

FINAL REPORT

To

YUKON FISH AND WILDLIFE ENHANCEMENT TRUST

For the project:

YUKON'S NATIVE POLLINATORS

YFWET Contribution Agreement 2024-25-11

By

Wild Tracks Ecological Consulting

(Maria Leung and Donald Reid)

February 2025

With Communications Update August 2025

TITLE: Improving the protection of Yukon’s native pollinators: Recommended legislative and policy changes guided by experience in other jurisdictions.

GOAL: To enhance conservation of native pollinators in Yukon by putting forward recommended changes to Yukon’s legislative, regulatory and policy regime that would reduce the risks to native pollinators from pathogens introduced by imported bees, and from competition for food sources from non-native bumble bees and honey bees.

ACTIVITIES:

1. Collect scientific and technical literature related to policy development for pollinator conservation in Canada and relevant States of the USA
2. Review the information to determine what legislative, regulatory and policy actions to aim for.
3. Collect relevant legislation, regulations and policies from jurisdictions across Canada, and select States in the USA that have or could be used to facilitate change in Yukon.
4. Assess the current Yukon governance regime to determine which pieces of legislation, regulation or policies need to be initiated, modified, revised, and adopted in Yukon.
5. Synthesize the information into a document for publication.

PROGRESS:

A. ACTIVITIES

1. Completion of Activities: We have completed all the Activities originally proposed. The result is a scientific manuscript that can be downloaded digitally from the journal’s webpage [here](#) and the text of which is in Appendix A of this Report. We submitted an earlier draft of this manuscript to the journal *Facets*, but the editor judged that it did not fit the journal’s mandate (January 2025). It is now published in a special issue on Pollination Biology in the open-access, peer-reviewed journal *Biology*.
2. Value of Activities: Each of the activities we accomplished was necessary to complete the project.
3. Variances from Work Plan: The only variance was the extent to which we used legislation from states in the USA to inform our approach. This was because we realized that (i) the relative jurisdictional power of the federal vs state governments for invertebrates and public lands is quite different in the USA than Canada, and so not readily transferrable, and (ii) the overall strategic approach to the problems of pathogen spread and competition was already largely the same in both countries. However, in our manuscript we still reference the key examples where governance approaches in the USA are leading the way.
4. Contributions of our work to Conservation: This project will contribute to conservation in Yukon when its findings are taken up by Yukon government in changes to current legislation and policy. That still has to happen in the future. As indicated in our project proposal, the main benefits of the project depend on future communications and promotion about the need for legislative change, beyond the timeline of this project’s funding. We are continuing that work.

5. Suggested changes to Approach: We do not suggest any substantial differences in approach or activities to accompany our original project Goal.

B. COMMUNICATIONS

1. Sharing Results: Sharing the results is an ongoing process, continuing beyond the project end date in February 2025. Our main effort so far has been publishing the manuscript in an open-access, peer-reviewed scientific journal – *Biology*. That work continued beyond February 2025, to successful result in May 2025. The paper can be downloaded digitally from the journal’s webpage [here](#). We have presented the results at the Yukon Biodiversity Forum (April 2025), and to staff of the Yukon Agriculture Branch (Energy, Mines and Resources). Maria Leung will present the results to the Circumpolar Agriculture Conference in Tromsø, Norway in September 2025. As indicated in our project proposal, we plan to share the results with the Yukon Fish and Wildlife Management Board.

2. Recognition of YFWET: In the Acknowledgement section of our published paper, we thank the YFWET contribution agreement as the source of funding.

3. Communications Approaches: One approach is to publish the results for wider use by government officials, scientists, and the interested public. We have published the manuscript in an open-access, peer-reviewed scientific journal – *Biology*. The paper can be downloaded digitally from the journal’s webpage [here](#). A second approach is to present the results in person to various Yukon and other audiences, focussing on those with influence on territorial government policies. We continue to do this in meetings and presentations with Department of Environment, Yukon Fish and Wildlife Management Board staff, the community of people interested in biodiversity in Yukon, and journalists.

4. Photos: We include with this Report ten photos taken by author, Maria Leung, of native pollinator species feeding on, and pollinating, various wildflower species on public lands in Yukon. These images are shown in small format in this file (next page), and are also submitted as individual electronic files.

IMAGES OF NATIVE POLLINATOR INSECTS ON WILD FLOWER SPECIES IN YUKON



Arctic Fritillary on Aster (Maria Leung)



Forest Bumble Bee on Lingonberry (Maria Leung)



Gypsy Cuckoo Bumble Bee on Bluebells (Maria Leung)



Hover Fly on Aster (Maria Leung)



Hover Fly on Jacob's Ladder (Maria Leung)



Marsh Fly on Fireweed (Maria Leung)



Mason Bee on Strawberry (Maria Leung)



Mining Bee on Labrador Tea (Maria Leung)



Northern Blue Butterfly on Yarrow
(Maria Leung)



Sweat Bee on Goldenrod (Maria Leung)

APPENDIX A

Reducing risks to native pollinators by introduced bees: A review of Canada's legislation with recommendations for Yukon Territory.

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Simple Summary: Natural ecosystems support a rich variety of native bees, many important economically. Honey bees, - not native to North America, - and domesticated bumble bees spread pathogens (diseases and parasites) and outcompete native bees for nectar and pollen. We aimed to reduce these threats by finding Canadian provincial legislation that could direct legislation in Yukon Territory, where native pollinator communities are still healthy and essential for pollinating agricultural crops. We classified legislative requirements as: tracking numbers and locations of honey bee hives (registry); controlling the spread of pathogens (inspections, quarantines, and cleaning); controlling competition with native pollinators (limiting shared use of space); applying regulations to all domesticated bee species. There is little Canadian legislation controlling interactions of honey bees and native pollinators; the competition problem is poorly addressed. We recommend controls on numbers, locations, and timing of honey bee hives on public lands, in permitted “foraging leases” (for domestic insect livestock), similar to “grazing leases” (for domestic mammalian livestock). We detail changes to Yukon legislation (Animal Health, Animal Protection and Control, Wildlife, and Public Lands Acts) to deal with pathogen spread and competition. Protecting native pollinators will conserve successful pollination of flowers producing foods and medicines for people.

Abstract: Imported, non-native, honey bees and bumble bees threaten native pollinators by spreading pathogens (disease and parasites) and outcompeting native pollinators for nectar and pollen. We reviewed Canadian federal, provincial/territorial, and municipal legislation to find governance requirements that potentially reduce these threats. We classified requirements as: tracking the number and location of honey bee hives (registry); controlling the spread of pathogens (registry with inspections, quarantines, and cleaning regimes); controlling competition with native pollinators (limiting shared use of space); making regulations applicable to all domesticated bees in addition to honey bees. Policies and regulations to control competition from honey bees were generally lacking. So, we propose the concept of “foraging leases” to manage location and duration of honey bee apiaries on public lands. Based on the identified requirements, we recommend amendments to legislation in Yukon Territory, a jurisdiction still with healthy native pollinator communities that pollinate various human food and medicine crops. Recommendations include tracking hives and their pathogen status with beekeeping regulations enabled by the Animal Health Act, controlling use of imported bumble bees with changes to the Animal Protection and Control Act and/or the Wildlife Act, and restricting use of public lands for apiaries with the Public Lands Act.

Keywords: boreal agriculture, native pollinator conservation, bumble bee, foraging lease, honey bee, recommended legislation, pathogens, Canada, Yukon

1. Introduction

Pollinators are necessary for the functioning and stability of terrestrial ecosystems, and natural ecosystems function well with native pollinator species (Nalepa and Colla 2023). The most efficient pollinators, the bees, are experiencing a disproportionate amount of global insect decline (Sánchez-Bayo and Wyckhuys 2019). Two factors contributing to this are (i) novel pathogens transmitted by, and (ii) competition with, honey bees and managed bumble bees.

The honey bee (*Apis mellifera*), a domesticated species not native to North America, can infect native bees and other arthropods with various pathogens (e.g. Deformed Wing Virus, Sac Brood Virus, and Small Hive Beetle) (Nanetti et al. 2021). Commercially raised bumble bee species (*Bombus* sp.) carrying *Nosema bombi*, a microsporidian parasite, are implicated in the decline of several native bumble bee species (Cameron et al. 2016; Graystock et al. 2014). Less understood, are the impacts of imported alfalfa leaf-cutter bees (*Megachile rotundata*) and blue orchard mason bees (*Osmia lignaria*) (Iwasaki and Hogendoorn 2022) that are closely related to native *Megachile* and *Osmia* species in northern Canada.

Honey bees and introduced bumble bees also outcompete and displace native pollinators, and disrupt plant-pollinator networks (Hatfield et al. 2018; Valido et al. 2019). Honey bee hives typically begin with 10,000 worker bees in spring and grow throughout summer. Displacement of native bumble bees by introduced bumble bees has occurred in Canada. The Common Eastern Bumble Bee (*Bombus impatiens*), which is used in commercial greenhouses, has expanded its range into southern British Columbia and Washington State (Looney et al. 2019) and is the most recorded bumble bee in the Greater Vancouver Area of British Columbia (iNaturalist community 2024).

Yukon Territory, Canada, is mostly in the northern boreal biome, with a relatively low human population density, low extent of private agricultural land, and high extent of wild lands under public (i.e. territorial government) jurisdiction, compared to many parts of Canada. It is a jurisdiction where native pollinator populations are still largely intact and perform a vital pollination service for human food sources in both wild and agricultural ecosystems, including various berry crops (Brown and McNeil 2009, Hoshide et al. 2018, Leung and Forrest 2019). Native pollinator species (e.g., *Bombus* spp.) are more cold-tolerant than imported honey bees, so are better adapted to provide this pollination service (Leung and Forrest 2019). Imported honey bees and bumble bees have limited agricultural functions in pollinating field and greenhouse crops, and in honey production (Yukon Agriculture Branch. 2016). Pro-active management of these imported species has the best chance of conserving native pollinators in this context.

Four bumble bee species that occur in Yukon have been assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2019; Environment and Climate Change Canada 2022a, 2022b, and 2024). The main threats identified for these bumble bees are pathogens, pesticides, climate change, invasive/problematic species, and habitat loss. These threats also pose risks to the native pollinator community in general. In the Recovery Strategies and Management Plans for the four at-risk bumble bees, high priority is placed on addressing the threats by creating, amending or influencing environment-related provincial or territorial laws and/or regulations, policies and guidelines. This legislative approach makes sense for Yukon which already has some legislation resembling that of the provinces where beekeeping is more tightly controlled to reduce risk of pathogen spread. Internationally, this legislative approach aligns with the Kunming-Montreal Global Biodiversity Framework's targets 6, 11 and 14 (Convention on Biological Diversity 2022) that aim to mitigate impacts

of alien species, maintain pollination services, and integrate valued contributions of biodiversity into legislation. It would also help fulfil Canada's 2030 Nature Strategy that aims to address these targets (Government of Canada 2024).

Our aim was to review legislation and regulations from federal, provincial/territorial, and municipal governments across Canada for examples of how the threats (pathogen introduction; competition) posed by non-native pollinators (honey bees; domesticated bumble bees) can be reduced and managed, so that we can (i) recommend changes to current legislation and regulations in Yukon Territory, and (ii) provide a review and general recommendations for improvements to legislation in other Canadian and North American jurisdictions.

We found that the most useful regulatory and management approaches include mandatory registration and monitoring of honey bee apiaries, prescriptive rather than permissive approaches to commercial extractive uses of public lands, the concept of foraging leases for honey bees on public lands, and seasonal limitations on use of domesticated bumble bees in greenhouses.

2. Materials and Methods

To understand how Canadian governments currently aim to reduce the threat of pathogen spillover to, and competition with, native pollinators, we examined legislation governing beekeeping and use of other managed bees at the federal and provincial / territorial levels.

We searched Canadian federal legislation for regulations dealing with bees, which led to the work of the Canadian Food Inspection Agency (CFIA) under the Health of Animals Act. The 10 provinces and 3 territories in Canada have jurisdiction over animals and lands, so we searched their legislation for governance of honey bees, other domesticated and imported bees, animal pathogens (particularly for honey bees), and beekeeping on public lands. This involved searches through the consolidated statutes for each jurisdiction.

The "legislation" consists of Acts, regulations and enabling statutes supplemented by other legally enforceable policies such as protocols. This legislation can be implemented by the federal, provincial/territorial, or municipal levels of government (see Results), though the bulk of it is provincial (Table 1).

Though we recognize that the main purpose of honey bee legislation and regulation is to protect the health of honey bees and the honey bee industry (including by reducing risks of pathogen transmission among honey bee hives), many of these precautions also reduce risk to wild pollinators by averting the introduction and spread of diseases and pests that potentially affect wild pollinators.

We categorized the legislative requirements by general function or intent (termed "requirement") with respect to their benefit to native pollinators. We consider 5 categories: tracking the number and location of honey bee hives; controlling the spread of pathogens; controlling competition with native pollinators; reducing lethal and sub-lethal effects of pesticides; making regulations applicable to domesticated bees other than honey bees. Within each category of requirement, we itemized the various actions required to satisfy the intent. For each requirement and action, we documented example wording, and noted additional clauses that could potentially abate threats. No dedicated legislation exists for beekeeping in Yukon, but what other legislation does exist, was examined for its applicability to the categories identified from the provincial pieces of legislation.

We also tabulated the pathogens identified by each province and whether they were considered reportable in each jurisdiction. The intent here was to understand the scope and sufficiency of the listing processes.

We then identified the requirements within municipal bylaws. Many municipalities have bylaws regulating beekeeping in urban areas. These are often less prominent than provincial / territorial governance but can still potentially reduce the risk of pathogen spillover to, and competition with, native pollinators. An exhaustive search of all municipalities across Canada was beyond the scope of this study. Instead, municipal bylaws and regulations were collected for the northern territories where available, along with a selection of representative ones from each province, if available.

To understand what legislation exists to reduce the risks associated with introduced bumble bees competing with, or spreading pathogens to, native bumble bees, we identified provincial and territorial legislation that complements the federal Species at Risk Act (SARA), and examined it for its relevance to pollinator species at risk. Other federal legislation relevant to the use of managed bumble bees was also identified, mainly legislation related to the importation of live organisms into Canada or into individual provinces.

Table 1. The statutes and regulations governing beekeeping in each Canadian province.

Province	Statute	Regulations
British Columbia	Animal Health Act, Statutes of British Columbia (2014 c. 16)	Bee Regulation. British Columbia Regulation 3/2015 Reportable and Notifiable Disease Regulation 7/2015 O.C. 14/2025
	Lands Act, Revised Statutes of British Columbia (1996, c. 245)	British Columbia Land Use Policy Permission, 2023
Alberta	Bee Act, Revised Statutes of Alberta (2000, c. B-2)	Bee Regulation. Alberta Regulation 194/2003
Saskatchewan	The Apiaries Act, Statutes of Saskatchewan (2005, c. A-22.01)	The Apiaries Regulations, Saskatchewan Regulations, 2005
	The Animal Health Act, Statutes of Saskatchewan (2019, c.A-20.01)	The Animal Health Regulations, 2019
Manitoba	The Bee Act, Continuing Consolidation of the Statutes of Manitoba (1988, c. B15)	Diseases of Bees Designation Regulation, 2024
	Animal Diseases Act, Continuing Consolidation of the Statutes of Manitoba (2022, c. A85)	Reportable Diseases Regulation, 2007

Ontario	Bees Act, Revised Statutes of Ontario (1990, c. B-6)	Regulation 57 General, Revised Regulations of Ontario 1990
Quebec	Animal Health Protection Act, Revised Statutes of Quebec (1964, P-42)	Regulations respecting the registration of bee keepers, 2024 Regulation respecting the inscription affixed on hives, 2024 Regulations to designate contagious or parasitic diseases, infectious agents and syndromes, 2020
New Brunswick	Bee Act, Statute of New Brunswick (2021, c.21)	New Brunswick Regulation 13/2023
Nova Scotia	Bee Industry Act, Statutes of Nova Scotia (2005, c. 3)	Bee Industry Regulations. Nova Scotia Regulation 133/2012
Prince Edward Island	Animal Health Act, Revised Statutes of Prince Edward Island (1988, c. A-11.1) ¹	Bee Health Regulations, 2019
Newfoundland	Animal Health and Protection Act, Statutes of Newfoundland and Labrador (2013, c. 1)	Animal Health Regulations, 2012 Animal Reportable Diseases Regulations, 2012

¹This is under revision (An Act to Amend the Animal Health Act Bill No. 45, 2024)

3. Results

Three levels of government, - federal, provincial/territorial, and municipal, - have legislation relevant to honeybees, managed bumble bees or other introduced bees. The federal government is responsible for regulating the import of organisms into Canada, and reporting of pathogens listed by the World Organisation for Animal Health. It is also responsible for wildlife species at risk on federal lands. The provinces and territories have most jurisdiction over domestic livestock such as honeybees, and animal husbandry such as beekeeping. They also have jurisdiction over what may enter the province or territory, and over management of non-federal public lands and species at risk on non-federal lands. Municipalities govern activities within urban boundaries, including activities that have traditionally been carried out on rural lands such as the raising of chickens or pigs, and beekeeping.

3.1. Federal

For all of Canada, the federal Health of Animals Regulation (Consolidated Regulations of Canada, c. 296), enabled by the Health of Animals Act (Statute of Canada, 1990, c.21), applies. The Canadian Food and Inspection Agency (CFIA) enforces the regulation and issues import permits for honey bees that meet the requirements of permissible source countries and any other measures intended to reduce the spread of pathogens (Canadian Food Inspection Agency 2011). Applications to import other species of bees, such as blue orchard mason bees and bumble bees, into Canada are assessed on a case-by-case

basis under authority of the Plant Protection Act (Statute of Canada, 1990, c.22) and CFIA Directive 12-02 (Canadian Food Inspection Agency 2023). Canadian Food and Inspection Agency (2013a) prohibits importation of alfalfa leaf-cutting bees from outside Canada due to risk of pathogens, including chalkbrood. Only one provincial region, Newfoundland and Labrador, also prohibits the importation of alfalfa leaf-cutting bees (that could come from other provinces), as well as all other managed bees (e.g., bumble bees, blue orchard mason bees) aside from honey bees; this is regulated by the Wild Life Regulations (Consolidated Newfoundland and Labrador Regulation 1156/96 s.83).

3.2. Species at Risk legislation

Species at Risk legislation governs the assessment process for identifying wildlife species at risk and implementing conservation actions. Federally identified wildlife species at risk do include some native pollinators such as the Gypsy Cuckoo Bumble Bee (*Bombus bohemicus*) and McKay’s Bumble Bee (*Bombus mckayi*). However, Canada’s federal Species at Risk Act only applies to federal lands such as National Parks. In Yukon, there is no complementary territorial Species at Risk Act for territorial public lands which account for approximately 85% of the Yukon’s land base (Government of Yukon 2022a). Six provinces and one territory have some form of a species at-risk act (Table 2) (Gordon et al. 2024). All the provinces with species at risk legislation have included at least some insect pollinators in their lists of species at risk. These pollinators include bees, butterflies and moths. Northwest Territories’ Species at Risk Act has enabled assessments of three bumble bees that are listed federally and in some other provinces, but has not included them in the resulting list of species at risk (Table 2).

Table 2. Provincial and territorial statutes for species at risk and a list of any pollinator species to which the legislation applies.

Province	Statute	Listed Pollinator Species
British Columbia	none	
Alberta	none	
Saskatchewan	none	
Manitoba	The Endangered Species and Ecosystems Act, Continuing Consolidation of the Statutes of Manitoba (1989-90, c. 39)	Dakota Skipper (<i>Hesperia dacotae</i>) Ottoe Skipper (<i>Hesperia ottoe</i>) Uncas Skipper (<i>Hesperia uncas</i>) Dusky Dune Moth (<i>Copablepharon longipenne</i>) Pale Yellow Dune Moth (<i>Copablepharon grandis</i>) Poweshiek Skipperling (<i>Oarisma poweshiek</i>) Verna's Flower Moth (<i>Schinia verna</i>) White Flower Moth (<i>Schinia bimatrix</i>)

Ontario	Endangered Species Act, Statutes of Ontario (2007, c. 6)	Bogbean Buckmoth (<i>Hemileuca</i> sp.) False-foxglove Sun Moth (<i>Pyrrhia aurantiago</i>) Gypsy Cuckoo Bumble Bee (<i>Bombus bohemicus</i>) Mottled Duskywing (<i>Erynnis martialis</i>) Rusty-patched Bumble Bee (<i>Bombus affinis</i>) Suckley's Cuckoo Bumble Bee (<i>Bombus suckleyi</i>) Northern Oak Hairstreak (<i>Satyrium favonius ontario</i>) Reversed Haploa Moth (<i>Haploa reversa</i>) American Bumble Bee (<i>Bombus pensylvanicus</i>) Dukes' Skipper (<i>Euphyes dukesi</i>) Monarch (<i>Danaus plexippus</i>) Red-tailed Leafhopper (<i>Aflexia rubranura</i>) West Virginia White (<i>Pieris virginiensis</i>) Yellow-banded Bumble Bee (<i>Bombus terricola</i>)
Quebec	Act Respecting Threatened or Vulnerable Species, Revised Statutes of Quebec (1989, c. E-12.01)	Rusty-patched Bumble Bee (<i>Bombus affinis</i>) Salt Marsh Copper (<i>Lycaena dospassosi</i>) Maritime Ringlet (<i>Coenonympha nipisiquit</i>)
New Brunswick	Endangered Species Act, Revised Statutes of New Brunswick (2012, c. 6)	Bumble Bee, Bohemian Cuckoo (<i>Bombus bohemicus</i>) Bumble Bee, Rusty-patched (<i>Bombus affinis</i>) Bumble Bee, Suckley's Cuckoo (<i>Bombus suckleyi</i>) Monarch (<i>Danaus plexippus</i>) Ringlet, Maritime (<i>Coenonympha nipisiquit</i>)
Nova Scotia	Endangered Species Act, Statutes of Nova Scotia (1998, c. 11. s. 1)	Gypsy Cuckoo Bumble Bee (<i>Bombus bohemicus</i>) Macropis Cuckoo Bee (<i>Epeoloides pilosulus</i>) Monarch (<i>Danaus plexippus</i>) Sable Island Sweat Bee (<i>Lasioglossum sablense</i>) Yellow-banded Bumble Bee (<i>Bombus terricola</i>)
Prince Edward Island	none	

Newfoundland	Endangered Species Act, Statutes of Newfoundland and Labrador (2001, c. E-10.1)	Gypsy Cuckoo Bumble Bee (<i>Bombus bohemicus</i>) Suckley's Cuckoo Bumble Bee (<i>Bombus suckleyi</i>) Yellow-banded Bumble Bee (<i>Bombus terricola</i>)
Yukon	none	
Northwest Territories	Species at Risk (NWT) Act, Statutes of Northwest Territories (2009, c. 16)	No pollinators listed ¹
Nunavut	none	

¹ NWT Species at Risk Committee (SARC) considers Gypsy Cuckoo Bumble Bee and McKay's Bumble Bee to be data deficient and Yellow-banded Bumble Bee to be not at risk; Suckley's Cuckoo Bumble Bee is not assessed. SARC assessments enabled by Species at Risk (NWT) Act.

3.3. Provincial and territorial legislation

All provinces have legislation that actively governs beekeeping. Six provinces have statutes specific to bees or apiaries (apiary: a collection of honey bee hives). The other four provinces, - British Columbia, Quebec, Newfoundland, and Prince Edward Island, - use their statutes on Animal Health to enable regulations pertaining to beekeeping (Table 1). Additional statutes also support beekeeping in some provinces. For example, despite Saskatchewan having an Apiaries Act, its Animal Health Act and Regulations control the reporting of bee pathogens. None of the three territories, - Yukon, Northwest Territories, or Nunavut, - has territorial statutes specific to beekeeping or beekeeping regulations. However, the Yukon's Animal Health Regulation (O.I.C. 2018/159) lists mandatory reporting of suspected or confirmed cases of two honey bee "transmissible hazards": American foulbrood (*Paenibacillus larvae*), and small hive beetle (*Aethina tumida*).

From the statutes and regulations overseeing beekeeping, we identified sets of requirements that are of benefit to native pollinators (Table 3) while facilitating the management of the honey bee industry. These legislative requirements, and associated actions, comprise a systematic assessment of governance functions.

The first requirement is the obligation to track the number and location of honey bee hives, including the following specific actions: register hives; identify individual hives; register the specific location of each hive; report all movements of hives or colonies (Table 3). Except for Prince Edward Island, all provinces require beekeepers to register their hives. Information collected during registration usually includes the number and location of hives, which is essential in tracking and containing pathogens, and may provide a density estimate of honey bees on the landscape. For adequate tracking and containment of the threats of pathogen spread and competition, we consider all 4 of these actions to be necessary.

The second requirement is to control the spread of diseases and pests (pathogens). This category includes various legislated actions, not all of which are mandatory or enacted in every province. These actions include restriction on sources of honey bees, quarantines, inspections of colonies, sanitization of equipment, and mandatory reporting of diseases and pests. All provinces control the importation of honey bees and beekeeping equipment from other provinces, and in the case of British Columbia,

movement of hives within the province is closely regulated, allowing for quarantine zones when pathogen outbreaks occur.

Table 3. Requirements within provincial legislation pertaining to beekeeping that potentially reduce risk to native pollinators. Requirements are organized first by general functions, and then by actions (identified in italics). See Table S1 in Supplementary Material for example legislative wording for each action identified here.

1. Requirements that track the number and location of honey bee hives.

Registering hives:

Bee Regulation (Alberta Regulation 194/2003; 221/2004, s.3)

Identification of hives:

New Brunswick Regulation 2023-13, s.18(1)

Registering specific location of hives:

Bee Industry Regulations (Nova Scotia Regulation 319/2007, s.5)

Mandatory reporting of movement of honey bee hives/colonies:

Bee Health Regulations (Pursuant to section 4 of the Animal Health and Protection Act, Revised Statutes of Prince Edward Island. 1988, Cap. A-11.1, s.6(1), s.6(2))

2. Requirements that control the spread of pathogens

Mandatory inspection of bees prior to importation:

Animal Health Regulations (Newfoundland and Labrador Regulation 33/2012, s.7(1), s.7(2))

Mandatory quarantine period:

Animal Health Regulations (Newfoundland and Labrador Regulation 33/2012, s.7(3))

Mandatory inspection of used honey bee equipment prior to importation:

Bee Industry Regulations (Nova Scotia Regulation 319/2007, s.6(1), s.6(2a), s.6(2b))

Mandatory sanitization of equipment prior to importation:

2024 Nova Scotia Honeybee Health Importation Protocol

Mandatory reporting of disease and pests:

Bees Act (Revised Statutes of Ontario, 1990, c. B.6, s.10)

Listing of specific pathogens: - Refer to Table 4 for list by province.

Restrictions on the source of honey bees and honey bee equipment:

The Apiaries Regulation (Saskatchewan 2005 cA-22.01 Regulation 1, s.4)

3. Requirements that can control competition with native pollinators

Regulations controlling apiaries on public land:

British Columbia Land Use Policy Permission, 2023

(issued under authority of Lands Act (C.245, Revised Statutes of British Columbia, 1996, s.60))

APPENDIX 4. CONDITIONS FOR TEMPORARY APIARIES

Restricting number of hives:

The City of Dawson Bylaw #12-28, s.6.08

4. Requirements that reduce lethal and sub-lethal effects of pesticides on native pollinators ¹

Restricting pesticides while flowers are in bloom:

Animal Health Protection Act (Revised Statutes of Quebec, 1964 Ch. P-42, s. 11.12)

5. Requirements that make regulations applicable to domesticated bees in addition to honey bees

Defining imported bee species (e.g. honey bees, bumble bees, alfalfa leaf cutter bees, blue orchard bees):

The Bee Act (Continuing Consolidation of the Statutes of Manitoba c. B15, s.1)

¹ Although we note this as an existing legislative requirement in some jurisdictions, we do not discuss this topic further because of its complexity. Substantial research has been done, often on species other than bees, leading to diverse governance outcomes beyond the scope of this paper.

The third requirement, to control competition between honey bees and native pollinators, has had very little legislative attention (Table 3). British Columbia is the only province to have specific regulations for apiaries on public (“Crown”) land. These allow the province to control the locations, densities, and duration of privately-owned hives on public lands, all of which are necessary tools to influence the competition between honey bees and the already established native pollinator community. This approach is easier with public lands legislation that is prescriptive (i.e. prohibiting any private use of public lands unless that use is explicitly allowed with conditions detailed in legislation) as compared to permissive (i.e. allowing all private uses of public land with controls and prohibitions only occurring when specifically addressed in the legislation). Restrictions on the number of hives on any piece of land were generally absent in provincial legislation, but common at the municipal level which is discussed later.

The fourth requirement, to reduce negative effects of pesticides on bees, is generally addressed in legislation other than what we reviewed, and was beyond the scope of this study. However, it is worth mentioning that Ontario’s Bee Act and Quebec’s Animal Health Protection Act both prohibit the spraying of fruit trees with any substance toxic to bees while the trees are in bloom.

The fifth requirement is to make regulations applicable to all domesticated bee species including honey bees (Table 3). This has had relatively little legislative attention, partly because importation to Canada is controlled with federal legislation (see above). Some provinces list various domesticated species as well as honey bees, giving government the option to act on threats these domesticated species pose.

Returning to the question of pathogen reporting and control (the second requirement), all provinces have identified some pathogens associated with beekeeping. These pathogens are listed in provincial legislation used to facilitate their control and eradication. The pathogens, including disease organisms and pest species, listed from provinces across Canada are comprised of the following numbers of species: 5 mites, 5 honey bees, 4 wasps or hornets, 3 beetles, 2 wax moths, 1 louse, 3 fungi, 2 bacteria, and 8 types of virus (Table 4). All 10 provinces list small hive beetle, Varroa mite, and American foulbrood. Only British Columbia and Manitoba identify viruses in their legislation. Some provinces specifically list “reportable” and “notifiable” pathogens. “Reportable” pathogens require immediate action to contain their spread. “Notifiable” pathogens are monitored to help understand their presence and impacts. In provinces where notifiable and reportable pathogens are named, the beekeeper is obligated to report suspected cases within a limited time.

At 23, British Columbia has identified the most pathogens in its legislation, followed by Alberta and Ontario at 18. All provinces have at least one reportable or notifiable pathogen, with the exception of Alberta which has no honey bee pathogens listed in its Reportable and Notifiable Diseases Regulation (Alberta Regulation 129/2014). Reporting of some pathogens is still recommended in Alberta (Nasr and Muirhead 2019). The Canadian Federal Inspection Agency also monitors tracheal mites, small hive beetle, American foulbrood and European foulbrood (Health of Animals Regulations, Consolidated Regulations of Canada, 2024, c. 296). Mandatory reporting by laboratories across Canada contributes to this monitoring effort.

Table 4. Pathogens identified in provincial and territorial statutes and regulations: X=identified only; R=reportable; N=notifiable. “Reportable” and “Notifiable” are defined in the text. Two letter codes for jurisdictions are: YT=Yukon Territory; BC=British Columbia; AB=Alberta; SK=Saskatchewan; MB=Manitoba; ON=Ontario; QC=Québec; NB=New Brunswick; NS=Nova Scotia; PEI=Prince Edward Island; NL=Newfoundland and Labrador.

Common Name	Scientific Name	YT	BC	AB	SK	MB	ON	QC	NB	NS	PEI	NL
<u>Mites</u>												
Asian bee mite sp. 1	<i>Tropilaelaps mercedesae</i>			X		X	R	R	R	R		
Asian bee mite sp.2	<i>Tropilaelaps clareae</i>		R	X	X	X	R	R	R	R		
<i>Euvarroa</i> genus	<i>Euvarroa</i>					X	R		R			
Tracheal mites	<i>Acarapis woodi</i>		N	X	X	R	R		X	R	R	R

Common Name	Scientific Name	YT	BC	AB	SK	MB	ON	QC	NB	NS	PEI	NL
<i>Varroa mites</i>	<i>Varroa destructor</i>		N	X	X	X	R	X	R ¹	R ¹	R	R
<u>Bees, Wasps and Hornets</u>												
Africanized honey bee	<i>Apis mellifera scutellata</i> and hybrids		R	X	X	X	R	R	R	R	X	
Asian honey bee	<i>Apis cerana</i> and species complex		R	X		X	R		R	R	X	
Cape honey bee	<i>Apis mellifera capensis</i>		R	X		X	R		R	R	X	
Dwarf honey bee	<i>Apis florea</i> and species complex					X	R		R			
Giant honey bee	<i>Apis dorsata</i>			X		X	R		R			
Asian predatory wasp	<i>Apis vilutina</i>		R									
Northern giant hornet	<i>Vespa mandarinia</i>		R	X		X	R		R	R		
Southern giant hornet	<i>Vespa soror</i>			X		X			R			
Yellow-legged hornet	<i>Vespa velutina</i>			X		X			R		X	
<u>Beetles</u>												
Large African hive beetle sp.1	<i>Oplostomus fuliginus</i>					X	R		R			
Large African hive beetle sp.2	<i>Oplostomus haroldi</i>					X	R		R			
Small hive beetle	<i>Aethina tumida</i>	R	R	X	X	R	R	R	X	R	R	X
<u>Moths</u>												
Greater wax moth	<i>Galleria mellonella</i>		N			X			X			R
Lesser wax moth	<i>Achoia grisella</i>		N			X			X			
<u>Other insects</u>												
Bee louse	<i>Braula coeca</i>					X			X			
<u>Fungi</u>												
Chalkbrood	<i>Ascosphaera apis</i>		N	X		X			X	X		
<i>Nosema</i> sp. 1	<i>Nosema apis</i> (<i>Vairimorpha apis</i>)		N	X		R	R		X	X		R

Common Name	Scientific Name	YT	BC	AB	SK	MB	ON	QC	NB	NS	PEI	NL
<i>Nosema</i> sp. 2	<i>Nosema ceranae</i> (<i>Vairimorpha ceranae</i>)		N	X		X	R		X	R		
<u>Bacteria</u>												
American foulbrood	<i>Paenibacillus</i> larvae	R	R	X	N	R	R	R	R	R	R	R
European foulbrood	<i>Melissococcus plutonius</i> and bacteria		N	X		R	R		R	R		R
<u>Viruses</u>												
Acute bee paralysis virus			N			X						
Black queen cell virus			N			X						
Chronic Bee Paralysis Virus						X						
Deformed wing virus			N			X						
Israel acute paralysis virus			N			X						
Kashmir bee virus			N			X						
Sacbrood virus	Family Iflaviridae		N	X		X			X	X		
Varroa destructor virus			N			X						

¹ Reportable for miticide resistant types only

3.4. Municipal Legislation

Municipal legislation pertaining to beekeeping is generally more developed in western Canada than in central or eastern Canada, with British Columbia having upwards of 20 municipalities permitting and regulating beekeeping. There were considerable similarities among bylaws, and the sample (see Table S2 in Supplementary Material) appeared sufficient to identify the main requirements. Regulations are usually enabled by animal control bylaws (e.g. Edmonton Animal Licensing and Control Bylaw No. 13145), Zoning bylaws (e.g. Winnipeg Zoning By-law) or dedicated urban beekeeping bylaws (e.g. Chilliwack Urban Beekeeping Bylaw 2019, No. 4680).

The focus of the regulations is on keeping the public safe from defensive behaviour of honey bees, especially bee stings. Regulations usually stipulate the maximum number of beehives by the size of property, placement of beehives relative to property boundaries, and often mention having the hive entrance directed away from adjacent properties and/or requirements for a physical barrier such as a fence or hedge to discourage direct flight of honey bees to adjacent properties (e.g. Municipal Planning Guide to Zoning Bylaws in Manitoba (Government of Manitoba 2015)). A few municipalities require

proof that the applicant has taken a beekeeping course or is being mentored by an experienced beekeeper (e.g. Mount Pearl Development Regulations 2010).

The two municipalities in Yukon that explicitly allow beekeeping use different bylaws to regulate the activity. The City of Whitehorse uses its Zoning Bylaw 2012-20 to specify where, within city limits, beekeeping is permitted. Beyond that, there are no published regulations on placement of beehives within properties or the permissible number of beehives and no permitting process to keep track of beekeeping activity. The beekeeping regulations in Dawson City are enabled by its Animal Control Bylaw and are similar to municipalities in southern Canada with well-developed beekeeping regulations specifying the maximum number of beehives, placement, and management practices to reduce risks to neighbouring properties. Dawson City has a permitting process in place which provides a record of the beekeeper, where hives are located, and where they were moved from.

4. Discussion

4.1. The Yukon Context

Having a diversity of pollinators for the large diversity of plants native to Yukon creates a complex plant-pollinator network. The production of northern wild foods, such as blueberries and lingonberries (*Vaccinium* spp.) and cloudberries (*Rubus chamaemorus*), and some domestic crops (e.g., haskap (*Lonicera caerulea*), beans (*Phaseolus* spp. and squash (*Cucurbita* spp.), depends on these pollinators (Brown and McNeil 2009; Hoshida et al. 2018; Leung and Forrest 2019). In Yukon, there are over a hundred species of bees, over a hundred species of butterflies, and many more moths, flies, and other pollinator insects (NatureServe. 2024). This native pollinator network is thought to be relatively intact compared to networks farther south in Canada and North America because Yukon has a relatively low human footprint. The bumble bees listed in Canada's Species at Risk Act are believed to be closer to historic levels in Yukon than other parts of Canada because less of the landscape has been subjected to alteration by agriculture, resource extraction, or other uses. So, now is an appropriate time to act to strengthen conservation for native pollinator species in Yukon before very many become threatened.

The Canadian legislative framework for reducing threats to native pollinators has improved in recent years. A 2007 review of federal and provincial legislation (Tang et al. 2007) concluded that Canadian federal and provincial legislation lacked explicit provisions for pollinator conservation, but did have provisions related to pollinator conservation. Since that study, there have been numerous amendments to existing legislation and introduction of new legislation. Although provisions specific to conservation of native pollinators are still generally lacking across Canada, there are many examples of legislation that is potentially useful in reducing the risks to native pollinators. In the context of legislation across the country, we examine current Yukon legislation to evaluate its ability to address the threat of pathogen spillover to native pollinators from introduced bees, and the threat of competition with native pollinators by introduced bees.

4.2. Pathogen Spillover

The main sources of pathogens affecting native bees are imported honey bees, a species not native to Canada, and commercially raised and imported bumble bees (mainly *Bombus impatiens*) used in greenhouse operations (Geldman and González-Varo 2018; Evans 2017). Pathogens and parasites weaken native pollinators, and when pervasive, or combined with other stressors, are capable of

reducing populations of native pollinators (Nalepa and Colla 2023). Pathogens associated with honey bees have been found in arthropods other than bees, likely transmitted at floral feeding sites, or by predation on infected honey bees (Nanetti et al. 2021).

Compared to the provinces, Yukon Territory has very little legislative infrastructure to protect native pollinators from pathogen spillover imposed by honey bees and other managed bees. This makes Yukon vulnerable to having infected honey bees from other Canadian jurisdictions. The territorial legislation is limited to mandatory reporting of two “transmissible hazards”, American foulbrood, and small hive beetle (Table 4). Dawson City is the only region in Yukon that reinforces this mandatory reporting.

Mandatory reporting is difficult to enforce, without a system to register beekeepers and the location of their hives, and a system to inspect and track imported honey bees. Unlike all the provinces, Yukon does not monitor honey bees or beekeeping equipment being moved into the territory and does not systematically regulate where honey bees may be imported from. Though, like the rest of Canada, Yukon beekeepers should be complying with the federal Health of Animals Regulation (C.R.C., c. 296) that includes restrictions on which countries honey bees can be imported from. For many years, a long-time beekeeper in Yukon was a proponent of sourcing honey bees from mite-free colonies to keep Yukon free of varroa mites (Yukon Agriculture Branch 2016), but there was no legislation to support this initiative. Today, honey bees in Yukon are commonly infected by varroa mite (Yukon Agriculture Branch 2016) and this could be widespread throughout Yukon. Viger (2022) reported that beekeeping is widespread in Yukon, ranging north to Dawson City, west to Haines Junction, east to Watson Lake and south to Teslin. However, the actual number of beekeepers and number of hives remains unknown in Yukon because the territory lacks a formal registry.

The pathogens associated with honey bees that could enter Yukon are not reflected in the territory’s current legislation. The list of two pathogens identified for honey bees by Yukon’s Animal Health Act (Statutes of Yukon 2013, c.10) is shorter than any province, and notably far less than the bordering provinces of British Columbia, with 23 listed pathogens, and Alberta with 18 (Table 4). It could be argued that the mandatory reporting of select pathogens in British Columbia offers some protection to Yukon; mandatory reporting in British Columbia facilitates the isolation and disinfection of affected hives. The same cannot be said of Alberta where reporting is recommended but not legislated (Nasr and Muirhead 2019).

Across Canada, legislation abating the risk of pathogen spillover from managed bumble bees is less developed than that from honey bees. Evans (2017) recommends the monitoring of pathogens in commercial bumble bee stock, preventing escape from greenhouses, and regulating the movement of commercial bumble bees, as the necessary management approaches to mitigate the risks of managed bumble bees to native bees. Newfoundland’s prohibition of any species other than those listed in their Wild Life Regulations (Consolidated Newfoundland and Labrador Regulation 1156/96 s.83) is the strictest provision pertaining to the movement of managed bumble bees. It prohibits any importation of bumble bees and is, in part, enforceable because it defines “wild animal” as “any live animal, including without limitation, any amphibian, arthropod, bird, coelenterate, crustacean, fish, other invertebrate, mammal, mollusk or reptile, whether or not bred, hatched or born in captivity and including any egg or offspring of them”. By contrast, the Animal Protection and Control Act of Yukon (Statutes of Yukon, 2022, c.13) currently does not enable the control of any invertebrates. As well, the Wildlife Act (Revised

Statutes of Yukon 2002, C.229) for Yukon only includes vertebrate species in its definition of “wildlife”, so is unable to offer any protection to invertebrates such as insect pollinators.

Another avenue for protecting native pollinators from pathogen spillover is possible, specifically for pollinator species listed in Canada’s Species at Risk Act (SARA). When species are listed under SARA, the federal government is obligated to prepare Recovery Strategies for “endangered” and “threatened” species, and Management Plans for “special concern” species. Such action plans identify approaches to reducing threats to the species, and it is mandatory to track the progress of these strategies and plans (Species at Risk Act, Statutes of Canada 2002, c.29). An example of an action within a Recovery Strategy to protect a native pollinator against pathogen spillover is the promotion of Bumblebee Sector Guide to the National Bee Farm-level Biosecurity Standard (Canadian Food Inspection Agency 2013b). This standard provides details on how to confine managed bumble bees to greenhouses and to prevent spread of pathogens.

Action plans enabled by the federal Species at Risk Act (SARA) are limited in their ability to achieve the goal of arresting or reversing species decline. One main limitation is the fact that, for terrestrial species, SARA only applies to federal lands (those “that belong to His Majesty in right of Canada”). In the Provinces, this is only 4% of the land (Gordon et al. 2024). The vast majority of land in Yukon is public land, still vested in the federal Crown but administered under territorial jurisdiction (Yukon Act S.C. 2002, c.7) (Government of Yukon 2022a). In practice, the application of SARA in Yukon has come to refer only to federally controlled or administered lands, as is done in the provinces. Federally controlled lands in Yukon (mostly conservation lands) comprise c. 8% of the land base (Data in Cooke 2017). Unlike the Northwest Territories and seven provinces, Yukon does not have legislation that complements the federal SARA (Table 2) (Gordon et al. 2024). Provincial and territorial equivalents of the federal SARA usually adopt components of federal Recovery Strategies and Management Plans for use on public lands under provincial and territorial administration.

4.3. Competition

Unlike native bees, worker honey bees can recruit each other to the best sources of nectar and pollen, thereby monopolizing the food source (Torné-Noguera et al. 2016; Valido et al. 2019). Hung et al. (2018) found that the level of numerical dominance by honey bees increases with flower abundance. Cane and Tepedino (2017) calculated that the amount of pollen a honey bee colony collects from June to August is equivalent to the amount needed to produce 100,000 progeny of an average solitary bee. Under such competition from honey bees, the most affected native species would have difficulty maintaining local population levels into the future.

Legislation that could reduce the risk of resource competition from honey bees and other managed bees is limited, with most examples coming from municipal bylaws. Urban beekeeping is a growing trend in Canada, with many municipalities moving away from the prohibition of beekeeping, not enforcing the prohibition, or developing regulations around beekeeping. Municipal regulations have the potential to control the amount of competition with native pollinators and the risk of pathogen spillover, by either prohibiting beekeeping or by limiting the number of honey bee hives. However, because public safety is the main rationale for restricting the number of bee hives within municipal boundaries, the overall density of bee hives and their risk to native pollinators has yet to be factored in. The risk of competition was highlighted by MacInnis et al. (2023) who found that the high honey bee density in Montreal was negatively impacting wild bee species richness. Similar findings have been documented from elsewhere

in Canada and Europe (MacKell et al. 2023; Renner et al. 2021). Beyond municipal boundaries, most provinces track the location and number of honey bee hives by using a registry system and such registries have the potential to track the density of bee hives and competition risk to native pollinators.

Legislation specifically restricting the placement of apiaries on public lands appears lacking for most provinces. The lack of regulation would indicate it is a prohibited activity if the particular provincial Lands Act is prescriptive in nature, meaning that by default, activities are prohibited unless authorized. British Columbia appears to be the only province that has explicitly authorized regulations pertaining to apiaries on public lands, and these were enabled by its provincial Lands Act (C.245, R.S.B.C., 1996, s.60.). Unlike British Columbia which has a prescriptive Lands Act, the existing Yukon Lands Acts (Territorial Lands (Yukon) Act, Revised Statutes of Canada, 1985, c. T-7 ; and Lands Act Revised Statutes of Yukon 2002, c. 132) are permissive, allowing any activities to occur without restrictions unless those activities are specifically addressed in the Act or by its enabled legislation. At present, that means that beekeeping on public lands administered by the Yukon Government is permitted without restriction. This may change as the Yukon's Lands Acts are undergoing major changes (Government of Yukon 2022a).

Providing sufficient forage is a general concern and recommendation for beekeepers (Eccles et al. 2017). Honey bees are essentially free ranging livestock, travelling beyond property lines to collect nectar and pollen. Unrestricted access to public lands by beekeepers with apiaries potentially creates problems with competition among beekeepers and their honey bees, and competition between honey bees and native pollinators. For other livestock in Yukon, such as cattle, sheep and horses, competition with wildlife is a consideration in deciding whether a land parcel can be a grazing lease. Adopting the approach of the Yukon Grazing Policy (Government of Yukon 2015) for identifying public lands for grazing livestock could be a starting point to developing an assessment of where suitable sites would be for apiaries on public lands. Specifically, the Yukon Grazing Policy stipulates a minimum amount of available forage within a defined area, and how the period of time that the land can be used for grazing livestock is determined. The policy also summarizes a process to identify conflicting land uses, and states that applications for grazing are subjected to review by the Yukon Government or the Yukon Environmental and Socio-economic Assessment Act.

We recommend the establishment of Foraging Leases as a necessary condition for private honey bee keepers to place apiaries on public lands. By using an approach like the Yukon Grazing Policy, regulators would limit the number of hives to the capacity of the forage (nectar and pollen) in defined areas (foraging leases), and such leases would be limited in time and space. These limitations could help mitigate competition with native insects reliant on similar nectar and pollen sources.

Geldman and González-Varo (2018) suggest management practices to reduce the number of apiaries on public lands during time periods outside the period of mass-flowering. Mass-flowering refers to events during when a set of plant species produce many blooms within a short period of time. Competition with native pollinators would be most intense before and after such mass flowering periods, when fewer food sources are available. Geldman and González-Varo (2018) further suggest prohibition of apiaries in protected areas to avoid disruption to native pollinators. This is supported by Henry and Rodet's (2018) study that found the carrying capacity of floral resources in protected areas was exceeded by the introduction of honey bees. As with British Columbia, restricting the window of time during which apiaries can be on public lands and regulating cleanup, would help ensure that the public lands will return to their original state as much as possible.

Precedents for limiting the density of honey bees and assessing risk to native pollinators on public lands are lacking in Canada. However, there are initiatives in the United States that demand environmental assessments prior to deciding whether to issue permits for apiaries on public land. Such assessments would consider the risk of displacing native pollinators from their essential food sources, and also the risk of potential pathogen spillover from honey bees to native bees (Bureau of Land Management 2022; O'Brien et al. 2020).

4.4. Recommendations for Legislative Change in Yukon

Through a combination of amending existing Yukon legislation and introducing new legislation, it would be possible to reduce the risk of pathogen spillover to native pollinators, and mitigate competition between introduced bees and native pollinators.

4.4.1. Pathogen Spillover

For Yukon, existing legislation can be used to reduce risk of pathogen spillover from honey bees. The Animal Health Act has the ability to create regulations to prevent the entry and spread of disease to domestic and wild animals. We recommend creating a set of regulations enabled by the Animal Health Act specific to beekeeping. In the regulations, we suggest inclusion of the following stipulations:

- Registration of apiaries, including beekeeper's name, number of hives, and specific location(s) of hives;
- Onsite identification of apiaries to facilitate contact with beekeeper if needed;
- Reporting of any movement of apiaries and equipment so as to track potential spread of pathogens;
- Inspection of honey bees and equipment prior to import into Yukon, and certification to ensure that honey bees and equipment are free of pathogens;
- Updated list of pathogens to include all pathogens at risk to honey bees in the provinces the bees are being imported from;
- Continued mandatory reporting of "transmissible diseases" as in the current Animal Health Regulations.

To reduce the risk of pathogen spillover from managed bumble bees, there are two options: one that would prohibit the use of managed bumble bees altogether, and another that would control the use of managed bumble bees. We prefer the higher effectiveness of the first option, but discuss how to implement either through legislative changes to existing Yukon Acts or Regulations.

Under option 1, prohibiting the use of managed bumble bees in Yukon would either need amendments to the Animals and Species Regulation (Ministerial Order 2024/12) or amendments to Yukon's Wildlife Act.

Currently, the Animals and Species Regulation enabled by the Animal Protection and Control Act prohibits "an animal that is not livestock and does not belong to an allowed species or a restricted species" (s 6(a)). This wording offers the possibility of preventing the import of non-native bumble bees if the definition of "animal" in the Animal Protection and Control Act were to include non-native bumble bees. That definition currently only includes vertebrates and "prescribed" species, and the "prescribed species" in the Animals and Species Regulation are limited to cephalopods, tarantulas and scorpions.

Adding bumble bees as “prescribed” species to Schedule 1 of the Animals and Species Regulation would enact a prohibition on the import of non-native bumble bees.

For the Wildlife Act to prohibit managed bumble bees, the definition of “wildlife” would need better clarity to include native insects, so that stipulations to protect wildlife through the Wildlife Act are applicable to native pollinators. The current definition of “wildlife” as “wild by nature” may or may not apply to native insects. Then a new section would be needed in the Act to prohibit importation of any species unless authorized, akin to Newfoundland and Labrador’s Wild Life Regulations (Consolidated Newfoundland and Labrador Regulation 1156/96 s.83). This would enable prohibition of insects considered a risk to Yukon’s wildlife, and insects that are considered invasive.

Under option 2, controlling the use of managed bumble bees to minimize pathogen spillover to native pollinators would require amendments to the Animal Protection and Control Act and its regulations. For the purposes of the Animal Protection and Control Act and the Animal Protection and Control Regulations (O.I.C. 2024/62), livestock is defined by the species in Schedule 2 of the Animals Species Regulation and Schedule A of the Game Farm Regulations (O.I.C. 1995/015). Adding non-native bumble bees as livestock to Schedule 2 of the Animals and Species Regulation would enable the Animal Protection and Control Act to prescribe conditions for the use of managed bumble bees in Yukon. The conditions should include assurances that the bees are only permitted for use in winter (November to March) and that they are confined to greenhouses. This would prevent contact between the managed bumble bees and native bees; native bees are dormant in winter. We also recommend the destruction of the managed bumble bee colonies at the end of winter to prevent any individuals from escaping out of the greenhouses.

4.4.2. Competition

The changes to legislation that we recommend in the Pathogen Spillover section (4.4.1.) are applicable to mitigating competition between managed bees and native pollinators. Regarding honey bees, the establishment of a registry that can track the location and density of apiaries throughout Yukon is not only useful for understanding where the competition risk to native pollinators is highest, but also useful for beekeepers wanting to ensure adequate food for their honey bees. Regarding managed bumble bees, by prohibiting the use of managed bumble bees or confining their use to greenhouses in winter, competition with native pollinators would be avoided.

Beyond the recommended changes from the Pathogen Spillover section, there are additional amendments to Yukon’s territorial legislation and municipal bylaws that could reduce competition with native pollinators by honey bees. Apiaries are kept on both public and private lands in Yukon though in both circumstances the honey bees have access to food on public lands and compete with native pollinators. This competition cannot be avoided altogether while beekeeping continues in Yukon because, unlike livestock that can be confined by fences, honey bees are free ranging. However, restrictions on the number of hives and the placement of apiaries can reduce competition with native pollinators by honey bees.

At a municipal level, having municipalities such as Whitehorse adopt wording similar to the Dawson City beekeeping regulations into its Zoning Bylaw or Animal Control Bylaw would potentially limit the

placement and density of honey bees within the municipality. The Dawson City regulations include a maximum of two hives for properties smaller than 0.41 ha, and a maximum of four hives for properties 0.41 ha or larger. Additionally, imposing a total quota of apiaries within city limits could reduce competition with native pollinators.

At a territorial level, the new Public Lands Act that the Yukon Government is now developing could direct the conditions by which apiaries would be permitted on public lands. At one extreme, apiaries on public lands could be prohibited altogether, and this would be the least risk to native pollinators. At the other extreme, what currently exists, apiaries would be permitted without restriction because, by default, activities are allowed unless prohibited by the current Lands Acts and enabled regulations. Somewhere between these extremes would require a regulated approach that mitigates the risk of competition with native species while still allowing some use of public lands. We recommend that the new Public Lands Act be prescriptive, rather than permissive, so that it includes clause(s) prohibiting apiaries on public land except under specific conditions, and through a permitting process similar to how grazing agreements are devised in Yukon.

To mitigate the negative consequences of competition with native species, the permitting process would include the following considerations:

- Forage: Identify sites that have a high abundance of floral resources, such as recent burns in forested lands, or repeatedly disturbed sites (rights-of-way and gravel pits). Estimate the longevity of the abundance, as some sites will lose their abundant floral resources as part of forest succession, or changes to land use;
- Timing: Restrict the window of time during which honey bees can be at a site. This could reduce competition when food is most limiting to native pollinators (e.g. early spring), and permit apiaries when flowers are most abundant, so least likely to be limiting to native pollinators;
- Quota: Limit the total number of apiaries so that total competition with native pollinators is reduced;
- Placement A: Avoid remote sites to reduce chances of pathogen spillover to native pollinator populations that are currently less affected by introduced pathogens and to maintain native plant-pollinator networks without intrusion. Instead, only use sites with easy road access. For native species, road access often indicates that the area is already disturbed, compared to a remote site. For beekeepers, road access to sites facilitates easier placement of hives and removal at the end of the growing season;
- Placement B: Prohibit apiaries in rare ecosystems and protected areas. Disrupting the native plant-pollinator network in ecosystems that are already spatially limited compromises their future. In particular, native grassland ecosystems in Yukon often support rare and/or range-restricted plant species (Vetter 2000), and their pollinator networks are incompletely understood and may contain specialist species.

4.4.3. Species at Risk

Creating species at risk legislation in Yukon would help to implement Management Plans and Recovery Strategies for safeguarding our native pollinators that are federally-listed species at risk. Yukon has previously signed on to the 1996 Accord for the Protection of Species at Risk, and the 2018 Pan Canadian Approach to Transforming Species at Risk Conservation in Canada. The Canada-Yukon Nature

Agreement (Government of Canada 2022) states that its purpose “is to establish the framework for cooperation between the Participants for measures and plans by the Participants for the protection, conservation and recovery of biodiversity, habitat, and species at risk in the Yukon.” These initiatives all point to the need and existing mandate for Yukon to enact species-at-risk legislation.

5. Conclusions

Given that imported non-native honey bees and bumble bees can threaten the viability of native bee pollinator species, and the native bees’ service of pollinating northern boreal food crops, our review of the Canadian governance regime indicates that legislation needs to: (i) track the number and location of honey bee hives; (ii) control the spread of pathogens; (iii) control competition with native pollinators; (iv) make regulations applicable to all domesticated bees in addition to honey bees. These four requirements or functions of governance need to occur in provincial or territorial legislation, and currently are very unevenly satisfied across these jurisdictions within Canada. In particular, policies and regulations aimed at controlling honey bee competition with native pollinators are generally lacking. In response, we propose the concept of “foraging leases” to manage any proposed location of honey bee (i.e. domestic insect livestock) apiaries on public lands, because those lands often support a full complement of native pollinators. Foraging leases would be modelled on “grazing leases”, a management tool already well established for management of domestic mammalian livestock on public lands.

Specific to Yukon Territory, we recommend new regulations under the Animal Health Act to satisfy the need to track the number and location of honey bee hives, and to control the potential spread of pathogens into and within the territory. We explain alternative options for managing domestic bumble bees under the Animal Protection and Control Act or the Wildlife Act, each of which would require explicit listing of domestic bumble bees as species requiring management. To control competition for floral resources between introduced bees and native bees, we recommend a new Public Lands Act (currently under development) that is prescriptive, controlling all placement of apiaries on public lands within a set of conditions defined by abundance of forage (flowers), timing window within the growing season, quota (density of hives), and placement with respect to permitted and non-permitted land covers. The resulting spaces and times when apiaries are allowed on public lands could be called foraging leases. We also recommend the establishment of a Yukon Territory Species at Risk Act to provide habitat protection for pollinators already at risk.

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