PROPOSED

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the White Wood Aster (*Eurybia divaricata*) in Canada

White Wood Aster

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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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« Programme de rétablissement de l'aster à rameaux étalés (*Eurybia divaricata*) au Canada [Proposition] »

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[1] http://sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1.

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 within five years after the publication of the final document on the SAR Public Registry.

The Minister of Environment and Climate Change is the competent minister under SARA for the White Wood Aster and has prepared this recovery strategy, as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the governments of Ontario and Quebec, as per section 39(1) of SARA.

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 and Climate Change Canada or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the White Wood Aster 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 and Climate Change 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 critical habitat is identified, either in a recovery strategy or an action plan, SARA requires that critical habitat then be protected.

In the case of critical habitat identified for terrestrial species including migratory birds SARA requires that critical habitat identified in a federally protected area[3] be described in the *Canada Gazette* within 90 days after the recovery strategy or action plan that identified the critical habitat is included in the public registry. A prohibition against destruction of critical habitat under ss. 58(1) will apply 90 days after the description of the critical habitat is published in the *Canada Gazette*.

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

[3] These federally protected areas are: a national park of Canada named and described in Schedule 1 to the *Canada National Parks Act*, The Rouge National Park established by the *Rouge National Urban Park Act*, a marine protected area under the *Oceans Act*, a migratory bird sanctuary under the *Migratory Birds Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* see ss. 58(2) of SARA.

For critical habitat located on other federal lands, the competent minister must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies.

If the critical habitat for a migratory bird is not within a federal protected area and is not on federal land, within the exclusive economic zone or on the continental shelf of Canada, the prohibition against destruction can only apply to those portions of the critical habitat that are habitat to which the *Migratory Birds Convention Act, 1994* applies as per SARA ss. 58(5.1) and ss. 58(5.2).

For any part of critical habitat located on non-federal lands, if the competent minister forms the opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of Parliament, or the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to prohibit destruction of critical habitat. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

Acknowledgments

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Executive Summary

In Canada, the White Wood Aster (*Eurybia divaricata*) occurs in southern Ontario and in southwestern Quebec. The species is listed as Threatened under Schedule 1 of the *Species at Risk Act* (SARA). The species is ranked as Imperilled to Vulnerable in Canada (N2N3) and Ontario (S2S3) and Imperilled in Quebec (S2). The global range of the White Wood Aster is restricted to eastern North America, and it reaches its southern limit in the U.S. states of Georgia and Alabama. The species' northern limit is in Canada where there are a total of 56 known extant[4] local populations[5]; 12 in southwestern Quebec and 44 in southern Ontario.

The White Wood Aster is an herbaceous late summer-to-fall-flowering perennial. The flower heads consist of petal-like white rays surrounding small yellow and purple disc florets. The upper leaves are deeply serrated, and the lower ones are heart-shaped. The species occurs in open deciduous and mixed forests. Owing to its preference for open sun-exposed areas, the species is sometimes found in disturbed areas, including woodlots disturbed by small-scale forest harvesting and the edges of recreational trails.

The primary threat to the White Wood Aster is habitat loss due to urban and agricultural development. Other threats include forest harvesting, alteration of the natural disturbance regime, invasive species, grazing by deer, and off-trail recreational activities.

The recovery of the White Wood Aster is considered feasible; therefore, this recovery strategy has been prepared as per section 41(1) of SARA. The population and distribution objectives for the White Wood Aster are: maintain the current distribution and abundance (i.e., total number of stems) of the White Wood Aster in Canada; and where necessary and technically and biologically feasible, support natural increases of abundance (i.e., total number of stems) of extant local populations. The broad strategies to be taken to address the threats to the survival and recovery of the species are presented in the section on Strategic Direction for Recovery (Section 6.2). They include surveys and monitoring, research, habitat management and conservation, landuse policy and planning, and communication, outreach and education.

Critical habitat for the White Wood Aster is partially identified in this recovery strategy, based on the best available data. Where detailed surveys have been conducted and White Wood Aster plant locations are known, critical habitat is identified as the extent of biophysical attributes (7.1.1) up to 80 m (radial distance) around existing mapped observations of the White Wood Aster (7.1.2). In cases where little or no mapping and/or documentation of plant locations or habitat features exists, but the approximate location of the local population has been verified, the area containing critical habitat is identified as the ecological or landscape feature containing the local population (7.1.2), and critical habitat for White Wood Aster is identified as the extent of biophysical

[4] Population which is considered to be still in existence, i.e., not destroyed or lost (extirpated).
[5] Plants contained in a discrete area, typically corresponding to a population or metapopulation, often equivalent to an element occurrence as defined by NatureServe (2002).

attributes (7.1.1) up to 80 m (radial distance) from any single plant wherever they occur within the areas containing critical habitat (7.1.2). In addition, in cases where the suitable habitat extends for less than 50 m around a White Wood Aster, a critical function zone capturing an area within a radial distance of 50 m is also included as critical habitat. A schedule of studies is included to obtain the information needed to complete the identification of critical habitat. As more information becomes available, additional critical habitat may be identified where critical habitat criteria are met. One or more actions plans for the White Wood Aster will be posted on the Species at Risk Public Registry by December 31, 2024.

Recovery Feasibility Summary

Based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility, recovery of the White Wood Aster has been deemed technically and biologically 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. The presence of viable local populations[6] and subpopulations[7] that contain mature plants capable of reproduction are confirmed in both Ontario and Quebec (COSEWIC 2002; Boisjoli 2010). Recent survey efforts by local naturalist organizations have resulted in the discovery of many new local populations. Since 2002, the total number of known extant local populations has increased from 10 to 12 in Quebec and from 15 to 44 in Ontario (COSEWIC 2002; Appendix B). For most local populations the number of stems is estimated (Appendix B); however, it is unknown how many individual plants this represents because the species can reproduce by cloning. The presence of more than one clone (i.e., more than one genetically distinct individual) has only been confirmed in a few local populations (COSEWIC 2002). These populations are therefore capable of sexual reproduction, whereas it is unclear whether the remaining local populations are capable of sexual reproduction or are restricted to vegetative reproduction.

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

Yes. Located at the northernmost extent of its North American range, the White Wood Aster has a limited distribution in Canada. The existing forest habitat within its range is geographically restricted and highly fragmented due to deforestation, which has occurred since European settlement (largely for agricultural purposes (Larson et al 1999)). However, forest stands remain at most local populations, maintaining functional habitats for individual plants and potentially providing suitable areas adjacent to where the White Wood Aster occurs for population expansion. The species is rarely found in regenerated forests that were previously cleared for agriculture (Singleton et al. 2001); therefore, recovery will largely depend on the protection of remaining old-growth woodlots and on-going habitat management, such as forest canopy thinning. It is possible that through these techniques, sufficient suitable habitat could be made available to enhance the population and improve its abundance.

[6] Plants contained in a discrete area, typically corresponding to a population or metapopulation, often equivalent to an element occurrence as defined by NatureServe (2002).

[7] Individual plants or groups of plants, generally found within one km of each other and not separated by unsuitable habitat. Local populations may comprise several subpopulations,

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

Yes. The primary threats to the White Wood Aster are habitat loss due to urban and agricultural development, tree canopy closure due to incompatible forest management practises and natural succession, and invasive plants. Suitable habitat can be conserved through land planning policies that mandate the retention or proper management of woodland habitat. Where appropriate, suitable habitat can be rehabilitated or restored through habitat stewardship (e.g., tree canopy thinning) and management measures that include forest best management practices. Wood harvesting on a small scale and using techniques that minimize the creation of even-aged stands can support the creation of natural forest gaps and encourage growth of the species. Best management practices can be used to manage invasive plants when necessary. Other threats such as grazing by deer, invasive invertebrates, consumption by weevils, and off-trail recreation can be mitigated through management measures that include sustainable deer management and best management practises reduce the spread of weevils. In addition outreach and education may promote the protection of local populations on private lands and may also reduce threats such as trampling and the intentional collection of individuals.

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

Yes. Based on the best available information and the nature of the primary threats, the development of new recovery techniques is not needed to achieve the population and distribution objectives at this time. White Wood Aster habitat may be conserved through land acquisition, conservation agreements or stewardship programs as well as promotion of forest best management practises into local land use policy. Habitat restoration methods, such as tree canopy thinning to maintain suitable open habitat, could also be used to promote the species’ recovery. Propagation techniques have been developed for the White Wood Aster (Kujawski and Davis 2001), and may be considered to support the persistence of self-sustaining populations in the future.

Table of Contents

1. COSEWIC* Species Assessment Information

Date of Assessment: November 2002

Common Name: White Wood Aster

Scientific Name: *Eurybia divaricata*

COSEWIC Status: Threatened

Reason for Designation: Geographically restricted and fragmented populations at risk from continued habitat loss, invasive species, deer browsing and recreational activities impacting populations along trails.

Canadian Occurrence: Ontario and Quebec

COSEWIC Status History: Designated Threatened in April 1995. Status re-examined and confirmed in November 2002.

*COSEWIC (Committee on the Status of Endangered Wildlife in Canada).

Former scientific name was *Aster divaricatus*, in 1994 the taxonomy of the genus *Aster* was revised (Nesom 1994), the species is now classified in the genus *Eurybia* (COSEWIC 2002).

2. Species Status Information

In Canada, the White Wood Aster occurs in southern Ontario and southwestern Quebec. The species was listed as Threatened under Schedule 1 of the *Species at Risk Act* (SARA) (S.C. 2002, c.29) in 2005. In Quebec, the White Wood Aster has been listed as Threatened under the *Act Respecting Threatened or Vulnerable species* (R.S.Q., c. E-12.01) since 2005. In Ontario, it has been listed as Threatened under the *Endangered Species Act*, *2007* (ESA)(S.O. 2007, c. 6) since 2008, and receives general habitat protection under the ESA.

Globally, this species is listed as Secure (G5) (CESCC 2016). In Canada, the White Wood Aster is ranked as nationally Imperilled to Vulnerable (N2N3), Imperilled to Vulnerable in Ontario (S2S3), and Imperilled in Quebec (S2) (CESCC 2016).In the U.S., it is listed as nationally Secure (N5) and occurs in 21 states throughout the eastern part of the country. Appendix A provides additional ranks and definitions of the NatureServe rankings. It is estimated that less than 5% of the species' global range occurs in Canada.

3. Species Information

3.1 Species Description

The White Wood Aster is a late summer-to-fall-flowering herbaceous perennial. The upper leaves are deeply serrated and the lower leaves are cordate (i.e., heart-shaped). This species grows 30-90 cm tall and is recognized by small florets (small individual flowers) that are joined together in heads that form flat topped clusters. The seeds are 2.6-3.8 mm long (Brouillet 2006) and are wind dispersed. The seeds have very low migration rates, which range from 0.25-0.31 m/yr (Matlack 1994; Singleton et al. 2001). This may explain why the species has been observed to have a limited distribution at some sites in Canada despite the availability of nearby suitable habitat (COSEWIC 2002). The flower heads consist of five to ten petal-like white rays surrounding yellow florets that turn purple once pollinated (Britton and Brown 1970; COSEWIC 2002). Flowering occurs in early August to September and fruiting occurs in mid- to late-September (COSEWIC 2002). The White Wood Aster is insect-pollinated. Common pollinator species include hoverflies (especially *Syrphus spp.* and *Toxomerus geminatus*), ants (Superfamily Formicoidea), Common Eastern Bumble Bee (*Bombus impatiens*), and sweat bees (*Lasioglossum (Dialictus) sp.* and *Augochlora pura* or *Augochlorella aurata*) (MacPhail 2013). The White Wood Aster can also spread via clonal reproduction[8] and thus form colonies (COSEWIC 2002).

3.2 Species Population and Distribution

The White Wood Aster is endemic to North America and is generally common throughout the eastern United States. It ranges from the Appalachian Mountains and New England south to Georgia and Alabama. In Canada, the species is found in the Niagara region of southern Ontario as well as in the Montérégie and Estrie regions of southwestern Quebec (Figures 1 and 2).

The COSEWIC status report (2002) reported 16 local populations of the White Wood Aster in Ontario and 10 in Quebec. Recent surveys have led to the discovery of new local populations within the previously known range for the species (i.e., the Niagara region of Ontario and the Montérégie and Estrie regions in Quebec). This does not imply a population or range increase, but rather an increase in survey effort. As of 2016, there are a total of 65 known local populations of the White Wood Aster in Canada: 13 in Quebec where 12 are extant (i.e., recorded between 1997-2016 and assumed to be still in existence), and one is extirpated (i.e., confirmed to no longer exist), and 52 in Ontario where 44 are extant, 6 are extirpated, one is historic (i.e., record predates 1997, but habitat remains suitable) and one is unknown (i.e., likely extirpated, but unconfirmed). A total of 56 local populations are extant in Canada, however, there is uncertainty regarding the number of individuals and the spatial distribution of local populations due to the lack of consistent monitoring and reporting. Details of the known

[8] Asexual reproduction by underground rhizomes (root stalks). Above ground, these plants appear to be distinct individuals, but underground they remain interconnected and are all clones of the same plant.

local populations and associated subpopulations in each province are presented in Appendix B.

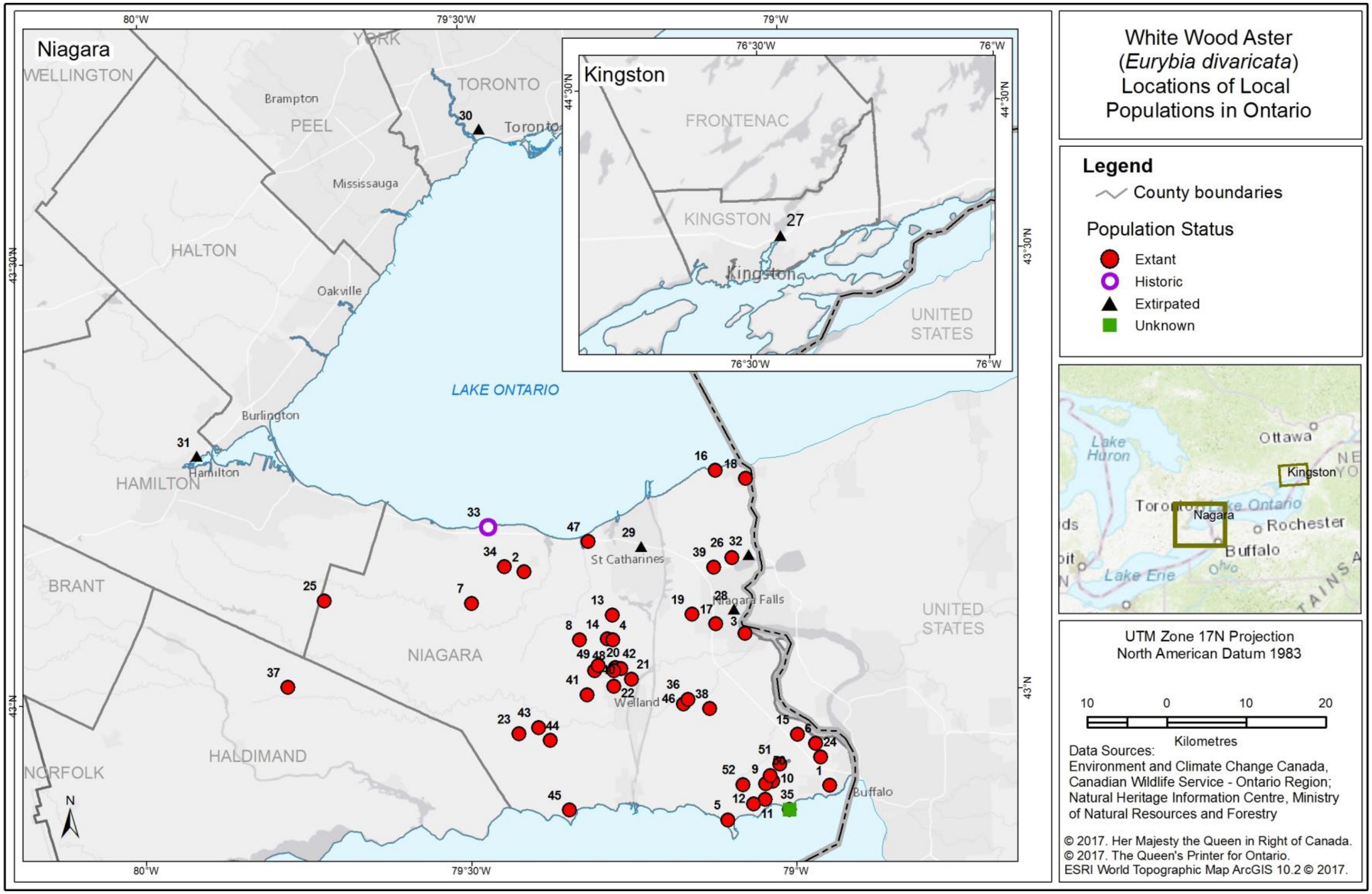

Figure 1. Locations of local populations of the White Wood Aster in Ontario and population status information. Local population numbers correspond to descriptions in Appendix B.

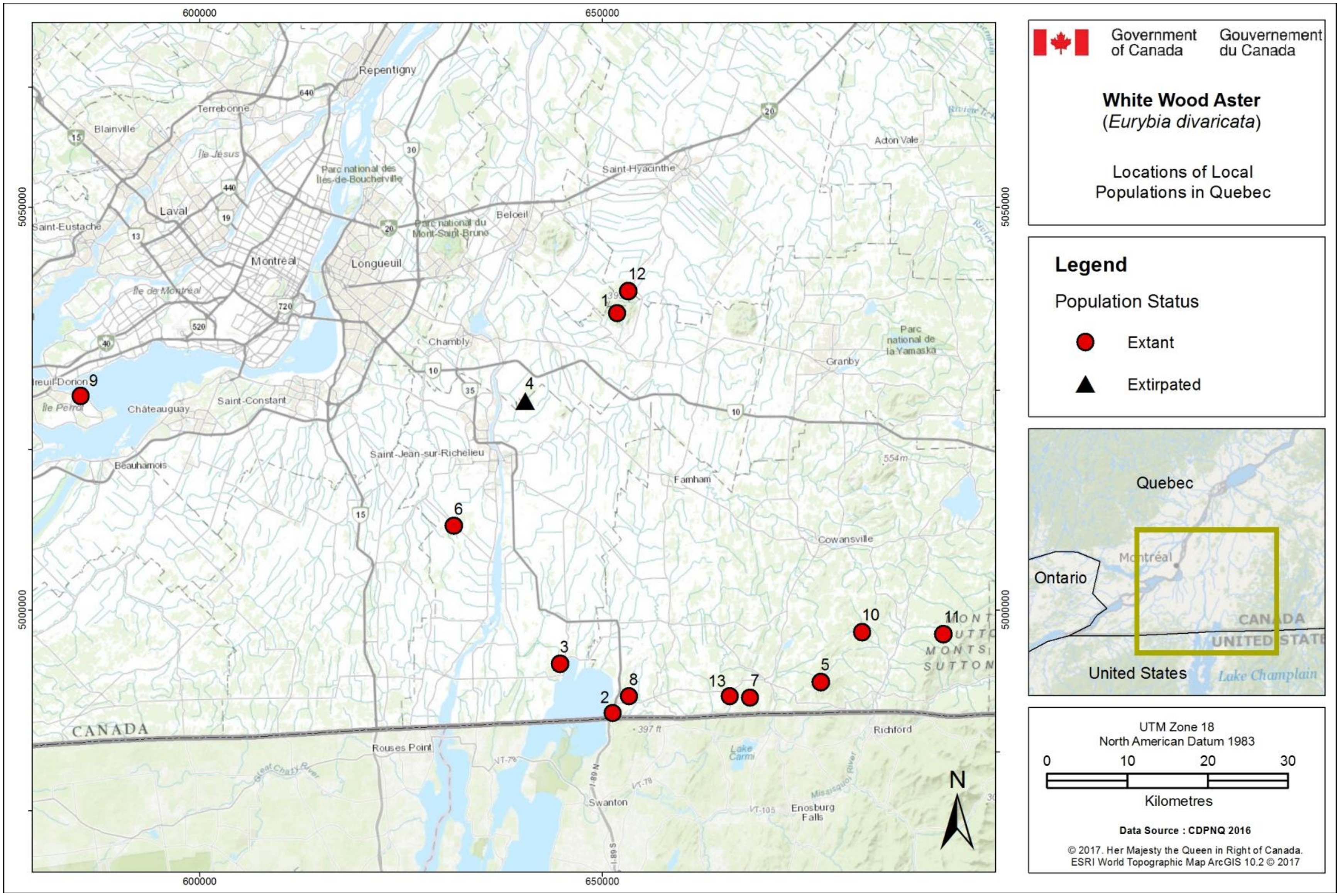

Figure 2. Locations of local populations of the White Wood Aster in Quebec and population status information. Local population numbers correspond to descriptions in Appendix B.

Overall, the Canadian population trend appears to be fairly stable (COSEWIC 2002; Boisjoli 2010; CDPNQ 2015). In general, the abundance of the White Wood Aster within Ontario local populations ranges from a few plants or stems to >1,000. Colonies (i.e. multiple stems belonging to a single genetic individual) can be difficult to distinguish from groups of individual plants, so the number of stems is often used as a surrogate measure of abundance within a local population. Although the number of stems is not necessarily equivalent to the number of plants, this survey method is preferred because it is difficult to determine the number of individual plants without applying invasive procedures which may cause harm to the plant (COSEWIC 2002). Based on abundance information, where available for local populations (n=21), it is estimated that there are at least 18,300 plants or stems in Ontario (Appendix B); however, this is almost certainly an underestimate as surveys to assess abundance have not been completed at all local populations in Ontario. When the COSEWIC status report was written in 2002, most of the local populations in Quebec had not undergone recent monitoring. Since then, several local populations have been revisited and new local populations have been discovered. Based on the most recent data, it is estimated that there are approximately 14,400 plants or stems in Quebec (CDPNQ 2015).

3.3 Needs of the White Wood Aster

The White Wood Aster grows in open, deciduous forests typically dominated by a variety of deciduous tree species including Sugar Maple (*Acer saccharum*) and American Beech (*Fagus grandifolia*) and sometimes accompanied by Bitternut Hickory (*Carya cordiformis*) and Ironwood (*Ostrya virginiana*) (COSEWIC 2002). In Quebec the species also occurs in Eastern Hemlock (*Tsuga canadensis*) stands, particularly stands that have undergone forest harvesting (COSEWIC 2002). The moisture regime has been described as fresh to moderately moist with very poor to moderately well-drained soils in Ontario (Imrie et al. 2005), predominantly mesic in Maryland (Yorks et al. 2000), submesic to mesic in the southern Appalachian Mountains (Boyle II et al. 2014), and rich mesic in Massachusetts (Bellemare et al. 2005). Stem density has been observed to decline with distance from old woods as the species is slow to re-colonize regenerated forests that were previously cleared for agriculture (Singleton et al. 2001; Hough 2008).

The persistence of the White Wood Aster is strongly influenced by light and tree canopy openness (Boisjoli 2010). Under a relatively open tree canopy, the species will utilise sexual reproduction (characterized by flowering, seed production and the recruitment of seedlings), as well as by clonal propagation (Boisjoli 2010). Seed production is only possible when at least two genetically distinct individuals are present within the same area (Avers 1953). The presence of more than one clone has only been confirmed in a few local populations (COSEWIC 2002). For this reason, recovery actions may include increasing the number of individuals within a local population (e.g., via propagation) if feasible and required to maintain local population abundance (Table 2). In less favourable light conditions (e.g., semi-closed to closed tree canopy), the White Wood Aster is able to persist in the form of sterile, mature individuals that remain capable of clonal reproduction. When light conditions improve, the number of stems associated with a population may increase considerably (Boisjoli 2010). The White Wood Aster tolerates, or may even prefer, some level of disturbance as many local populations are found growing in woodlots disturbed by small-scale forest harvesting and along the edges of recreational trails (COSEWIC 2002). The openings in the canopy created by these types of disturbance benefits the species and reflect its preference for open, well-lit areas (Boisjoli 2010).

The species prefers drier soils but is fairly tolerant of wet conditions. In Quebec, all populations are on dry soils or rocky slopes between 0-58% (Boisjoli 2010). In Ontario, it was reported at sites with very poor to moderately well-drained soils with a slope ranging from 10-57% (Imrie et al. 2005). Litter depth also appears to have a strong influence on the presence of the White Wood Aster. A thick accumulation of litter likely protects seeds and seedlings from freezing and may also serve as an important source of nutrients (Boisjoli 2010).

In Ontario, the White Wood Aster is currently only known to occur within the Niagara region of the southern Ontario deciduous forest. It is previously known from the Hamilton, Toronto and Kingston areas in Ontario. The Niagara region is one of the warmest regions of Ontario and has the longest growing season. This area is characterized by humid warm to hot summers and mild winters. The region of Quebec containing the White Wood Aster is similarly characterized by warm summers and mild winters (COSEWIC 2002).

4. Threats

4.1 Threat Assessment

The White Wood Aster threat assessment is outlined in Table 1. Threats are described as proximate activities or processes that have caused, are causing or may cause in the future the destruction, degradation, and/or impairment of the White Wood Aster population in Canada. The threats are presented in decreasing order of level of concern within each category. Additional information on the nature of the threats is presented in the Description of Threats section (4.2).

Table 1. Threat Assessment Table

Threat	Level of Concern[a]	Extent	Occurrence	Frequency	Severity[b]	Causal Certainty[c]
Habitat Loss or Degradation						
Residential development and urbanization	High	Localized	Historic/ Anticipated	Recurrent	Medium	High
Agricultural development	High	Localized	Historic/ Anticipated	Recurrent	Medium	High
Forest harvesting	Medium	Localized	Historic/ Anticipated	Recurrent	Low	Medium
Changes in Ecological Dynamics or Natural Processes						
Alteration of the natural disturbance regime	Medium	Widespread	Historic/ Current	Continuous	Medium	High
Invasive Species						
Invasive plants	Medium	Widespread	Current	Continuous	Unknown	Low
Invasive invertebrates	Low	Widespread	Current	Continuous	Unknown	Low
Natural Processes or Activities						
Grazing by deer	Low	Localized	Current	Recurrent	Unknown	Low
Disturbance or Harm						
Off-trail recreation	Low	Localized	Current	Recurrent	Low	Medium

[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).*

4.2 Description of Threats

Threats listed for the White Wood Aster include habitat loss due to residential development, agricultural expansion and forest harvesting alteration of the natural disturbance regime, invasive plants, invasive invertebrates, grazing by White-tailed Deer (*Odocoileus virginianus*) and off-trail recreation. Threats are listed below in order of level of concern.

Residential Development and Urbanization
The conversion of woodlands to developed lands leads to the permanent loss or degradation of White Wood Aster habitat by removing the habitat the species uses or may disperse into, along with the ecosystems that support them. Residential development and urbanization poses a serious threat to several White Wood Aster local populations in both Ontario and Quebec, and is the main cause of local extirpations (COSEWIC 2002; ECCC, unpublished data). The White Wood Aster occurs in southern Ontario and Quebec, which is the most heavily populated region of Canada (Statistics Canada 2008) and has experienced significant changes to the natural landscape over the last century. It is now a highly developed region dominated by urban and agricultural landscapes; between 2000 and 2011, about one half of the land (2,348 ha) deforested in southern Ontario was cleared for urban development purposes (Ontario Biodiversity Council 2015). The threat from deforestation for residential and commercial development is expected to continue given the human population growth projected for 2015-2041 within the species' range in Ontario (Ministry of Finance 2016). In southern Quebec, there was an overall reduction of forest cover of 3% between 1993 and 2001, with an increase in suburban sprawl (Jobin et al. 2010).

Agricultural Development
Habitat for the White Wood Aster has been historically lost due to the conversion of land for agricultural development. The maintenance and expansion of agricultural lands continues to threaten the persistence of some White Wood Aster local populations. For example, the Mont Rougement area in Quebec is home to many apple orchards and sugar maple stands for the production of maple syrup. Activities carried out for the maintenance and expansion of these orchards and maple stands (e.g., forest harvesting, use of pesticides and mowing) may result in damage or destruction of habitat. In 1991, the Culp's Woods local population in Ontario contained thousands of White Wood Aster stems; in 2002 only 400 stems were observed. The decline in population abundance at this site is thought to have been a result of the fragmentation and loss of suitable woodland habitat due to orchard expansion into adjacent woodlands (COSEWIC 2002).

Forest Harvesting
Wood harvesting can result in different impacts on the White Wood Aster. Under certain conditions, small scale tree removal and other forest best management practices

(e.g., thinning of the forest canopy and/or pruning of vegetation) may actually be beneficial to the species, as creating tree canopy openings is conducive to the species' growth provided careful precautions are taken to avoid direct harm to the species. Forestry operations should also take precautions to avoid spreading invasive species, compacting soils, and using herbicides and insecticides which may harm this aster or its pollinators. However, several local populations in both Ontario and Quebec are vulnerable to habitat loss due to incompatible forest harvesting and regeneration practices (e.g., harvesting that results in the growth of even-aged stands and thus changes to the natural disturbance regime). In addition, asters are generally vulnerable to trampling (e.g., through the use of heavy equipment) (Dignard et al. 2008).

Alteration of the Natural Disturbance Regime (Forest canopy closure)

Light and canopy openness are considered the most important factors influencing the growth of the White Wood Aster (Boisjoli 2010). Natural succession leads to maturation of forests and increases in canopy cover. Historically, small gaps in the forest canopy would have been created and maintained by natural processes such as windthrow[9] and natural tree mortality. Current silvicultural practices (e.g., clearcutting, high grade cutting) have resulted in the alteration of natural forest age structure, creating fairly young, even-aged stands in which mature trees are rare. As part of natural forest dynamics, canopy gaps are naturally formed when mature trees fall to the forest floor. Young forests may not possess trees that are large enough to create gaps sufficient for the White Wood Aster when they fall (Boisjoli 2010). Harvesting practises that select mature trees for removal reduce the potential for natural tree fall. Consequently, natural canopy gaps are less common in harvested forest landscapes (Jetté et al. 2013), a situation that has contributed to canopy closure.

Invasive Plants

Invasive species of concern to the White Wood Aster include Garlic Mustard (*Alliaria petiolata*) and non-native Common Reed (*Phragmites australis*). Garlic Mustard has been observed at the Two Mile - Four Mile Creek Area of Natural and Scientific Interest (ANSI) and the Short Hills Provincial Park local populations in Ontario (COSEWIC 2002). Garlic Mustard is a persistent threat throughout southern Canada due to its ability to outcompete local flora (Catling et al. 2015), and may pose a threat to the White Wood Aster at these locations (COSEWIC 2002). In Ontario, Imrie et al. (2005) found Garlic Mustard to be the second most dominant vascular plant species in deer exclosures constructed for the White Wood Aster. In New England, Stinson et al. (2007) found that the White Wood Aster increased in response to the removal of Garlic Mustard. Non-native Common Reed is present near the Mont Petit Pinacle local population, one of the largest local populations of the White Wood Aster in Quebec based on number of stems (Désilets 2015). The non-native Common Reed is an aggressive invasive plant species that outcompetes local flora and can form very dense colonies (Catling and Mitrow 2011). It will be necessary to monitor these local populations to determine the extent of threat Garlic Mustard and non-native Common Reed pose to the continued persistence of the White Wood Aster. In addition, Norway Maple (*Acer platanoides*) and Bird Cherry (*Prunus avium*) are considered to be

[9] Trees uprooted of broken by wind

degrading the native oak-pine forest at the Fort George National Historic Site (i.e., Two Mile – Four Mile Creek ANSI local population) (Jalava 2004).

Invasive Invertebrates
The non-native invasive Hairy Spider Weevil (*Barypeithes pellucidus*) feeds on various species of Aster (Campbell et al. 1989), and has been observed preferentially feeding on the White Wood Aster in central Ohio (Galford 1987). In Quebec, Boisjoli (2010) observed signs of weevil feeding on seeds still attached to flower heads. During recent fieldwork conducted at the Mont Petit Pinacle local population, nearly 50% of the plants showed signs of damage due to insect feeding (Désilet 2015). The Hairy Spider Weevil is widespread in Canada and one of most common weevil species in several woodlots of southern Ontario (Proctor et al. 2010). This species may pose a significant threat to the White Wood Aster.

Non-native earthworms may reduce the availability of suitable habitat by reducing leaf litter to nearly bare soil (Alban and Berry 1994; Hale et al. 2005). In addition, earthworms may facilitate the spread and growth of non-native plants, reduce the cover of native plants (Nuzzo et al. 2009; Craven et al 2017), and alter the soil nutrient profile (Sackett et al. 2013; Dobson et al. 2017). Invasive non-native earthworms have been identified as threats to forest ecosystems in southern Quebec and southern Ontario (Wironen and Moore 2006; Sackett et al. 2012). Considering that litter depth is an important factor in seed germination and seedling recruitment (Boisjoli 2010), the presence of non-native earthworms may be having a negative impact on the species but is yet unconfirmed.

Grazing by Deer
Grazing by White-tailed Deer is considered a significant threat to some White Wood Aster local populations in southern Ontario, notably at the Short Hills Provincial Park and Fonthill-Sandhill Valley ANSI subpopulations (Faison et al. 2016). The White Wood Aster is known to be preferentially browsed by White-tailed deer in Pennsylvania (Williams et al. 2000). Given the abundant deer populations in southern Ontario and Quebec, deer browse is likely a threat to the species (COSEWIC 2002). Deer browse may also facilitate the growth and spread of some invasive forest understory plants (Shen et al. 2016; Russell et al. 2017). The impact of this threat is dependent on White-tailed Deer population abundance and the deer management techniques that may be applied at specific locations.

Off-trail Recreation
The edges of woodlots and trails offer open, sun-exposed light conditions that are favourable to the White Wood Aster. However, where the species occurs near trail edges and other recreational use areas, it may be subject to unintentional trampling. For example, recreational trails run through colonies at the Marcy’s Woods, Short Hills Provincial Park and the St. John Conservation Area in Ontario, camping is permitted near the Mont Rougemont local population in Quebec, and the Saint-Blaise-sur-Richelieu and Venise-en-Québec local populations are adjacent to golf courses (COSEWIC 2002).

Other Potential Threats

There are several potential threats that are believed to impact the White Wood Aster in Canada, although more information is needed to confirm the extent and level of concern. For example, signs of shallow excavation were observed in the Crescent Estates Woodlot in Ontario which may have been a result of intentional harvesting of the species (COSEWIC 2002) although this is not typically a harvested species. Surveys at the Fort George National Historic Site noted the occurrence of several plants that appeared to be intermediate between the White Wood Aster and the Bigleaf Aster (*Eurybia macrophylla*) (Jalava 2004), therefore it is possible that hybridization may be a threat to the White Wood Aster at this site or others where the species co-occur. Other potential threats mentioned may include erosion and quarry expansion (COSEWIC 2002) although the current status of these threats is unknown.

5. Population and Distribution Objectives

The population and distribution objectives for the White Wood Aster in Canada are:

- Maintain the current distribution and abundance (i.e., total number of stems) of the White Wood Aster in Canada; and
- Where necessary and technically and biologically feasible, support natural increases of abundance (i.e., total number of stems) of extant local populations.

The White Wood Aster reaches the northern limit of its North American range in southern Ontario and Quebec, and may never have been common or widespread in Canada (COSEWIC 2002). The number of identified extant local populations and subpopulations has increased since the last COSEWIC status report in 2002 as a result of an increased search effort and data reporting. It is possible that targeted surveys for the species may result in the discovery of previously undetected local populations and subpopulations. Therefore, maintaining the species' current distribution in Ontario and Quebec, including any new local populations that are discovered and identified in the future, is considered an appropriate objective for recovery.

For most local populations, the species' abundance is measured by the total number of stems, because the number of clones can be difficult to determine without damaging the plants (COSEWIC 2002). Therefore, the total number of stems is used as a measure of abundance for local populations where the number of colonies has not yet been determined. A population viability analysis would be beneficial to determine if and where increases in abundance are considered necessary to promote self-sustaining[10] local populations and long-term persistence of the species. For example, it may be necessary to increase the species' abundance at local populations threatened by small population size (e.g., where only one colony is known to occur). Recovery measures to support natural increases of abundance at local populations will include habitat management

[10] A population that on average demonstrates stable or positive population growth and is large enough to withstand random events and persist in the long term without the need for permanent active management intervention.

techniques and threat mitigation; propagation and transplantation is not currently being recommended, but as understanding of the number of individuals at each local population improves, may become important in the future Additional research may need to be conducted to determine if activities to increase abundance within local populations are feasible and required.

6. Broad Strategies and General Approaches to Meet Objectives

6.1 Actions Already Completed or Currently Underway

Since 2006, the Habitat Stewardship Program (HSP) for Species at Risk has provided support to enable environmental organizations to implement activities targeting the recovery of the White Wood Aster in both Ontario and Quebec. In Ontario, the Niagara Parks Commission, Nature Conservancy of Canada and the Carolinian Canada Coalition have contributed to the formation of conservation agreements, conservation easements and the acquisition of lands to support the protection of habitat for the White Wood Aster, as well as various habitat restoration, monitoring, and outreach and education activities. Natural area inventories have contributed to the identification of additional local populations including those completed by the Niagara Naturalist Club and the Bert Miller Nature Club of Fort Erie.

In Ontario, broader scale ecosystem management is contributing to the recovery of species that rely on Carolinian forest habitat. For example, the National Recovery Strategy for Carolinian Woodlands and Associated Species at Risk (Jalava et al. 2009), identifies recovery approaches for threatened habitats and species in the Carolinian life zone. In addition, conservation action plans that specifically identify recovery actions for species at risk including the White Wood Aster have been developed for the Hamilton-Burlington, Short Hills, and Niagara River Corridor areas (Jalava et al. 2010a-c) and Fort George National Historic Site (Parks Canada Agency 2016). Best Stewardship Practices[11] have also been developed by the Carolinian Canada Coalition specifically for the White Wood Aster.

In Quebec, the HSP has supported Nature-Action Québec, Centre d'interprétation du milieu écologique du Haut-Richelieu, the Nature Conservancy of Canada and the Appalachian Corridor to implement activities within the areas of Vaudreuil-Soulanges and Mont Rougemont, Missisquoi Bay (northern Lake Champlain area), and a portion of the Appalachians known as the Green Mountains. Over the last few years, these organizations have met with landowners to raise awareness of the importance of conserving this species and promote beneficial forest management practices. This has led to the formation of conservation agreements, conservation easements and the acquisition of lands. Additionally, the exploration of areas adjacent to known occurrences has led to the identification of new local populations.

[11] https://caroliniancanada.ca/bmp/pdf_depository

In Quebec, a significant research project (Boisjoli 2010) was carried out in Saint-Armand and Mont Petit Pinacle that included studying microhabitat needs and habitat thresholds for canopy openness and litter depth. Additional studies have been undertaken to examine the potential impacts on the White Wood Aster due to invasive species. For example, one study found the species to be sensitive to chemical substances emitted by the roots of the Norway Maple (Rich 2004).

Over the past few years, exceptional forest ecosystems (EFE) have been designated on Mont Rougemont. The EFE status, regulated by the Quebec government, consists of a long-term strategy for conserving high value or threatened ecosystems and habitats. The Quebec Department of Sustainable Development, Environment and Parks (MDDELCC) carried out an analysis of potential habitats on Mont Rougemont in 2012 and conducted population surveys in 2015. In addition, canopy thinning has been tested as a method of habitat restoration (Bachand-Lavallé 2015), and a conservation plan has been developed for the White Wood Aster in Mont Rougemont (Bachand-Lavallée 2015).

6.2 Strategic Direction for Recovery

Table 2. Recovery Planning Table

Threat or Limitation	Broad Strategy to Recovery	Priority[a]	General Description of Research and Management Approaches
Knowledge gaps pertaining to species' population and distribution	Surveys and monitoring	High	• Implement existing monitoring protocols, or if necessary develop a standardized monitoring protocol for the species. • Confirm the distribution and abundance of extant local populations and subpopulations and determine the boundaries of contiguous suitable habitat to refine the delineation of the areas containing critical habitat. • Search suitable habitat adjacent to areas containing critical habitat for possible new occurrences or subpopulations.
		Medium	• Determine the need to increase local population abundance with consideration of clonal/genetic diversity. If determined to be necessary, identify opportunities to increase abundance via habitat restoration and/or threat mitigation. • Determine the reproductive status of local populations (i.e., ability to produce seed). Determine whether the propagation of individuals is recommended as an activity necessary to maintain or increase abundance in order to support the persistence of self-sustaining local populations. • Conduct surveys within the species' range to identify new or previously unknown extant local populations.
	Research	High	• Increase knowledge of the species' ecology and habitat needs (e.g. local and range-wide population viability analysis and interannual variability; genetics studies, seed dispersal; interactions with invasive plans and invertebrates; confirm optimal habitat conditions for the species; determine effectiveness of recovery methods).
Canopy closure, invasive plants, grazing by deer and weevil feeding	Monitoring; habitat management	Medium	• Monitor local populations for thresholds in canopy openness. If necessary, determine and implement effective methods of habitat restoration. • Monitor local populations for direct or indirect impacts from

Threat or Limitation	Broad Strategy to Recovery	Priority[a]	General Description of Research and Management Approaches
			invasive plant species. Where necessary, implement best management practices for the control of invasive plant species. • Monitor local populations for damage from deer browse. Where necessary implement actions to protect plants from deer browse. • Monitor local populations to determine the impacts from weevils, earthworms and other unforeseen invasive species.
All threats	Communication, outreach and education	Medium	• Hold identification workshops for landowners in southern Ontario and Quebec to improve the reliability of observations. • Encourage landowners who have the species on their land to use habitat management and development practices that are favourable to the species. • Develop and implement a communication strategy targeting the general public, private landowners, and appropriate stakeholders to increase awareness of the species and its threats.
Residential development and urbanization, agricultural development, forest harvesting	Land use policy and planning; habitat management and conservation	High	• Research and develop measures to mitigate impacts to the species and its habitat as a result of activities that pose a threat to the species or its habitat such as residential development and incompatible forest harvesting. • Develop ecosystem conservation plans for deciduous forests containing White Wood Aster. • Ensure county and municipal or other planning authorities are aware of locations of White Wood Aster local populations and the types of activities that may threaten the species or its habitat. • Support protection, stewardship and restoration of habitat containing local populations.

[a] "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

There are significant knowledge gaps pertaining to the White Wood Aster's local population distribution, abundance and viability. Surveys of extant local populations are required to more accurately map the current distribution and estimate the abundance of the White Wood Aster in Canada. A standardized monitoring protocol should be adopted or developed and implemented regularly for all known local populations to improve knowledge of natural variability of local populations and trends in abundance. The White Wood Aster may be more common in Canada than current data suggest. Under unfavourable light conditions, the plants rarely flower making them difficult to detect (Boisjoli 2010). Searching for new occurrences in suitable habitat, at sites near previously extirpated populations, is also recommended to confirm, or if possible expand, the known distribution of the species in Canada.

Studies on the ecology and dynamics of the White Wood Aster population are also necessary to fill knowledge gaps and provide the basis for the species' recovery. For example, determining the number of colonies within a local population will be important, as the genetic diversity within a local population is a key factor in a population's seed production capacity and therefore its long-term viability.

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. Under section 2(1) of SARA, critical habitat is "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".

Where detailed surveys have been conducted and White Wood Aster plant locations are known, critical habitat is identified as the extent of biophysical attributes (7.1.1) up to 80 m (radial distance) around existing mapped observations of the White Wood Aster (7.1.2). In cases where little or no mapping and/or documentation of plant locations or habitat features exists, but the approximate location of the local population has been verified, the area containing critical habitat is identified as the ecological or landscape feature containing the local population (7.1.2), and critical habitat for White Wood Aster is identified as the extent of biophysical attributes (7.1.1) up to 80 m (radial distance) from any single plant wherever they occur within the areas containing critical habitat (7.1.2). Additionally, as the White Wood Aster may be found near the transition zone between suitable and unsuitable habitat (e.g., within small forest openings, or along woodland edges), a critical function zone distance[12] of 50 m (radial distance) is identified as critical habitat when the biophysical attributes around an individual plant or patch of plants extend for less than 50 m.

Critical habitat is identified for 51 of 56 known[13] extant local populations of the White Wood Aster in Canada (Appendix B-C). The identified critical habitat is considered insufficient to achieve the population and distribution objectives. Available information on the species at a number of locations is outdated or lacking detailed spatial references or additional information is required to confirm the continued persistence of the species. To address these knowledge gaps, a Schedule of Studies (section 7.3, Table 3) has been developed which outlines the activities required for the identification of additional critical habitat necessary to support the population and distribution objectives. Extant local populations and subpopulations where persistence or location information is unverified will be targeted by the schedule of studies to identify additional critical habitat. If new or additional information becomes available (e.g., new or re-discovered local populations and/or subpopulations), refinements to, or additional critical habitat may be identified in an amendment to this recovery strategy.

7.1.1 Biophysical Attributes

The White Wood Aster occurs in open, dry deciduous forests with undulating topography (ridges, slopes, and terraces) and in fresh-moist deciduous swamp forests (COSEWIC 2002). These forests are typically dominated by Sugar Maple and American Beech. In Ontario, associated trees species may also include red, white and black oaks, Shagbark Hickory *(Carya ovata)*, Basswood *(Tilia americana)* and other Carolinian forest species (COSEWIC 2002) and in Quebec, tree associates of Eastern Hemlock (*Tsuga canadensis*), Bitternut Hickory and Ironwood may occur. The biophysical attributes of the critical habitat for the White Wood Aster include:

- Tree canopy cover is 60% or greater, of which 75% or more of the canopy cover consists of deciduous tree species:
    - The dominant tree species is most often Sugar Maple, but may also be Red Maple (*Acer rubrum)*, American Beech, Red Oak *(Quercus rubra),* Bitternut Hickory, Shagbark Hickory, Yellow Birch *(Betula alleghaniensis),* Eastern Hemlock, Basswood or Black Maple *(Acer nigrum)*
    - Other overstory species present typically include White Oak *(Quercus*

[12] Critical function zone distance is the radial length surrounding an occurrence that is required to maintain constituent microhabitat properties (e.g. light, moisture, and humidity levels) critical to the survival of an individual of the species. Although it is not clear at what exact distances physical and/or biological processes begin to negatively affect White Wood Aster, existing research provides a logical basis for suggesting a minimum critical function zone distance of 50 m for rare plant species occurrences (see: http://www.registrelep-sararegistry.gc.ca/default.asp?lang=En&n=6A845288-1%20-%20_Toc285808423#_Toc285808423 Appendix 1). The area within the critical function zone distance may include habitat that does not contain the biophysical attributes described for the species and may not be currently mapped as part of the area containing critical habitat

[13] Based on data available to Environment and Climate Change Canada as of September 2016.

    - *alba),* Black Oak *(Quercus velutina)*, White Ash (*Fraxinus pennsylvanica)*, White Elm *(Ulmus americana),* Basswood *(Tilia americana)* and Black Cherry *(Prunus serotina)*
    - Ironwood is a common mid-story tree species
- Micro-topography may include undulating dry upland features such as dune ridges, slopes and terraces, and lowlands of wet-mesic troughs and depressions;
- Moisture regime is often mesic to dry-mesic in upland habitat (dune ridges, slopes and terraces) and wet mesic in lowland features (troughs and depressions);
- Soils range from silty and loamy clay, sand, and rocky hills.

7.1.2 Areas Containing Critical Habitat

In Canada, the presence and persistence of the White Wood Aster in a given location depends on an area greater than that occupied by individual plants. The areas containing the critical habitat for the White Wood Aster are the continuous deciduous forest ecosystems that promote and maintain suitable habitat conditions for the plants where they are known to occur[14], and provide for natural processes related to population dynamics and reproduction (e.g., dispersal and pollination).

A tiered approach is used to identify the areas containing critical habitat for White Wood Aster, based on the accuracy of available data for verified local populations. Areas containing critical habitat for White Wood Aster are identified as follows:

1) In cases where detailed surveys have been conducted and White Wood Aster plant locations are known, application of 80 m[15] (radial distance) from any existing mapped observation within the local population or subpopulation. This case currently applies to all Quebec local populations.
   OR
2) In cases where little or no mapping and/or documentation of plant locations or habitat features exists, but the approximate local population has been verified, the areas containing critical habitat are identified as the ecological or landscape feature (i.e., the extent of continuous deciduous forest) where a White Wood Aster local population or subpopulation is known to occur. This case currently applies to all Ontario local populations;

[14] For White Wood Aster plants observed in the last 25 years.

[15] At present, the minimum area of suitable habitat required to allow for the maintenance of viable local population or subpopulations of the White Wood Aster, and to also allow for natural processes related to population dynamics and reproduction (e.g., dispersal) to occur, is unknown. Existing research provides a logical basis for suggesting an area with a minimum radial distance of 80 m to support the maintenance of suitable habitat for the White Wood Aster by minimizing edge effects and associated threats such as invasion by exotic species and White-tailed Deer browse (Gratton and Nantel 1999; Ranney et al. 1981). Therefore, an 80 m distance from any White Wood Aster mapped observation is deemed an appropriate distance to ensure that a minimum area of suitable habitat is maintained and incorporated in the identification of critical habitat.

The tiered approach uses the precautionary principle to identify generalized areas as containing critical habitat where more detailed data on the plant locations are not currently available. The areas containing critical habitat are presented in Appendix C. Due to provincial data sharing agreements in Ontario, critical habitat in Ontario is only presented using the 1 x 1 km UTM grid squares to indicate the general geographic areas containing critical habitat (Appendix C, Figures C-1-1 to C-1-15). In Quebec, the areas containing critical habitat are represented by the shaded yellow polygons (Appendix C, Figures C-2-1 to C-2-12). The UTM grid squares presented in Appendix C are part of a standardized grid system that indicates the general geographic location of the areas within which critical habitat is found, which can be used for land use planning and/or environmental assessment purposes. For more information on critical habitat identification, contact Environment and Climate Change Canada – Canadian Wildlife Service at ec.planificationduretablissement-recoveryplanning.ec@canada.ca.

7.2 Schedule of Studies to Identify Critical Habitat

Table 3. Schedule of studies to identify critical habitat

Description of Activity	Rationale	Timeline
Confirm the continued persistence and location of the species and its biophysical attributes at locations where critical habitat was not identified.	Locations of local populations and/or subpopulations considered extant but having insufficient spatial accuracy are confirmed, and if the species persists at these locations, critical habitat is identified.	2018-2023

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. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat was degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single activity or multiple activities at one point in time or from the cumulative effects of one or more activities over time. It should be noted that not all activities that occur in or near critical habitat are likely to cause its destruction. Activities described in Table 4 are examples of those likely to cause destruction of critical habitat for the species; however, destructive activities are not necessarily limited to those listed.

Table 4. Activities Likely to Result in the Destruction of the White Wood Aster's Critical Habitat

Description of Activity	Description of Effect in Relation to Function Loss	Details of Effect
Conversion of wooded habitats to other land uses, including residential, agricultural, recreational or industrial areas (e.g., subdivisions, row crops, roads, quarries, landfills, golf courses).	Direct destruction of critical habitat. These activities remove soils, tree and vegetation cover and alter natural hydrological patterns that are required for the growth, reproduction and dispersal of White Wood Aster.	When this activity occurs within the bounds of critical habitat, at any time of year, the effects will be direct, and is certain to result in the permanent destruction of critical habitat. There are no possible thresholds for this activity.
Incompatible forest management activities including: clear cutting; some types of small-scale forest harvesting; and operation of heavy equipment.	Clear cutting and small-scale forest harvesting may result in direct removal and loss of tree canopy and light conditions, indirectly changing soil moisture regimes of critical habitat. Use of forestry equipment (if not cleaned properly) may result in an increase in the probability of propagules of invasive species being introduced.	When this activity occurs within critical habitat, it may result in its destruction. The effects may be direct (e.g. through habitat loss) or indirect (e.g. through introduction of invasive species). Some small-scale forest harvesting that results in the thinning of the forest canopy, and/or pruning of vegetation may be beneficial provided careful precautions are taken (e.g., forestry equipment is properly cleaned, use of existing roads and trails, direct harm to the species is avoided, responsible removal of brush and wood from habitat as needed).
Introduction of non-native species, especially plants or invertebrates (e.g., introduction of non-native plant seeds, plants, foreign soil, composting or dumping of garden waste).	Non-native species may out-compete the White Wood Aster, and/or cause physical changes to habitat (e.g., changes in canopy cover), such that the habitat is no longer suitable for this species.	When this activity occurs within or adjacent to critical habitat, at any time of year, the effects may be direct and/or cumulative. The introduction of an invasive species can lead to gradual destruction of critical habitat over time (i.e., cumulative impacts).

8. Measuring Progress

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

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

- Species distribution and abundance is maintained; and
- Where necessary and technically and biologically feasible, natural increases in abundance are supported at extant local populations.

9. Statement on Action Plans

One or more action plans will be completed by December 31, 2024.

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Appendix A: Conservation Ranks of the White Wood Aster in Canada and the United States

Global (G) Rank	National (N) Rank	Subnational (S) Rank
G5	Canada: N2N3	Ontario (S2S3), Quebec (S2)
	United States: N5	Alabama (SNR), Connecticut (SNR), Delaware (S4), District of Columbia (SNR), Georgia (S5), Kentucky (S5), Maine (S3), Maryland (SNR), Massachusetts (SNR), New Hampshire (SNR), New Jersey (S5), New York (S5), North Carolina (S5), Ohio (SU), Pennsylvania (SNR), Rhode Island (SNR), South Carolina (SNR), Tennessee (SNR), Vermont (SNR), Virginia (S5), West Virginia (S5)

Rank Definitions (Master et al. 2012)

G5/N5/S5: Secure: At very low risk of extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.

S4: Apparently Secure: At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.

N3/S3: Vulnerable: At moderate risk of extinction or elimination due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.

N2/S2: Imperilled: At high risk of extirpation in the jursidiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.

SNR: Unranked: Conservation status not yet assessed

U: Unrankable: Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

N#S#/S#S#: Range Rank: A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).

Appendix B: Local populations and subpopulations of the White Wood Aster, with estimated abundance, last observed date and population status[a].

Local Population	Local Population Status[b]	Subpopulation	COSEWIC Population	Conservation Data Centre Element Occurrence (EO) ID	# plants/stems	Last Observed	Area Containing Critical Habitat[c]
ONTARIO							
1. Crescent Estates & Helena Road Woodlots	Extant	1a. Crescent Estates Woodlot	Crescent Estates Woodlot	n/a	100 plants	2002	Yes
		1b. Helena Road Woodlot			Unknown	2015	Yes
2. Culp's Woods	Extant		Culp's Woods	EO11196	400 plants	2002	Yes
3. Dufferin Island	Extant		Dufferin Island	EO66852	15-20 plants	2008	Yes
4. Fonthill-Sandhill Valley ANSI	Extant		Fonthill-Sandhill Valley ANSI	EO31887	1000's of plants "appears widespread throughout ANSI (2002)"	2016	Yes
5. Marcy's Woods and Point Abino	Extant	5a. Marcy's Woods	Marcy's Woods (Point Abino Peninsula ANSI)	EO31886	200 plants	2001	Yes
		5b. Point Abino			Unknown; single patch	2000	No
6. Miller Creek Swamp Woodlot (Fort Erie North)	Extant		Miller Creek Swamp Woodlot	EO66857	100 plants	2002	Yes
7. Nelson Quarries	Extant		Nelson Quarries	EO31897	Unknown	1999	Yes
8. North Pelham Valley ANSI	Extant		North Pelham Valley ANSI	EO31898	30 plants or stems	2008	Yes
9. Oakhill Forest (Ridgewood)	Extant		Oakhill Forest - 1	EO66853	10-20 plants or stems	2002	Yes
10. Oakhill Forest (Ridgeway)	Extant		Oakhill Forest - 2	EO66854	6 plants or stems	2002	Yes
11. South Fort Erie (Ridgeway)	Extant	11a. Dominion Woods	South Fort Erie	EO66855	Unknown "species is persistent"	2004	Yes
		11b. South of Thunder Bay Rd			20-30 plants; habitat since destroyed, now considered extirpated	2002	No*
12. South Fort Erie 2 (Crystal Beach)	Extant		South Fort Erie 2	EO66856	3 plants	2002	Yes
13. Short Hills Provincial Park	Extant	13a. Twelve Mile Creek ANSI	Short Hills Provincial Park - Twelve Mile Creek ANSI	EO1711	1555 plants "plants are scattered in the area"	2002	Yes
		(13a.) Howell Pumpkin Farm			Unknown	2006	Yes
		13b. Cataract Woods	Short Hills Provincial Park - Cataract Woods		3800 stems "very abundant throughout; evidence deer management has increased abundance and spread"	2016	Yes
		13c. Terrace Creek			5350 stems	2002	Yes
14. St. Johns Conservation Area	Extant		St. Johns Conservation Area	EO31888	3 stems	2002	Yes

Local Population	Local Population Status[b]	Subpopulation	COSEWIC Population	Conservation Data Centre Element Occurrence (EO) ID	# plants/stems	Last Observed	Area Containing Critical Habitat[c]
15. Summer Street Woodlot (Fort Erie North)	Extant		Summer Street Woodlot	EO66859	20 plants	2002	Yes
16. Two Mile – Four Mile Creek ANSI	Extant	16a. Four Mile Creek	Two Mile-Four Mile Creek ANSI (Niagara Shores Conservation Area)	EO1708	>425 plants	2002 2008 2009	Yes
		16b. Two Mile Creek	Two Mile-Four Mile Creek ANSI (Department of National Defense)		165 plants Unknown	2000 2003	Yes
		16c. Three Mile Creek		n/a	>550 plants	2008 2009	Yes
17. Welland Canal	Extant			EO93597	Unknown “a few flowering stems”	2004	Yes
18. Paradise Grove	Extant			EO92423	>200 flowering stems; 3 patches	2006	Yes
19. Fernwood Woodlot Park	Extant			EO92702	~200 plants or stems “scattered clumps in northeast corner”	2016	Yes
20. Kunda Park	Extant			n/a	~2900 plants or stems	2008	Yes
21. Lancaster Park	Extant			n/a	~50-70 plants or stems	2016	Yes
22. Woodlawn Park	Extant			n/a	1000s plants or stems “common to abundant; expanding throughout forest”	2016	Yes
23. Woodlot at Wilford and Putnam	Extant			n/a	Unknown	2007	Yes
24. Fort Erie Wetland	Extant			n/a	~30 plants or stems	2007	Yes
25. Burns Road Woodlot	Extant			n/a	Unknown	2010	Yes
26. Along Bruce Trail North of Queenston Quarry	Extant			n/a	~12 plants or stems	2008	Yes
27. Kingston Mills	Extirpated			EO31899		1991	No*
28. Niagara Falls	Extirpated			EO5076		1893	No*
29. St. Catherines	Extirpated			EO5077		1987	No*
30. Swansea	Extirpated			EO1710		1927	No*
31. Royal Botanical Gardens	Extirpated			EO1709		1955	No*
32. Queenston Heights	Extirpated			EO1705		1898	No*
33. Beamsville Shoreline	Historic			EO1706	Unknown	1973	No
34. Beamsville Escarpment Life Science ANSI	Extant			n/a	Unknown	2008	Yes
35. Windmill Point	Unknown (currently pending); however likely extirpated and considered lost			n/a	Unknown	1879	No

Local Population	Local Population Status[b]	Subpopulation	COSEWIC Population	Conservation Data Centre Element Occurrence (EO) ID	# plants/stems	Last Observed	Area Containing Critical Habitat[c]
36. Cooks Mills	Extant			n/a	Unknown	2006	Yes
37. HAL-32	Extant			n/a	Unknown	2007	No
38. Old Lincoln Street Slough Forest	Extant			n/a	Unknown	2007	Yes
39. Fireman’s Park	Extant			n/a	Unknown	2008	No
40. Juard Woods - Ridgeville Swamp	Extant			n/a	Unknown “an amazing abundance throughout the ground layer”	2008	Yes
41. Coyle Creek Headwaters	Extant			n/a	Unknown	2008	Yes
42. Rose Little Woods – Merritt Road Swamp	Extant			n/a	Unknown	2008	Yes
43. Elsie Road Woods	Extant			n/a	Unknown	2007	No
44. Fork Creek Meanders	Extant			n/a	Unknown	2007	No
45. Morgan’s Point	Extant			n/a	Unknown	2007	No
46. Doan’s Ridge	Extant			n/a	Unknown “very abundant, 30% cover throughout property”	2016	Yes
47. Woodland Elementary School Grove	Extant			n/a	Unknown	2002	Yes
48. Wetland South of Rose Little	Extant			n/a	100’s of plants or stems “very abundant, 50-70% cover along western edge”	2016	Yes
49. Hillcrest Park, Pelham	Extant			n/a	100’s of plants or stems “very abundant, 40 stems/m^2 in ~60-150m^2 area”	2016	Yes
50. Woodlot “13D”	Extant			n/a	Unknown	2005	Yes
51. Woodlot “13A” – Ridge Street @ Split Rock Ridge	Extant			n/a	Unknown “seen along western edge road allowance”	2016	Yes
52. Woodlot “6D” – Cherry Hill Woodlot	Extant			n/a	Unknown	2003	Yes
QUEBEC							
1. Mont Rougemont	Extant	2 subpopulations	Mont Rougemont	3865	805	2014	Yes
2. Collines de Saint-Armand	Extant	2 subpopulations	Saint-Armand	3866	50	2013	Yes
3. Venise-en-Québec	Extant	2 subpopulations	Venise-en-Québec	3867	271	2011	Yes
4. Mont-Saint-Grégoire	Extirpated		Mont St-Grégoire	3868	15	1987	No*
5. Monts Petit-Pinacle et Pinacle	Extant	6 subpopulations	Frelighsburg -Petit Pinacle / Mont Pinacle / Colline Spruce	3870	2700	2015	Yes

Local Population	Local Population Status[b]	Subpopulation	COSEWIC Population	Conservation Data Centre Element Occurrence (EO) ID	# plants/stems	Last Observed	Area Containing Critical Habitat[c]
6. Saint-Blaise-sur-Richelieu	Extant	3 subpopulations	Saint-Blaise	3872	30	2001	Yes
7. Frelighsburg (Saint-Armand centre)	Extant		Frelighsburg - Saint-Armand Centre	3873	100	1997	Yes
8. Saint-Armand ouest	Extant			11275	300	2005	Yes
9. Notre-Dame-de-l'Île-Perrot 2	Extant			19830	75	2009	Yes
10. Sutton 1	Extant			20860	Unknown	2011	Yes
11. Sutton 2 Mont Round Top	Extant			20861	40	2010	Yes
12. Mont-Rougemont 2 (Saint-Damase)	Extant			21901	35	2014	Yes
13. Frelighsburg Eccles Hill	Extant	2 subpopulations		22348	10000	2014	Yes

[a] Sources: COSEWIC (2002); Bert Miller Nature Club (2003); AMEC Earth & Environmental Limited 2009; Niagara Peninsula Conservation Authority (2010); CDPNQ (2015); Garofalo (pers. comm. 2016); Natural Heritage Information Centre (2016); ; Sankey (pers. comm. 2016); ECCC (unpublished data); Niagara Falls Nature Club (unpublished data).

[b] Status is indicated for the local population. Extant: record from 1997-2017; historic: record predates 1997 (habitat remains suitable); extirpated: no longer exists (confirmed); unknown: likely extirpated (unconfirmed).

[c] Yes: local populations or subpopulations where areas containing critical habitat have been identified and mapped (Appendix C); No: local populations or subpopulations where areas potentially containing critical habitat have not been identified or mapped, confirmation of persistence of the species or spatial verification is required (i.e., included in the schedule of studies). No*: local population or subpopulation is extirpated (i.e., not included in schedule of studies).

Appendix C: Critical Habitat for the White Wood Aster in Canada

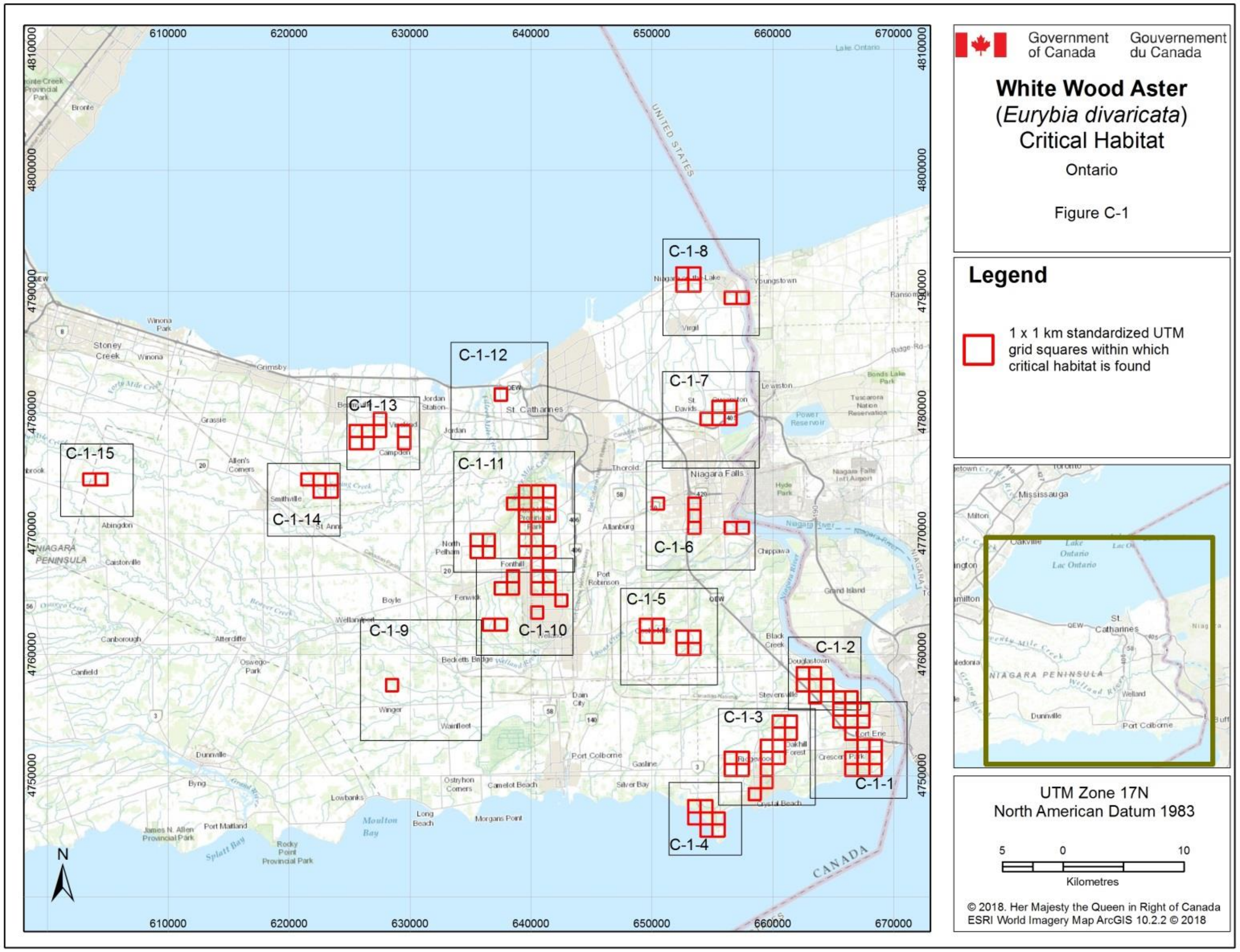

Figure C-1. Critical habitat for the White Wood Aster in Ontario occurs within these 1 x 1 km standardized UTM grid squares (red squares), where the criteria and methodology set out in Section 7 are met. This standardized national grid system indicates the general location within which critical habitat is found. The areas containing critical habitat, as described in Section 7.1.2, are not shown on the map.

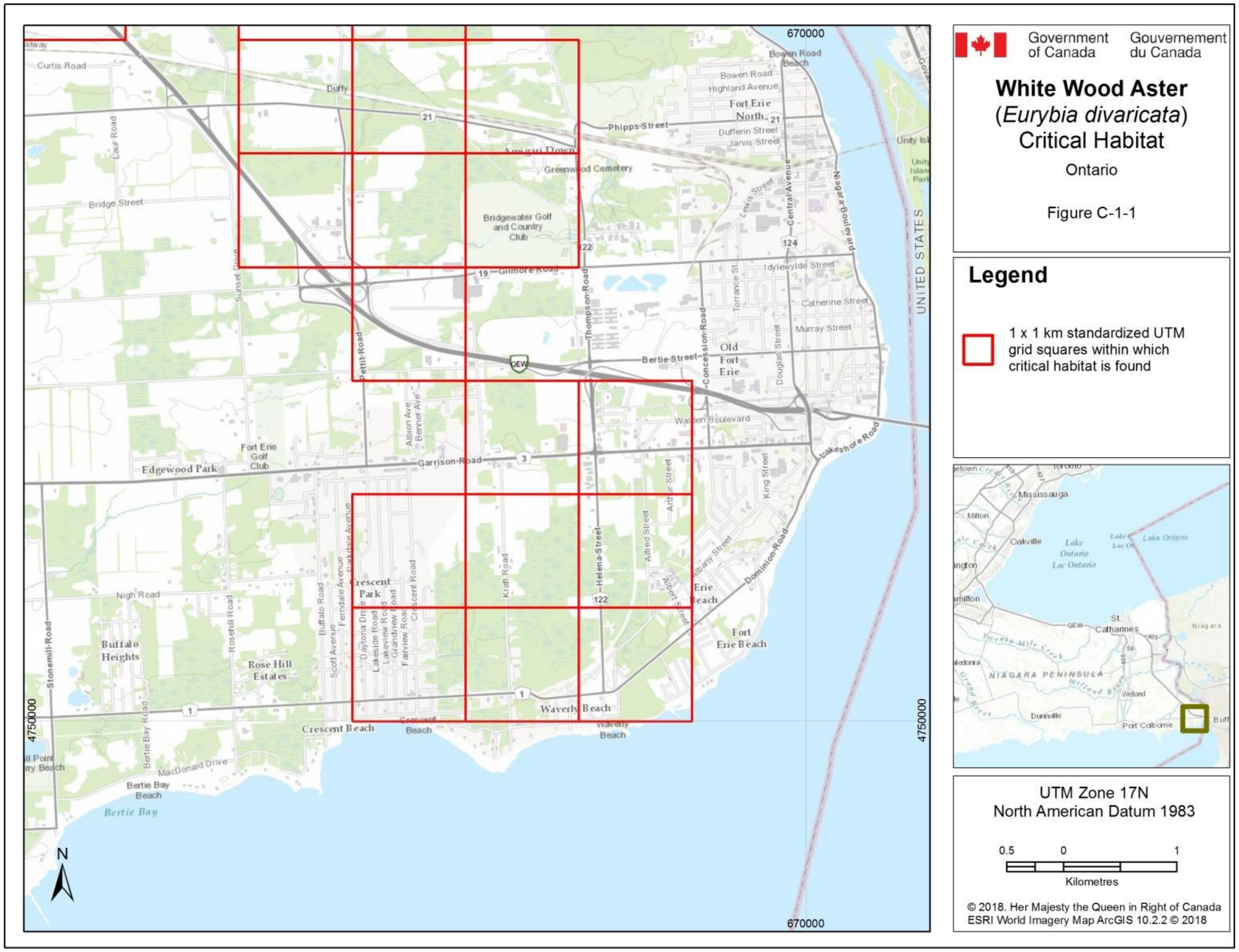

Figure C-1-1. Critical habitat for the White Wood Aster in Ontario occurs within these 1 x 1 km standardized UTM grid squares (red squares), where the criteria and methodology set out in Section 7 are met. This standardized national grid system indicates the general location within which critical habitat is found. The areas containing critical habitat, as described in Section 7.1.2, are not shown on the map.

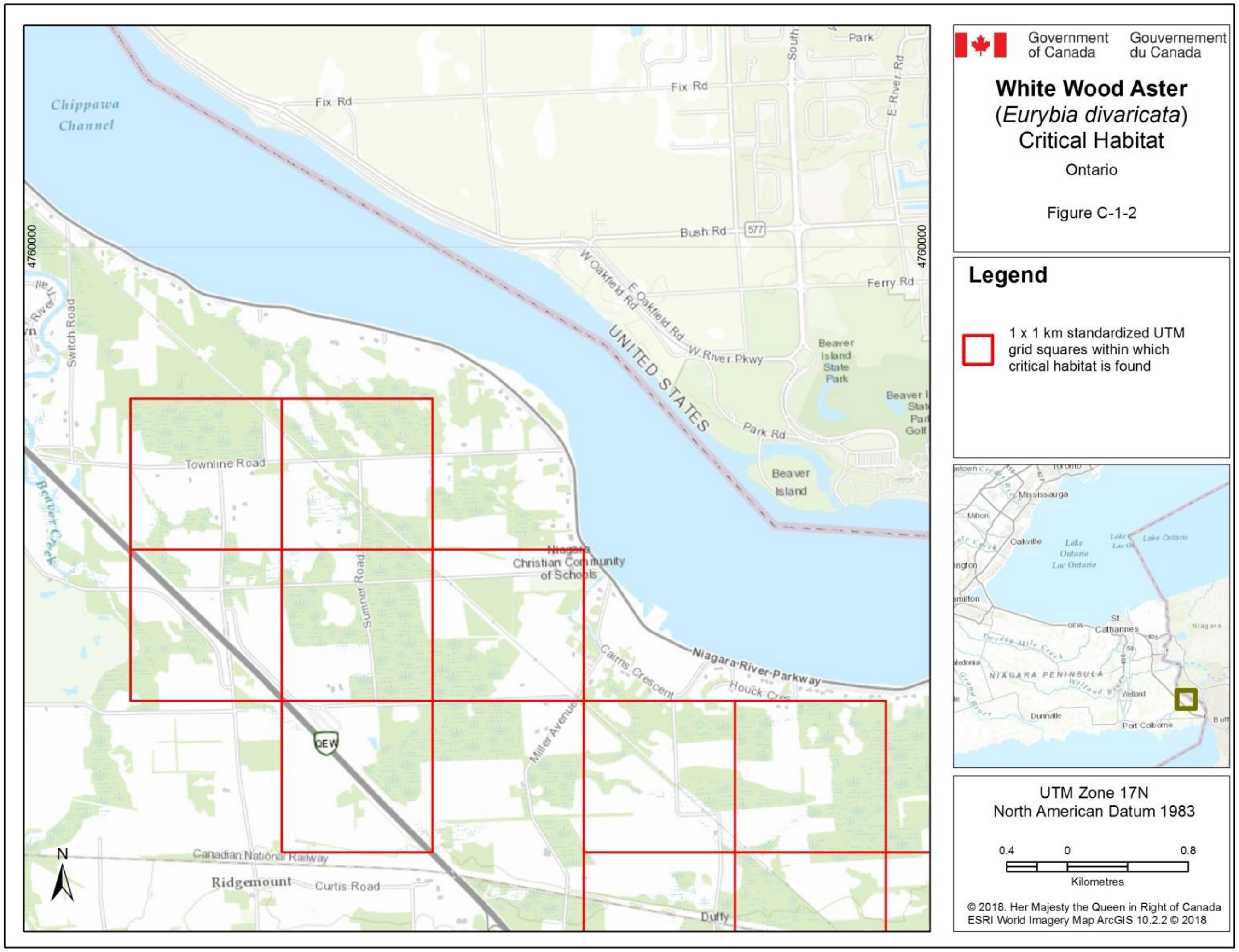

Figure C-1-2. Critical habitat for the White Wood Aster in Ontario occurs within these 1 x 1 km standardized UTM grid squares (red squares), where the criteria and methodology set out in Section 7 are met. This standardized national grid system indicates the general location within which critical habitat is found. The areas containing critical habitat, as described in Section 7.1.2, are not shown on the map.

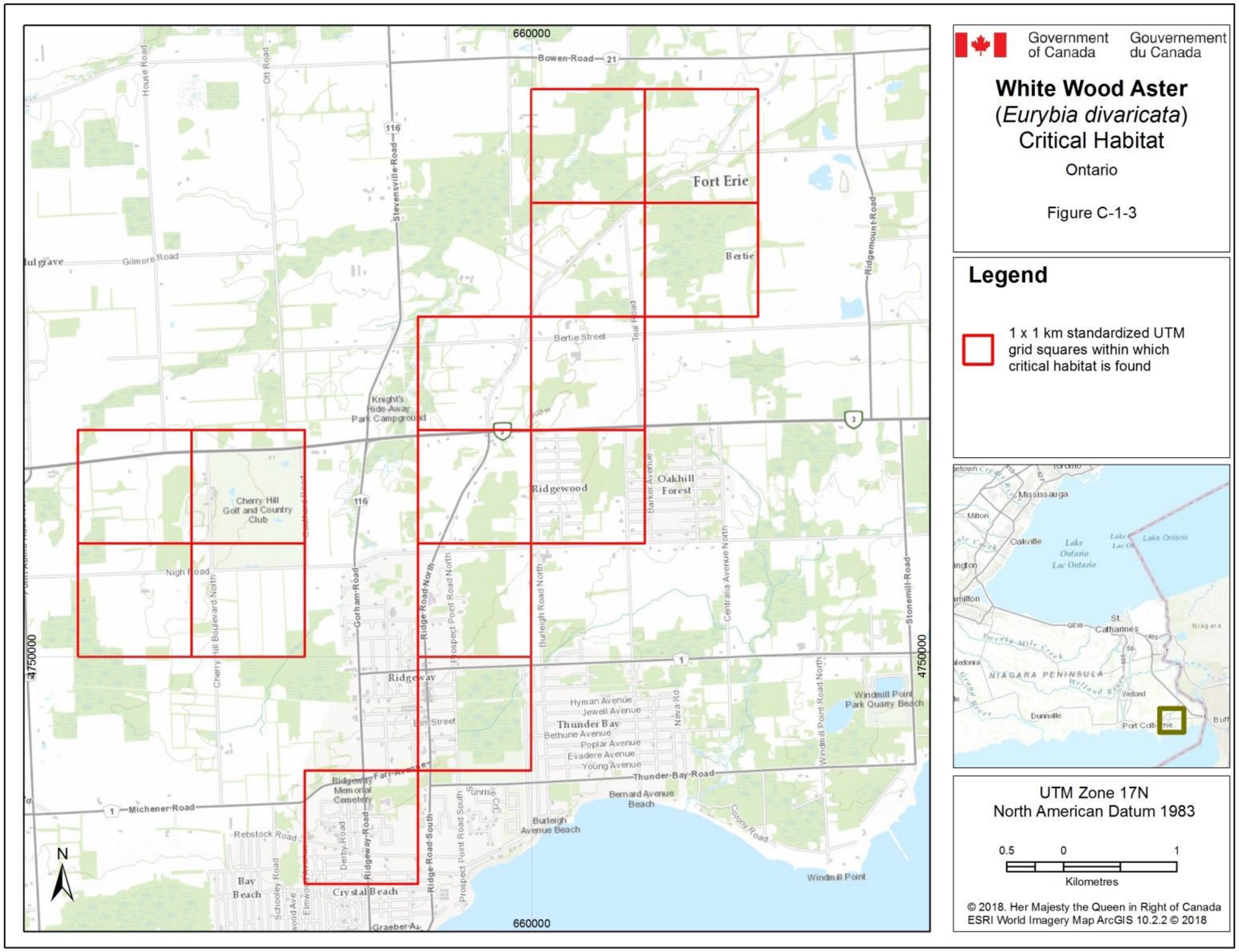

Figure C-1-3. Critical habitat for the White Wood Aster in Ontario occurs within these 1 x 1 km standardized UTM grid squares (red squares), where the criteria and methodology set out in Section 7 are met. This standardized national grid system indicates the general location within which critical habitat is found. The areas containing critical habitat, as described in Section 7.1.2, are not shown on the map.

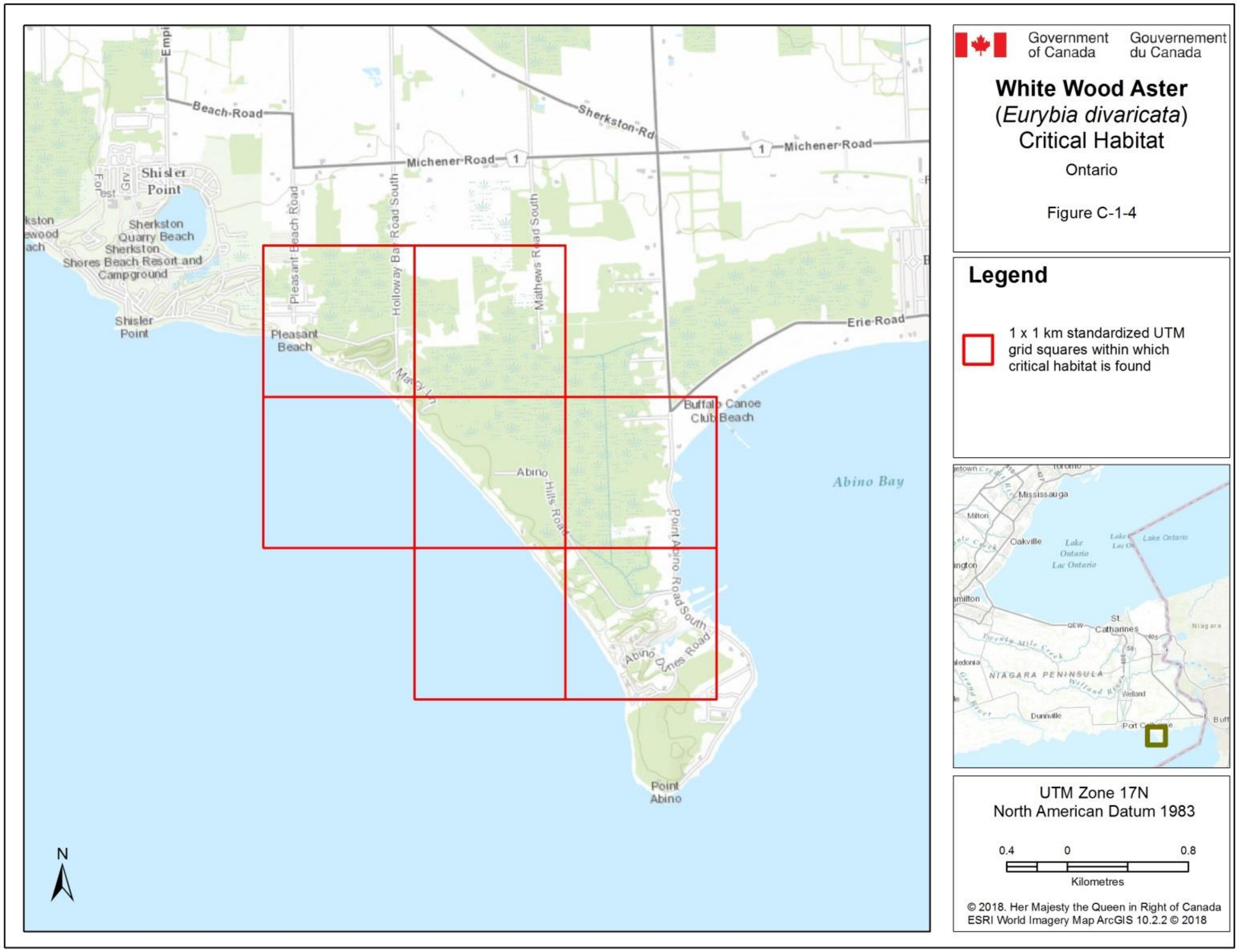

Figure C-1-4. Critical habitat for the White Wood Aster in Ontario occurs within these 1 x 1 km standardized UTM grid squares (red squares), where the criteria and methodology set out in Section 7 are met. This standardized national grid system indicates the general location within which critical habitat is found. The areas containing critical habitat, as described in Section 7.1.2, are not shown on the map.

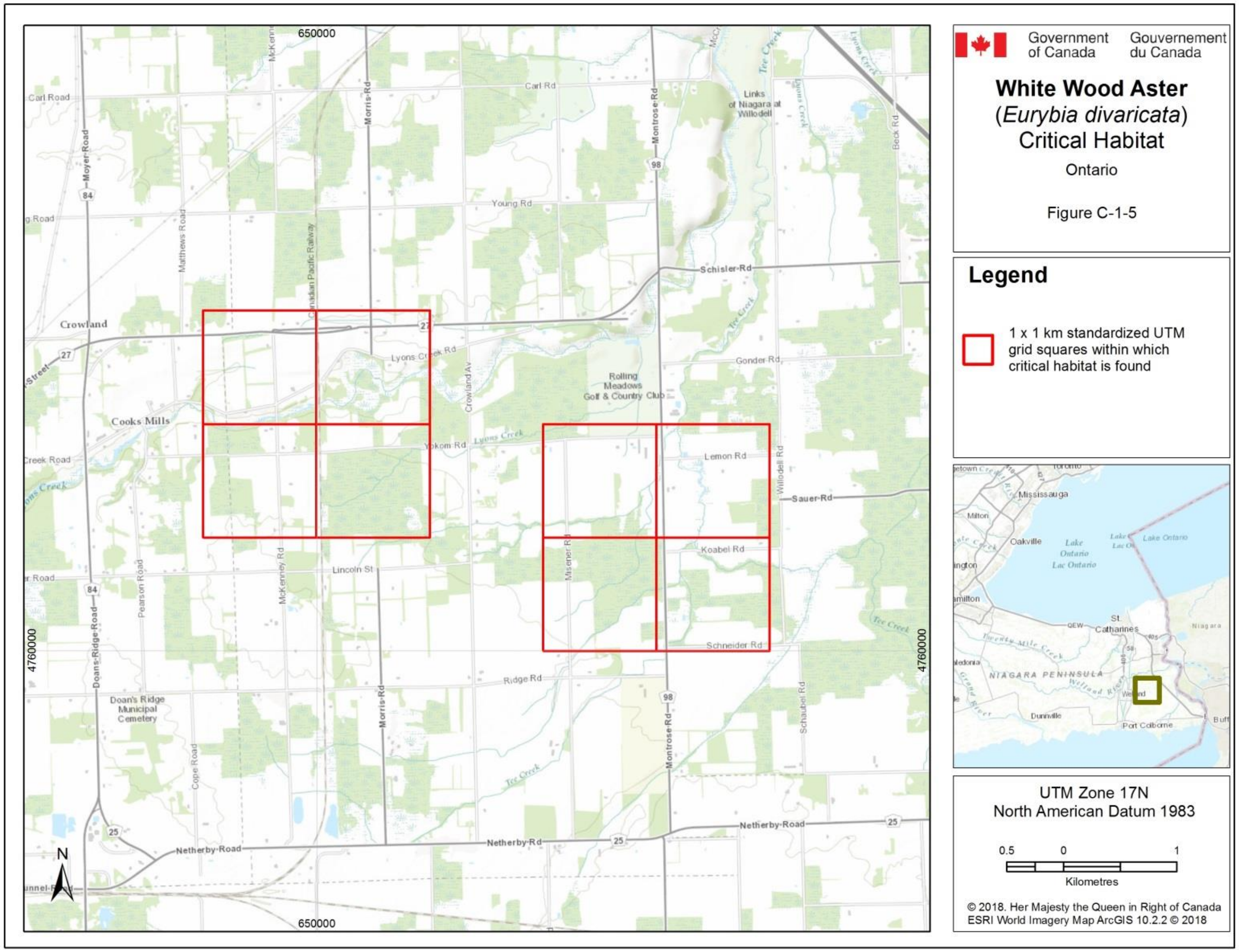

Figure C-1-5. Critical habitat for the White Wood Aster in Ontario occurs within these 1 x 1 km standardized UTM grid squares (red squares), where the criteria and methodology set out in Section 7 are met. This standardized national grid system indicates the general location within which critical habitat is found. The areas containing critical habitat, as described in Section 7.1.2, are not shown on the map.

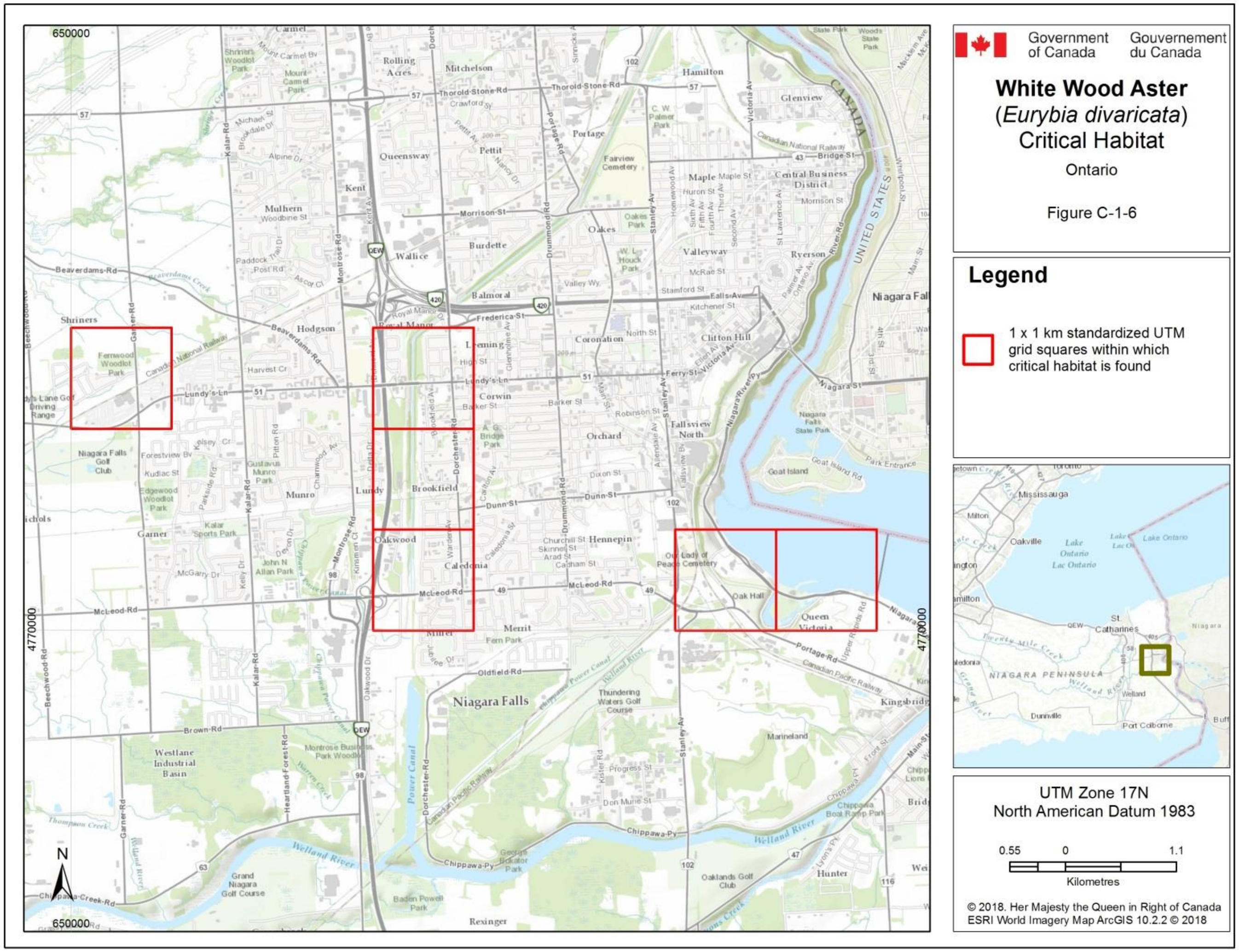

Figure C-1-6. Critical habitat for the White Wood Aster in Ontario occurs within these 1 x 1 km standardized UTM grid squares (red squares), where the criteria and methodology set out in Section 7 are met. This standardized national grid system indicates the general location within which critical habitat is found. The areas containing critical habitat, as described in Section 7.1.2, are not shown on the map.

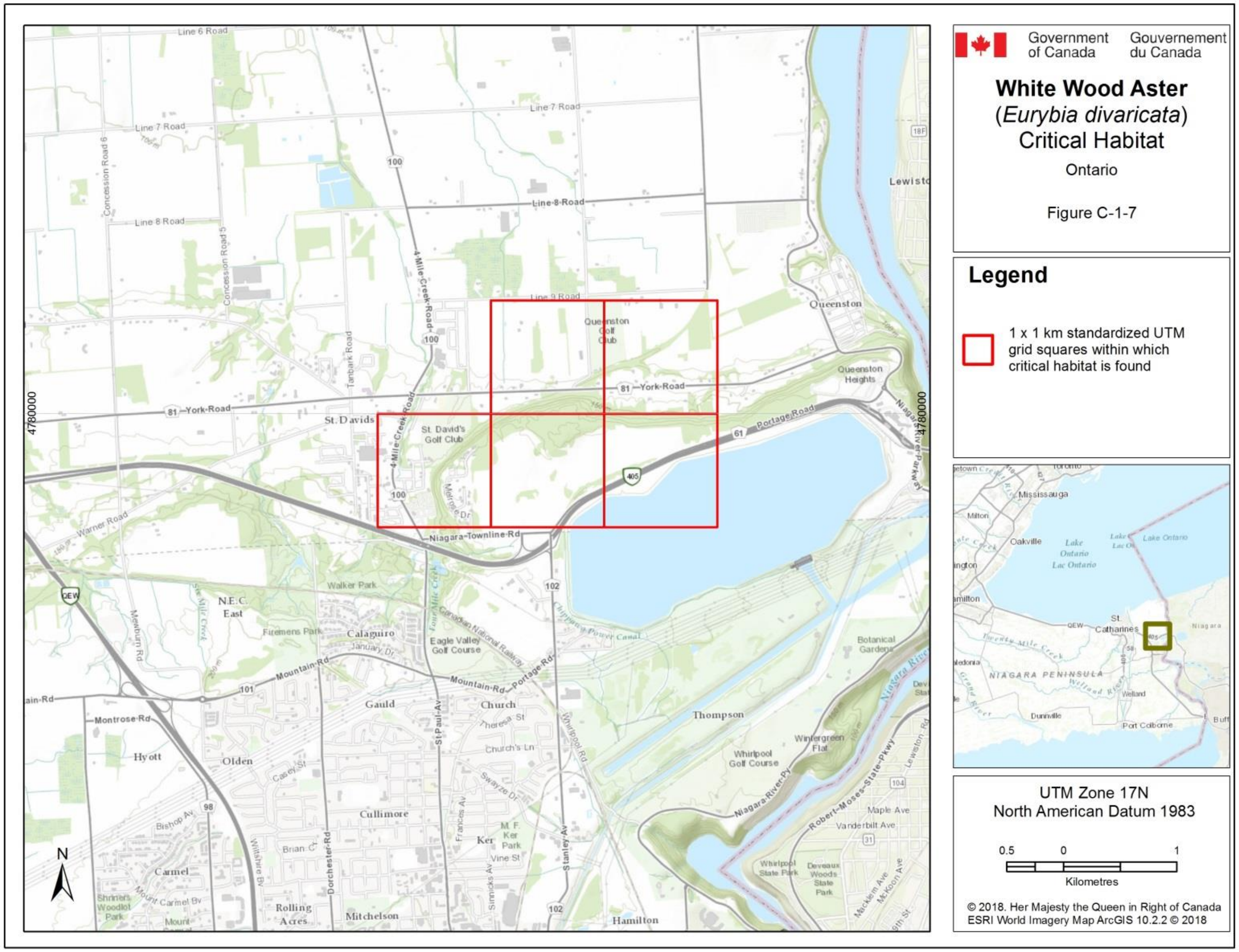

Figure C-1-7. Critical habitat for the White Wood Aster in Ontario occurs within these 1 x 1 km standardized UTM grid squares (red squares), where the criteria and methodology set out in Section 7 are met. This standardized national grid system indicates the general location within which critical habitat is found. The areas containing critical habitat, as described in Section 7.1.2, are not shown on the map.

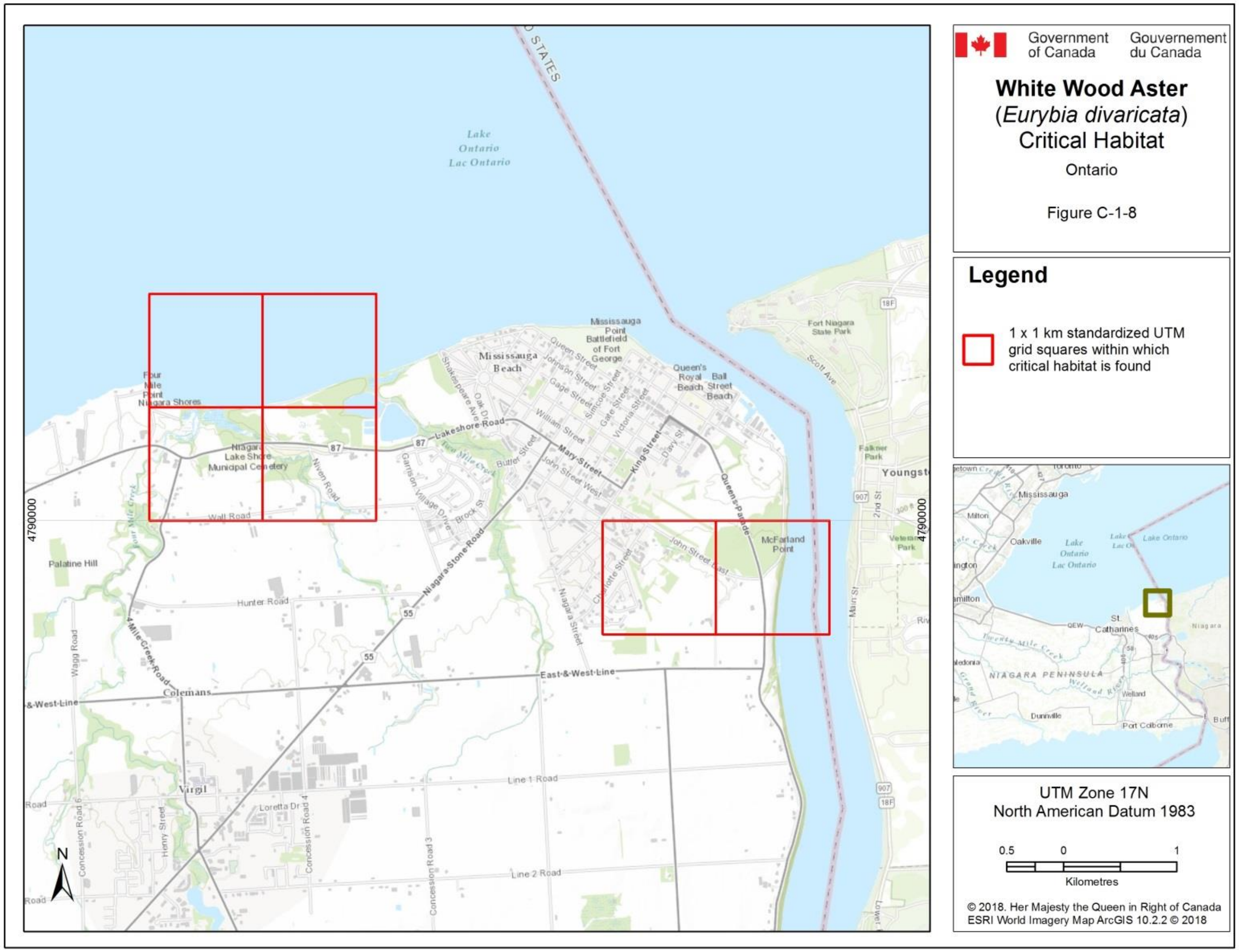

Figure C-1-8. Critical habitat for the White Wood Aster in Ontario occurs within these 1 x 1 km standardized UTM grid squares (red squares), where the criteria and methodology set out in Section 7 are met. This standardized national grid system indicates the general location within which critical habitat is found. The areas containing critical habitat, as described in Section 7.1.2, are not shown on the map.

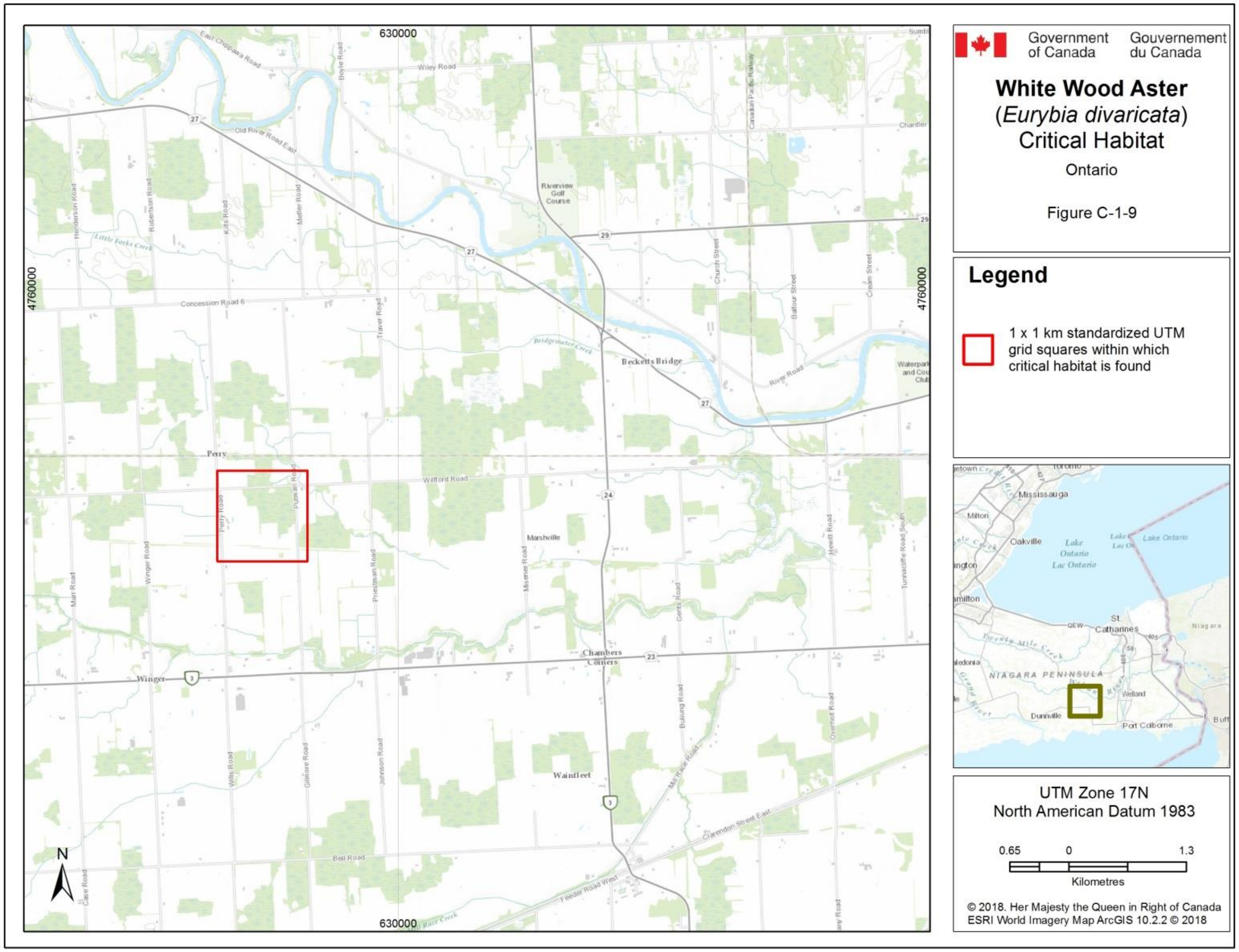

Figure C-1-9. Critical habitat for the White Wood Aster in Ontario occurs within these 1 x 1 km standardized UTM grid squares (red squares), where the criteria and methodology set out in Section 7 are met. This standardized national grid system indicates the general location within which critical habitat is found. The areas containing critical habitat, as described in Section 7.1.2, are not shown on the map.

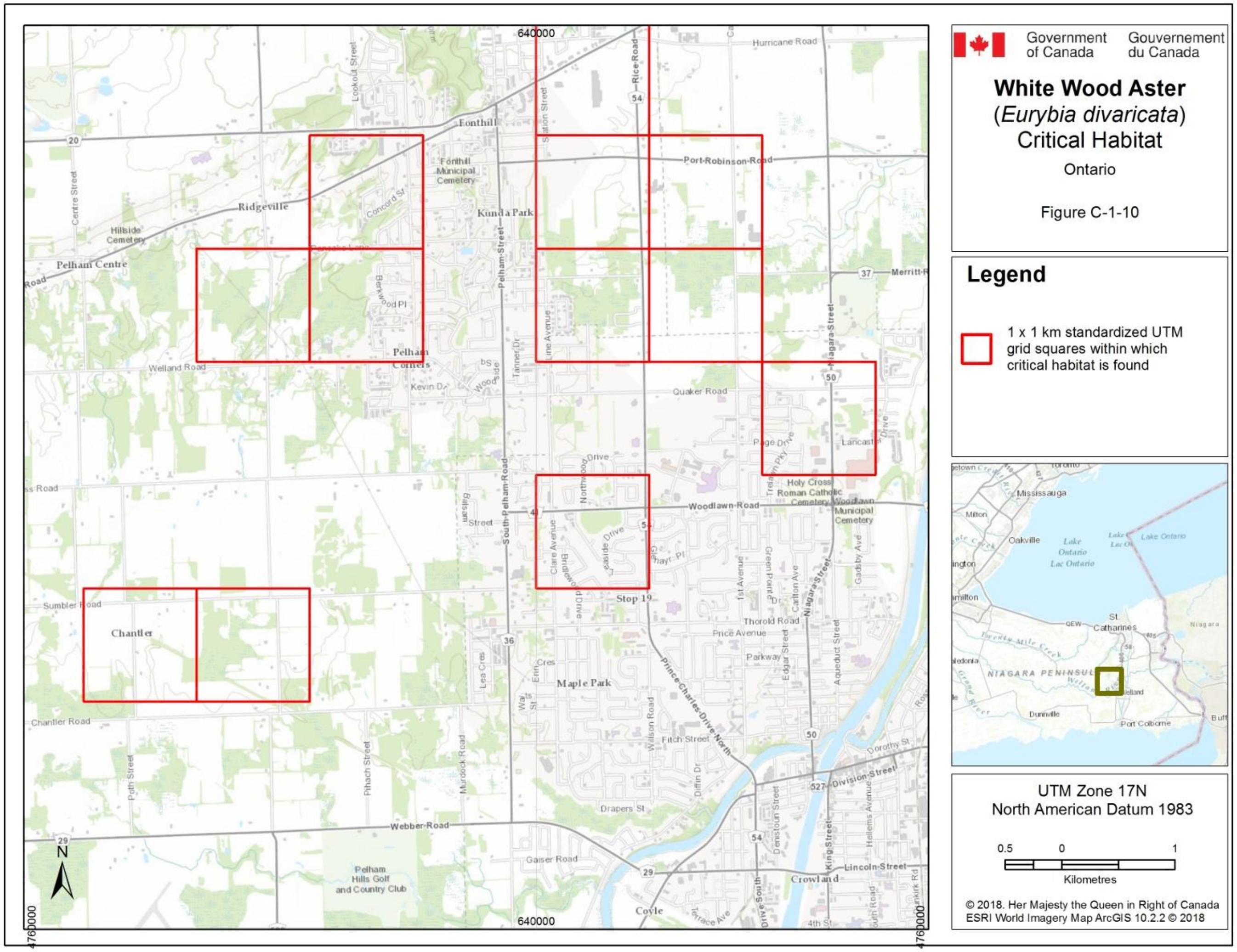

Figure C-1-10. Critical habitat for the White Wood Aster in Ontario occurs within these 1 x 1 km standardized UTM grid squares (red squares), where the criteria and methodology set out in Section 7 are met. This standardized national grid system indicates the general location within which critical habitat is found. The areas containing critical habitat, as described in Section 7.1.2, are not shown on the map.

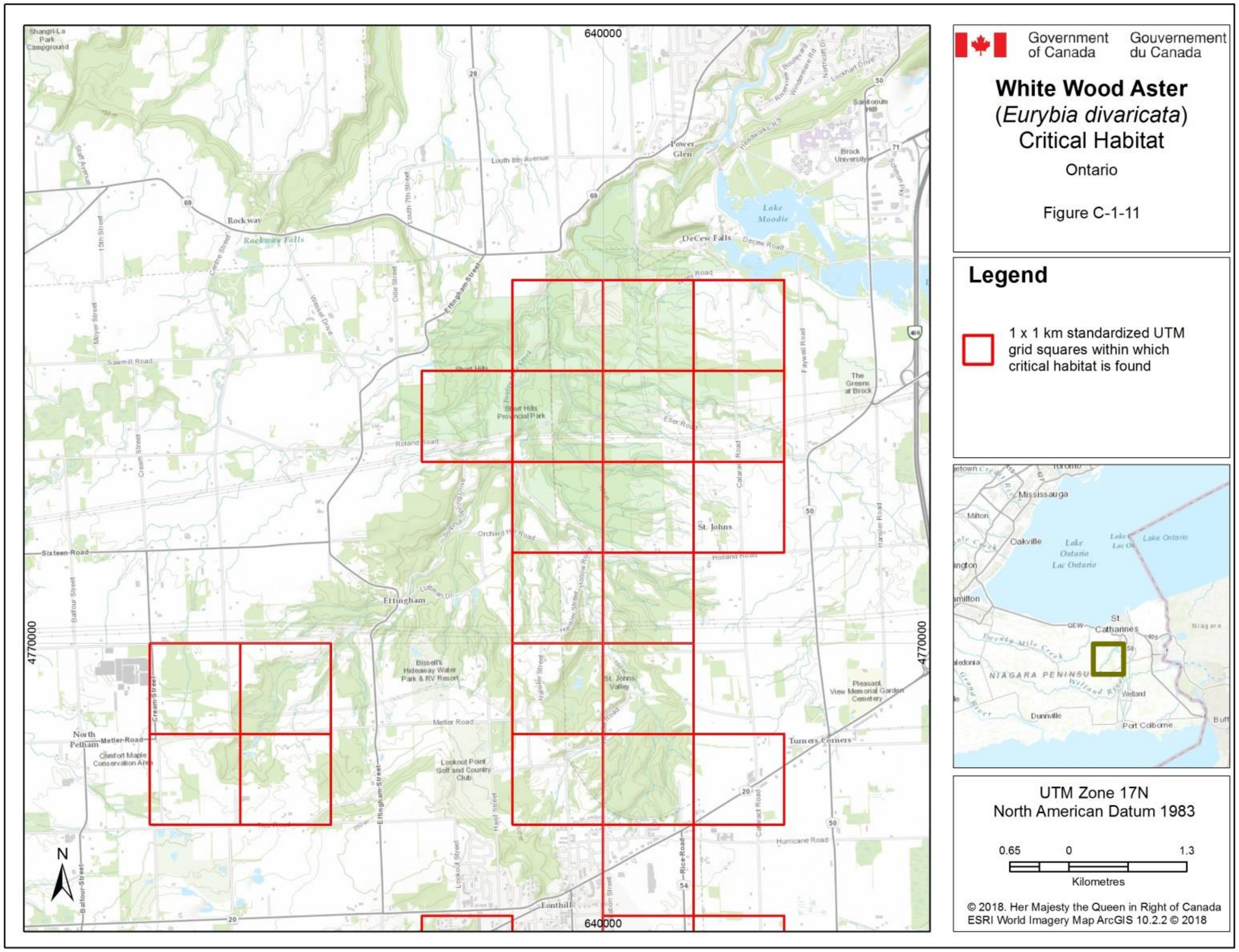

Figure C-1-11. Critical habitat for the White Wood Aster in Ontario occurs within these 1 x 1 km standardized UTM grid squares (red squares), where the criteria and methodology set out in Section 7 are met. This standardized national grid system indicates the general location within which critical habitat is found. The areas containing critical habitat, as described in Section 7.1.2, are not shown on the map.

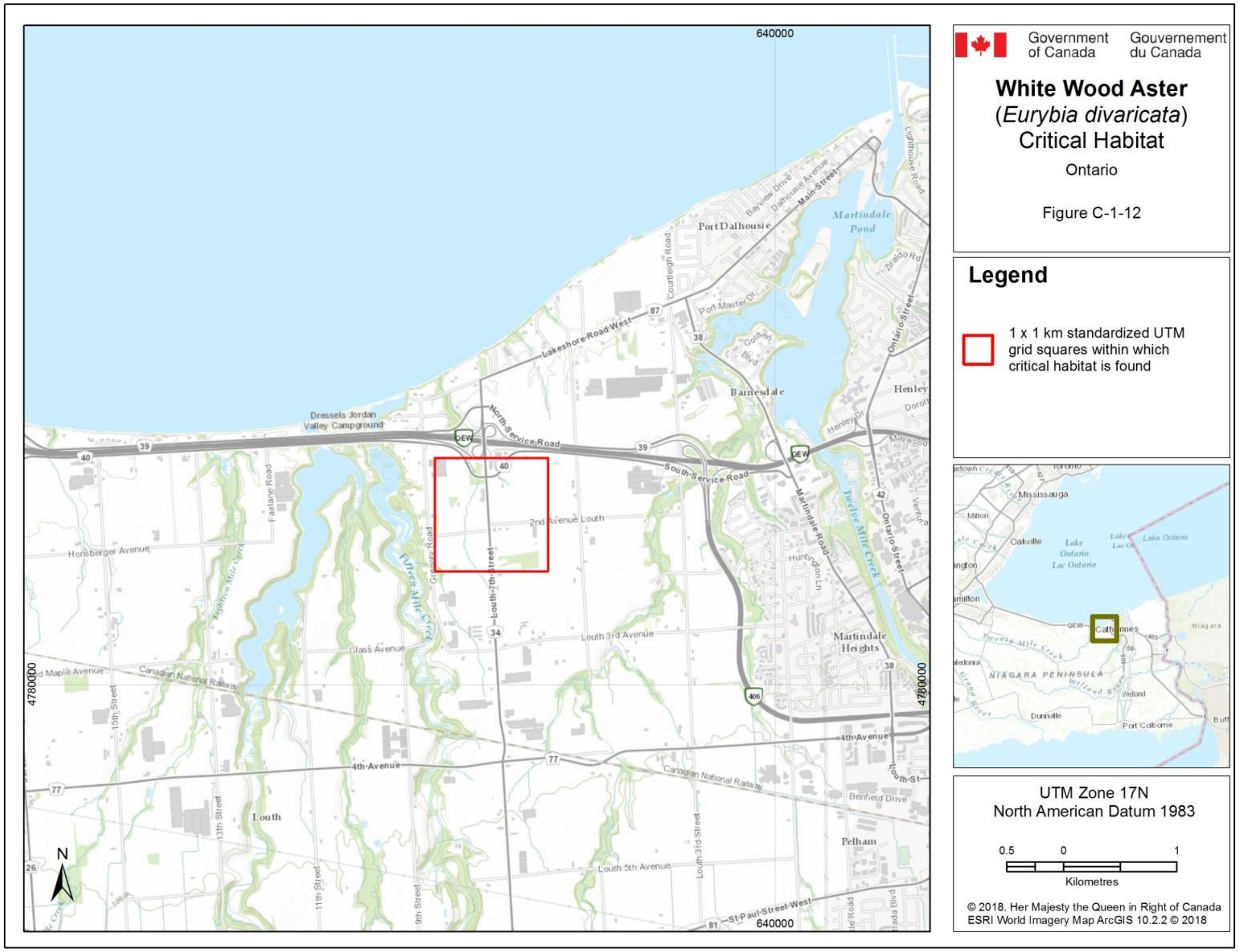

Figure C-1-12. Critical habitat for the White Wood Aster in Ontario occurs within these 1 x 1 km standardized UTM grid squares (red squares), where the criteria and methodology set out in Section 7 are met. This standardized national grid system indicates the general location within which critical habitat is found. The areas containing critical habitat, as described in Section 7.1.2, are not shown on the map.

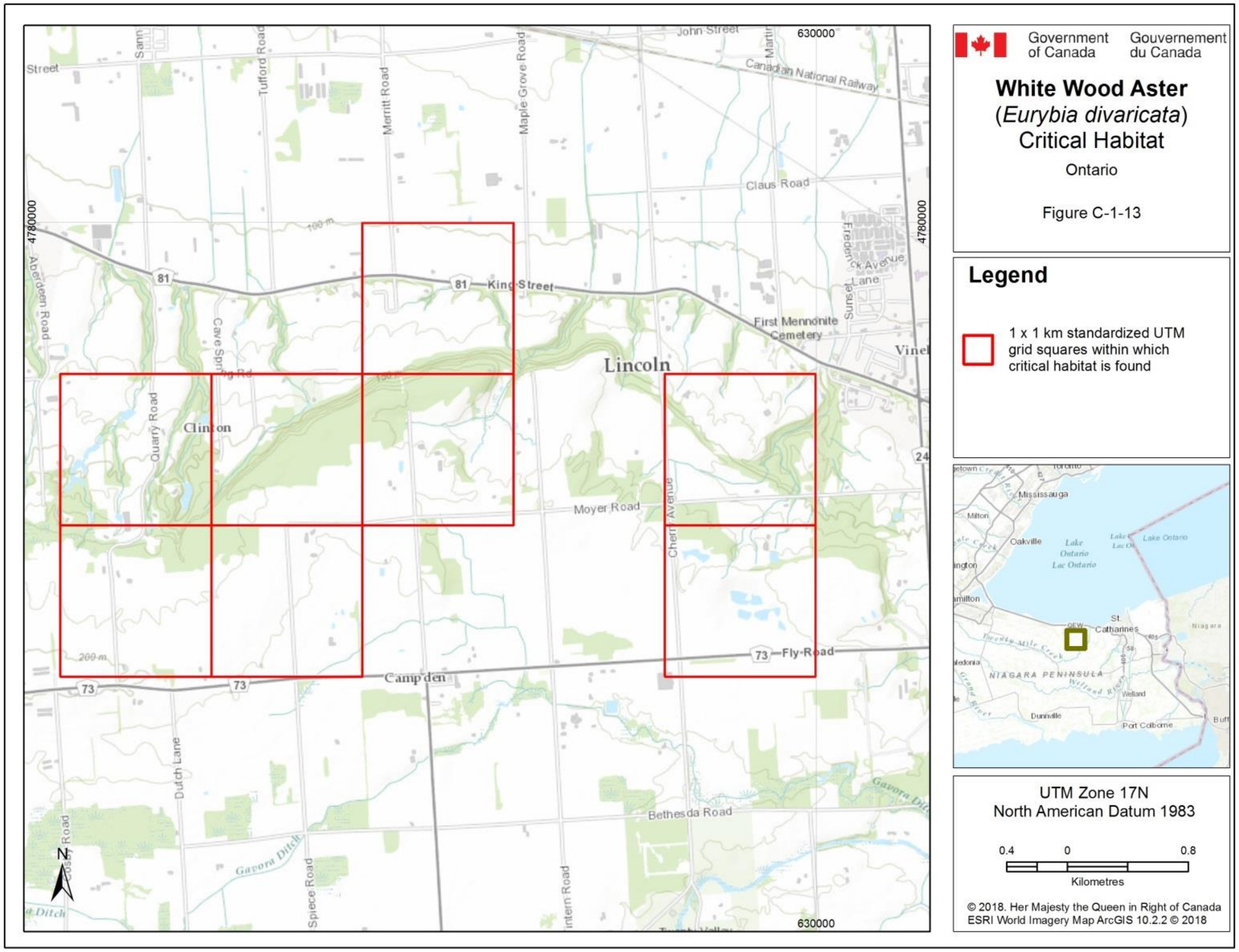

Figure C-1-13. Critical habitat for the White Wood Aster in Ontario occurs within these 1 x 1 km standardized UTM grid squares (red squares), where the criteria and methodology set out in Section 7 are met. This standardized national grid system indicates the general location within which critical habitat is found. The areas containing critical habitat, as described in Section 7.1.2, are not shown on the map.

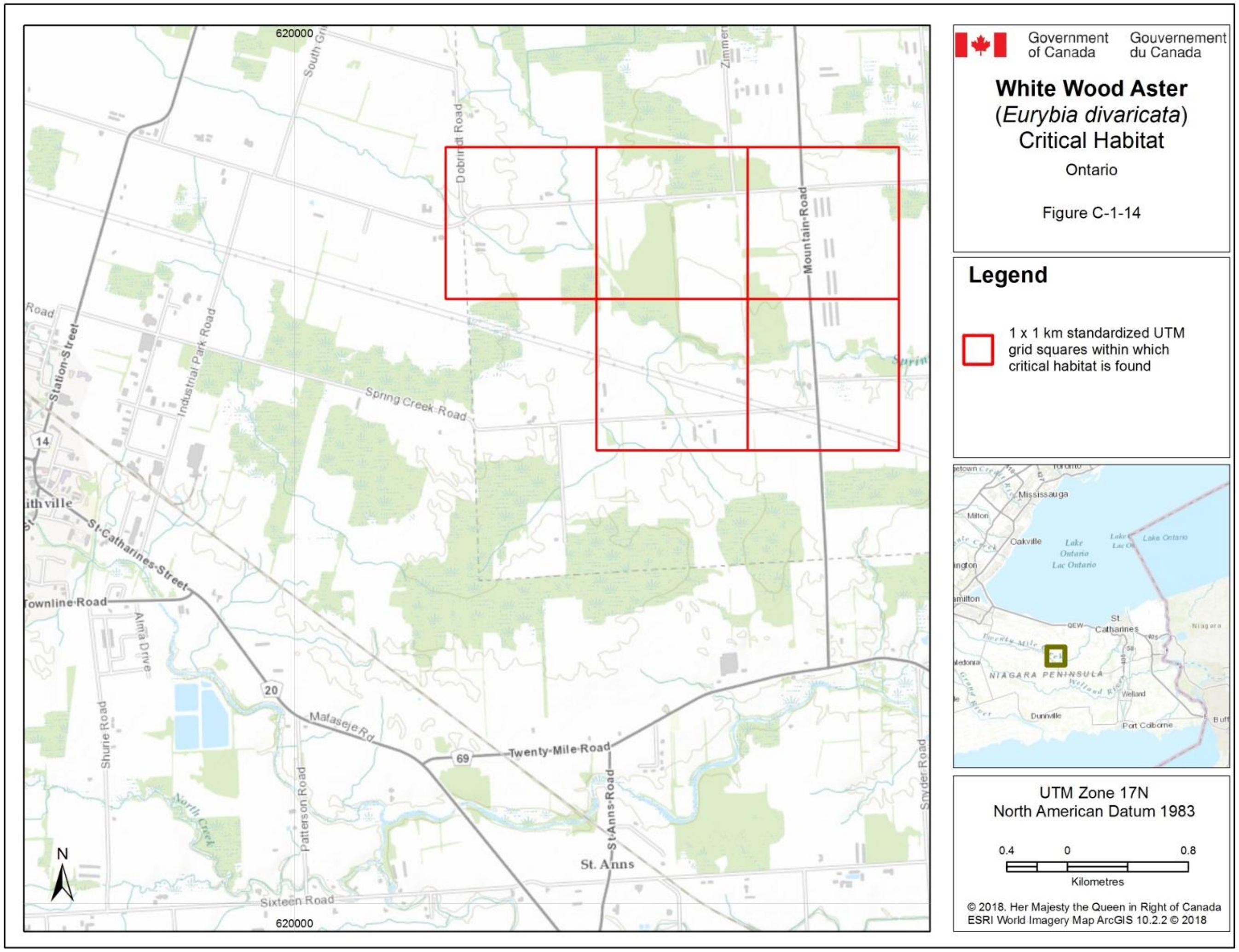

Figure C-1-14. Critical habitat for the White Wood Aster in Ontario occurs within these 1 x 1 km standardized UTM grid squares (red squares), where the criteria and methodology set out in Section 7 are met. This standardized national grid system indicates the general location within which critical habitat is found. The areas containing critical habitat, as described in Section 7.1.2, are not shown on the map.

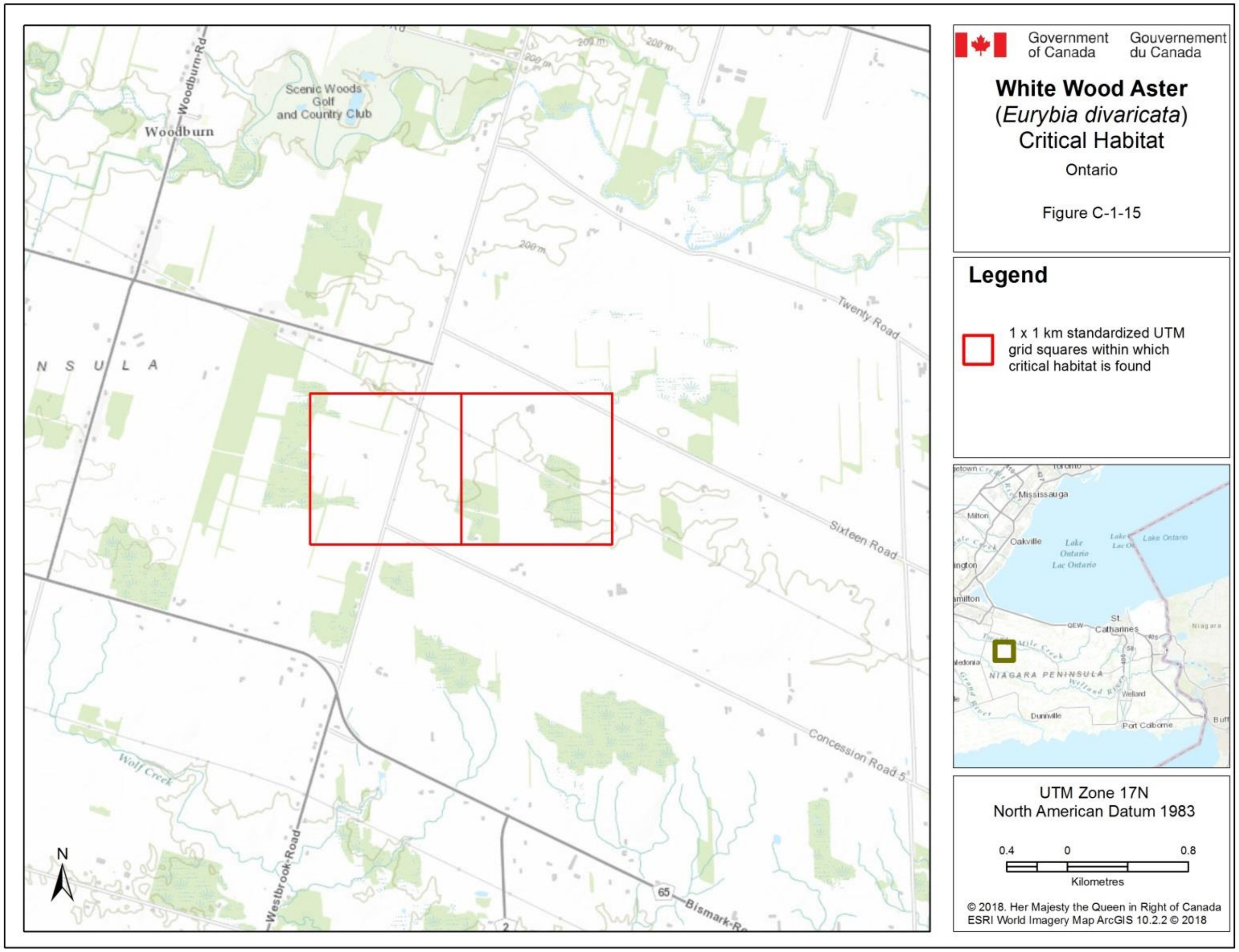

Figure C-1-15. Critical habitat for the White Wood Aster in Ontario occurs within these 1 x 1 km standardized UTM grid squares (red squares), where the criteria and methodology set out in Section 7 are met. This standardized national grid system indicates the general location within which critical habitat is found. The areas containing critical habitat, as described in Section 7.1.2, are not shown on the map.

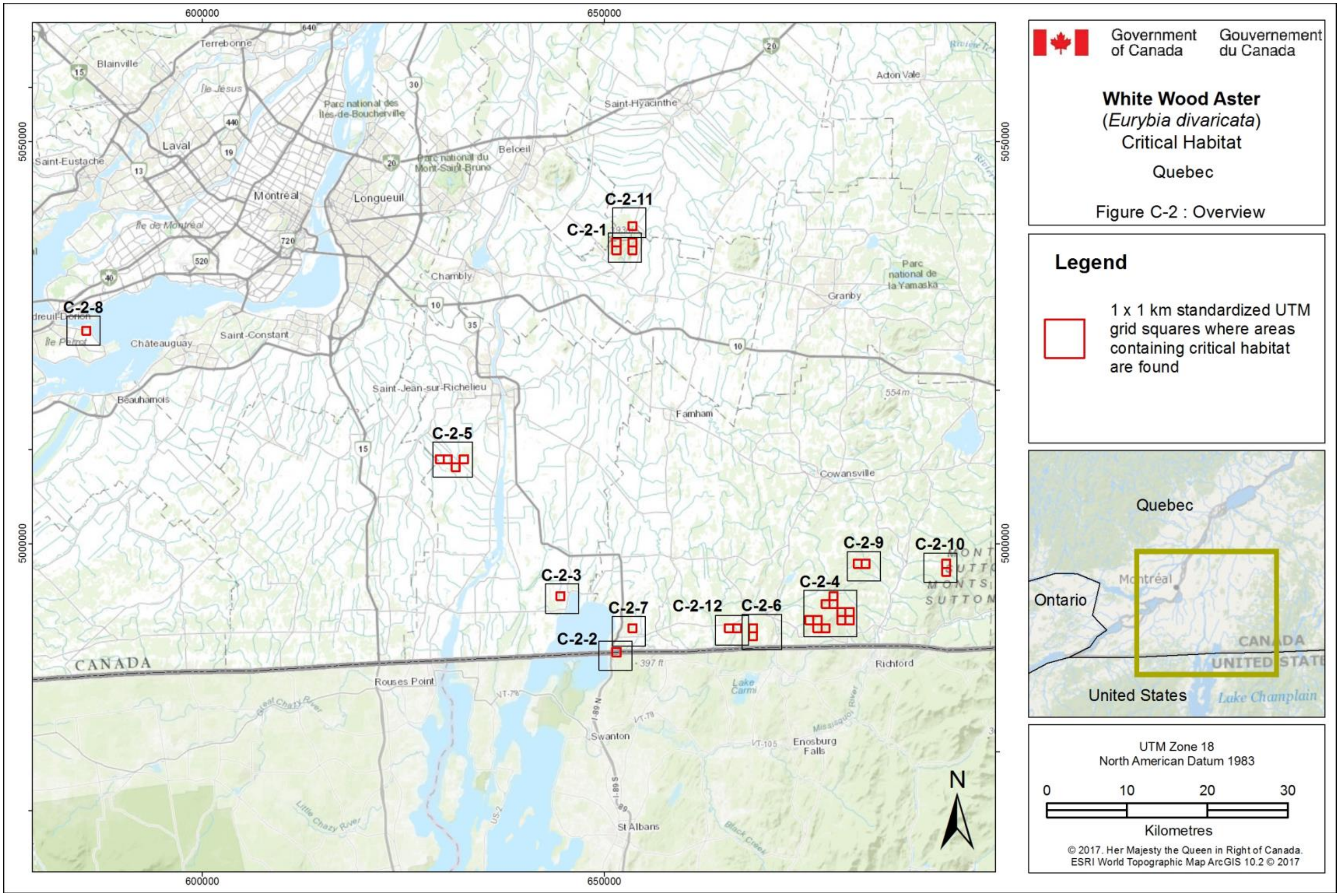

Figure C-2. Critical habitat for the White Wood Aster in Quebec occurs within the areas containing critical habitat (yellow shaded units – not shown on index map), where the criteria set out in Section 7 are met. The 1 x 1 km UTM grid (red squares) shown on the figure is a standardized national grid system that indicates the general location containing critical habitat.

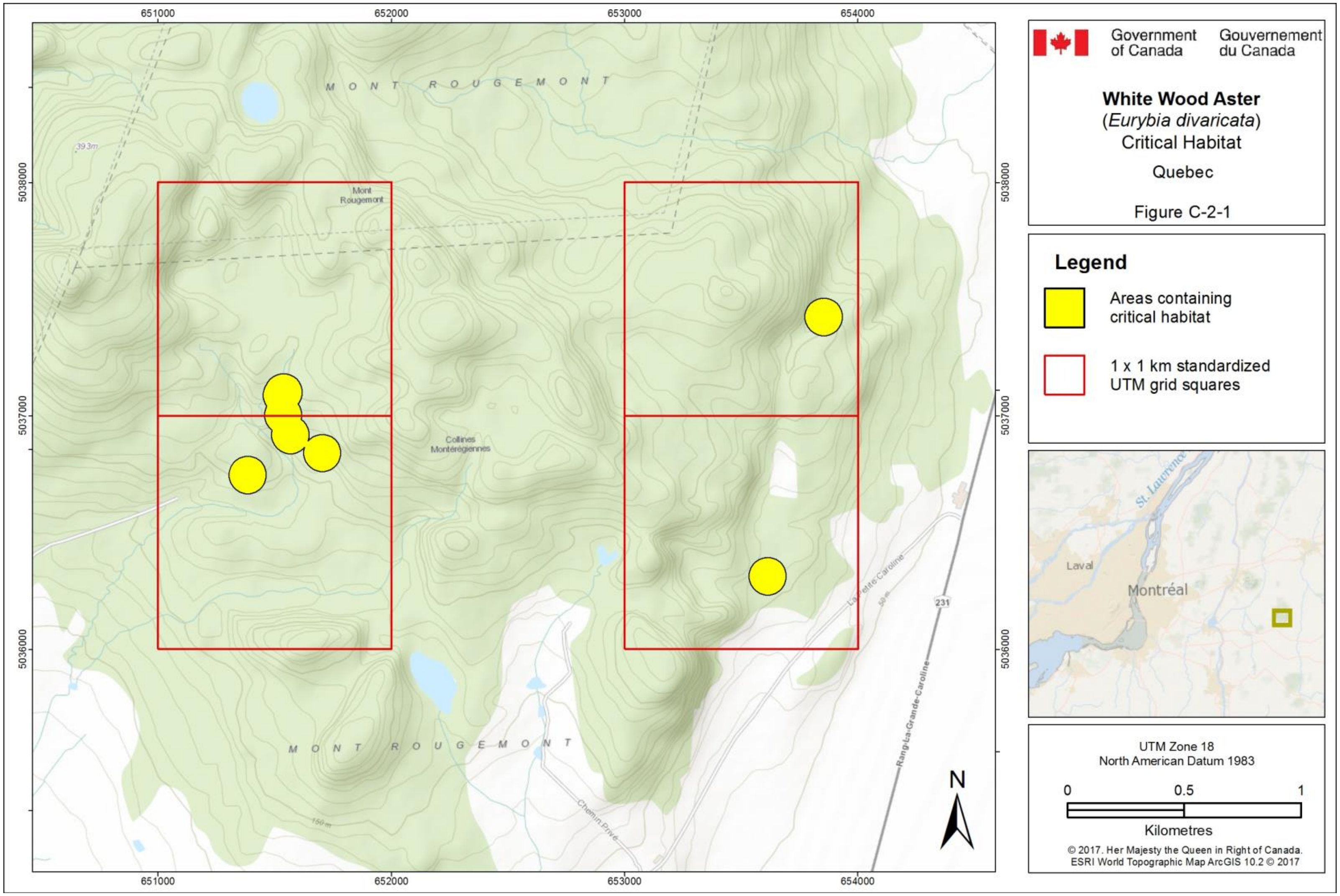

Figure C-2-1. The area containing critical habitat for the White Wood Aster in Quebec, as described in section 7, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.1 exist. The 1 km × 1 km standardized UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

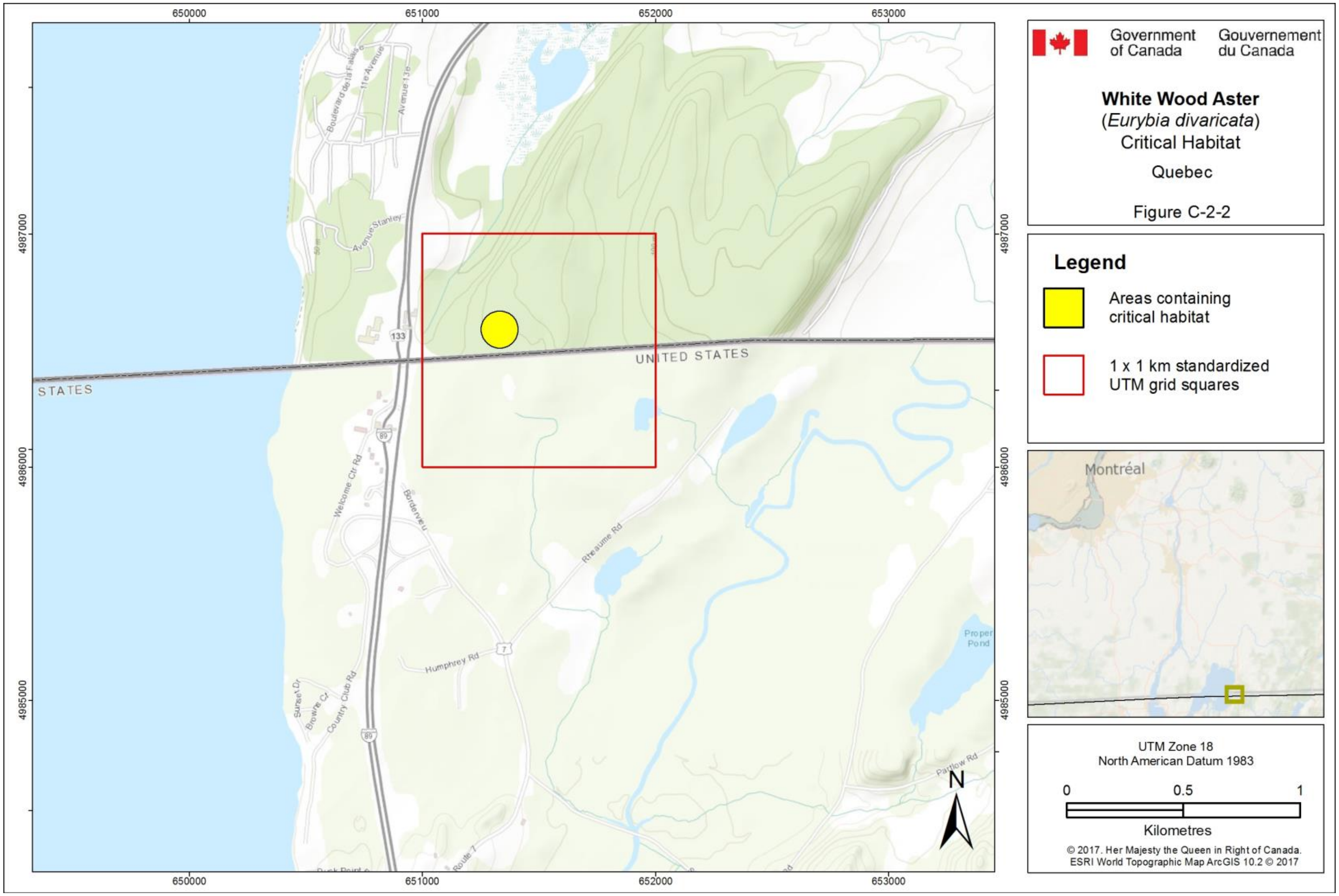

Figure C-2-2. The area containing critical habitat for the White Wood Aster in Quebec, as described in section 7, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.1 exist. The 1 km × 1 km standardized UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

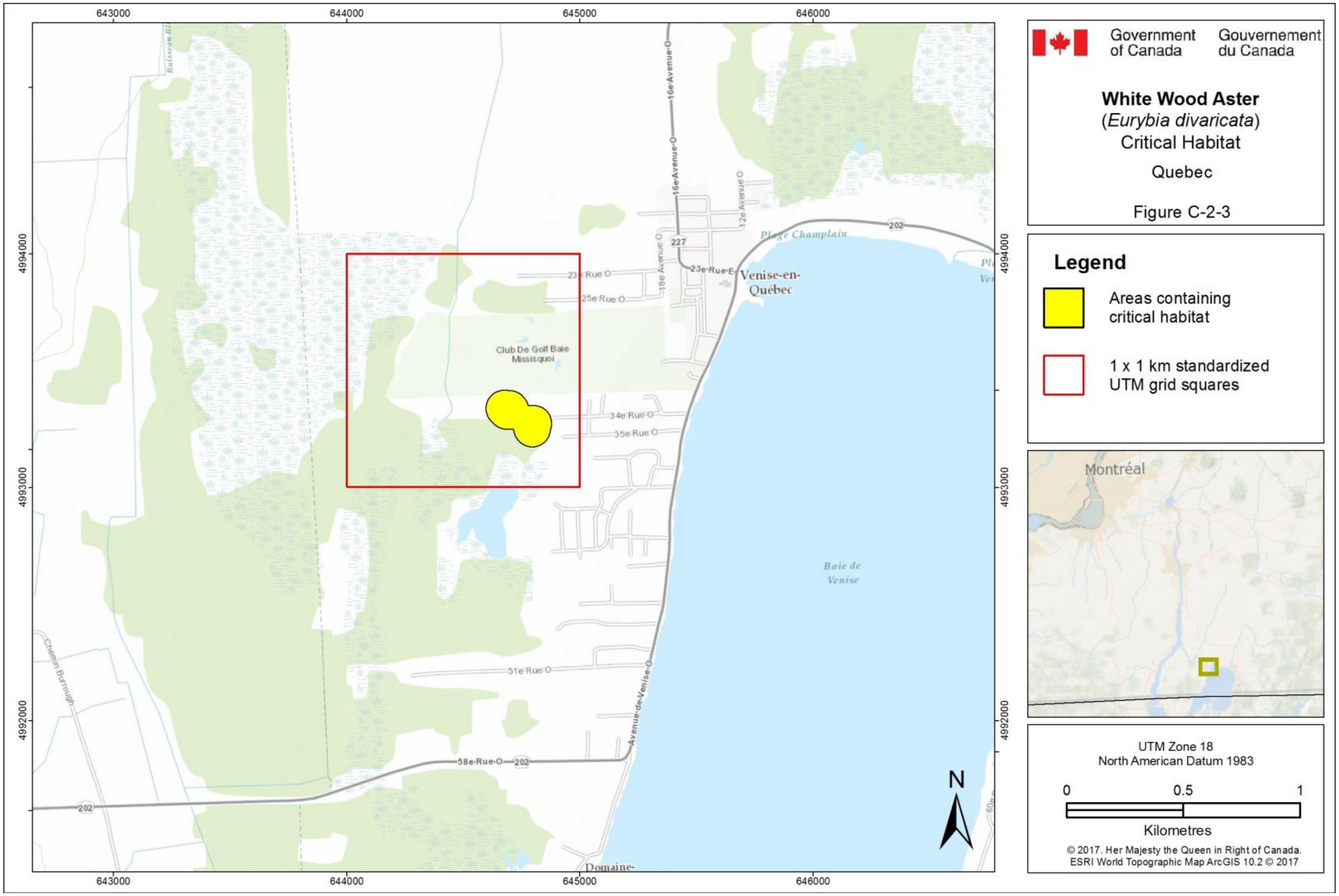

Figure C-2-3. The area containing critical habitat for the White Wood Aster in Quebec, as described in section 7, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.1 exist. The 1 km × 1 km standardized UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

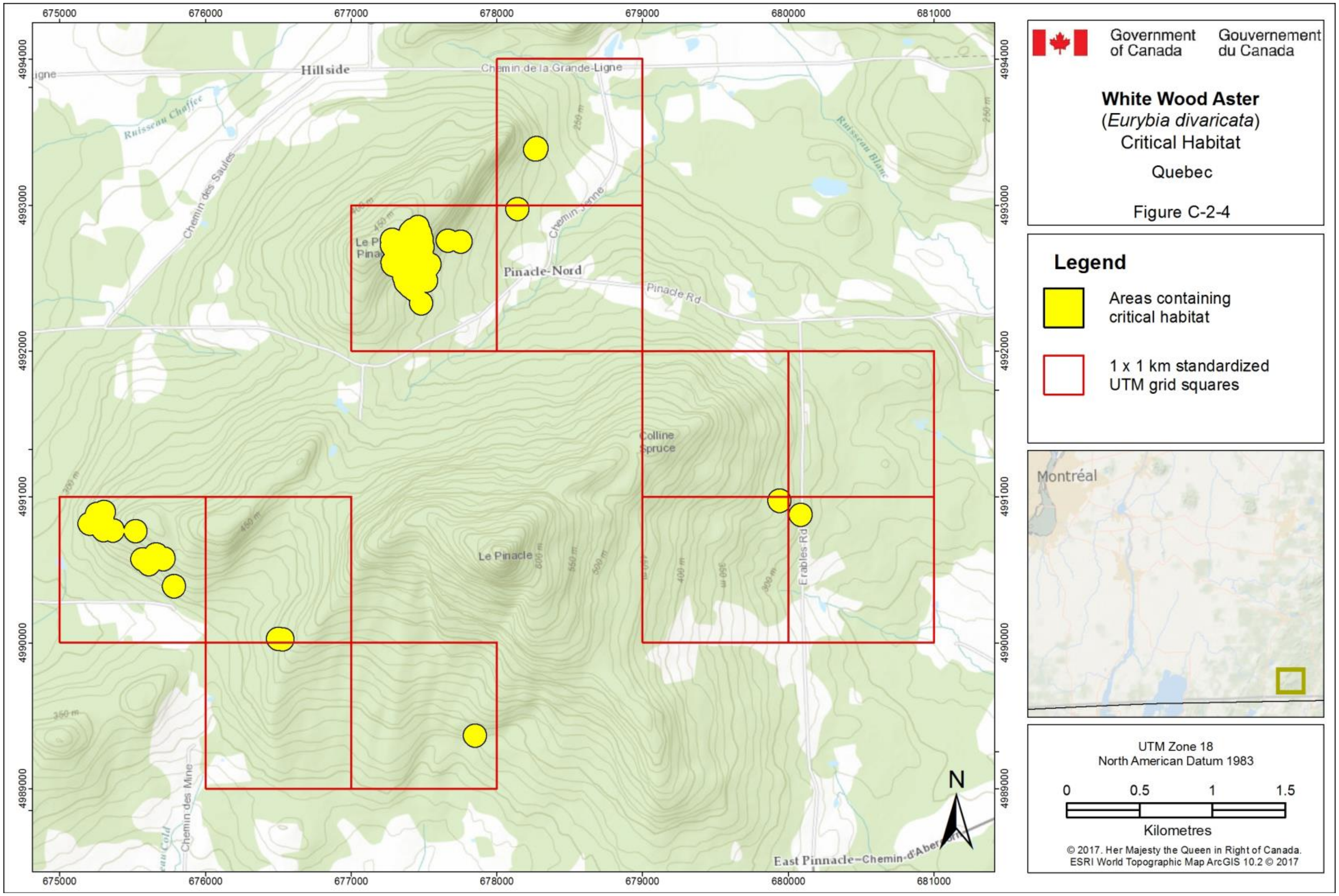

Figure C-2-4. The area containing critical habitat for the White Wood Aster in Quebec, as described in section 7, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.1 exist. The 1 km × 1 km standardized UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

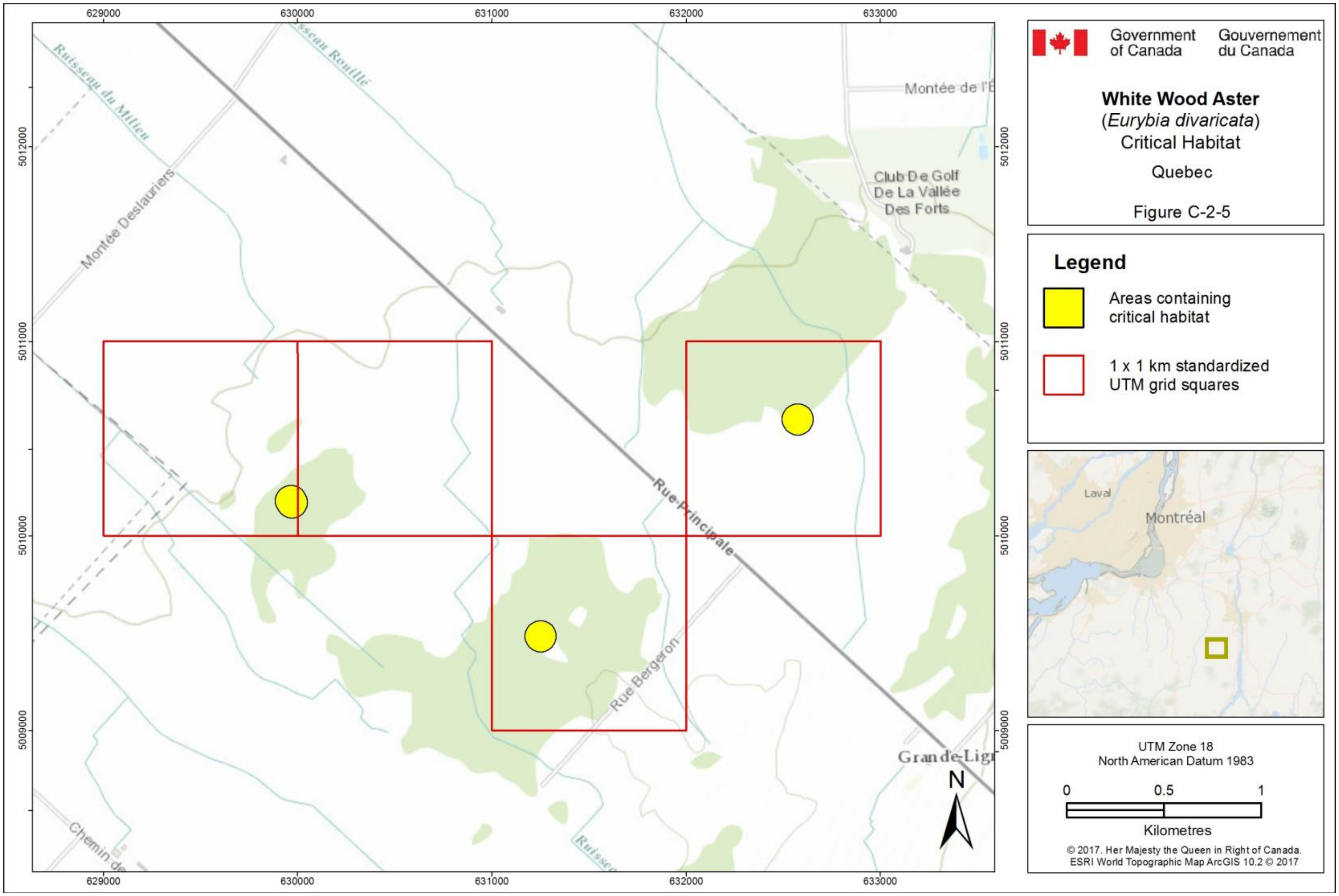

Figure C-2-5. The area containing critical habitat for the White Wood Aster in Quebec, as described in section 7, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.1 exist. The 1 km × 1 km standardized UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

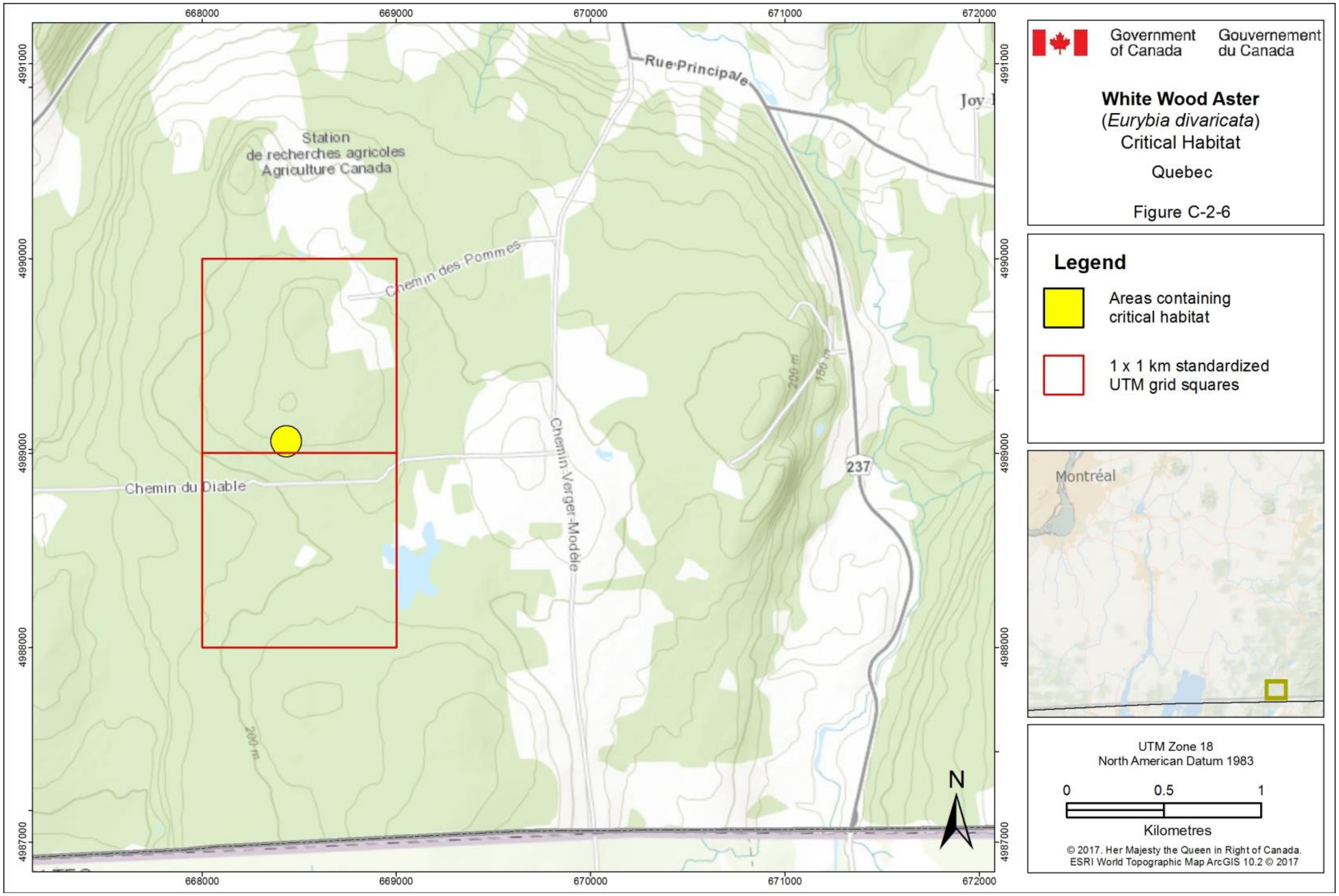

Figure C-2-6. The area containing critical habitat for the White Wood Aster in Quebec, as described in section 7, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.1 exist. The 1 km × 1 km standardized UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

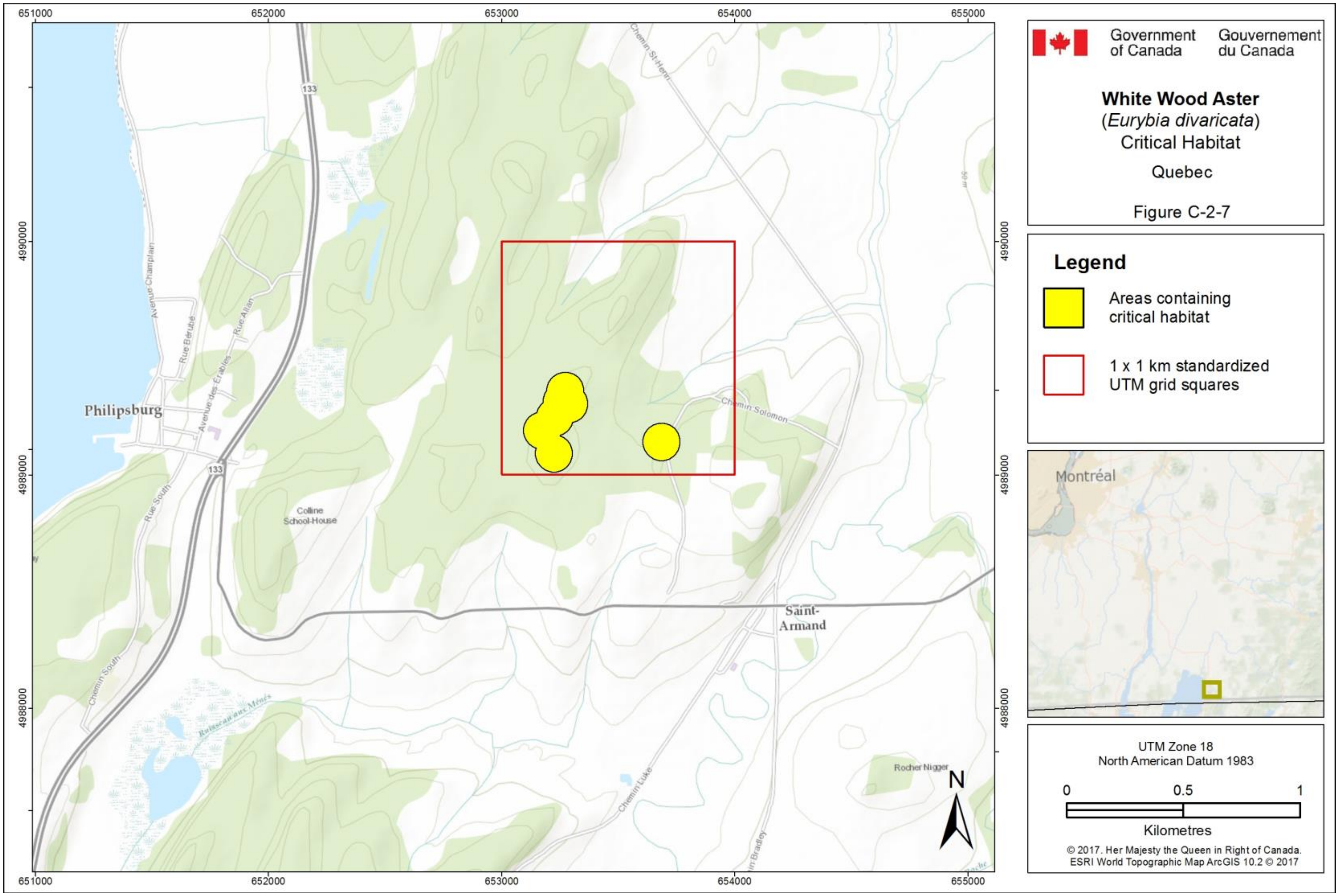

Figure C-2-7. The area containing critical habitat for the White Wood Aster in Quebec, as described in section 7, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.1 exist. The 1 km × 1 km standardized UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

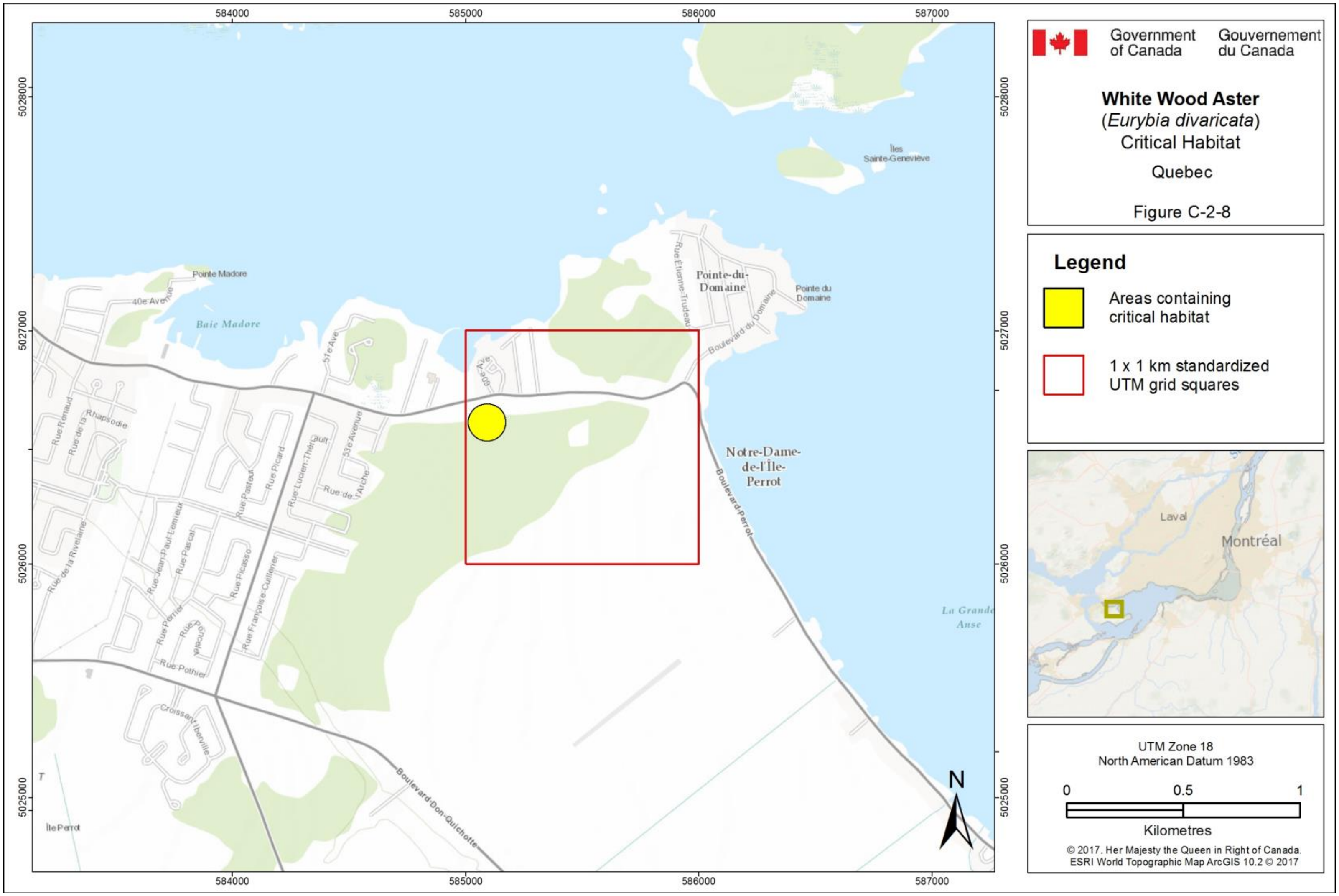

Figure C-2-8. The area containing critical habitat for the White Wood Aster in Quebec, as described in section 7, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.1 exist. The 1 km × 1 km standardized UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

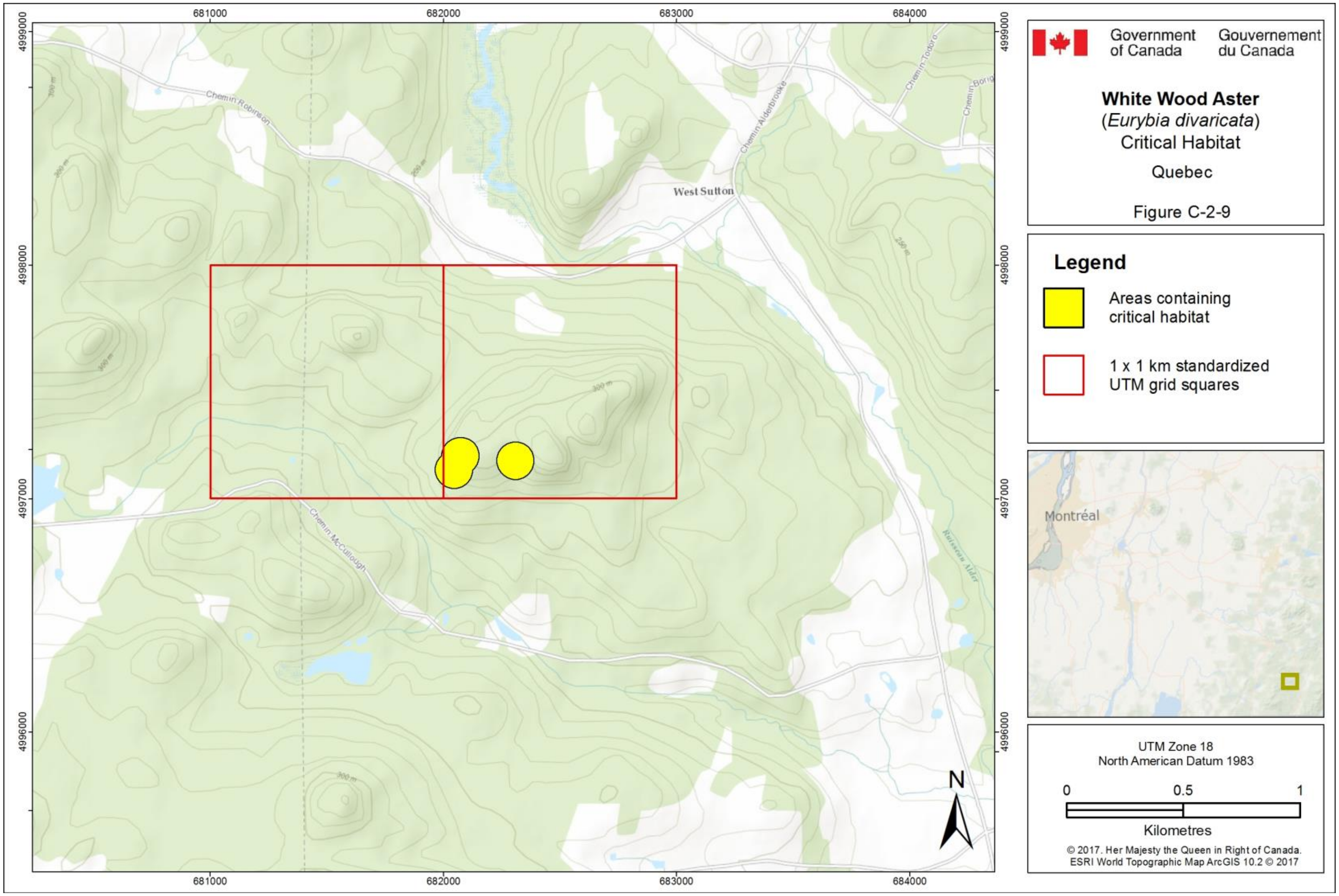

Figure C-2-9. The area containing critical habitat for the White Wood Aster in Quebec, as described in section 7, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.1 exist. The 1 km × 1 km standardized UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

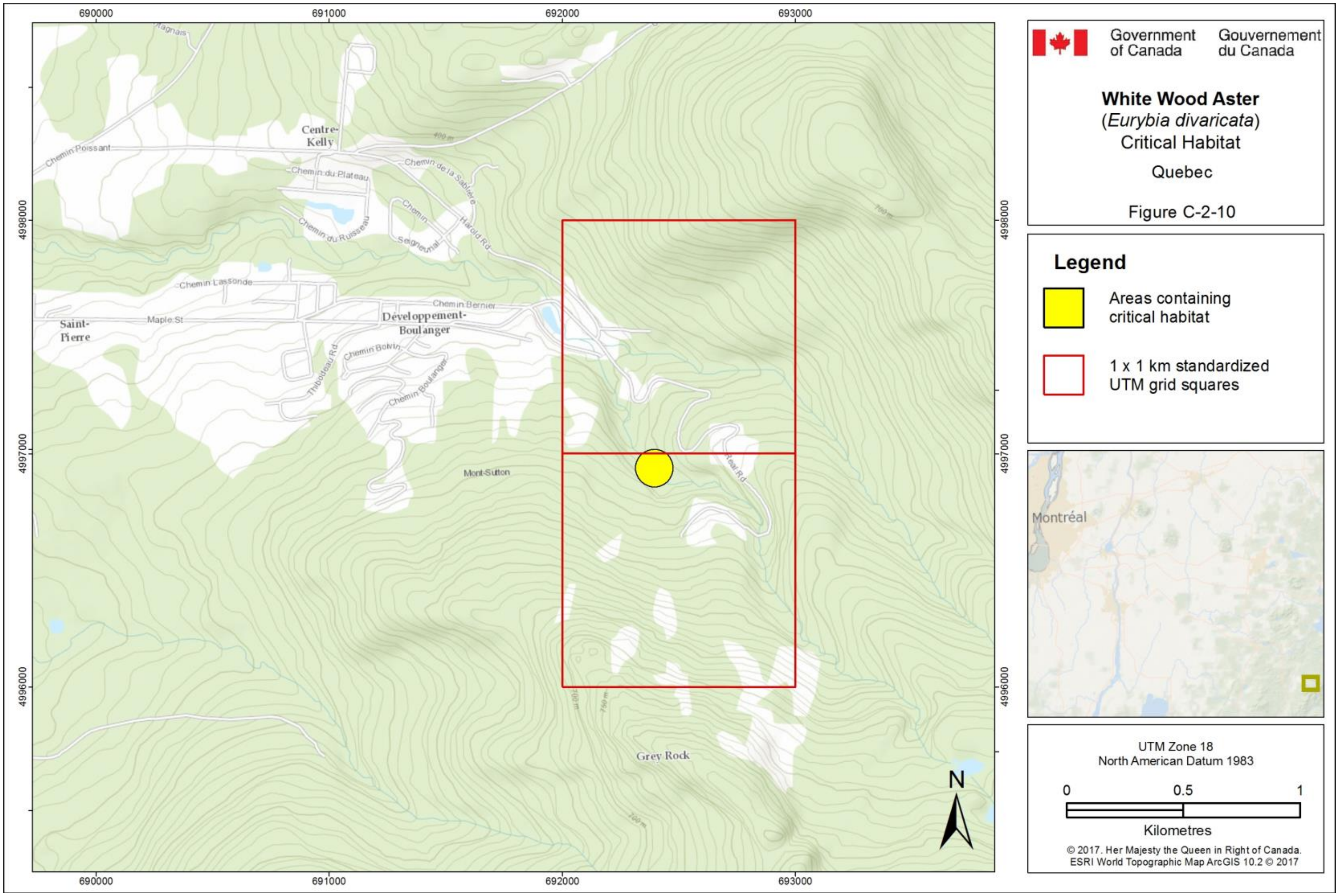

Figure C-2-10. The area containing critical habitat for the White Wood Aster in Quebec, as described in section 7, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.1 exist. The 1 km × 1 km standardized UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

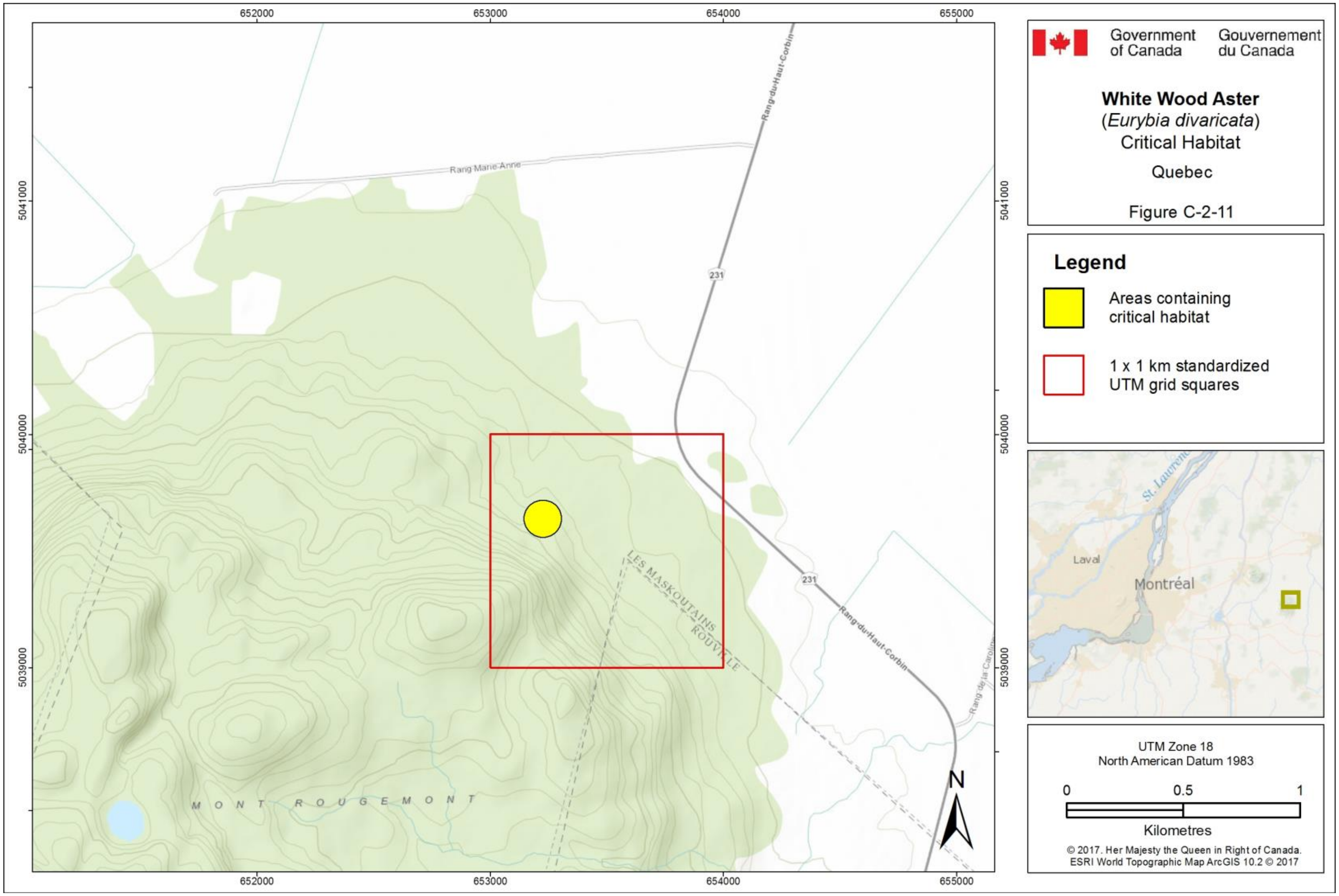

Figure C-2-11. The area containing critical habitat for the White Wood Aster in Quebec, as described in section 7, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.1 exist. The 1 km × 1 km standardized UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

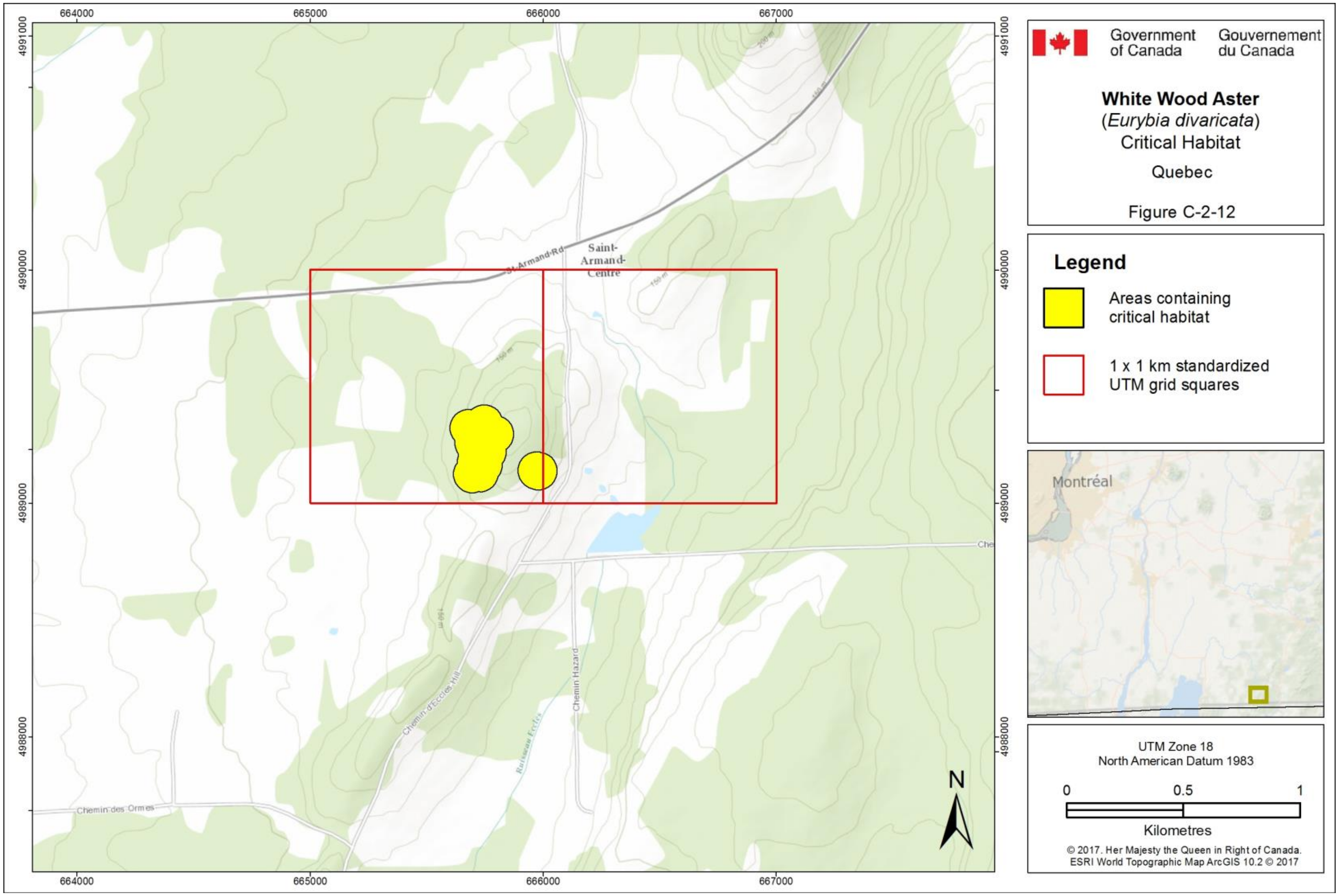

Figure C-2-12. The area containing critical habitat for the White Wood Aster in Quebec, as described in section 7, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.1 exist. The 1 km × 1 km standardized UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

Table C-1. 1 x 1 km standardized UTM grid squares within which critical habitat for the White Wood Aster is found in Canada. Critical habitat occurs where the where the criteria set out in Section 7 are met.

Local Population #	1 x 1 km Standardized UTM grid square ID[a]	UTM Grid Square Coordinates[b]		Land Tenure[c]
		Easting	Northing	
Ontario				
1	17TPH6560 17TPH6561 17TPH6570 17TPH6571 17TPH6572 17TPH6580 17TPH6581 17TPH6582	666000 666000 667000 667000 667000 668000 668000 668000	4750000 4751000 4750000 4751000 4752000 4750000 4751000 4752000	Non-federal Land
2	17TPH2797 17TPH2798	629000 629000	4777000 4778000	Non-federal Land
3	17TPH5760 17TPH5770	656000 657000	4770000 4770000	Non-federal Land
4	17TPH3698 17TPH3699 17TPH3790 17TPH4607 17TPH4608 17TPH4609 17TPH4618 17TPH4700	639000 639000 639000 640000 640000 640000 641000 640000	4768000 4769000 4770000 4767000 4768000 4769000 4768000 4770000	Non-federal Land
5	17TPH5436 17TPH5437 17TPH5445 17TPH5446 17TPH5447 17TPH5455 17TPH5456	653000 653000 654000 654000 654000 655000 655000	4746000 4747000 4745000 4746000 4747000 4745000 4746000	Non-federal Land
6	17TPH6556 17TPH6566	665000 666000	4756000 4756000	Non-federal Land
7	17TPH2714 17TPH2723 17TPH2724 17TPH2733 17TPH2734	621000 622000 622000 623000 623000	4774000 4773000 4774000 4773000 4774000	Non-federal Land
8	17TPH3658 17TPH3659 17TPH3668 17TPH3669	635000 635000 636000 636000	4768000 4769000 4768000 4769000	Non-federal Land
9	17TPH5590 17TPH5591	659000 659000	4750000 4751000	Non-federal Land
10	17TPH6501 17TPH6502	660000 660000	4751000 4752000	Non-federal Land
11	17TPH5499	659000	4749000	Non-federal Land
12	17TPH5488	658000	4748000	Non-federal Land

13	17TPH3782 17TPH3791 17TPH3792 17TPH3793 17TPH4700 17TPH4701 17TPH4702 17TPH4703 17TPH4711 17TPH4712 17TPH4713	638000 639000 639000 639000 640000 640000 640000 640000 641000 641000 641000	4772000 4771000 4772000 4773000 4770000 4771000 4772000 4773000 4771000 4772000 4773000	Non-federal Land
14	17TPH3698 17TPH3699	639000 639000	4768000 4769000	Non-federal Land
15	17TPH6527 17TPH6528 17TPH6536 17TPH6537 17TPH6538 17TPH6547	662000 662000 663000 663000 663000 664000	4757000 4758000 4756000 4757000 4758000 4757000	Non-federal Land
16	17TPH5920 17TPH5921 17TPH5930 17TPH5931	652000 652000 653000 653000	4790000 4791000 4790000 4791000	Other Federal Land and Non-federal Land
17	17TPH5730 17TPH5731 17TPH5732	653000 653000 653000	4770000 4771000 4772000	Non-federal Land
18	17TPH5869 17TPH5879	656000 657000	4789000 4789000	Other Federal Land
19	17TPH5702	650000	4772000	Non-federal Land
20	17TPH4605 17TPH4606	640000 640000	4765000 4766000	Non-federal Land
21	17TPH4624	642000	4764000	Non-federal Land
22	17TPH4603	640000	4763000	Non-federal Land
23	17TPH2587	628000	4757000	Non-federal Land
24	17TPH6554 17TPH6555 17TPH6563 17TPH6564 17TPH6565 17TPH6574 17TPH6575	665000 665000 666000 666000 666000 667000 667000	4754000 4755000 4753000 4754000 4755000 4754000 4755000	Non-federal Land
25	17TPH0734 17TPH0744	603000 604000	4774000 4774000	Non-federal Land
26	17TPH5749 17TPH5759 17TPH5769 17TPH5850 17TPH5860	654000 655000 656000 655000 656000	4779000 4779000 4779000 4780000 4780000	Non-federal Land
34	17TPH2757 17TPH2758 17TPH2767 17TPH2768 17TPH2778 17TPH2779	625000 625000 626000 626000 627000 627000	4777000 4778000 4777000 4778000 4778000 4779000	Non-federal Land

36	17TPH4691 17TPH4692 17TPH5601 17TPH5602	649000 649000 650000 650000	4761000 4762000 4761000 4762000	Non-federal Land
38	17TPH5620 17TPH5621 17TPH5630 17TPH5631	652000 652000 653000 653000	4760000 4761000 4760000 4761000	Non-federal Land
40	17TPH3675 17TPH3685 17TPH3686	637000 638000 638000	4765000 4765000 4766000	Non-federal Land
41	17TPH3662 17TPH3672	636000 637000	4762000 4762000	Non-federal Land
42	17TPH4615 17TPH4616	641000 641000	4765000 4766000	Non-federal Land
46	17TPH4691	649000	4761000	Non-federal Land
47	17TPH3871	637000	4781000	Non-federal Land
48	17TPH4605	640000	4765000	Non-federal Land
49	17TPH3686	638000	4766000	Non-federal Land
50	17TPH5592 17TPH6502	659000 660000	4752000 4752000	Non-federal Land
51	17TPH6503 17TPH6504 17TPH6513 17TPH6514	660000 660000 661000 661000	4753000 4754000 4753000 4754000	Non-federal Land
52	17TPH5560 17TPH5561 17TPH5570 17TPH5571	656000 656000 657000 657000	4750000 4751000 4750000 4751000	Non-federal Land
Québec				
1	18TXR5136	651000	5036000	Non-federal Land
	18TXR5137	651000	5037000	
	18TXR5336	653000	5036000	
	18TXR5337	653000	5037000	
2	18TXQ5186	651000	4986000	Non-federal Land
3	18TXQ4493	644000	4993000	Non-federal Land
5	18TXQ7590	675000	4990000	Non-federal Land
	18TXQ7689	676000	4989000	
	18TXQ7690	676000	4990000	
	18TXQ7789	677000	4989000	
	18TXQ7792	677000	4992000	
	18TXQ7892	678000	4992000	
	18TXQ7893	678000	4993000	
	18TXQ7990	679000	4990000	
	18TXQ7991	679000	4991000	
	18TXQ8090	680000	4990000	
	18TXQ8091	680000	4991000	
6	18TXR2910	629000	5010000	Non-federal Land
	18TXR3010	630000	5010000	
	18TXR3109	631000	5009000	
	18TXR3210	632000	5010000	
7	18TXQ6888	668000	4988000	Non-federal Land
	18TXQ6889	668000	4989000	
8	18TXQ5389	653000	4989000	Non-federal Land

9	18TWR8526	585000	5026000	Non-federal Land
10	18TXQ8197	681000	4997000	Non-federal Land
	18TXQ8297	682000	4997000	
11	18TXQ9296	692000	4996000	Non-federal Land
	18TXQ9297	692000	4997000	
12	18TXR5339	653000	5039000	Non-federal Land
13	18TXQ6589	665000	4989000	Non-federal Land
	18TXQ6689	666000	4989000	

[a] Based on the standard UTM Military Grid Reference System (see http://www.nrcan.gc.ca/earth-sciences/geography/topographic-information/maps/9789), where the first 2 digits and letter represent the UTM Zone, followed by a letter representing the UTM Band, 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, and the last 2 digits indicate the 1 x 1 km standardized UTM grid containing the geographic location of the area containing critical habitat. 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).

[b] The listed coordinates are a cartographic representation of where the areas containing critical habitat can be found, presented as the southwest corner of the 1 x 1 km standardized UTM grid square. The coordinates are provided as a general location only.

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

Appendix D: 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*[16]. 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[17] (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 incorporates 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.

The potential for this recovery strategy to inadvertently lead to adverse effects on other species was considered. Some habitat restoration activities, including opening forest canopy, have the potential to harm certain other species, at least in the short term. The ecological risks of such activities must be considered individually before undertaking them, in order to reduce possible negative effects. Some species, such as the Hooded Warbler (*Wilsonia citrina*), are expected to benefit from tree canopy openings created through activities aimed at restoring habitat for the White Wood Aster. In general, protecting the deciduous forest habitat of this species in Canada will benefit other species that co-occur with the White Wood Aster including several species at risk such as the Round-leaved Greenbrier (*Smilax rotundifolia*), Cucumber Tree (*Magnolia acuminata*), American Columbo (*Frasera caroliniensis)*, and Eastern Flowering Dogwood (*Cornus florida*). Controlling invasive species and promoting responsible recreational use of public trails are also expected to be beneficial to other native species that occur with the White Wood Aster.

Because of the potential benefit of forest conservation and management to several other species at risk, the SEA concluded that this strategy will clearly benefit the environment and will not entail significant adverse effects.

[16] www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1.
[17] www.ec.gc.ca/dd-sd/default.asp?lang=En&n=CD30F295-1.