# Pollinators in National Ecosystem Assessments

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# Overview of pollination

- Pollination services to crops
  - Globally: Pollinator dependence is growing, covering millions of Ha globally [1]
  - In your countries: 3.97M ha (2019) [2]
  - Major crops include Oil Palm, Soy and Cotton [3]

- Pollination services to wild plants
  - ~80% of global flowering plants depend on pollinators [4]
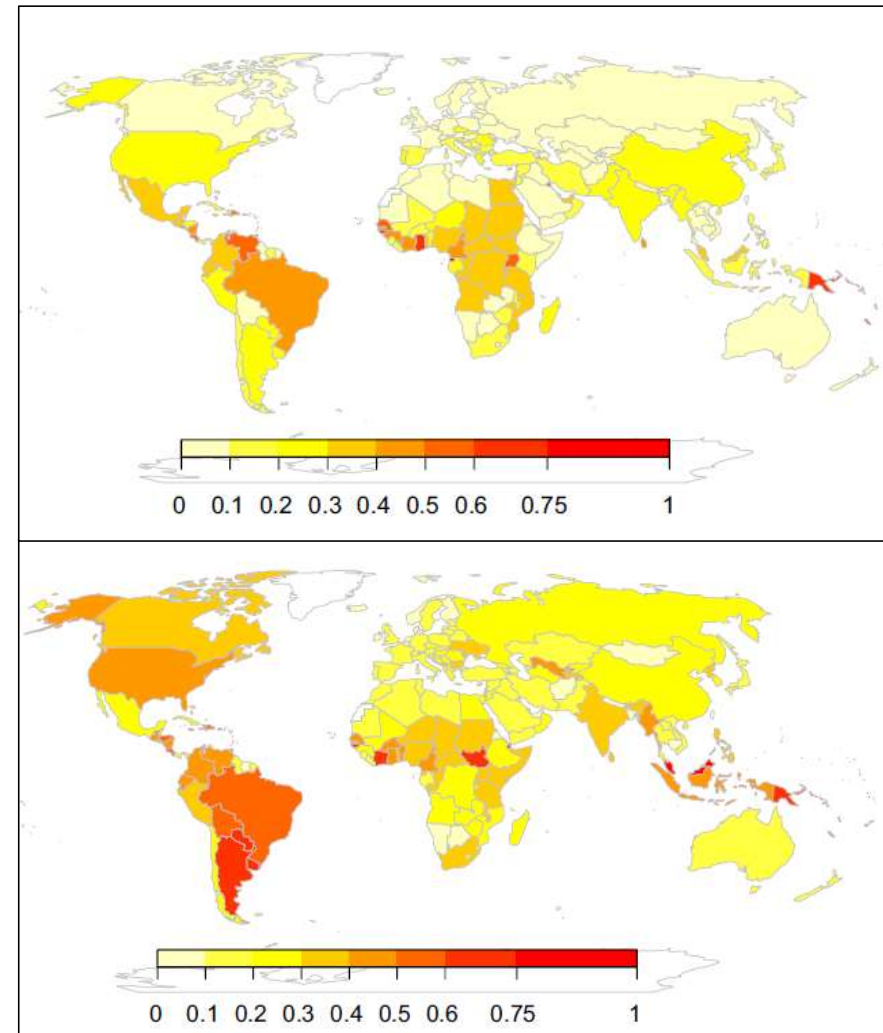


[1] Aizen et al., 2019. [2] FAOSTAT, 2022. [3] Klein et al., 2007, [4] Ollerton et al., 2011
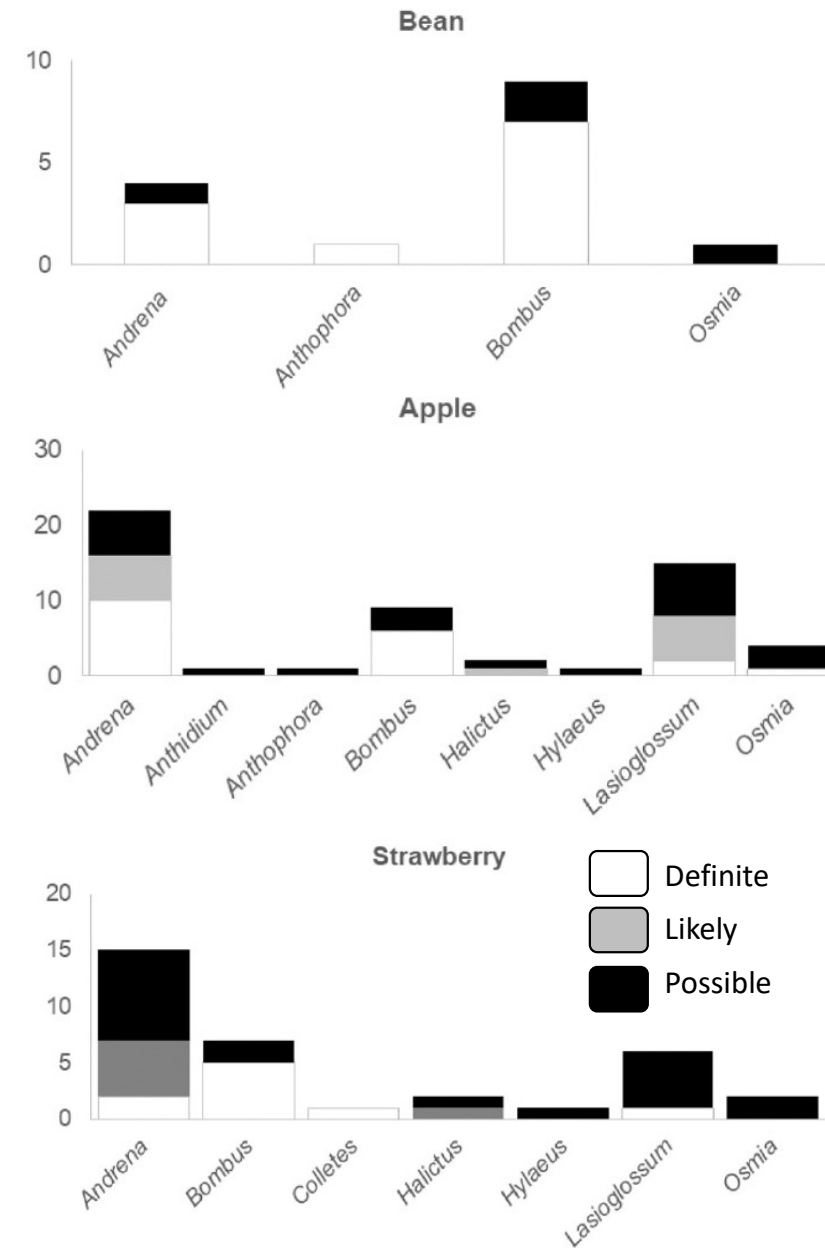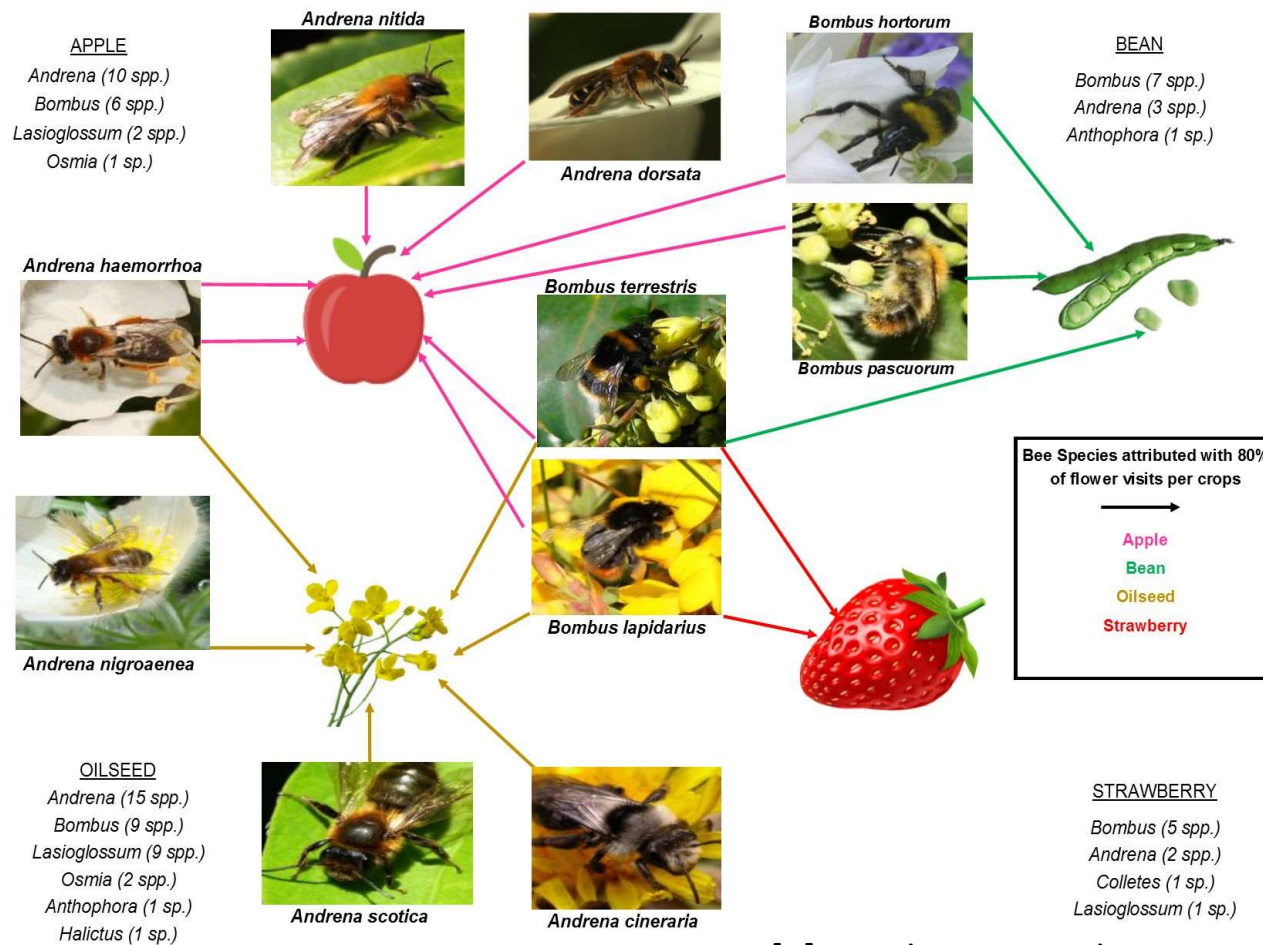
# Status and Trends
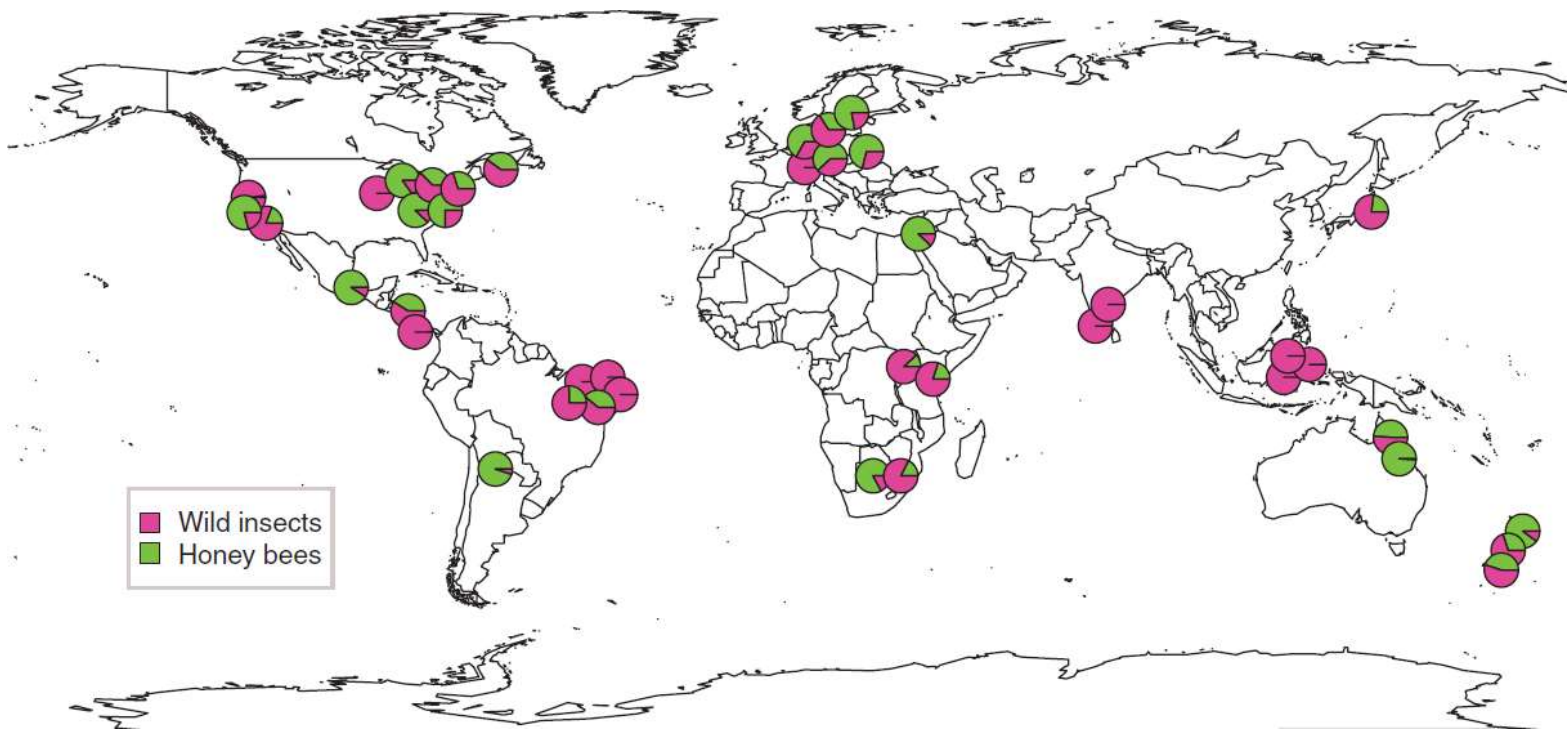


In most countries, wild insects provide the majority of services

Other pollinators include bats and birds

[5] Garibaldi et al., 2013

# Status and Trends



APPLE
Andrena (10 spp.)
Bombus (6 spp.)
Lasioglossum (2 spp.)
Osmia (1 sp.)

Andrena nitida

Andrena dorsata

Bombus hortorum

BEAN
Bombus (7 spp.)
Andrena (3 spp.)
Anthophora (1 sp.)

Andrena haemorrhoa

Bombus terrestris

Bombus pascuorum

Andrena nigroaenea

Bombus lapidarius

Bee Species attributed with 80%
of flower visits per crops

→

Apple
Bean
Oilseed
Strawberry

OILSEED
Andrena (15 spp.)
Bombus (9 spp.)
Lasioglossum (9 spp.)
Osmia (2 spp.)
Anthophora (1 sp.)
Halictus (1 sp.)

Andrena scotica

Andrena cineraria

STRAWBERRY
Bombus (5 spp.)
Andrena (2 spp.)
Colletes (1 sp.)
Lasioglossum (1 sp.)

[6] Hutchinson et al., 2021

Bean

Apple

Strawberry

Definite
Likely
Possible

# Status and Trends

- Trends over time suggest declines
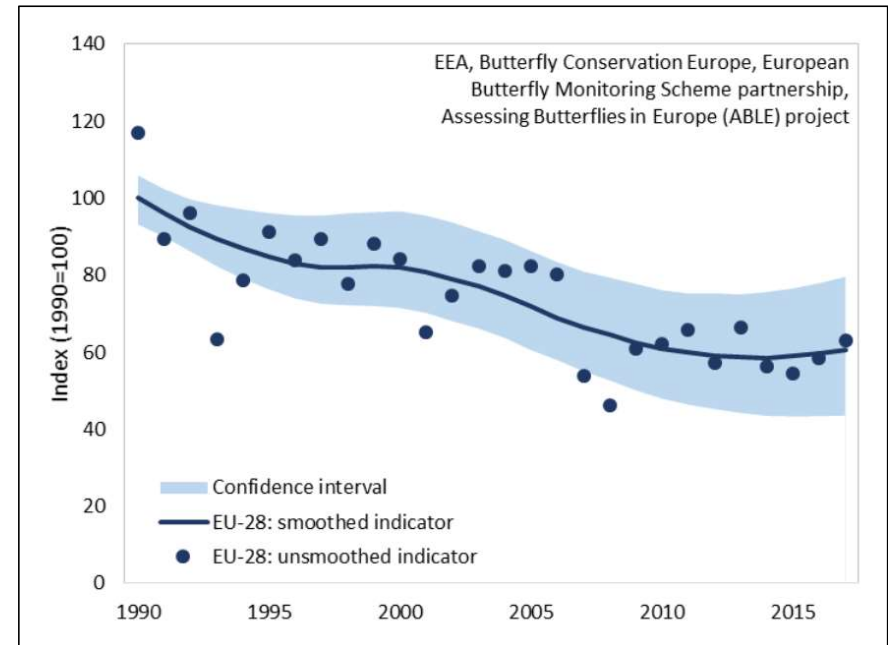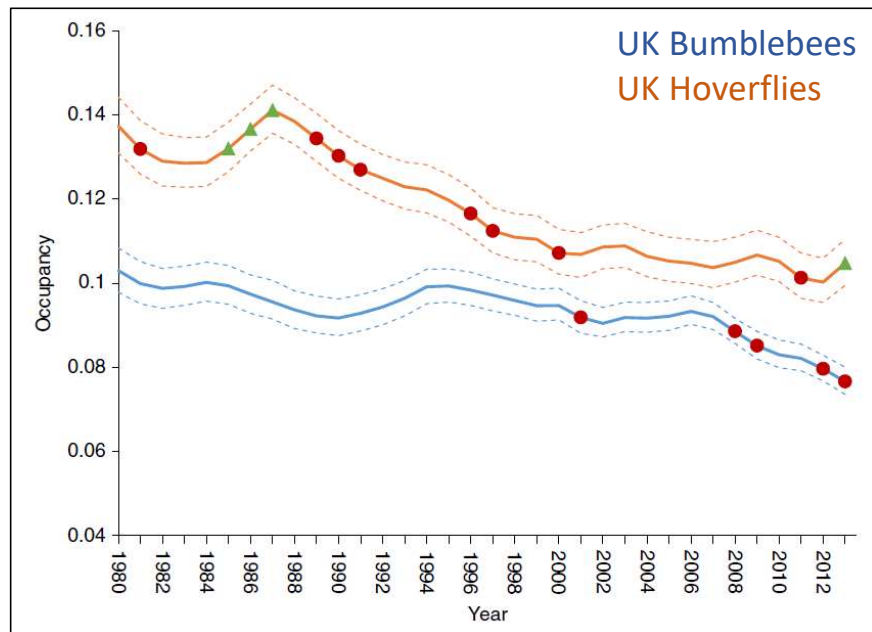


[10] Powney et al., 2021, [11] van Swaay et al., 2019

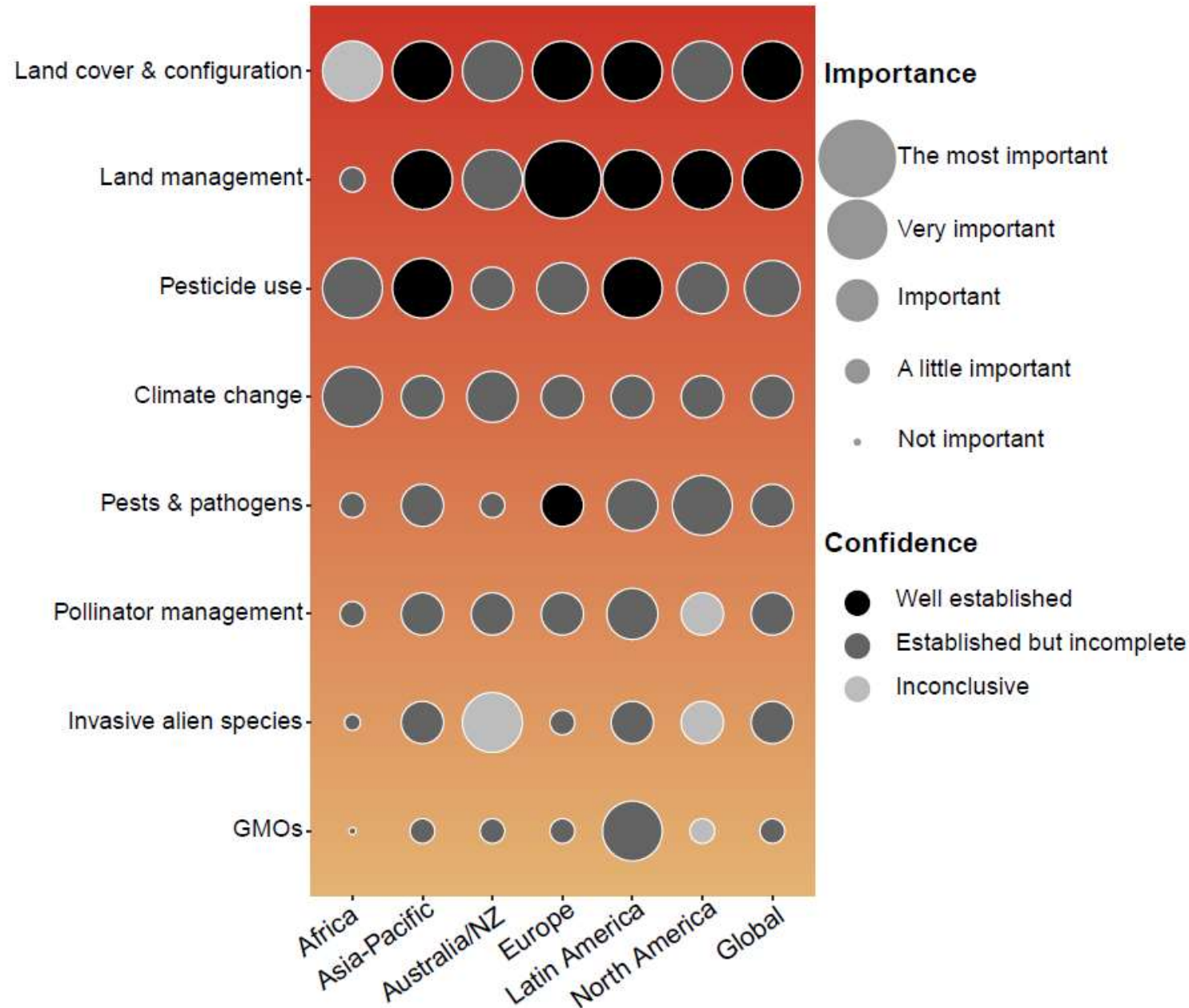# Drivers

Major drivers:

- Land cover
- Land management
- Pesticides (not just insecticides)
- Climate change

Much uncertainty still...

[12] Dicks et al., 2021

# Pollination deficits
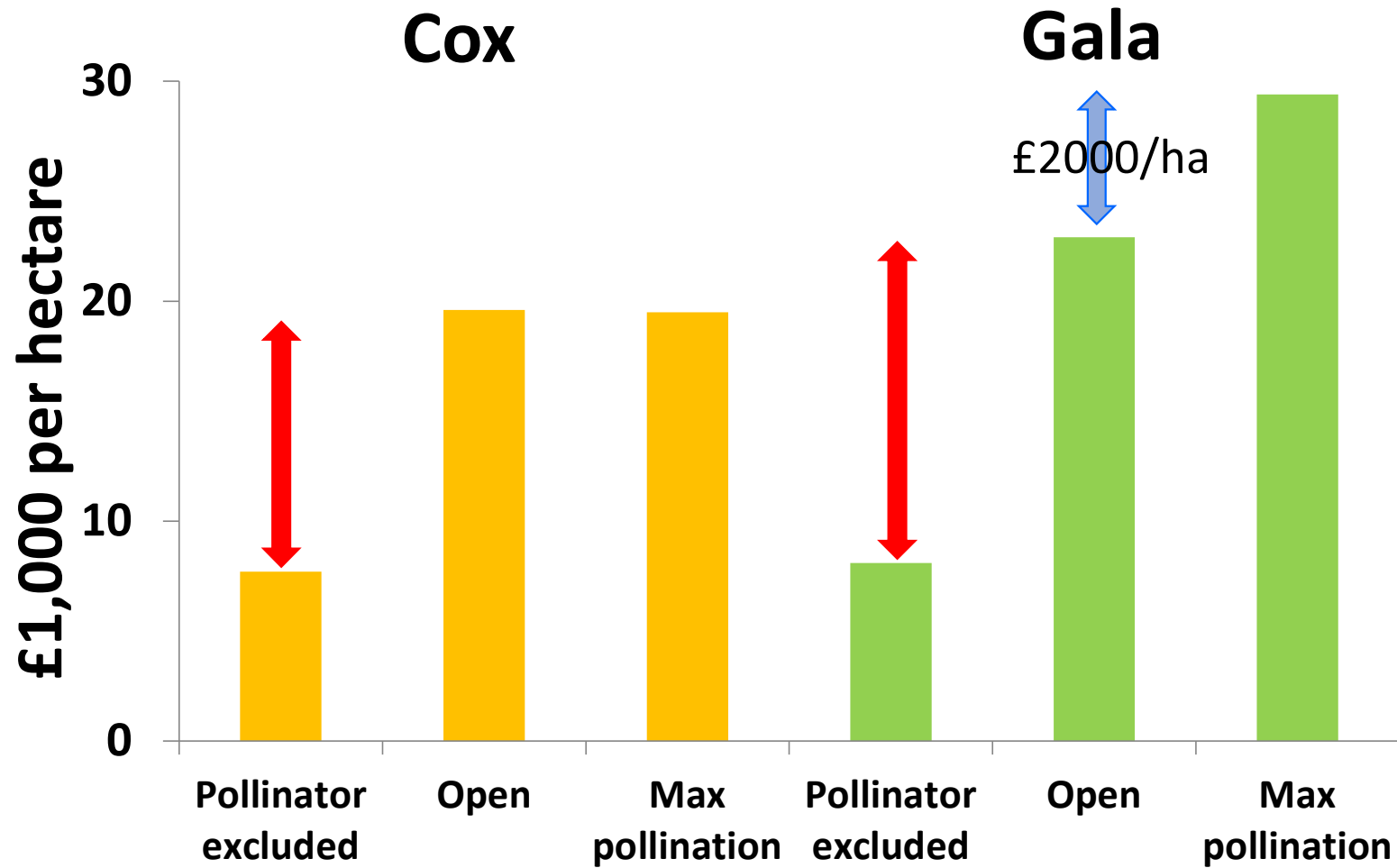


[13] Garratt et al., 2014

**Global value: $235-577bn**

Pollination benefits (US$ per ha agricultural area)

No data   No pollination demand   0   10   25   60   100   250   1500
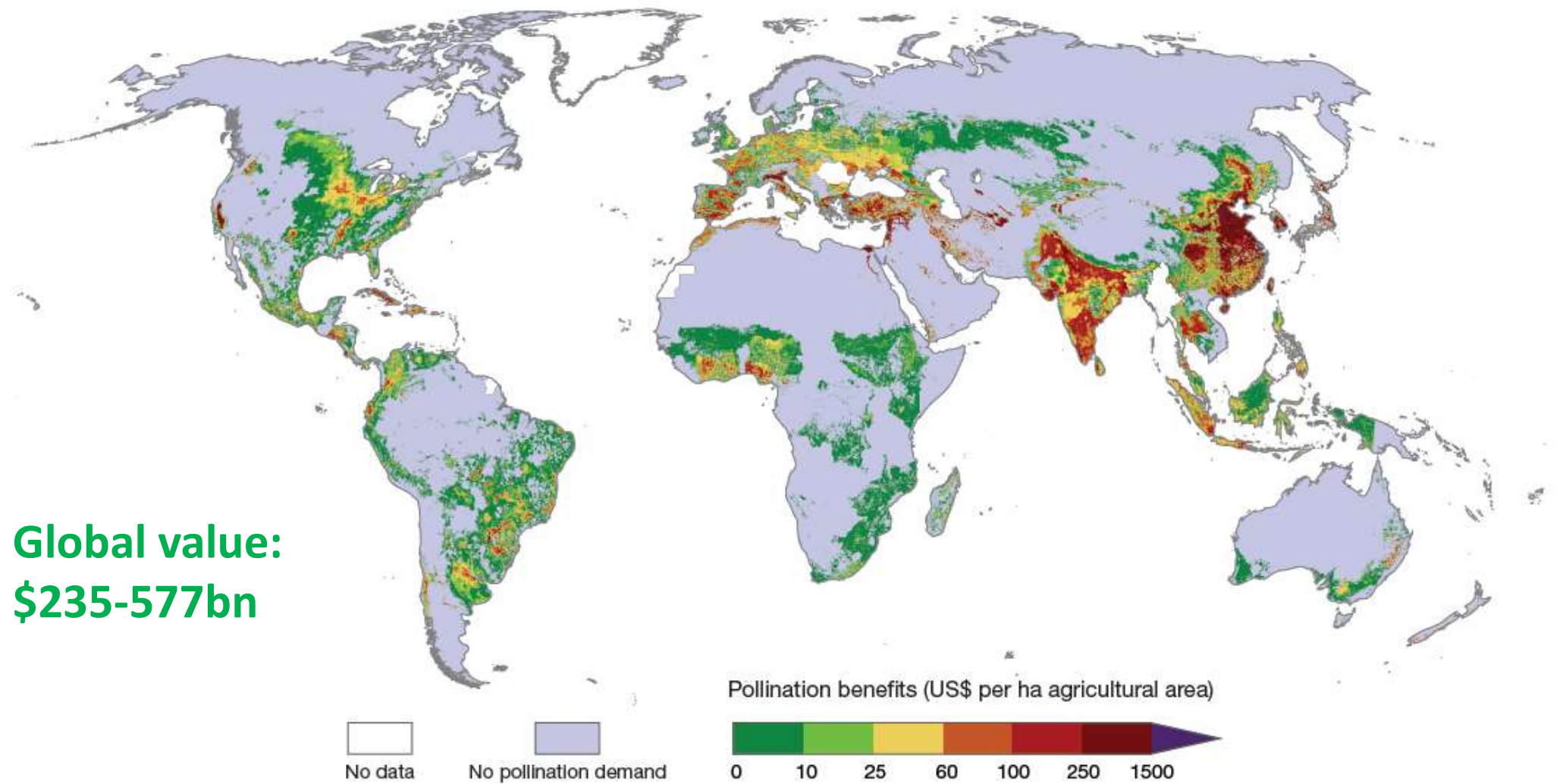
[15] Lautenbach et al., 2012

# Value of pollination

- Capturing the value of all crops is crucial [23]
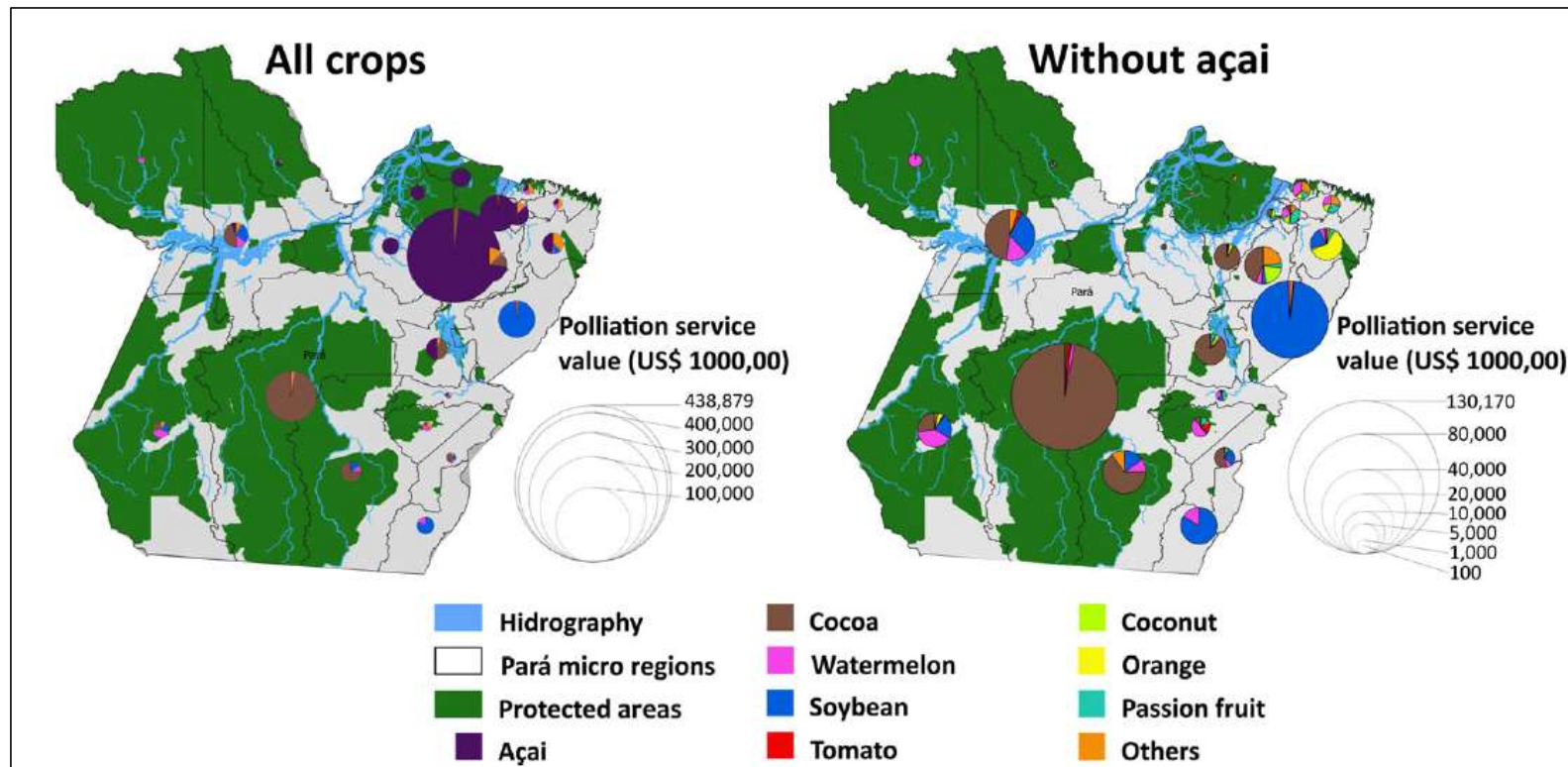


[16] Borges et al., 2020

# Value of pollination

- The value of pollination can increase through the value chain & trade
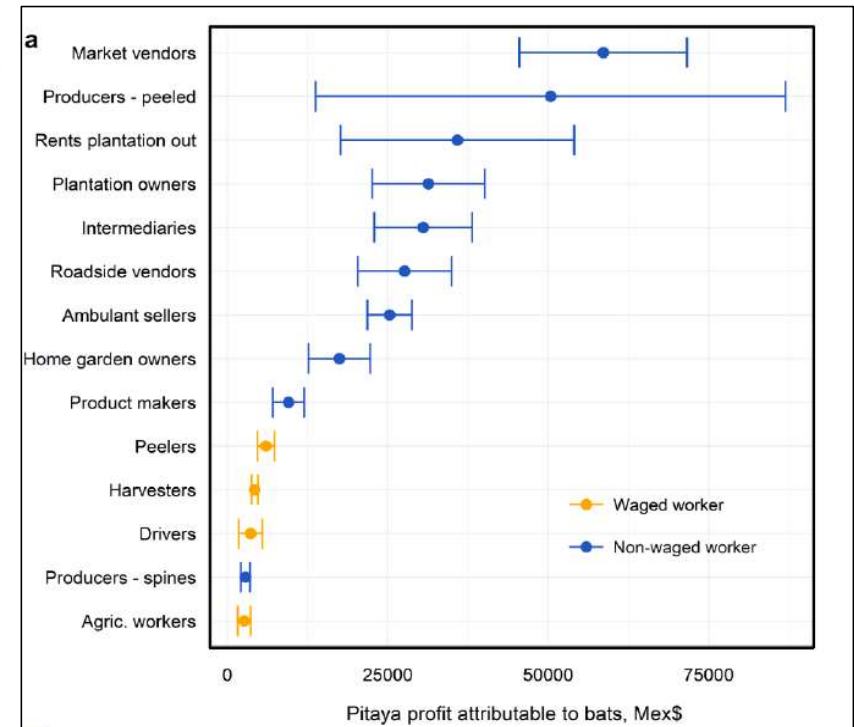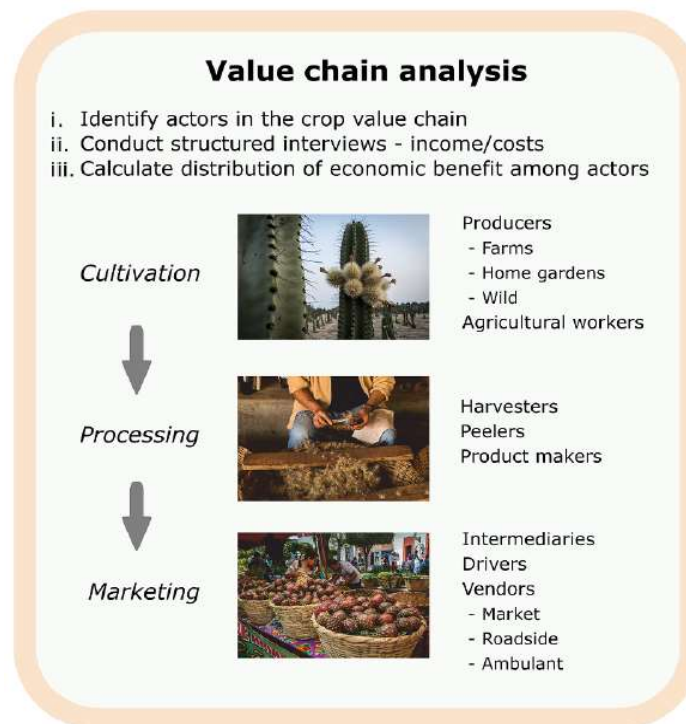


[17] Hasnain et al, 2021. [18] Tremlett et al., 2021
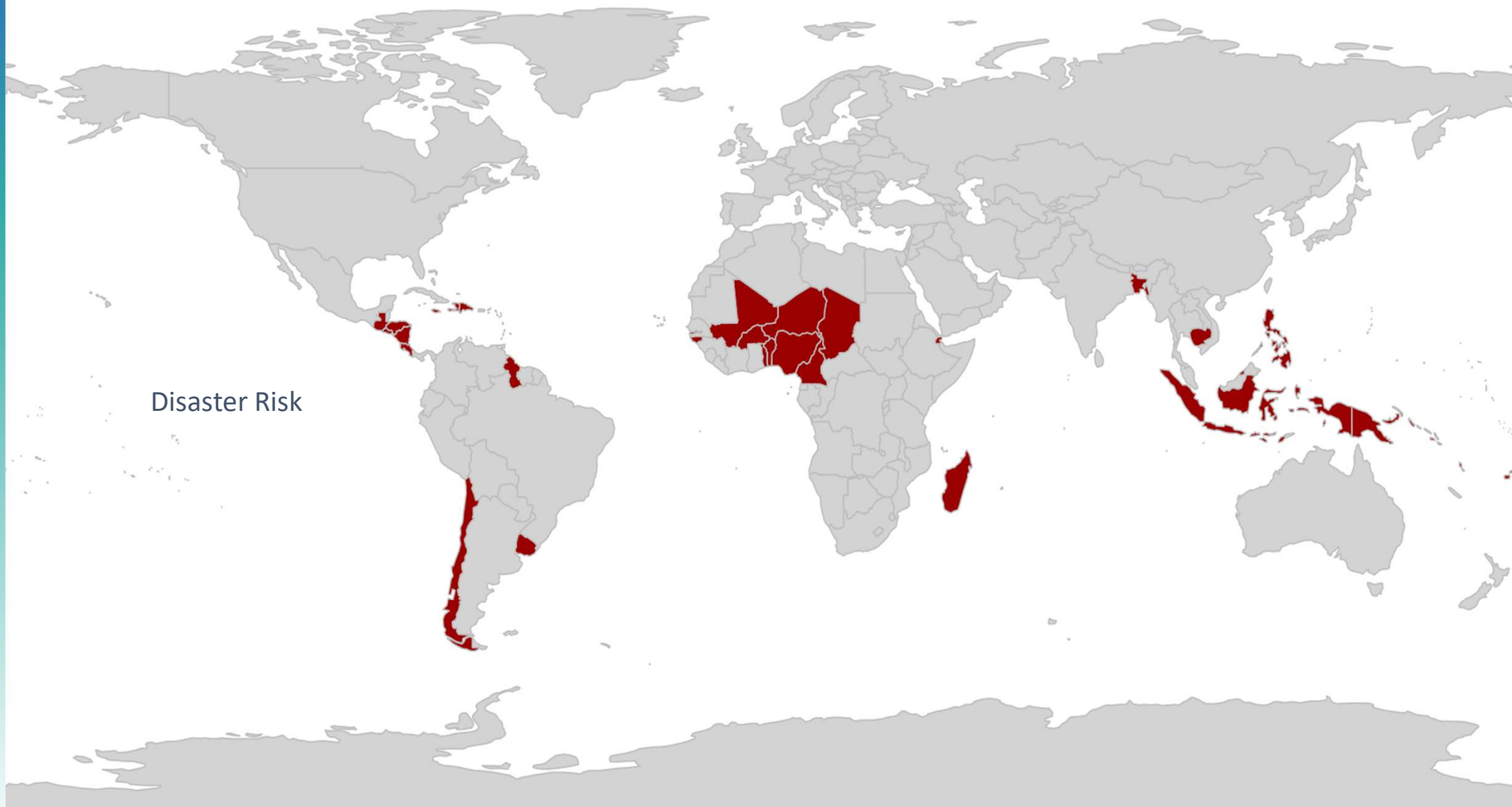
Disaster Risk

[19] Murphy et al., 2022

Countries where pollinators are lost

Disaster Risk

Bn US$

[19] Murphy et al., 2022

−1.7　−0.94　−0.37　−0.16　−0.055　−0.013　0.041　0.13　0.34　1.2

# Value of pollination



Vitamin A pollination dependency

Low — High

Areas excluded 0 — 0.7
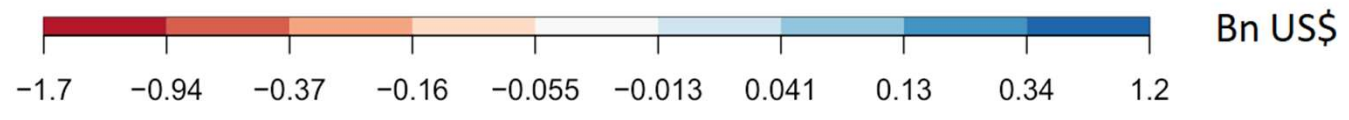
- Nutritional value
  - Pollinators contribute to nutrition by improving the quantity and availability of nutrients [32]

- Social values
  - Pollinators contribute cultural value in themselves and through pollinating culturally valuable plants
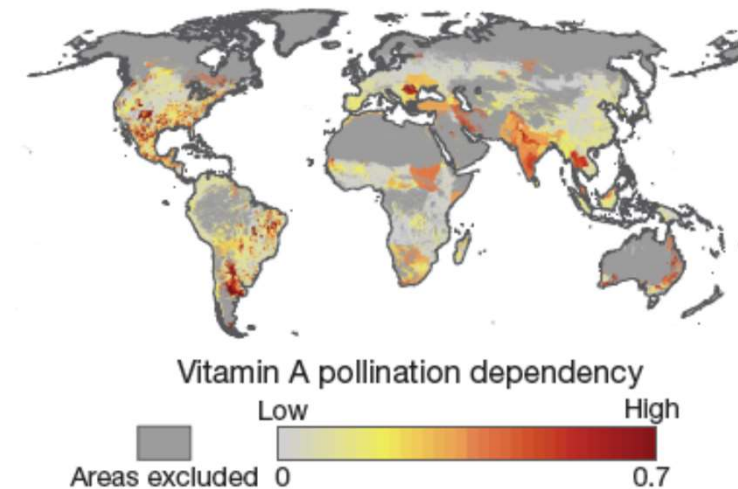


[20] Chaplin-Kramer et al., 2014. [21] Sumner et al., 2018

# Why include pollinators in NEAs?

UKNEA (2011) [22]

- Outlined the importance of pollinators to crops and ecosystems

- Highlighted their status and trends

- 
  Gave evidence on their main pressures and mitigations
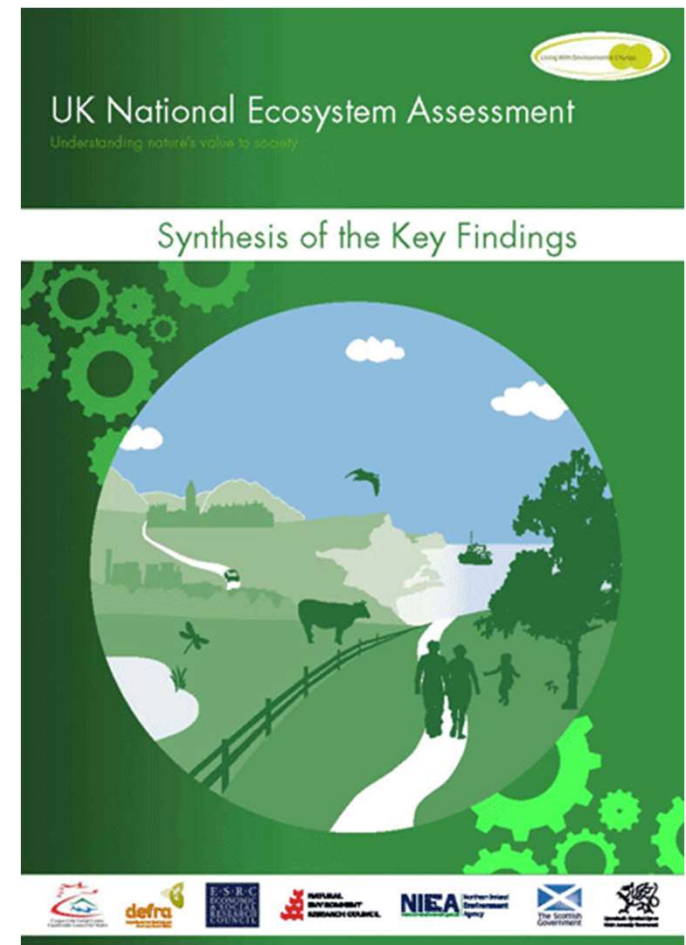
# Why include pollinators in NEAs?

UK Pollinator Strategy (2014) [23]

UK Pollinator Monitoring Scheme [24]

# Why include pollinators in NEAs?

Countryside Stewardship (2015) [25]

Dasgupta Review (2020) [26]
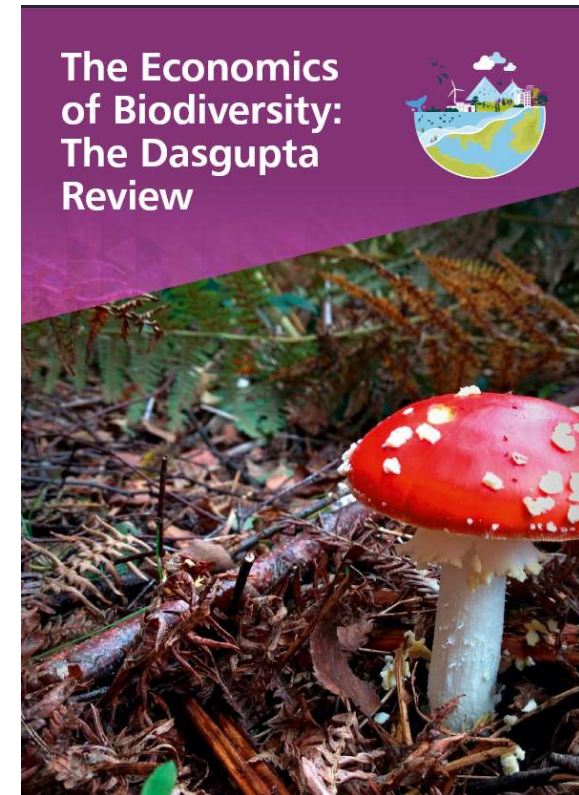
# Important statistics for NEAs

**Key Data**

This is the most basic data that is useful in itself

- How many animal pollinated crop species are there?
- How many species of wild pollinators are there?
- How many managed honeybees are there?

# Important statistics for NEAs

- How many animal pollinated crop species are there?
    - FAO/National statistics
    - Other local sources
- How many species of wild pollinators are there?
    - National museums
    - Literature
- How many managed honeybees are there?
    - National beekeeping societies
    - National agricultural statistics

# Important statistics for NEAs

**Basic Data**

This data is useful itself but can be easily transformed to create eye-catching statistics on the importance of pollination

- What is the area of pollinated crops?
- What is the total yield of pollinated crops?
- How much do pollinated crops sell for?
- How pollinator dependent are local crops?
- What species are key pollinators?
- What policy includes pollinators directly?

# Important statistics for NEAs

**Basic Data**

- What is the area/yield of pollinated crops and how much do they sell for?
  - **Gives an overview of how important pollinators are**
  - National and FAO statistics
  - Local farmers markets
- How pollinator dependent are local crops?
  - Klein et al., (2007) is a global review but needs an update
  - Primary literature for specific crops
  - *Field studies using bagging experiments

**Can be transformed into economic values**

# Important statistics for NEAs

**Basic Data**

- What species are key pollinators?
  - **Important to identify priority species**
  - Identified from literature
  - Can be estimated from literature in other countries
  - *Observational field studies
- What policy includes pollinators directly?
  - **Useful for an overview of the current policy landscape**
  - Review of current policy documents on e.g. biodiversity
  - *Consultation with relevant stakeholders

# Important statistics for NEAs

**Intermediate Data**

This data is harder to acquire but can be transformed into management recommendations or analyses of values

- Number of pollinated wild plant species
- Information on key traits (e.g. emergence, size) of pollinators
- Spatially explicit maps of habitats at a coarse (>1Km) resolution
- Pollinated crop prices (paid by other actors)
- Honeybee hive rental costs
- Beekeeper payments to farmers
- Information on the consumption of crops in local diets

# Important statistics for NEAs

**Intermediate Data**

- Number of pollinated wild plant species
    - **Gives an indication of the importance of pollination to wider ecosystems**
    - Drawn from the literature
    - Botanical databases (e.g. Kew [27]) may help
- Information on key traits (e.g. emergence, size) of pollinators
    - **Allows linking of pollinators to plants & analysis of trends**
    - Drawn from literature
    - *Traits can be estimated from specimens in the field or museums

# Important statistics for NEAs

**Intermediate Data**

- Spatially explicit maps of habitats at a coarse (>1Km) resolution
  - **Allows understanding of the general status of pollinator habitat**
  - Land records
  - Local or satellite mapping data
- Pollinated crop prices (paid by other actors)
  - **Illustrates the importance of pollinated crops to other actors**
  - Government databases on crop trade
  - *Direct interviews with stakeholders (e.g. retailers, co-operatives)

# Important statistics for NEAs

**Intermediate Data**

- Honeybee hive rental costs/beekeeper payments to farmers
  - **Important to understand the managed pollinator market**
  - Some beekeeping societies keep records
  - *Surveys of beekeepers and farmers
- Information on the consumption of crops in local diets
  - **Allows us to illustrate how important pollinators are to health**
  - Government databases on food consumption
  - *Food diaries and surveys

# Important statistics for NEAs

**Advanced Data**

This data will need dedicated work to gather and/or model but will result in some of the most powerful evidence.

*Managed pollinators*

- Wild honeybee population estimates
- Map of honeybee distribution
- Numbers of other managed pollinators used in agriculture

# Important statistics for NEAs

**Advanced Data**

This data will need dedicated work to gather and/or model but will result in some of the most powerful evidence.

*Trends and pressures*

- Information on species occurrence
- Systematic transects data of pollinators
- Spatially explicit climate data
- Spatially explicit maps of habitats at a high (<1km) res.
- Spatially explicit data on pesticide use

# Important statistics for NEAs

**Advanced Data**

This data will need dedicated work to gather and/or model but will result in some of the most powerful evidence.

*Values*

- Observational data of key plant-pollinator networks
- Information on pollinated crop value chains
- Crop price elasticities of demand
- Cross-price elasticities of crops
- Information on social and cultural values of pollinators

# Important statistics for NEAs

**Advanced Data**

*Managed pollinators*

- **Illustrates the importance of managed pollinators and the pressures they may pose to wild species.**

*Trends and pressures*

- **Allows us to map and model pollinator populations and track their populations over time relative to ecosystems/crops**

*Values*

- **Allows us to highlight the values to wider society, including international trade**

# Discussion session

1. What do you think pollinators will fit in your assessment?

2. What information do you think would be most useful?

3. What data is actually available?

4. What can we do to support you?

# DEVELOPING DATA CHECKLIST

**Checklist developed – based on:**

1. the country context

2. expert's experiences

3. data visibility
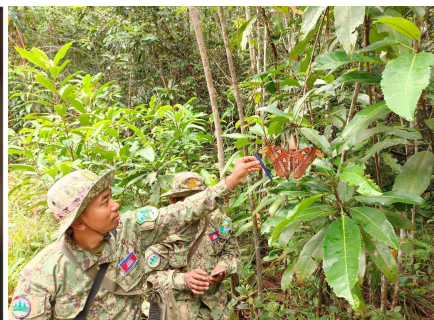


| Data | Yes/No | Source(s) | Regional or National scale | Time Period | Notes | NEA Section |
|---|---|---|---|---|---|---|
| List of pollinated crop species in Cambodia | Yes | Try - List of crop species, Klein et al to identify which are pollinator dependent | Maybe | Since 15 years ago | | Ch2: S5.1.4. |
| Pollinated crop yield statistics | Yes | Try - can provide some key crops, may have more on the ministry of agriculture, also some FAO data, Klein et al 2007 | Regional | | | Ch2: S4.2. |
| Pollinated crop prices (paid to growers) | Yes | Try - can provide average price through the year for some crops (e.g. Longan), check the ministry of agriculture website | | | | Ch2: S4.2. |
| Pollinated crop prices (paid by other actors) | No | | | | | |
| Information on pollinated crop value chains | Yes | Try - to list different actors in Longan value chain | | | | Ch2: S5.1.4. |
| Field data on observed pollinators | Yes | Try - UNESCO report and ask your colleauge about the stingless bee work | | | | Ch2: S5.1.4. OR Ch3 |
| Managed honeybee numbers | Yes | Try - Beekeeping association counts based on annual gathering (~10,000) | | | | Ch2: S5.1.4. |
| Honeybee hive rental costs | No | Very rare, if it occurs at all | | | | Ch2: S4.2. |
| Beekeeper payments to farmers | Yes | Try - can provide estimates for some crops (e.g. Longan $100/50 hives, Capo Tree $200/50 hives, Rubber Tree - payment to protect the hives from theft. Cashew nut - challenges with insecticide so no payment to use that crop), Common occurance, especially for larger numbers of hive | | | | Ch2: S4.2. |
| Wild honeybee population estimates | No | | | | | |
| Number of wild pollinator species | Yes | UNESCO Report | | | | Ch2: S5.1.4. OR Ch3 |
| Map of honeybee distribution | Yes | Try - habitat suitability maps for honeybee distribution | | | | Ch2: S5.1.4. OR Ch3 |
| Habitat maps (vector or raster format) | Yes | Ministry of Environment - May not be very habitat specific | | | | Ch3 (minor mention) |
| Information on species occurance | No | | | | | |
| Systematic transects of pollinators | No | | | | | |
| Spatially explicit climate data | Yes | Ministry of Environmnet | | | | Ch3 (minor mention) |
| Crop price elasticities of demand | Yes | Phanith - Ministry of Commerce may have elasticities, may be difficult to get hold of. May be able to estimate from FAO report. | | | | Ch2: S4.2. |
| Cross-price elasticities of crops | Yes | see above | | | | Ch2: S4.2. |
| Information on crop consumption in local diets | No | | | | | |
| Policy documents that concern pollinators | No | No specific policy documents on them yet | | | | |

# INTEGRATING INTO THE NEA REPORT

This section will highlight the crucial value of ecosystems that are contributing to priority sectors in Cambodia such as agriculture, tourism, health, education… Cambodia designed a huge Protected Areas, so we will also highlight the contribution of of PAs in economic development and human wellbeing

**Key Outline of Pollination Integration in NEA Report**
- General awareness of pollination for Cambodia people
- What is pollination?
- Pollinators in Cambodian Agriculture
- What species are important as pollinators?
- Pressures on pollinators in Cambodia
- Beekeeping in Cambodia



eg. of the patterns recorded the beekeepers

# POLLINATORS IN CAMBODIAN AGRICULTURE

| English name | Latin name | Average yield | Pollinator dependence | Planted Area | Reference |
|---|---|---|---|---|---|
| Kapok tree | *Ceiba pentandra* | 2000fruit/plant | Unknown | 2500ha | Dr Yorn Try |
| Coffee | *Coffea robusta Lindens.* | 7/ha | 25% | 100ha | Dr Yorn Try |
| Lemon | *Citrus limonia Osbek.* | 8/ha | 5% | Unknown | Dr Yorn Try |
| Pomelo | *Citrus grandis oshek.* | 15/ha | 5% | Unknown | Dr Yorn Try |
| Orange | *Citrus sinensis* | 14t/ha | 5% | Unknown | Dr Yorn Try |
| Rose apple | *Eugenia jambos* | 10t/ha | Unknown | Unknown | Dr Yorn Try |
| Lotus | *Nelumbo nucifera Gaetem.* | 1t/ha | Unknown | 3000ha | Dr Yorn Try |
| Coconut | *Cocus nucifera L.* | 100fruit/plant | 25% | 8000ha | Dr Yorn Try |
| Egg plant | *Solanum melogena L.* | 70t/ha | 25% | Unknown | Dr Yorn Try |
| Guava | *Psidium guajava L.* | 2t/ha | 25% | 5000ha | Dr Cheang Hong |
| Cucumber | *Cucumis sativus L.* | 30/ha | 65% | 15000ha | Mr Uk Sam On |
| Wax gourd | *Benincasa cerifera savi.* | 28t/ha | Unknown | 9000ha | Mr Uk Sam On |
| Durian | *Durio zibenthinus L.* | 14t/ha | 65% | 25000ha | Mr Touch Ratha |
| Cashew nut | *Anacardium occidentale* | 1t/ha | 65% | 300000ha | Mr Neang Khemrin |
| Sapodilla | *Manilkara zapota* | 8t/ha | 95% | Unknown | Mr Khorn Sainghea |
| Sunflower | *Helianthus annuus* | 1.5t/ha | 25% | Unknown | Dr Bob Martin |
| Jujube | *Zyziphus mauritiana Lam.* | 5t/ha | 25% | Unknown | Dr Cheang Hong |
| Longan | *Euphoria longan Steud.* | 9t/ha | 5%-65%* | 17000/Ha | Mr Touch Sin |
| Bitter melon | *Momordica chorantia L.* | 40t/ha | Unknown | Unknown | Mr leum Bunthy |
| Sesame | *Sesamum idicum L.* | 0.72t/ha | 25% | 34127ha | MAFF |
| Pumpkin | *Cucurbita pero L.* | 23t/ha | 95% | Unknown | MAFF |
| Papaya | *Carica papaya L.* | 20t/ha | 5% | Unknown | Mr Khen |
| Rambutan | *Nephelium lappaceum L.* | 7t/ha | 5% | Unknown | Mr Khen |
| Mango | *Manghifera indica L.* | 15t/ha | 65% | 100000ha | Mr Touch Sin |
| Dragon fruit | *Hylocereus undatus Britta R* | 5t/ha | Unknown | 2000ha | Dr Yorn Try |
| Soya bean | *Soya hispida moench.* | 1.47t/ha | 25% | 78435ha | MAFF |
| Mung bean | *Vigna radiat* | 1/ha | 5% | 53282ha | Bob Martin |
| Watermelon | *Citrullus lanatus Mats.* | 25t/ha | 95% | 10000ha | CamSID project |

# PRESSURES ON POLLINATORS IN CAMBODIA
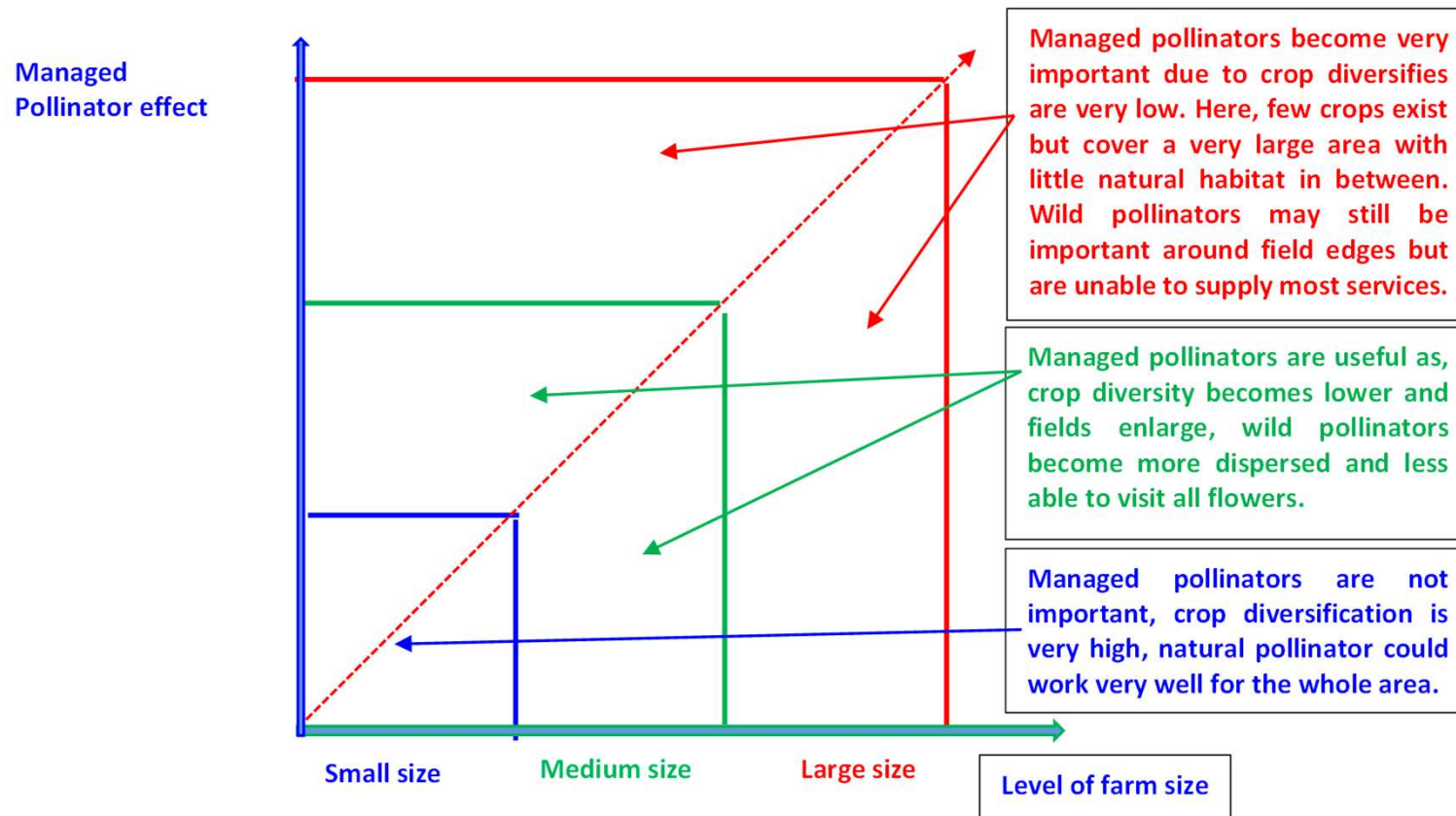


Relationship between crop area and managed pollinator importance

# Thank !