Optimizing Biodiversity Benefits

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Loss of Biodiversity

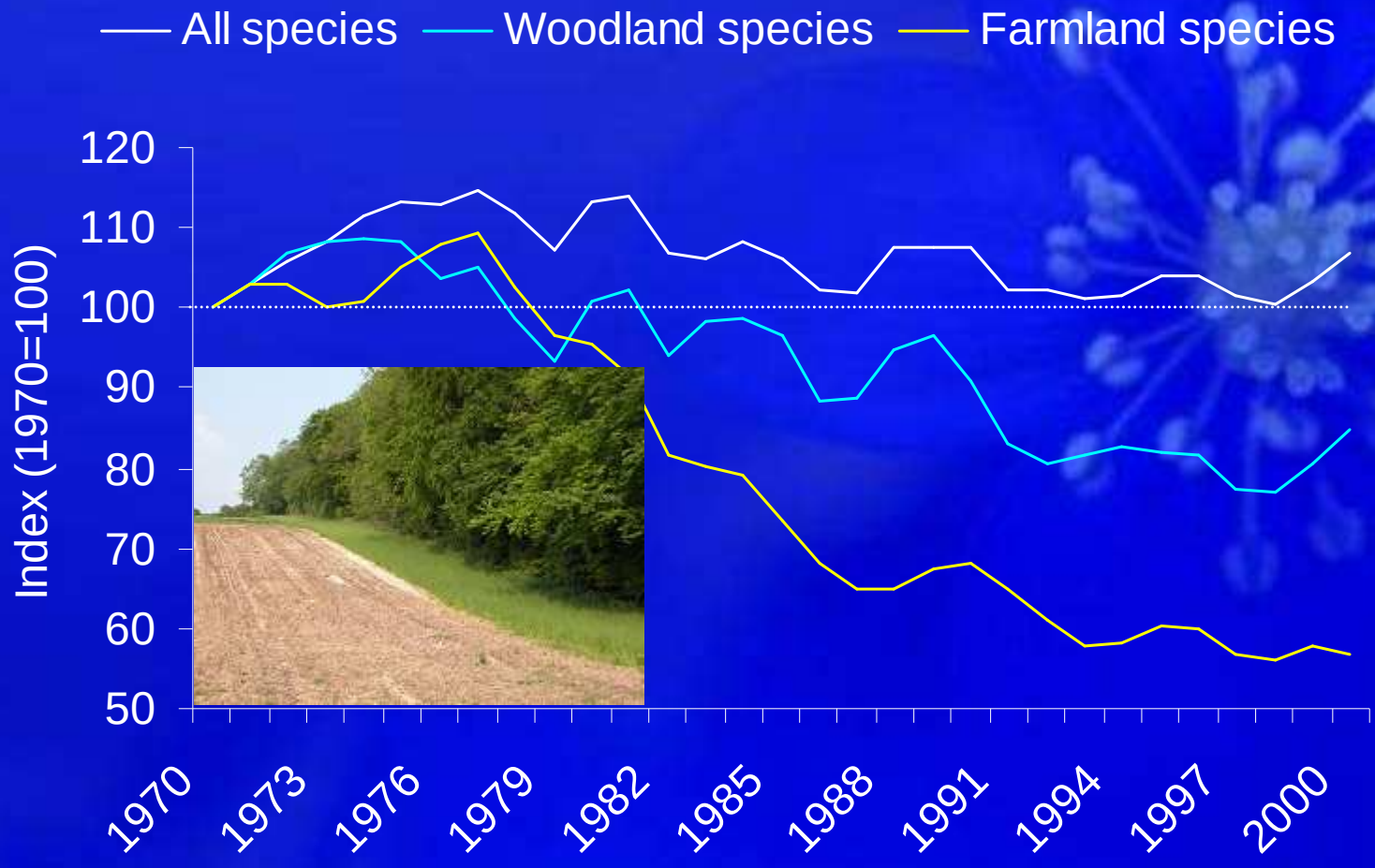
<u>On the landscape level:</u>

- Larger fields
- Loss of non-crop elements

<u>On the field level:</u>

- Fewer crop varieties
- Increased use of agrochemicals

Agri Environment Schemes



Source: RSPB, BTO, DEFRA

Agriculture → **Environment**

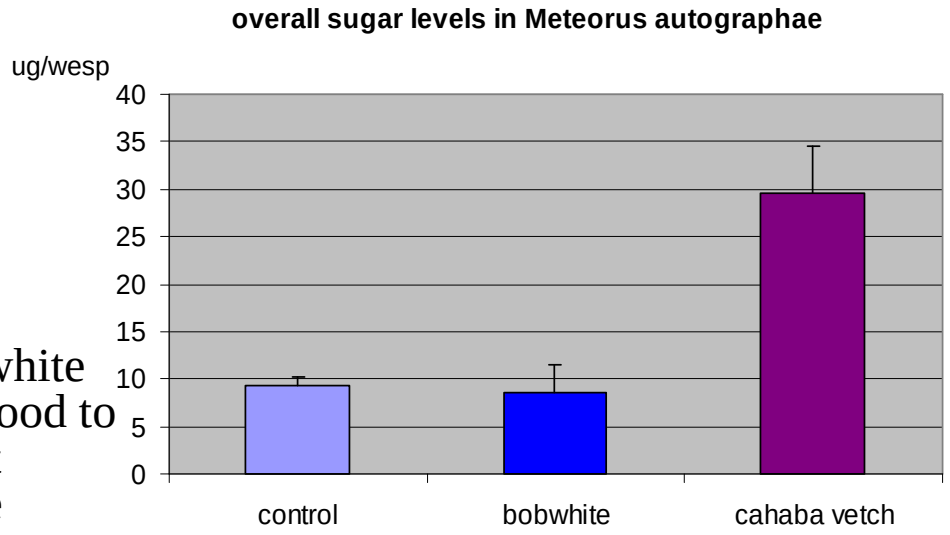
?

Do diverse bird conservation margins benefit biological pest control?

Meteorus autographae

Parasitoid feeding at a vetch nectary

Conclusions



High diversity field margins for bobwhite quail conservation failed to provide food to a biological control agent and did not enhance biological pest control in the adjacent crop.

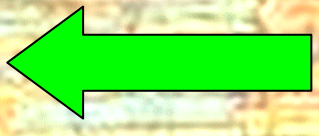
Parasitoids did clearly benefit from pure stands of cahaba white vetch.

We can optimize ecosystem services if we target agri-environment scheme options to requirements of beneficial insects

Olson & Wäckers (2007), J. Appl. Ecol. 44:13-21

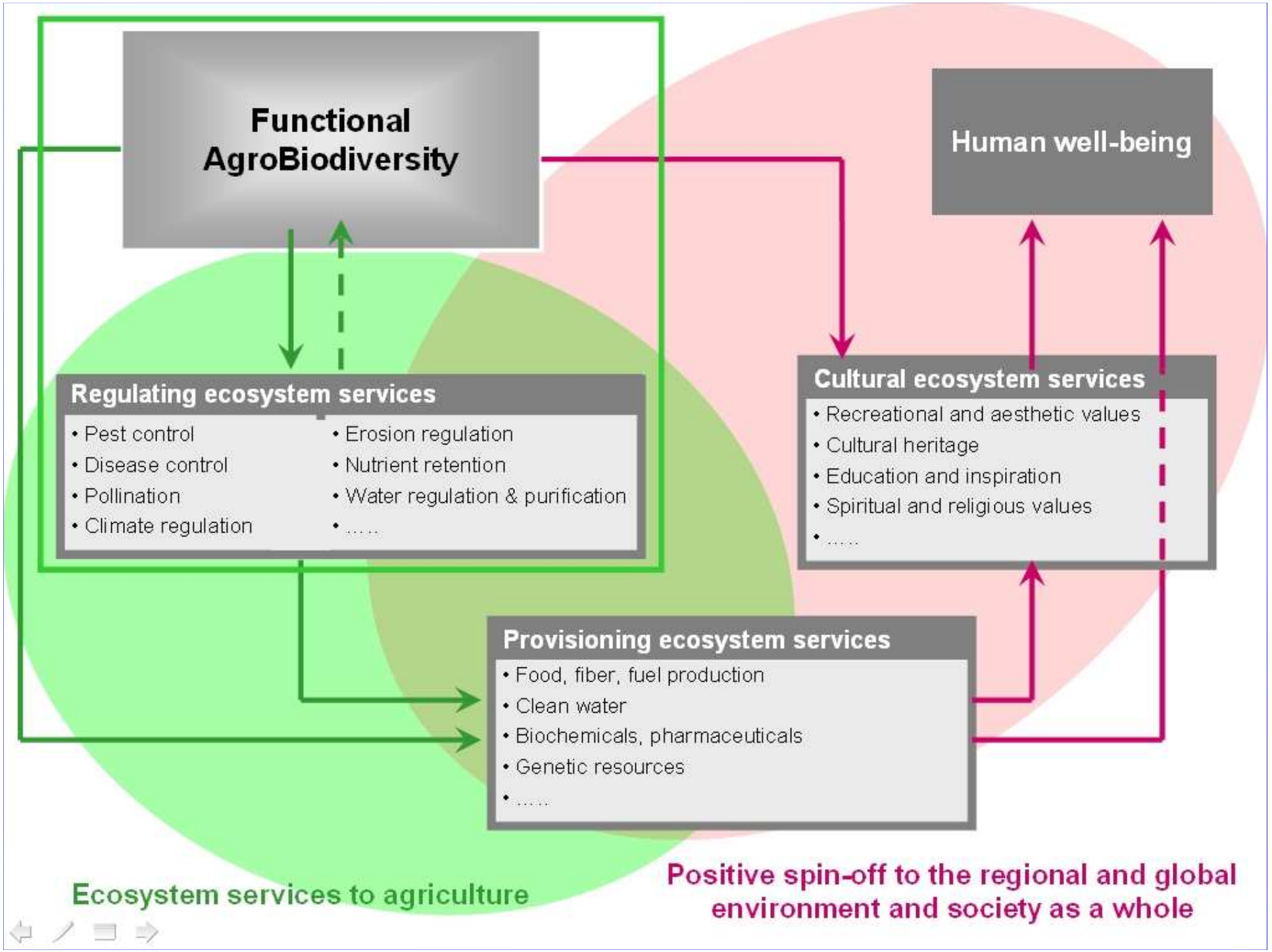
Parasitoid feeding at a vetch nectary

Functional Biodiversity

Agriculture  **Environment**

Biodiversity on the scale of agricultural fields or landscapes, which provides ecosystem services that support sustainable agricultural production

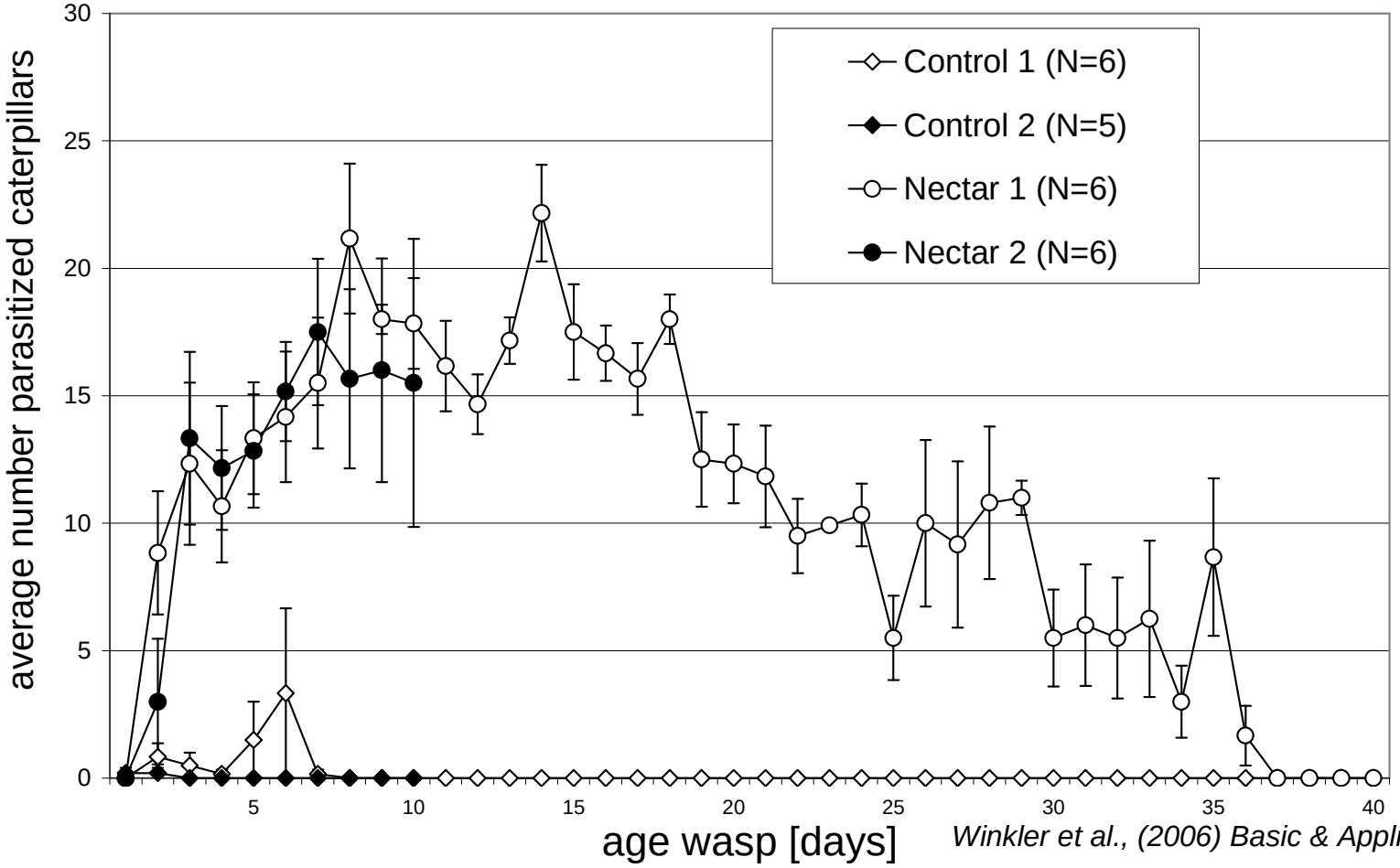
and can also have a positive spin-off to the regional and global environment and society as a whole.


Functional AgroBiodiversity
Human well-being
Regulating ecosystem services
• Pest control
• Disease control
• Pollination
• Climate regulation
• Erosion regulation
• Nutrient retention
• Water regulation & purification
• .....
Cultural ecosystem services
• Recreational and aesthetic values
• Cultural heritage
• Education and inspiration
• Spiritual and religious values
• .....
Provisioning ecosystem services
• Food, fiber, fuel production
• Clean water
• Biochemicals, pharmaceuticals
• Genetic resources
• .....
Ecosystem services to agriculture
Positive spin-off to the regional and global environment and society as a whole

EXAMPLE:
Optimizing biological pest control / pollination

Bottleneck: Lack of nectar and pollen in many cropping systems

The impact of nectar sources on biocontrol efficacy



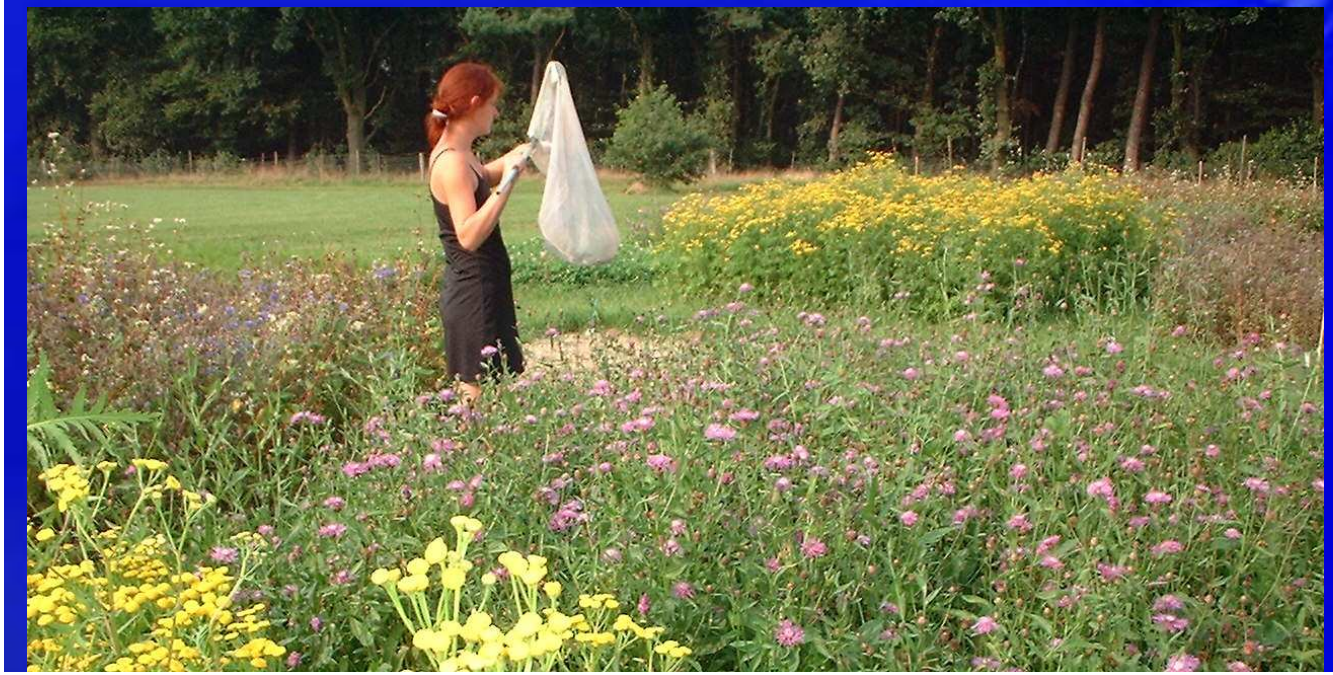
Winkler et al., (2006) Basic & Applied Ecol. 7:133-140

How to optimize services?

Informed selection of flowering plant species

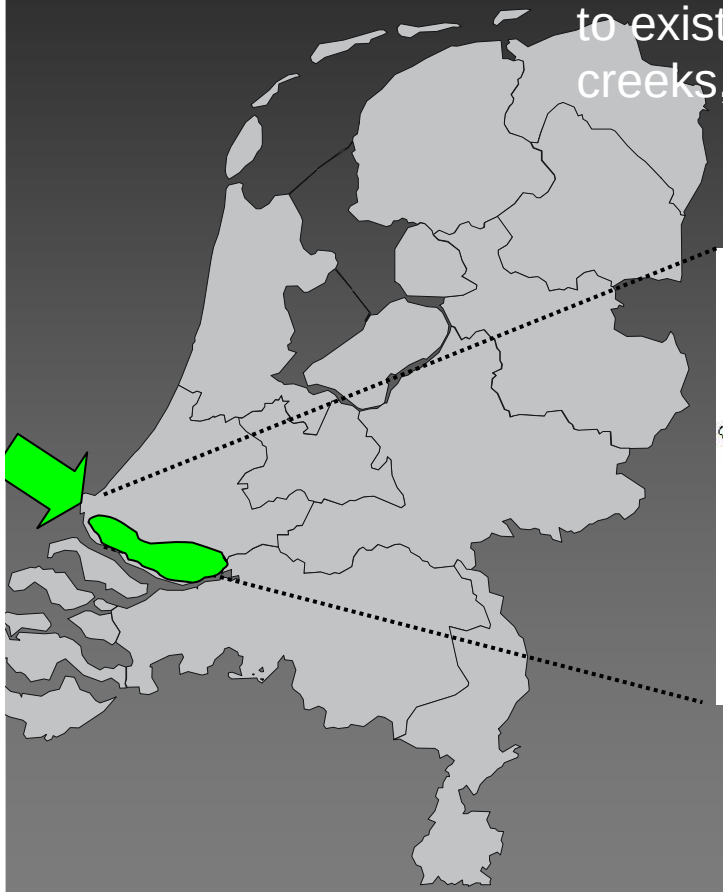
Different organisms have different requirements

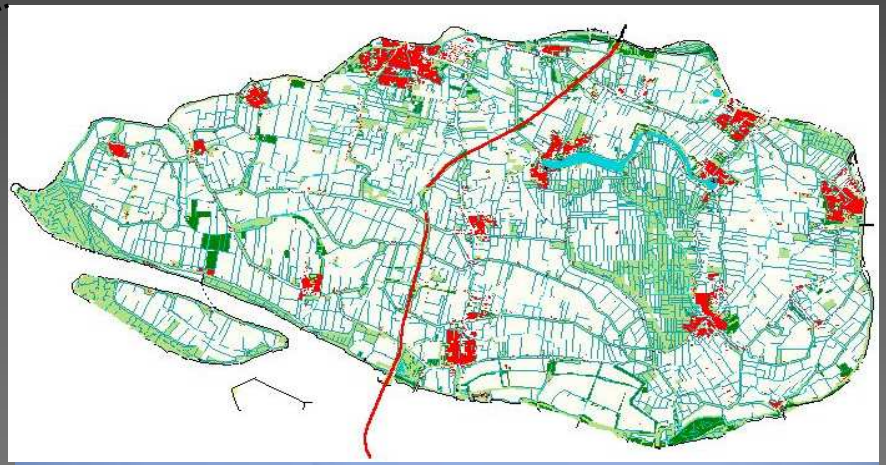
- Identify resource requirement of target organisms providing ecosystem services
- Identify plant species that are effective in providing these resources
- Introduce selected biodiversity into agro-ecosystem



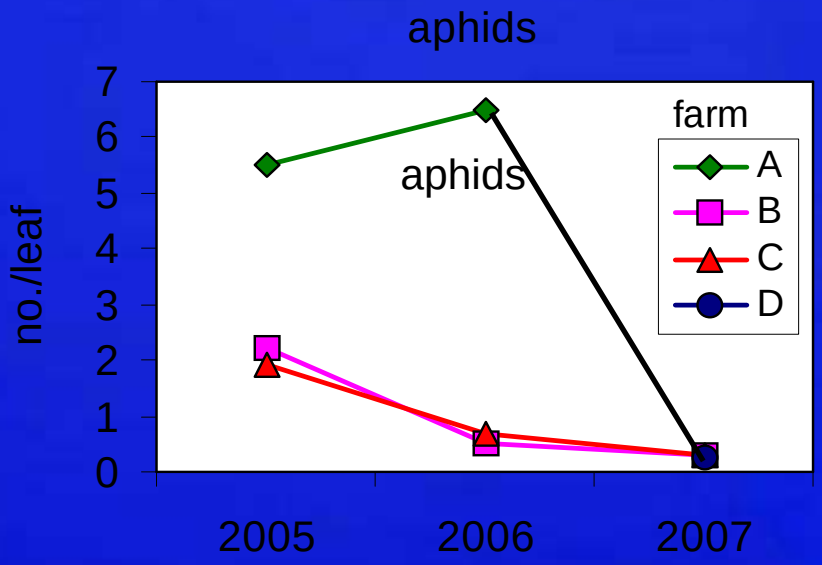
Functional agro-biodiversity (FAB).

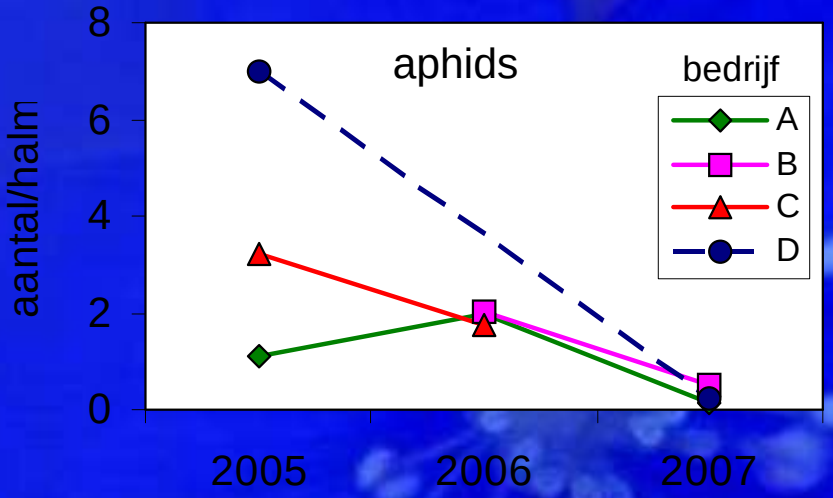
Large scale biodiversity project in the Hoekse Waard working with conventional growers. Addition of annual and perennial field margins to existing landscape features (polders, dikes, creeks, canal borders).

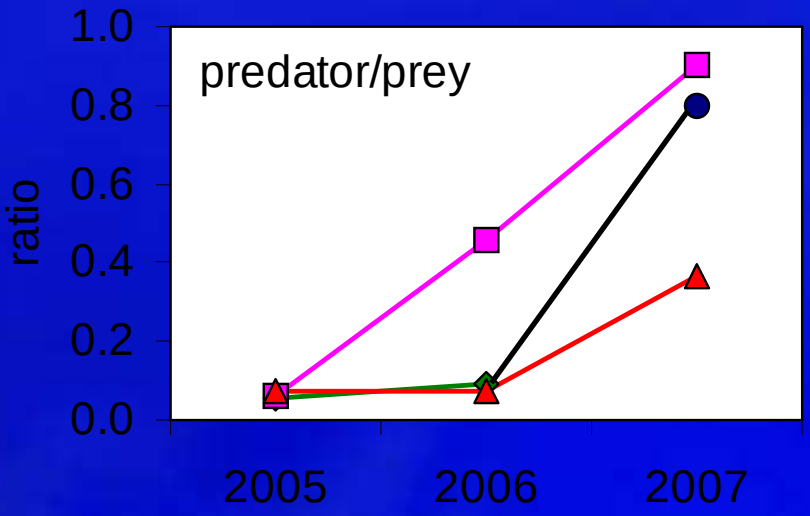


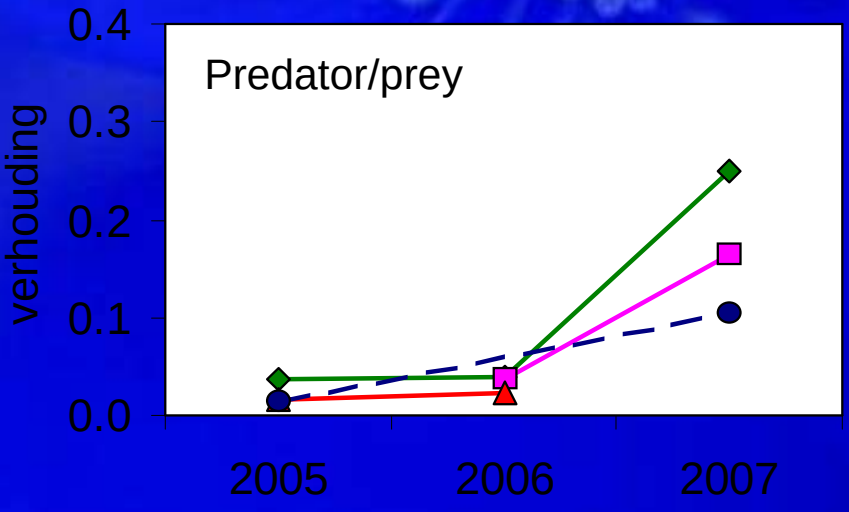


Three year trends in aphid and natural enemy populations at conventional farms









Potato

Aphid peak: mid July

Wheat

mid June

Optimizing Ecosystem Services in Terms of Agronomy and Conservation (ECOSTAC)

Lancaster University · STC · Central Science Laboratory

European Initiatives

- Swedish Agricultural University, Plant Protection Biology, Alnarp, Sweden
- University of Aarhus/ Faculty of Agricultural Sciences, Denmark
- Universiteit Gent, Belgium
- Wageningen University, the Netherlands
- Leibniz University, Hannover, Germany
- Departament de Protecció Vegetal, IRTA, Barcelona, Spain
- INRA, Nantes, France
- FIBL, Frick, Switzerland

E·L·N F·A·B

European Learning Network on Functional AgroBiodiversity

to exchange knowledge and practical experience across country and language borders, between farmers, policy makers, scientists, business and NGOs to enable effective implementation of best practices.

This will help to optimize agrobiodiversity benefits, while promoting sustainable agriculture.

Conclusions

- Current AES options are often not suited to deliver services relevant to agronomy.
- Biocontrol and pollination can be supported by informed choice of field margins.
- European and national policy needs to reflect the fact that agriculture depends on the larger landscape for the delivery of ecosystem services such as natural pest/disease regulation and pollination.
- Agri-environment schemes should include options that support both production and the environment.
- Policy should stimulate synergies between agrobiodiversity benefits and sustainable agriculture by making functional biodiversity options eligible for CAP payments

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Not all flowering plants provide suitable food for all insect groups

(Wäckers, 2004, Biological Control 29:307-314)

	Accessible nectar	Inaccessible nectar
Attractive	 Coriandrum sativum  Vicia sativa	 Leucanthemum vulgare  Galium mollugo
Non-attractive	 Daucus carota  Trifolium pratense  Origanum vulgare	 Medicago lupulina  Trifolium repens  Erigeron annuus  Achillea millefolium

Select to optimize Biological Control benefits