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IPBES Plenary: 4th Session

Pollinators, Pollination and Food Production

Deliverable 3a

Chairs: Prof Simon Potts and Prof Vera Lucia Imperatriz-Fonseca

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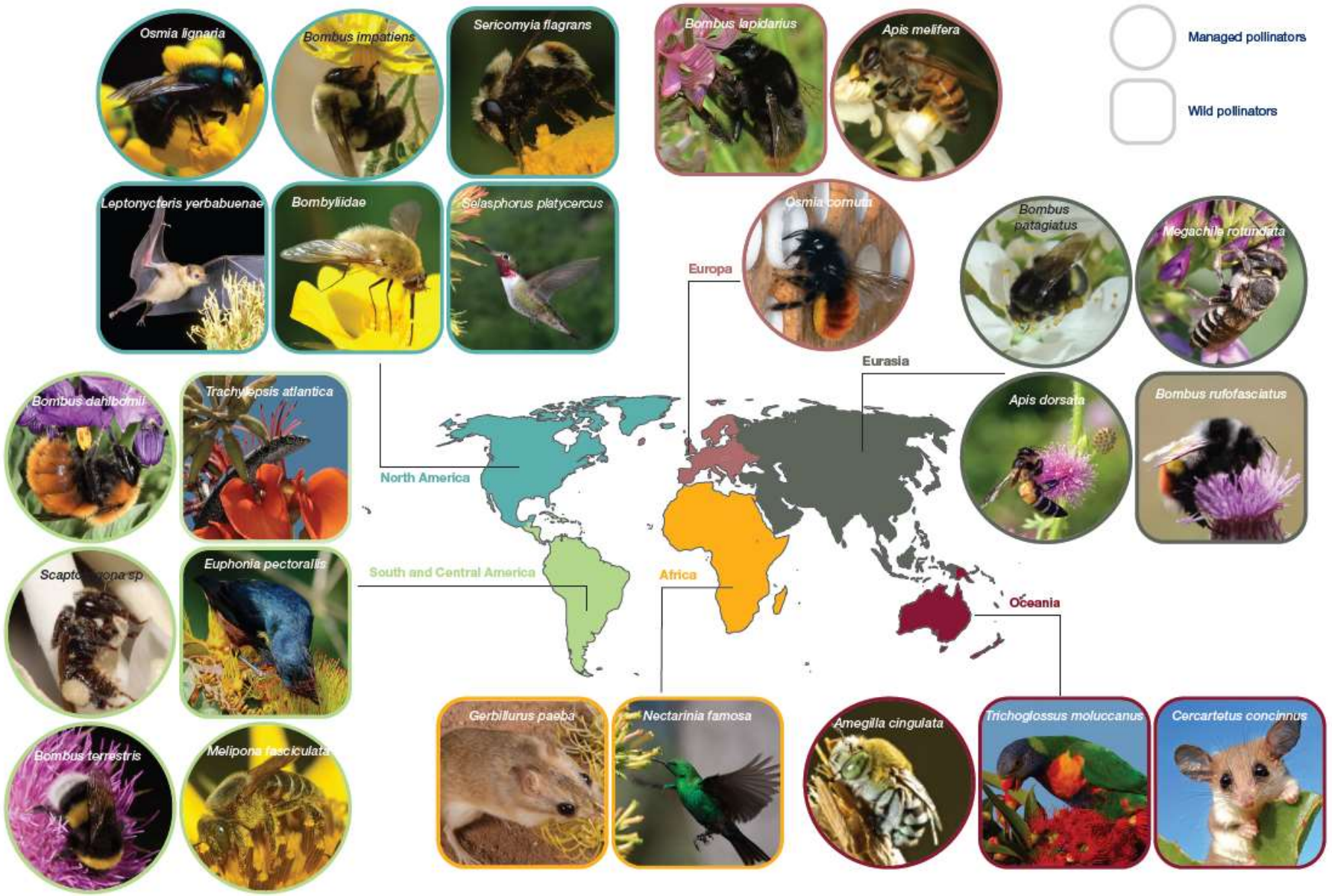
Pollinators are diverse



Wide range of benefits

- More than **75%** of leading food crops
- Almost **90%** of the world's flowering plants

Rely, at least in part, on animal pollination

Crop dependency varies

Wheat

Rice

Cassava

Cocoa

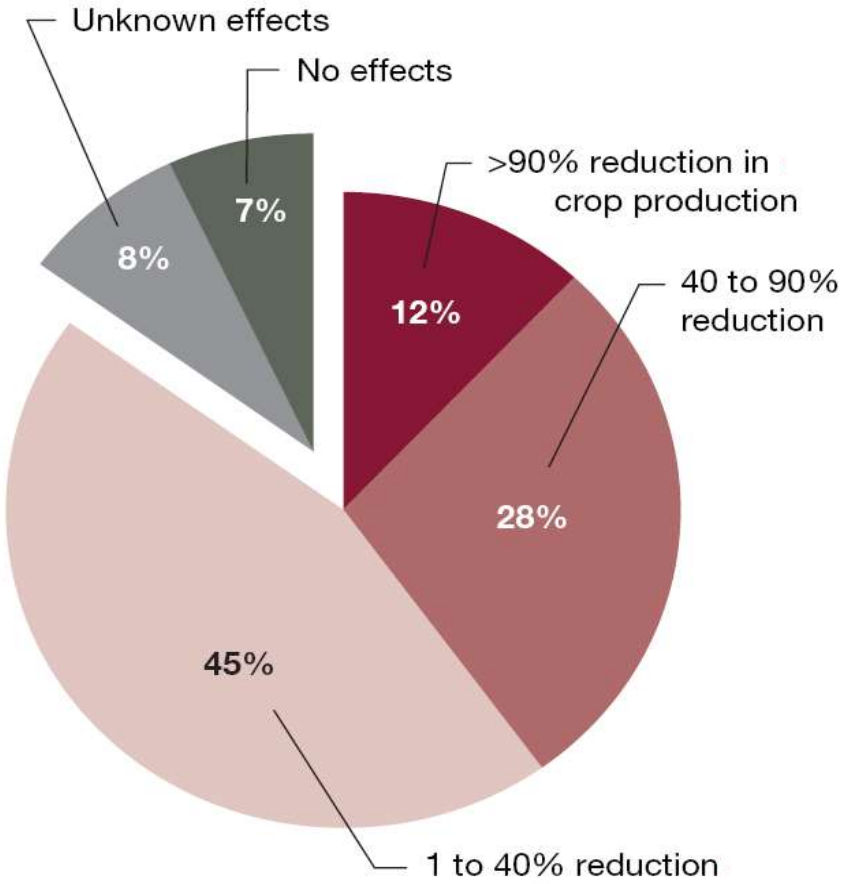
Soy

Apple

Coffee

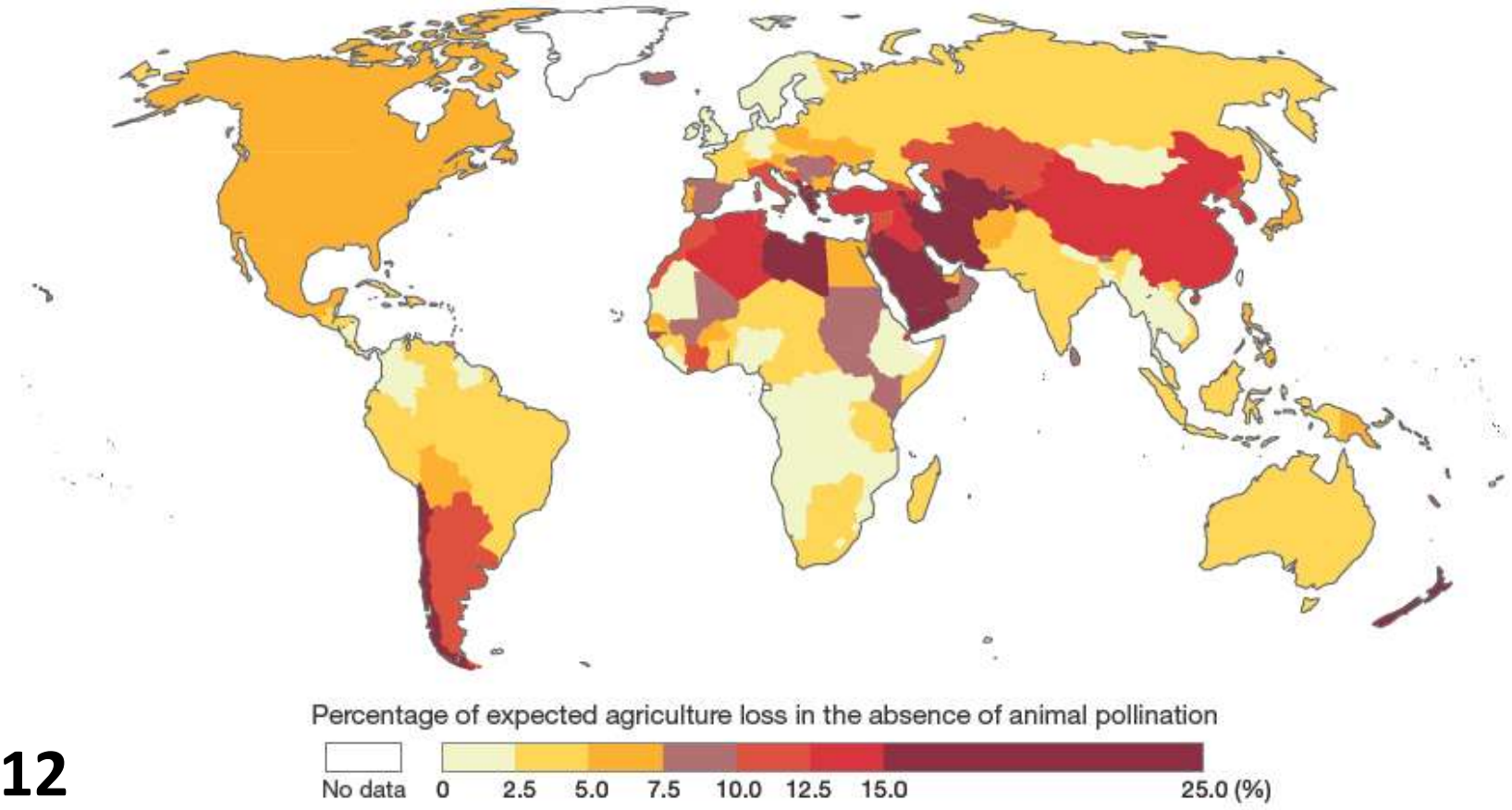
Oilseed rape/Canola

Mango



Global agriculture
is increasingly reliant on pollinators

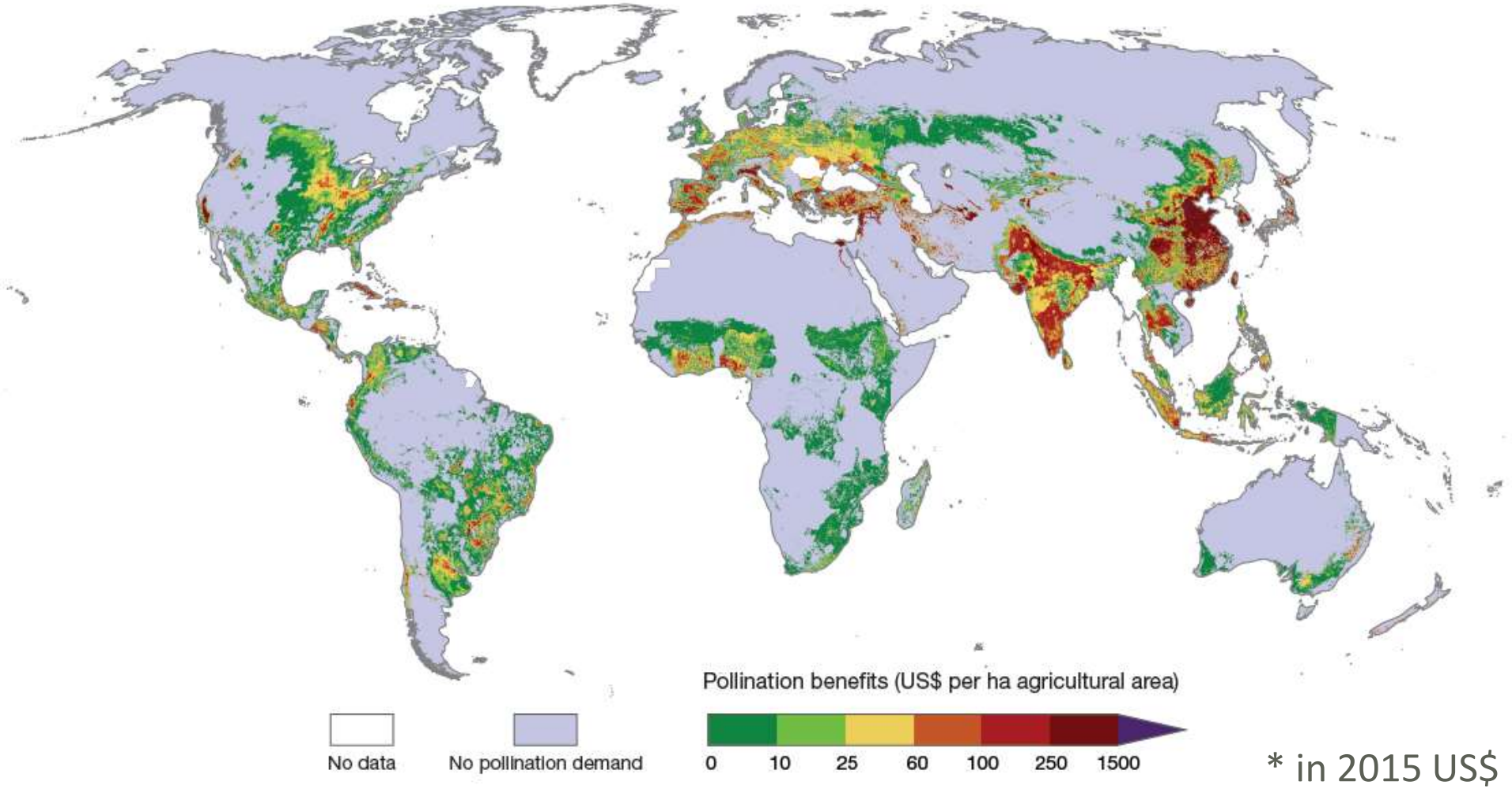
More than 300% increase in volume of agricultural production dependent on pollinators since 1961



2012

Economic value

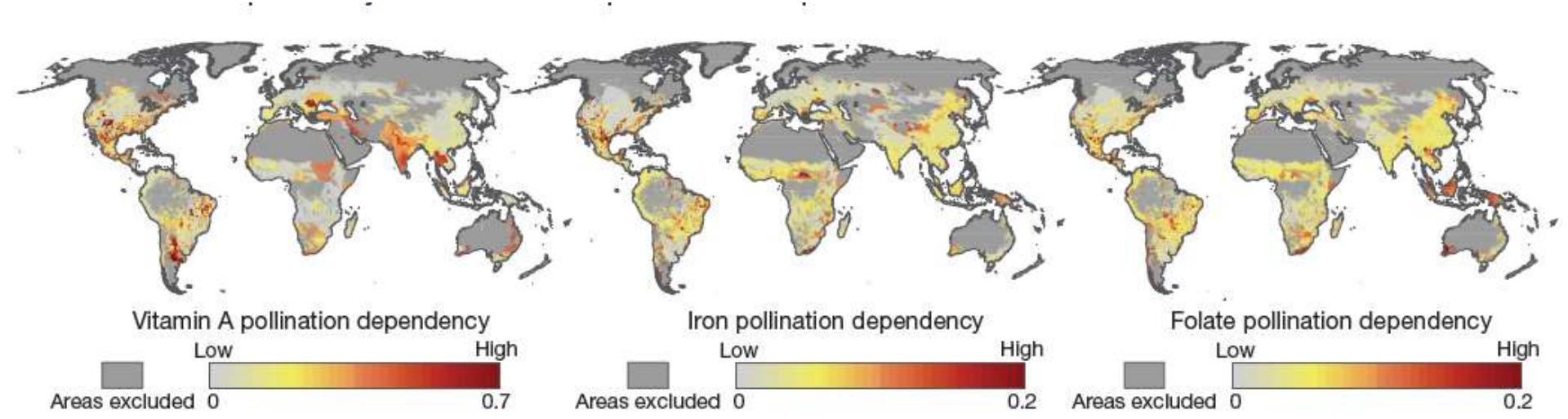
Annual market value linked to pollinators is US$ 235 – 577 billion*



* in 2015 US$

Healthy human diets

Animal pollinated crops are a key source of vitamins and minerals



Beekeeping and honey hunting

Anchor many rural livelihoods

Bakaya man
(Cameroon)
© Timothy Allen

Traditional hives
(Ethiopia)
© Peter Kwapong

Karumba man
(India)
© Riverbank Studios

Clay pot hives
(Mexico)
© J. Quezada-Euán

Many values beyond food

- Medicines, biofuels, fibres and construction materials

Honey

Cotton

Canola

Eucalyptus

- Sources of inspiration for art, music, literature, religion and technology

National symbols

Jamaica

Red-billed streamertail (*Trochilus polytmus*)
Source: Charles Sharp

Singapore

Vanda Miss Joaquim orchid (*Vanda teres* and *Vanda hookeriana* hybrid)
Source: Calvin Teo

Mauritius

Trochetia blackburniana visited by a *gecko* (*Phelsuma cepediana*). Source: Hansen et al. Biol. Lett. 2006

Sri Lanka

Sri Lankan Birdwing (*Troides darsius*)
Source: Jim Bleak

Sources of inspiration

Part of the Mayan Codex
(held in Madrid) about *Xunan-Kab,* a stingless bee

Three-bee motif of Pope Urban VIII
(ceiling of Barberini Palace, Rome) Photo: R. Hill

Celebrating pollinators in Islamic Art
Chinese Export Rose Canton porcelain © Islamic Arts Museum, Kuala Lumpur

Technological innovation

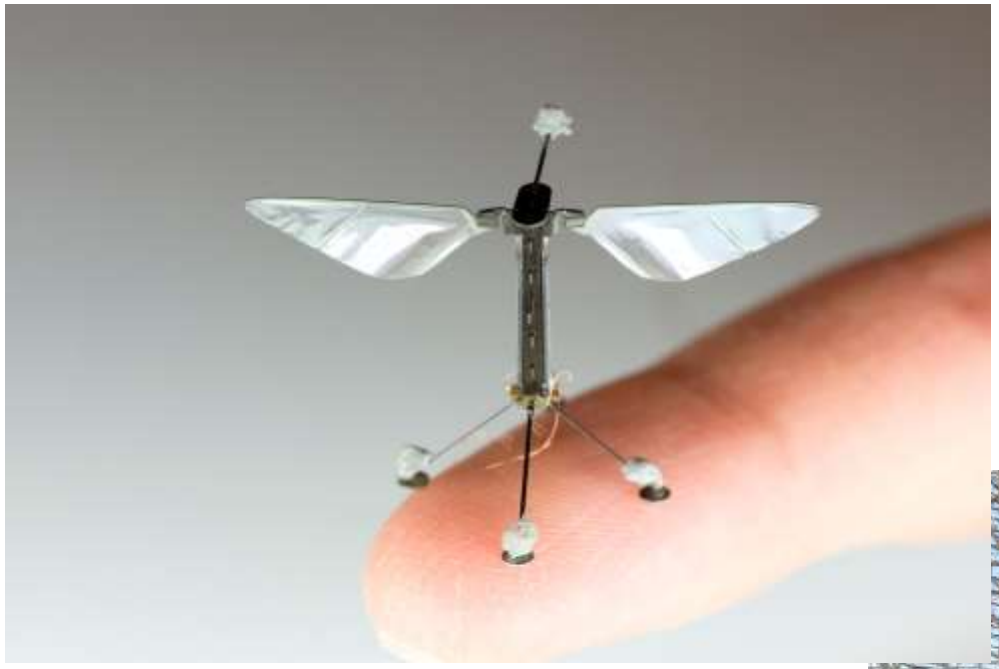


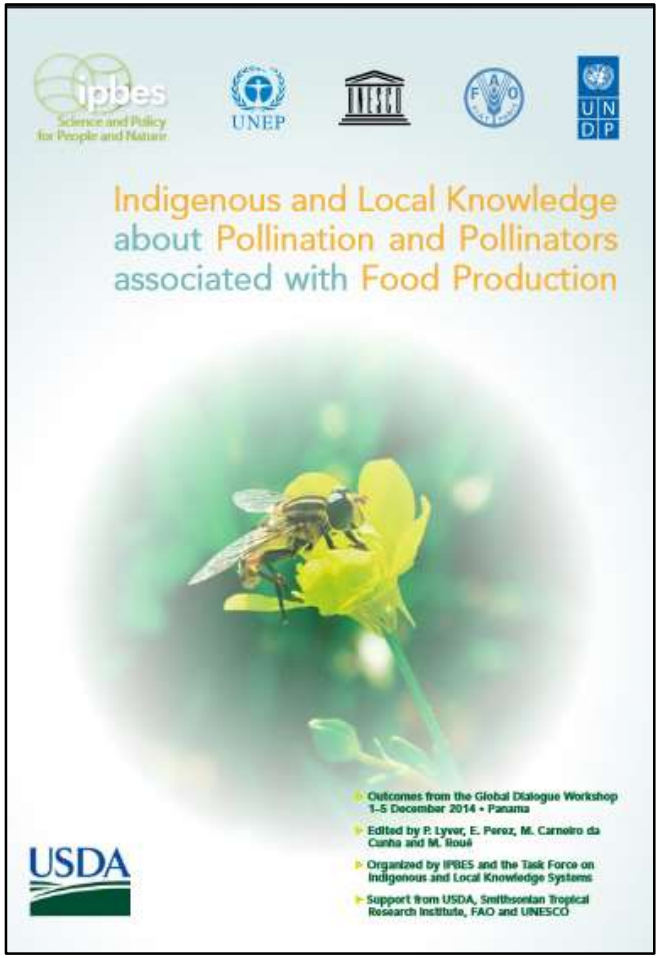
Photo credit: Kevin Ma and Pakpong Chirarattananon

Robotic bees

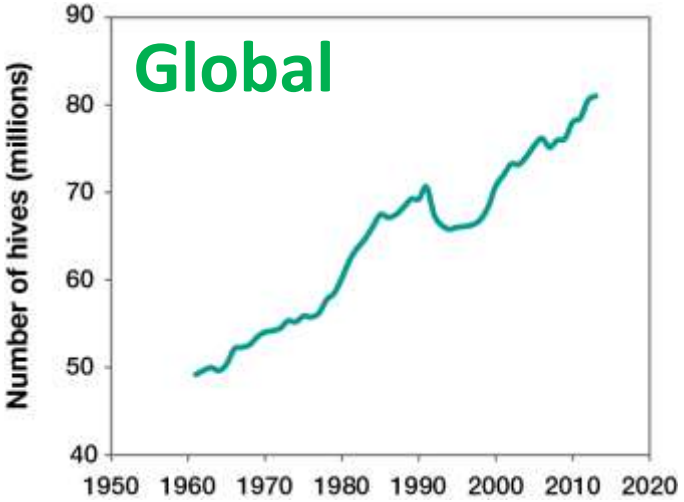
The “hive” at Milan EXPO Pavilion

Photo credit: © 2016 Hufton + Crow

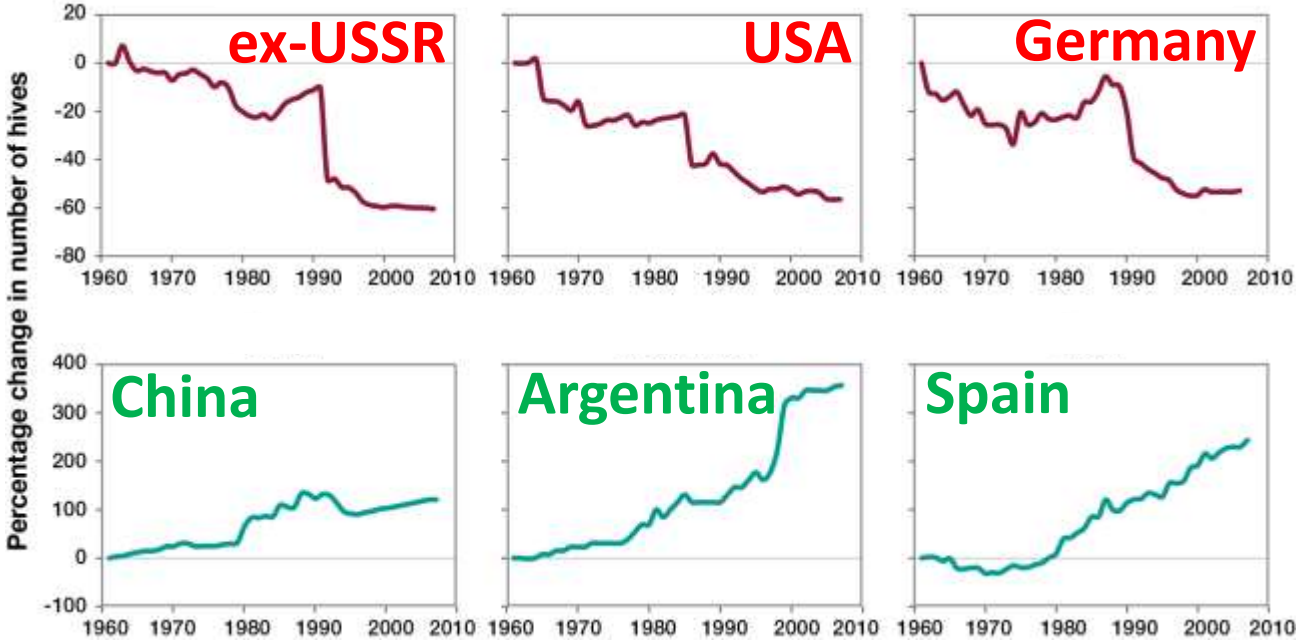
Significance for Indigenous and Local Knowledge systems



Status of managed honeybees (*Apis mellifera*)



- **45% increase globally**
- **Losses in N. America and many European countries**



Status of wild insects

- Declines in diversity and occurrence of some bees, hoverflies and butterflies in Europe and North America
- >40% bee species are threatened in some National lists
- 9% of European bee and butterfly species are threatened
- **Lack of data** for other regions precludes assessment of status, but some reports of declines

Bombus cullumanus
(Critically Endangered)
Source: P. Rasmont

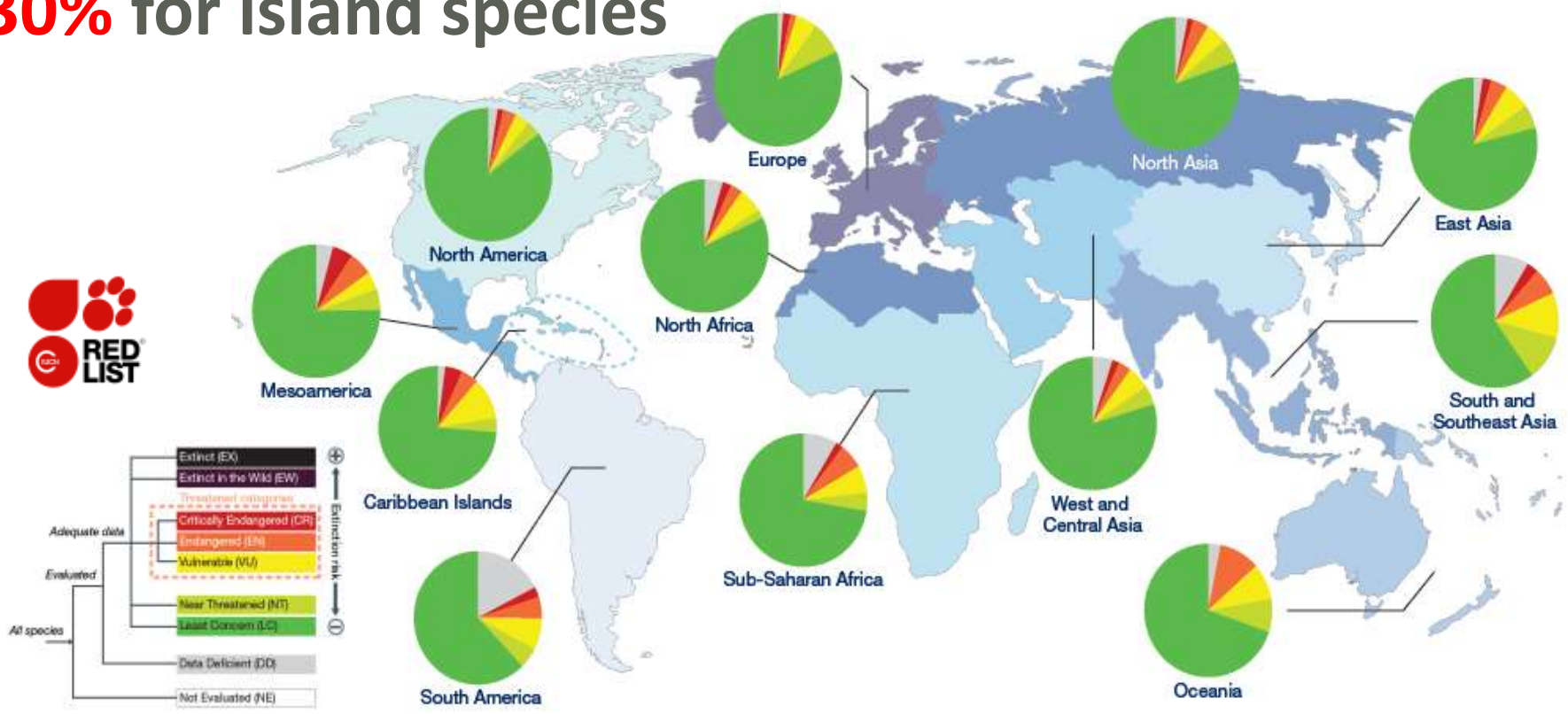
Status of vertebrates

16.5% of vertebrate pollinator species are threatened

30% for island species

Grey-headed Flying Fox
(*Pteropus poliocephalus*)

Ruby-throated hummingbird
(*Archilochus colubris*)



Causes of declines

- Multiple threats to pollinators:
  - **Land use change**
  - **Intensive agricultural management**
  - **Pesticides**
  - **Genetically Modified (GM) crops**
  - **Pathogens and pests**
  - **Climate change**
  - **Invasive alien species**
  - **Interactions**
- Often difficult to link specific drivers to observed declines

▪Photo credit: Kenneth Rhodes

Land use change

Risks

- Reduction in food, nesting or other resources
  - **Loss of habitat**
  - **Fragmentation**
  - **Degradation**
- Applies to agricultural,
- natural and urban areas
- Loss of practices based on Indigenous and Local Knowledge

Land use change

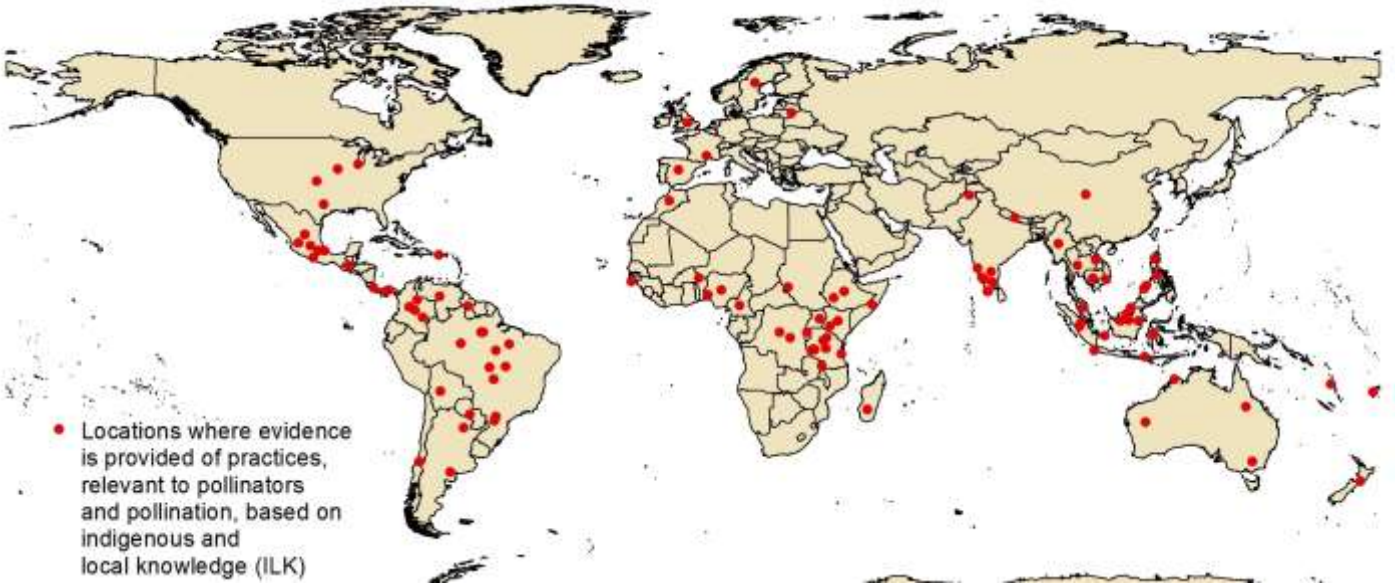
Responses

- Provide food and nesting resources:
  - **Manage or restore native habitat patches**
  - **Establish protected areas**
  - **Increase habitat heterogeneity**
- Applies to agricultural, natural and urban areas

Land use change

Responses

- Practices based on Indigenous and Local Knowledge can, in co-production with science, be a source of solutions
  - **Favouring diverse gardens and landscapes**
  - **Kinship relationships (taboos, totems) that protect pollinators and their habitat**



Intensive agriculture

Risks

- Loss of non-cultivated habitat patches
- Large field sizes and monocultures
- High inputs of fertilizers, herbicides etc.
- Intensive grazing

Intensive agriculture

Responses

- Create patches of flower rich habitat
- Support organic farming
- Strengthen existing diversified farming systems
- Reward farmers for good practices

Pesticides

Risks

- Broad range of lethal and sub-lethal effects
- Impacts vary with compound toxicity, exposure level, location and pollinator species
- Risks can be increased by, for example:
  - **If labelling is insufficient or not respected**
  - **Application equipment faulty or not fit-for-purpose**
  - **Risk assessment or regulations insufficient**

Pesticides

Responses

- Raise standards of risk assessment and regulation of pesticide use
- Reduce usage
- Seek alternative forms of pest control (e.g. Integrated Pest Management)
- Train farmers, extensionists and land managers in best practices
- Adopt technologies to reduce spray drift and dust emissions

Genetically Modified Crops

Risks

- Herbicide Tolerant (HT) crops:
  - **High herbicide use may reduce pollinator forage**
- Insect Resistant (IR) crops:
  - **Sub-lethal effects largely unknown**

Genetically Modified Crops

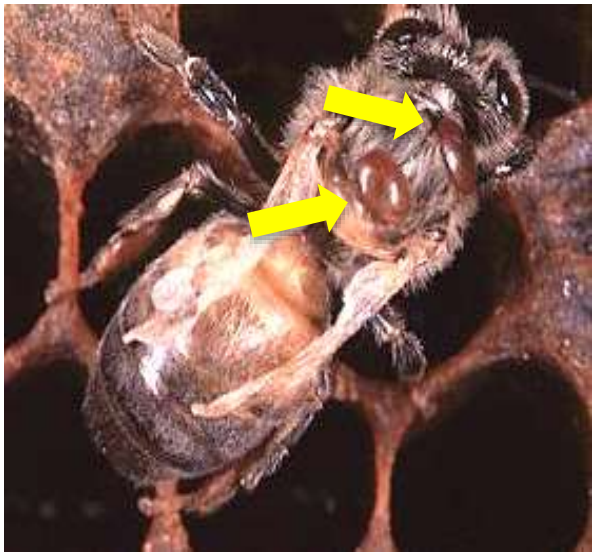
Responses

- Raise the standard of risk assessment for approval of GM crops
- Quantify the indirect, and sublethal, effects of GM crops on pollinators

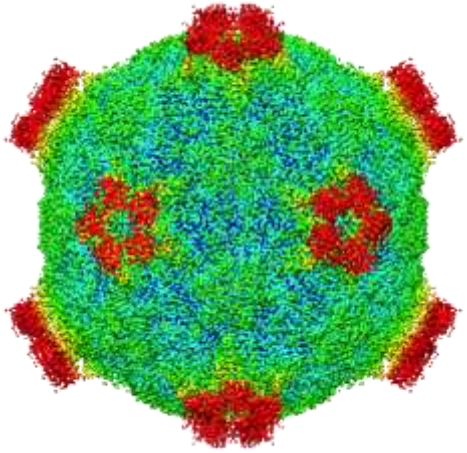
Photo: Myrabella / Wikimedia Commons, via Wikimedia Commons

Pathogens and pests

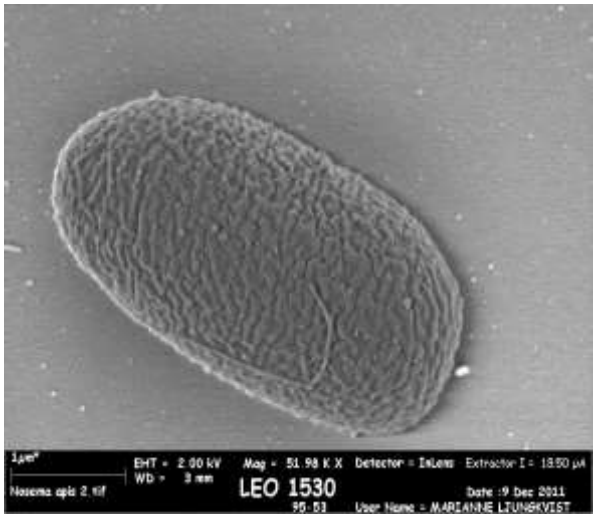
Risks



Varroa mites (*Varroa destructor*) on a honeybee.
Source: MAAREC



Deformed Wing Virus
electron density image
Source: Pavel Plevka



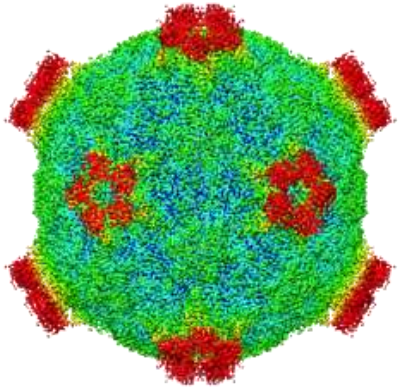
Nosema ceranae
a fungal parasite of honeybees
Source: Ingemar Fries

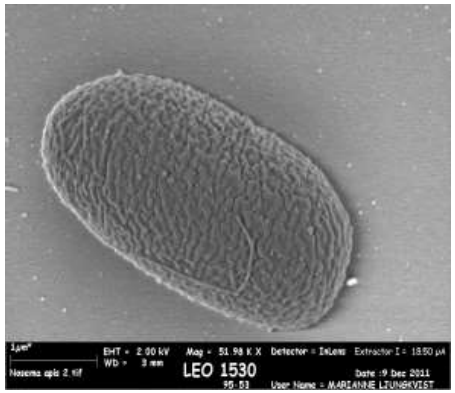
Asian hornet (*Vespa velutina*) eating a honeybee.
Source Alain C.

Pathogens and pests

Risks

- Varroa mites and their viruses are a major threat to western honeybees
- Trade, mass breeding and transport of commercial bees increases the risk of:
  - **Pathogen spread within and between managed and wild species**
  - **Invasions and competition with wild pollinators**





Pathogens

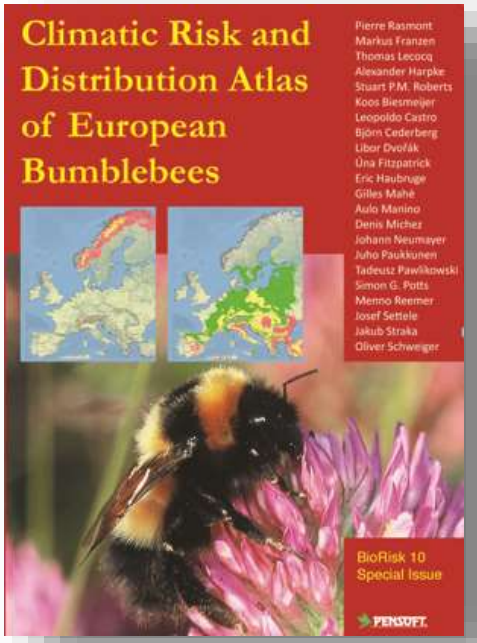
Responses

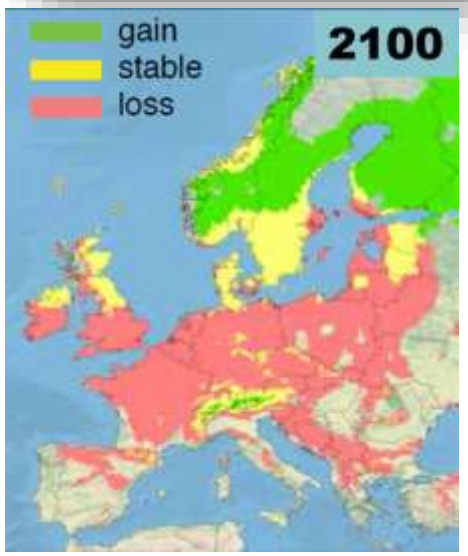
- Improve managed bee husbandry:
  - **Better disease detection and management**
  - **Breeding programmes for disease resistance**
- Improve regulation:
  - **Trade and mass breeding**
  - **Movement (nationally and internationally)**

Climate change

Risks

- For some pollinators (e.g. bumblebees and butterflies):
  - **Range changes**
  - **Altered abundance**
  - **Shifts in seasonal activities**
  - **Risk of disruption of future crop pollination**
- Climate shifts across landscapes may exceed species dispersal abilities





Red-tailed bumblebee (*Bombus lapidarius*

Climate change

Responses

- Largely untested but could potentially include:
  - **Targeted habitat creation or restoration to increase refuges and connectivity**
  - **Increased crop diversity**

Photo credit: Max Licher

Invasive species

Risks

Impacts of alien invasives are usually negative (but can be positive or neutral depending upon species and location):

- **Plants (wild and cultivated)**
- **Pollinators**
- **Predators**
- **Diseases**

Himalayan Balsam (*Impatiens glandulifera*)

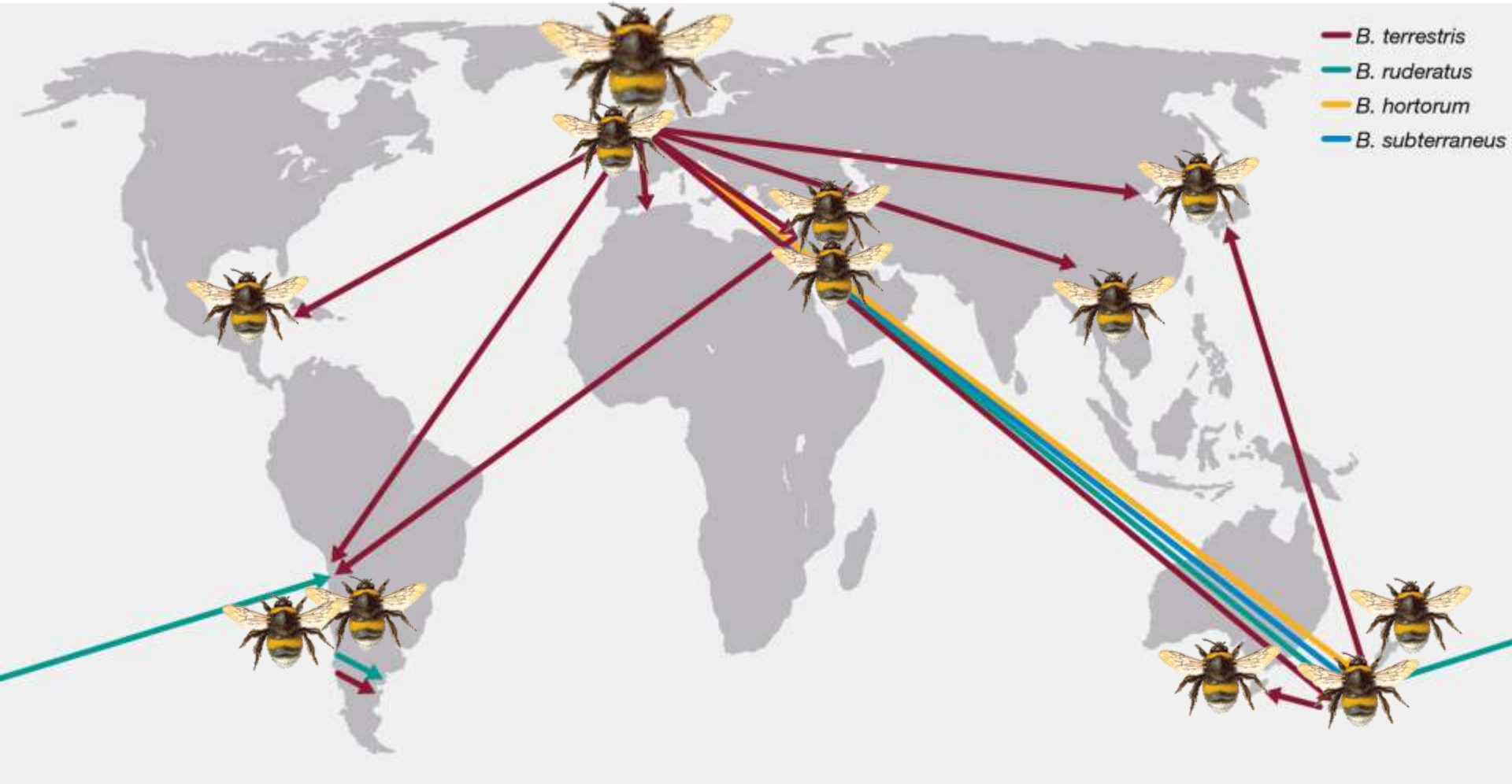
Buff-tailed bumblebee (*Bombus terrestris*)

Asian hornet (*Vespa velutina*) and honeybee

Invasive species

Risks

Global introductions of European bumblebees for pollination of crops



Red arrows show some of the routes of introductions for *Bombus terrestris*

Invasive species

Responses

- Eradication after invasions is rarely successful
- Policies and practices to prevent new invasions can be effective

Summary

1. Well documented declines in some wild and managed pollinators
2. Both provide us with a broad range of benefits
3. Pollinators face multiple threats
4. Wide range of response options to protect pollinators drawing on both scientific and Indigenous and Local Knowledge

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The Experts