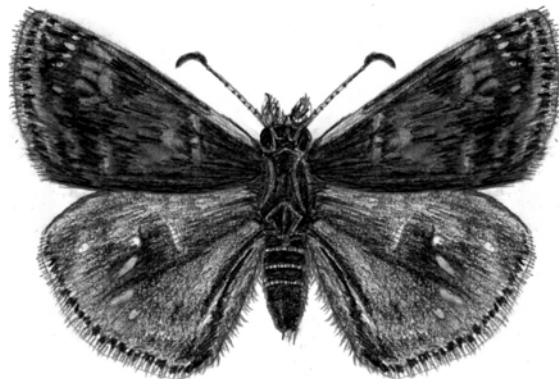


COSEWIC
Assessment and Status Report

on the

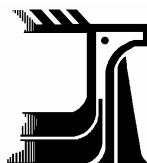
Eastern Persius Duskywing
Erynnis persius persius

in Canada



ENDANGERED
2006

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA



COSEPAC
COMITÉ SUR LA SITUATION
DES ESPÈCES EN PÉRIL
AU CANADA

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Production note:

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Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur l'Hespérie Persius de l'Est (*Erynnis persius persius*) au Canada.

Cover illustration:
Eastern Persius Duskywing — Original drawing by Andrea Kingsley

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COSEWIC Assessment Summary

Assessment Summary – April 2006

Common name

Eastern Persius Duskywing

Scientific name

Erynnis persius persius

Status

Endangered

Reason for designation

This lupine-feeding butterfly has been confirmed from only two sites in Canada. It inhabits oak savannahs in southern Ontario, a habitat that has undergone substantial declines and alterations. Larval host plant populations have been greatly reduced. There have been no confirmed records of this butterfly for 18 years, but unconfirmed sight records suggest that the species might still exist in Canada.

Occurrence

Ontario

Status history

Designated Endangered in April 2006. Assessment based on a new status report.



COSEWIC
Executive Summary

Eastern Persius Duskywing
Erynnis persius persius

Species information

The Persius Duskywing (*Erynnis persius*) is a small, dark butterfly with four tiny white spots on the forewings. It is in the group of butterflies known as skippers in the subfamily Pyrginae, within the family Hesperiiidae. The species is presently separated into four described subspecies, one of which, the Eastern Persius Duskywing is the subject of this report.

Distribution

As presently recognized, the range of the Persius Duskywing extends from the north Atlantic states within the United States, westward to the Pacific Coast, north to the Yukon and south to California. The Eastern Persius Duskywing occupies the eastern portion of this range, from the north Atlantic states to the Great Lakes region. The subspecies' known range in Canada is restricted to southwestern Ontario.

Habitat

Eastern Persius Duskywings are believed to be restricted to sites where the larval food plants, wild lupine and wild indigo, grow. Typically, they are found in open oak savannahs, pine barrens and prairies or other open, sunny locations, such as forest glades and road rights-of-way.

Biology

Adult Eastern Persius Duskywings fly from early May to early June in Canada. Eggs are laid singly on new leaves of wild lupines or wild indigo, and the caterpillars grow to maturity by July. The caterpillars enter diapause during the last instar and overwinter. The following spring they complete development and emerge as adults.

Population sizes and trends

The Eastern Persius Duskywing has declined in much of its range, and is widely considered to be rare. It is considered to be extirpated from Maine and has not been reported from Maryland, New Jersey or New York in the last twenty years. In Ontario, it

was first collected in 1969 and was last reported in 1987. Provincial sources consider the Eastern Persius Duskywing to be extirpated in Ontario and therefore Canada.

Limiting factors and threats

It is believed that the Eastern Persius Duskywing has suffered from poor habitat management and habitat change, which resulted in sharp decreases and destruction of populations of host plants. Wild lupines and wild indigo are the only known host plants for the caterpillars of the Eastern Persius Duskywing. Natural succession of open woodland, fire suppression, and direct anthropogenic alterations of the habitat through resource extraction or tree-planting have adversely affected many areas that may have been occupied by this skipper in the past.

Special significance of the species

The Eastern Persius Duskywing is a lupine-feeder, like the Karner Blue and the Frosted Elfin. Together, these butterflies are representative of a rare and declining natural community within northeastern North America. Attention drawn to the Eastern Persius Duskywing and the other butterflies may aid in conserving the special animal and plant community of which they are a part.

Existing protection or other status designations

The Eastern Persius Duskywing is designated as Endangered in Indiana, New Hampshire, New York and Ohio; Threatened in Michigan and Massachusetts; and of Special Concern in Connecticut and Pennsylvania. It is considered to be extirpated from Maine. Provincial sources consider the Eastern Persius Duskywing to be extirpated in Ontario and therefore Canada. It is not specifically protected under any federal or provincial legislation in Canada.



COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5th 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS (2006)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and it is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.



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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

COSEWIC Status Report

on the

Eastern Persius Duskywing

Erynnis persius persius

in Canada

2006

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SPECIES INFORMATION

Name and classification

Scientific name: *Erynnis persius persius* (Scudder, 1863)
Synonyms: *Nisionades persius*, *Thanaos persius*
Bibliographic Citation: Scudder, S.H. 1863. A list of the butterflies of New England. Proceedings of the Essex Institute 3: 161-179.
Type Loc. = New England.
English names: Persius Duskywing
French name: Hespérie Persius de l'Est

The Persius Duskywing (*Erynnis persius*) was first described in 1863, but the original description is ambiguous, and Scudder (1863) was undoubtedly confusing *E. persius* with the Wild Indigo Duskywing (*E. baptisiae* (Forbes)) and the Columbine Duskywing (*E. lucilius* (Scudder and Burgess)), neither of which were described at the time. Confusion persisted in later works, such as that by Skinner (1914), which depicted male genitalia of what is considered by M. Holder to be *E. baptisiae*. However, Scudder and Burgess (1870) and Forbes (1936) accurately described and portrayed genitalia of *E. persius*. Although Forbes (1936) mentioned type material and depicted genitalia from the type specimen, Scudder (1863) did not assign types in his original description and it is unclear where the type material is deposited, if this material still exists.

Four subspecies of the Persius Duskywing have been described, three of which may occur in Canada: *E. p. persius*, *E. p. borealis* and *E. p. avinoffi*. The subspecies *borealis* was described by Cary (1907), but was originally designated a race of the Propertius Duskywing (*E. propertius* Scudder and Burgess). This common and widespread race is found across northern and western Canada, from James Bay in Ontario to Yukon. The known ranges of *E. p. borealis* and *E. p. persius* do not overlap, but appear disjunct by at least 1,000 km (Figure 1), as judged by collection data presented by the Canadian Biodiversity Information Facility (2005), and the United States Geological Survey (2005). *Erynnis (p.) avinoffi* (Holland 1930) was described from a series of specimens collected in the Yukon River Valley and sites in Alaska. This subspecies' distribution is unclear, other than the localities mentioned in the original description, and Layberry *et al.* (1998) do not consider the subspecies valid. A fourth subspecies, *E. p. fredericki*, occurs in the western United States and does not occur in Canada. Figure 1 shows the distribution of *E. p. persius* as well as that of the other subspecies in North America.

Further work on the taxonomy of this *E. persius* complex is needed to clarify spatial boundaries and distribution of its taxa. Burns (1964) did not delve into this skipper complex beyond giving a brief discussion of the problem and stating the close affinities of the four taxa. With differences in biology (different host plants and habitat requirements) and apparent differences in morphology, it may be best to consider nominate *E. persius* a species that is separate from the three western subspecies (see Kondla and Guppy 2001).



Figure 1. North American range of *Erynnis persius*: *E. p. persius* range is grey, other subspecies combined is black.

Description

The Eastern Persius Duskywing is a small (24-31 mm wingspan), dark skipper (Figure 2) with diffuse grey patches in the upper forewing separated by a line of four white spots; a fifth white spot may be present at the lower border of the forewing's grey patch. Fine hair-like scales cover much of the upper surface of the forewings, a variable proportion being white. A subterminal row of grey spots borders the outer edge of the forewing, and each hindwing is solid brown with a smattering of slightly paler brown spots dotted throughout. The head, thorax and abdomen are dark brown.

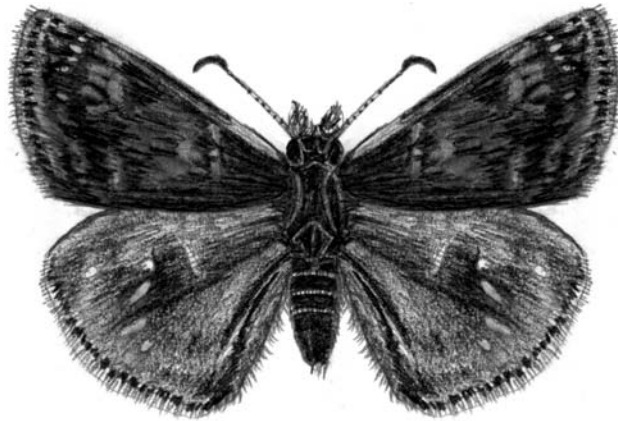


Figure 2. Dorsal view of *Erynnis persius persius* (original drawing by Andrea Kingsley).

Despite statements to the contrary (Balogh 1981, Nielsen 1999), the pattern and shape of the forewing spots are not diagnostic (D. Lafontaine, pers. comm., 2002, D. Schweitzer, pers. comm., 2002, M. Holder, pers. obs.). An examination of series of specimens at the Royal Ontario Museum and the Canadian National Collection resulted in the conclusion that the abundance of white hair on the forewings and the arrangement of the small white forewing spots, where the basal edges of the spots align along a straight line, are indicators of the species, but exhibit such variability within *E. persius* and closely related *E. lucilius* and *E. baptisiae* that they are not useful for diagnosis. The different host plant associations exhibited by the three species may help with species identification in a general way: *E. lucilius* is associated with wild columbine (*Aquilegia canadensis* L.), but *E. baptisiae* is associated with the same host plants as *E. persius*, namely wild indigo (*Baptisia tinctoria* (L.) R. Br. ex Ait. f.) and wild lupine (*Lupinus perennis* L.), in addition to other species such as wild blue indigo (*B. australis* (L.) R. Br. ex Ait. f.) and crown vetch (*Coronilla varia* L.). The best method of identifying *E. persius* adults is through an examination of male genitalia, which are diagnostic (Figure 3). The right and left valves of *E. p. persius*, *E. baptisiae* and *E. lucilius* are shown for comparison (Figure 3), with arrows highlighting features on the upper and lower lobes of the valves where differences exist. *Erynnis baptisiae* have genitalia similar in many ways to *E. lucilius*, although the upper lobe of the left valve is thicker than in *E. lucilius*. The genitalia can only be examined with the help of a dissecting microscope after the hairs and scales that cover them are removed with a brush. Identification of females is problematic, and M. Holder does not have any useful characters for diagnosis, other than the general wing features described above.

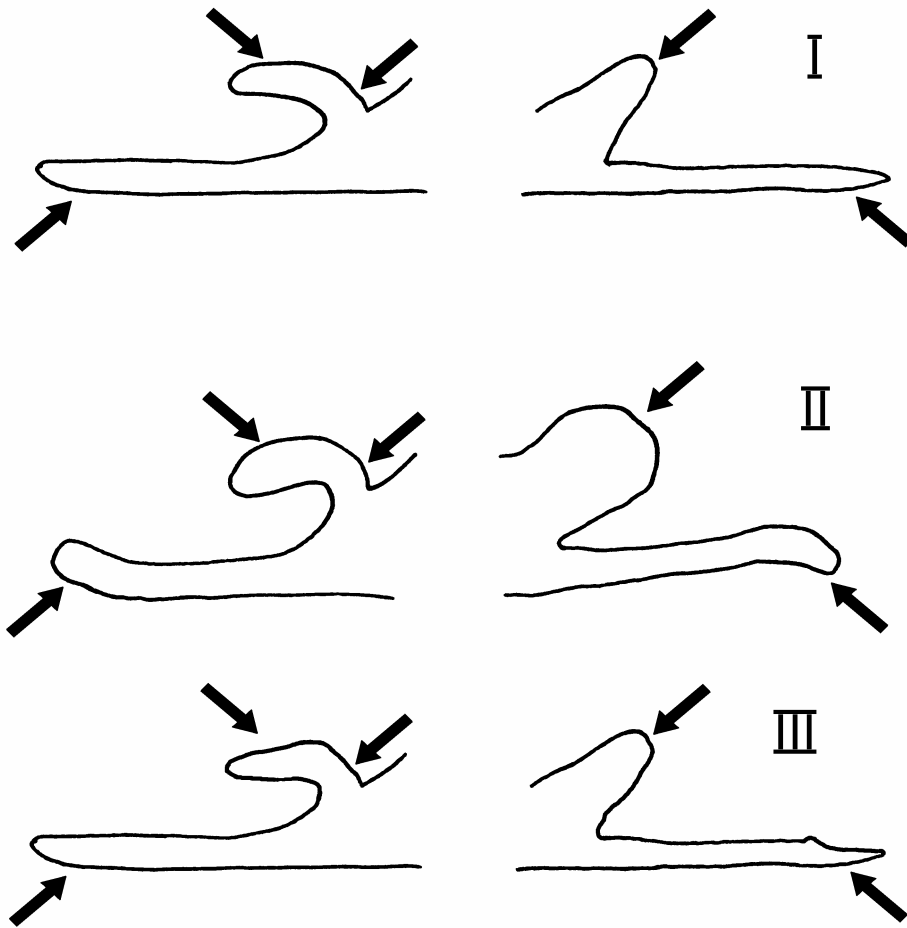


Figure 3. Diagram showing the right (on right) and left valves of male genitalia. Valves are shown inverted, laterally viewed. Arrows point to features useful for separating the three species. I) *Erynnis lucilius*, II) *Erynnis persius*. III) *Erynnis baptisiae* (Original drawing by Matt Holder.).

Descriptions and illustrations of adults are found in Klots (1951), Allen (1997), Layberry *et al.* (1998) and Glassberg (1999). A detailed description of the adult is found in Burns (1964).

Layberry *et al.* (1998) state the larva is similar to that of the Afranius Duskywing (*E. afranius*), which is pale green striped with black and yellow along its back. Larval *E. p. borealis* is described as pale green with numerous white spots (Guppy and Shepard 2001). The rounded head is brown, unlike the angular black head of *E. lucilius* (Figure 4; Lindsey 1927, Layberry *et al.* 1998). The larva of *E. baptisiae* has not been described (Layberry *et al.* 1998), and may be a source of confusion.

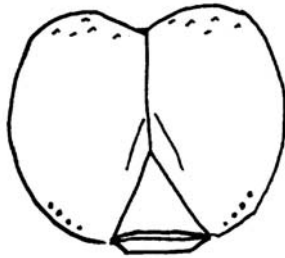


Figure 4. Head capsule of fifth-instar *Erynnis persius persius* larva (Drawing by Matt Holder, based on Lindsey 1927).

DISTRIBUTION

Global range

The nominate Eastern Persius Duskywing is generally distributed in the Great Lakes region eastward to New England, New Jersey and the Appalachian Mountains (Burns 1964). Specifically, the taxon is known from states in the United States shown in Figure 5 (based on Burns 1964 and NatureServe Explorer 2001). It is believed to have been extirpated from Maine, and has not been reported in Maryland, New Jersey or New York in the last twenty years (NatureServe Explorer 2001); fewer than 20 extant populations are known continent-wide (NatureServe Explorer 2001).

Canadian range

In Canada, records of nominate Eastern Persius Duskywing supported by valid specimens are restricted to two sites in southwestern Ontario: St. Williams, Norfolk County, and near The Pinery Provincial Park, Lambton County (Figure 6, Appendix 1). Although this species is known from only a few, relatively recent records in Canada, it almost certainly occurred from pre-settlement times as scattered populations in southern Ontario. If it were a vagrant, it would be unlikely to have occurred consistently at the St Williams site over several years, and would be more likely to have turned up at lupine patches much closer to the United States border. In addition, major published works, such as *The Butterflies of Canada* (Layberry *et al.* 1998) as well as NatureServe (2001) include the butterfly as an accepted Canadian species.

Although the first Canadian record of the Eastern Persius Duskywing is from St. Williams in 1972, an earlier record has now been confirmed. An unidentified and thus unreported specimen that was collected in the Pinery area in 1969 and resides in the private collection of Sid Daniels was examined by Matt Holder and was identified as *E. p. persius*. Although one should be cautious with historical records to ensure specimens have not been mislabelled, the Pinery area hosts suitable habitat and is a well-known historical locality for the ecologically related Karner Blue (*Lycaeides melissa samuelis* Nabokov). Matt Holder thinks it likely that the Eastern Persius Duskywing occurred in the Pinery area and believes the specimen to be correctly labelled.

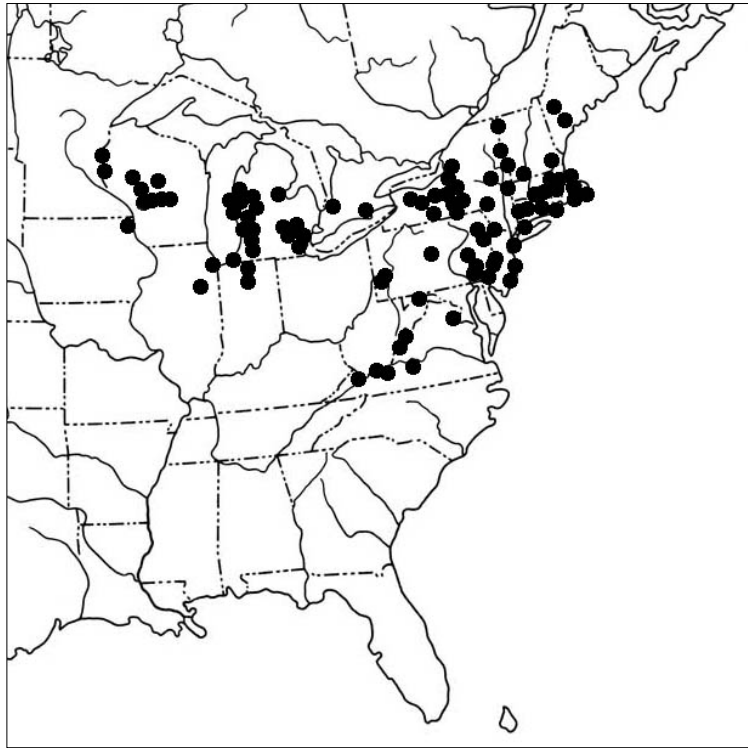


Figure 5. North American range of *Erynnis persius persius*, based on NatureServe Explorer (2001), Opler *et al.* (1995) and Burns (1964).

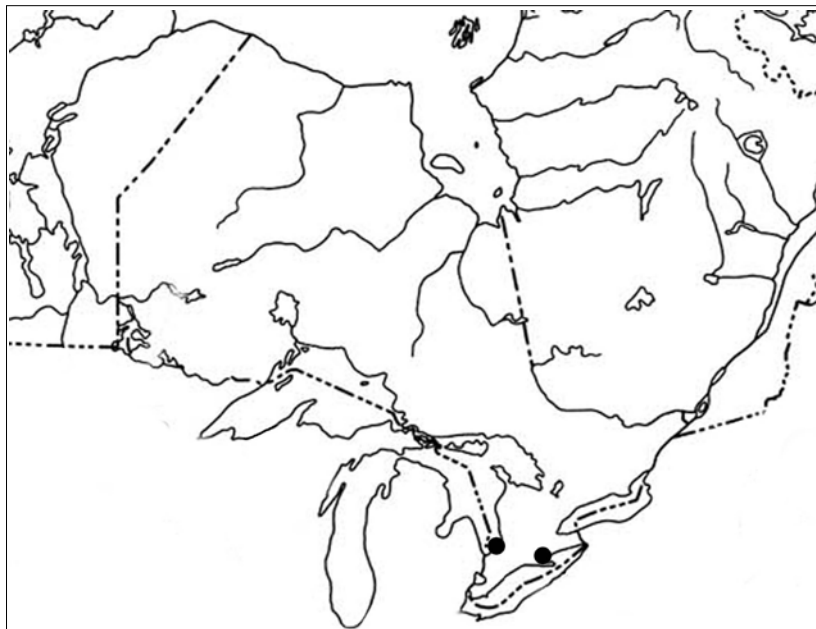


Figure 6. Canadian range of *Erynnis persius persius*, based on confirmed specimens.

Reports of the Eastern Persius Duskywing from elsewhere in southern Ontario, including Muskoka District Municipality, Manitoulin Island, other sites in Lambton County and Norfolk Township, Middlesex County, Essex County, Niagara Regional Municipality, Hamilton, Toronto and Ottawa (Hess and Hanks 1981, Hess and Hanks 1986, Kulon *et al.* 1987, Hess 1988, Holmes *et al.* 1991, Riotte 1992), are not supported by specimens known to M. Holder, or are based on misidentified specimens that M. Holder has examined (Appendix 1). On May 28, 2005, eight adult duskywings purported to be *E. p. persius* were observed by Brenda Kulon flying over wild lupines at Port Franks Forested Dunes Nature Reserve in Lambton County, but their identification was not confirmed. Moreover, because no voucher specimens were collected and because of the difficulty of identifying *E. p. persius* with certainty, particularly in the field, there is a high probability that these observations were of *E. baptistae* or *E. lucilius*. Matt Holder knows of no other reports or specimens from this site, and Skevington *et al.* (2001) do not list the species from North Lambton County. Sporadic unconfirmed reports (mostly from non-expert observers) of *E. p. persius*, especially from southwestern Ontario, are likely to continue. Elsewhere in Ontario, a report from Algonquin Provincial Park in Nipissing District is based on a worn female that the collector believes may be *E. lucilius* (C. Durden, pers. comm., 2002). Reports of the Eastern Persius Duskywing from Cochrane District, Temiskaming District and further north (and potentially Manitoulin Island) would certainly refer to *E. p. borealis*, if correctly identified to species; no specimens are known to support these observations (e.g., Hess and Hanks 1979, 1981, 1984, 1985, 1986, 1988) and there are no confirmed records of any subspecies of *E. persius* from any of these areas. Specimen and observation data are presented in Appendix 1.

Based on existing information, the species was confirmed from two widely separated and isolated sites in southern Ontario. Additional sites where the species may have once occurred include Walpole Island (which had a noteworthy population of wild lupines until its destruction by sandpit operations in 2001 (P.A. Woodliffe, pers. comm., 2002)), a number of sites in the St. Williams area, Toronto, and the Rice Lake Plains east of Peterborough. The historical range of *E. p. persius* probably included a number of areas within southern Ontario, occupying areas of savannah and prairie that have since been destroyed. Figure 7 presents an estimated distribution of tallgrass prairie and savannah that existed in presettlement times, and shows the patchy distribution of these habitats across southern Ontario. Although it is unknown whether the distribution of *E. p. persius* mirrored the distribution of these habitats, it does indicate that the distribution of the skipper would have been patchy and disjunct even if it was found in all prairie and savannah habitats. Populations of *E. p. persius* no longer occur (if they ever did) at Walpole Island (due to the destruction of the site and elimination of host plants) or Toronto, despite recent efforts to restore habitat at the latter locale (City of Toronto 2002). These sites were not visited in 2002 because disturbance and habitat change have very likely eliminated populations of *E. p. persius* that may have been present. Similarly, a site in Sarnia (Clearwater Nature Trail) was not visited during this study because few lupines are present, and M. Holder considered it unlikely that the area could support a persistent population of *E. p. persius* given the expected minimum patch size of lupine of about 20 m² is required to sustain

E. p. persius populations (Mo Nielsen, pers. comm., 2005). Fieldwork in Norfolk County, Lambton County and Northumberland County during Spring 2002 (Appendix 2), did not result in any observations or collections of the Eastern Persius Duskywing.

Erynnis p. persius has not been reported from Pinery in 35 years or St. Williams in 18 years (despite targeted searches in the past and in 2002), and the Eastern Persius Duskywing is probably extirpated from Ontario and Canada.



Figure 7. Pre-settlement Ontario range of savannah and prairie habitat, based on data from the Natural Heritage Information Centre and the Royal Ontario Museum.

HABITAT

Habitat requirements

Erynnis p. persius occurs in jack pine (*Pinus banksiana*) barrens, pine-oak barrens, oak savannahs and other open woodland with populations of wild lupine (*L. perennis*) or wild indigo (*B. tinctoria*) (NatureServe Explorer 2001). In the United States, skipper is sometimes found along roadsides through forest (S. Daniels, pers. comm., 2002) and has been collected in seemingly unsuitable habitat away from any obvious populations of lupines (Borth 1997, Layberry *et al.* 1998, NatureServe Explorer 2001). Adults are believed to nectar at a variety of plant species (NatureServe Explorer 2001), but because the presence of the larval host plants is necessary for breeding, the species should be considered a habitat specialist. Older literature lists a variety of host plants for the species, including wild indigo, hairy ceanothus (*Ceanothus oliganthus* Nutt.), milkpea (*Galactia* sp.), bush-clover (*Lespedeza* sp.), birdsfoot trefoil (*Lotus unifoliolata* (Hook.) Benth.), poplars and aspens (*Populus* spp.), scrub oak (*Quercus*

ilicifolia Wangenh.), tall prairie willow (*Salix humilis* Marsh.) and tree clover (*Trifolium ciliolatum* Benth.) (Tietz 1972). Scudder (1889) states he found *E. p. persius* in abundance on tall prairie willow and poplars, and Lindsey (1927) reports rearing it on poplar. This information was widely reported and believed until the late 1970s, when wild lupine was reported as the host plant of the Eastern Persius Duskywing (Balogh 1981). Since then, wild indigo has also been reported as a host plant for *E. p. persius* (D. Schweitzer, pers. comm., 2002). Because *E. p. persius* is so difficult to identify, most early observers were likely not identifying *Erynnis* species correctly, and the early reports of a wide range of host plants are unlikely to be trustworthy, especially given the host-specific nature of other taxa within the complex.

Matt Holder believes that wild lupine (at least *L. perennis*) is the main host plant for *E. p. persius* in Canada, and populations of the skipper will be associated with populations of the plant. Wild lupines are known to occur at several locations in southwestern Ontario, usually in sites with tallgrass prairie or savannah habitats. Savannahs, such as those found in the Grand Bend area, are open areas interspersed with mature trees (especially oaks) that often grade into tallgrass prairie. Under natural conditions, these habitats are subject to frequent fires that prevent woody plants from colonizing and a significant shrub layer or understory from forming. *Lupinus perennis* still persists in some locations in southern Ontario and it is to these locations that *E. p. persius* was likely restricted.

Many rare insect and plant species are also associated with tallgrass and prairie communities, including two butterflies designated by COSEWIC as Extirpated: Karner Blue (*L. m. samuelis*) and Frosted Elfin (*Callophrys irus* (Godart)). Although the Eastern Persius Duskywing's tolerance to disturbance is unknown, the two other lupine butterfly species have shown intolerance to habitat change. Additionally, the Mottled Duskywing (*Erynnis martialis*) has been reported to require open habitats and to be absent from otherwise suitable sites that have more than 55% woody cover (Swengel 1994). It is reasonable to expect that the Eastern Persius Duskywing shares a similar intolerance, although this hypothesis is purely conjectural and the skipper may be restricted only by the presence and abundance of its host plant.

In addition to the presence of the host plant, *E. p. persius* appears to favour habitat with other characteristics. Swengel (1994) and others have identified that open woodland habitat, principally sandy areas with sparse vegetation interspersed with oak saplings, is key to *E. p. persius* (Kons 1997). Additionally, Iftner *et al.* (1992) report that *E. p. persius* will not oviposit on lupines in shade. However, Maxwell and Ferge (1994) found this skipper in both open and shady woodland habitat, and Kons (1995) believed that *E. p. persius* flies through closed forest to disperse to patches of lupine. It is likely that open areas with patches of lupine are necessary for oviposition, but forest is not a barrier to dispersal.

Although the spatial structure of *E. p. persius* populations has not been quantified, it appears that population dynamics, characterized by local extinctions and recolonizations as described by Givnish *et al.* (1988), exist at the landscape scale. In

the past, open woodlands that hosted wild lupines were maintained through fire, and *E. p. persius* populations would only persist if individuals escaped to neighbouring unburned patches of lupine. However, in the absence of fire, it is possible that *E. p. persius* may be able to persist in isolated patches of suitable habitat if maintained through some other means (e.g., mowing after mid-July as part of a plan to inhibit woody plant colonization and to promote lupine growth). Most extant lupine sites in Ontario are isolated with few plants (P.A. Woodliffe, pers. comm., 2002; W. Bakowsky, pers. comm., 2002; D. Sutherland, pers. comm., 2002), although there are several locations with large patches of lupine, such as St. Williams and The Pinery. In Michigan, it is thought that at least 200 sq. ft. (approximately 20 m²) of suitable habitat with an abundance of lupines would be required to support a small population (M. Nielsen, pers. comm., 2005). Management through clearing of woody plants and replanting or reseeding of lupines in Lambton County and at St. Williams has maintained a patchy distribution of the host plants. Additionally, one small population (50-100 plants) in Peterborough County (Don Sutherland, pers. comm., 2002) has persisted on a roadside through standard roadside management (mowing).

Trends

Declines in savannah and prairie habitat are widespread in northeastern North America. Reasons for this decline include resource extraction, agricultural use and development, urbanization and fire suppression. In the Midwestern United States, where conservation of savannah and prairie habitat is considered the most progressive, less than 25% of original habitat survives, and then in a degraded state (Nuzzo 1986). Nuzzo (1986) estimated that 0.02% of the upper Midwest (Missouri northward) that supported oak savannah before European settlement still existed in a healthy state. Still, D. Schweitzer (pers. comm., 2002) reports that much of the existing habitat across northeastern North America that would appear to be capable of supporting *E. p. persius* lacks the species entirely.

In Ontario, widespread habitat change through urbanization, agricultural development and resource use has adversely affected many species. Indications are that prairie and savannah habitat occurred across much larger areas of southern Ontario than at present (Bakowsky 1999), probably hosting populations of wild lupine and potentially supporting *E. p. persius* populations. It is estimated that roughly 2,000 km² of prairie, savannah and open woodland occurred in Ontario prior to European settlement, but less than 20 km² of this habitat remains (Varga 1999). Catling *et al.* (1992) believed the Rice Lake Plains north of Cobourg were composed of prairie and savannah habitat and had the most extensive lupine populations in Ontario. These plains could have hosted *E. p. persius* and other lupine feeders, such as *L. m. samuelis* (Catling and Brownell 2000), but the habitats had been destroyed by 1900 and now only relict populations of lupines survive in this area (Brownell and Blaney 1996, D.A. Sutherland, pers. comm., 2002). However, one large patch of existing tallgrass prairie and savanna habitat in the region hosts a sizeable population of several thousand lupines.

Other sites with lupine populations include High Park in Toronto, and Walpole Island. High Park has suffered from disturbance and habitat degradation, including poor habitat management in the past, invasion of non-native plants and human disturbance. Recent efforts have improved the habitat at High Park (City of Toronto 2002), but considering several factors (e.g., the distance from source populations of *E. p. persius*, and past habitat change), it is unlikely that *E. p. persius* will occupy this extant habitat by natural means. There are unconfirmed records (no specimens) of *Erynnis p. persius* from Walpole Island (Kulon *et al.* 1987), which had hosted a "substantial" population of wild lupines (Woodliffe and Allen 1988). However, this lupine population was destroyed in 2001 with the expansion of a sand extraction operation (P.A. Woodliffe, pers. comm., 2002). This site will not support *E. p. persius* without rehabilitation.

Habitat degradation in the St. Williams and Pinery areas has been well documented (e.g., Stead 1993). Human-induced forest succession, through tree planting and fire suppression, has been the primary cause of this habitat change. At least at The Pinery Provincial Park, extensive browsing by White-tailed Deer (*Odocoileus virginianus* (Zimmermann)) may also be responsible for declines in lupine populations (Hess 1992). Although browsing by White-tailed Deer is a natural factor, the tremendous population of this herbivore brought about by removal of deer predators and competitors and landscape change is exerting extreme pressure on lupines and other herbaceous plants in the prairie and savannah remnants of southern Ontario. St. Williams and the Pinery area were important to *E. p. persius*, and details on habitat change and rehabilitation efforts at these two sites are provided below.

Recent efforts have been put forth by Ontario Parks and Lambton Wildlife Incorporated to restore savannah habitat in North Lambton County, primarily for the purpose of conserving habitat for *L. m. samuelis*. However, these initiatives were implemented after suitable habitat had become sufficiently rare to cause the extirpation of *L. m. samuelis* and probably *E. p. persius*. In The Pinery Provincial Park, Ontario Parks has undertaken planning and management activities to promote the health of natural oak savannah (Ontario Ministry of Natural Resources 1986), which has resulted in a recovery of wild lupine populations. These efforts include population control of White-tailed Deer through an organized cull, creation and maintenance of a deer enclosure in open woodland near the south end of the park, and transplantation of wild lupines from a source population outside the park. As a result of these efforts, four small areas within The Pinery Provincial Park host lupine populations (Appendix 2).

There are several areas with wild lupine populations outside the park (Appendix 2). The most significant site is the Karner Blue Sanctuary near Port Franks, Ontario, a significant natural area owned and managed by Lambton Wildlife Incorporated. The site hosts hundreds of individual lupines, mostly in the open woodland of "The Bowl" found in the southeastern corner of the property, and has the highest quality of habitat for *E. p. persius* in the area. A management plan has been drafted (Banks *et al.* 2001) and is undergoing implementation with the intention of creating habitat suitable for a re-introduction of *L. m. samuelis*. Restoring the integrity of the oak savannah habitat at the Karner Blue Sanctuary has included prescribed burns, removal of woody vegetation and

planting of wild lupines (Banks *et al.* 2001, P.M. Banks, pers. comm., 2002). Matt Holder believes this area has high quality habitat for *E. p. persius*.

Outside of The Pinery Provincial Park, the St. Williams Crown Forest hosts the largest area of savannah still remaining in the Carolinian life zone of Canada and possesses a very high diversity of plants and animals, many of them rare in Ontario and Canada (Draper *et al.* 2002). Although much of the area was forested in 1945, a large portion of the Manestar Tract, where considerable numbers of lupines presently grow, was clearcut by 1953 and sand was extracted between 1955 and 1972 (Draper *et al.* 2002). Throughout these years, savannah habitat persisted in certain southern sections of the property. These small remnants were subject to forest succession in the absence of a natural thinning process, but were thinned to savannah conditions in 1991 (Draper *et al.* 2002). The last observations of *E. p. persius*, *C. irus* and *L. m. samuelis* were made at one of these remnants. Elsewhere in the Tract, lupines and other plants with savannah/prairie affinities have continued to occupy open areas adjacent to ingrown savannah, particularly along access roads, open trails and the large field at the north end of the property.

Management for savannah at the Manestar Tract of the St. Williams Crown Forest has included vegetation removal and seeding of lupines. A management plan for the Manestar Tract exists in draft form (Allen 1992), but has yet to be finalized and implemented. Further recommendations for rehabilitating and managing the St. Williams Crown Forest are presented by Draper *et al.* (2002). The St. Williams Crown Forest will soon be a Conservation Reserve to be administered by Ontario Parks (OMNR 2005).

Protection/ownership

Habitat suitable for breeding *E. p. persius* exists in the St. Williams area on Crown land managed by the Ontario Ministry of Natural Resources; in The Pinery Provincial Park, controlled and managed by Ontario Parks; and on property owned and controlled by Lambton Wildlife Incorporated, a conservation and naturalist group in Lambton County. Additional areas with wild lupines are controlled by First Nations (Walpole Island) and local government (e.g., in Norfolk County and Toronto), although the ownership of some sites is unclear. For most sites, it is unlikely ownership will change in the future, but the fate of lupine populations east of Delhi (Appendix 2) is to be determined. Roughly 80-90% of suitable habitat is protected from destruction, although management plans have not been created for many sites.

BIOLOGY

General

Erynnis p. persius is a univoltine skipper, although rarely individuals may eclose out of season (NatureServe Explorer 2001). Females oviposit directly on host plants, with single eggs laid on the underside of leaves (Mo Nielsen, pers. comm., 2002). After

larvae hatch, they feed exclusively on the host plant and construct rolled-leaf nests for protection while they eat, like other *Erynnis* species. Feeding ends in July and the late-instar larvae remain in diapause until the following spring, when they pupate (NatureServe Explorer 2001). Adults fly during May and early June, exhibiting the quick flight typical of *Erynnis* skippers (Mo Nielsen, pers. comm., 2002). Apparently, adults hilltop (i.e., fly up-slope to converge at the top of a hill or ridge to facilitate pairing and mating) (Kirk 1996).

Reproduction

Very little is known regarding the reproduction of this species. Females lay single eggs on host plants. Nothing is reported regarding the species' fecundity or the survivorship or special requirements of the eggs, besides presence of host plants. Sex ratios in collections are biased toward males, probably reflecting the habits of males vs. females and the ease with which males are captured and identified, rather than true sex ratios. Matt Holder knows of no reports of breeding behaviour, copulation or oviposition in Ontario.

Survival

Nothing is known regarding the survivorship of *E. p. persius*, or its minimum viable population size. Based on the life history of the species, zero recruitment for even one year would have dire consequences for a local population. Populations would be extirpated with any, even short-term, catastrophic event unless they could be rescued by dispersal (the extent of which is unknown) from source populations. In the past, the presence and abundance of host plants in an area largely dictated the health of the population and its recruitment. Other factors, such as weather, fire or disturbance, could have devastating effects. Fire is recognized as especially destructive to *E. p. persius* populations because of the species' life history (Kirk 1996); however burned areas can create favourable conditions for recolonization (Maxwell and Ferge 1994). Burns that are of high intensity and over a large scale could be detrimental to this species, while lower intensity burns over a smaller scale could be beneficial to *E. p. persius*.

Physiology

This taxon enters diapause as a mature larva in the leaf litter. The temperature and other environmental requirements are unknown, although mature larvae were apparently able to withstand the cold winter temperatures normal for southern Ontario. No studies on the physiology of *E. p. persius* have been conducted to date.

Movements/dispersal

Very little is known regarding this taxon's movements. However, specimens have been collected "far" from known lupine or indigo locations (NatureServe Explorer 2001), indicating that the species may be able to disperse to some degree. Kons and Borth

(1997) found individuals eight kilometres from the closest known lupine population. Considering the dynamic nature of oak savannah and prairie habitat, *E. p. persius* is expected to be able to disperse from altered and temporally unsuitable areas and repopulate newly suitable habitats. A spatially structured population or a metapopulation structure is probably the norm for this species (Givnish *et al.* 1988). However, the spatial scale at which populations link is unknown. Schweitzer (2001) believes this taxon is a “fairly good short range colonizer.”

Although closed forest does not appear to provide a barrier to dispersal, it is unknown what effect urbanization may have on the dispersal of individuals. It is very unlikely extant populations in the United States could become natural sources for Canadian populations. *Erynnis p. persius* has been found as close as Monroe and Wayne Counties in Michigan, and Genesee County in New York. The closest extant populations of *E. p. persius* are in Wayne County, Michigan, approximately 150 km from The Pinery Provincial Park (Mo Nielsen, pers.comm., 2005).

Nutrition and interspecific interactions

Larval *E. p. persius* are host-specific to wild lupines (*L. perennis*) and to wild indigo (*B. tinctoria*) plants, although the former plant is likely its predominant host (Mo Nielsen, pers. comm., 2002). Dale Schweitzer (pers. comm., 2002) believes a third unknown plant is also utilized by *E. p. persius* because of the skipper's existence at some sites where neither of the two known host species occurs. Although *E. p. persius* occupies the same habitat as other lupine-feeders, such as *L. m. samuelis*, and is expected to compete for food with these other species, nothing is known regarding interspecific competition. Adult *E. p. persius* are generalists with respect to feeding as they nectar at many different flower species. From a herbivory perspective, white-tailed deer may be considered to be a competitor because of this mammal's preference for eating lupines in spring.

Behaviour/adaptability

Little is known about the behaviour of *E. p. persius*. Hilltopping is reported as the skipper's reproductive strategy (D. Schweitzer, pers. comm., 2002), but no details have been provided. *Erynnis p. persius* appears to be restricted in its larval host species (which are themselves rare), and is likely very susceptible to any habitat changes that affect host plant populations. Inappropriate fire regimes may have caused population declines (NatureServe Explorer 2001).

POPULATION SIZES AND TRENDS

Suitable habitat for breeding *E. p. persius* has suffered dramatic declines over the last 100 years. *Erynnis p. persius* is considered extirpated in Maine and is probably extirpated in Maryland, New Jersey and New York. If it ever occurred in Illinois, Iowa, West Virginia, Vermont or Tennessee, it is probably extirpated in those states also.

Erynnis p. persius is considered to be declining rapidly in the United States and has disappeared from most of its previous range since the late 1950s (NatureServe Explorer 2001). Across its range, habitat change and insecticide spraying are blamed for its demise (D. Schweitzer, pers. comm., 2002). In most jurisdictions where it is still extant, the skipper is considered critically imperilled (Table 1), and in its stronghold in Michigan, it is rare and considered to be Threatened. The Nature Conservancy reports that only 25 or so extant occurrences of *E. p. persius* are known across the United States (D. Schweitzer, pers. comm., 2002).

Canadian populations of *E. p. persius* were restricted to southwestern Ontario, where no individuals have been seen or collected in at least 18 years, despite recent survey efforts at the three areas where, based on prior consultation with expert botanists and entomologists, the likelihood of finding *E. p. persius* was the greatest (Appendix 2). Prior to that, little was known regarding Canadian populations, which were reliably reported sporadically over the previous ten to fifteen years from only two locations. The demise of this subspecies in Canada largely occurred before it was even known to occur there, and was likely caused by destruction, fragmentation and isolation of suitable habitat. Habitat loss, degradation and fragmentation have continued in southern Ontario since the skipper's apparent disappearance. Despite recent efforts to restore habitat for this subspecies, *L. m. samuelis* and *C. irus*, there is very little chance *E. p. persius* still occurs in Canada.

LIMITING FACTORS AND THREATS

The most important factor limiting the size and distribution of *E. p. persius* populations is the quality and distribution of its breeding habitat. The skipper almost always occurs in savannah and prairie habitats with populations of wild lupine or wild indigo, although specimens are sometimes taken in other habitats. Disturbance (natural or through management regimes) is needed to ensure the health of open woodland and prairie communities, but large-scale and high intensity fires may destroy all *E. p. persius* populations in an area. Fire suppression and tree planting have certainly had devastating effects on *E. p. persius* populations through successional habitat change and the resultant decline in natural lupine populations. Increased isolation of host plant patches through human-induced or natural processes (e.g., forest succession, creation of dispersal barriers through industrial or urban development) likely had direct negative consequences for *E. p. persius*.

Superabundant deer populations are also thought to cause declines in host plants through extensive herbivory. The requirements of this skipper for specific plant species that are themselves rare and occur in isolated, fragmented patches is the biggest problem faced by the butterfly.

Natural factors likely to influence individual survivorship include parasitoids and predators (although none are specifically known to attack *E. p. persius*), and such density independent factors as fire, desiccation, weather and even incidental browsing

by deer. Due to the dynamic nature of the habitat in which this skipper is found, it is likely that individual survivorship is low and is influenced by natural habitat change and disturbance by fire. In the past, populations survived by dispersing to other areas of suitable habitat, but when alternate pockets of suitable habitat became unavailable, the likelihood of individuals escaping hostile conditions to reproduce elsewhere declined.

Anthropogenic factors affecting survivorship include insecticide spraying and indirect factors that affect the species' habitat, including fire suppression, and facilitating the growth of deer populations and the colonization of invasive plant species. The spraying of insecticide to combat the Gypsy Moth (*Lymantria dispar* (L.)) is thought to have been responsible for the substantial decline in *E. p. persius* populations in the 1950s, and modern spray programs could eliminate any remaining populations that may be in the sprayed areas (NatureServe Explorer 2001). The drought of 1988 in combination with spraying of *Bacillus thuringiensis* (Bt) at St. Williams may have eliminated what must have been an already small population of *E. p. persius*, if it indeed had survived to that time (Peter Carson, pers. comm., 2002). Indirectly, humans have also modified the habitat by suppressing fire, which has allowed woody plants to colonize, creating an environment that inhibits the survival and growth of the host plants. The elimination of the natural predators of white-tailed deer in southwestern Ontario and the change in landscape structure has caused this herbivore's population to grow significantly, which has placed a large amount of pressure on lupines and other herbaceous plants within the prairie and savannah habitats of southern Ontario.

SPECIAL SIGNIFICANCE OF THE SPECIES

Erynnis p. persius is a regional endemic, restricted to the Great Lakes region east to New England and south to Virginia and West Virginia. It is presently considered a subspecies of a wide-ranging species. Matt Holder, however, believes it may be taxonomically distinct, based on biological and morphological differences between it and the three other identified subspecies within the species, and may deserve full species status, pending a more thorough taxonomic review of material.

No traditional knowledge on this skipper was discovered.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

Presently, *E. p. persius* enjoys no specific legal protection in Canada through either federal or provincial legislation. It is considered to be extirpated from Ontario by the Ontario Ministry of Natural Resources (NHIC 2001).

In the United States, *E. p. persius* is designated as Endangered in Indiana, New Hampshire, New York and Ohio; Threatened in Michigan and Massachusetts; and of Special Concern in Connecticut and Pennsylvania. It is considered by relevant state authorities to have been extirpated from Maine, and it has not been recorded within the last 20 years in New York, New Jersey or Maryland. Elsewhere, it is mostly considered critically imperilled, but in its presumed stronghold of Michigan, it is considered to have a sub-national rank of S3. Global, national and sub-national conservation ranks for all jurisdictions where it is known to have occurred are presented in Table 1.

Table 1. Conservation ranks and status for *Erynnis persius persius* for jurisdictions in Canada and USA.

Jurisdiction	Conservation Rank	Other Designation
Global	G5T2T3	
Canada	NX	
Ontario	SX	
USA	N2N3	
Connecticut	S1	SC
Indiana	S1S2	E
Maine	SX	
Maryland	SH	
Massachusetts	S1S3	T
Michigan	S3	T
Minnesota	S1?	
New Hampshire	S1	E
New Jersey	SH	
New York	SH	E
Ohio	S?*	E
Pennsylvania	S1S2	SC
Tennessee	S?*	
Virginia	S1	
West Virginia	S?*	
Wisconsin	S2	

Note:

G5T2T3 = Globally secure as a species, but the subspecies is considered to be very rare to rare.

NX = Nationally extirpated.

N2N3 = Nationally very rare to rare.

SX = Extirpated in the state or province.

SH = Historically known from the state or province, but not reported in the last 20 years.

S1 = Extremely rare in state or province; usually 5 or fewer occurrences in the state or province or very few remaining individuals; often especially vulnerable to extirpation.

S2 = Very rare in state or province; usually between 5 and 20 occurrences in the state or province or with many individuals in fewer occurrences; often susceptible to extirpation.

S3 = Rare to uncommon in state or province; usually between 20 and 100 occurrences in the state or province; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.

S? = Unknown status, or if following a numbered S-rank, indicates uncertainty in the ranking.

*Noted in these jurisdictions by Burns (1964), but S ranks not given by The Nature Conservancy.

E = Endangered, T = Threatened, SC = Special Concern

Of the two sites where *E. p. persius* has been confirmed to have historically occurred in Ontario, one is owned and controlled by the conservation group Lambton Wildlife Incorporated, and the other is owned and controlled by the Ontario government. Specific protection is not provided at either site, although Lambton Wildlife Incorporated forbids collecting of flora and fauna on its property without prior written permission.

TECHNICAL SUMMARY

Erynnis persius persius
 Eastern Persius Duskywing
 Ontario

Hespérie Persius de l'Est

Extent and Area information	
• <i>extent of occurrence (EO)(km²)</i>	None known
• <i>specify trend (decline, stable, increasing, unknown)</i>	Past decline
• <i>are there extreme fluctuations in EO (> 1 order of magnitude)?</i>	Not applicable
• <i>area of occupancy (AO) (km²)</i>	None known
• <i>specify trend (decline, stable, increasing, unknown)</i>	Past decline
• <i>are there extreme fluctuations in AO (> 1 order magnitude)?</i>	Not applicable
• <i>number of extant locations</i>	None known
• <i>specify trend in # locations (decline, stable, increasing, unknown)</i>	Not applicable
• <i>are there extreme fluctuations in # locations (>1 order of magnitude)?</i>	No
• <i>habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat</i>	Habitat is still being destroyed, yet rehabilitation is occurring in some areas. Overall, a large decline in habitat extent and quality has occurred over the last several decades
Population information	
• <i>generation time (average age of parents in the population) (indicate years, months, days, etc.)</i>	One year
• <i>number of mature individuals (capable of reproduction) in the Canadian population (or, specify a range of plausible values)</i>	None known
• <i>total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals</i>	Declined over the past fifty years, with no individuals known to occur in the last 18 years
• <i>if decline, % decline over the last/next 10 years or 3 generations, whichever is greater (or specify if for shorter time period)</i>	Declined to presumed extirpation 18 years ago
• <i>are there extreme fluctuations in number of mature individuals (> 1 order of magnitude)?</i>	No
• <i>is the total population severely fragmented (most individuals found within small and relatively isolated (geographically or otherwise) populations between which there is little exchange, i.e., ≤ 1 successful migrant / year)?</i>	No extant population known
• <i>list each population and the number of mature individuals in each</i>	None extant known
• <i>specify trend in number of populations (decline, stable, increasing, unknown)</i>	Declined to presumed extirpation
• <i>are there extreme fluctuations in number of populations (>1 order of magnitude)?</i>	No

Threats (actual or imminent threats to populations or habitats)	
- Habitat loss and degradation due to:	
<ul style="list-style-type: none"> • fire suppression • tree planting • herbivory of host plants • agriculture, urban development and resource extraction 	
- Pesticide spraying	
Rescue Effect (immigration from an outside source)	No
• <i>does species exist elsewhere (in Canada or outside)?</i>	Yes, in US
• <i>status of the outside population(s)?</i>	Declining and rare
• <i>is immigration known or possible?</i>	Unknown and unlikely
• <i>would immigrants be adapted to survive here?</i>	Yes
• <i>is there sufficient habitat for immigrants here?</i>	Possibly
Quantitative Analysis	None performed
Current Status	
COSEWIC: Endangered (2006)	

Status and Reasons for Designation

Status: Endangered	Alpha-numeric code: B1ab(iii)+2ab(iii); C2a(i); D1
<p>Reasons for Designation: This lupine-feeding butterfly has been confirmed from only two sites in Canada. It inhabits oak savannahs in southern Ontario, a habitat that has undergone substantial declines and alterations. Larval host plant populations have been greatly reduced. There have been no confirmed records of this butterfly for 18 years, but unconfirmed sight records suggest that the species might still exist in Canada.</p>	
<p>Applicability of Criteria</p>	
<p>Criterion A: (Declining Total Population): not applicable, no decline data.</p> <p>Criterion B: (Small Distribution, and Decline or Fluctuation): If any individuals of the species persist, the EO is certainly much less than 5,000 km² B1. The AO is certainly much less than 500 km² – B2. This species occurs at fewer than 5 locations – a. There is a continuing decline – b. In habitat (iii)</p> <p>Criterion C (Small Total Population Size and Decline): There are fewer than 2,500 mature individuals and there is likely a continuing decline in the number of mature individuals – 2 with a population structure such that no population contains more than 250 mature individuals – a(i)</p> <p>Criterion D: (Very Small Population or Restricted Distribution): There are fewer than 250 mature individuals – D1.</p> <p>Criterion E: (Quantitative Analysis): not available.</p>	

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BIOGRAPHICAL SUMMARY OF REPORT WRITER

Matt Holder is a biologist at Jacques Whitford Limited. Mr. Holder has over ten years of work and research experience in biology, particularly ecology, encompassing many plant and animal taxa. His research interests include ecology of animals and plants in disturbed environments, landscape ecology and systematics of certain animal taxa.

Mr. Holder's past work relating to species-at-risk include field surveys of rare insects in Maritime peatlands for the Atlantic Canada Conservation Data Centre, creation and maintenance of a species-at-risk database for the Ontario Natural Heritage Information Centre, and the development of a records database for dragonflies and damselflies in Ontario; Mr. Holder was also on a committee charged with providing conservation ranks for Ontario dragonflies and damselflies. He has conducted projects on insect ecology and distribution at many locations in eastern North America, examining many different taxa, including butterflies and moths, dragonflies and damselflies, grasshoppers, and certain groups of beetles and flies.

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COLLECTIONS EXAMINED

The Canadian National Collection of Insects, Arachnids and Nematodes at the Department of Agriculture and Agri-Food Canada, and collections at the Royal Ontario Museum and the University of Guelph were consulted. Additionally, private collections of Quimby Hess, Sid Daniels, Mary Gartshore and Richard Romeyn were consulted, and specimen information was examined from other collections listed in Species Analyst (CBIF 2002), including: Great Lakes Forestry Centre Insect Collection, Northern Forestry Centre Arthropod Collection, Point Pelee National Park Collection, Nova Scotia Department of Natural Resources Insectary Collection, New Brunswick Museum, Nova Scotia Museum of Natural History, Lyman Entomological Museum, McGill University, McMaster University, University of New Brunswick, University of Western Ontario, and the private collections of R. Curry, M. Gollop, Crispin S. Guppy, Gerald J. Hilchie, Donald F. Hooper, Ross A. Layberry, Jeff Ogden, and Alan Wormington.

Appendix 1. Specimens and reports of *Erynnis persius persius* in Ontario.

Correct Species	Location	Date	Collector/observer	Col*	Ob*	Abundance Notes	Examined	Source
Unknown	St. Williams	1969.05.00	S.M. Daniels	7		total of 7 collected, combining 1969 and 1971		Hess and Hanks 1979
<i>E. persius</i>	St. Williams	1969.05.24	S.M. Daniels	4		four male specimens	SMD, pers. coll. H Apr 8/02	
<i>E. persius</i>	Pinery	1969.05.31	S.M. Daniels	1		male specimen	SMD, pers. coll. H Apr 8/02	
<i>E. persius</i>	St. Williams	1971.05.28	S.M. Daniels	2		two male specimens	SMD, pers. coll. H Apr 8/02	
Unknown	St. Williams	1971.05.00	S.M. Daniels	7		total of 7 collected, combining 1969 and 1971		Hess and Hanks 1979
Unknown	Timmins	1973.06.06	A.M.Holmes	1		male (certain misID - MLH)		Hess, Q.F. 1992. Butterflies of Ontario and Summaries of Lepidoptera Encountered in Ontario in 1991. Toronto Entomologists' Association Occasional Publication #24-92.
<i>E. juvenalis</i>	Burnley, Northumberland Co.	1975.05.19	W.J.D. Eberlie	1		male specimen	ROM. BOC#. L&H Feb 21/02	
Unknown	St. Williams	1976.05.00	R. MacLaren	1		1 collected, in W. Plath Jr. collection		Hess <i>et al.</i> 1977
<i>E. persius</i>	St. Williams	1976.06.05	J. Troubridge	1		male specimen	CNC. L&H Feb 21/02	
<i>E. persius</i>	Davidson[?]	1977.07.01	unknown	1		male specimen	UoG. L&H Feb 21/02	
Unknown	St. Williams	1978.06.09	Q.F.Hess		1	1 seen		Hess and Hanks 1979
<i>E. baptisiae</i>	St. Williams	1978.05.17	unknown	1		male specimen	ROM. BOC#. L&H Feb 21/02	
<i>E. persius</i>	St. Williams	1979.05.23	J.Troubridge	1		male specimen	CNC. L&H Feb 21/02	Pictured in Layberry <i>et al.</i> 1998.
Unknown	St. Williams	1980.06.16	Q.F. Hess		1	1 observed		Hess and Hanks 1981
Unknown	St. Williams	1983.06.08	Q.F. Hess		1	1 observed		Hess and Hanks 1984
Unknown	St. Williams	1984.05.24	Q.F. Hess	3		3 collected		Hess and Hanks 1985
Unknown	St. Williams	1984.06.11	Q.F. Hess	1		1 collected		Hess and Hanks 1985
Unknown	St. Williams	1985.05.25	Q.F. Hess	1		1 collected, at forest nursery, along Con. 7 (sand road)		Hess and Hanks 1986
<i>E.juvenalis</i>	Backus Woods	1985.05.25	W.J.D. Eberlie	1		"noted". Male specimen at ROM dated May 26.	ROM. BOC#. L&H Feb 21/02	Hess and Hanks 1986

Correct Species	Location	Date	Collector/observer	Col*	Ob*	Abundance Notes	Examined	Source
<i>E. juvenalis</i>	St. Williams	1985.05.26	W.J.D. Eberlie	1		male specimen	ROM. BOC#. L&H Feb 21/02	
Unknown	St. Williams	1985.05.30	Q.F. Hess	1		1 collected, at forest nursery, along Con. 7 (sand road)		Hess and Hanks 1986
Unknown	Backus Woods	1985.05.30	Q.F. Hess	1		1 collected, on Con. 4 (sand road)		Hess and Hanks 1986
Unknown	Bracebridge	1985.06.15	Q.F. Hess	1		1 collected (2km N of High Falls)		Hess and Hanks 1986
Unknown	Walpole Island	1986.00.00	Ben Kulon, Brenda Kulon			reported but unconfirmed		Kulon <i>et al.</i> 1987
<i>E. juvenalis</i>	St. Williams	1986.05.26	W.J.D. Eberlie	1		male specimen	ROM. BOC#. L&H Feb 21/02	
Unknown	St. Williams	1987.06.16	Q.F. Hess	1		1 collected, on New Jersey Tea		Hess and Hanks 1988
Unknown	Matatchewan	1992.06.29	L. Taman		1	reported but unconfirmed		Hess, Q.F. 1993. Butterflies of Ontario and Summaries of Lepidoptera Encountered in Ontario in 1992. Toronto Entomologists' Association Occasional Publication #25-93.
Unknown	Bosanquet Tp.	nd	fide Q.F. Hess			possible, but no records known to Hess		Hess and Hanks 1981
Unknown	Algonquin P.P.	nd	fide Q.F. Hess			reported but unconfirmed		Hess and Hanks 1981
Unknown	Manitoulin Island	nd	fide Q.F. Hess			reported from Manitoulin Island but no vouchers were taken		Hess 1988
Unknown	Middlesex County	nd	[mapped]			reported but unconfirmed		Holmes <i>et al.</i> 1991
Unknown	Essex County	nd	[mapped]			reported but unconfirmed		Holmes <i>et al.</i> 1991
Unknown	Ottawa	nd	[mapped]			reported but unconfirmed		Holmes <i>et al.</i> 1991
Unknown	Toronto	nd	[mapped]			reported but unconfirmed		Holmes <i>et al.</i> 1991
Unknown	Hamilton	nd	[mapped]			reported but unconfirmed		Holmes <i>et al.</i> 1991
Unknown	Niagara R.M.	nd	[mapped]			reported but unconfirmed		Holmes <i>et al.</i> 1991
Unknown	Pinery	nd	fide Campbell and Coulson			reported but unconfirmed		Campbell and Coulson 1989
<i>E. persius</i>	[no locale]	nd	unknown	1		male specimen	UoG. L&H Feb 21/02	University of Guelph. Examined and determined by Lafontaine and Holder, February 21, 2002.

Correct Species	Location	Date	Collector/observer	Col*	Ob*	Abundance Notes	Examined	Source
<i>E. lucilius</i>	Port Franks	1993.05.22	Q.F. Hess	2		two male specimens	ROM. BOC#. L&H Feb 21/02	
<i>E. lucilius</i>	Warsaw Caves	1970.05.26	W.J.D. Eberlie	1		specimen	ROM. BOC#. L&H Feb 21/02	
<i>E. lucilius</i>	Greenwater P.P., Cochrane	1980.06.30	W.J.D. Eberlie	1		specimen	ROM. BOC#. L&H Feb 21/02	
<i>E. lucilius</i>	Twin Lakes, Methuen Tp.	1997.05.28	W.J.D. Eberlie	1		specimen	ROM. BOC#. L&H Feb 21/02	
<i>E. icelus</i>	Sudbury	1980.07.02	W.J.D. Eberlie	1		specimen	ROM. BOC#. L&H Feb 21/02	
<i>E. icelus</i>	Burnley, Northumberland Co.	1985.06.09	W.J.D. Eberlie	1		specimen	ROM. BOC#. L&H Feb 21/02	
Unknown	Port Franks	2005.05.28	Brenda Kulon		8	reported but unconfirmed		B. Kulon, pers.comm.

*Col = number of specimens collected, Ob = number of individuals observed.

Other Abbreviations: ROM = Royal Ontario Museum collection, UoG = University of Guelph collection, CNC = Canadian National Collection (Ottawa, Agriculture and Agri-Food Canada), SMD = S.M. Daniels Collection. L&H = examined by Layberry and Holder.

Appendix 2. *Erynnis persius persius* Surveys 2002.

Surveys were done on six separate dates during May and June, 2002. The spring was considered by many to be a late spring, perhaps by as much as two weeks. However, observations of other insect species during the surveys indicate that if *E. p. persius* was present, it should have been flying.

Survey Sites

Because of project constraints preventing the surveying of all extant or possibly extant lupine sites, three study areas considered to have the highest potential for hosting *E. p. persius* were identified for surveys. One study area was centred on St. Williams Regional Forest, specifically the Manestar Tract (Figure A1), which was the location for most of the previous observations of *E. p. persius*. This study area also included other prairie remnants north of the Manestar Tract within Norfolk County (Figure A2). The second study area was the Municipality of Lambton Shores (formerly Bosanquet Township) in northern Lambton County. Focus was placed on locations within and near to The Pinery Provincial Park (Figure A3) and the Karner Blue Sanctuary (Figure A4). The third study area included locations near Rice Lake in Peterborough County (Figure A5). Within each of the study areas, specific sites were walked where wild lupines (*Lupinus perennis*) were found (noted as black areas). Other areas of similar habitat where lupines were apparently absent (marked as grey, bordered with black) were usually walked or were slowly traversed in a car while lupines or butterflies were sought.

Other sites were considered but were excluded from surveys for various reasons. A site on Walpole Island was seriously considered, but after consulting with A. Woodliffe (pers. comm., 2002), it was determined that the site had been destroyed prior to the 2002 field season. A site in Sarnia was described by P.M. Banks (pers. comm., 2002) as hosting very few, scattered lupines. The lupine population of High Park was not surveyed because the likelihood that *E. p. persius* would be located at the site was low. This low likelihood was based on knowledge that the habitat and the lupine population at High Park had suffered from management that was not intended to promote or maintain oak savannah habitat. Although land management has since been modified to promote the health of lupine populations and oak savannah, M. Holder considered it unlikely that *E. p. persius* populations had persisted in this urban park, if indeed the species ever existed at High Park.

Survey Timing and Conditions

The following table describes the dates, time spent, weather and observers for each of the surveys (Table A1). The observers listed in Table A1 are all capable observers, in particular Andrea Kingsley and Carl Rothfels. They assisted in both searching for and catching *Erynnis*. Another capable observer, Mary Gartshore, visited St. Williams throughout May and June, 2002, and collected multiple *Erynnis* specimens for later determination by Matt Holder.

Table A1. Survey Timing and Conditions.

Site	Dates	Survey Duration*	Weather	Observers
St. Williams (Figure A1)	May 11, 2002	6 hours	Sunny, cool, ~14°C	Matt Holder
	May 31, 2002	5 hours	Sunny, warm, ~25°C	Matt Holder, Andrea Kingsley
	June 1, 2002	6 hours	Sunny, warm, ~27°C	Matt Holder, Andrea Kingsley, Carl Rothfels
Norfolk County (Figure A2)	May 31, 2002	3 hours	Sunny, warm, ~25°C	Matt Holder, Andrea Kingsley
	June 1, 2002	3 hours	Sunny, warm, ~27°C	Matt Holder, Andrea Kingsley
Pinery Provincial Park and Environs (Figure A3)	May 22, 2002	4.5 hours	Sunny, partly cloudy, cool, ~15°C	Matt Holder, Andrea Kingsley
	May 23, 2003	6 hours	Sunny, warm, ~25°C	Matt Holder, Andrea Kingsley, Melody Cairns, Annie Scherz
Karner Blue Sanctuary and Environs (Figure A4)	May 22, 2002	5 hours	Sunny, partly cloudy, cool, ~15°C	Matt Holder
	May 23, 2003	4 hours	Sunny, warm, ~25°C	Matt Holder
Rice Lake and Environs (Figure A5)	June 11, 2002	9 hours	Sunny, warm, ~28°C	Matt Holder

Note

* Time spent surveying by principal observer (Matt Holder). This time does not include other survey time undertaken by other observers and is a conservative estimate of observer effort.

Survey Site Habitat

Overall, the visited sites appeared suitable for *E. p. persius* at a coarse scale (i.e., they were open environments with prairie or savannah affinities), but the quality differed. Some sites had abundant lupines, while at other sites, lupines were sparse. Figures A1-A5 show the sites that were surveyed during the dates and times identified in Table A1. Sites where lupines were present are identified in black. Below are some further details on the habitat surveyed.

The St. Williams site (Figure A1) has many wild lupines present (and wild indigo *Baptisia tinctoria*), spread out along the edges (especially southern and western edges) of the open sand area present at the site. The largest patches had between 75 and 100 plants, while other patches had as few as one or two plants. Overall, between 250 and 300 individual lupines were noted at St. Williams, with many of them in the open sand area of the Tract. Smaller clumps of lupines were located along partly wooded trails leading to the west and south of the open sand area. Shrubby vegetation is encroaching on the areas with lupines, and the canopy cover, though fairly open, is probably greater

than 30% at all sites away from the open sand area. An estimated 0.03-0.04 ha of lupines were surveyed, scattered throughout the site (Figure A1).

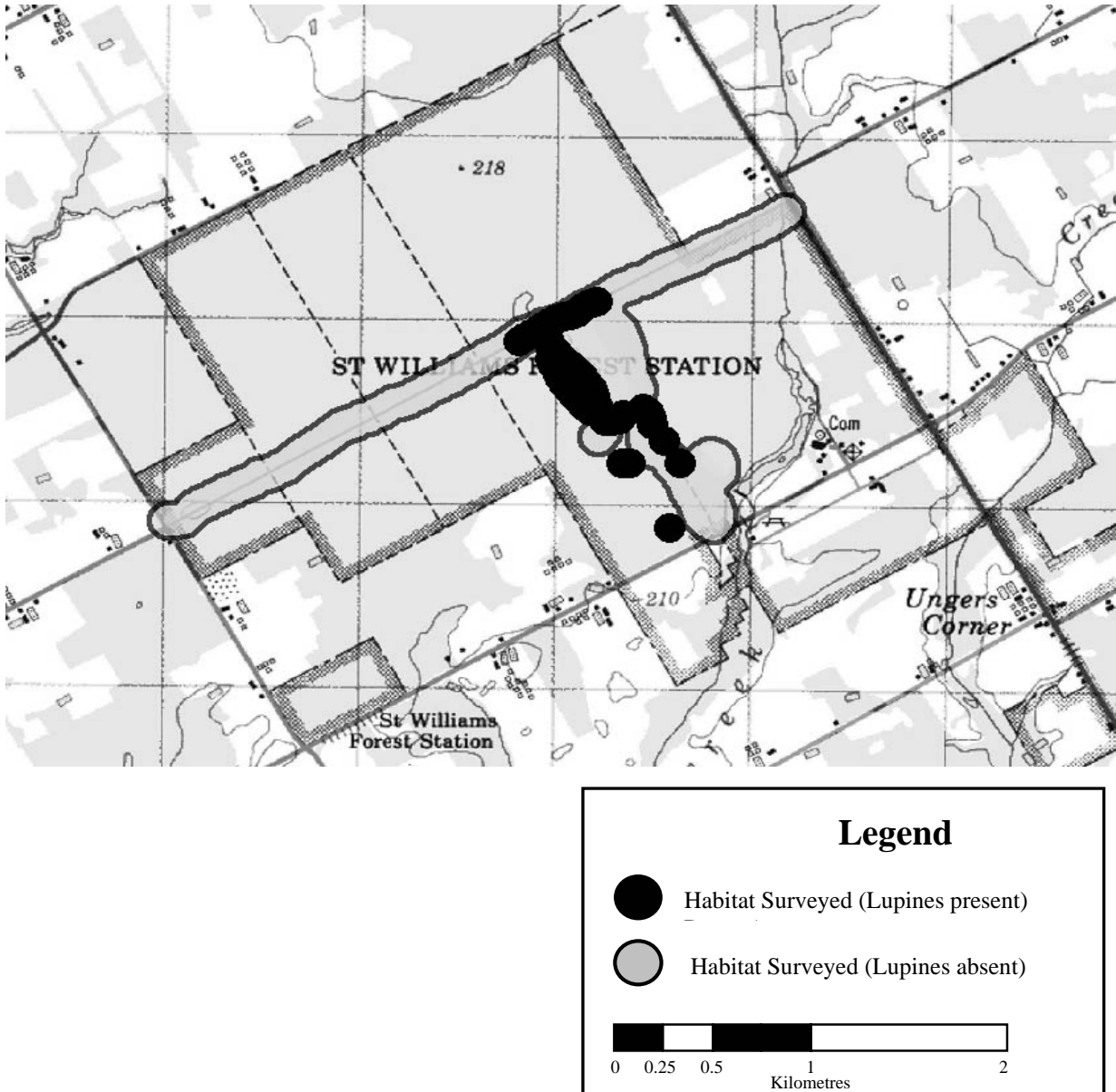


Figure A1. St. Williams Regional Forest Survey Sites.

Surveyed sites elsewhere in Norfolk County (Figure A2) were roadsides or railway beds. These sites are heavily fragmented and influenced by roadside/railway management. Although many superficially similar-looking sites were surveyed, only four sites with lupine plants were found, and each of these was sparsely populated by lupines. Combined, approximately 0.01 ha of suitable habitat with lupines was surveyed.

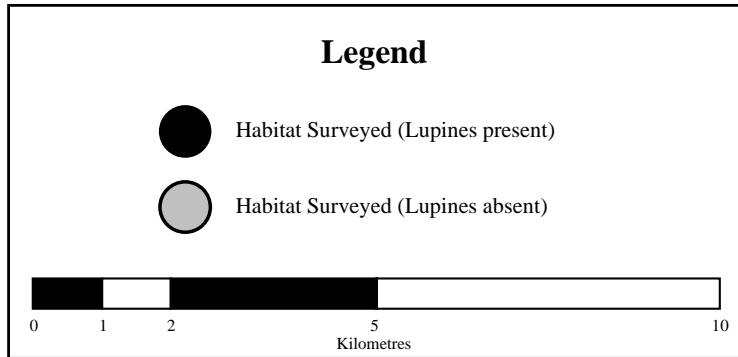
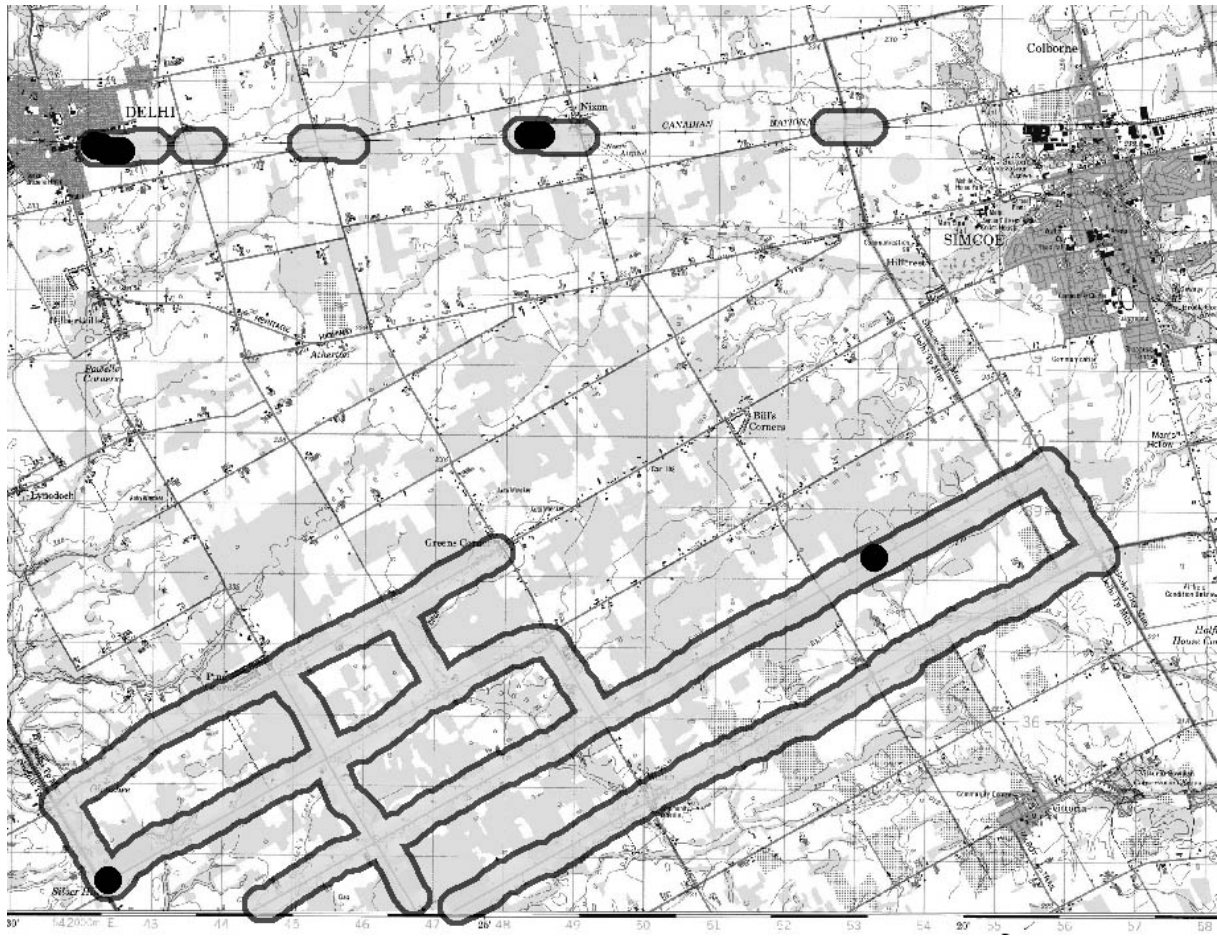


Figure A2. Norfolk County Survey Sites.

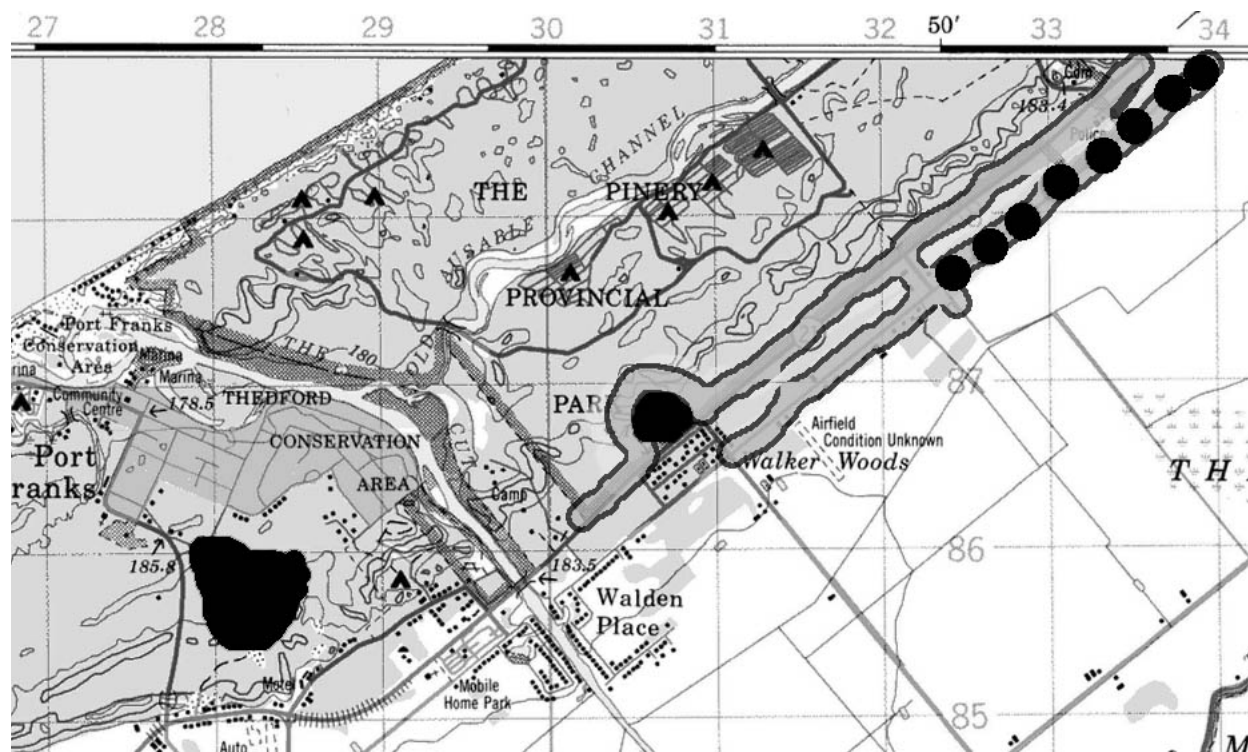


Figure A3. Pinery Provincial Park and Environs Survey Sites.

In the Municipality of Lambton Shores (formerly Bosanquet Township) in northern Lambton County, lupines were more abundant than at other sites. The Pinery Provincial Park has prime examples of oak savannah, although its health has suffered from past forest management practices and the influence of hundreds of browsing deer. However, lupines persist with hundreds of plants noted at several sites. Some patches of plants had as few as six lupines, while the bigger patches had between 100 and 200 plants, for an estimated total of 400 plants covering a combined area of approximately 0.04 ha. Outside of the park, lupines were found growing on roadsides in scattered and sparse clumps of 2 to 25 plants per station for an estimated total of 100 plants, covering a combined area of less than 0.01 ha. The Karner Blue Sanctuary had hundreds of plants

at certain locations within its confines, for a total of between 500 and 1000 plants over a combined area of between 0.1 ha and 0.2 ha (Figure A4), while other areas in the Sanctuary, though appearing similar structurally, did not host lupines.

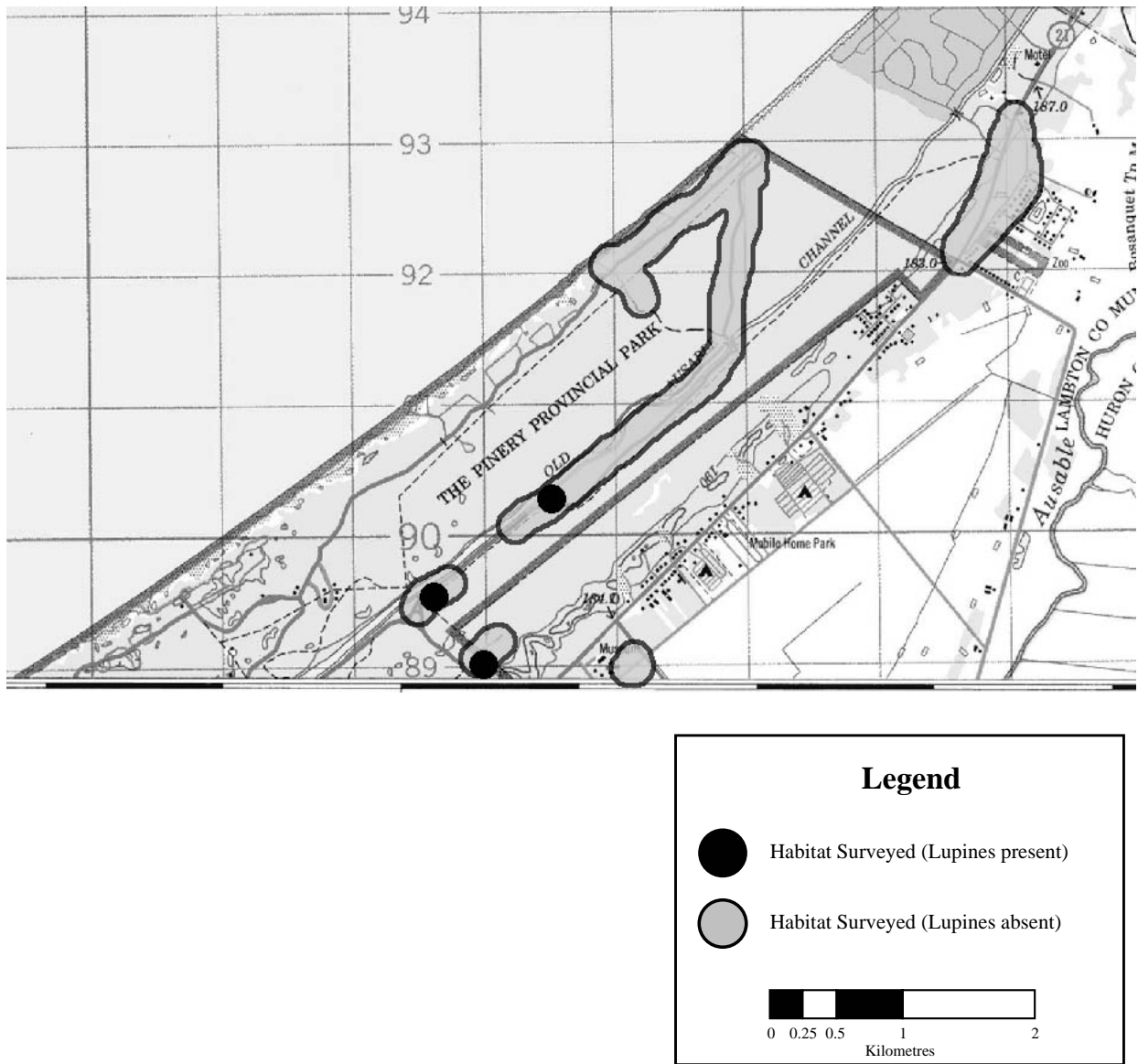


Figure A4. Karner Blue Sanctuary and Environs Survey Sites.

The Rice Lake study area included survey sites to the south and north of Rice Lake in Hiawatha First Nation (Figure A5). Only one patch of lupines, comprising between 200 and 300 plants in an area of approximately 0.04 ha, was located on a roadside. Other sites within the area were surveyed, but no other lupines could be located.

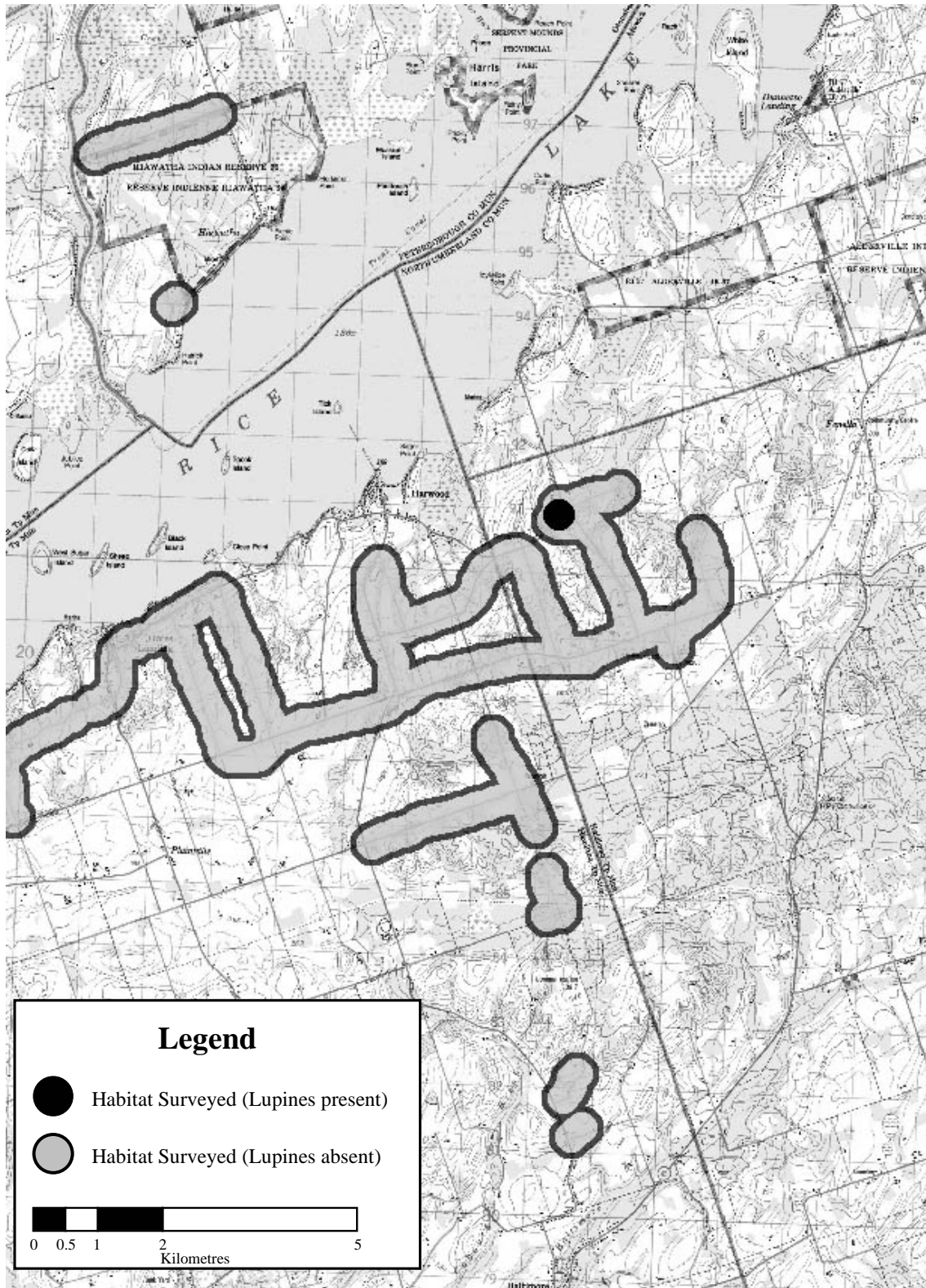


Figure A5. Rice Lake Study Area Survey Sites.

Survey Methodology

At each site, observers searched for lupines and looked for any skipper visiting the flowers or leaves of the lupines or flying through or near the patches. All *Erynnis* individuals seen were carefully observed, and attempts were made to capture all individuals seen. All species of butterflies (and other taxa opportunistically) observed and/or captured during surveys were noted. Additionally, lupine leaves were examined for insect herbivory, and an attempt was made to look for eggs on the undersurfaces of the leaves (although the efficacy of this approach is unknown and could very well be poor). Candidate *Erynnis* were collected and identified by examining their genitalia using a dissecting microscope.

Survey Results

No *E. p. persius* was observed or collected during surveys done for this report. Other *Erynnis* spp. observed and collected included *E. lucilius*, *E. icelus*, *E. baptisiae*, *E. juvenalis* and *E. brizo*. Other early spring, small butterflies were also noted throughout the survey period, including *Callophrys niphon* and *Celastrina ladon*, in addition to other larger species (e.g., *Nymphalis antiopa*).

The first survey at St. Williams, was conducted on May 11, 2002 during a cool spring day. Very few insects were observed until it warmed up during midday, and even then, the only butterflies observed were two *C. ladon*. However, a lot of butterfly activity was noted on May 22, 2002 in Lambton County, with many species seen. Many *Erynnis* spp. were seen and captured, although all of them were identified on site or later in the lab to be *E. juvenalis*, *E. icelus* and *E. lucilius*. Other butterflies observed on May 22, 2002 include several *C. ladon*, *N. antiopa* and a single *Pieris* sp. that could not be identified to species. No new species were seen the following day, but the warmer temperatures helped to increase the number of butterflies flying. Still later, on May 31, 2002, insects were very active and a typical assemblage of May butterfly species was noted, including *E. brizo* and *E. baptisiae*. The remainder of the species observed on May 31 and especially June 1, 2002 included: *Papilio polyxenes*, *P. glaucus*, *Pieris rapae*, *Colias* sp., *Lycaena phlaeas*, *Callophrys niphon*, *Celastrina ladon*, *Polygonia interrogationis*, *N. antiopa*, *Vanessa atalanta*, *V. virginiensis*, *Coenonympha tullia*, *Danaus plexippus* and *Poanes hobomok*. The survey undertaken on the final day in the Rice Lake area on June 11, 2002 was in very warm and sunny weather, and the local insect fauna was active with many individuals observed. Species observed during this survey included the duskywings *E. juvenalis*, *E. lucilius* and *E. icelus*, as well as other species, including *Papilio canadensis*, *Pieris rapae*, *P. oleracea*, *Celastrina ladon*, *Glaucopsyche lygdamus*, *Phyciodes tharos*, *Nymphalis vaualbum*, *Coenonympha tullia*, *Carterocephalus palaemon*, *Thymelicus lineola*, *Poanes hobomok*, and *Amblyscirtes vialis*.

Existing Threats

No threats to *E. p. persius* were identified beyond those already mentioned in the report (e.g., forest practices, deer herbivory).