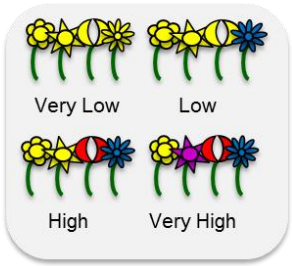
Morvan (France) Pictures: S. Hatt

What you may have missed last time…

?

Goal: Enhance biological pest control

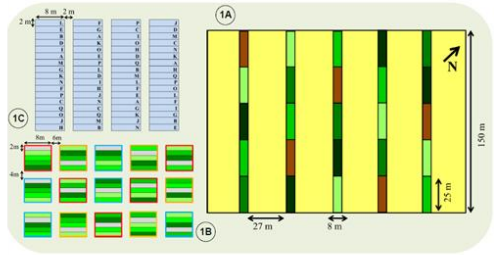
Wildflower strips



Functional diversity?

Mowing regime?

Research questions



Experimental field

Insect trapping and observation

Efficiency of biological pest control?

From Hatt et al., 2014

UNIVERSITE DE LIÈGE
Gembloux Agro-Bio Tech

AgricultureIsLife.be

Séverin HATT [1]*, Frédéric FRANCIS [2]

[1] AgricultureIsLife.be, Gembloux Agro-Bio Tech (ULg), [2] Functional and Evolutionary Entomology Unit, Gembloux Agro-Bio Tech (ULg)

From Landscape Infrastructures to Conservation Biological Control

Why the concept of Functional Diversity may be useful?

* severin.hatt@ulg.ac.be

AgricultureIsLife Seminar - Gembloux Agro-Bio Tech - 19th September 2014

What is it?

Picture: M. Jeanson

Landscape infrastructures…

Picardie (France)

Find the difference…

Hedgerows

Pictures: S. Hatt

Landscape infrastructures…

Gembloux (Belgium)

Wood land

Picture: S. Hatt

Landscape infrastructures…

Gembloux (Belgium)

Wildflower strips

Picture: S. Hatt

…provide Ecosystem Services

- **To limit soil erosion and nutrient leaching**

Zhang et al., 2007

giser.be

Soil erosion

saisons-vives.com

Algae proliferation due to nutrient leaching

cc-mauron-broceliande.com

Edgerows to limit soil erosion

Picture: M. Dufrêne

Grass strips to limit nutrient leaching

…provide Ecosystem Services

Loss of insect diversity

Wildflower strips support insect conservation

Haaland et al., 2011

Pictures: S. Hatt

Wildflower strips for biological control

For insect conservation

1 Food resource
(nectar, pollen, alternative preys)

2 Shelter
(for reproduction and wintering)

Wildflower strips provide to insects…

…because they are…

3 Species diversed

4 Relatively undisturbed

5 Not treated with insecticide

Landis et al., 2000 ; Pfiffner & Wyss, 2004

Picture: S. Hatt

Wildflower strips for biological control

For pest control?

From insect conservation…

…to pest control?

Pictures: S. Hatt

For pest control?

Do wildflower strips sown at field margin help to control pests in the adjacent crops?

References	They help to control pests	They do not help to control pests
Lee & Heimpel, 2005	♦	
Balzan et al., 2014	♦	
Pfiffner et al., 2009		♦

Conclusions are not unanimous

WHY ?

Wildflower strips for biological control

This is not that easy !

- **Floral ressources should be adapted to the targeted natural enemies**

Short mouth part insect can better feed on open nectaries flower

Dongbufarmceres.com

Parasitoid

Anthriscus sylvestris

en.wikipedia.org

Trifolium pratense

Campbell et al., 2011

Wildflower strips for biological control

This is not that easy !

- Flowering period should be adapted to pest attack period

No flowers, No natural enemies

Colley & Luna, 2000

Pictures: S. Hatt

THINK FUNCTIONAL !

Uyttenbroeck et al., 2014

Wildflower strips for biological control

Think functional !

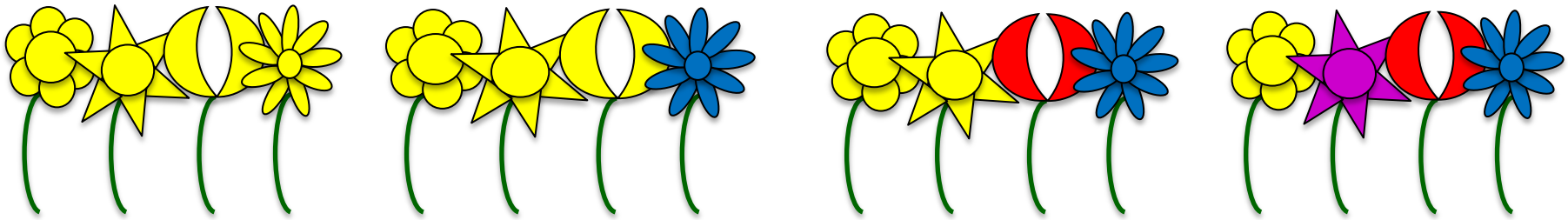
Functional diversity: what is it?

*Diversity of flower functional **traits** into a group of species*

Petchey & Gaston, 2006

Example

1 trait = colour and 4 species per mix → 4 functional diversities



Very Low | Low | High | Very High

Think functional !

Insects are sensitive to flower characteristics (= traits)

Picture: S. Hatt

Think functional !

Hypothesis:

Higher Functional Diversity

Higher diversity of insects attracted

Wildflower strips for biological control

We think functional in Gembloux!

The traits used to constitute our 4 flower mixes…

- Flowering time
- Flower color
- Flower UV pattern
- Flower morphology
- Height
- Flowering duration
- Flower UV reflectance

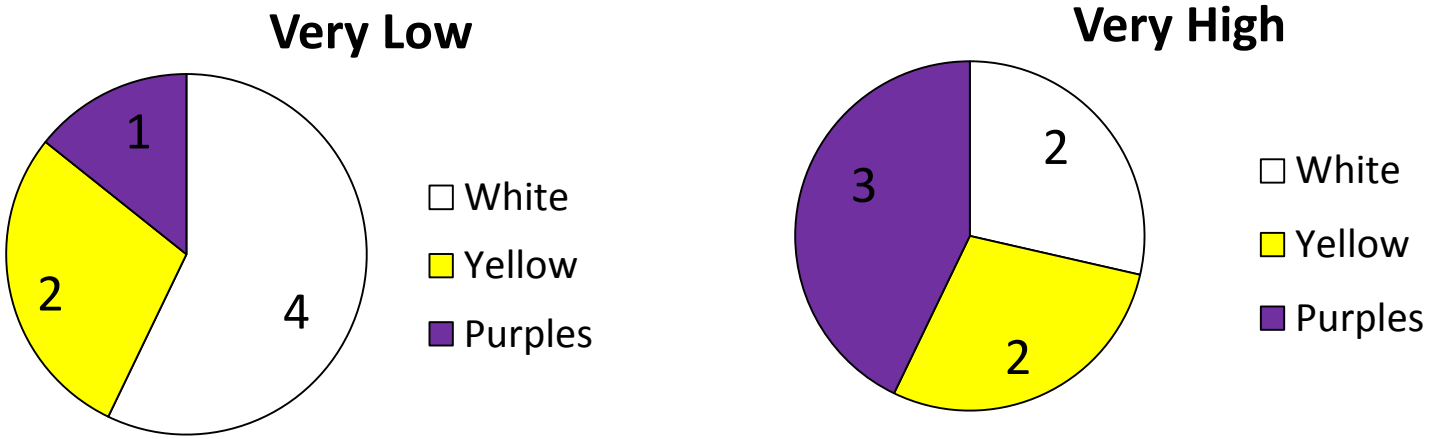
Wildflower strips for biological control

We think functional in Gembloux!

4 flower mixes have been sawn in the field…
How constrasted are there?

Mix 1: Very Low FD
Mix 2: Low FD
Mix 3: High FD
Mix 4: Very High FD

Flower color

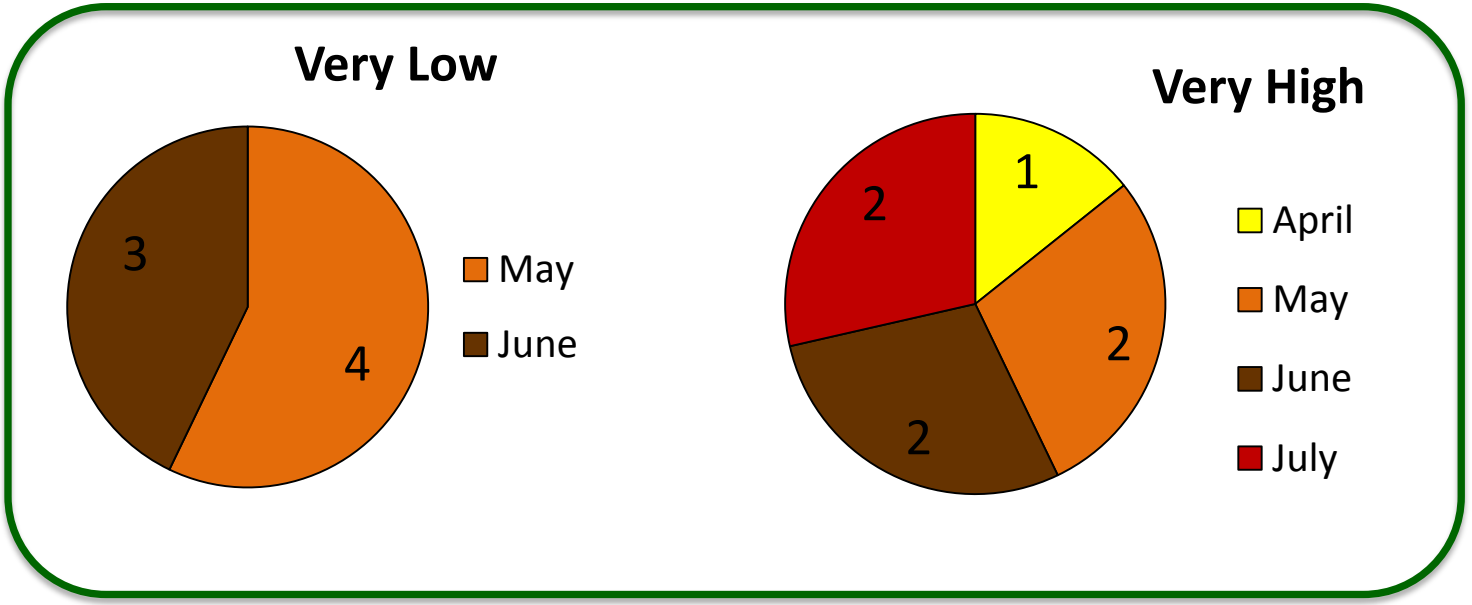


Repartition of the value taken by the flower species within a mix. The 2 more contrasted mix are compared. The number indicated represents the number of species which have this value (7 species per mix).

Wildflower strips for biological control

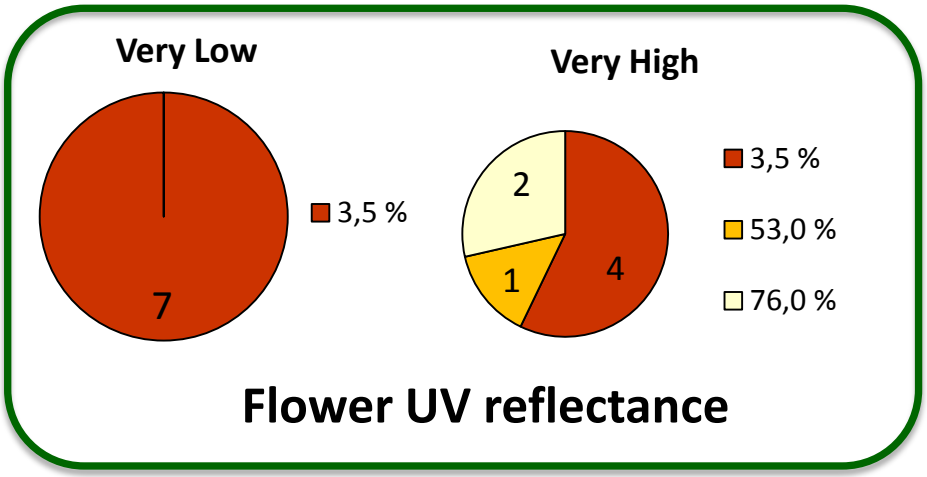
We think functional in Gembloux!

Flowering start

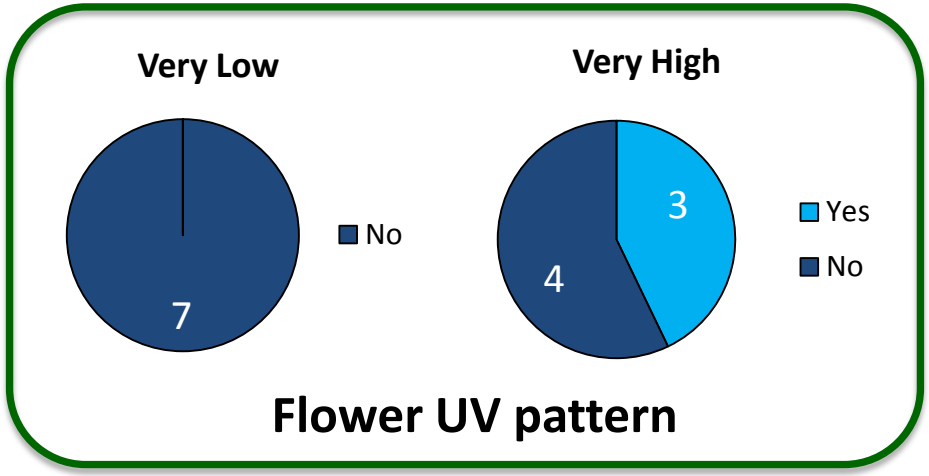


Wildflower strips for biological control

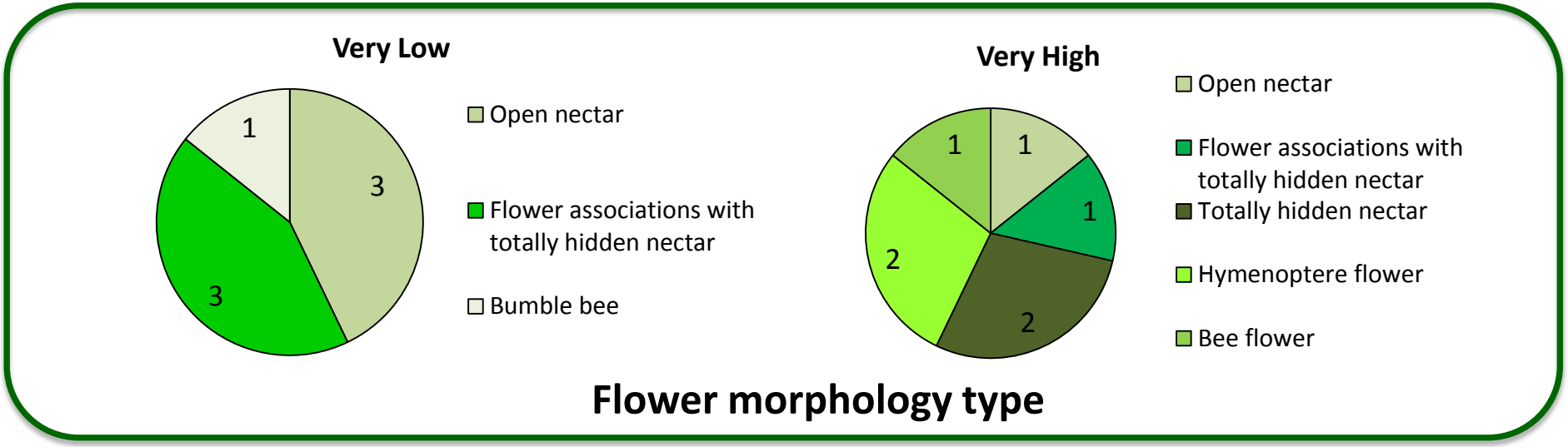
We think functional in Gembloux!



Flower UV reflectance



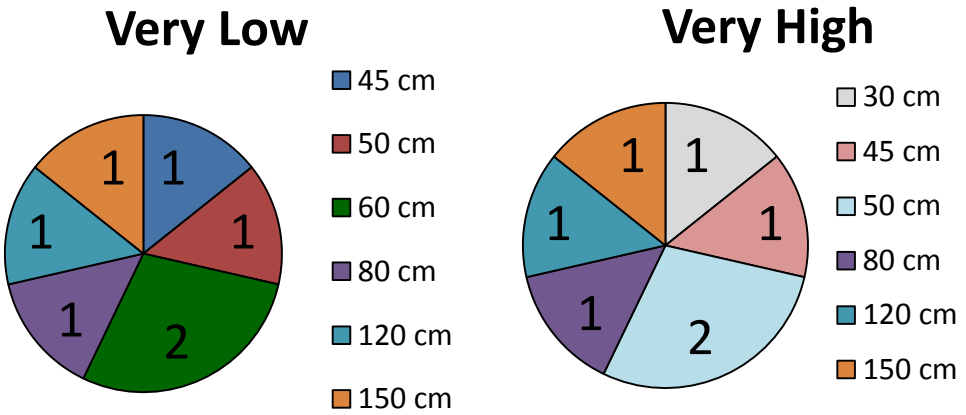
Flower UV pattern

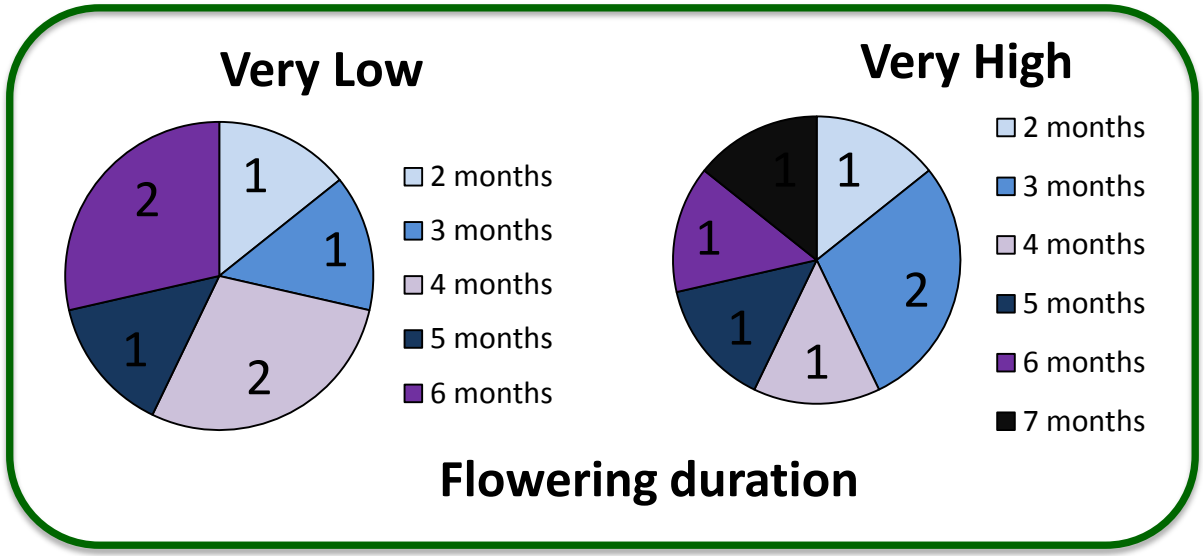


Flower morphology type

Wildflower strips for biological control

We think functional in Gembloux!





Summary

Landscape infrastructures provide ES

Wildflower strips support insect conservation

For biological control?

Currently tested in Gembloux Agro-Bio Tech

Applying the concept of Functional Diversity could provide interesting improvement !

Pictures: S. Hatt

Thank you for your attention

For more information

severin.hatt@ulg.ac.be

Agriculture Is Life.be

Drome (France) Pictures: S. Hatt

References

- Balzan M. V., & Moonen A.-C. (2014). Field margin vegetation enhances biological control and crop damage suppression from multiple pests in organic tomato fields. *Entomologia Experimentalis et Applicata*, **150** (1), p. 45–65.

- Campbell A. J., Biesmeijer J. C., Varma V., & Wäckers F. L. (2012). Realising multiple ecosystem services based on the response of three beneficial insect groups to floral traits and trait diversity. *Basic and Applied Ecology*, **13** (4), p. 363–370.

- Colley M. R., & Luna J. M. (2000). Relative Attractiveness of Potential Beneficial Insectary Plants to Aphidophagous Hoverflies (Diptera: Syrphidae). *Environmental Entomology*, **29** (5), p. 1054–1059.

- Haaland C., Naisbit R. E., & Bersier L.-F. (2011). Sown wildflower strips for insect conservation: a review. *Insect Conservation and Diversity*, **4** (1), p. 60–80.

- Hatt et al. (2014). Wildflower strips, a help for crop protection? Proceedings of the ENVITAM PhD Student Day 2014, p.35. http://hdl.handle.net/2268/164330

- Landis D. A., Wratten S. D., & Gurr G. M. (2000). Habitat Management to Conserve Natural Enemies of Arthropod Pests in Agriculture. *Annual Review of Entomology*, **45** (1), p. 175–201.

- Lee J. C., & Heimpel G. E. (2005). Impact of flowering buckwheat on Lepidopteran cabbage pests and their parasitoids at two spatial scales. *Biological Control*, **34** (3), p. 290–301.

- Petchey, O. L., Gaston, K. J. (2006). Functional diversity: back to basics and looking forward. Ecology letters, 9(6), 741-758.

- Pfiffner L., & Wyss E. (2004). Use of sown wildflower strips to enhance natural enemies of agricultural pests. *In* G. M. Gurr, S. D. Wratten, & M. A. Altieri (Eds.), *Ecological engineering for pest management*. CABI-Publishing, Collingwood, Australia, p. 167–188.

- Pfiffner L., Luka H., Schlatter C., Juen A., & Traugott M. (2009). Impact of wildflower strips on biological control of cabbage lepidopterans. *Agriculture, Ecosystems & Environment*, **129** (1–3), p. 310–314.

- Uyttenbroeck et al. (2014). Biodiversity and ecosystem services: think functional! Poster session of the National Symposium on Applied Biological Science, 7th September 2014, Gembloux. http://hdl.handle.net/2268/163605

- Zhang W., Ricketts T. H., Kremen C., Carney K., & Swinton S. M. (2007). Ecosystem services and dis-services to agriculture. *Ecological Economics*, **64** (2), p. 253–260.