Wildflower strips as a tool for conservation biological control and pollination service: Impact of functional diversity and mowing regime

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Introduction

- Conventional practices are partly responsible for the loss of biodiversity in agricultural landscapes (Krebs et al., 1999).
- Biological control methods are studied as alternatives to chemical insecticide use (Landis et al., 2000; Haaland et al., 2011).
- Wild pollinators are important for many crops (Klein et al., 2007; Aizen et al., 2008)
- Wildflower strips at field margins are known to attract insects such as natural enemies and pollinators (Pfiffner et al., 2009; Haaland et al., 2011; Carrié et al., 2012).

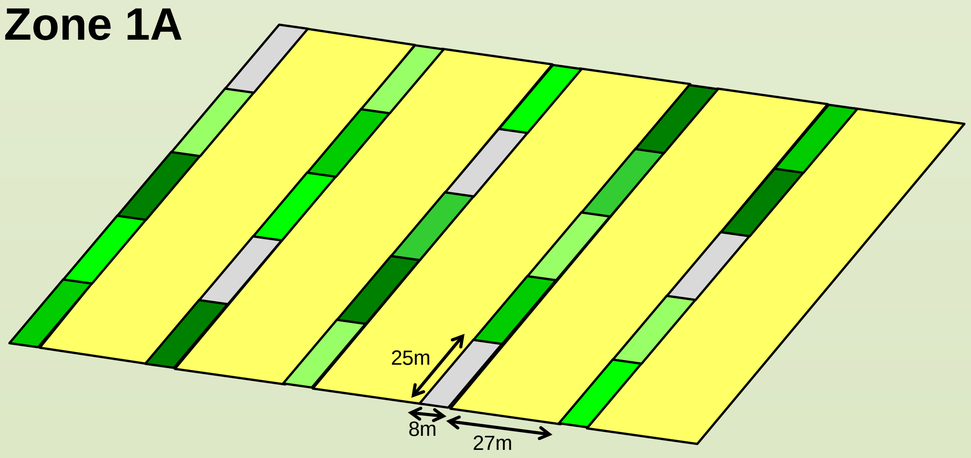
General hypothesis

- Trophic relations built up by the insect diversity living in wildflower strips will help to limit pests in the adjacent crops (conservation biological control).
- Pollinator communities sustained by wildflower strips deliver a pollination service to the adjacent crops.
- Flower traits are determinants in the attraction of natural enemies and the composition of the pollinator community.
- Mowing regime impacts flower mixes and thus the entomofauna, which can *in fine* affect conservation biological control and pollination service.

How do functional diversity and mowing regime of wildflower strips affect conservation biological control and pollination service?

Experimental design & research questions

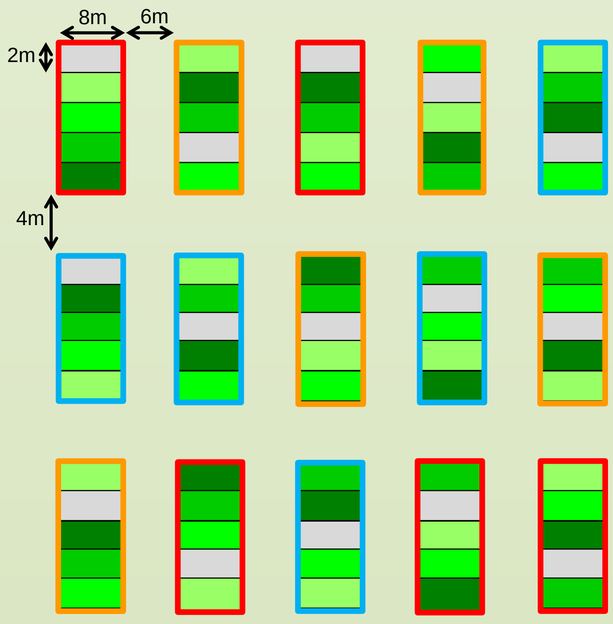
Zone 1A



How does functional diversity of wildflower mixes affect:

- *the diversity and abundance of pests, natural enemies and pollinators?*
- *the induced trophic relations and pollination networks?*
- *the yield and the quality of the adjacent crops?*

Zone 1B



How does mowing regime affect:

- *the vegetation development and flower availability within the flower strips?*
- *the trophic relations induced by the insects living in the strips*

Zone 1C

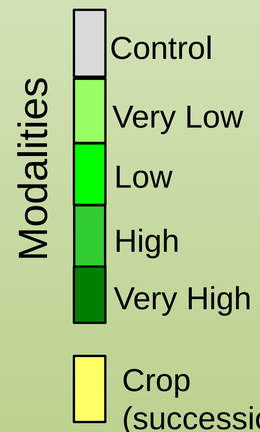
How does each flowering species in the mixes take part of the mechanisms observed?

Flower species mixtures with different functional diversity level			
Very Low	**Low**	**High**	**Very High**
Achillea millefolium (A)	*Achillea millefolium* (A)	*Achillea millefolium* (A)	*Achillea millefolium* (A)
Anthriscus sylvestris (B)	*Crepis biennis* (C)	*Anthriscus sylvestris* (B)	*Anthriscus sylvestris* (B)
Galium verum (D)	*Galium verum* (D)	*Geranium pyrenaicum* (E)	*Lotus corniculatus* (K)
Heracleum sphondylium (F)	*Hypochaeris radicata* (G)	*Leontodon hispidus* (I)	*Lythrum salicaria* (L)
Knautia arvensis (H)	*Knautia arvensis* (H)	*Leucanthemum vulgare* (J)	*Malva moschata* (M)
Leucanthemum vulgare (J)	*Leontodon hispidus* (I)	*Origanum vulgare* (O)	*Medicago lupulina* (N)
Trifolium pratense (Q)	*Lythrum salicaria* (L)	*Prunella vulgaris* (P)	*Prunella vulgaris* (P)

Plant traits (used to calculate functional diversity)		
Flower color	Flower type (nectar and pollen availability)	Start time of flowering
Flowering duration	UV reflectance (periphery of the flower)	Height
UV pattern (difference center-periphery of the flower)		

Legend

Functional diversity



Mowing regimes

Crop
(succession : winter wheat, rapeseed)

Methods

- Insect trapping and observations of interactions on plants/flowers
- Vegetation monitoring with quadrats
- Insect identification

→ Setting up food webs and pollination networks

- Crop yield measurements

References

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