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Biodiversity and Ecosystem Services Network

Background Document for the Biodiversity and Ecosystem Services Network (BES-Net) Caribbean Regional Trialogue on Pollinators, Food Security and Climate Resilience

Dominican Republic, 4–6 September 2018

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BESNet Biodiversity and Ecosystem Services Network

The Biodiversity and Ecosystem Services Network (BES-Net) is a capacity sharing "network of networks" that promotes dialogue between science, policy, and practice for more effective management of biodiversity and ecosystems, contributing to long-term human well-being and sustainable development. The Network is using a three-pillar approach: face-to-face capacity building activities (the BES-Net Trialogues), National Ecosystem Assessments and an online platform for networking– with all components mutually reinforcing. BES-Net is hosted by UNDP GC-RED.

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1. KEY MESSAGES

What is the importance of pollination and pollinators?

- The natural resources in the Americas have a much greater capacity to contribute to the quality of life of humans than the world average. These resources contribute in an essential way to food, water and energy security, and in particular to pollination.

- Approximately 90 per cent of flowering plants rely on the transfer of pollen by animals (IPBES, 2016b). Pollination is a mutually beneficial interaction since the plants increase their reproductive success, and in return they "compensate" the mediating animals, generally in the form of food (mainly pollen and nectar).

- The vast majority of pollinators are wild, including more than 20,000 species of bees, some flies, butterflies, moths, wasps, beetles and thrips, as well as birds, bats and other vertebrates. Some species of bees are managed, including the European honeybee (*Apis mellifera*), the Asian honeybee (*Apis cerana*), some bumblebees (*Bombus* sp.) and other solitary bees. Beekeeping using Africanized varieties of *A. mellifera* is an important economic activity in the Caribbean.

- One-third of production (by volume) and three-quarters of the different types of agricultural products are at least partially dependent on animal pollination (IPBES, 2016a). In 2015, the global economic value of pollination was estimated at between US$235,000 million and US$577,000 million (IPBES, 2016b). Moreover, insect pollination improves fruit and seed quantity and quality of at least 39 out of 57 of the main products at the global level.

- The productivity of several crops of great economic importance in the Caribbean region, such as coffee and cocoa, depend or benefit significantly from access to pollinators, whether domesticated or wild. Both the abundance and the diversity of pollinators are critical in the productivity and quality of some important crops (IPBES, 2016a).

- Pollinator-dependent crops are extremely important for food security and human nutrition. Some crops such as fruits, vegetables, seeds, nuts and oils are important for maintaining healthy diets because they provide most of the necessary vitamins, minerals and micronutrients.

- Honeybees and the pollination services they provide are an important economic alternative for rural communities in developed and developing countries. Their breeding contributes to the financial and food security of the people who depend on agricultural activities, to a greater or lesser extent. In addition to honey, the hives of honeybees produce other products of commercial value such as wax and propolis. The products of the hives of stingless bees have medicinal uses and can be utilized in the manufacture of cosmetics and other products. Another example is butterflies, which are used to make handicrafts, serve as tourist attractions, and provide other aesthetic values.

- Pollination by animals contributes to the integrity and resilience of natural areas. Animal-mediated pollination promotes the genetic variability of plants, which could increase the ability of the natural vegetation to recover and to cope with climate change.

- Pollination also maintains the diversity of wildlife in natural systems. It is necessary for the production of many fruits and seeds that serve as food for various animal species.

- Pollinators are found in various cultural contexts, both current and ancestral. Numerous pollinating animals are represented in human spirituality, as well as in the values of their ethnic, national or regional identity. Currently, insects such as bees and butterflies are used as an artistic inspiration or as symbols of beauty.

What is the problem?

- Despite their great importance, pollinator populations have declined drastically during the last decades (IPBES 2016b). In addition, a relationship has been found between this phenomenon and the decrease in the productivity of some crops that depend on pollinators (IPBES, 2016a).

- Although information is scarce in the Caribbean region, there is a trend towards a reduction in populations. Globally, 16.5 per cent of the vertebrate pollinators are in the list of the world's threatened species, increasing to 30 per cent for island species. Among Antillean species, five nectarivorous bats from Cuba have been classified as "least concern"; however, the nectarivorous bat of Jamaica *Phyllonycteris aphylla* appears on the critically endangered list.

The known causes to date are:

- The change in land use and loss of habitat, such as the natural forests, mainly caused by the advance of the agricultural frontier. This not only decreases the availability of food and nesting sites for wild pollinators but also hinders access to these resources by honeybees and other managed pollinators. The fragmentation and loss of connectivity between natural habitats could be reducing access to the pollination services for crops and natural vegetation. This could encourage the pollination of plants by their close relatives, to the detriment of their resilience and reproductive success.

- Intensive farming practices involve the use of chemical inputs, such as pesticides, with potentially harmful effects on pollinating insects and other beneficial insects. Pesticides have a wide range of sub-lethal effects on pollinators under laboratory conditions (IPBES, 2016b).

- There is evidence of the negative effects of introduced or invasive pollinators on local populations, against whom they can compete for limited resources. These species have shown aggressive behaviour against native pollinators, which may cause them to move away and affect the structure of plant-pollinator interaction networks. The presence of exotic pollinators could also contribute to the spread of invasive weeds that come from the same region as exotic pollinators. Aggressive behaviours of these species against native pollinators have been observed. In Trinidad and Tobago, beekeeping is practised with Africanized *Apis mellifera* hives, although there are often colonies that live in the wild and are not subject to management.

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- Bees, especially the managed species, are susceptible to diseases caused by different parasites, viruses and other pathogens. The transport of managed pollinators promotes the spread of diseases to the natural populations.

- In addition to being affected by global threats such as climate change, land use change, and intensive agriculture, Caribbean pollinators also face the particular characteristics of the archipelago such as the high endemism of island biota and high susceptibility to climatic phenomena.

- Although little is known about the effects of climate change and meteorological phenomena on pollinator populations, changes have been documented in recent decades in the distribution, abundance and seasonality of some pollinator species such as bumblebees and butterflies. In Quintana Roo, Mexico, hurricanes have been identified as one of the causes of the loss of colonies of stingless bees. Among the effects of Hurricane Sandy and other hurricanes that swept through the Caribbean in 2013, the destruction of large numbers of managed nests of social bees and native solitary bees was reported. Climate change could also affect plant-pollinator interactions in other ways, in addition to the increase in the frequency of extreme events. For example, certain microclimatic humidity and temperature conditions are required to maintain the small fly-like insects populations needed for cocoa pollination.

- Plantations of genetically modified crops can use herbicides that eliminate wild herbs, thus reducing the availability of food for the pollinators. Very little is known about the effects of the spreading of modified insect-resistant genes on the natural plant populations, or on pollinating insects.

What do we know (and not know) about the viable options to address the problem?

The challenges that pollinators face at the regional level can be divided into the following general issues:

- *Educational and training programmes:* All the key informants who collaborated in the drafting of this paper highlighted the value of providing information and raising awareness on the importance of pollinators and the necessary actions to conserve them. It is also necessary to build capacities so that each sector of society fulfils its role in the process.

- *Legislation and institution:* Another common concern is the need to formulate laws and regulations that focus on the protection of pollinators, as well as mechanisms to put them into practice.

- *Scientific and technological development:* Assessments based on scientific information and other knowledge systems are important for decision-making, as well as the creation of production methods that are accessible to farmers and include the protection of pollinators. There are other factors that are less mentioned and that need to be addressed since they are characteristic of the region. This also means that there are fewer previous experiences globally that could serve as a basis for proposing viable actions.

- *Resilience to climate change:* The region is particularly susceptible to the effects of climate change. Given the scenarios predicted for the 21st century, it is urgent to address the necessary actions for mitigating the potentially adverse and irreversible effects on pollinator populations.

- *Ecological connectivity* (regional and local): Many species of pollinators can move between islands, or these islands are part of their migration routes. Understanding these migratory dynamics can contribute to improving strategies for the conservation of these species. However, the connectivity between natural and agricultural areas increases resilience to extreme events, because natural or semi-natural habitats act as sources or reservoirs of wild or feral pollinators for nearby crops.

TABLE 1

SUMMARY OF STRATEGIC RESPONSES TO RISKS AND OPPORTUNITIES ASSOCIATED WITH POLLINATORS AND POLLINATION

GOAL	STRATEGY	EXAMPLES OF ACTIONS/RESPONSES
Improve current conditions for the maintenance of pollinator populations and pollination services	Manage immediate risks	Allow growth of native forest plants in agricultural areas • Preserve edges and non-tilled areas • Promote traditional cropping systems that integrate the use of different species that are compatible and mutually beneficial (such as milpa)
		Promote pollinator-friendly practices among farmers • Train farmers in organic/ecologically sustainable practices • Capacity building in the use of pesticides (or alternative pesticides) and/or in its responsible use, and in integrated pest management • Control of the use of genetically modified organisms (GMOs) • Train on the prevention and management of diseases of domesticated pollinators
	Capitalize on immediate opportunities	Improve the methods of breeding bees • Support beekeepers and stingless beekeepers in technical monitoring services • Assist in the certification of hive products • Provide training in the breeding of native social bees
		Create pollinator-friendly urban spaces • Increase natural areas • Set up gardens for pollinators, wild bee hotels, etc.

GOAL	STRATEGY	EXAMPLES OF ACTIONS/RESPONSES
Transform agricultural landscapes	Ecological intensification[1] of agriculture through the management of ecosystem services	Support diversified agricultural systems • Conserve traditional varieties to improve the adaptation of crops to climate change • Encourage community participation in land use planning • Monitor crop pollinators • Establish economic incentives for pollination services • Open the market for managed native pollinators • Support traditional practices such as mixed plots and crop rotation
	Strengthen agriculturally diversified systems	Support organic farming systems • Encourage diversified systems focused on food safety • Encourage farmers' involvement in food-related policies, resilience and production methods
		Support "cultural biodiversity" • Approach conservation through the recognition of rights to land tenure, traditional knowledge and local governance, for the protection of pollinators
	Invest in ecological infrastructure	Restoration of natural habitats • Promote restoration in conservation areas and urban areas • Protect sites of cultural or spiritual importance • Encourage land use planning that includes complex landscapes and concepts of "cultural biodiversity"
Transform the relationship between society and nature	Integrate knowledge and diverse values in management	• Translate research on pollinators into agricultural practices • Support joint production of knowledge through sharing with other interested parties and by integrating indigenous and local knowledge into scientific knowledge • Compile and strengthen indigenous and local knowledge on pollinators and pollination, and encourage the sharing of knowledge • Encourage innovative activities that build recognition in and ownership of socio-cultural values related to pollinators
	Link people and pollinators through cross-sectoral collaboration	Create the Regional Network for the Conservation of Pollinators in the Insular Caribbean (CAI-Pol) that would facilitate: • Build collaboration among farmers, expert scientists and other interested sectors in monitoring pollinators • Improve scientific and technical skills and competencies • Train the taxonomists • Create local administration of urban spaces that are appropriate for pollinators • Support high-level initiatives and strategies focused on the protection of pollinators

Note: Adapted from IPBES (2016a) and BES-Net (2017), and contextualized for the region

[1] La Ecological intensification may be formally defined as a knowledge-intensive process that requires optimal management of nature's ecological functions and biodiversity to improve agricultural system performance, efficiency and farmers' livelihoods (http://www.fao.org/agriculture/crops/thematic-sitemap/theme/biodiversity/ecological-intensification/en/).

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2. INTRODUCTION

The purpose of this document was to provide a background for the participants of the Biodiversity and Ecosystem Services Network's (BES-Net) Second Regional Trialogue, which took place in the city of Santo Domingo, Dominican Republic, on 4–6 September 2018. The BES-Net Trialogues are multi-sectoral dialogues between the political, scientific and practice sectors that focus on specific issues in regulations and policies at the national and regional levels. The aim of the discussions was to facilitate the assimilation of the findings of the assessment on pollinators, pollination and food production of the Intergovernmental Scientific-Policy Platform on Biodiversity and Ecosystem Services (IPBES). During the event, discussions were held on key issues on the best ways to protect pollinators, as well as their role in food security and resilience to the effects of climate change.

IPBES's global assessment report on pollinators, pollination and food production provides current knowledge on the subject. It also provides a critical assessment of the evidence of the value, status and trends of, and threats to, pollinators and pollination. It exposes the risks associated with these threats and provides some regulatory and management options in response to each of them. The key findings conclude that there are well-documented declines among some species of wild pollinators and a worrying lack of data regarding the status of most species. There are also local declines and significant seasonal losses that affect the domesticated pollinators, which are of vital social and economic interest.

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Pollinator populations face numerous threats, but there is a wide range of possible responses or solutions for the conservation of pollinators and pollination services, drawn from local traditional knowledge and scientific studies. However, these solutions have not often been put into practice, due to the lack of attention to the issue and of incentives in order to face it, as well as information gaps that must be filled in order to set up and improve regulations and policies that promote the protection of pollinators.

Although the findings are valid for the Caribbean, there are particular conditions in the region that must be addressed by local actors. During the Trialogue, discussions will be promoted on the issue of the status of pollinators in the region, as well as their relationship with food security and climate resilience. It is hoped that proposals will emerge that will contribute to the creation and implementation of joint strategies for the conservation of pollinators and pollination services at the regional level.

The report of the IPBES assessment on pollinators, pollination and food production[2] describes the following characteristics of the issue:

- **The values of pollinators and pollination**
- **The current state and trends**
- **Change agents**
- **Response options (possible solutions).**

This document uses the results of the IPBES report as well as a set of semi-structured interviews with key stakeholders of the three sectors – science, politics and practice – in order to ground the knowledge in the context of the seven Caribbean countries participating in the Regional Trialogue, identifying gaps and opportunities for public policy and agricultural practices in the region.

[2] Summary for policymakers of the assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on pollinators, pollination and food production (https://www.ipbes.net/system/tdf/ipbes_6_15_add.2_spm_americas_spanish.pdf?file=1&type=node&id=28521).

3. DESCRIPTION OF CHALLENGES AT THE GLOBAL AND REGIONAL LEVELS

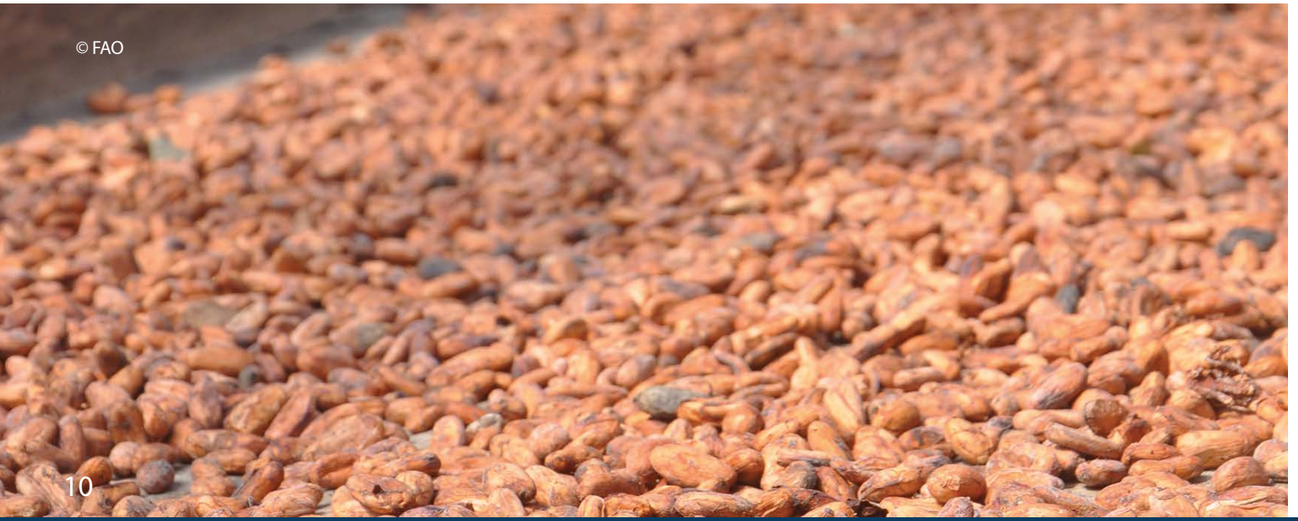
At the global level, the value of pollinators and pollination is recognized, economically, ecologically and culturally. Its influence on the quality of life of human beings is undeniable, because the derived products are vital for subsistence, nutrition, health and recreation, among other things. These characteristics are also recognized in the Caribbean region, where the production of honey and crops pollinated by animals are important economic activities. The role of pollinators in the regeneration and restoration of ecosystems, which is critical to the risks posed by climate change, is also recognized.

3.1 The value of pollinators and pollination

Biodiversity. Approximately 90 per cent of flowering plants require the transfer of pollen through animals (IPBES, 2016a). Pollination is an interaction of mutual benefit since the plants increase their reproductive success, and in return, they "compensate" the mediating animals, generally in the form of food (mainly pollen and nectar). The pollinating animals constitute a broad and diverse group. The vast majority of pollinators are wild, including more than 20,000 species of bees, other insects, bat, birds and other vertebrates. Some species of bees are managed, including the European honeybee (*Apis mellifera*), Asian honeybee (*Apis cerana*), some bumblebees (*Bombus* sp.) and other solitary bees. Although the vast majority of pollinating insects are bees, this group also includes several families of flies, wasps, butterflies, moths, beetles, thrips, ants, culicoids, bats, birds, primates, marsupials, rodents and reptiles (IPBES, 2016a).

Social and semi-social bees are the main group of pollinators that are under technified management for agricultural uses. The most frequently used are honeybees (*Apis mellifera*), bumblebees (*Bombus* sp.), and, to a lesser extent, stingless bees. The management of solitary bees, such as *Osmia* sp., has also been successfully used as a source of pollinators in blueberry and alfalfa orchards, for example. It should be noted that agricultural practices are also diverse so that both their effect on biodiversity and their dependence on pollinators vary greatly among different forms of agriculture (IPBES 2016a).

In the Caribbean region, much more needs to be learned about the diversity and conservation status of local pollinators, mainly insects. Very little is also known about other important aspects such as their habitat and feeding requirements, their efficiency as pollinators, and their importance for specific crops. In the case of bees, although Caribbean species have been included in several systematic studies, there are still many more species to describe, mainly from the island of Hispaniola, shared by the Dominican Republic and Haiti. As expected in island ecosystems, the diversity of bees in the Caribbean shows a high degree of endemism.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Ecosystem services. Pollination is one of the services that ecosystems provide to humanity and mainly to agriculture and food security. Pollination by animals contributes to the integrity and resilience of natural areas. Animal-mediated pollination promotes the genetic variability of plants, which could increase the ability of natural vegetation to recover and cope with climate change. Pollination also maintains the diversity of wildlife in natural systems. It is necessary for the production of many fruits and seeds that serve as food for various animal species. Similarly, pollination is also necessary for the maintenance of other services that the environment provides to humanity, such as raw materials, recycling of materials and recreation.

Economic valuation. The products pollinated by animals have, on average, a higher economic value than those that do not depend on pollination. One-third of production (by volume) and three-quarters of different types of agricultural products depend at least partially on pollination by animals (IPBES, 2016a). The global economic value of pollination was estimated at between US$235,000,000 and US$577,000,000 in 2015 (IPBES, 2016b).

The loss of pollinators may increase the price of these products, which would cause large economic losses (IPBES, 2016a). Most studies on the economic value of pollination take into account only the direct value of pollinated agricultural products and their derivatives.

The productivity of several crops of great economic importance in the Caribbean region, such as coffee and cocoa, depend or benefit significantly from access to pollinators, whether domesticated or wild. Both the abundance and the diversity of pollinators are critical in the productivity and quality of some important crops (IPBES, 2016a).

Honeybees and the pollination services they provide are an important economic alternative for rural communities in developed countries and transition economies, and even in developing countries. Its cultivation contributes to the financial and food security of the people who depend on agricultural activities, to a greater or lesser extent. The bees use the plants to extract propolis, a resin with which they seal all the gaps in their hives and that is also an antiseptic and an antibiotic that they use to neutralize the contaminating effects of any insect or animal they kill inside the hive. This keeps the purity of the honey. In addition to honey, hives of honeybees produce other products of commercial value. Wax can be used to make candles, crafts, cosmetics and for waterproofing, among other uses. Propolis is used in natural therapies as a topical healer and to treat gastritis. The products of stingless beehives have medicinal uses and can also be used in the manufacture of cosmetics and other products. Another example is butterflies, which are used to make handicrafts, serve as a tourist attraction and provide other aesthetic values.

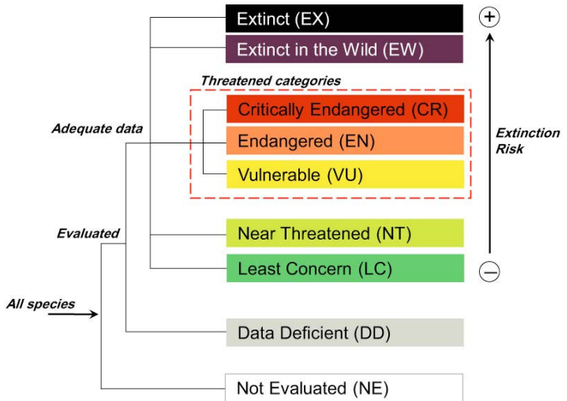
Non-economic valuation. Economic valuation indices do not fully cover the benefits that pollination by animals provide to human beings. In addition to the direct economic benefits, crops pollinated by animals provide food with different nutritional content, which is fundamental for nutrition and human health. The value of fruits and other wild products that complement nutrition and the family economy in rural areas has not been assessed.

Pollinators have a cultural value and are therefore present in various cultural aspects, both current and ancestral. Numerous pollinating animals are represented in human spirituality, as well as in the values of their ethnic, national or regional identity. Currently, insects such as bees and butterflies are used as artistic inspiration and symbols of beauty. In the Dominican Republic, bees are a symbolic theme for social organizations, such as teamwork and work organization. They are also the inspiration for songs, poetry and other types of art. In Mesoamerica, the cultivation of stingless native bees has ancestral origins. Its products are traditionally used as medicine and as a raw material for the production of musical instruments and toys, among others.

3.2 Current status and trends

Despite their great importance, pollinator populations have declined drastically during the last decades (IPBES 2016b). In addition, a relationship has been found between this phenomenon and the decrease in the productivity of some crops that depend on pollinators (IPBES, 2016a).

Although information is scarce, there is a trend towards population reduction. Worldwide, 16.5 per cent of the vertebrate pollinators are in the IUCN Red List of Threatened Species, which increases to 30 per cent for island species. Among the Antillean species, five species of nectarivorous bats from Cuba have been classified in the IUCN Red List of Threatened Species as "least concern"; however, the nectarivorous bat of Jamaica *Phyllonycteris aphylla*, appears on the list as critically endangered. In most islands of the Caribbean, there are no laws for the protection of bats. In addition, due to the ignorance of their importance and the fear of them, there are often attempts to eliminate them. In addition, there is very little information on the state of conservation of insects in America, in terms of gender or species. Also, of seven of the bumblebee species in tropical America (*Bombus* sp.) included in the list are classified as vulnerable or endangered to various degrees: *B. brachycephalus, B. diligens, B. haueri, B. medius, B. mexicanus, B. steindachneri* and *B. variabilis*.



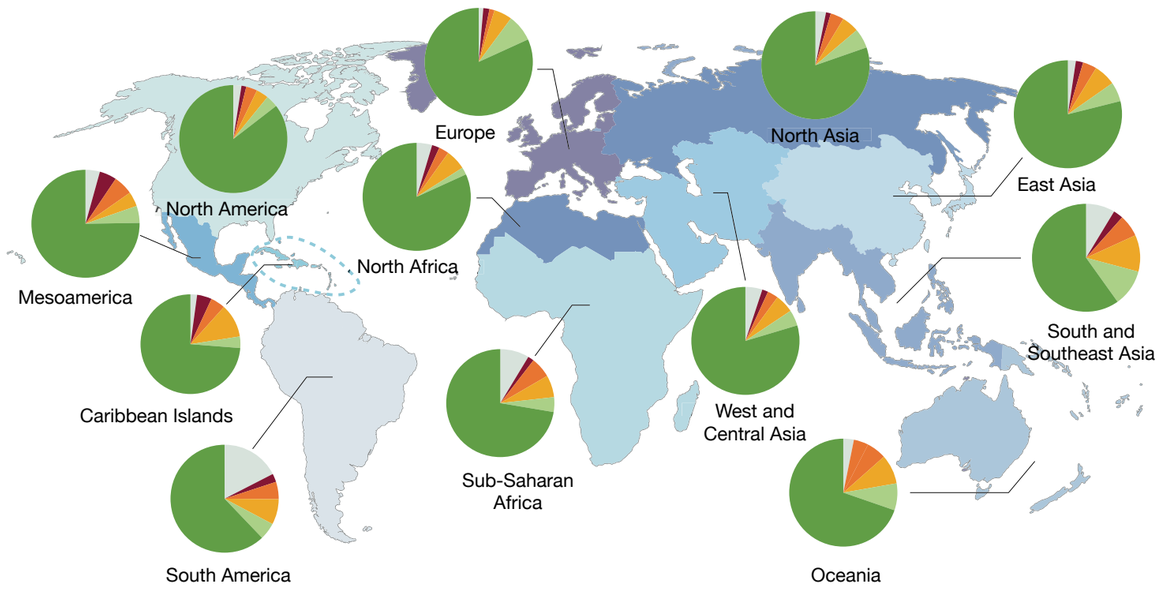


Figure 1. Status of conservation of vertebrate pollinators, according to IUCN (adapted from IPBES, 2016a)

3.3 Agents of change

There are several agents of change that can affect pollinator populations, networks of plant-pollinator interactions and pollination services. Some agents (such as the use of pesticides, loss of habitat, climate change and the introduction of invasive species) exert direct pressure on the species, their interactions and their environment. Other agents are indirect (such as population growth and an increase in economic activities) because they increase the demand for the activities that give rise to the direct factors. The incremental or combined effect of two or more factors may explain more clearly the changes in pollinator populations and communities, and in pollination services. These include:

- Change in land use, both for agriculture and for urbanization, can cause the loss of natural areas and the connectivity between them, as well as the decrease in the resources needed for pollinators, which negatively affects their diversity and abundance.
- Intensive agricultural practices can cause the reduction of floral resources and nesting sites for pollinators. For example, some large-scale monocultures bloom massively and can be used by pollinators, but only for a short period of time.
- The use of agrochemicals, especially pesticides, may have direct lethal effects or residual (sub-lethal) effects on pollinators.
- The use of herbicides in herbicide-resistant genetically modified crops can decrease the availability of floral resources for pollinators that come from wild herbs.
- The use and transport of managed pollinators lead to the risk of spreading pathogens and vectors of diseases, even among different species.
- Exotic (non-native) species, both plants and pollinators, can become invasive and affect the structure of the interactions of local ecosystems by competing with native species. Other invasive species (not plants or pollinators) can also be predators or pathogens of pollinators or plants that provide them with resources.

- Predicted scenarios for climate change during the 21st century foresee changes in the composition of pollinator communities, as well as abundance and geographic distribution. These scenarios have also led to speculations about possible changes in the phenology (seasonality) of the species, affecting the structure of the interactions and pollination services.

The threats to which pollinators and pollination services are exposed at the global level are not foreign to the situation in the Caribbean. Indeed, the international economy increase pressure on the habitats on which pollinators depend, and much of the biodiversity in developing countries. Common threats and weaknesses at the regional level include the following:

- There is little legislation that covers the protection of pollinators, and the issue is virtually absent in policies, strategies and action plans for the conservation of biodiversity and for agroforestry development. There is a regional council that meets annually to coordinate the regulation, import and handling of pesticides; however, there is no mention of pollinators during these meetings. There is a lack of engagement of the local authorities in the implementation of policies related to natural resources conservation in general and of pollination services, in particular.

- There is weak scientific capacity to fill existing information gaps, as well as to create or propose alternatives to improve agricultural practices and biodiversity conservation that effectively contribute to the maintenance of the pollination services provided by ecosystems.

- The reduced abundance of pollinators is not a priority issue for the governments of the region.

- Conservation strategies and management plans for protected areas do not include pollinator issues as one of their priorities.

- The levels of poverty and access to health and education are associated with changes in land use and unsustainable uses of the natural resources, to the detriment of the conservation of pollinators and biodiversity in general. This situation can be aggravated by the lack of legislation as well as the weakness of institutions that lack the necessary means to enforce existing legislation and therefore allow little control over changes in land use.

- The weakness of the institutional framework is also pervasive in other aspects that directly affect human health. For example, there is a lack of control over the use of pesticides, including some pesticides whose use is prohibited in North America and Europe.

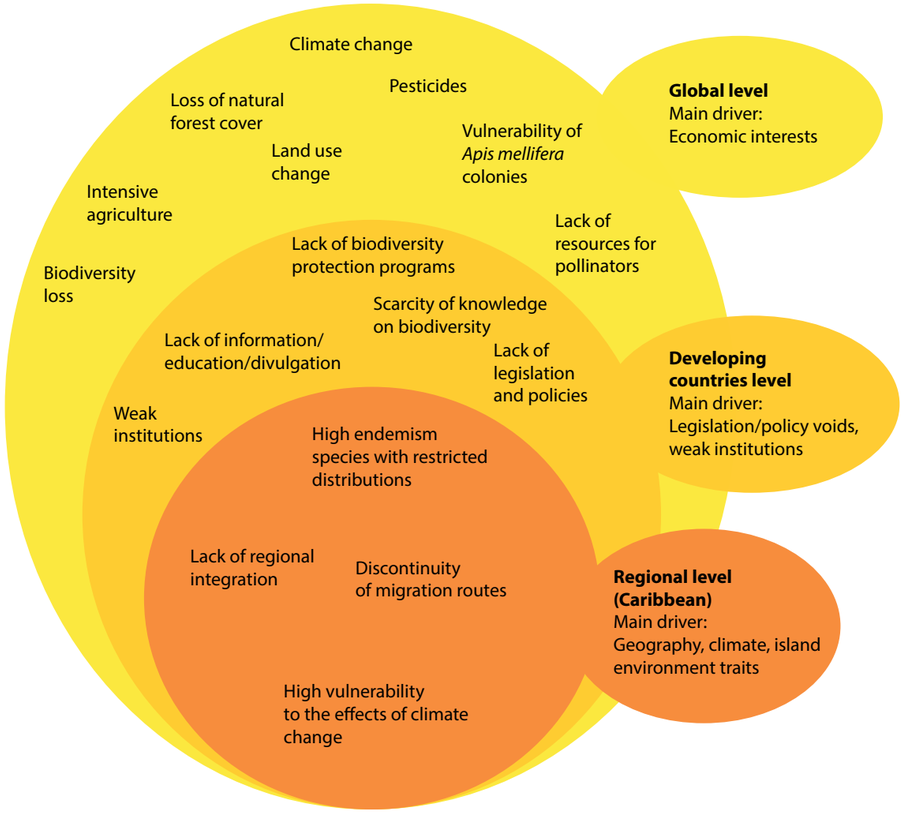


Figure 2. Threats to pollinators and pollination services, at different levels

3.4 Response options (possible solutions)

Various response options have been identified to address the factors and agents of change:

TABLE 2

THREATS, RESPONSE OPTIONS OF RESPONSE AND KEY ACTORS AT THE REGIONAL LEVEL
(Source: key informers, communication media).

THREATS	RESPONSE OPTIONS	KEY ACTORS/SPECIFIC EXAMPLES
• Change in land use • Deforestation for tourist and commercial use • The advance of the agriculture frontier	• Community participation in land use planning • Involvement of stakeholders in decision making	• Productive sector and civil society in general
• Environmental effects • Forest fires • Drought • Floods	• Cultivate and protect food plants from drought and other extreme events for pollinators • Protect effectively the forests and remaining natural ecosystems	• Community-based organizations
• Agricultural practices • Intensive agriculture • Insecticides • Herbicides • Genetically modified organisms (GMOs) • Introduction of exotic pollinators • Lack of access to alternative technologies	• Plant and protect plants that provide resources to pollinators • Prioritize the implementation of organic farming and other pollinator-friendly methods • Promote the development of a green infrastructure in agricultural landscapes that guarantees the maintenance of healthy and diverse populations of pollinators • Application of technology/facilitation of the use of local pollinators • Use of knowledge about pollinators in the decision-making	• Farmers, with access to training and technical advice • Academic and research institutes, scientists and technicians (to improve knowledge of diversity and generate appropriate technologies) • Governments
• Weak legislation and institutional frame • Lack of laws and regulations • Lack of legal action • Lack of follow-up to signed/ ratified agreements/ protocols • Weak linkage between the Government and civil sectors • Lack of research focused on solving specific problems • Lack of evaluation and monitoring mechanisms	• Draft/improve the laws aimed at the protection of biological diversity • Share technical/scientific findings among decision makers • Strengthen the institutional frame • Implement the ongoing programmes with institutional support and follow-up • Encourage the outreach and knowledge on existing lawsand agreements • Involve local actors in capacity building • Monitor and offer technical support for regional, national and local initiatives • Promote the research and monitoring that generate verifiable information, in order to comply with programmes to protect biodiversity and pollinators	• Community initiatives that put pressure on the decision- makers • Research centers • Academia • Private sector
• Ignorance of biodiversity • Few scientific studies • Ignorance of the problem in society • Few education and outreach programmes	• Provide technical and economic support for scientific studies • Share the scientific findings • Promote educational programmes at different levels • Implement local/community educational programmes	• Government (Ministries of Education) • The scientific and academic sector • Community associations
• Threats to biodiversity • Decrease in populations • Loss of habitat • Parasites/pathogens	• Perform population monitoring • Practice the restoration of ecosystems • Create urban habitats • Control infectious vectors	• Farmers/producers • Taxonomy experts • Social organization • Academic • Public health • Ministries and other relevant entities (agriculture, the environment, higher education, science and technology)

4. DESCRIPTION OF THE SITUATION AT THE NATIONAL LEVEL

While the Caribbean countries share similar situations at the regional level, there are specific aspects that are distinct to each at the national level.

ANTIGUA AND BARBUDA

Pollination is recognized as an important process in agricultural productivity. Manual pollination is a common practice in the cultivation of pumpkins.

There are community initiatives that include the protection of pollinators, as in the case of the Wallings Nature Reserve. Management entails using diverse plants that serve as a source for pollinators (see Table 3). Nectarivorous bats are recognized among the important pollinators, which are important pollinators of cacti and other local plants.

Antigua and Barbuda have managed to stay free of Africanized honey bees. In March 2005, the presence of *Varroa* sp. was reported for the first time, which entered the island through imported products and has spread significantly through the island of Antigua; thus far, Barbuda has been free of this parasite. The presence of the mite has caused a drastic mortality of hives, drastically damaging the honey production industry and causing serious economic losses. A low productivity of Cucurbitaceae has also been reported, which may be due to the lack of pollinators.

The recovery of beekeeping has been slow but has increased as a result the population's interest in the production of wax and honey. It has also encouraged the cultivation of honey flowers, such as sunflowers (orange and yellow), cempasuchil (marigold), as well as medicinal and culinary herbs such as thyme, rosemary, mint [balm] and other plants that help maintain the supply of food for wild pollinators.

Major pollinators

- Honeybees, butterflies, birds, insects in general. There are 14 known species of bats, including the nectarivores that are pollinators of cacti.
- The tree bat (*Ardopsnichollsi annectens*) was discovered by Kevel Lindsay while carrying out an inventory of the Wallings Nature Reserve in 2008. This bat is endemic to Antigua and Guadeloupe and depends on forest areas of sufficient size to maintain its populations. In Guadeloupe, it is found only in the south of the island and infrequently.

Other uses of pollinators

- Bat droppings are used as fertilizer in traditional agriculture.

Practices and cultural values associated with pollinators

- Honey plants are highly valued within communities and are protected during droughts.
- Some people believe that manual pollination is more effective than natural pollination.

Use of Pesticides

The administrative entities responsible for the use, prohibition, restriction and regulation of the import, export, management and sale of chemicals, including pesticides, are specified in the Pesticides and Toxic Chemicals Act. At present, the draft law, the Integrated Chemicals Administration Act, is currently under review. This new draft law is focused on protecting human health and the environment, and on promoting the responsible use of potentially toxic chemicals. Although pesticides for agricultural use are taken into account, there are no specific references to the protection of pollinators.

TABLE 3

SOME PLANTS PLANTED IN ANTIGUA AND BARBUDA THAT ARE BENEFICIAL FOR POLLINATORS

COMMON NAME	SCIENTIFIC NAME
Marigold	*Tagetes erecta* L. *Calendula officinalis* L.
Thyme	*Thymus vulgaris* L.
Rosemary	*Rosmarinus officinalis* L.
Mint Balm	*Melissa officinalis* L.
West Indian locust, stinking toe	*Hymenaea courbaril* L.
Black loblolly	*Pisonia frangans* Dum. Cours.
Black sage	*Cordia* spp.
Spanish oak	*Inga laurina* (Sw.) Willd.
Whitewood	*Tabebuia* sp.
White cedar	*Tabebuia pallida* (Lindl.) Miers
Ducana leaf	*Coccoloba pubescens* L.
Swartz's pigeon plum	*Coccoloba diversifolia* Jacq.
Sugar grape	*Coccoloba venosa* L.
Ironwood	*Exostema caribaeum* (Jacq.) Schult.
Mahogany	*Swietenia mahagoni* (L.) Jacq.
Mahoe	*Daphnopsis americana* subsp. *caribaea* (Griseb.) Nevling
Mango	*Mangifera indica* L.
Turpentine	*Bursera simaruba* (L.) Sarg.
Gunstock	*Guazuma ulmifolia* Lam.

CUBA

In Cuba, there are 89 known species of bees, of which 43.8 per cent are endemic to the country and another 33.1 per cent are endemic to the Antillas. Thirty-four of the Cuban species are found on Isla de la Juventud.

The population is aware of the importance of pollinators. Beekeeping is an economic activity for rural communities, where the importance of pollinators in crop productivity is also known. Meliponiculture (cultivation of native stingless bees) is also practised to obtain honey and other products from the hive. Moreover, the need to reduce dependence on agricultural inputs has encouraged the conversion of agriculture towards environmentally sustainable alternatives.

Pollinator populations are recovering with promising results after the terrible effects of Hurricane Irma and the subtropical storm Alberto. The severe winds and floods of these climate events caused great losses to the habitats, as well as the floral and crop resources. Approximately 8,000 tons of honey is currently being produced by 2,800 beekeepers who manage around 180,000 hives.

In addition to many wild flowering plants, several main crops in Cuba (Table 4) require pollinators.

TABLA 4

SOME IMPORTANT CROPS OF CUBA THAT REQUIRE POLLINATORS

COMMON NAME	SCIENTIFIC NAME
Avocado	*Persea americana Mill.*
Pumpkin	*Cucurbita sp.*
Coconut	*Cocos nucifera L.*
Cowpea beans	*Vigna unguiculata (L.) Walp*
Gandul bean, pigeon pea	*Cajanus cajan (L.) Huth*
Bitter melon	*Momordica charantia L..*
Cucumber	*Cucumis sativus L.*
Watermelon	*Citrullus lanatus (Thunb.) Matsum. & Nakai*
Okra	*Abelmoschus esculentus*

Climate change also has impacts on water resources, agriculture and human health. By 2100, a 37 per cent reduction in the potential availability of water is expected, compared to the 1961–1990 baseline. In the case of agriculture, it is forecast that there will be a drop in the potential yields of some crops (e.g. potatoes, tobacco, etc.) due to changes in the duration of the rain cycles. The deficit of water for irrigation, as well as soil salinization and degradation, can cause a reduction of the agricultural areas.

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Major pollinators

- Honey bees, stingless bees (*Melipona beecheii*), earth bees, solitary bees, bumble bees, wasps, butterflies and moths, ants, beetles, bed bugs and flies, as well as birds.
- Cuba is a major ecological corridor for migrating birds, including migratory hummingbirds.

Other uses of pollinators

- *M. beecheii* honey is used in traditional medicine to treat cataracts and other conditions.
- Viprol® is a pharmaceutical product based on propolis of *Apis mellifera*.

Practices and cultural values associated with pollinators

- The rural tradition emphasizes the importance of *M. beecheii* in the flourishing of crops.

Use of pesticides

Prior to the 1990s, chemical pesticides were used intensively. Since the 1990s, traditional agricultural practices began to be implemented. At the same time, the use of 'national enemies' as agents of biological control, the creation of smaller and diverse plantations or crops, and the trend towards organic farming also began. Similarly, the protection of bees and the production of honey began to be encouraged.

During the last 18 years, regulations have been implemented on the import and distribution of pesticides. Also, biological fertilizers combined with chemicals have been used. In general, since pesticides have been recognized as harmful to pollinators, people have attempted to minimize their use. Although monitoring has been conducted on the use of pesticides, their effects on pollinator communities and their consequences on crop productivity are little known (There is some concern, however, due to their environmental and economic implications.).

DOMINICAN REPUBLIC

Although there are no quantitative studies that provide figures to measure the importance of pollinators, there is some awareness related to environmental issues among government entities. The recent results of the IPBES assessment serve as a wake-up call to the authorities. Within the framework of current processes, and as a developing country, pollination has been considered among the important aspects of agricultural production and the economic sector. Other important functions of groups that include pollinators are also known, such as bats that are important seed dispersers. There is also some awareness among farmers, mainly those who practise greenhouse farming, and some may be implementing pollinator-friendly practices. In intensive agriculture, there is little knowledge on the importance of pollinators; however, pollination with honeybees is a common practice in the cultivation of melon, watermelon and other cucurbits in the south of the country.

With respect to the threats faced by pollinators, agricultural and cultural practices have been identified that are not very environmentally friendly (burning of weeds, indiscriminate use of glyphosate-based herbicides) and deforestation. These practices are sometimes encouraged or carried out by state institutions, and there is little response from the authorities to complaints from those affected.

The beekeepers reported bee mortality after the application of pesticides. Annual cases of mass deaths of honeybees have also been recorded, which coincide with the sugar cane harvest and extensive areas of productive crops such as tomatoes, corn, melon and other cucurbits.

The issue of the dangers associated with the introduction of exotic bumblebees for pollination has been addressed through tomato pollination testing in greenhouses with the Carpenter bee (*Xylocopa mordax*), a native species with potential to be managed commercially, as an alternative to importing pollinators. The results of these studies show the efficiency and viability of the native species, which produces significant differences in the weight and quantity of seeds per fruit and in productivity. Tomato production by manual pollination under controlled conditions is 16 to 18 pounds per square meter for a period of six to nine months. The results of pollination with the Carpenter bee produced between 30 and 34 pounds per square meter in a period of three months. In spite of this knowledge, there have been reports of cases where varieties of honey bees that did not previously exist in the Dominican Republic were illegally introduced, as well as cases of bumblebees of the genus Bombus (including *Bombus terrestris)*.

Another important product is the avocado, one of the main fruits produced in the Dominican Republic and the fourth most important fruit crop of the country. The Dominican Republic is the second producer of this fruit worldwide. Avocado production has increased in recent years while production in competing countries had stagnated or reduced. This has created an opportunity for the Dominican Republic to position its products that on pollinated by native bees on international markets, specifically focusing on the United States and Europe (Table 5).

TABLA 5

SOME IMPORTANT CROPS OF DOMINICAN REPUBLIC THAT REQUIRE POLLINATORS

NOMBRE COMÚN	NOMBRE CIENTÍFICO
Avocado	*Persea americana* Mill.
Cocoa	*Theobroma cacao* L.
Coffee	*Coffea* spp.
Carambola	*Averrhoa carambola* L.
Chinola or passion fruit	*Passiflora edulis* Sims
Citrus	*Citrus* spp.
Coconut	*Cocos nucifera* L.
Guava	*Psidium guajava* L.
Cashew	*Anacardium occidentale* L.
Mango	*Mangifera indica* L.
Neem	*Azadirachta indica* A.Juss.
Papaya	*Carica papaya* L.
Mamey sapote	*Calocarpum sapota* (Jacq.) Merr.
Tomato	*Lycopersicon esculentum* Mill.

Factors that are causing threats to the quantity, health and diversity of managed and wild pollinators in the Dominican Republic include:

- Modification, fragmentation and loss of habitats (deforestation, change in land use);
- Overexploitation of species (in the case of bees whose hives are moved in order to pollinate in structures such as greenhouses);
- Climate change/Uncertainty in temperature and humidity conditions due to climate change (irregular, absent or excessive rainfall)that affect the floral cycles and the phenology of floral resources, affecting the health of pollinators; and
- Pollution by agrochemicals.

In terms of legislation, both the general laws on the Environment and Natural Resources and the sectoral laws on Protected Areas include explicit articles for the protection of biological diversity. Although this includes all pollinators, there are no laws that specifically focus on their protection. Based on a series of workshops sponsored by the Ministry of Environment to review the list of endangered, threatened or protected species, it was identified that among the invertebrates included, there were no insects of the Hymenoptera order, to which bees and wasps belong, and it was proposed to include several species, including a species of a bee *Centris*.

To strengthen the institutional framework and ensure that the protection of biological diversity is taken into account in the economic model, it is necessary that the laws are drafted according to a model of sustainable development. This entails ensuring that structural changes in the economy, culture, policies and society revisit and own the theme of conservation. It is also necessary to promote civil society's commitment. Also, local governments must be involved, because they are the ones that can identify the needs and opportunities of citizens.

Major pollinators

- Honeybees, native bumblebees (*Xylocopa mordax*), other native bees, bats.

Other uses of pollinators

- Honey and other products of the hive such as pollen and propolis are harvested for commercialization.
- The products of native beehives, which have medicinal uses and are commercialized on a small scale.

Cultural practices and values associated with pollinators

- Bees are important in the popular imagination as a symbol of unity and teamwork.
- Honey is used in alternative medicine by communities, and it is used industrially in the pharmaceutical and cosmetic industries.
- Cultural expressions with themes related to pollinators and pollination.

Use of pesticides

Some pesticides have been banned due to their harmful effects on human health; however, it is known that they continue to be marketed and used, because their residues have been detected (e.g. in bat populations). There are no current studies on the impacts of pesticides on pollinators, and farmers have not observed declines in their populations. However, farmers are aware of the impact of pesticides on bee populations and on the possible effects on pollination and the productivity of their crops. There is a trend towards the use of alternative forms of pest control to avoid harming pollinators. For example, farmers prefer to use pesticides at noon, possibly to avoid harming bees.

It has been observed that carpenter bees (*Xylocopa* sp.) are resilient to the use of pesticides and it has not been detected that their populations are decreasing. Although there are no documented effects, the bees do not seem to adjust well to greenhouse conditions. Farmers have not shown concern about pollinators in open field crops.

SANTA LUCIA

Among the main threats to pollinators in the country are: climate change and climate variability; the increase in the use of glyphosates; the use of chemicals to control pests; little assimilation of integrated pest management practices; low genetic variability in managed beehives; decreased diversity of herbs, shrubs and perennials (also related to the use of glyphosates); little diversity in cultivars and other types of managed landscapes; and loss of natural habitats due to housing and tourism development.

Major pollinators

- Birds: antilles crested hummingbird, green-throated caribs, purple-throated caribs
- Mammals: long-tongued bat, jamaican fruit bat, yellow-shouldered bat, antillean fruit-eating bat.

Use of pesticides

There is knowledge about the impact of pesticides. There is a list of regulated pesticides, and farmers comply with these regulations. There are laws for the protection of biodiversity and 'non-target' insects, but they do not explicitly mention pollinators.

TABLE 6

SOME IMPORTANT CROPS OF SANTA LUCIA THAT REQUIRE POLLINATORS

NOMBRE COMÚN	NOMBRE CIENTÍFICO
Garden sorrel	*Rumex acetosa* L.
Avocado	*Persea americana* Mill.
Sugar apple	*Annona squamosa* L.
Eggplant	*Solanum melongena* L.
Cocoa	*Theobroma cacao* L.
Cashew	*Anacardium occidentale* L.
Cucurbitaceae	*Cucurbita* spp.
Citrus	*Citrus* spp.
Chillies	*Capsicum* sp.
Coconut	*Cocos nucifera* L.
Guava	*Psidium guajava* L.
Yellow mamey	*Mammea americana* L.
Mango	*Mangifera indica* L.
Nutmeg	*Myristica fragrans* Houtt.
Okra	*Abelmoschus esculentus* (L.) Moench
Tomato	*Lycopersicon esculentum* Mill.
Vanilla	*Vanilla* sp.

SAINT KITTS AND NEVIS

Crops pollinated by animals include different fruit trees such as: cantaloupe, melon, cucumber, musk cucumber, pumpkin and watermelons.

The main threats to pollinators that have been identified in Saint Kitts and Nevis are:

- Human settlements, since they involve the loss, fragmentation and disturbance of natural habitats;
- Economic activities, especially the sugar industry, which have resulted in various types of soil degradation;
- Land degradation, which is prevalent in low altitude areas;
- Invasive species, which have been introduced intentionally or accidentally, and cause ecological stress;
- Subsistence practices, such as unregulated felling for coal production;
- Monkeys, which destroy wild hives, eat the eggs of birds and flower buds, reducing the floral resources that are available to pollinators;
- Natural disasters and extreme weather events, such as floods, droughts and hurricanes; and
- The loss of coconut palms, due to lethal yellow, which has had negative effects on the pollinators of the island.

Use of pesticides

There is very little information on pesticides, and there are no control measures on their use. There are also difficulties in the control of the practices related to the correct use in terms of time and doses of application. There is also no connection between the use of pesticides and the reduction of pollinators.

Although there are no data or documentation in this regard, there has been a decrease in pollinator populations, as well as the movements of these populations away from areas where pesticides are applied.

TRINIDAD AND TOBAGO

There are few recent studies on aspects related to pollinators and pollination. However, some recent studies show the importance of pollinators for several crops, such as cucumber, okra and chillies, and that the productivity of these crops decreases considerably in the absence of pollinators (Figure 3). In 2012, an estimate was performed on the national loss in cucumber production in the case of a lack of pollinators, which amounted to 1,326,370 kg, at an estimated cost of TT$7,653,156 (US$1,195,806). The estimated loss in the case of a lack of pollinators in cucumber production would be 96.5 per cent, for chillies, 88.1 per cent and for okra, 86.1 per cent. Bees, flies and wasps contribute even more to agricultural pollination in the country (Figure 4). However, the situation could get worse due to warm temperatures, which contribute to the pollen drying out and the flowers withering rapidly, especially in tomato crops.

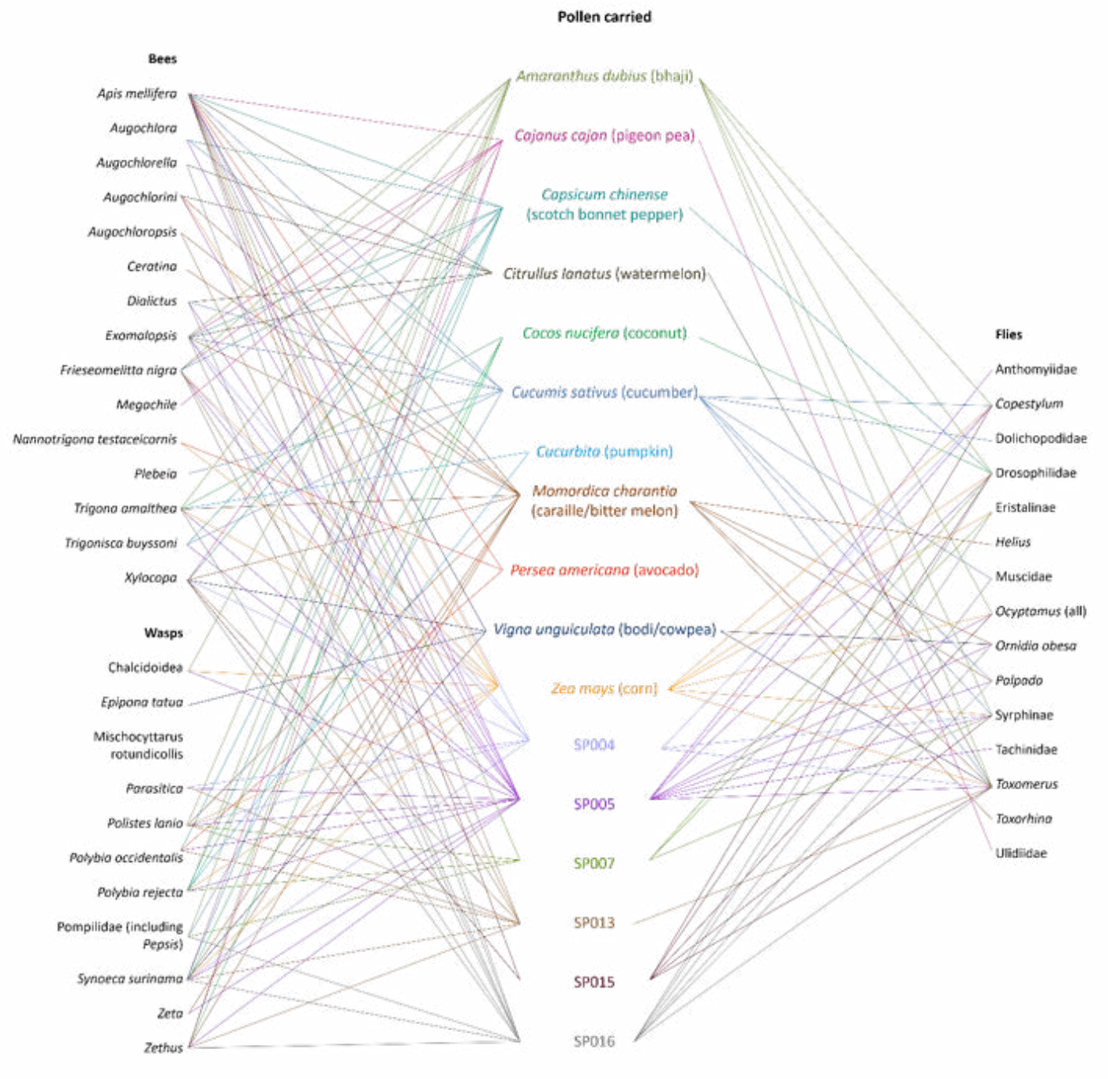

Figure 3. Graph of interactions between plants and pollinators that transport their pollen in Trinidad and Tobago. This information was produced by ProEcoServ, the first project in the country that assesses pollination as an ecosystem service.[1].

[1] Based on: Dempewolf, L. (2017). *Identification, assessment and valuation of pollination services in neotropical agricultural landscapes, Tesis doctoral*, University of the West Indies.

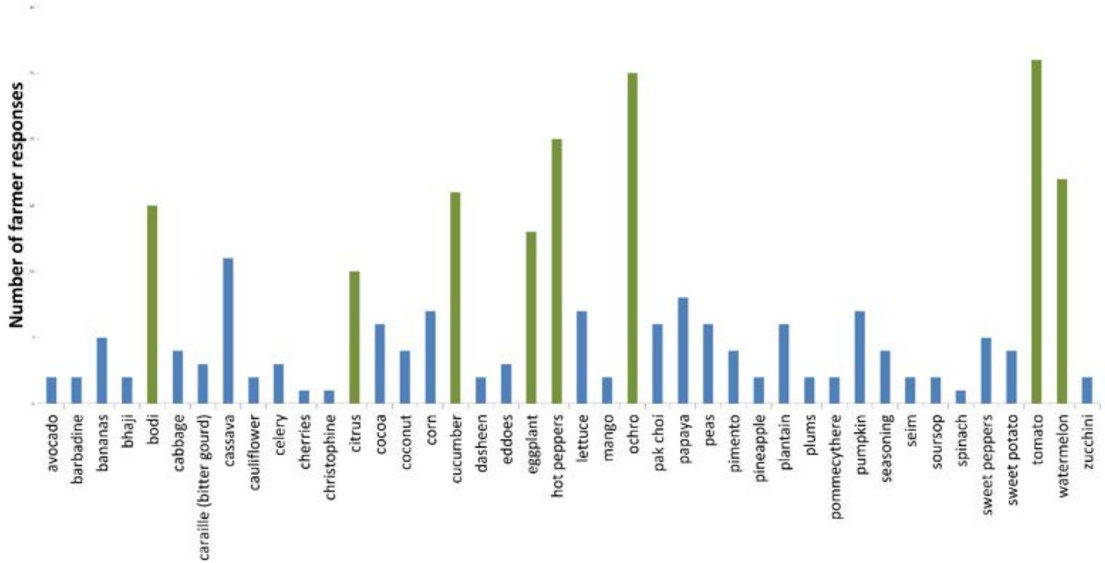

Figure 4. Plants reported as frequent crops by farmers in Trinidad and Tobago. The green columns correspond to the most frequently sown plants that are pollinated by insects[2].

[2] Based on: Dempewolf, L. (2017). *Identification, assessment and valuation of pollination services in neotropical agricultural landscapes, Tesis doctoral*, University of the West Indies.

There is very little knowledge about the role of pollinating insects, which explains why the vast majority of farmers see them as potential pests and prefer to eliminate them using chemical pesticides. Nevertheless, some farmers practise alternative methods, such as planting cempasúchil, marigold (*Tagetes* sp.) and use garlic and onion as pest repellents. The use of extracts of neem (*Azadirachta indica*) is also mentioned. Tracts of land left uncultivated due to financial constraints benefit productivity by providing pollination services. Although this effect derives from economic problems and does not respond to a plan that includes the protection of pollinators, it is a practice that could be encouraged among farmers.

The main threats to pollinators identified in the country are:

- The use of pesticides and herbicides;
- The destruction of the habitat by quarry construction, wood extraction and housing development;
- The lack of laws, policies and plans for the protection of pollinators;
- The lack of knowledge, information and awareness among farmers and the general public;
- The Apis mellifera bee, which could be negatively affecting pollinators; and
- Climate change.

Major pollinators

- Bees, other insects, bats, birds (hummingbirds). Although bees transport the largest amount of pollen from several important crops, so do some flies, wasps, butterflies (larvae and adults), beetles and treehoppers/stinkbugs/killer bugs on a smaller scale.
- At least 12 species of bees have been reported as crop flower visitors in Trinidad and Tobago, from at least 61 species of insects. These species include wasps, butterflies, flies, beetles, and even treehoppers, stink-bugs and killer bugs (see Figure 5).

Other uses of pollinators

- Honey of stingless bees in traditional medicine to treat eye cataracts. The honeybee venom is believed to have therapeutic properties.
- Marketing of *Apis mellifera* honey and stingless bees. A significant number of managed honeybees are hybrids of Africanized bees. Importing honey is prohibited, so prices are high.

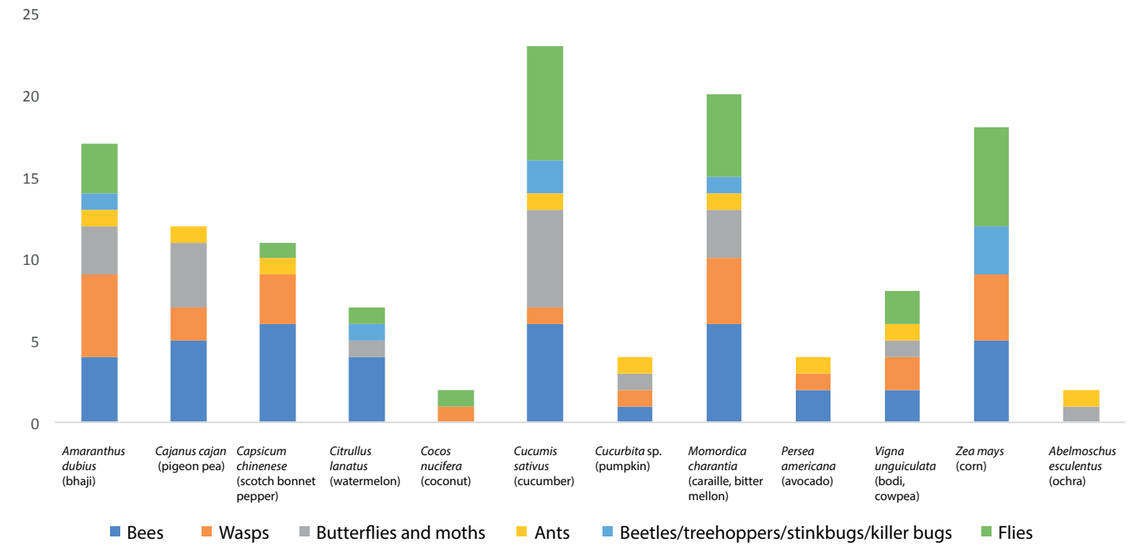

Figure 5. Insects that visit various crops in Trinidad and Tobago, by taxonomic group (identified by family, gender or species)[3].

5. OPTIONS AND APPROACHES FOR ADDRESSING THE PROBLEM IN THE REGION

- *Promote the development of a green infrastructure in agricultural landscapes:* Preserve the natural habitat relics and generate forest that provides refuge and resources to pollinators and allows them to sustain healthy populations.

- *Incorporate the issue of pollinators into policy instruments:* Ensure that national strategies, as well as action plans and biodiversity and agricultural practices management plans, explicitly incorporate the issue of pollinators and seek solutions accordingly.

- *Create resource source in urban areas:* Pollinator-friendly spaces can be set up at all scales, from home gardens to community parks. The "gardens for pollinators" include plant species that provide food for pollinators. You can also set un "hotels" for solitary bees, which can be made with accessible materials.

- *Adopt traditional cultivation practices:* The forms of traditional agriculture provide a good opportunity to promote areas of wildflowers, allowing them to grow on the edges of the cultivation plots and on the land that is not being cultivated. Milpa agriculture, which is practised in Mesoamerica, is a traditional farming system that integrates the cultivation of corn, squash, beans and edible herbs, which also gives rise to the wildflower growth. This alternative is mainly viable in small-scale agriculture.

- *Use managed native pollinators:* Native diversity for pollination under controlled conditions should be capitalized on, creating an alternative to the introduction of exotic species. To achieve this, it is necessary to carry out studies on the effectiveness of native species, such as those carried out in the Dominican Republic on *Xylocopa mordax*.

- *Encourage the shifting of agriculture towards environmentally friendly systems:* Build capacities in organic agriculture, integrated crop management and sustainable agriculture. There are processes to encourage controlling the insecticide trade, mainly focused on sharing information, such as in the Caribbean Community (CARICOM).

- *Increase support for beekeeping:* Support and technical monitoring should be provided to beekeepers, including the control of hives to prevent or reduce the frequency of wild Africanized colonies.

- *Promote meliponiculture:* breeding stingless bees have several potentially beneficial aspects for maintaining pollination services. They are native species that are adapted to the ecosystems of the region. The responsible and adequately mechanised practice (non- extractive) of local species serves as a genetic reservoir to help its conservation. The stingless bees form colonies with many individuals so their breeding increases the availability of pollinators around their hives. Moreover, the products of their hives, mainly honey, has a high monetary value in the local market, so they are also a potential source of income for rural communities.

- *Encourage an ecosystem approach:* Consider aspects of the biology and ecology of the species that must be approached together. Give importance to the connectivity of ecosystems in the Caribbean when considering strategies to protect migratory species. The Caribbean Biological Corridor is an example from which experiences can be acquired for formulating conservation strategies for the entire region.

- *Improve knowledge of the role of pollinators in climate resilience:* Pollinators are susceptible to weather phenomena and changes in climate variables. The knowledge of its biology, its evolutionary history and its adaptation capacity will make it possible to propose strategies to protect them. Moreover, being an important part of the process of plant reproduction, pollinators also play an important role in the climate resilience of ecosystems. The study of these dynamics will also provide tools to propose options for responding to and mitigating the effects of climate change.

6. CONCLUDING OBSERVATIONS

During discussions with the key informants in preparing this paper, it was frequently observed that the rules and regulations regarding the protection of pollinators were not respected frequently and there was also a lack of mechanisms to implement the existing policies. During the review process, it was not possible to identify in the participating countries regulations or agreements highlighting the importance of pollinators, the existing threats to them, or strategies for their conservation. This theme is also not mentioned in the reports of the Convention on Biological Diversity.

It was also noted that there was a need to generate and disseminate scientific and technical information for exerting pressure on decision-makers, and to encourage the involvement of different social sectors in the protection of pollinators.

A frequently mentioned strength is the ability of community organizations to implement local programmes. It was widely recommended to support farmers through training in pollinator-friendly agricultural practices and technical support.

Finally, it should be noted that the issue of the effects of climate change on pollinators, pollination services and food security was little discussed. The trialogue presents a good opportunity to fully approach the issue, as well as to discuss and complete the regional contextualization of the findings of the IPBES assessment for the Caribbean.

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8. ANNEXE 1. REGULATIONS, INITIATIVES, NEEDS, STRENGTHS AND OPPORTUNITIES, BY COUNTRY, ACCORDING TO KEY INFORMANTS

COUNTRY	LAWS AND REGULATIONS	INITIATIVES/ ACTIONS TAKEN	NEEDS	STRENGTHS/ OPPORTUNITIES
ANTIGUA AND BARBUDA	There are no regulations to ensure reforestation. Environmental Protection and Management Bill (2015). It was requested and promoted by community groups.	NGOs and beekeepers' associations are interested in launching an awareness campaign. Media campaigns to protect hives. GEF-founded Project Pathways 2020, which has components for the protection of pollinators through an ecosystem approach. Access and Benefit Sharing Project (IUCN) for the implementation of the Nagoya Protocol. Projects focused on invasive species. Education and awareness initiatives to identify and protect local genetic resources. Education campaigns among local groups. Initiatives to increase the areas of community administration. Partnerships between the private sector and community groups to strengthen the legality of initiatives, offer technical support, and seek solutions at the community level Bio-Bridge, Forest People's Programme (FFP), SwedBio. Small Grants Programme (SGP) (supported through partnerships with churches and local groups that support Indigenous and Local Knowledge).	Educating the general population. Government attention. Actions by the civil sector to put pressure on decision-makers to protect pollinators. Involvement of citizens. Financial support for local initiatives. Access to information and popular consultations (regarding the Escazú Agreement). Greater effective participation of local groups in the formulation/ implementation of policies and programmes. Support for compliance with regulations. Media information campaigns. Identification of public figures who have the trust of the people and are willing to get involved in the campaign.	Civil society, producers and beekeepers are active in the protection of honeybees. The receptivness of the Government (Ministry of Agriculture). Experiences in community management that includes sowing crops and other plants that provide resources for pollinators. Valorize and capitalize on the local knowledge and first-hand experience.
CUBA		At the community level: beekeepers plant live fences and engage in reforestation and restoration of ecosystems, with the aim of creating habitats and resources for pollinators. At the governmental level: natural disaster prevention programmes.	Participation in scientific events, to strengthen research. Involvement of the scientific community in education programmes.	

COUNTRY	LAWS AND REGULATIONS	INITIATIVES/ ACTIONS TAKEN	NEEDS	STRENGTHS/ OPPORTUNITIES
GRANADA		Bees for Development, Association of Caribbean Beekeepers' Organisations. Grenada Fund for Conservation (protection of the environment; they have a beekeeping programme).		
DOMINICAN REPUBLIC	There are rules that include the conservation of biodiversity. The Red List includes some species of threatened pollinators: 3 species of bats classified as "vulnerable" and 4 species of butterflies classified as "endangered". Constitution of the Republic General Environmental Law (6400). National Biodiversity Law (application of the Biodiversity Agreement, Nagoya Protocol). Central America-Dominican Republic Free Trade Agreement (CAFTA) regulations take into account biodiversity. Washington Convention of 1940 (for the Protection of the Flora, Fauna and the Scenic Beauties of the American countries).	National Strategy for the Conservation of Biodiversity (developed based on the United Nations Sustainable Development Goals), the strategic plan of the Ministry of Environment). Initiatives to protect the habitat of bats. Support activities for beekeepers for the protection of honeybees (Animal Health, through the Department of Agricultural Production).	Strengthen institutionalist. Include the protection of diversity within the economic model. Produce information on diversity. Involve decision makers who own the subject. Obtain technical and financial support. Conduct studies to assess the degradation of natural habitats, as well as the effects of pesticides and other factors on pollinator populations. Review other international agreements such as those that control chemical substances.	The interest of the authorities in responding to the findings of the IPBES assessment. There is legislation that includes the protection of pollinators
TRINIDAD AND TOBAGO	There is no known legislation aimed at protecting pollinators. Specially Protected Areas and Wildlife (SPAW) Protocol. Nagoya and Cartagena Protocols. Law on Security and Biodiversity.	Project for Ecosystem Services (ProEcoServ). Beekeepers' Association of Trinidad and Tobago.	Conduct studies to assess the degradation of natural habitats, as well as the effects of pesticides and other factors on pollinator populations. Prioritize outreach on the importance and risks of pollination services. Train farmers to recognize pollinator species and differentiate them from pests.	Little intensive agriculture and the availability of natural spaces. Farmers' willingness to learn/ implement alternative techniques. Cultivation of stingless bees.

BESNet

Biodiversity and Ecosystem Services Network

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