# How great is the problem? Status and Trends for Pollinators and Food Security

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UN environment

United Nations Educational, Scientific and Cultural Organization

Food and Agriculture Organization of the United Nations

UNDP
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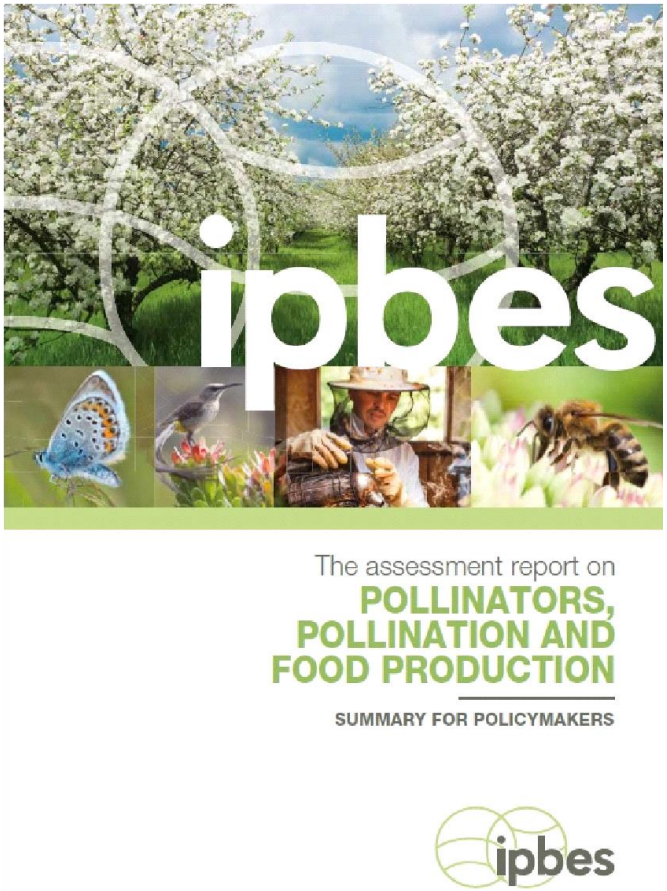
# Pollination Assessment Report & Process

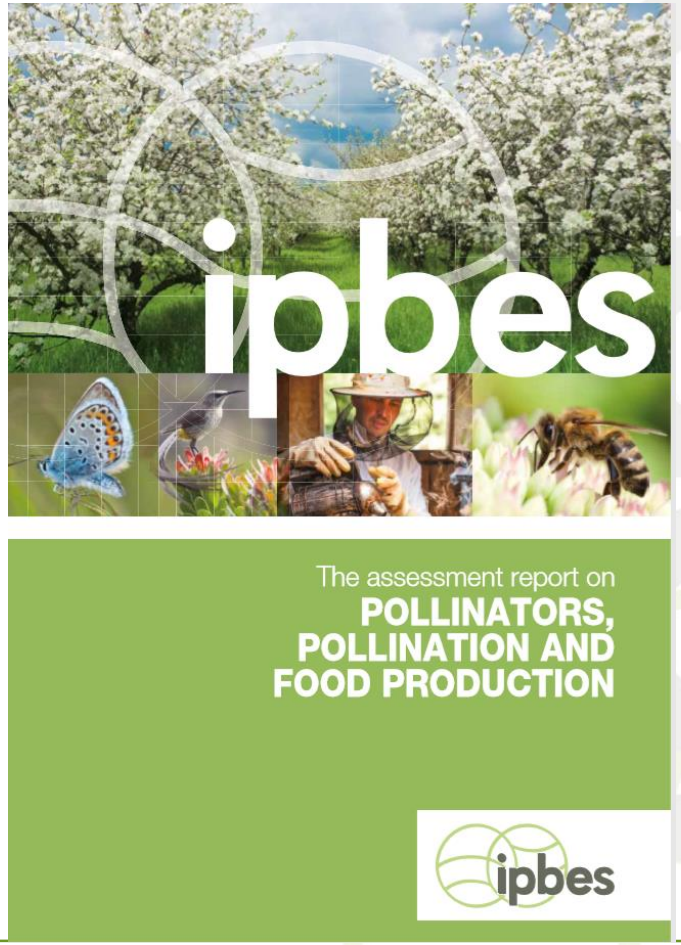

- **2 year process (2014-2016)**
- First output of IPBES
- 2 Co-chairs (Drs Simon Potts & Vera Imperatriz-Fonseca)
- 19 Coordinating Lead Authors
- 41 Lead Authors
- 14 Review Editors
- 35 Contributing Authors

- **TOTAL: 76 experts**

# Output

- Scientific literature review and Indigenous and local knowledge
- 550 pages



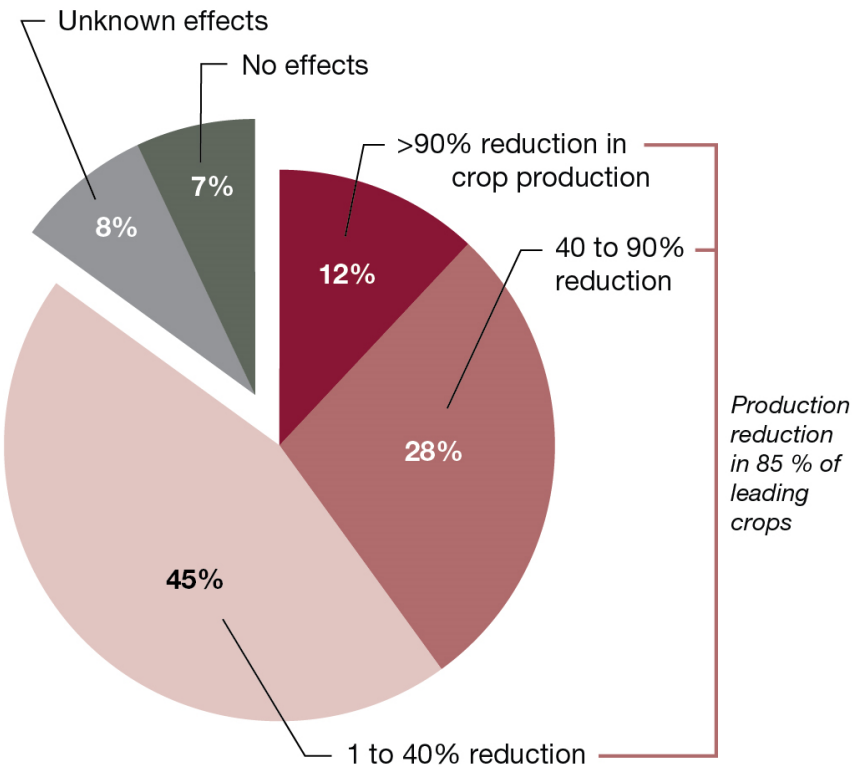
# Multiple Value of Pollinators

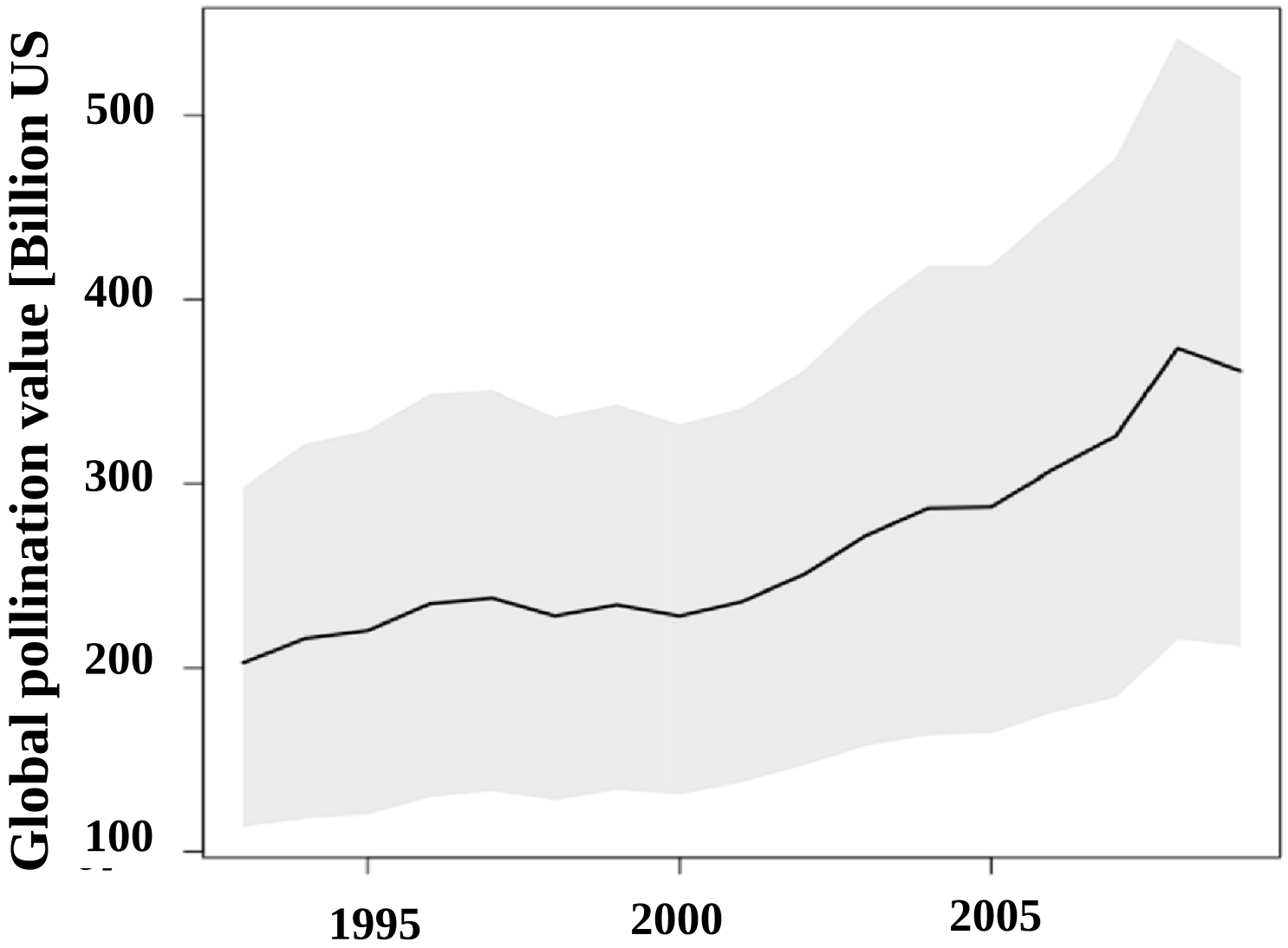
- Pollination of world's **wild flowering plant species** – avg. almost 90% depend on pollinators (94% in tropical communities)
- **Global food crops** (production, yield and quality) (3/4 of the world's leading food types and 30% by volume) + regional crop economies rely (to varying degrees) on animal pollinators = **<$577 bn (USD/yr)!**
- **Healthy human diets and nutrition** depend on pollinator dependent crops
- **Livelihoods** – beekeeping and honey hunting & pollination services and food production
- **medicines, biofuels** (e.g. canola and palm oil), **fibres** (e.g., cotton and linen) **construction materials (timbers), musical instruments, arts and crafts, recreational activities** and as sources of inspiration for art, music, literature, religion, traditions, technology and education
- globally significant heritage, as **symbols of identity**, as aesthetically significant landscapes and animals, in social relations, for education and recreation and in governance interactions.

*Man of Bicorp*
Valencia,
Spain, 6000 BC

# The importance of pollinators

Percentage of production loss due to pollinator loss in leading global crops





Global pollination value [Billion US
500
400
300
200
100
1995
2000
2005

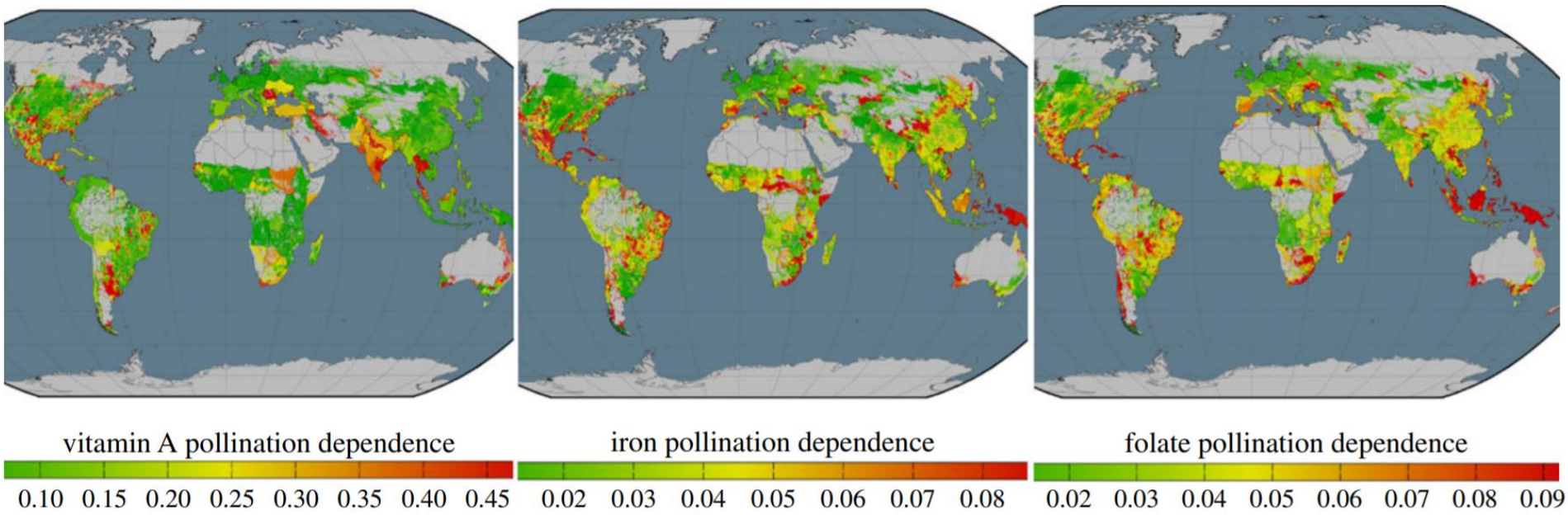
# Pollinator-Mediated Crops & Nutrients in the Human Food Supply

- Staple crop production (e.g. cassava, corn, potato, rice, wheat, yam) = wind-pollinated, self-pollinated, or vegetatively propagated crops, they provide the **majority of calories** in the human diet = **poor sources of micronutrients.**
- Crop plants that depend fully or partially on animal pollinators contain >90% of **vitamin C**, the whole quantity of **Lycopene** and almost the full quantity of the antioxidants b-cryptoxanthin and b-tocopherol, the **majority of the lipid**, **vitamin A** (>70%) and related **carotenoids** (98%), **calcium and fluoride**, and a large portion of **folic acid** (55%)
- **58% of calcium** and **62% of fluoride** are derived from plants with marginally yield increase due to animal pollination, such as beans, but also strongly pollinator dependent plants such as fruits and nuts (including almonds) – these minerals are crucial for development of teeth and bones and prevention of osteoporotic fracture risk
- 29% of iron is derived from pollinator-dependent crops, with 6% yield increase due to animal pollination – plant sources of iron crucial to human health

**Animal-pollinated crops contain the majority of the available dietary lipid, vitamin A, C and E, and a large portion of the minerals calcium, fluoride, and iron worldwide**

Ongoing pollinator decline may thus exacerbate current difficulties of providing a nutritionally adequate diet for the global human population.

# Fractional dependency of micronutrient production on pollination



# The diversity of pollinators

- flies, butterflies, moths, wasps, beetles, thrips, birds, bats and other vertebrates.

- BEES! **20,100** species of bees; most are wild

# Global Trends

- **Wild pollinators have declined in occurrence and diversity** (and abundance for certain species) at local and regional scales in North West Europe and North America.
- Although a **lack of wild pollinator data** (species identity, distribution and abundance) for Latin America, Africa, Asia and Oceania preclude any general statement on their regional status, local declines have been recorded.
- Wild insects are extremely important pollinators and can pollinate many crops more effectively than managed bees
- The IUCN Red List assessments indicate that 16.5 per cent of **vertebrate pollinators are threatened with global extinction** (increasing to 30 per cent for island species). ****There are no global Red List assessments specifically for insect pollinators**.
- Regional and national assessments indicate high levels of threat for some bees and butterflies.

# Trends in managed pollinators

- Global: The number of managed western honey bee hives has **increased** over the last five decades, even though declines have been recorded in some European countries and North America

## HONEYBEE TRENDS (1960s-2010)

**Globally managed hives increased ~ 50%**

**The volume of production of pollinator dependent crops increased by 300%**

**Global agricultural is now twice as pollinator-dependent**

# DRIVERS OF POLLINATOR AND POLLINATION CHANGE

- The abundance, diversity and health of pollinators and the provision of pollination are threatened by direct drivers that generate risks to societies and ecosystems.

Threats include:

- **land-use change**
- **intensive agricultural management and pesticide use**
- environmental pollution
- invasive alien species
- Pathogens
- Climate change

## HABITAT LOSS AND HOMOGENISATION

- **Corporate control of global agriculture**
- Destruction of bat roosts

## PESTICIDES

- **Sulfoximine pesticides**
- **Reduced impacts in non-agricultural settings**
- Nanoparticle pesticides
- Increasing fungicide use

## PARASITES AND PATHOGENS

- **New RNA viruses**
- Reduced pollinator richness drives epidemics
- Pollinators as disease vectors

## CLIMATE CHANGE

- **Extreme weather events**
- Altered pathogen epidemiology

## NOVEL INDIRECT DRIVERS

- **Increased diversity of managed pollinators**
- Cutting pollinators out of food production
- Impacts of IPBES pollinators assessment

## INVASIVE SPECIES

- Invasive bees in Asia

Bees suffer from a broad range of parasites, including ***Varroa*** **mites** in western and eastern honey bees. Emerging and re-emerging diseases are a significant threat to the health of honey bees, bumble bees and solitary bees, especially when they are managed commercially.

- **hygiene** and the control of pathogens would help reduce the spread of disease
- mass breeding and large-scale transport of managed pollinators can pose risks for the transmission of pathogens and parasites
- the risk of unintended harm to wild and managed pollinators could be decreased by better regulation of their trade and use

The seasonal loss of western honey bees in Europe and North America varies strongly by country, state and province and by year, but in recent decades (at least since the widespread introduction of *Varroa*) has often been higher than the 10-15 per cent that was previously regarded as normal.

Data for other regions of the world is largely lacking

- movement of *Apis* hives results in a spill over of pathogens both to this species, in the case of *Varroa* – and from this species to wild pollinators like deformed wing virus
- *Varroa* mites, a key parasite of honey bees, have developed resistance to some chemical treatments so new treatment options are required

# LAND-USE CHANGE

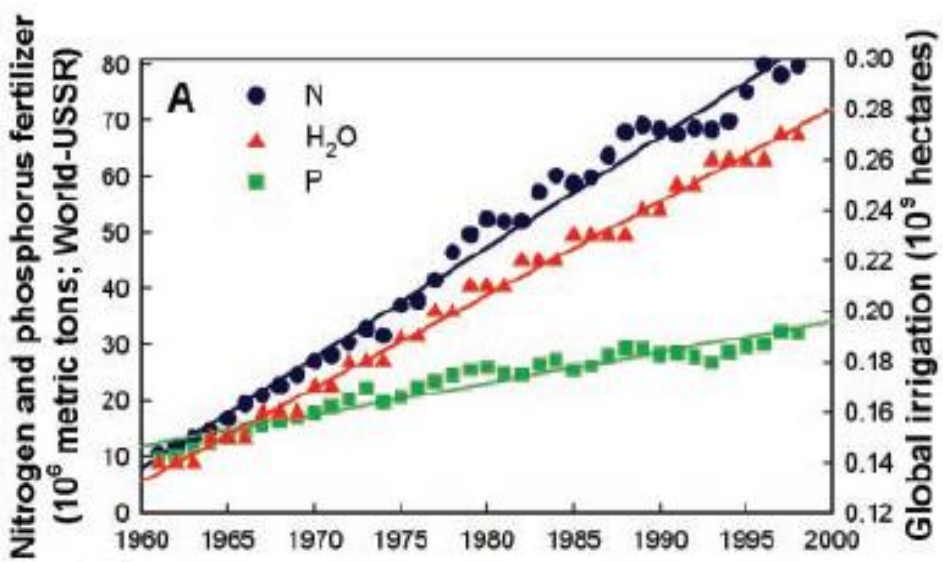
- Habitat destruction
- fragmentation and degradation
- conventional intensive land management practices:
- high use of agrochemicals
- intensively performed tillage, grazing or mowing
- By 2030, the area of agricultural land is expected to increase a further 10%, mainly in the developing world

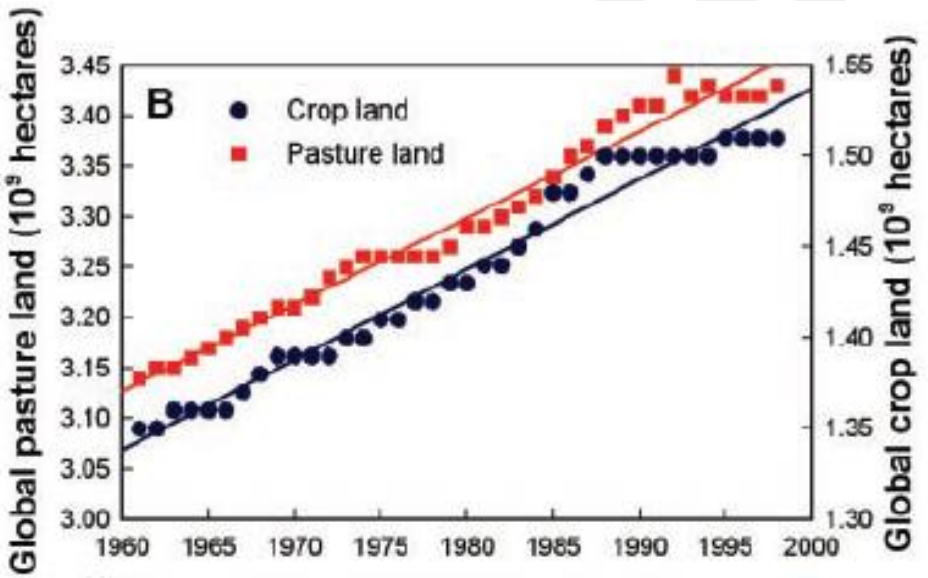

# FERTILISER, PESTICIDE USE

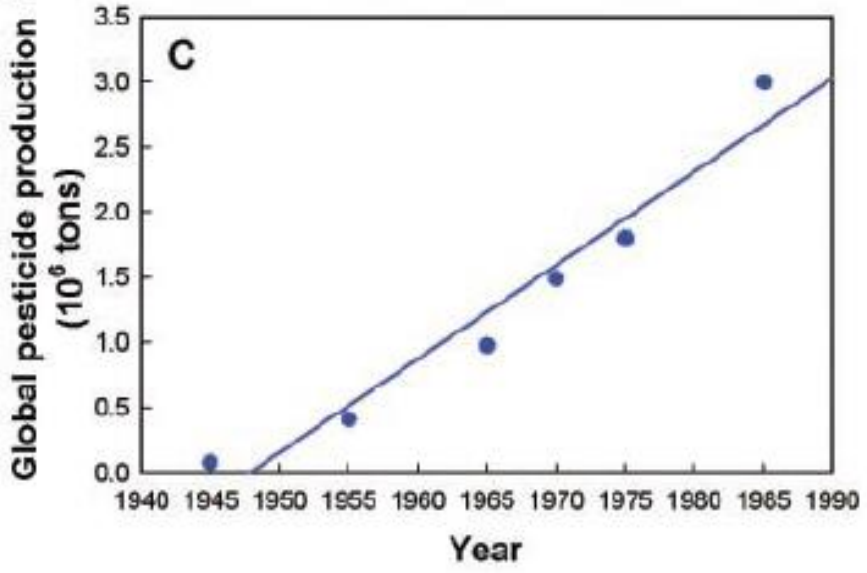
- Risk to pollinator depends on the combination of toxicity and the level of exposure, which varies geographically with the compounds used and the scale of land management and habitat in the landscape.
- Pesticides (sp. Insecticides) have a broad range of lethal and sublethal effects on pollinators under **controlled experimental conditions.**
- It is currently unresolved how sublethal effects of pesticide exposure recorded for individual insects affect colonies and populations of managed bees and wild pollinators, especially over the longer term.
- There is evidence from a recent study that shows impacts of neonicotinoids on **wild pollinator survival and reproduction at actual field exposure**. Evidence, from this and other studies, of effects on managed honey bee colonies is conflicting

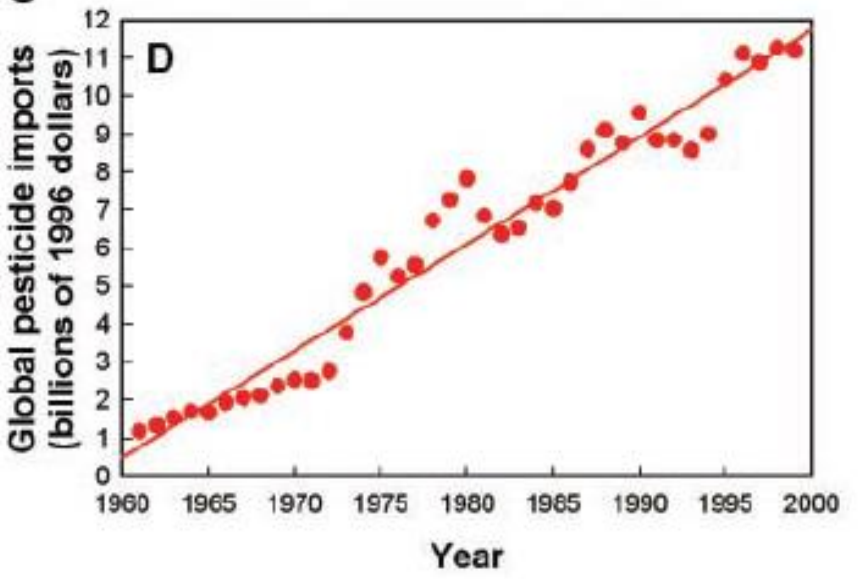
**For many other countries (e.g., in Africa and Asia) data are incomplete or absent.**

# FERTILISER, PESTICIDE USE



## Genetically Modified Organisms (GMOs)

- Are herbicide tolerance (HT) or insect resistance (IR) (traits); reduced weed populations accompany HT crops which decrease food resources for pollinators. Insect resistant (IR) crops can result in the reduction of insecticide use - the reduction in insecticide use **could** reduce pressure on non-target insects.
- Risk assessments required for the approval of genetically modified organism (GMO) crops in most countries do not adequately address the direct sublethal effects due to **lack of data**

## Invasives

- can disrupt native pollinator communities by outcompeting indigenous insects for resources or by spreading pests and disease - **there is little available evidence that alien plants are detrimental to pollinator diversity**

## Diseases and pests

- Bees suffer from a broad range of parasites, including ***Varroa*** mites in western and eastern honey bees.
- Emerging and re-emerging diseases are a significant threat to the health of bees, especially when they are managed commercially.

# Climate change

- Climate change is anticipated to bring about **changes in rainfall distribution**, wind patterns, **temperature, air pollution and occurrence of extreme weather events**, among other environmental changes
- The effects of climate change on plant-pollinator interactions are still mostly **unknown** and the **indirect effects** upon interacting species and networks of species are poorly represented in the literature
- Plant and pollinator ranges are **shifting/moved their ranges**, altered their abundances and shifted their seasonal activities in response to observed climate change over recent decades – **A recent analysis: bumble bees appear to be undergoing range contractions as climate changes across Europe and North America**
- Differential migration rates of co-occurring plants and insects as a result of changing climatic conditions may lead to a spatial dislocation of processes like pollination.
- climate change may alter the synchrony between plant flowering and pollinator flight periods = **PHENOLOGICAL MISMATCHES =** probably contribute to pollinator losses that subsequently disrupt pollination of plants

# Climate Change scenarios

- Under all climate change scenarios for the second half of the 21st century

(i) **pollinator community composition is expected to change** as a result of **decreases in the abundance** of some species and increases in others

(ii) the **seasonal activity of many species is predicted to change** differentially, potentially disrupting life cycles and species interactions between plants and pollinators

Impacts of ongoing climate change on pollinators and pollination services to agriculture may not be fully apparent for **several decades, owing to a delayed response in ecological systems.**

Adaptive responses to climate change include **increasing crop diversity and regional farm diversity and targeted habitat conservation, management or restoration.**

The effectiveness of adaptation efforts at securing pollination under climate change is untested

# Convention on Biological Diversity (CBD)

- The Thirteenth meeting of the Conference of the Parties (COP 13) (Cancun, Mexico, December 2016) adopted decision XIII/15 on the **Implications of the IPBES assessment on pollinators, pollination and food production** for the work of the Convention, in which the Conference of the Parties welcomed the IPBES summary for policymakers of the thematic assessment on pollinators, pollination and food production and endorsed its key messages.

UN BIODIVERSITY CONFERENCE
COP13-COPMOP8-COPMOP2
CANCUN, MEXICO 2016
MAINSTREAMING BIODIVERSITY FOR WELL-BEING

# Convention on Biological Diversity (CBD)

## The Regional Report for Africa on Pollinators and Pollination and Food Production

The report highlights the state of knowledge of animal pollination in the Africa region as a regulating service that underpins food production, and contribution to gene flow, biodiversity-related plant-pollinator interactions and the restoration of ecosystems in Africa.

UN BIODIVERSITY CONFERENCE
COP13 -COPMOP8-COPMOP2
CANCUN, MEXICO 2016
MAINSTREAMING BIODIVERSITY FOR WELL-BEING

# Convention on Biological Diversity (CBD)

- PROMOTING POLLINATOR-FRIENDLY HABITATS
- IMPROVING THE MANAGEMENT OF POLLINATORS, AND REDUCING RISK FROM PESTS, PATHOGENS AND INVASIVE SPECIES
- REDUCING RISK FROM PESTICIDES, INCLUDING INSECTICIDES, HERBICIDES FUNGICIDES
- ENABLING POLICIES AND ACTIVITIES
- RESEARCH, MONITORING AND ASSESSMENT

## Declaration - Coalition of the Willing on Pollinators

The Netherlands announced at the high level segment of COP-13, the launch of a new initiative, called the **Coalition of the Willing on Pollinators.**

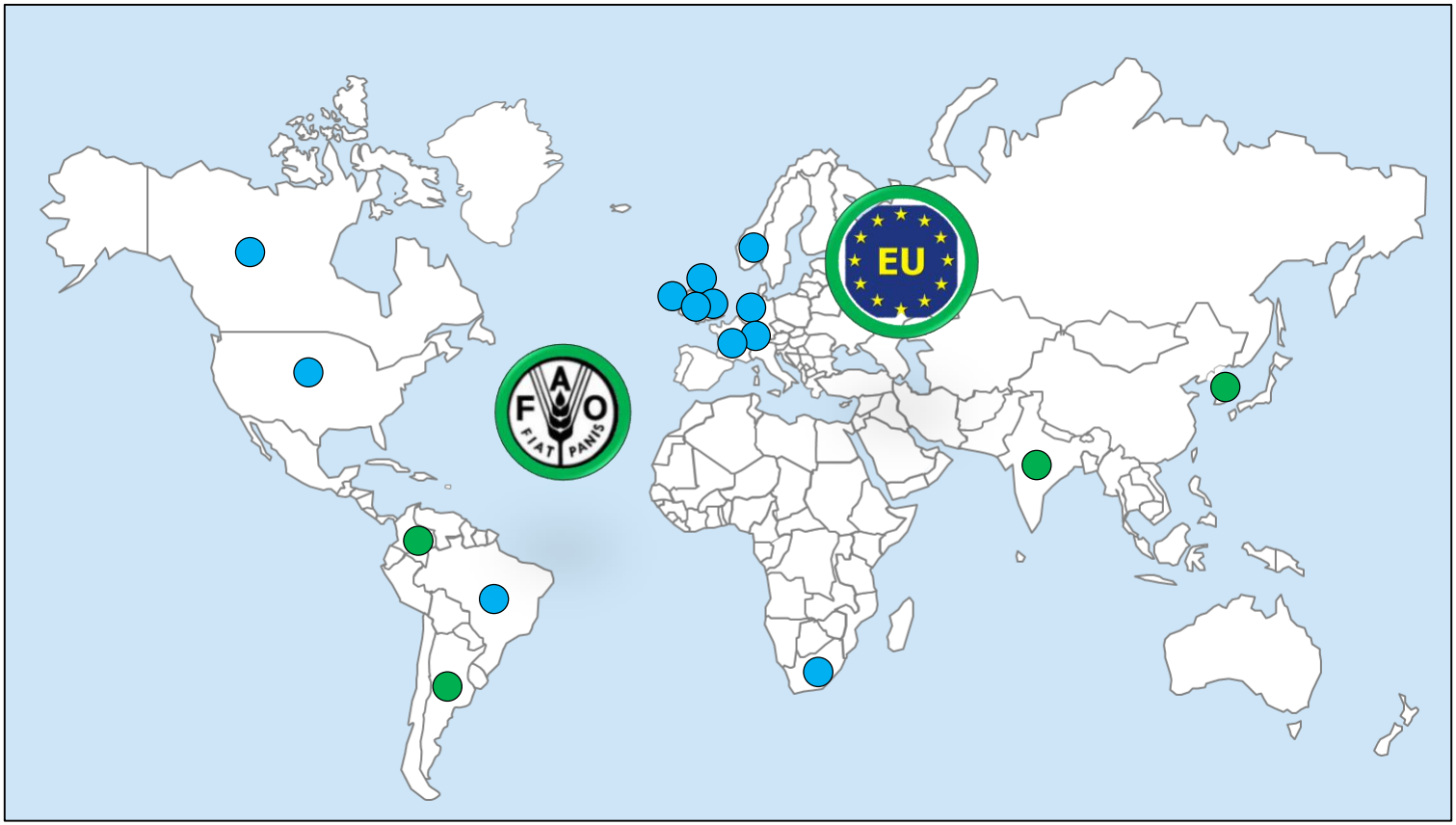
Signatories include:
France, Germany,
the United Kingdom,
Belgium, Austria,
Denmark,
Luxembourg, Finland,
Spain, the Netherlands,
Uruguay, Peru and
Slovenia (n=13)


*__Ethiopia__ signed the Declaration on the Coalition of the Willing on Pollinators (2017)

# Many National Initiatives

## Established or in development

England
Scotland
Wales
All Ireland
France
Switzerland
Netherlands
Norway
USA
Canada
Brazil
Argentina
Colombia
South Africa
India
Republic of Korea
EU and global and others



**Awareness and communication opportunities:**

**World Bee Day**

**https://www.worldbeeday.org/en/bee-with-us.html**


**Capacity Building & mainstreaming:**

**BES-Net Trialogue (Sarajevo, Bosnia and Herzegovina)**
**18-20 October 2017**
**BES-Net Trialogue (Santo Domingo, Dominican Republic)**

BESNet
Biodiversity and Ecosystem Services Network

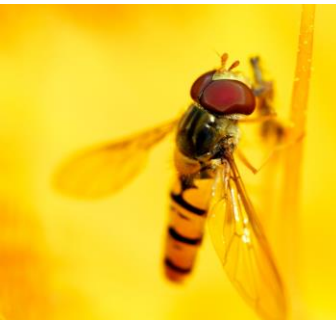
**More Initiatives**

**- National pollinator strategies (to be developed)**
**- EU Pollinators Initiative**
**- The International Pollinator Initiative – Plan of action 2018-2030 – based on IPBES**

**Recommendation adopted by SBSTTA for upcoming COP-14 - Adopts the Plan of Action 2018-2030 for the International Initiative for the Conservation and Sustainable Use of Pollinators as contained in annex I to the present decision, for implementation according to national circumstance**

# Conclusions

- Pollinator loss is an urgent problem
- Food Security: High policy relevance (impact on food production)
- Nutritional security: pollinators improve yields for crops that contribute nutrients to the food supply
- Economic, Ecological, social and cultural importance
- Impact is still limited by the lack of global policy uptake and implementation effort
- Globally we share many of the broad challenges and these will need **locally and regionally** developed solutions to enhance pollinators and pollination services
- Regional and national initiatives have a critical role to play in sharing knowledge, building capacity and supporting the development of better policies and practices





# Thank you!

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