



Documenting shifts in pollinators and plants ... and mitigation options

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European Commission FP 7

More information: www.STEP-project.net



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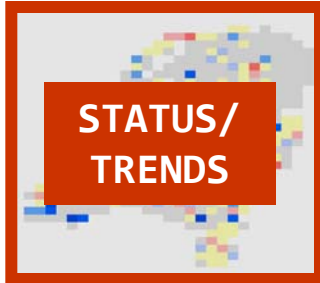
Towards holistic approaches to the risk assessment of multiple stressors in bees

an open scientific debate on the most recent scientific progress made on:

- **Monitoring** **STATUS / TRENDS**
- **Risk assessment of multiple stressors** **DRIVERS**
- **(crop) Pollination** **IMPACTS**
- **Current and future food security**



What is affecting bees ?



How are bee populations changing?



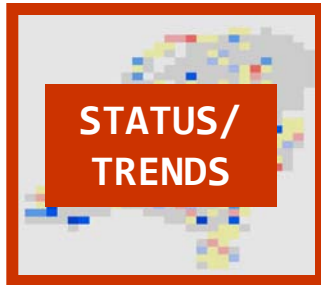
Is food production affected ?



What can we do about it ?



What is affecting bees ?



How are bee populations changing?
Carvalho et al. 2013 Ecology Letters



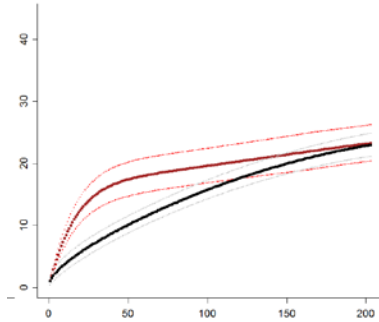
Is food production affected ?



What can we do about it ?
What are we aiming to protect?

Documenting change in bees

1 - How to compare unequally sampled cells ?

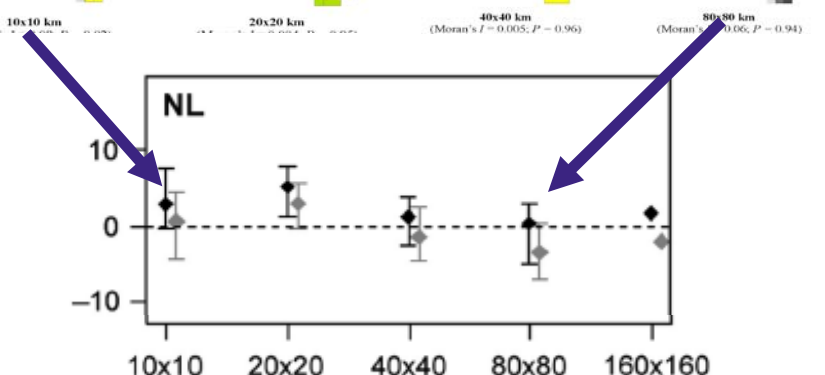
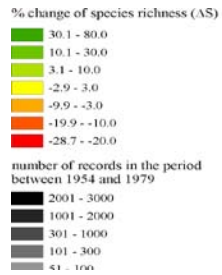
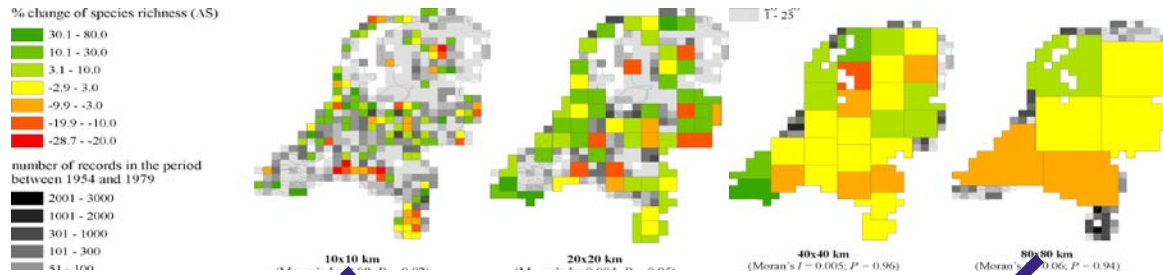


Cell level:
accumulation
curves



Across cells:
meta-analysis
methods

2 - What is optimal spatial resolution for analysis?



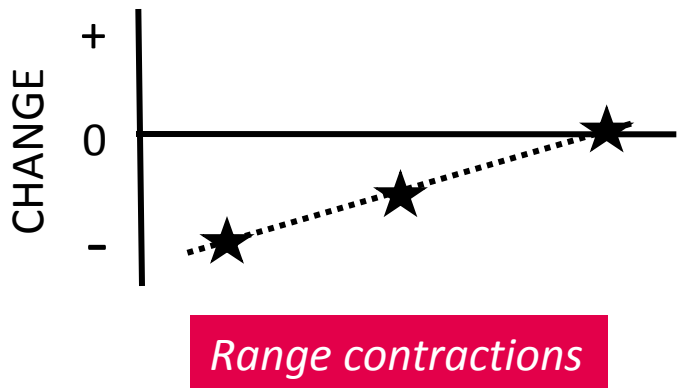
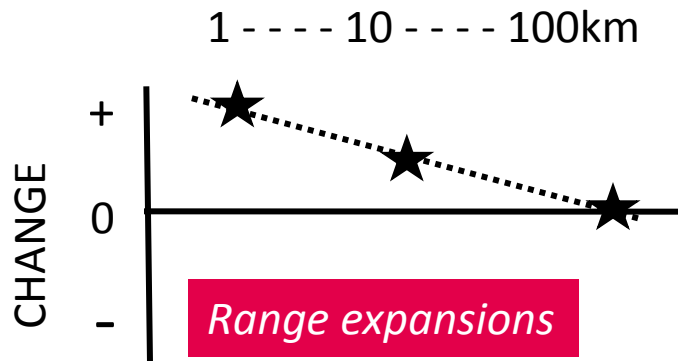
Keil et al. (2010)
Ecography



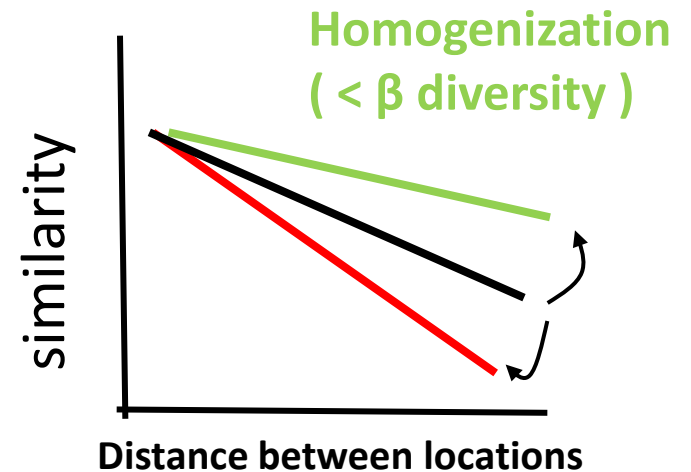
Spatial scale of analysis determines levels of change detected!

Multi-scale analysis hints at process

SPECIES RICHNESS



COMMUNITY SIMILARITY



Heterogenization
($> \beta$ diversity)

Data, Space and Time

Area



Data

➤ 32 Million records

Spatially explicit historical records

1km → All country

Time periods of 20 years

1950-1969

1970-1989

1990-2009

Species

➤ Bees

➤ Butterflies

➤ Hoverflies

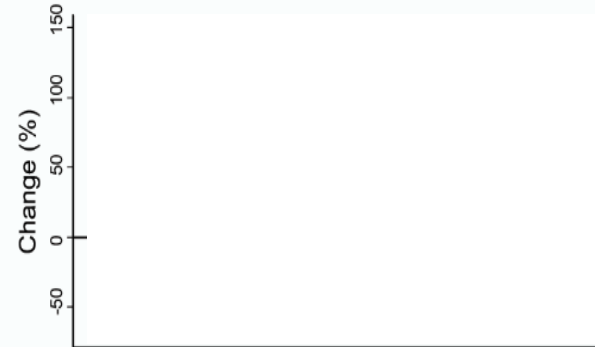
➤ Plants

Changes in bee assemblages up to 1990

Netherlands



Belgium



UK

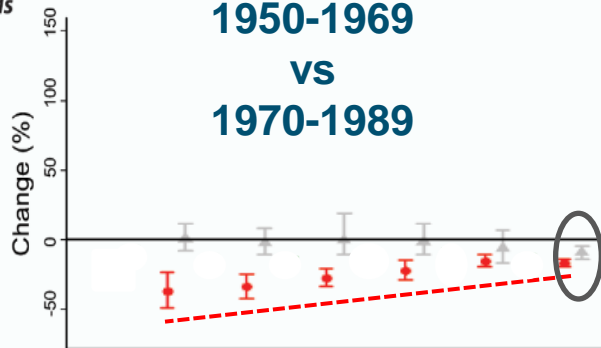


Changes in bee assemblages up to 1990

Netherlands



1950-1969
VS
1970-1989

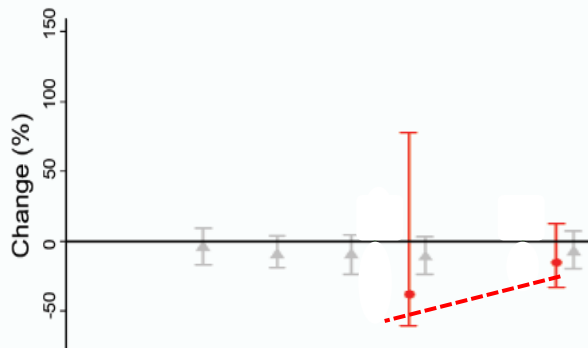


Bombus



other bees

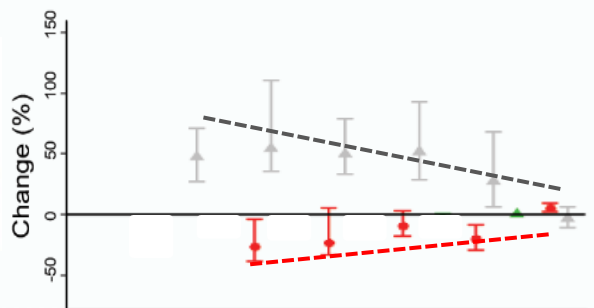
Belgium



**Bumblebees
richness loss &
range contractions**

Other bees
Richness loss in Netherlands
UK are doing OK

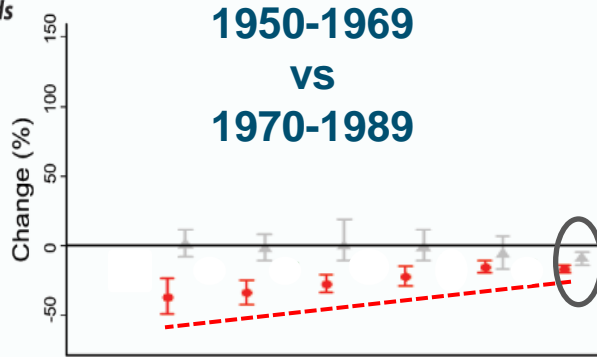
UK



1 km 10 km 20 km 40 km 80 km 160 km All country

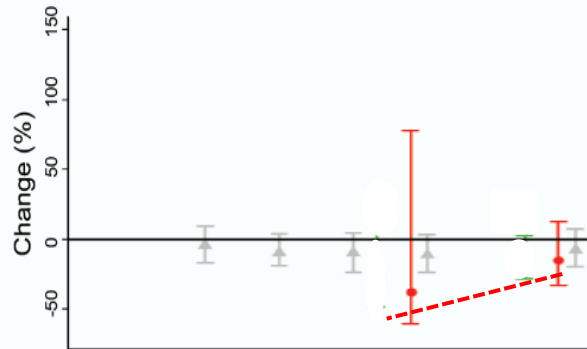
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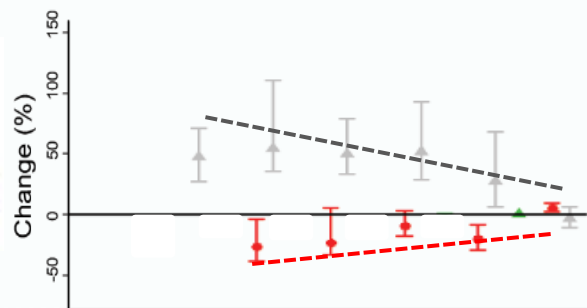


■ Bombus
▲ other bees

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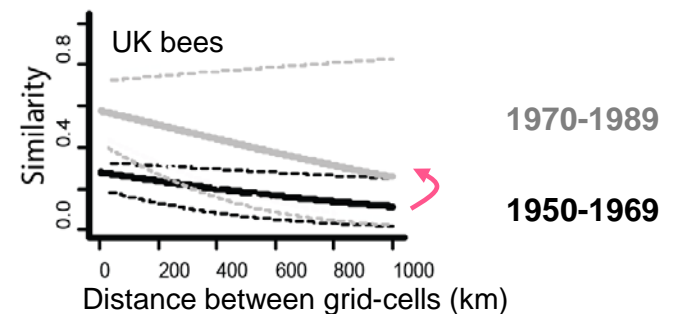
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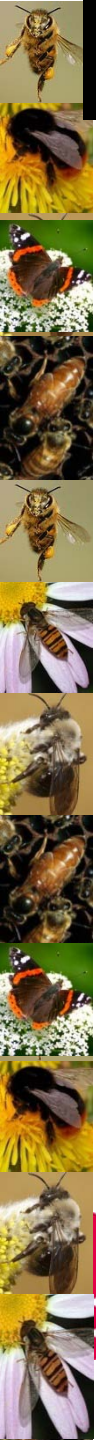


BUT....





became more homogeneous
through space

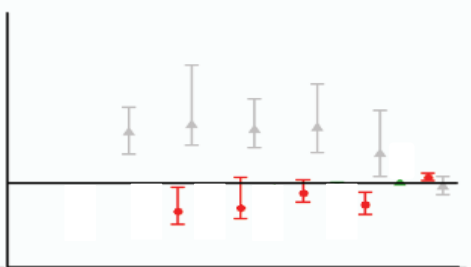
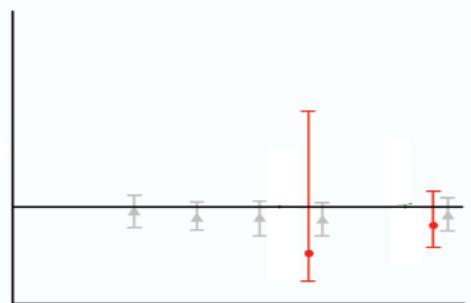
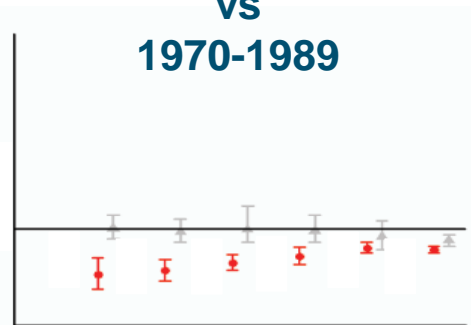


Changes in bee assemblages after 1990



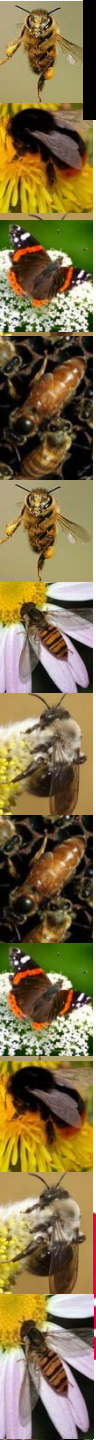
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  Bombus
  other bees







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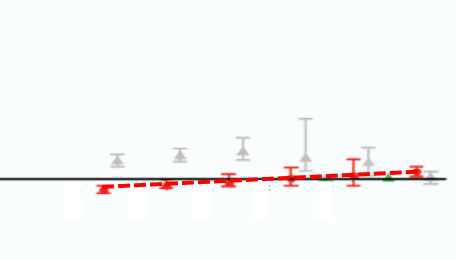
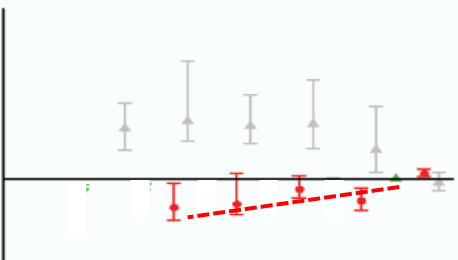
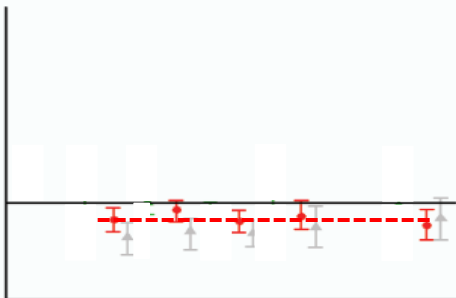
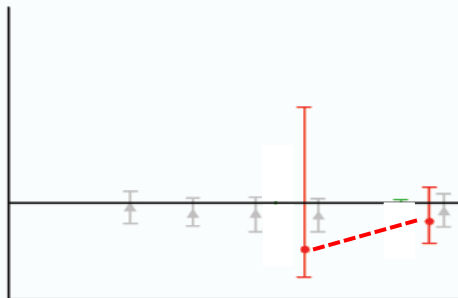
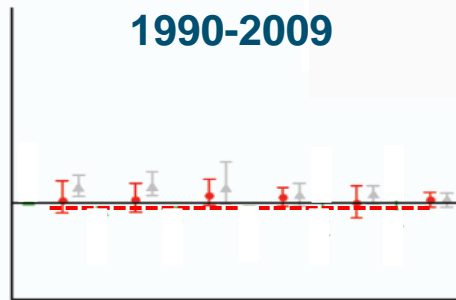
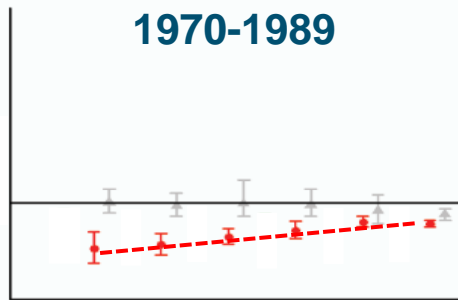
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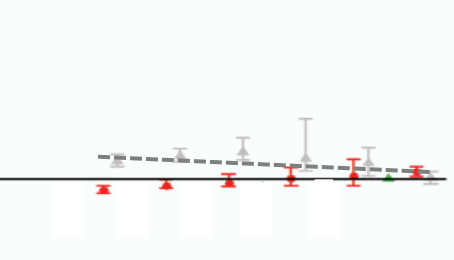
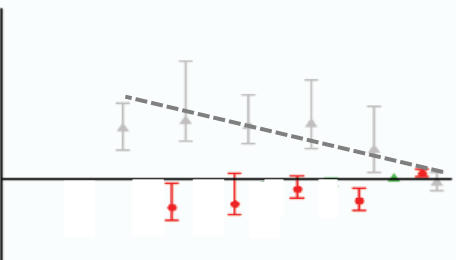
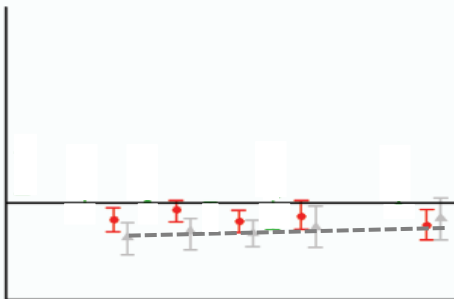
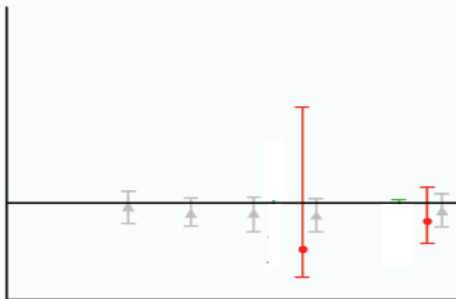
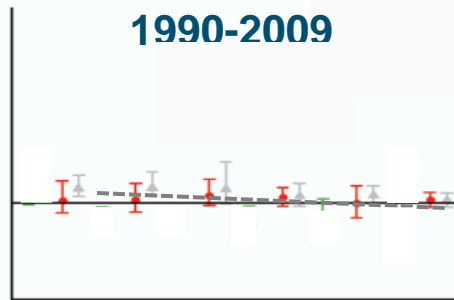
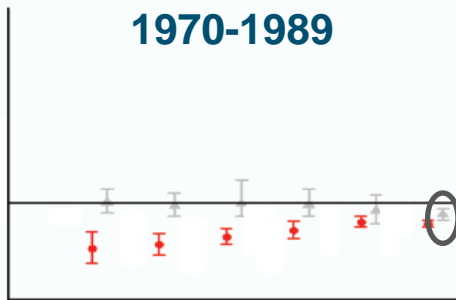
**Bumblebees
richness loss
less accentuated**

Changes in bee assemblages after 1990

1950-1969
VS
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  Bombus
  other bees



**Bumblebees
richness loss
less accentuated**

Other bees

No more losses in NL

**Small richness increases
in UK
but decline in Belgium**

1 km 10 km 20 km 40 km 80 km 160 km All country

Is community similarity changing through time?

1950-1969

1970-1989

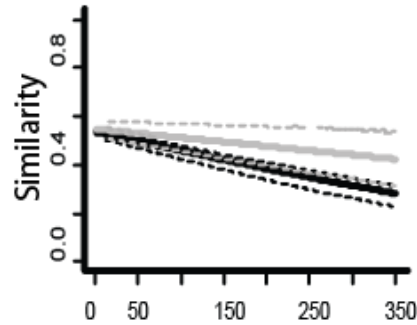
1990-2009

10km grids
Netherlands only

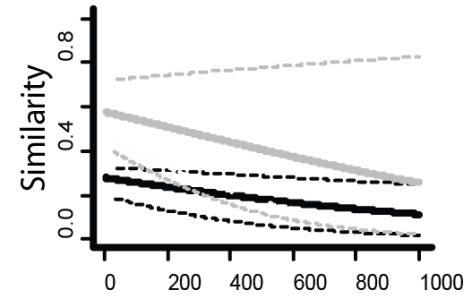
Bees



NL



UK

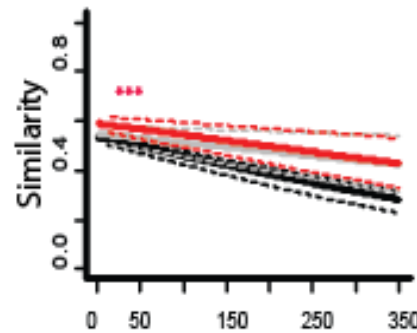


Distance between 10km² grids (km)

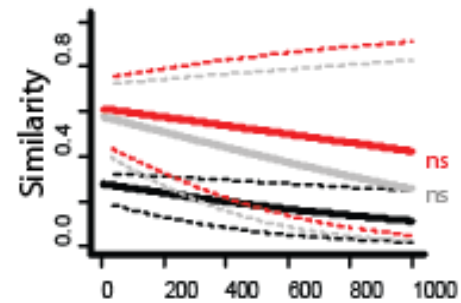
Bees

Bees

NL



UK



Homogenization has slowed down

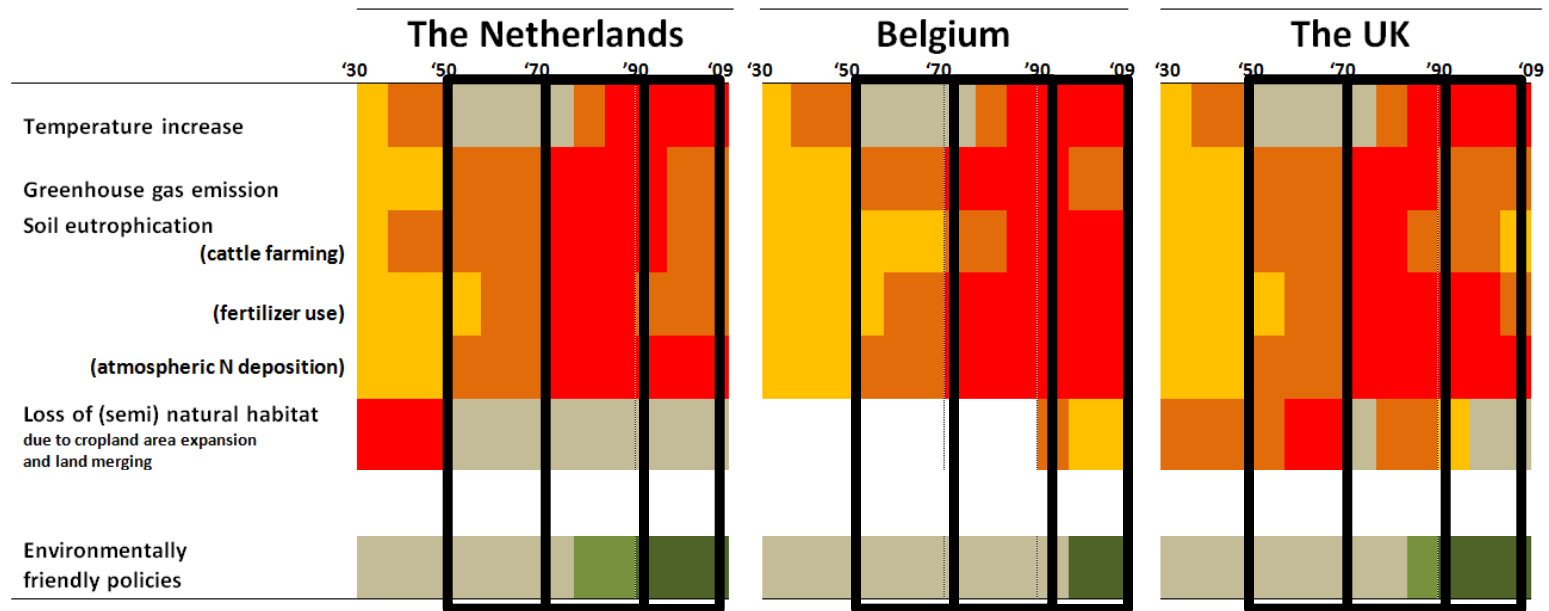
Summary of results

1950s to 1979

Extensive biodiversity loss and biotic homogenisation

1990s to 2009

Negative trends have slowed down (or recovery has set in)





MITIGATION

What can we do about it ?

What are we aiming to protect?

Honeybees

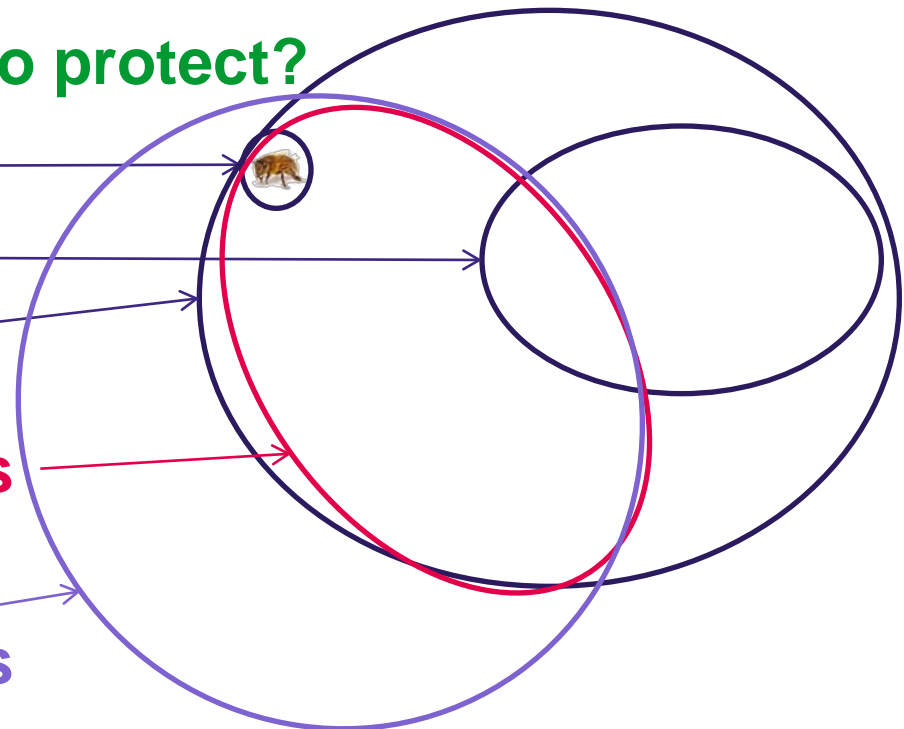
Rare bees

All bees

Crop pollinating bees

Crop production

→ all crop pollinators

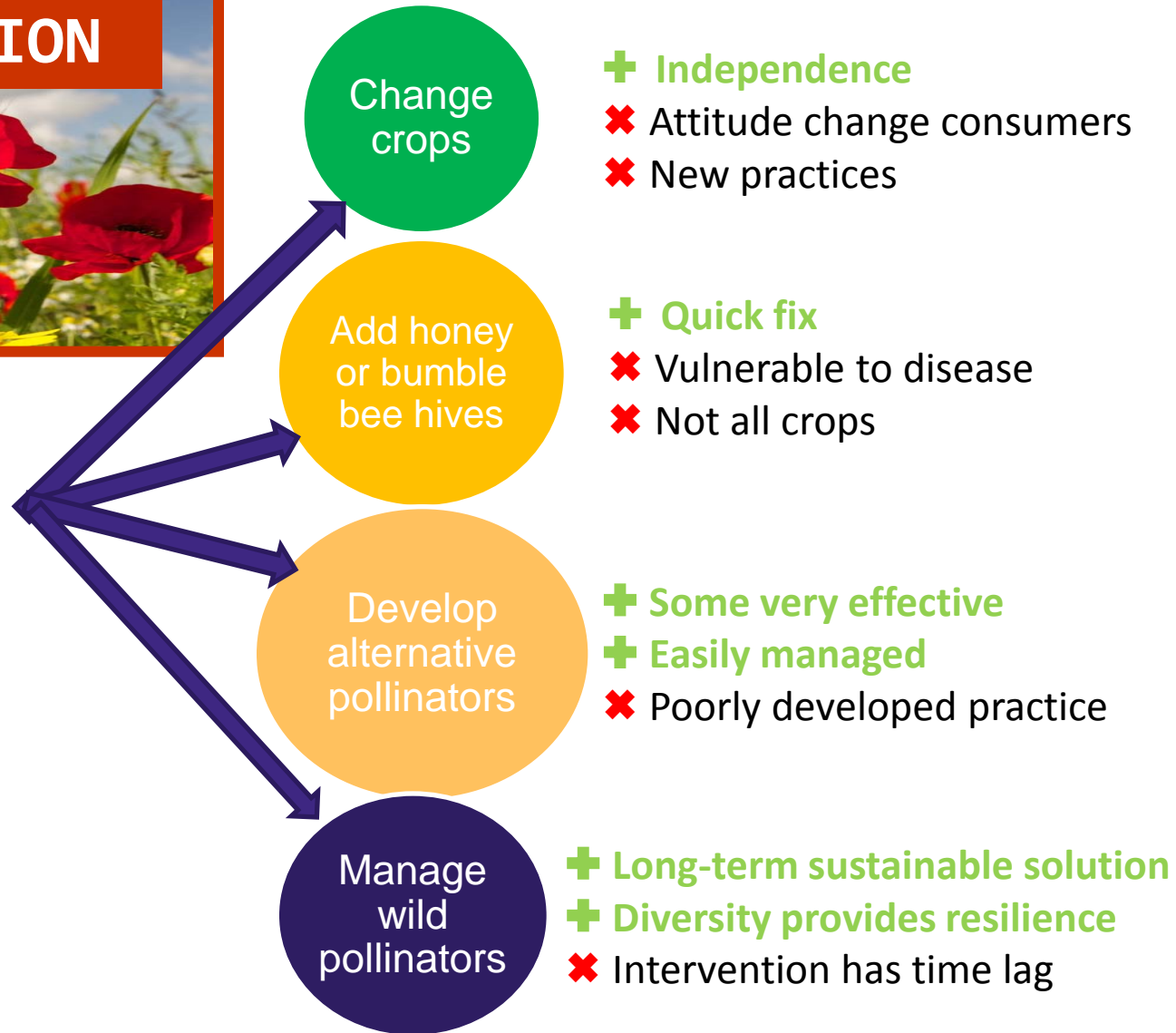


Which measures work for which aim?



MITIGATION

Crop pollination deficits

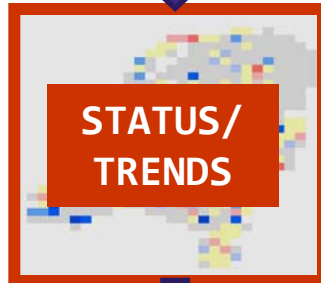


..... in the year 2013:



Multiple pressures!

[Vanbergen et al. 2013 Front Ecol. Evol
Gonzalez et al. TREE in press]



Wild bee declines less severe than <1990
We are still worse off than <1970

[Carvalho et al. 2013 Ecology Letters]



Bee diversity is best for production !

[Garibaldi et al. 2013 Science]



Organic and diverse farms/landscapes are best!
Flower strips work for pollinators !

[Kennedy et al. 2013 Ecology Letters
Scheper et al. 2013 Ecology Letters]



Thank You

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