals exhibited larger ranges, most likely due to exploratory movements after release (AMEC 2013).

Though a clear outlier in comparison to all other recaptured snakes in the study, one snake was recaptured 1,200 m from its initial capture site in Point Edward, Ontario (adjacent to Sarnia) (J. Kamstra pers. comm. 2009). This behaviour may be a response to dry summer conditions and a lack of available food. As temporary wet areas dry up in late spring and early summer, Butler's Gartersnakes are known to move to portions of their habitat where wet or moist areas remain throughout the year (W. King pers. comm. 2014). Long linear movements of up to 250 m have also been associated with movement from basking sites towards hibernacula in the fall (AMEC 2013; M. Hazell pers. comm. 2014).

3.4 Biological Limiting Factors

Although some populations may still be relatively large, even within the City of Windsor, many Butler's Gartersnake subpopulations in Ontario are small and isolated, and the disjunct distribution of this species indicates that it likely occupied a much wider range in the past (COSEWIC 2010). This previous range is believed to have occurred under warmer, drier conditions and may suggest that the species is limited by climate (Grand River Conservation Authority 2004). The tendency of Butler's Gartersnakes to typically move only short distances suggests that they may not attempt to cross gaps between unsuitable habitats, making them susceptible to habitat fragmentation (COSEWIC 2010). Butler's Gartersnake has become quite dependent on earthworms as its preferred food source, largely restricting its distribution to grassland habitats associated with wet

[20] Commuting here refers to short-distance movement within the home range in order to complete different life stages (e.g., foraging), while dispersal refers to long-distance movement related to emigration of individuals.

or moist areas supporting earthworms and possibly limiting its ability to colonize more arid grasslands (Carpenter 1952; Lyman-Henley and Burghardt 1995).

The small subpopulation sizes of Butler's Gartersnake in Ontario may limit the ability of the species to adapt to environmental change and, as a result, subpopulations may be subjected to higher extinction risks (Shaffer 1981; Reed et al. 2003; Santos et al. 2009) due to stochastic and human related factors (Santos et al. 2009). Boulding and Hay (2001) indicate that environmental changes can decrease population size, causing genetic variation to decrease. Decreased genetic variation in combination with inbreeding depression, can limit further adaptive responses (Hoffman and Willi 2008). Specific data on inbreeding depression in Butler's Gartersnake are not available, but studies focused on other snake species (e.g., Madsen et al. 1996) found that inbreeding depression does occur and can cause reduced brood size and a high proportion of unviable offspring. A simulation involving the Wisconsin population of Butler's Gartersnake found that populations with less than approximately 40-50 adult females begin to show disproportionally higher risk of extirpation (Hyde et al. 2007). Hyde et al. (2007) also indicates that reductions in survival of juveniles through inbreeding depression can have a major impact on Butler's Gartersnake population viability. That said, other recent studies show that some reptile species are not affected by these genetic issues, suggesting that further work is needed.

4. Threats

4.1 Threats Assessment

Table 1. Threat Assessment Table

Threat	Level of Concern[a]	Extent	Occurrence	Frequency	Severity[b]	Causal Certainty[c]
Habitat Loss, Degradation, or Fragmentation						
Urban and industrial development	High	Widespread	Historic/ Current	Recurrent	High	High
Agricultural practices, expansion and intensification	High	Widespread	Historic/ Current	Continuous	High	High
Development of roads and highways	High	Widespread	Historic/ Current/ Anticipated	Recurrent	High	High
Exotic, Invasive, or Introduced Species						
Exotic and invasive species	Medium	Widespread	Current/ Anticipated	Continuous	Low	Medium
Snake Fungal Disease	Medium	Widespread	Unknown	Unknown	Unknown	Low
Changes in Ecological Dynamics or Natural Processes						
Subsidized predation	Medium/Low	Widespread	Unknown	Unknown	Unknown	Low
Disturbance or Harm						
Direct persecution	Medium/Low	Widespread	Unknown	Unknown	Unknown	Low
Biological Resource Use						
Collection for personal use	Low[d]	Localized	Historic/ Current	Recurrent	Low	High

[a] *Level of Concern: signifies that managing the threat is of (high, medium or low) concern for the recovery of the species, consistent with the population and distribution objectives. This criterion considers the assessment of all the information in the table.*

[b] *Severity: reflects the population-level effect (high: very large population-level effect, moderate, low, unknown).*

[c] *Causal certainty: reflects the degree of evidence that is known for the threat (high: available evidence strongly links the threat to stresses on population viability; medium: there is a correlation between the threat and population viability e.g. expert opinion; low: the threat is assumed or plausible).*

[d] *Threats with a low Level of Concern are listed and described but may not be specifically addressed in the recovery approaches.*

4.2 Description of Threats

This section describes major threats outlined in Table 1, emphasizes key points and provides additional information. Although threats are listed individually, an important concern is the long-term cumulative effect of a variety of threats to local Butler's Gartersnake subpopulations.

It should be noted that most of these threats are typically more harmful during the species' active season (generally April to September) because they lead to higher levels of direct mortality or mutilation. Moreover, exposure to threats increases in periods in which Butler's Gartersnake movements increase, for example when some females move greater distances between hibernation and live birthing areas in the spring. Some of these threats could also affect the species during the non-active season, such as those that destroy or alter hibernacula.

Among the mechanisms through which threats can impact Butler's Gartersnake populations, isolation through habitat loss is of special concern, as it can lead to a breakdown of metapopulation dynamics[21] and a reduction in genetic diversity and possibility of rescue effect[22]. Threats such as increasing urbanization, agricultural practices, the development of road networks, and the spread of exotic or invasive species can all contribute to further isolation of remaining subpopulations. Most threats including the various types of development can impact the species significantly regardless of the time of year by eliminating habitat. Collection for personal use has also been documented in Ontario (M. Hazell pers. comm. 2014) and subsidized predation and direct persecution are believed to occur. Threats are listed in decreasing order of concern.

Urban and Industrial Development

Rare habitat types in Southern Ontario such as prairies and grasslands are quickly disappearing due to an increasingly urbanized environment. Urbanization is a widespread threat and has resulted in the documented loss of Butler's Gartersnake locations in Michigan (T. Cox pers. comm. 2009 as cited in COSEWIC 2010) and Ontario. Research conducted in 2009 within the Windsor – Sarnia region identified eight previously known sites destroyed by development (COSEWIC 2010).

Other threats associated with increasing urban and industrial development include the frequent mowing and management of lawns, and the destruction or alteration of natural and man-made structures that are used by Butler's Gartersnake for thermoregulation or hibernacula (COSEWIC 2010). Additionally, the drainage of wet areas (seasonal wetlands, small marshes, ponds) used by Butler's Gartersnakes may result from various development projects (Joppa and Temple 2005).

Agricultural Practices, Expansion and Intensification

Dense cover of grasses or herbs and a heavy thatch layer are essential habitat characteristics of Butler's Gartersnake (Planck and Planck 1977). The prevalence of intensive agricultural practices in southwestern Ontario limits the establishment of Butler's Gartersnake habitat. Continued disturbances through tilling and ploughing prevent the establishment of grasses and thatch. The expansion of agricultural land might also involve the drainage of seasonal wetlands, small marshes and ponds which are often used by Butler's Gartersnake. The conversion of snake habitat into arable[23] land has been documented (COSEWIC 2010). In the 1980s a location within Essex County, which was known as one of the largest local subpopulations of Butler's Gartersnake, was destroyed when it was converted to agricultural use (Planck and Planck 1977).

[21] Short and long-term changes in the size and age composition of a group of spatially separated (sub)populations of the same species which interact at some level (also known as a metapopulation), and the biological and environmental processes influencing those changes.
[22] The possibility for snakes to repopulate Ontario from the United States.
[23] Cultivated by ploughing or tillage.

Pesticides and herbicides could negatively affect Butler's Gartersnake because pesticides easily find their way into soils and can be toxic to earthworms (Pimentel 2005), their main prey item. A study conducted by Potter et al. (1990) found that pesticides can significantly decrease earthworm populations. Casbourn et al. (1976) found a strong relationship between the number of earthworms and density of Butler's Gartersnake.

Development of Roads and Highways

An ever-expanding road network across southern Ontario has created a severely fragmented landscape, increasing subpopulation isolation, reducing landscape connectivity, and threatening the survival of this species across its range. Road networks fragmenting continuous tracts of suitable habitat have a significant impact on Butler's Gartersnakes, which already have a limited home range (Carpenter 1952; Oliver 1955; DRIC 2009; COSEWIC 2010). Butler's Gartersnakes are particularly susceptible to road mortality (Sandilands 2001) because they are slow-moving in non-vegetated areas (Ruthven 1904; Ontario Nature 2011), are small and very difficult for drivers to see on roads, and can be attracted to the open habitat of road corridors for their thermal properties. Although no detailed studies have investigated the effects of road networks on Butler's Gartersnake, road mortality has been observed across the species' range (Harding 1997; J. Choquette pers. comm. 2009 as cited in COSEWIC 2010; LGL 2010). One study that did document road mortality in 2010 found multiple Butler's Gartersnakes killed on roads (Choquette 2014), and dispersal of radio-tracked Butler's Gartersnakes appeared to be limited by existing roads.

Exotic and Invasive Species

Exotic or invasive species have contributed to the loss of suitable habitat for Butler's Gartersnake (Hyde et al. 2007; Kapfer et al. 2013; Mifsud 2014). Although Butler's Gartersnakes may readily use small stands or patches of some non-native grass species; large, dense stands of European Common Reed (*Phragmites australis australis*) and Reed Canary Grass (*Phalaris arundinacea*) are not preferred, as they can alter habitat structure by shading basking sites and eliminating live birthing areas (Kapfer et al. 2013; W. King pers. comm. 2014).

As Butler's Gartersnake uses crayfish burrows as hibernacula, the invasion of Rusty Crayfish (*Orconectes rusticus*) poses a potential threat, as it has been known to outcompete and displace native crayfish species in Ontario and occurs within the Butler's Gartersnake range (Hamr 1997; Momot 1997). Although the effect of Rusty Crayfish on *C. diogenes* and *F. fodiens* is not yet determined, a Wisconsin study found that occurrences of Rusty Crayfish heavily overlap with occurrences of *C. diogenes*, as well as several other native crayfish (Olden et al. 2006). The displacement of *C. diogenes* and *F. fodiens* could reduce the amount of suitable hibernation habitat for Butler's Gartersnake, as Rusty Crayfish generally do not dig burrows other than small pockets under rocks and debris (Gunderson 2008).

Subsidized Predation

Predation by dogs and domestic and feral cats, as well as raccoons and skunks, may be a significant threat (Loss et al. 2013). This is due to the large human population within the highly urbanized portions of the Butler's Gartersnake range in Canada, and the fact that Butler's Gartersnakes will use human-modified habitats. Recent research shows that feral cats are

a significant threat to reptile populations in the United States (Loss et al. 2013). Populations of raccoons are dense in southern Ontario (approximately 1.1 million), especially around urban areas where there is an estimated 8-18 raccoons per square kilometre (OMNR 2009).

Direct Persecution
Negative attitudes toward snakes are common throughout North America, and even harmless species such as Common Gartersnakes are routinely killed (Gillingwater, pers. obs.) out of fear, prejudice or ignorance (Choquette 2011). Although it is unclear how significant a threat human persecution[24] is to the Butler's Gartersnake, the risk of persecution is generally greater for snake species that inhabit highly urbanized areas where the incidence of snake-human interaction is high (Choquette 2011). Snakes regularly elicit reactions of fear or hostility from the general public, and as a result, discriminate killing can be a significant source of mortality (Ashley et al. 2007).

Collection for Personal Use
There have been several instances of collection observed in Ontario, presumably for personal use (M. Hazell pers. comm. 2014). While this threat may be of low concern to the species as a whole (COSEWIC 2010), urban snake populations may be at greater risk due to the proximity of large human populations.

Snake Fungal Disease
Another potential threat that may affect the Butler's Gartersnake is Snake Fungal Disease (SFD) (*Ophidiomyces ophiodiicola*) (Sleeman 2013). This is an emerging fungal disease in wild snakes that causes severe skin lesions, leading to widespread morbidity and mortality (Sleeman 2013; Allender et al. 2015). SFD is currently known to affect several species including the Northern Watersnake (*Nerodia sipedon*), Eastern Foxsnake (*Pantherophis gloydi*), Eastern Milksnake (*Lampropeltis triangulum*), and Massasauga (*Sistrurus catenatus*) (Sleeman 2013). SFD has been confirmed in Ontario, in an Eastern Foxsnake found in southwestern Ontario in 2015 (Crowley pers. comm. 2015). It has also been confirmed in nine states in the U.S., although it is considered likely to be even more widespread (Sleeman 2013).

5. Population And Distribution Objectives

The population and distribution objective for Butler's Gartersnake is to maintain the current abundance and distribution of all extant subpopulations. Where biologically and technically feasible, the distribution and abundance of extant subpopulations should be increased and habitat connectivity between local subpopulations improved.

The above objective has been set recognizing that the abundance of this species is challenging to determine due to the species' habits. However, some effective methods for detecting this species have been developed during the Herb Gray Parkway (HGP) project as discussed in section 3.2.

[24] Human persecution of snakes occurs when people either fear or do not like the species. Many times persecution results in snakes being intentionally killed, and contributes to lower population numbers or local extirpation of the species.

Butler's Gartersnake has recently been found in only two regions in Ontario: Windsor – Sarnia and Luther Marsh. Additional surveys are needed to determine the presence/absence of the species in two others, Skunk's Misery and Parkhill, as well as nine unknown and four historical locations throughout Windsor-Sarnia, including Walpole Island (COSEWIC 2010; J. Choquette pers. comm. 2014). As many Butler's Gartersnake populations are disconnected within the species' range, so too are many of the local subpopulations found in urban areas in Ontario, such as the habitat in the Windsor – Sarnia region. Some of the urban subpopulations numbers in particular may be below sustainable levels. Because of this, increasing the area occupied by subpopulations, as well as improving habitat connectivity between occupied habitats is vital for the survival of the species. Increasing connectivity will also reduce the likelihood of a genetic bottleneck[25] within the species' Canadian range.

6. Broad Strategies and General Approaches to Meet Objectives

6.1 Actions Already Completed or Currently Underway

Recovery actions described in the Draft Walpole Island Ecosystem Recovery Strategy (Bowles 2005) included raising awareness in the First Nation community about species at risk, including Butler's Gartersnake. Pamphlets, calendars, newsletter articles, posters and other promotional material about species at risk have been prepared and distributed in the Walpole Island First Nation community.

The general habitat for Butler's Gartersnake was protected under the ESA when the species was uplisted to Endangered in 2010.

In the Windsor area, the construction of a divided multi-lane highway, the HGP during the period from 2011 to 2015 resulted in impacts to at least one subpopulation of Butler's Gartersnake. Portions of the Butler's Gartersnake subpopulations in this area were formerly found in the corridor being developed for the HGP during pre-construction surveys in 2010 and 2011. After exclusion fencing was erected along the corridor, all snakes found within the fenced construction area were relocated to adjacent habitat on the outside of the fence under a permit issued under the provincial ESA.

Mitigation efforts for Butler's Gartersnake included developing a restoration and management plan. An ongoing mark/recapture radio telemetry study was initiated to study the effects of mitigation measures and help determine key habitat areas for Butler's Gartersnake including hibernacula, live birthing habitat and movement corridors (LGL 2010; AMEC 2012, 2013, 2014). An extensive monitoring program, which began in 2009, has been underway to determine impacts to the subpopulations as a requirement of the permit. This includes monitoring activities such as radio tracking snakes, assessing movement behaviours of displaced snakes, monitoring the effectiveness of created habitat features (e.g., hibernacula, corridors, basking and cooling areas) and expanding the baseline knowledge of subpopulation size, distribution and behaviour. Monitoring activities will continue five years post-construction; the permit expires in 2021.

[25] A sharp reduction in the size of a population due to environmental events (such as earthquakes, floods, fires, or droughts) or human activities.

A number of stewardship and outreach activities including the development of vegetation management best practices and outreach that increases public knowledge and protection of Butler's Gartersnake are also currently ongoing in the area of the HGP.

Large areas of habitat were also created or enhanced as one of the requirements of this permit. This included the creation of corridors of open habitat to connect fields, facilitate movements, and enhance genetic mixing, removal of non-native invasive herbaceous plant species and woody species, and the creation of additional basking sites, open foraging habitat, habitat linkage corridors and cover objects for concealment (LGL 2010). A specially designed tunnel top specifically included to function as an eco-passage for snakes was also constructed. The eco-passage reconnected two Butler's Gartersnake populations (Spring Garden ANSI and Oakwood Bush) that were separated since the construction of Huron Church Road 60 years ago.

A study to evaluate the effects of road mortality on all reptiles, including Butler's Gartersnake, within the Ojibway Prairie remnants in Windsor and LaSalle was conducted from 2010 – 2014. The study involved a systematic road mortality survey to determine the nature and extent of reptiles found dead on roads bisecting the natural heritage features of the Ojibway Prairie Complex and surrounding natural areas. Butler's Gartersnake was identified as having the second highest number of individuals recorded as dead on road out of the six species at risk surveyed, and was found to be threatened by road mortality within multiple road segments (Choquette 2014).

The Ojibway Nature Centre has undertaken many beneficial activities for local snake populations, including Butler's Gartersnake, for many years. This includes activities such as conducting public outreach to educate the community on the threats facing the species, hosting educational events, habitat restoration, conducting mark-recapture studies, radio-telemetry and land acquisition. The Ojibway Nature Centre also maintain a database of sight records and known populations of Butler's Gartersnake.

Research to better understand the genetic structure of Butler's Gartersnake across Ontario and examine the unique genetics and morphology of the Luther Marsh subpopulation was completed in 2013 (Noble et al. 2013). As a result of this research, it was discovered that there are four to five genetically distinct clusters of Butler's Gartersnake in Ontario: Sarnia (1), Luther Marsh (1) and Windsor (2-3), and these clusters are subdivided into 3 or 4 subpopulations (Noble et al. 2013).

An ongoing research project focused on Butler's Gartersnake populations and habitat in southwestern Ontario is being undertaken by AMEC Foster Wheeler, Queen's University and University of Waterloo. This project is using occurrence records and genetic samples, to build habitat suitability models for the species and its subpopulations in the Windsor area. In addition to habitat preferences, this project will also provide information on habitat connectivity and dispersal between subpopulations, and effective population sizes within subpopulations.

6.2 Strategic Direction for Recovery

Table 2. Broad strategies and approaches necessary for the recovery of the Butler's Gartersnake.

Threat or Limitation	Priority[e]	Broad Strategy to Recovery	General Description of Research and Management Approaches
Urban and industrial development; agricultural practices, expansion and intensification.	High	Habitat Protection and Restoration	• Identify priority sites for securement (e.g., purchase, donation, easement, agreement), such as suitable habitat adjacent to and connecting existing occupied sites • Identify and prioritize sites for new habitat creation, enhancement or restoration and, if feasible, restore former habitat at extant and historic sites, adjacent tracts and connecting corridors • Identify new areas and update mapping of existing occupied habitat • Determine locations and site-specific characteristics and extent of hibernacula • Increase municipalities', businesses' and landowners' awareness of habitat protection legislation related to Butler's Gartersnakes • Encourage landowner stewardship to protect or restore habitat • Develop and encourage alternatives to chemical use (fertilizers, pesticides, herbicides) on agricultural lands that may impact grassland communities (i.e., upslope and upstream agricultural lands bordering riverine, wetland or prairie areas) • Develop and apply (where possible) best management practices (e.g., for livestock grazing, vegetation management) for maintaining or enhancing Butler's Gartersnake habitat
All threats	High	Threat Mitigation	• Develop and implement best management practices for mitigating road mortality of Butler's Gartersnake • Develop and implement threat mitigation techniques for other key threats to this species, including subsidized predation, illegal collection and intentional persecution • Implement restoration practices in a strategic manner, including site-specific monitoring
All threats	High	Surveys and Monitoring	• Survey historic, and potential sites using a standard survey protocol and solicit data on occurrences of this species to improve our knowledge of Butler's Gartersnake distribution in Ontario • Implement targeted and/or mark recapture surveys to evaluate habitat use within mitigation areas, including restoration areas associated with the DRIC Plaza site and HGP and evaluate critical habitat. • Develop and implement a long-term population monitoring program at known sites across Ontario to assess the natural level of variability in population dynamics from year to year and to determine status and effects of recovery efforts. Also include a focus on hibernation site monitoring at regular intervals (e.g., every three years) • Monitor the species for Snake Fungal Disease and determine and implement appropriate mitigation techniques if present.

All threats	High	Communication and Outreach	• Develop and implement best management practices and provide guidance to private and public landowners, and managers and First Nations on minimizing impacts of activities that threaten the species (e.g., timing of prescribed burns, wetland drainage, pollution), property maintenance (e.g., mowing) and recreational activities • Educate the public about the threats to Butler's Gartersnake and how they can contribute to protection and recovery efforts for this species • Coordinate public outreach with respect to consistent messaging with other conservation groups (e.g., Tallgrass Ontario, Carolinian Canada, Nature Conservancy of Canada, World Wildlife Fund, etc.) • Encourage the transfer and archiving of Traditional Ecological Knowledge
Genetic and demographic stochasticity; Knowledge gaps	Medium	Research	• Undertake research (e.g., radio-tracking, mark-recapture) to further determine the habitat necessary for various life stages of Butler's Gartersnake in Ontario (e.g., hibernation, foraging, etc.) in both natural and restoration areas, particularly in areas with heavily fragmented habitat i.e. Windsor • Investigate the effects of road networks on Butler's Gartersnake mortality and restriction of movement due to road aversion • Research into effective techniques that can be used to mitigate threats for Butler's Gartersnakes in Ontario, especially road mortality • Investigate the mortality rates from domestic and feral pets and other subsidized predators, and determine the potential impact of illegal collection for the pet trade and direct persecution on Butler's Gartersnake • Undertake genetic work to determine if inbreeding depression and/or hybridization is occurring at any populations or if low genetic diversity may result in local extirpation of any of the populations • Conduct a Population Habitat Viability Analysis (PHVA) for extant subpopulations of Butler's Gartersnake in both rural and urban settings in order to refine recovery targets, further refine critical habitat and determine extinction risk.

[e] *"Priority" reflects the degree to which the broad strategy contributes directly to the recovery of the species or is an essential precursor to an approach that contributes to the recovery of the species.*

6.3 Narrative to Support the Recovery Planning Table

The approaches above focus on conserving and, where feasible, increasing, the distribution and abundance of extant subpopulations and remaining natural habitats, particularly between local subpopulations, of the Butler's Gartersnake in Canada. There is also a focus on developing best management practices for Butler's Gartersnake habitat, which can be implemented by engaging various stakeholders (e.g., private and public land owners, land users and planners, Aboriginal groups, non-government organizations, governments). Habitat protection, management and restoration are of the utmost importance to recover Butler's Gartersnake, as habitat loss and fragmentation are the major threats to this species. The emphasis of habitat protection and restoration efforts should consider both creation and maintenance of corridors between core habitats as habitat fragmentation is a significant concern particularly for urban local subpopulations. Threat mitigation such as the development of best management practices to address road mortality and strategic restoration practices to combat invasive species will also be essential. Because there is uncertainty regarding site specific characteristics of certain components of Butler's Gartersnake habitat (e.g., hibernacula and live birthing sites), it will be necessary to determine the habitat requirements for these life processes so that existing and former suitable habitat may be prioritized for restoration. The extent of the impacts of road networks will also need to be examined. The significance of Snake Fungal Disease to Butler's Gartersnake is unknown at present; however, there is concern for small populations of conservation concern if infections result in mortalities. Continued research on the genetic structure of the Canadian population of Butler's Gartersnake is needed to determine whether inbreeding depression and or/hybridization is occurring in any of the extant subpopulations in Ontario.

7. Critical Habitat

7.1 Identification of the Species' Critical Habitat

Section 41 (1)(c) of SARA requires that recovery strategies include an identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction. Critical habitat is defined in SARA as "...the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species" (subsection 2(1)).

Critical habitat identification for Butler's Gartersnake must describe the habitat necessary to maintain the current subpopulations and distribution and promote connectivity between local subpopulations where feasible (see section 5). This federal recovery strategy identifies critical habitat for 27 extant locations of Butler's Gartersnake in Canada, within the geographic regions of Windsor-Sarnia and Luther Marsh (see Figures 4 and 5, and also Table 3) and based on best available information as of June 2014. Additional critical habitat may be added in the future if new information supports the inclusion of areas beyond those currently identified. In some of the areas identified as critical habitat, the quality of the habitat will need to be improved for recovery to be achieved.

It is recognized that the critical habitat identified below is insufficient to achieve the population and distribution objectives for the species because there are locations that may still support Butler's Gartersnake but have not been adequately or recently surveyed, or that may be

contributing to local subpopulation viability but critical habitat could not be identified due to a lack of certainty in the data. A schedule of studies (section 7.2; Table 4) has been developed that outlines the activities required to complete the identification of critical habitat in support of the population and distribution objectives. The identification of critical habitat will be updated, as required, either in a revised recovery strategy or an action plan once these studies are completed.

The identification of Butler's Gartersnake critical habitat is based on three criteria: habitat occupancy, habitat suitability and habitat connectivity between local subpopulations, which are discussed in detail below.

7.1.1. Habitat Occupancy

This criterion refers to areas where there is a reasonable degree of certainty of current use by the species (an indicator of habitat suitability).

Habitat is considered occupied when:

- At least one Butler's Gartersnake individual has been observed in any single year since 1994.

Habitat occupancy is based on documented live birthing or hibernacula locations, survey and radio telemetry data, and incidental observations of Butler's Gartersnakes (live or dead) in locations where key biophysical attributes are present nearby. These observational data must have a spatial precision of $\leq$ 1 km or provide enough detail to be associated with a specific suitable habitat feature(s) to be considered adequate to identify critical habitat.

Most available records are from the past ten years, from the 2010 COSEWIC status report and from survey and monitoring work undertaken in relation to the Detroit River International Crossing (DRIC) and HGP and surrounding areas (AMEC 2013). However, the species is challenging to track and monitor and difficult to find in its preferred habitat outside of the mating season (COSEWIC 2010). Due to the fact that the species is fairly cryptic and longevity in the wild is currently unknown (maximum recorded age in captivity is 14 years old; COSEWIC 2010), the timeframe of twenty years is deemed appropriate to allow for the inclusion of a number of local subpopulations that likely persist but have not been targeted by recent surveys or may have gone undetected. Locations with records older than twenty years require surveys to confirm the species' occupancy and persistence of critical habitat (section 7.2).

Critical habitat is not identified for locations where recent surveys or other information (e.g., aerial photos) determined that the location no longer contains habitat (e.g., housing development) to support Butler's Gartersnake (i.e., extirpated) or where significant portions of habitat have been destroyed (e.g., 'unknown' status) (See Appendix B). Locations recently surveyed but where no Butler's Gartersnakes were observed, but the habitat appears to remain suitable were considered 'unknown', requiring additional surveys to confirm current use by Butler's Gartersnake (See Appendix B, section 7.2).

For clarity, Butler's Gartersnakes located within the DRIC Plaza site and HGP footprint were relocated into existing suitable habitat or restored habitat (the majority of these restoration sites occur within the Ojibway Prairie complex and surrounding areas in Windsor, Ontario). The HGP

relocation sites are included in the identification of critical habitat as many of the sites already supported Butler's Gartersnakes; the DRIC Plaza relocation site (Black Oak Heritage Park) may be included in the future as more information becomes available (i.e., if the relocation proves to be successful since there was not an existing subpopulation at this location). Any observations from within the DRIC Plaza site or the HGP footprint where road construction and expansion has occurred and mitigation/relocation of individuals was carried out are not identified as critical habitat at this time. A large amount of land (>35 ha) within the current HGP construction footprint is to be restored back to snake habitat under the provincial ESA permit, and it is expected that Butler's Gartersnake will recolonize these formerly occupied areas once restoration activities are completed and habitat becomes available. Critical habitat will be revisited as additional information on the success of this restoration project becomes available.

7.1.2. Habitat Suitability

Habitat suitability relates to areas possessing a specific set of biophysical attributes that support individuals of the species carrying out essential aspects of their life cycle (i.e. live birthing, thermoregulation, mating, foraging and hibernation) as well as their movements. Suitable habitat for Butler's Gartersnake can therefore be described as a conglomerate within grassland or other open/semi-open habitat mosaics, in which specific biophysical attributes can be associated with essential life stages and needs. Within the area of suitable habitat, the biophysical attributes required by Butler's Gartersnake will vary over space and time with the dynamic nature of ecosystems. In addition, particular biophysical attributes will be of greater importance to snakes at different points in time (e.g., during different life processes, seasons or at various times of the year).

The biophysical attributes of critical habitat include the characteristics described below.

For live birthing, thermoregulation, mating, foraging, and hibernation:

- Open to early-successional areas with sparse to dense grasses (e.g., tallgrass prairie communities, grasslands, cultural meadows, thicket, old fields or deciduous swamps that contain access to wet areas (e.g., seeps, wet depressions surrounded by higher and drier land).
- Edges of habitat types as described above (e.g., edges of wet depressions, forested areas and cultural thickets).
- For hibernation: areas that contain crayfish burrows, small mammal burrows or dens, log piles, drains, dogwood bushes, or rocky outcrops.

For movement:

- Habitat and/or land cover types that are permeable to Butler's Gartersnake; not interrupted by barriers to movement (i.e., major paved roads, untraversable habitat such as cliffs, dense upland forests, dense urbanized developments, and large bodies of open water).

Suitable habitat for Butler's Gartersnake may be partially described using the Ecological Land Classification (ELC) framework for Ontario (from Lee et al. 1998)[26], which provides a

[26] ELC in Ontario is being revised to further distinguish between different types of cultural habitats (e.g., row crops, perennial cover crops, specialty crops, pasture) in addition to various native grassland ecotypes (H. Lee pers. comm.

standardized approach to the interpretation and delineation of dynamic ecosystem boundaries. The ELC approach classifies habitats not only by vegetation community but also considers hydrology and topography, and as such encompasses the biophysical attributes of the habitat for Butler's Gartersnake. In addition, ELC terminology and methods are familiar to many land managers and conservation practitioners who have adopted this vegetation community classification tool as the standard approach for Ontario.

The biophysical attributes of Butler's Gartersnake suitable habitat for live birthing, thermoregulation, mating, foraging, and hibernation are typically found in the following ELC Community Series designations: Open Tallgrass Prairie (TPO), Tallgrass Savanna (TPS), Cultural Meadow (CUM), Cultural Thicket (CUT), Cultural Savanna (CUS), Deciduous Swamp (SWD), Meadow Marsh (MAM), and Shallow Marsh (MAS). Due to their rarity, confirmed hibernacula will also be identified as critical habitat wherever they are located (they do not need to occur in ELC polygons; see below). Movement habitat (commuting and dispersal) is also not described using the ELC framework. Instead it refers to any contiguous[27] habitat (free from barriers to the species' movement) that connects adjacent suitable ELC habitat patches for live birthing, thermoregulation, mating, foraging, and hibernation and/or hibernacula.

Given the lack of information on minimum habitat quantities required for life cycle activities within a home range, the following approach has been used to identify functional habitat for Butler's Gartersnake. This description of suitable habitat reflects the fact that certain biophysical attributes do not need to be immediately adjacent to each other, as long as they remain connected so that the individuals can easily move between them to meet all their biological needs and respond to or avoid disturbances as required. The distances determining the extent of suitable habitat are specific to Butler's Gartersnake and based on the species' biological and behavioural requirements (see section 3.3).

Suitable habitat for Butler's Gartersnake consists of live birthing, thermoregulation, mating, and foraging habitat, and hibernacula (throughout the home range for at least one individual) and the movement (commuting and dispersal) habitat that occurs between them (See Figure 3), and is described as follows:

- The entire suitable live birthing, thermoregulation, mating, foraging, or hibernation habitat patch(es) (i.e., the entire ELC community series polygon) or known hibernaculum located within 200 m of an observation of Butler's Gartersnake (i.e. meets the occupancy criteria); AND
- The contiguous movement (commuting and dispersal) habitat(s) between them, being permeable to Butler's Gartersnake movement (i.e., no barriers) and occurring with 200 m of an observation of Butler's Gartersnake.

Movement habitat is only considered where it creates a continuous linkage between two or more live birthing, thermoregulation, mating, foraging, and hibernation habitat patches and/or hibernacula (Figure 3). Barriers to Butler's Gartersnake include major paved roads or roads with

2012). It is recommended that these new ELC ecotypes be incorporated when the next version of the classification scheme has been approved and/or becomes widely adopted.

[27] Adjacent habitat patches and/or land cover that may or may not be of the same type but are permeable to Butler's Gartersnake movement (no barriers).

obstructions such that Butler's Gartersnake rarely if ever cross successfully; untraversable topography (e.g., cliff); dense urbanized areas lacking suitable habitat and large bodies of open water (Carpenter 1952; COSEWIC 2010; LGL 2011; Noble et al. 2013).

Suitable habitat for hibernacula is defined as:

- The area, both natural and man-made, within a 150 m radial distance of a Butler's Gartersnake hibernaculum entrance and/or exit, and which meets the habitat occupancy criterion.

The search for live birthing sites, hibernacula, shelter from heat and cold, and food constitute the majority of movements for snakes (Carpenter 1952). The 200 m distance is based on the average home range lengths observed for radio-tracked individuals over a four-year Ontario study (average 218 m) (AMEC 2012, 2013, 2014, 2015). These movements demonstrate that critical habitats (e.g., foraging, thermoregulation habitats) are available within several areas of their home range. A habitat-based approach (functional habitat) is important to preserve the habitat remnants that remain occupied and available to Butler's Gartersnake. This is due to the fact that suitable habitat occupied by Butler's Gartersnakes is very fragmented within the landscape and development pressures for housing and road construction are high.

Hibernacula are one of the most important habitat features for Butler's Gartersnake and require special consideration. They are critical for over winter survival (Shoemaker et al. 2009; LGL 2010). Hibernacula are also difficult to identify due to their small entrance points and the cryptic habits of the snakes entering and exiting the hibernacula. It is not currently known to what extent subterranean features of hibernacula extend from an entrance or exit point. A 150 m radius area is considered necessary to maintain the biological composition, structure and function of the surrounding subterranean environment (Rossman et al. 1996; M. Hazell pers. comm. 2014) and to protect staging areas in the vicinity of the hibernacula. Butler's Gartersnakes have been located underground 30 m away from their original hibernacula site in Ontario (AMEC 2013) and the additional area may support the soil/substrate suitability and certain moisture regimes around this extent of hibernacula use. Recent data in Ontario indicates that Butler's Gartersnake hibernacula are typically over 150 m from other core areas used during the active season, and the species may select hibernacula up to 100 m from the previous year's location, (AMEC 2013, 2014). This criterion may be refined in the future as more hibernacula for Butler's Gartersnake are discovered and additional information on their structure and use by the species becomes available.

Butler's Gartersnakes are readily found individually or in small groups under various types of materials including rocks, concrete, plywood boards, roofing shingles, metal tins, old carpet, rubber, cardboard, and fiberglass sheets (COSEWIC 2010). Since many of the Butler's Gartersnake populations currently persist in highly degraded habitats (e.g., urban parks, railroad right-of-ways, etc.) and rely on man-made cover, these features are important components of the species' habitat (COSEWIC 2010). Where feasible, these man-made features should be left in place to provide areas for foraging, cover, and thermoregulation when they occur in or immediately adjacent to critical habitat.

Active agricultural fields in row crops or in crop rotation are considered unsuitable habitats and are excluded from critical habitat (including hibernacula) as they are poor quality habitats offering limited cover and use of these habitats can result in increased rates of mortality; also these habitats

may become ecological traps[28]. Marginal lands (i.e., idle land >10 years) and unimproved pasture are considered suitable habitats (i.e., cultural meadow).

7.1.3 Habitat Connectivity

Connectivity between local subpopulations is important for immigration and emigration (movement into and out of subpopulations, respectively) which increases gene flow (maintaining genetic diversity) and allows the species to react to environmental stressors (e.g., pollution, droughts, habitat alterations) by moving to another location. In Canada, habitat loss and fragmentation is the greatest threat to Butler's Gartersnake; many local subpopulations are distributed in small, mostly isolated patches within an urban landscape (e.g., high housing and road development pressures). This can result in the loss of dispersal corridors, isolating local subpopulations and causing reductions in genetic diversity. Habitat connectivity is necessary to meet the population and distribution objectives.

To allow short-distance movements needed to complete the Butler's Gartersnake life cycle (commuting movement), connectivity is ensured by the defined functional habitat (seasonal movements between habitats (e.g., between hibernacula and live birthing sites) as required to complete an annual life cycle) (section 7.1.2)). To allow long-distance movements such as immigration or emigration to promote genetic stability within local populations (dispersal movement), the habitat connectivity criterion connects local subpopulations based on the documented tendency of Butler's Gartersnakes to undertake terrestrial movements for dispersal[29].

The habitat connectivity criterion identifies unoccupied[30] suitable habitat as critical habitat where it occurs within a dispersal distance of two individuals' home ranges, and is defined as:

- The movement (commuting or dispersal) habitat (s) where it creates a contiguous linkage between two (or more) functional habitats separated by up to a maximum distance of 600 m.

The 600 m distance is based on the maximum home range length for radio-tracked individuals of Butler's Gartersnake observed over a four-year period in Ontario (max. 662 m in 2012) (AMEC 2012, 2013, 2014, 2015) and is three times the average linear home range length (200 m), which is the minimum separation distance between local populations recommended by NatureServe (NatureServe 2014) to maintain connectivity and reduce the probability of genetic isolation. This distance is appropriate given the imminent threats to the species and its continued decline in Canada (COSEWIC 2010). Estimates of dispersal for Butler's Gartersnake vary; most movement studies showcase localized movements (LGL 2010). The species will, however, move large distances at certain times of its life cycle (e.g., females observed moving up to 395 m to birthing sites in the spring and summer, snakes searching for hibernacula in late summer or fall

[28] A low-quality habitat that animals choose over other available, better quality habitats.
[29] There has been some colonization of islands by Butler's Gartersnake which would require traversing unsuitable habitat such as open water [which may have occurred accidentally (e.g., species washed downstream)]. To date, no studies have considered swimming as a means of dispersal (COSEWIC 2010).
[30] In this document, 'unoccupied' refers to suitable habitats that do not contain an observation record for Butler's Gartersnake; however, as this species is under surveyed, additional and/or systematic surveys may showcase these areas in the future to be occupied by Butler's Gartersnake.

(LGL 2010) and young of the year moving more than 400 m from their activity areas, likely to establish new territories (LGL 2011).

Because a major road (e.g., multi-laned paved road) or other large paved surface (e.g., parking lot) between occupied functional habitats usually results in Butler's Gartersnake mortality, the area is not identified as part of the movement corridor (if it exists) unless a culvert or tunnel underneath it is present. In those cases, the movement corridor may be considered the width of that culvert or tunnel and would require verification in the field.

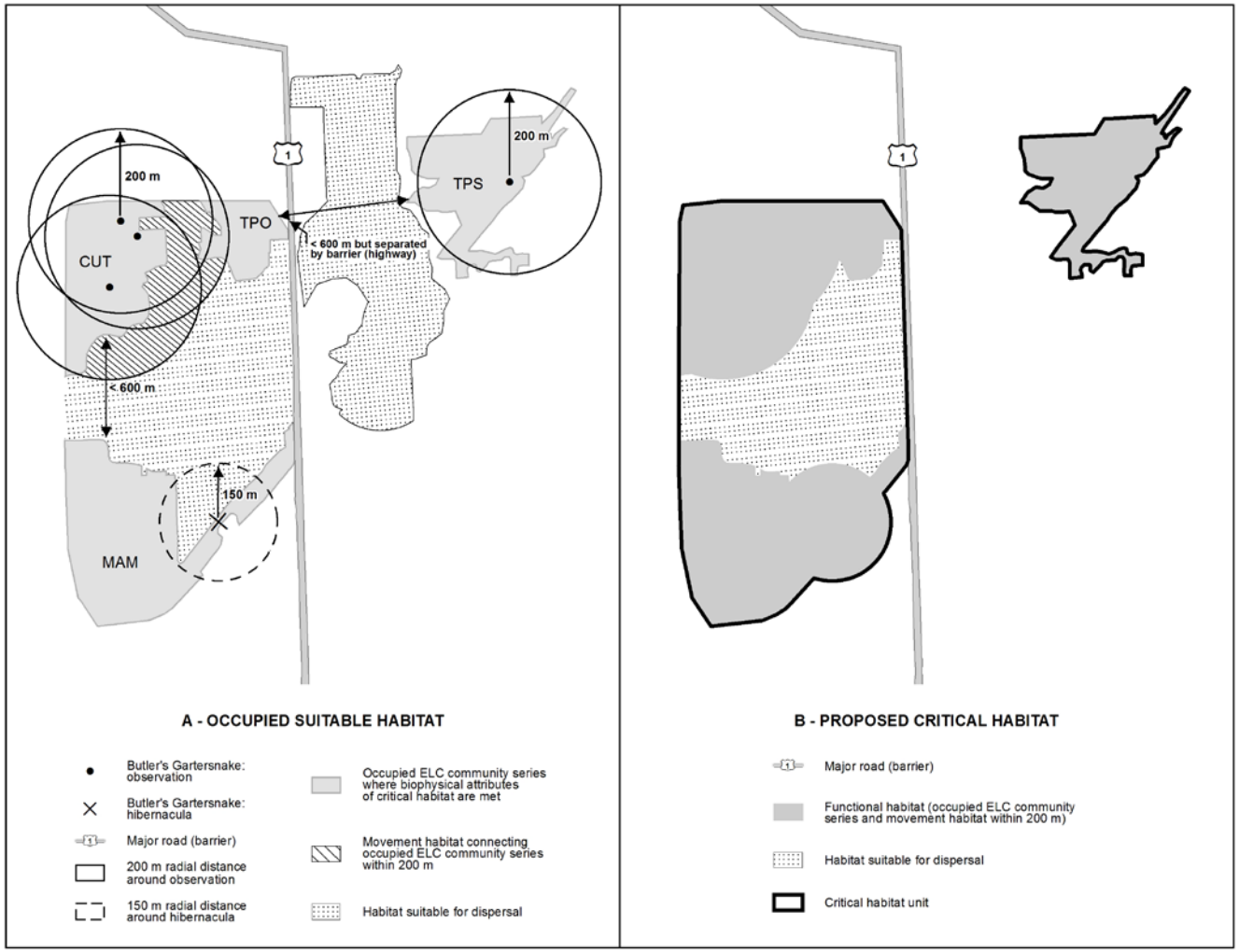

Figure 3. Schematic of Critical Habitat Criteria for Butler's Gartersnake. (**A.)** Functional suitable habitat is identified for Butler's Gartersnake as the entire suitable ELC community series polygon where it occurs within 200 m of an observation and the movement habitat between them, up to 200 m from an observation. Hibernacula suitable habitat is identified as the area within 150 m of a hibernaculum entrance or exit, and may or may not exist within functional habitat (see section 7.1.2.). (**B.)** A critical habitat unit includes the boundary of functional habitat and/or hibernacula suitable habitat that meets the habitat occupancy criterion. The critical habitat unit boundary is extended (using a minimum bounding polygon) where two or more functional habitats and/or hibernacula suitable habitats are separated by up to a maximum distance of 600 m and contain habitat suitable for movement (dispersal) between them (free from barriers).

7.1.4 Application of the Butler's Gartersnake Critical Habitat Criteria

Critical habitat for Butler's Gartersnake includes the suitable habitat (i.e., functional habitat or hibernacula) (section 7.1.2), that meets the habitat occupancy criterion (section 7.1.1), herein referred to as a critical habitat unit. The critical habitat unit bounds a functional habitat complex for Butler's Gartersnake, consisting of core habitat areas based on ELC and/or hibernacula suitable habitat and areas permeable to the species' movement. Where the habitat connectivity criterion is applied (in cases where two or more functional or hibernacula suitable habitats are separated by up to a maximum dispersal distance of 600 m, section 7.1.3), the critical habitat unit is extended (using a minimum bounding polygon) identifying a larger habitat complex for Butler's Gartersnake (Figure 3). Thus, the critical habitat unit represents the maximum extent of critical habitat at a particular location.

Application of the critical habitat criteria to the best available data current to June 2014 identified critical habitat for the 27 known extant locations of Butler's Gartersnake in Canada, within the Windsor-Sarnia and Luther Marsh regions of Ontario, totaling up to 1,460 ha. The critical habitat identified is considered a partial identification of critical habitat and is insufficient to meet the population and distribution objectives. Available information on the species and subpopulation status at a number of locations is unknown, outdated or lacking detailed spatial references or unavailable to Environment Canada. Specifically, critical habitat could not be identified for locations at Skunk's Misery, Parkhill, or nine locations within the Windsor-Sarnia region (including Walpole Island) with unknown subpopulation status and four historical locations (see section 3.2 and Appendix B). A schedule of studies (section 7.2) has been developed to provide the information necessary to complete the identification of critical habitat that will be sufficient to meet the population and distribution objectives. As additional information becomes available, critical habitat may be refined or more units meeting critical habitat criteria may be added.

The portions of critical habitat that had extended into the development footprints of the DRIC Plaza site and HGP are not identified as critical habitat. All Butler's Gartersnakes previously occurring within the DRIC Plaza site and HGP footprints were relocated into existing or restored habitat.

Critical habitat for Butler's Gartersnake is presented using 1 x 1 km UTM grid squares. The UTM grid squares presented in Figures 4 and 5 are part of a standardized grid system that indicates the general geographic areas containing critical habitat, which can be used for land use planning and/or environmental assessment purposes. In addition to providing these benefits, the 1 x 1 km UTM grid respects provincial data-sharing agreements in Ontario. Critical habitat within each grid square is defined by the criteria described in section 7.1.1 through 7.1.3. More detailed information on critical habitat to support protection of the species and its habitat may be requested on a need-to-know basis by contacting Environment Canada – Canadian Wildlife Service at ec.planificationduretablissement-recoveryplanning.ec@canada.ca.

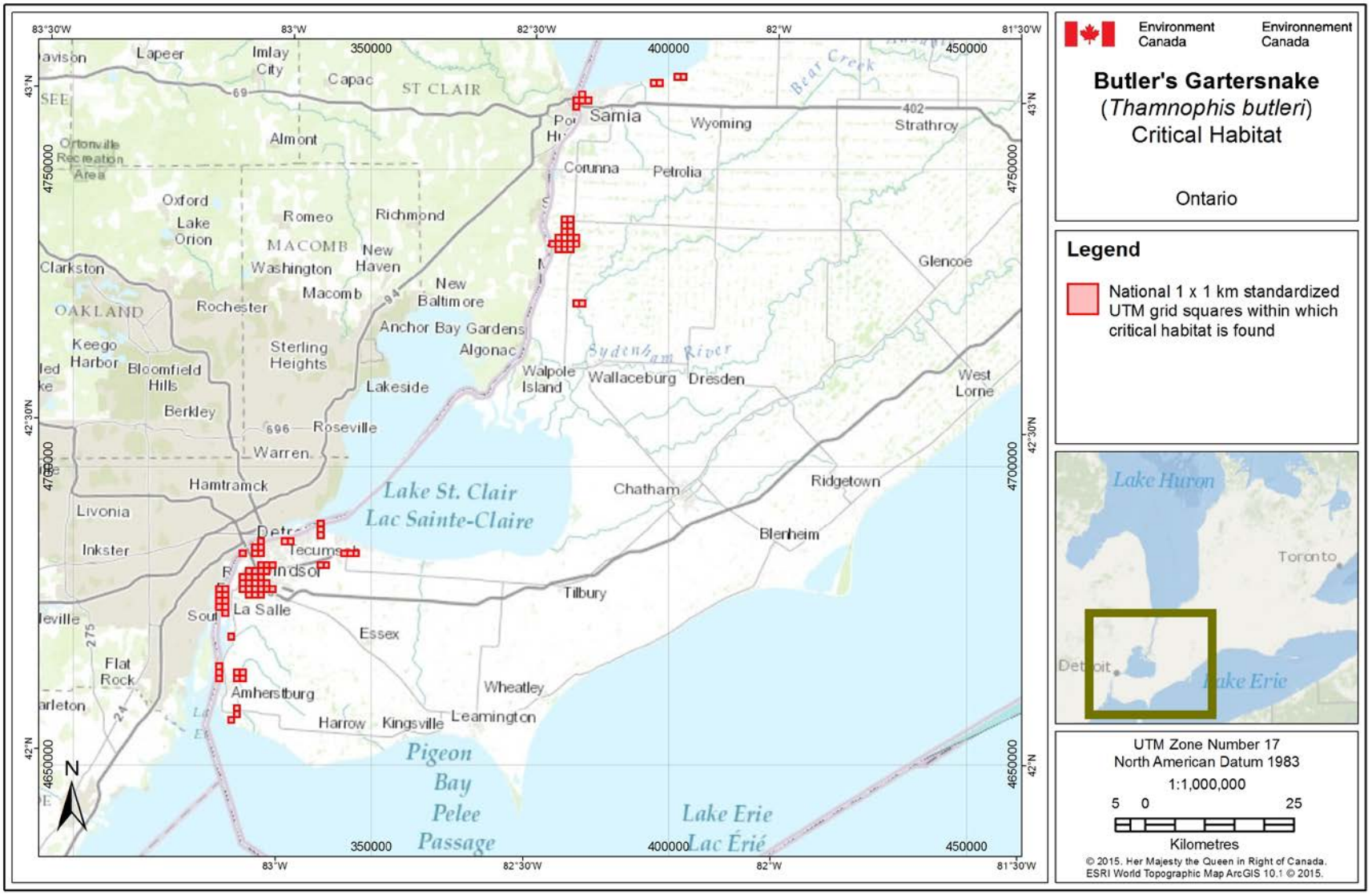

Figure 4. Grid squares that contain critical habitat for Butler's Gartersnake in Canada (Windsor-Sarnia Region). Critical habitat for Butler's Gartersnake occurs within these 1 x 1 km standardized UTM grid squares (red shaded outline), where the criteria described in section 7 are met.

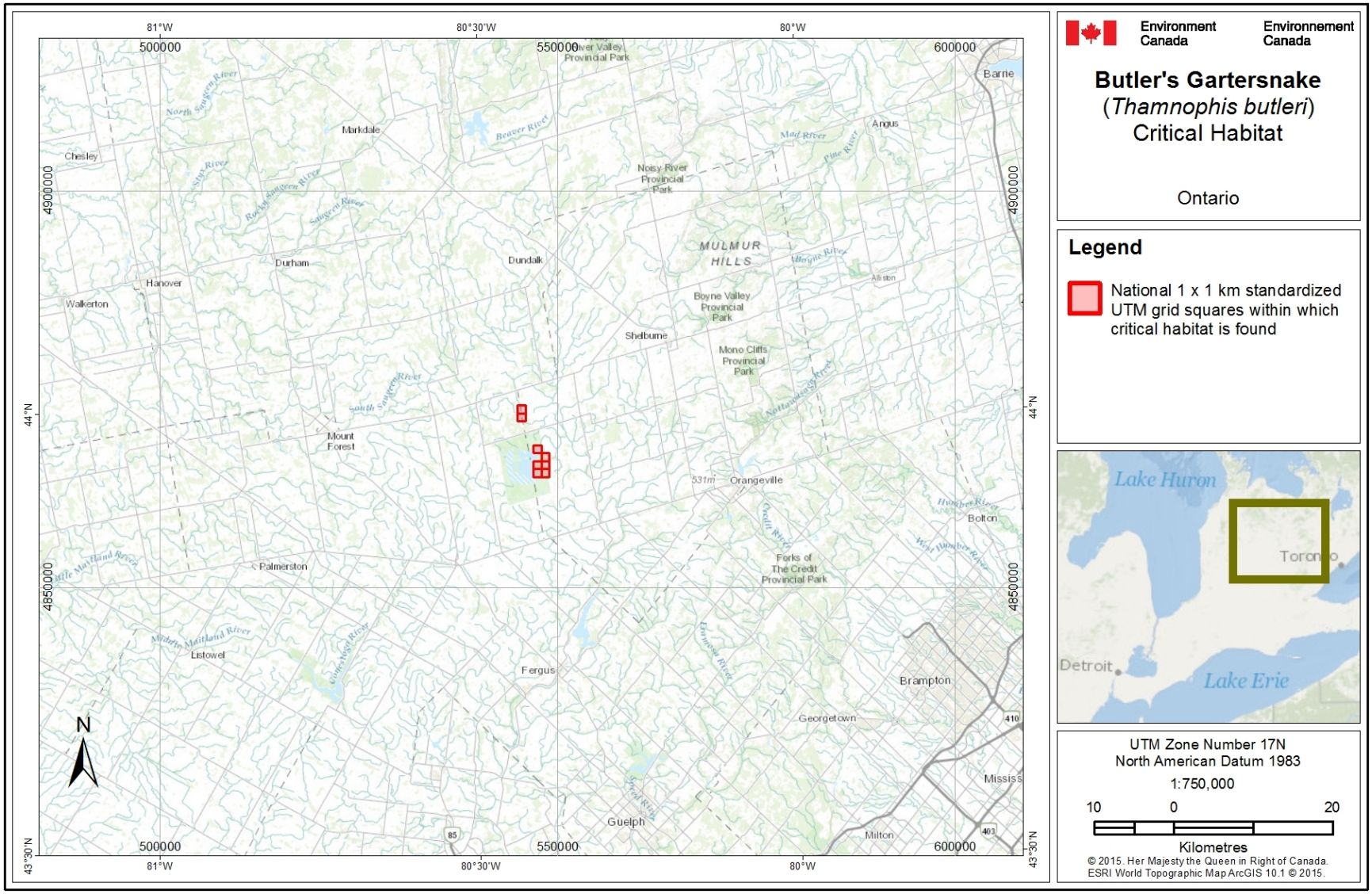

Figure 5. Grid squares that contain critical habitat for Butler's Gartersnake in Canada (Luther Marsh Region). Critical habitat for Butler's Gartersnake occurs within these 1 x 1 km standardized UTM grid squares (red shaded outline), where the criteria described in section 7 are met.

Table 3. Grid squares that contain critical habitat for Butler's Gartersnake in Canada. Critical habitat for Butler's Gartersnake occurs within these 1 x 1 km standardized UTM grid squares, where the criteria described in section 7 are met.

Subpopulation/Location (based on COSEWIC 2010)	Number of critical habitat units identified	1 x 1 km Standardized UTM Grid Square ID[f]	County	UTM Grid Square Coordinates[g]		Land Tenure[h]
				Easting	Northing	
1	2	17TLG2567 17TLG2578 17TLG2579	Essex	326000 327000 327000	4657000 4658000 4659000	Non-federal Land
2	1	17TLG2674 17TLG2675 17TLG2684 17TLG2685		327000 327000 328000 328000	4664000 4665000 4664000 4665000	Non-federal Land
3	1	17TLG2644 17TLG2645 17TLG2646		324000 324000 324000	4664000 4665000 4666000	Other Federal Land and Non-federal Land
4	1	17TLG4819 17TLG4910		341000 341000	4689000 4690000	Other Federal Land and Non-federal Land
5	1	17TLG2746 17TLG2747 17TLG2748 17TLG2749 17TLG2755 17TLG2756 17TLG2757 17TLG2758 17TLG2759		324000 324000 324000 324000 325000 325000 325000 325000 325000	4676000 4677000 4678000 4679000 4675000 4676000 4677000 4678000 4679000	Non-federal Land
6	1	17TLG3801		330000	4681000	Non-federal Land
10	1	17TLG4855 17TLG4865 17TLG4875		345000 346000 347000	4685000 4685000 4685000	Non-federal Land
13	1	17TLG2798 17TLG2799		329000 329000	4678000 4679000	Non-federal Land

15	1	17TLG3708 17TLG3718	330000 331000	4678000 4678000	Other Federal Land and Non-federal Land
16	1	17TLG2885	328000	4685000	Other Federal Land and Non-federal Land
19	1	17TLG4818	341000	4688000	Non-federal Land
20	1	17TLG4813 17TLG4823	341000 342000	4683000 4683000	Non-federal Land
21	5	17TLG2789 17TLG2799 17TLG2880 17TLG2881 17TLG2890 17TLG2891 17TLG3709 17TLG3719 17TLG3800 17TLG3801 17TLG3810 17TLG3811	328000 329000 328000 328000 329000 329000 330000 331000 330000 330000 331000 331000	4679000 4679000 4680000 4681000 4680000 4681000 4679000 4679000 4680000 4681000 4680000 4681000	Non-federal Land
22	2	17TLG2891 17TLG2892 17TLG3801	329000 329000 330000	4681000 4682000 4681000	Non-federal Land
23	1	17TLG3729 17TLG3810 17TLG3820	332000 331000 332000	4679000 4680000 4680000	Non-federal Land
24	1	17TLG3729 17TLG3739	332000 333000	4679000 4679000	Non-federal Land
25	1	17TLG3805 17TLG3806 17TLG3815 17TLG3816	330000 330000 331000 331000	4685000 4686000 4685000 4686000	Non-federal Land
26	1	17TLG3816 17TLG3817	331000 331000	4686000 4687000	Non-federal Land

27	1	17TLG3857 17TLG3867		335000 336000	4687000 4687000	Non-federal Land
28	3	17TLG3802 17TLG3812 17TLG3813 17TLG3822 17TLG3823 17TLG3833		330000 331000 331000 332000 332000 333000	4682000 4682000 4683000 4682000 4683000 4683000	Non-federal Land
30	1	17TLH9674 17TLH9684	Lambton	397000 398000	4764000 4764000	Non-federal Land
31	1	17TMH0615 17TMH0625		401000 402000	4765000 4765000	Non-federal Land
32	4	17TLH8307 17TLH8316 17TLH8317 17TLH8318 17TLH8326 17TLH8327 17TLH8329 17TLH8336 17TLH8337 17TLH8338 17TLH8339 17TLH8347 17TLH8348 17TLH8420 17TLH8421 17TLH8430 17TLH8431		380000 381000 381000 381000 382000 382000 382000 383000 383000 383000 383000 384000 384000 382000 382000 383000 383000	4737000 4736000 4737000 4738000 4736000 4737000 4739000 4736000 4737000 4738000 4739000 4737000 4738000 4740000 4741000 4740000 4741000	Non-federal Land
34	1	17TLH8247 17TLH8257		384000 385000	4727000 4727000	Non-federal Land
35	1	17TLH8651 17TLH8652 17TLH8661		385000 385000 386000	4761000 4762000 4761000	Non-federal Land
41	2	17TLH8640 17TLH8641		384000 384000	4760000 4761000	Other Federal Land and Non-federal Land

46	3	17TNJ4674 17TNJ4675 17TNJ4677 17TNJ4684 17TNJ4685 17TNJ4686 17TNJ4651 17TNJ4652	Wellington/ Dufferin	547000 547000 547000 548000 548000 548000 545000 545000	4864000 4865000 4867000 4864000 4865000 4866000 4871000 4872000	Non-federal Land

[f] Based on the standard UTM Military Grid Reference System (see http://www.nrcan.gc.ca/earth-sciences/geography-boundary/mapping/topographic-mapping/10098), where the first 2 digits represent the UTM Zone, the following 2 letters indicate the 100 x 100 km Standardized UTM grid, followed by 2 digits to represent the 10 x 10 km Standardized UTM grid. The last 2 digits represent the 1 x 1 km Standardized UTM grid containing all or a portion of the critical habitat unit. This unique alphanumeric code is based on the methodology produced from the Breeding Bird Atlases of Canada (See http://www.bsc-eoc.org/ for more information on breeding bird atlases).

[g] The listed coordinates are a cartographic representation of where critical habitat can be found, presented as the southwest corner of the 1 x 1 km Standardized UTM grid square containing all or a portion of the critical habitat unit. The coordinates may not fall within critical habitat and are provided as a general location only.

[h] Land tenure is provided as an approximation of the types of land ownership that exist at the critical habitat units and should be used for guidance purposes only. Accurate land tenure will require cross referencing critical habitat boundaries with surveyed land parcel information.

7.2 Schedule of Studies to Identify Critical Habitat

Critical habitat for Butler's Gartersnake is partially identified in this recovery strategy, and is considered insufficient to meet the population and distribution objectives (section 5) for the species. There are locations that may still support Butler's Gartersnake that i) have not been recently or sufficiently surveyed or ii) may be contributing to overall local subpopulation viability but critical habitat could not be identified due to a lack of certainty in the data. Within the areas where Butler's Gartersnakes were not confirmed in 2009 (Skunk's Misery, Parkhill, 9 locations within the Windsor-Sarnia region including Walpole Island listed with an unknown subpopulation status, and 4 locations listed with a historical subpopulation status) (COSEWIC 2010), extensive surveying using proper survey methods to determine detection probabilities is required.

Table 4. Schedule of Studies to Identify Critical Habitat

Description of Activity	Rationale	Timeline
Conduct surveys, particularly in the spring, at the areas where presence/absence was not confirmed in 2009 (Skunk's Misery, Parkhill, and 13 other locations within the Windsor-Sarnia region including Walpole Island) and determine detection probability.	Confirm presence/absence of Butler's Gartersnake at Skunk's Misery, Parkhill and other unknown and historical locations along the Lake St. Clair shoreline between Windsor and Sarnia. (Unknown 7, 9, 11, 14, 17, 38, 40, 43, 44, 45, 47; Historical 18, 29, 33, 42)	2016 - 2019

7.3 Activities Likely to Result in the Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Habitat destruction is determined on a case-by-case basis. Destruction would result if part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from one or several activities occurring at one point in time, or from the cumulative effects of one or more activities over a prolonged period. Table 5 provides examples of activities likely to destroy critical habitat of the species based on where the activity takes place and the component(s) of critical habitat affected, however, it does not represent an exhaustive list of all activities likely to destroy critical habitat.

Destruction of critical habitat for Butler's Gartersnake can result from activities undertaken at a variety of scales. Destruction may occur from an activity, or activities, either within or outside the critical habitat unit, and may occur in any season of the year. Restricted or permitted activities that may occur within the critical habitat unit are evaluated based on the species' functional requirements (components of functional habitat, hibernacula suitable habitat and/or connective habitat) of the portion(s) of impacted area. For example, some activities may be permitted in the movement (commuting and dispersal) habitat(s) within a critical habitat unit (functional habitat and/or connective habitat) that would be restricted within the live birthing, thermoregulation, mating, foraging, hibernation and movement component of the functional habitat, as these are heavily used by Butler's Gartersnakes and are of the utmost importance to the species' habitat needs. In this case, certain activities would not be considered destruction of the movement (commuting and dispersal) habitat(s) as long as sufficient habitat permeability (no barriers) is maintained, consistent with the species' functional requirements of that habitat. This information must be integrated in the case-by-case analysis when evaluating restricted/permitted activities. Some activities can result in the destruction of critical habitat, even if they occur outside the boundaries of the critical habitat unit. These instances will need to be evaluated on a case-by-case basis to determine what restrictions or mitigation should be put in place to prevent the destruction of critical habitat (e.g., housing and industrial development, creation or expansion of roads, drainage of wetlands).

Due to Butler's Gartersnakes' use of habitat features seasonally, it may be possible to mitigate some impacts on critical habitat through the timing of activities. Timing of the activity and whether it would result in destruction of critical habitat will need to be discussed with the appropriate agencies (generally, the province of Ontario (Ontario Ministry of Natural Resources and Forestry) on non-federal lands, and Environment Canada on federal lands) on a case-by-case basis.

Table 5. Examples of Activities Likely to Destroy Critical Habitat for the Butler's Gartersnake

Description of activity	Description of effect (biophysical attribute or other)	Location of the activity likely to destroy critical habitat				
		Within the critical habitat unit				Outside the critical habitat unit (where activity may still result in destruction)
		Functional Habitat (live birthing, thermoregulation and foraging)	**Functional Habitat** (commuting, movement)	**Connective Habitat** (dispersal movement)	**Hibernacula**	
Activities such as residential and/or industrial development; habitat conversion for agriculture, construction of roads, and promotion of succession towards woodlots	Urban and industrial development and roads may cause permanent habitat destruction, while agriculture and succession may significantly alter live birthing, thermoregulation, mating, foraging, hibernation and movement habitat. Major development may permanently fragment suitable habitat and inhibit Butler's Gartersnake from accessing suitable habitat areas.	X	X	X	X	
Removal of trees, other vegetation or structures (not including areas undergoing succession where restoration is needed)	Removal of vegetation or other structures could result in changes to critical habitat so that it would no longer provide suitable characteristics such as cover, warmth, shading (etc.) for activities such as live birthing, thermoregulation, mating, foraging, hibernation and	X			X	X

	movement.					
Destruction or alteration of natural and/or man-made structures providing hibernacula	Destruction or alteration to natural and/or man-made structures that provide hibernacula sites may create permanent unsuitable sites for overwintering.	X			X	
Activities which alter the composition of ELC communities where Butler's Gartersnake are found, including drainage of damp and/ or wet areas	Complete or partial alteration of ELC communities where Butler's Gartersnakes are found may cause permanent loss of live birthing, thermoregulation, mating, foraging, hibernation and movement habitat. Even drainage of damp or wet areas outside the critical habitat unit may indirectly drain areas used by Butler's Gartersnake as foraging areas may be dried out.	X		X	X	X
Activities that increase the density of invasive vegetation (e.g., Reed Canary Grass, Purple Loosestrife, Giant Reed)	Replacement of native species with invasive vegetation may lead to permanent loss or degradation of live birthing, thermoregulation, mating, foraging, hibernation and movement habitat and connective habitat.	X	X	X	X	X

8. Measuring Progress

The performance indicators presented below provide a way to define and measure progress towards achieving the population and distribution objectives.

Every five years success of recovery strategy implementation will be measured against the following performance indicators:

- Distribution and current abundance of extant subpopulations of Butler's Gartersnake are maintained and, where biologically and technically feasible, increased within their historic range in Canada.
- Habitat connectivity between local subpopulations is improved.

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9. Statement On Action Plans

One or more action plans will be completed for Butler's Gartersnake by December 2023.

10. References

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Appendix A: Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*[31]. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the Federal Sustainable Development Strategy's[32] (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporate consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below in this statement.

This recovery strategy will clearly benefit the environment by promoting the recovery of the Butler's Gartersnake. The potential for the strategy to inadvertently lead to adverse effects on other species was considered. Many at risk and rare species occur in tallgrass prairie habitats. Therefore, it is expected that recovery efforts for Butler's Gartersnake will also benefit many other species that occur in these habitats, such as Colicroot (*Aletris farinosa*), Dense Blazing Star (*Liatris spicata*), Willowleaf Aster (*Symphyotrichum praealtum*), and Eastern Foxsnake (*Pantherophis gloydi*). Habitat securement, policy, and stewardship approaches are not expected to have any adverse effects on habitat or co-occurring species. The SEA concluded that this strategy will clearly benefit the environment and will not entail any significant adverse effects. The reader should refer to the following sections of the document in particular: Population and Distribution Objectives and Strategic Direction for Recovery.

[31] http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1
[32] http://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=CD30F295-1

Appendix B: Subpopulations of Butler's Gartersnake in Canada

For the purposes of this recovery strategy, subpopulations are identified based on the description of Butler's Gartersnake locations in the 2010 COSEWIC status report and are provided below.

Most locations were visited to obtain information for the COSEWIC status report (2010) unless they were considered extirpated (e.g., lost to development). Some locations were not surveyed because significant portions of habitat for the Butler's Gartersnake appeared destroyed. These locations are given an 'unknown' status until extirpation is confirmed. Locations where the last observation date is >20 years are identified as 'historical'. Locations recently visited, but where no Butler's Gartersnake were observed and suitable habitat remains available to the species (determined from field visits or air photos), these locations are also given 'unknown' status. Additional surveys are required to confirm subpopulation status at these locations. A schedule of studies identifies additional surveys at historical and unknown locations to confirm the status of Butler's Gartersnake. New locations for Butler's Gartersnake have been found, not previously identified in the literature. New information has not yet been formally assessed by the Ontario Conservation Data Centre (Ontario Natural Heritage Information Centre). In the future, the enumeration of Butler Gartersnake locations may better align with element occurrence information.

Location/Subpopulation (based on COSEWIC 2010)	County	Last verified observation record	Status
Windsor-Sarnia			
Location 1	ESSEX	2009	Extant
Location 2	ESSEX	2009	Extant
Location 3	ESSEX	2009	Extant
Location 4	ESSEX	2008	Extant
Location 5	ESSEX	2009	Extant
Location 6	ESSEX	2009	Extant
Location 7	ESSEX	1976	Unknown
Location 8	ESSEX	1986	Extirpated
Location 9	ESSEX	1984	Unknown
Location 10	ESSEX	2009	Extant
Location 11	ESSEX	1996	Unknown
Location 12	ESSEX	1986	Extirpated
Location 13	ESSEX	1996	Extant[i]
Location 14	ESSEX	1996	Unknown
Location 15	ESSEX	2009	Extant
Location 16	ESSEX	2009	Extant
Location 17	ESSEX	1977	Unknown
Location 18	ESSEX	1977	Historical

Location 19	ESSEX	2009	Extant
Location 20	ESSEX	2009	Extant
Location 21	ESSEX	2009	Extant
Location 22	ESSEX	2009	Extant
Location 23	ESSEX	2009	Extant
Location 24	ESSEX	2007	Extant
Location 25	ESSEX	2009	Extant
Location 26	ESSEX	2009	Extant
Location 27	ESSEX	2009	Extant
Location 28	ESSEX	2008	Extant
Location 29	CHATHAM-KENT	1881	Historical
Location 30	LAMBTON	2009	Extant
Location 31	LAMBTON	2009	Extant
Location 32	LAMBTON	2008	Extant
Location 33	LAMBTON	1986	Historical
Location 34	LAMBTON	2008	Extant
Location 35	LAMBTON	2009	Extant
Location 36	LAMBTON	1977	Extirpated
Location 37	LAMBTON	1977	Extirpated
Location 38	LAMBTON	1982	Unknown
Location 39	LAMBTON	1982	Extirpated
Location 40	LAMBTON	2001	Unknown
Location 41	LAMBTON	2008	Extant
Location 42	LAMBTON	1982	Historical
Location 43	LAMBTON	1986	Unknown
Location 44	LAMBTON	1990	Unknown
Skunk's Misery			
Location 45	MIDDLESEX/LAMBTON	1989	Unknown
Luther Marsh			
Location 46	WELLINGTON/DUFFERIN	2009	Extant
Parkhill			
Location 47	MIDDLESEX/LAMBTON	1992	Unknown
Rondeau			
Location 48	CHATHAM-KENT	1940	Extirpated

[i] Status has changed to extant since the 2010 COSEWIC report, due to more recent observations.