

**Ontario Species at Risk Evaluation Report for Nine-spotted Lady Beetle (*Coccinella novemnotata*)**

Committee on the Status of Species at Risk in Ontario  
(COSSARO)

Assessed by COSSARO as Endangered

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Final

## Coccinelle à neuf points (*Coccinella novemnotata*)

La coccinelle à neuf points est une espèce indigène de coccinelle de la famille des coccinellidés. C'est une espèce généraliste qui se nourrit de divers insectes à corps mou (pucerons et insectes apparentés). À l'âge adulte, elle mesure environ 4 à 7 mm de long et possède généralement neuf points noirs sur ses élytres, ainsi que d'autres marques qui permettent de l'identifier assez facilement. La coccinelle à neuf points vit dans des habitats très variés, aussi bien naturels qu'artificiels (tels que les champs agricoles). Par le passé, on pouvait retrouver la coccinelle à neuf points dans tout le Sud de l'Ontario, jusqu'au lac Supérieur, mais sa présence n'a pas été signalée depuis le milieu des années 1990. D'après des relevés récemment effectués au Québec et dans l'État de New York, il est possible que la coccinelle à neuf points soit encore présente dans certaines régions de l'Ontario.

Compte tenu du déclin de son abondance depuis quelques dizaines d'années, attribuable à plusieurs facteurs (présence d'une espèce envahissante, exposition aux pesticides), la coccinelle à neuf points est considérée comme une espèce en voie de disparition.

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## Executive summary

The Nine-spotted Lady Beetle (*Coccinella novemnotata*) is a native lady beetle species (Coleoptera: Coccinellidae) and is a generalist predator on various soft bodied insects, (e.g., aphids and their relatives). Adult beetles are approximately 4-7 mm long and usually have nine distinct black dots on their elytra, along with other markings that make identification relatively easy. The Nine-spotted Lady Beetle occurs in a wide variety of habitats, both natural and artificial (including agricultural fields). Historically, the Nine-spotted Lady Beetle could be found throughout southern Ontario, extending as far north as Lake Superior, but there are no records in the province since the mid 1990's. Recent records in Quebec and New York indicate that it possible that the Nine-spotted Lady Beetle still occurs in parts of Ontario.

The Nine-spotted Lady Beetle is assessed as Endangered based on the decrease in abundance over the past few decades due to several possible factors (invasive species, pesticide exposure).

# 1. Background information

## 1.1. Current designations

- GRANK: G2 (NatureServe 2016)
- NRANK Canada: NNR
- COSEWIC: Endangered (April 2016)
- SARA: No Status (No Schedule)
- ESA 2007: No Status
- SRANK: SH

## 1.2. Distribution in Ontario

Historical records of the Nine-spotted Lady Beetle record it from throughout southern Ontario, occurring as far north as the eastern shores of Lake Superior (Figure 1), with anecdotal evidence indicating that this was once one of the most commonly encountered lady beetle species in Ontario. A very small number of observations were recorded in the 1980's (Figure 2). Since the mid 1990's, there have been no records of this species in Ontario, despite various survey projects of southern Ontario and specific, directed efforts to find it. This absence of recent records suggests that the Ontario population may now be extirpated, but individuals or small populations may have been overlooked in parts of its range.

Figure 1. All known Ontario Nine-spotted Lady Beetle records. Data provided by Dr. P. Grant, and was used in COSEWIC (2016). Created for this report [GeoCAT online web tool](#).

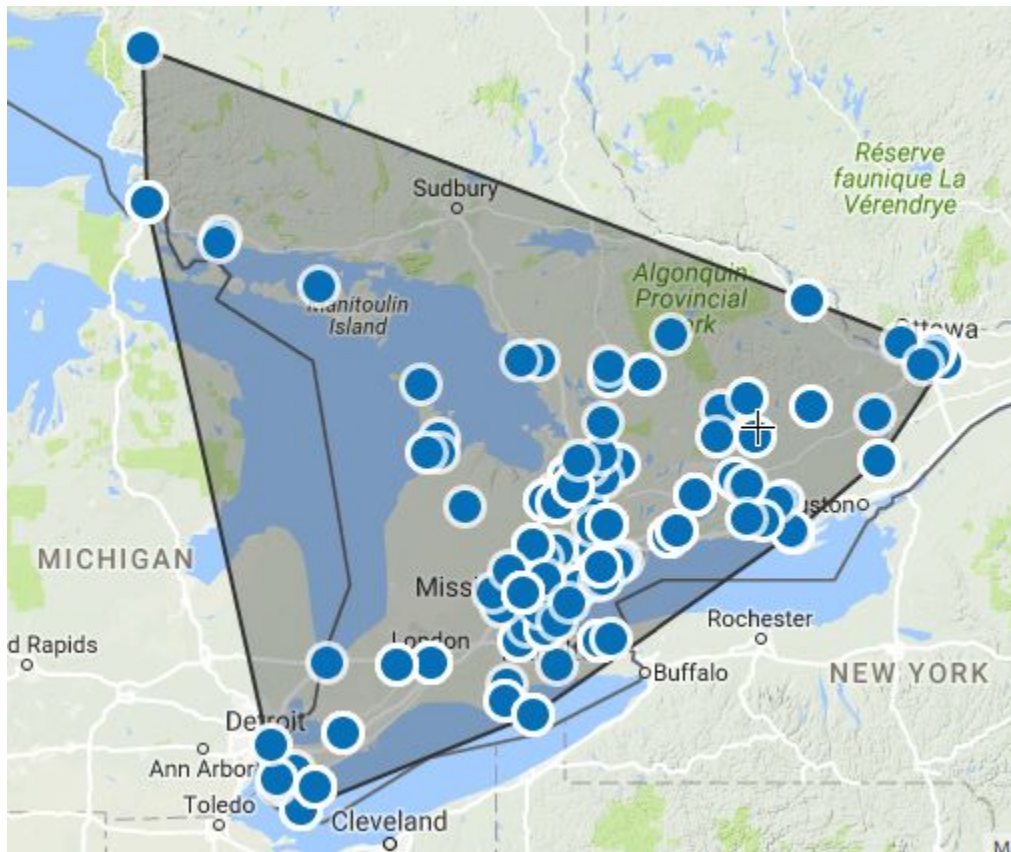
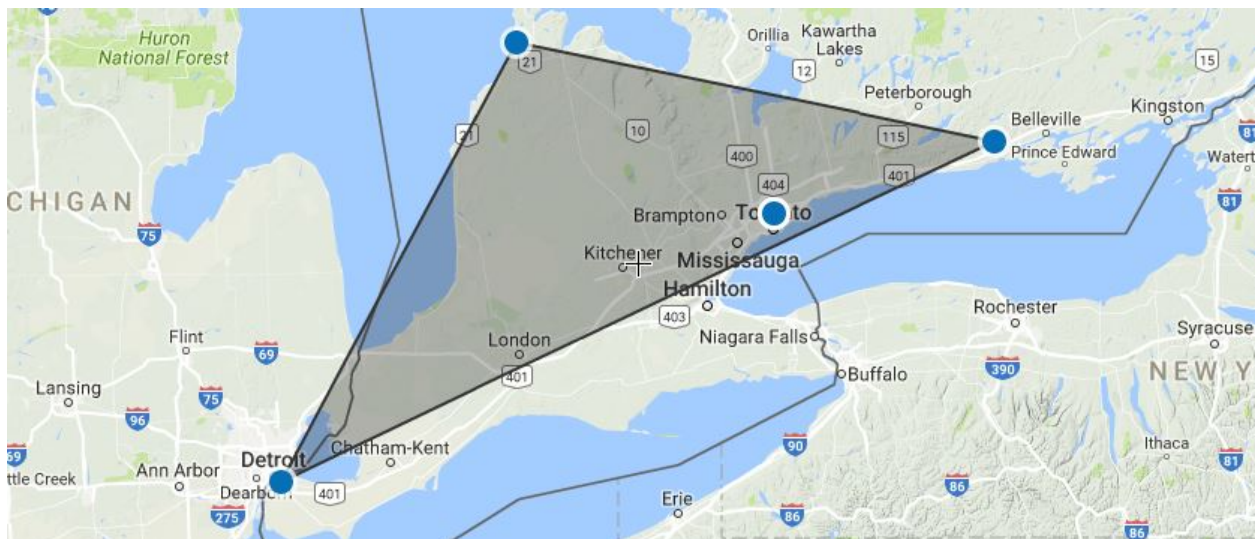


Figure 2. All known Ontario Nine-spotted Lady Beetle records from 1980-1987 (last recorded occurrence in Ontario). Data provided by Dr. P. Grant, and was used in COSEWIC (2016). Created for this report [GeoCAT online web tool](#).



### 1.3. Distribution and status outside Ontario

In Canada, the Nine-spotted Lady Beetle has also been recorded from British Columbia, Alberta, Saskatchewan, Manitoba and Quebec (COSEWIC 2016). In the U.S.A., it was previously widely distributed and commonly represented in historic collections, occurring in most continental US jurisdictions south to the Mexican border (COSEWIC 2016). Within the past 10 years, there have been 13 records from Canada, in the provinces of British Columbia (6), Alberta (6) and Quebec (1) (COSEWIC 2016). The species also appears to have been extirpated from much of the eastern US, with all recent records resulting from a major Cornell University initiative with the majority of occurrences in the western US (NatureServe 2016). One of the eastern records for Nine-spotted Lady Beetle that the Cornell University initiative (called the “Lost Ladybug Project”, Cornell University, 2016), was successful in locating was from New York state, where it had not previously been documented for 29 years (New York Times 2011).

### 1.4. Ontario conservation responsibility

Ontario’s global conservation responsibility is relatively minor (percentage not available but, based on historical ranges is much below 25%, and based on modern records, is 0%). Ontario represented almost one-third (31.2%) of 1061 historical Canadian records for this species (COSEWIC 2016). With no recent records, it is unlikely to play a significant role in helping re-establish this species in other parts of the Nine-spotted Lady Beetle’s historic range.

### 1.5. Direct threats

The known threats and causes behind the decline of the Nine-spotted Lady Beetle are unknown. The introduction of several invasive lady beetle species, specifically the Multi-coloured Asian Lady Beetle (*Harmonia axyridis*) and the Seven-spotted Lady Beetle (*Coccinella septempunctata*), coincides with and are strongly implicated in the decline of the Nine-spotted Lady Beetle. It seems likely that increased competition between species, predation upon the Nine-spotted Lady Beetle by these invasive species, or disease, pathogens or parasites transferred from invasive species led to the decline over its entire range (COSEWIC 2016). Utilization of certain pesticides in agricultural systems may have also contributed to a decrease in its population.

### 1.6. Specialized life history or habitat use characteristics

The Nine-spotted Lady Beetle was previously found in a variety of habitats, including agricultural areas, was one of the most common lady beetles in Canada, and did not appear to have any specialization that would make it more susceptible to disturbance than any other native lady beetle species. As a generalist predator on sternorrhynchan Hemiptera (e.g., aphids, scales) and other soft-bodied insects, it was not limited to one food source. Little is known about its specific ovipositioning behaviour.

## 2. Eligibility for Ontario status assessment

### 2.1. Eligibility conditions

#### 2.1.1. Taxonomic distinctness

The Nine-spotted Lady Beetle is easily separable from its congeners on the basis of morphological characters and colour patterns.

#### 2.1.2. Designatable units

There is only one designatable unit, the species *Coccinella novemnotata*; there are no subspecies or discrete populations designated for the Nine-spotted Lady Beetle.

#### 2.1.3. Native status

The Nine-spotted Lady Beetle is native to Ontario with historical records of its occurrence in Ontario from over 100 years ago.

#### 2.1.4. Occurrence

The lack of recent records in Ontario of the Nine-spotted Lady Beetle suggests that the provincial population may have become extirpated. Directed efforts to document it within parts of its historical range were unsuccessful, but they have not fully surveyed the historic range in Ontario allowing for the possibility that the Nine-spotted Lady Beetle still occurs in a small discrete population. In New York, where 29 years had passed since a verified record of the Nine-spotted Lady Beetle occurred, a small population was discovered. A recent record in Quebec (Mount St. Hilare) indicates there is still an eastern Canadian population present and offers hope that it may still be found in parts of Ontario. Although the decline of this species in Ontario is documented based on historical collections, its perceived decline may, in part be attributed to “collector satiation” of lady beetles, when collectors stop collecting or examining lady beetles because of the abundance of the similar invasive species; McCorquodale *et al.* (2011) argued that this was unlikely. Recent publicity of the disappearance of this species has created sufficient interest (including several citizen science initiatives in the northeastern USA), and it is likely that records of the Nine-spotted Lady Beetle by amateur naturalists in Ontario would have been recorded, but these efforts are difficult to document and the distribution of their efforts over the historic range is unknown.

### 2.2. Eligibility results

The Nine-spotted Lady Beetle (*Coccinella novemnotata*) is eligible for status assessment in Ontario.

## 3. Ontario status assessment

### 3.1. Application of endangered/threatened status in Ontario

#### 3.1.1. Criterion A – Decline in total number of mature individuals

Meets Endangered under Criterion A2abce. The documented records of Nine-spotted Lady Beetle have been reduced by more than 50% over the past 30 years, both in anecdotal observations and specimen vouchers (subcriteria a and b). Due to the precipitous decline in verifiable records, the IAO and EOO have substantially declined, and the effects of the various introduced lady beetle species on Nine-spotted Lady Beetle still persist (subcriteria c and e). Although Criterion A2 specifies a period over the past 10 years, its application here meets the spirit of the criteria. Furthermore, as efforts to support its extirpation in Ontario are questionable at the provincial scale, any remaining population(s) that may still occur in Ontario likely remain under threat from the cause(s) of the original decline nearly 30 years ago.

#### 3.1.2. Criterion B – Small distribution range and decline or fluctuation

Not applicable. The Nine-spotted Lady Beetle was known to have a relatively wide distribution in Ontario based on historical data but its current EOO and IAO are in question. If any recent records of the Nine-spotted Lady Beetle were to be verified then, Criterion B1 and B2 may be applicable.

#### 3.1.3. Criterion C – Small and declining number of mature individuals

Insufficient information. Criterion C does not apply as no population data is available. However if the Nine-spotted Lady Beetle is considered to be present in Ontario, the population is very likely under the numerical threshold for Endangered, and the population decline can be inferred to be continuing.

#### 3.1.4. Criterion D – Very small or restricted total population

Insufficient information. No data exists to indicate the current population number.

#### 3.1.5. Criterion E – Quantitative analysis

Not applicable.

### 3.2. Application of Special Concern in Ontario

Not applicable.

### 3.3. Status category modifiers

#### 3.3.1. Ontario's conservation responsibility

Not applicable. The G-Rank is G2 but Ontario's conservation responsibility is not significant (<<25%) and there is no recent record of this species occurring, let alone



reproducing, in Ontario.

### 3.3.2. Rescue effect

Rescue effects from neighbouring populations to enhance or establish Ontario's population are unlikely, but possible. Recent records of the Nine-spotted Lady Beetle in Quebec suggest there are relatively nearby populations, and, as Quebec is climatically similar and with similar flora and fauna, immigrants from here would have a high likelihood of surviving. The Nine-spotted Lady Beetle is also able to travel large distances (COSEWIC 2016) supporting the possibility of some level of rescue effect. However, the low population status elsewhere in eastern North America precludes any real likelihood of rescue effect for the Ontario population.

## 3.4. Other status categories

### 3.4.1. Data deficient

Not applicable. There is enough data to demonstrate a decline in the population although it may be applicable if COSSARO supports the possibility that directed efforts to sample this species in Ontario were not sufficient enough to sample eastern Ontario sites. The majority of sampling for this species were done along the Lake Huron coastline (or close to it) and ignored the majority of historical localities, which occurred in eastern Ontario (see Fig. 7, COSEWIC 2016).

### 3.4.2. Extinct or extirpated

Not applicable. Specimens have been found within the last 50 years and insufficient effort has been made to survey for the Nine-spotted Lady Beetle throughout its historical range in Ontario. As previously discussed, the absence of records in the past 29 years, despite having once been one of the more common lady beetle species in Ontario, along with the variety of efforts in the past 15 years to document it in Ontario, suggests that the Nine-spotted Lady Beetle may be extirpated in Ontario. Although this evidence is compelling, efforts to survey for it throughout the historical range in Ontario is considered here to be insufficient to exclude the possibility that the Nine-spotted Lady Beetle persists in the province as a small discrete population(s).

### 3.4.3. Not at risk

Not applicable.

## 4. Summary of Ontario status

The Nine-spotted Lady Beetle (*Coccinella novemnotata*) is classified as Endangered in Ontario based on meeting criterion A2abce.

## 5. Information sources

Cornell University. 2016. Lost Ladybug Project <http://www.lostladybug.org/c9-in-decline-1119.php> [website accessed December 2016].

COSEWIC 2016. COSEWIC assessment and status report on the Nine-spotted Lady Beetle *Coccinella novemnotata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 57 pp.

McCorquodale, D.B., D.J. Giberson, and S.M. Marriott. 2011. Changes in the status and geographic ranges of Canadian lady beetles (Coleoptera: Coccinellidae: Coccinellinae) and the selection of candidate species for risk assessment. Part 3: Final Report. Committee on the Status of Endangered Wildlife in Canada, Ottawa.

Natureserve. 2016. [NatureServe Explorer: An online encyclopedia of life \[web application\]](#). Version 7.0. NatureServe, Arlington, VA. U.S.A. [website accessed November 29 2016]

New York Times. 2011. Ladybug, Ladybug, Welcome Back Home: Good News for the Official State Insect. <http://www.nytimes.com/2011/11/25/science/earth/nine-spotted-ladybug-new-york-state-insect-is-back.html> [website accessed November 29 2016].

## Appendix 1: Technical summary for Ontario

Species: Nine-spotted Lady Beetle (*Coccinella novemnotata*)

### Demographic information

Demographic attribute	Value
Generation time. Based on average age of breeding adult: age at first breeding = X year; average life span = Y years.	0.5 years
Is there an observed, inferred, or projected continuing decline in number of mature individuals?	Unknown. If a population still persists in Ontario, it is very clearly in decline.
Estimated percent of continuing decline in total number of mature individuals within 5 years or 2 generations.	Unknown
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over the last 10 years or 3 generations.	Unknown
Projected or suspected percent reduction or increase in total number of mature individuals over the next 10 years or 3 generations.	Unknown
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over any 10 years, or 3 generations, over a time period including both the past and the future.	Unknown
Are the causes of the decline (a) clearly reversible, and (b) understood, and (c) ceased?	a. No b. No c. No/Unknown
Are there extreme fluctuations in number of mature individuals?	Unknown

### Extent and occupancy information in Ontario

Extent and occupancy attributes	Value
Estimated extent of occurrence (EOO). <i>Data was estimated from COSEWIC EO data for Ontario, using <a href="http://geocat.kew.org">geocat.kew.org</a>.</i>	_0_ km <sup>2</sup> Historical: 251 639.1 km <sup>2</sup> Post-1980: 39822.6km <sup>2</sup>
Index of area of occupancy (IAO). <i>Data was estimated from COSEWIC EO data for Ontario, using <a href="http://geocat.kew.org">geocat.kew.org</a></i>	Current IAO Unknown Historical: 392 km <sup>2</sup> Post-1980: 16km <sup>2</sup>

Is the total population severely fragmented? i.e., is >50% of its total area of occupancy in habitat patches that are: (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	a. Unknown b. No
Number of locations.	Recent: 0 Historical: Not available
Number of NHIC Element Occurrences	Data Not Available
Is there an observed, inferred, or projected continuing decline in extent of occurrence?	No/Unknown
Is there an observed, inferred, or projected continuing decline in index of area of occupancy?	No/Unknown
Is there an observed, inferred, or projected continuing decline in number of populations?	No/Unknown
Is there an observed, inferred, or projected continuing decline in number of locations?	No/Unknown
Is there an observed, inferred, or projected continuing decline in [area, extent and/or quality] of habitat?	Unknown but unlikely
Are there extreme fluctuations in number of populations?	Unknown
Are there extreme fluctuations in number of locations?	No/Unknown
Are there extreme fluctuations in extent of occurrence?	No/Unknown
Are there extreme fluctuations in index of area of occupancy?	No/Unknown

## Number of mature individuals in each sub-population or total population (if known)

Currently, no mature individuals of the Nine-spotted Lady Beetle are known to occur in Ontario.

## Quantitative analysis (population viability analysis conducted)

Not conducted.

## Threats

An IUCN Threats calculation was done by COSWEIC (2016). Low impact threats included agriculture and natural system modifications. The high impact threats were invasive species and pollution from agricultural and forestry effluents.

## Rescue effect

<b>Rescue effect attribute</b>	<b>Value</b>
Status of outside population(s) most likely to provide immigrants to Ontario	Not ranked (Quebec, New York) but likely to be considered in the near future.
Is immigration of individuals and/or propagules between Ontario and outside populations known or possible?	Possibly
Would immigrants be adapted to survive in Ontario?	Yes
Is there sufficient suitable habitat for immigrants in Ontario?	Yes (unless negated due to the presence of invasive lady beetle species)
Are conditions deteriorating in Ontario?	No, although continuing presence of established invasive lady beetle species may have some impact if their range is still expanding.
Is the species of conservation concern in bordering jurisdictions?	Probably but not ranked in any bordering jurisdictions
Is the Ontario population considered to be a sink?	Unknown but possible
Is rescue from outside populations likely?	Possibly, but highly unlikely

## Sensitive species

This is not a data sensitive species.

## Appendix 2: Adjoining jurisdiction status rank and decline

### Information regarding rank and decline for Nine-Spotted Lady Beetle (*Coccinella novemnotata*)

Jurisdiction	Subnational rank	Population trend	Sources
Ontario	SH (current)	Endangered/Extirpated	NatureServe (2016)
Quebec	SNR	Unknown	COSEWIC (2016)
Manitoba	SNR	Unknown but either declining or extirpated. Undetected in past decade	COSEWIC (2016)
Michigan	SNR	Unknown	N/A
Minnesota	SNR	Unknown	N/A
Nunavut	Not Present	Not historically present	COSEWIC (2016)
New York	SNR	Unknown	No sightings for past 30 years, until a localized population located in 2011 (New York Times 2011)
Ohio	SNR	Unknown	N/A
Pennsylvania	SNR	Unknown	N/A
Wisconsin	SNR	Unknown	N/A

### Acronyms

COSEWIC: Committee on the Status of Endangered Wildlife in Canada

COSSARO: Committee on the Status of Species at Risk in Ontario

ESA: Endangered Species Act

GRANK: global conservation status assessments

IAO: index of area of occupancy

MNRF: Ministry of Natural Resources and Forestry

NHIC: Natural Heritage Information Centre

NNR: Unranked

NRANK: National conservation status assessment

SARA: Species at Risk Act

SNR: unranked

SRANK: subnational conservation status assessment

S1: Critically imperiled

S3: Vulnerable

S5: Secure

IUCN: International Union for Conservation of Nature and Natural Resources

CDSEPO: Le Comité de détermination du statut des espèces en péril en Ontario