

**ASSESSMENT OF THE CAPACITY OF  
CANADIAN FEDERAL AND PROVINCIAL LEGISLATION TO  
CONSERVE NATIVE AND MANAGED POLLINATORS**

*Jennifer Tang<sup>1</sup>, Joanna Wice<sup>2</sup>, Vernon G. Thomas<sup>1</sup> and Peter G. Kevan<sup>2</sup>*

<sup>1</sup> Department of Integrative Biology, College of Biological Science, University of Guelph,  
Guelph, Ontario N1G 2W1, Canada.

<sup>2</sup> Department of Environmental Biology, Ontario Agricultural College, University of Guelph,  
Guelph, Ontario N1G 2W1, Canada.

**A Report Compiled by**  
*The International Network of Expertise for Sustainable Pollination*  
**at the request of**  
*The North American Pollinator Protection Campaign*

23 December, 2005

## TABLE OF CONTENTS

<b>Executive Summary .....</b>	<b>3</b>
<b>Abstract.....</b>	<b>4</b>
<b>Introduction to the issues .....</b>	<b>5</b>
<b>Methods.....</b>	<b>8</b>
<b>Results .....</b>	<b>9</b>
<b>Discussion .....</b>	<b>12</b>
<b>References.....</b>	<b>16</b>
<b>Recommendations for further action.....</b>	<b>21</b>

## Executive Summary

.The International Network of Expertise for Sustainable Pollination, at the request of the North American Pollinator Protection Campaign, NAPPC, completed a study of Canadian federal and provincial legislation to determine the capacity of existing laws to afford protection to wild, native, species of pollinating insects.

. The report focussed on federal legislation and that of the province of Ontario in particular, since this is where the greatest impacts upon wild pollinating insects may be expected from the pressures of increased human population growth and its attendant urban sprawl and elimination of wild and agricultural lands. The analysis confined itself to hard law (i.e. binding statutes), rather than soft laws (accords, agreements, or strategies) that usually lack any legal backing.

. Canadian jurisdiction over wild pollinating insects may be both federal and provincial. Federal laws apply in all National Parks and National Wildlife Areas. Provincial laws apply to the same species in all other areas of Canada, as well as to managed populations of bees.

. There is no *explicit* provision in either federal laws or provincial laws for the protection or conservation of wild pollinating species of insects.

. At the federal level, legal provisions could be created by amending the Parks Act, for example, to allow pollination by wild species of insects to be recognized as a vital ecological service and a component of ecosystem integrity. The federal Species at Risk Act should replace the term “Lepidoptera” by “Insecta” so that all protection is afforded, potentially, to all pollinating species of insects in Canada. The Pest Control Products Act, administered by the Canadian Pest Management Agency, could be amended to include explicit reference to wild and managed species of pollinators, especially since new pesticide registration under the Act may require studies on bee toxicity. It is acknowledged that this Agency has begun to consider insect pollination as an important agricultural service.

. Similar amendments could be made to provincial Acts, coupled with provisions to secure the habitats of wild native pollinating insects. Here, it is important to recognize that pollination by wild species is not only an important ecological service, but may be important to the existence of certain rare and/or threatened plants and the insects that they, in turn, support.

. It is recommended that NAPPC extend this analysis to other provinces of Canada, and commission similar analyses on the legislation of the USA and Mexico to determine their capacity to conserve native pollinating species.

. The same analysis could be extended to the North American Agreement on Environmental Cooperation of the North American Free Trade Agreement.

. The NAPPC is encouraged to investigate progressive, adaptive, initiatives undertaken by other countries, and to indicate how they could be incorporated into the policy and law of its member Parties, wherever appropriate, so that the services of native wild pollinators to both nature and agriculture will persist.

## ABSTRACT

The plant-pollinator relationship is critical in conserving the World's natural and agricultural ecosystems, but yet is largely unappreciated. The decline in pollinator numbers, particularly in the southern regions of Canada, makes this issue of great concern. There is a need for active conservation that includes native, wild, and managed pollinators. Current federal and provincial legislation was examined to determine whether Canada has the capacity to manage native pollinators. Legislation was chosen based on its potential to contain provisions for pollinator protection. The wording, specific statements within each act, and the context in which they are used, was analyzed. Federal and provincial legislation was categorized into one of three classes: A) has explicit provisions for pollinator conservation, B) is related to but no explicit provisions for pollinator conservation are present, C) has nothing to do with pollinator conservation. Results indicate that Canada has inadequate legislative provisions for native pollinator conservation at the federal and provincial level. There are generally few, or no specific provisions, dealing directly with native pollinators, but some legislation alludes to it. Some existing legislation pertains to the protection of managed pollinators, especially the Western honeybee (*Apis mellifera*). Therefore, amending existing or creating new legislation is needed. Provincial acts related to managed bees could be amended to include all bees and other pollinator species. Federal acts such as the National Parks Act and the Species at Risk Act (and their provincial counterparts) could also be amended to include provisions for native pollinator conservation. Effective pollinator conservation requires management, research, education and monitoring, but the enabling legislative provisions have to be created first for this to happen. Both levels of government should provide the necessary legal provisions for the protection and conservation of native pollinators to ensure that these ecological and agricultural services continue.

## INTRODUCTION TO THE ISSUES

There are several key biological processes called “ecosystem services” upon which human life depends (Daily, 1997). These services maintain the diversity and abundance of organisms, and also produce goods such as food, fibre, biomass and timber that we require for survival (Daily, 1997). Pollination is one of these essential processes and is important in the functioning of ecosystems (Nabhan and Buchmann, 1997; Kevan and Viana, 2003). Pollination is the transfer of pollen from the anther of one flower to the stigma of another or same flower (Faegri and van der Pijl, 1979; Proctor *et al.*, 1996) and is the first event, after flowering, leading to seed and fruit production. Pollination occurs through biotic and abiotic means. Abiotic pollination is achieved by wind, water or gravity, but biotic pollination occurs through the activities of animals. Animals that serve as pollinators include bees, wasps, moths, butterflies, flies, beetles, birds, and mammals (Faegri and van der Pijl, 1979; Proctor *et al.*, 1996).

The plant-pollinator relationship is vital for the conservation of the earth’s flora and fauna via the maintenance of biodiversity, but the importance of this interaction is not always appreciated (Daily, 1997; Kearns *et al.*, 1998; Kevan and Viana, 2003). The understanding of the diversity of species involved in pollinating plants is increasing. It is estimated that 90% of the World’s flowering plants require biotic pollination (Buchmann and Nabhan, 1996; Kearns *et al.*, 1998). Because of the complex relationship between the plant and pollinator, the decline or loss of either species could ultimately affect the survival of both, and have ramifications throughout food-webs, including those of human beings.

Pollinators are economically important to agriculture because about a third of the crops we eat require insect pollination (McGregor, 1976; Free, 1993; Buchmann and Nabhan, 1996). The economic value of all pollinator services including honeybees, *Apis mellifera*, to US agriculture has been estimated to be 5.7-13.4 billion \$US a year (Southwick and Southwick, 1992; Robinson *et al.*, 1989; Morse and Calderone, 2000; Anon, 2003). The full economic contribution of pollination has not been assessed rigorously, but the adverse implications of pollinator shortages to producers and to consumers can be appreciated readily (Kevan and Phillips, 2001). That problem has been recognized for specific crops in Canada (e.g. alfalfa and lowbush blueberries) since the 1940s, and in the natural environment since the 1970s (Kevan and Phillips, 2001). Canada has experienced a decline in both the number of beekeepers and of honeybee hives. There are now approximately 10,000 beekeepers operating a total of 600,000 honeybee colonies in Canada (Canadian Honey Council, 2003). Since the 1990s, losses in managed honeybee populations have also occurred in the United States (Allen-Wardell *et al.*, 1998; Watanabe, 1994). Many species of native bees are known to be efficient pollinators of crops, but few have been managed for this purpose (Goulson, 2003; Strickler and Cane (eds), 2003). Although some farmers rely on native insects for crop pollination, their economic value as pollinators is not known and their importance generally unappreciated (Allen-Wardell *et al.*, 1998; Kevan and Phillips, 2001). In Canada, native pollinators include birds and insects, but this paper is limited to the latter, including species from the orders Hymenoptera (mostly bees), Diptera (true flies), Lepidoptera (butterflies and moths) and Coleoptera (beetles).

The general decline in the number of pollinators is evident, particularly in the southern regions of Canada. This decline can be attributed to habitat loss and destruction, habitat

fragmentation, pesticide use and pests (Kevan, 1975, 2001; Stubbs and Drummond (eds), 2001; Kremen and Ricketts, 2000; Kremen *et al.*, 2002; Kearns and Inouye, 1997; Kearns *et al.*, 1998, Rathcke and Jules, 1993). The consequences of decline in native pollinators are varied, but the main issue is the potential decrease in biodiversity with its associated social and economic concerns. Declines or losses of pollinators and plant species in natural or semi-natural environments (e.g. forests, parks, grasslands) could impact adversely species higher in food webs (Kearns and Inouye, 1997; Allen-Wardell *et al.*, 1998). Pollinator declines in agriculture cause decreases in crop yields and harvest quality, with concomitant economic hardship (Watanabe, 1994; Allen-Wardell *et al.*, 1998; Kevan and Phillips, 2001). The European races of the western honeybee (*A. mellifera*) provide pollination services, alone, in Canada worth about 1 billion \$CDN each year (Canadian Honey Council, 2005). In Canada, as in the rest of the world, there are few insect pollinators, other than the honeybee, managed commercially for agricultural purposes. The honeybee has been managed in Canada for honey and wax production and is also widely used to pollinate agricultural crops globally and throughout North America (McGregor, 1976; Free, 1993; Canto-Aguilar and Parra-Tabla, 2000). In most of North America three species of bumble bees (*Bombus impatiens* in eastern Canada and USA, *B. occidentalis* was used in western Canada and USA until its populations crashed and it was replaced by *B. impatiens*, and *B. epiphiattus* is being tried in Mexico) have been used to pollinate greenhouse tomatoes and other crops. The alfalfa leafcutting bee, *Megachile rotundata*, is managed specially for alfalfa seed pollination (Bohart, 1972; Richards, 1984). Orchard bees (*Osmia lignaria*) show promise for fruit tree pollination in various parts of North America (Bosch and Kemp, 2001). A few other solitary bees can be encouraged through “bee-friendly” land management practices that protect nesting sites (e.g. the hoary squash bee, *Peponapis pruinosa* for pumpkin and squash pollination (Willis and Kevan, 1995), and *Habropoda laboriosa* for blueberry pollination in the southeastern USA (Cane and Payne, 1990; Cane, 1997).

Conservation concerns for pollinators have gained momentum in the past decade. In 1995, the United Nations Convention of Biological Diversity introduced an Agricultural Biodiversity Policy which led to the establishment of the International Initiative for the Conservation and Sustainable Use of Pollinators (Convention on Biological Diversity, 2005; Kevan and Viana, 2003). In 1998, an international workshop on The Conservation and Sustainable Use of Pollinators in Agriculture, with Emphasis on Bees took place in São Paulo, Brazil, to discuss monitoring the decline of pollinators, conservation and restoration of pollinator diversity, and sustainable use of pollinators (Kevan *et al.* (eds), 2002). That led to the formation of the International Pollinators Initiative (IPI) by the Food and Agriculture Organization (FAO) (International Pollinators Initiative, 1999). A broad international movement to conserve pollinators had already begun, especially in North America, and included The Forgotten Pollinators Campaign which continued as the North American Pollinator Protection Campaign (NAPPC, 2005). Those initiatives to promote the health of resident and migratory pollinating species have been followed by movements around the world. The International Network of Expertise for Sustainable Pollination (INESP), based in Canada, was formed for scientists to provide reliable and up-to-date information to organizations concerned with pollination, such as FAO, Honey Packers International and IUCN) (INESP, 2005).

Although the importance of biodiversity is already reflected in much international and national law, developing the legal protection of wild pollinators is equally important. Most legislation deals with proprietary rights and liabilities related to the keeping of domesticated bees

(Frimston and Smith, 1993). The purpose of this paper is to evaluate current legislation in Canada to determine whether adequate provisions exist for conserving and improving the status of native, wild, pollinators. We hypothesize that Canada does not have the capacity to conserve native, wild, pollinators and has generally weak capability to protect managed pollinators. Should any legislative deficiencies exist at the federal and/or provincial level, recommendations can be made for amending existing legislation and developing new legislation for better pollinator conservation.

## METHODS

Under Canadian jurisdiction, native and managed pollinators fall under provincial, not federal, law, except for issues to do with trans-border shipping, which are federally regulated. However, legislative issues concerning biodiversity and the general environment exist at both the federal and provincial levels. Thus, both federal legislation and its provincial counterparts could contain provisions for native pollinator protection and conservation. Current federal and provincial legislation in Canada was examined with respect to pollinators. The legislation analyzed dealt with agriculture, forestry, parks and protected areas, the general environment, and wildlife conservation. This legislation was chosen based on its potential to contain consideration for pollinator protection (Tables 1 and 2). The preamble to each Act, as well as the regulations contained therein, was examined. The wording, specific statements within each act, and the context in which they were mentioned and used, was analyzed. The methodology was based on the approach taken by Campbell and Thomas (2002a, 2002b), Vásárhelyi and Thomas (2003, 2006), and Vásárhelyi *et al.*, (2004).

Federal and provincial legislation was categorized into one of three classes: A) Contains definite, explicit, provisions for pollinator conservation, B) Is related to, but does not currently have specific and explicit provisions for pollinator conservation, as when giving direction for the protection of other invertebrate species or broad environmental protection, C) Has nothing to do with pollinator conservation and no provisions are present. A situation in which legislation could be related to pollinator conservation, but was not specific enough, would be exemplified in Acts with broadly-based provisions that need to be more clearly defined or amended to include pollinator conservation. For example, several pieces of legislation have provisions to conserve biodiversity and maintain ecological integrity. Since plant-pollinator interaction plays an important role in ecosystem function, this provides the rationale for pollinators to be given legal protection and managed for the pollination services they provide.

Separate tables were created for both federal and provincial legislation (Tables 1, 2, and 3), and a checkmark was placed for each Act analyzed according to which criterion category it fell under. This indicates the extent to which a particular law is able to protect pollinators. Special attention was given to Ontario in this analysis because it is the province wherein the greatest amounts of natural habitat change and degradation have occurred, and the province for which a variety of environmental-agricultural legislation has been developed (Table 3). Following the analysis, recommendations were made for the amendment of current federal and provincial legislation, or the creation of new legislation, to enhance pollinator protection and conservation.



## RESULTS

### Canadian Federal Legislation

Analysis of the federal legislation reveals that there is currently no legislation in Canada dealing explicitly with native pollinator conservation (Table 1). However, some legislation is related indirectly to pollinator conservation. This legislation involves provisions to protect biodiversity, manage wildlife species at risk, conserve ecological integrity or protect the environment and agriculture. The conservation of pollinators and the importance of their protection is implied in this legislation, but no specific and explicit provisions for native pollinator conservation is are present.

An example of legislation related indirectly to pollinator conservation is the Canada National Parks Act (2000, c. 32) which defines ecological integrity and states that “*maintenance or restoration of ecological integrity, through the protection of natural resources and natural processes, shall be the first priority of the Minister when considering all aspects of the management of parks*” (s. 8 (2)). Pollination is one of these natural processes and is important for ecosystem function. The concept of restoring and maintaining ecological integrity of habitats like national parks and their adjacent areas can be realized more readily if there are provisions for pollinator conservation. Although this Act does not address native pollinator protection explicitly, it is implied as the Act contains provisions for habitat protection.

### Canadian Provincial Legislation

The provincial legislation examined in this study were the Acts related to bees as they were the most relevant and the only type of legislation directly associated with pollinators (Table 2). However, not all provinces have legislation for pollinators as only 8 of the 10 provinces examined had Acts related to bees. Analysis of the provincial legislation reveals that there is little legislation dealing explicitly with native pollinator conservation for most Canadian provinces. The definition of “bee” in these documents is limited to the European honeybee, *Apis mellifera* which is exotic. Therefore, these acts do not have specific provisions for native pollinator conservation because they deal with only one particular non-native bee species. The exception to this is the Manitoba Bee Act (C.C.S.M. c. B15) which includes the alfalfa leafcutting bee, *Megachile rotundata*, also an introduced species (Stephen, 2003). The definition of “bee” as *Apis mellifera* and *Megachile rotundata* means there are provisions for their protection, but not for any native bee species. In general, the provincial bee Acts and regulations provide protection of the beekeepers’ apiaries and areas where crops are primarily insect-pollinated. The main purpose of this legislation is to protect the beekeeping and agricultural industry, rather than native pollinators in general.

## **Ontario Legislation**

There is currently no provincial legislation containing specific provisions for wild pollinator protection (Table 3). The only Act that identifies a specific pollinator is the Ontario Bees Act (R.S.O. 1990, c. B.6). That Act defines “bees” as the “*insects known as Apis mellifera*” (s. 1) which precludes any possible protection of other pollinator species. The Act mainly makes provisions for the maintenance of apiaries, regulations regarding diseases of the bees, and rules regarding the importation of queens and hives. The legislation has little provision for the protection of honeybees in the natural environment. However, the Act requires cessation of biocide spraying during the period when orchard fruit trees are in bloom (s. 19(1)). This indirectly aids to preserve other pollinator species, but only during the blooming period.

Although provisions exist within the Ontario legislation for ecosystem-wide conservation, there are few instances of provisions made for functional groups of species within ecosystems, agricultural or otherwise. Where they do exist, for example, within the Fish and Wildlife Conservation Act (S.O. 1997, c. 41), specific regulations pertain to traditional game species available for trapping, hunting and fishing (s. 40-47), rather than to species comprising invertebrate communities. While it is recognized that the role of pollinators in ecosystems is important, and that protection should be covered under those Acts which demand the conservation of ecosystem structure, the legal protection afforded pollinators is, at best, indirect, and requires more specific definition of terms and legal intentions.

The newly instituted Greenbelt Act (S.O. 2005, c. 1) could play an indirect, but important, role for native pollinators. Two of the objectives of the Act are to “*preserve agricultural land as a continuing commercial source of food and employment*” (s. 5(c)) and to “*provide protection to the land base needed to maintain, restore and improve the ecological and hydrological functions of the Greenbelt Area*” (s. 5(e)). Because of the importance of pollination services to farmers, the provisions within this Act may be the strongest for wild pollinator conservation.

The two Acts that have specifically identified invertebrates are the Fish and Wildlife Conservation Act (S.O. 1997, c. 41) and the Provincial Parks Act (R.S.O. 1990, c. P.34). These Acts have been harmonized to define invertebrates, animals and fish in the same way, as seen in Section 2(a-d) of the Fish and Wildlife Conservation Act. There is a broad definition of insects named within the act that does not allow for specific provisions to be made. Thus, a more precise definition of animals is needed to facilitate enforcement of the provisions. Furthermore, the purposes of both Acts include conservation and preservation of wildlife and ecosystems, even though pollination as an ecosystem service has not been defined. The Wilderness Areas Act (R.S.O. 1990, c. W.8) is anomalous in that it contains no specific regulations regarding conservation or protection of species, but its main objective aids pollinator protection directly, since the purpose of the Act is to set apart lands as wilderness areas (s. 1) and to care for and improve those areas (s. 6(1)(a)). This may serve to slow habitat loss and/or destruction for pollinators, and provide residual areas where species may persist.

The Conservation Land Act (R.S.O. 1990, c. C.28) and Farming and Food Production Act (S.O. 1998, c. 1), were not included in Table 3 because they were found not to have a basis

for pollinator protection according to the terms of this study. However, the Conservation Land Act (R.S.O. 1990, c. C.28) does define “*areas of natural and scientific interest*” (s. 1), as well as award grants for research (s. 2(2)). This may be indirectly of some benefit should research show that an area is an important part of the ecosystem for pollinators. The Farming and Food Protection Act (S.O. 1998, c. 1) serves to enforce farm by-laws, and legal protection is offered only to conventional farming practices.

## DISCUSSION

The results of the Canadian legislative analysis reveal that inadequacies exist at the federal and provincial levels regarding effective conservation and protection of native pollinators. There is generally, little or no specific provisions dealing directly with native pollinators, although some legislation alludes to it. This has important implications because without the necessary legal provisions, Canada might not have the legal capacity to protect its native pollinator populations.

The major limitation of current federal and provincial legislation with respect to native pollinator protection is the definitions used. The definitions used are generally broad terms, such as “bees”, “wildlife” and “animals.” The legislation needs to be amended to make the wording more specific and effective. Although legislation already allows for broad ecosystemic protection, the failure to identify specific elements of that system, such as pollinator communities, results in an inadequate basis for pollinator management. Because native pollinator populations have been declining in Canada despite these provisions, this would suggest, or confirm, that the federal and provincial legislation are ineffective in conserving pollinators. The legislation that is related to, but does not have specific and explicit provisions for pollinator conservation continues to play an important general role in ecosystem and environmental protection. However, more specific legislation is needed to enhance native pollinator protection.

It should be noted that the Canadian Pest Management Regulatory Agency (PMRA) of Health Canada is the constituted body responsible for pesticide registration and regulation under the provisions of the Pest Control Products Act (R.S. 1985,c.P-9). The act itself does not mention pollinators or bees, but PMRA’s labelling requirements for registration of pesticides include results of bee toxicity studies and appropriate cautions. Pollination became a major issue (Kevan and Plowright, 1989) in the eventual deregistration of the insecticide, fenitrothion, for broadscale aerial application in forestry in 1998 (Agriculture Canada 1993; Agriculture and AgriFood Canada, 1995). More recently, pollination and other ecosystem services are being considered by PMRA in respect of environmental protection (Delorme *et al.*, 2005).

Using the information obtained through this study, recommendations can be made for amending existing or creating new legislation, especially at the provincial level. A re-definition of pollinators is required. Therefore, provincial acts related to bees should be amended to include all species of bees (managed and wild) and other pollinators. New legislation could also be created such as a “Native Pollinator Protection Act” at the provincial level.

Federal acts such as the National Parks Act (2000, c.32) could also be amended to include provisions for native pollinator conservation. The National Parks Act emphasises the importance of maintaining ecological integrity by protecting natural resources and natural processes. Because pollination is one of these natural processes, this Act could be amended to include a definition or example of pollination as a “natural process” so that ecological integrity, as well as native pollinators can be protected. The concept of restoring ecological integrity to habitats such as national and provincial parks can be realized more readily if there are such provisions for pollinator conservation.

The Species at Risk Act (2002, c. 29) could also be amended to include provisions for native pollinator conservation. This legislation provides protection for wildlife species at risk in Canada to conserve biological diversity. One of the provisions in the act is the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), which assesses the status of wildlife species. COSEWIC identifies existing and potential threats to the species and classifies them as extinct, extirpated, endangered, threatened or of special concern (s. 15 (1) a). Assessments are made on native species of mammals, birds, amphibians, fish, reptiles, molluscs, arthropods, plants, lichens and mosses. In the Species at Risk Act, the order Lepidoptera is used instead of the category Arthropods. Lepidoptera does not include all insects, but is limited to butterflies and moths. Although the COSEWIC list uses arthropods as a category, the insects on the list happen to be only butterflies and moths, perhaps reflecting the human bias towards them. This can be a problem if there are other insect species at risk, but are not monitored or given protection since they do not fall under any of the respective categories or might not be considered as important.

On the COSEWIC list, there are currently 74 plants that are endangered, 48 plants that are threatened and 35 plants that are of special concern (Canadian Species at Risk, 2005). Although not all these plants require biotic pollination, there are several endangered plants in Ontario that depend on insects for pollination (Environment Canada, 2004a). Pollination problems range from wide geographic separation of individual plants (isolation), to apparent lack of appropriate pollinators, erosion of genetic diversity, and introgression with exotic species (Ambrose and Kevan, 1990).

Another issue is the possible consequences of eliminating some insects' foraging plant species. In Ontario, noxious weeds are controlled under the Ontario Weed Control Act (R.S.O. 1990, c. W.5), which states that "*Every person in possession of land shall destroy all noxious weeds on it*" (s. 3). Unfortunately, many of the plant species deemed noxious are good sources of nectar and pollen for foraging bees, butterflies and other pollinators. For example, various thistles (*Cirsium* spp. and *Carduus* spp.) provide abundant nectar for bees and butterflies, yet requires elimination under this Act. Moreover, all milkweeds (*Asclepias* spp.) are defined in Ontario as "noxious weeds" but only the field milkweed (*Asclepias syriaca*) can be considered as weedy. Swamp milkweed (*A. incarnata*) and several other species (some noted on the "Candidate List: 2005" by COSEWIC as needing protection) is also an important host plant for the development of the monarch butterfly, *Danaus plexippus* (Haribal and Renwick, 1998; Ladner and Altizer, 2005). Therefore, destroying its host plants could affect its populations.

Changes in plant-pollinator relationships, such as declines in pollinator abundance, could affect endangered plant species adversely, as they often comprise small populations vulnerable to ecological change (Kearns and Inouye, 1997). Thus, a consideration of those endangered plant species that depend on insect pollinators needs to be taken into account. Amendments to legislation that create provisions for protecting native insect pollinators could improve the status of endangered and threatened plants that depend on them (and also the converse if the wording were altered appropriately).

Provisions for a suitable definition of "native pollinator" and *their habitats* in new or amended legislation would allow for the appropriate management to be instituted. Moreover, a list of the pollinator species to be given protection could be included in the regulations of any

amended laws. Amending or enacting new legislation for pollinators is important because it creates precedents that could influence other provinces or states in North America (as well as other countries) to pass similar laws.

The idea of conserving species and their habitats is not a new concept. The best example and perhaps the greatest conservation success story entails waterfowl and migratory birds under The Canada – USA Migratory Bird Treaty. The actual species of migratory birds that are protected is listed under both the Canadian and the US legislation of this treaty (Lyster, 1985). Furthermore, under the general understanding of the terms of this Treaty among Canada, the USA, and Mexico, enormous efforts have been made to enhance the habitats of migratory birds throughout their life cycles at the continental level (USFWS, 2005). Although it can be argued that such birds contribute much to the North American economy, pollinators contribute none less, and so deserve no less.

Suggestions can be made on other ways to improve native pollinator conservation. One would be creating better management by reviewing, assessing, and revising current regulations and practices to minimize impacts on pollinators from pesticide use, fire management, and forest and agricultural practices. Also, reviewing species conservation plans to make sure that restoring ecological relationships, such as pollination, is included. Another could be monitoring pollinators by developing local, regional and national monitoring programs to assess the status of native pollinators.

Research on the relationships between pollinators and plant species that are rare, threatened and endangered could also be undertaken. For example, research can be initiated in the Carolinian forests, as it is one of Canada's most threatened habitats with more than 40 per cent of the national list of threatened and endangered species occurring within the zone (Environment Canada, 2004b). Determining the factors affecting the status of native pollinators and the value of native pollinators to agriculture and other related ecosystems is important, because our knowledge of native pollinators is limited. Including the importance of pollinator conservation in the education and training of land resource managers is a vital step. Similarly, educating the public on the importance of pollinator conservation and working with other pollinator conservation programs could enhance native pollinator protection at different levels e.g. the Pollinator Watch initiative of Environmental Monitoring and Assessment Network (EMAN) of Environment Canada.

These suggestions are appropriate for pollinator conservation, but without legislation, all of these initiatives become discretionary. Effective pollinator conservation requires management, research, education and monitoring, but the enabling legislation and provisions have to be created first for this to occur. With the decline in the number of native pollinators in Canada, especially in the southern zones, there is an egregious need for active conservation that includes native and wild pollinators, and not just commercially-managed pollinators. Protection of native pollinators will take a combined effort by the government, conservation and agricultural communities and the public. The Canadian legislation for the conservation of native pollinators is inadequate and governments need to create the necessary legal provisions for their protection and management. Protecting native pollinators will ensure the continuation of the services they provide to nature, agriculture and society.

## REFERENCES

- Allen-Wardell, G., P. Bernhardt, R. Bittner, A. Burquez, S. Buchmann, J. Cane, P.A. Cox, V. Dalton, P. Feinsinger, M. Ingram, D. Inouye, C.E. Jones, K. Kennedy, P. Kevan, H. Koopowitz, R. Medellin and G.P. Nabhan. 1998. The potential consequences of pollinator declines on the conservation of biodiversity and stability of food crop yields. *Conservation Biology* 12(1): 8-17.
- Agriculture Canada, 1993. Registration status of fenitrothion. Discussion document D93-01 (April 2, 1993). Food Production and Inspection Branch, Plant Industry Directorate and Submission Management and Information Division, Pest Management Regulatory Agency, Health Canada, Ottawa. 27 pp.
- Agriculture and Agri-Food Canada, 1995. Registration status of fenitrothion insecticide. Decision document E95-01 (April 13, 1995). Information Division, Agriculture and Agri-Food Canada, Ottawa. 35 pp.
- Ambrose, J. D. and P. G. Kevan. 1990. Reproductive biology of rare Carolinian plants with regard to conservation management. In: G. M. Allen, P. F. J. Eagles and S. D. Price (eds). *Conserving Carolinian Canada: conservation biology in the deciduous forest region*. University of Waterloo Press, Waterloo, Ontario. pp. 57 - 63.
- Anon. 2003. Pollination: an essential ecosystem service. Ecological Society of America and the Union of Concerned Scientists. September 30, 2003. <http://www.esa.org/ecoservices/poll/body.poll.fact.html>
- Bohart, G.E. 1972. Management of wild bees for pollination of crops. *Annual Review of Entomology*. 17: 287-312.
- Bosch, J. and W. P. Kemp, 2001. How to manage the blue orchard bee, *Osmia lignaria*, as an orchard pollinator. Sustainable Agriculture Network (SAN), Handbook Series 5, National Agriculture Library, Beltsville, MD, 88 pp.
- Buchmann, S.L. and G.P Nabhan. 1996. *The forgotten pollinators*. Island Press, Washington, D.C.
- Campbell, M.L. and V.G. Thomas. 2002a. Protection and conservation of marine mammals in Canada: a case for legislative reform. *Ocean and Coastal Law Journal*. 7(2): 221-258
- Campbell, M.L. and V.G. Thomas. 2002b. Constitutional impacts on conservation: effects of federalism on biodiversity protection. *Environmental Policy and Law*. 32(5): 223-332.
- Canadian Honey Council. 2003. Industry Overview. <http://www.honeycouncil.ca/users/folder.asp?FolderID=2380>. 2005, August 18.

- Canadian Honey Council. 2005. Miscellaneous Facts. <http://www.honeycouncil.ca/users/folder.asp?FolderID=1738>. 2005, February 6.
- Canadian Species at Risk. 2005. Table 1: Summary of Cosewic's assessment results for the risk categories. [http://www.cosewic.gc.ca/eng/sct0/rpt/rpt\\_csar\\_e.cfm](http://www.cosewic.gc.ca/eng/sct0/rpt/rpt_csar_e.cfm). 2005, September 22.
- Cane, J.H. 1997. Lifetime monetary value of individual pollinators: The bee *Habropoda laboriosa* at rabbiteye blueberry (*Vaccinium ashei* Reade). *Acta Horticulturae* 446: 67-70.
- Cane, J. H. and J. A. Payne, 1990. Native bee pollinates rabbiteye blueberry. *Alabama Agriculture Research Station, Highlights in Agricultural Research*. 37 (4): 4.
- Canto-Aguilar, M.A and V. Parra-Tabla. 2000. Importance of conserving alternative pollinators: assessing the pollination efficiency of the squash bee, *Peponapis limitaris* in *Cucurbita moschata* (Cucurbitaceae). *Journal of Insect Conservation*. 4: 203–210.
- Convention on Biological Diversity. 2005. Agricultural Biodiversity: International Initiative for the Conservation and Sustainable Use of Pollinators. <http://www.biodiv.org/programmes/areas/agro/pollinators.asp>. 2005, August 18.
- Daily, G.C. 1997. Introduction: What are ecosystem services? pp. 1-10. *In* Daily, G. C. (ed.) *Nature's Services: Societal Dependence on Natural Ecosystems*. Island Press, Washington, D.C.
- Delorme, P., D. François, C. Hart, V. Hodge, G. Kaminski, C. Kriz, H. Mulye, R. Sebastian, P. Takacs, and F. Wandelmaier. 2005. Final report for the PMRA workshop: Assessment endpoints for environmental protection. PMRA, Health Canada, Ottawa. 63 pp. + CD.
- Environment Canada. 2004a. Species at Risk. [http://www.speciesatrisk.gc.ca/search/default\\_e.cfm](http://www.speciesatrisk.gc.ca/search/default_e.cfm). 2005, March 15.
- Environment Canada. 2004b. Conserve Ontario's Carolinian Forests: Preserve Endangered Songbirds. [http://www.on.ec.gc.ca/wildlife/factsheets/fs\\_songbirds-e.html#speciesranges](http://www.on.ec.gc.ca/wildlife/factsheets/fs_songbirds-e.html#speciesranges). 2005, August 28.
- Faegri, K. and L. van der Pijl. 1979. *The principles of pollination ecology*. Pergamon, Oxford, UK.
- Free, J. B. 1993. *Insect pollination of crops* (2<sup>nd</sup> edition). Academic Press Limited, London.
- Frimston, J.D. and D. Smith. 1993. *Beekeeping and the law – swarms and neighbours*. Bee Books New and Old, Bridgewater, Somerset, UK.
- Goulson, D. 2003. Conserving wild bees for crop pollination. *Food, Agriculture & Environment*. 1(1): 142-144.



Haribal, M and J.A.A Renwick. 1998. Differential postalightment oviposition behavior of monarch butterflies on *Asclepias* species. *Journal of Insect Behavior*. 11: 507-538.

INESP 2005 ([www.uoguelph.ca/~inesp](http://www.uoguelph.ca/~inesp))

International Pollinators Initiative: The São Paulo Declaration on Pollinators. Report on the Recommendations of the Workshop on the Conservation and Sustainable Use of Pollinators in Agriculture with Emphasis on Bees. Brasília: Brazilian Ministry of the Environment, December 1999.

Kearns, C.A. and D. Inouye. 1997. Pollinators, flowering plants and conservation biology. *Bioscience*. 47(5): 297-307.

Kearns, C.A., D. Inouye and N.M. Waser. 1998. Endangered mutualisms: the conservation of plant-pollinator interactions. *Annual Review of Ecology and Systematics*. 29: 83-112.

Kevan, P.G. 1975. Pollination and environmental conservation. *Environmental Conservation* 2(4): 293-297.

Kevan, P.G. 2001. Pollination: a plinth, pedestal, and pillar for terrestrial productivity. The why, how, and where of pollination protection, conservation, and promotion. pp. 7-68. In Stubbs, C.S. and F.A. Drummond (eds.), *Bees and Crop Pollination - Crisis, Crossroads, Conservation*. Entomological Society of America.

Kevan P. G., V. L. Impertariz-Fonseca, G. W. Frankie, C. O'Toole, R. Jones, and C. H. Vergara (eds). 2002. *Pollinating bees: The conservation link between agriculture and nature*. Ministry of Environment, Secretariat for Biodiversity and Forests, Government of Brazil, Brasília. 313 pp.

Kevan, P. G. and T. P. Phillips. 2001. The economic impacts of pollinator declines: an approach to assessing the consequences. *Conservation Ecology* 5(1): 8. [online] URL: <http://www.consecol.org/vol5/iss1/art8/>

Kevan, P. G. and R. C. Plowright. 1989. Fenitrothion and insect pollination. In: W. R. Ernst, P. A. Pearce and T. L. Pollock (eds). *Environmental effects of fenitrothion use in forestry: Impacts on pollinators, songbirds, and aquatic invertebrates*. Environment Canada, Dartmouth, N. S. Pp 13 - 42.

Kevan, P.G and B.F. Viana. 2003. The global decline of pollination services. *Biodiversity* 4(4): 3-8

Kremen, C. and T. Ricketts. 2000. Global perspectives on pollination disruptions. *Conservation Biology*. 14(5):1226-1228.

- Kremen, C., N.M. Williams and R.W. Thorp. 2002. Crop pollination from native bees at risk from agricultural intensification. *Proceedings of the National Academy of Science*. 99: 16812-16816.
- Ladner, D.T and S. Altizer. 2005. Oviposition preference and larval performance of North American monarch butterflies on four *Asclepias* species. *Entomologia Experimentalis et Applicata*. 116(1): 9-20
- Lyster, S. 1985. Basic principles of international wildlife law. In: *International wildlife law*. Grotius Publishing Ltd., Cambridge, UK.
- McGregor, S.E. 1976. Insect pollination of cultivated crop plants. *Agriculture Handbook 496*, SDA-ARS, Washington, D.C.
- Morse, R. A., and N. W. Calderone. 2000. The value of honey bees as pollinators of U.S. crops in 2000. *Bee Culture* (March 2000): 2-15.
- Nabhan, G. P. and S. Buchmann. 1997. pp. 133–150. In Daily, G. C. (ed.) *Nature's Services: Societal Dependence on Natural Ecosystems*. Island Press, Washington, D.C.
- NAPPC. 2005. North American Pollinator Protection Campaign. <http://www.nappc.org/>. 2005, August 23.
- Proctor, M., P. Yeo and A. Lack. 1996. *The natural history of pollination*. HarperCollins, London.
- Rathcke, B.J. and E.S. Jules. 1993. Habitat fragmentation and plant-pollinator interactions. *Current Science*. 65: 273-277.
- Richards, K. W. 1984. Alfalfa leafcutter bee management in western Canada. Canada Department of Agriculture Publication 1495, Ottawa.
- Robinson, W. S., R. Nowogrodski, and R. A. Morse. 1989. The value of honey bees as pollinators of U. S. crops. *American Bee Journal* 129: 411-423, 477-478.
- Salzman, J. 2004. Costing Mother Nature's services. *Ecos* (Jan.-Mar.) 118: 26-27.
- Southwick, E.E. and L.Southwick, Jr. 1992. Estimating the economic value of honey bees as agricultural pollinators in the United States. *Economic Entomology* 85(3): 621-633.
- Stephen, W. P. 2003. Solitary bees in North American agriculture: A perspective. In K. Strickler and J. H. Cane (eds). *For nonnative crops, whence pollinators of the future*. Thomas Say Publications in Entomology, Entomological Society of America, Lanham, MD. Pp. 41 - 66.

- Strickler, K. and J. H. Cane (eds). 2003. For nonnative crops, whence pollinators of the future. Thomas Say Publications in Entomology, Entomological Society of America, Lanham, MD. 204 pp.
- Stubbs, C. S. and F. A. Drummond (eds). 2001. Bees and crop pollination – Crisis, crossroads, conservation. Thomas Say Publications in Entomology, Entomological Society of America, Lanham, MD. 156 pp.
- U.S. Fish and Wildlife Service. 2005. North American Waterfowl Management Plan Joint Venture. <http://www.fws.gov/birdhabitat>. 2005, September 23.
- Vásárhelyi, C. and V.G. Thomas. 2003. Analysis of Canadian and American legislation for controlling exotic species in the Great Lakes. Aquatic Conservation: Marine and Freshwater Ecosystems. 13: 417-427.
- Vásárhelyi, C. and V.G. Thomas. 2006. Evaluating the adequacy of Canadian and American legislation to implement terrestrial protected areas networks. Environmental Science and Policy: In press.
- Vásárhelyi, C., V.G. Thomas and A.J. Niimi. 2004. Analysis of legislation pertaining to the control and management of exotic aquatic species in Canadian and adjacent United States waters. Canadian Technical Report of Fisheries and Aquatic Sciences 2561: vii +39 pp. Fisheries and Oceans Canada.
- Watanabe, M.E. 1994. Pollination worries rise as honey bees decline. Science 265: 1170.
- Willis, D. S. and P. G. Kevan. 1995. Foraging dynamics of *Peponapis pruinosa* on pumpkin *Cucurbita pepo* in southern Ontario, Canadian Entomologist 127: 167 - 175.

## **RECOMMENDATIONS FOR FURTHER ACTION**

### **Actions for NAPPC**

1. To review and comment on this report with respect to its suitability as the basis for a continuing Task Force with a trinational mandate (see below re: Actions in Canada, Actions in Mexico and U. S. A.).
2. To endorse this report, possibly with emendations, for submission to an appropriate scholarly journal so as to identify NAPPC as having been instrumental in its compilation.
3. To seek funding and personnel to sponsor and work on the continuing Task Force with the aims of preparing similar reports, and possibly publications, for Mexico and the U.S.A.

### **Actions in Canada**

1. The present analysis needs to be extended to other provinces and territories that have native populations of pollinators, so that suggested legislative amendments can be developed.
2. At the federal level, certain pieces of legislation, such as the Parks Act, the Species at Risk Act, and the Pest Control Products Act, could be examined to create better provisions for pollinator protection. Creating the appropriate wording and definition of terms for amendment of each Act is a vital first step.

### **Actions in the USA and Mexico**

1. The type of analysis performed for Canada should be prepared for the USA at both the federal and state level with a view to achieving more effective legislation for pollinator conservation. The complementary analysis should be undertaken for Mexico.
2. Analyze the provisions in the North American Agreement on Environmental Cooperation (under the Canada-USA NAFTA) to determine how this Agreement could facilitate pollinator protection at the continental level.
3. Seek collaborators in the areas of environmental policy and law, as well as branches of federal and state government, who can play an important supportive role in the above analyses.
4. Examine the situation regarding wild pollinators in other countries (eg. Australia) to determine if there are progressive initiatives that could be incorporated into the North American policy and law (e.g. Salzman, 2004).

Table 1. Enacted and proposed federal legislation of Canada pertaining to the conservation of native pollinators

<b>Federal Legislation</b>	Has definite, explicit provisions for pollinator conservation	Is related to, but does not have specific and explicit provisions for pollinator conservation	Has no provisions, nor anything to do with pollinator conservation
Canada National Parks Act (2000)		x	
Canada Wildlife Act (1985)		x	
Canada Endangered Species Protection Act (2001)		x	
Canadian Environmental Protection Act (1999)		x	
Canadian Environmental Assessment Act (1992)		x	
Plant Protection Act (1990)		x	
Species at Risk Act (2002)		x	

Table 2. Enacted legislation of the Provinces of Canada pertaining to the conservation of native pollinators.

Provincial Legislation	Has definite, explicit provisions for pollinator conservation	Is related to, but does not have specific provisions for pollinator conservation	Has no provisions, nor anything to do with pollinator conservation
Alberta – Bee Act (1995)		x	
British Columbia – Bee Act (1996)		x	
Manitoba – The Bee Act (1998)	x		
New Brunswick – Apiary Inspection Act (1986)		x	
Nova Scotia – Bee Industry Act (1990)		x	
Ontario – Bees Act (1990)		x	
P.E.I – Bee Health Regulations of the Animal Health and Protection Act (1988)		x	
Saskatchewan – The Apiaries Act (1979)		x	

Table 3. Ontario provincial legislation pertaining generally to the conservation of wild species and their habitats, and specifically to native wild pollinators.

Legislation	Pollinator Protection	Invertebrate Protection	Ecosystem Protection	Primary intent of Act
Bees Act (R.S.O. 1990)	x		x	The protection of beekeepers' property.
Conservation Authorities Act (R.S.O. 1990)			x	Flood planning, development of wild areas, conservation of crown land.
Endangered Species Act (R.S.O. 1990)			x	Protection of endangered species, defining endangered species.
Environmental Assessment Act (R.S.O. 1990)			x	s. 2 "Betterment ... any part of Ontario by providing protection, conservation and wise management of the environment..."
Environmental Bill of Rights (1993)			x	s. 2(1)a-c Integrity, sustainability and health of the environment.
Environmental Protection Act (R.S.O. 1990)			x	s. 3(1) "...to provide for the protection and conservation of the natural environment."
Fish and Wildlife Conservation Act (1997)		x	x	Conservation of wildlife, regulations regarding hunting and fishing.
Greenbelt Act (2005)			x	s. 5(a-h) "(e) to provide protection...ecological functions", "(h) to promote linkages between ecosystems and provincial parks or public lands;"
Planning Act (R.S.O. 1990)			x	s 1.1(a) "healthy natural environment"
Provincial Parks Act (R.S.O. 1990)		x	x	Protection, conservation and determination of provincial parks.
Wilderness Areas Act (R.S.O. 1990)				s. 1 "Establishment of wilderness areas"