The potential of landscape management in IPM

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Why is there a potential for landscape management?

- Traditionally, pest control is focused in farmers’ fields where the insect, weed and pathogen pests do their damage.

BUT

- Pests/pest enemies move outside fields
  - Between fields (e.g. codling moth)
  - To alternative hosts (e.g. aphids)
  - To overwintering sites (e.g. pollen beetles/ syrphids)

- Crops move around the landscape from year to year.

- -> some pest/pest enemies make use of resources at larger scale.
Questions asked within ENDURE?

• What landscape characteristics lead to suppression of insect pests and weeds? Analysis of existing data.

• What is the expert opinion of the potential for landscape management to suppress insect pests by encouraging natural enemies?

• What future approaches are needed to achieve pest-suppressive landscapes?
What is “landscape” in landscape and pest/pest enemies studies?

• The ‘pest’ landscape is a spatial and temporal representation of resources used by the organism in a mosaic of crops and uncultivated areas.

• However, authors usually attempt to relate pest abundance to general landscape variables most readily available or observed.
  – Composition.
  – Configuration

• The extent of the landscape depends on study organisms and...authors! from field margins to 10x10km2 areas

From Tscharntke et al. 2004, 2005
> Exploitation of Landscape and Community Ecology

Understanding the spatial strategies in simplified pest/pest enemies systems:
« mecanistic » approach

Assessing a link between landscape characteristics and pest abundance or predation/parasitism
« correlative » approach

Resources
Alimentary, Overwintering...
Quantity, quality,
Availability in space and time

Agricultural practices
• **Litterature review (1998-2008)**
  52 study cases, at least area over 100m from field margin

![Bar chart showing the impact of landscape composition on in-field pest abundance.](image)

- Positive or negative relationships between acreage of a crop over a landscape and pest abundance in that specific crop.
- Marginal positive effect of semi-natural areas.

A Veres et al.
Impact of landscape composition on in-field pest parasitism or predation

- Semi natural areas in the landscape favour lower pest abundance and in-field attacks against pests by natural enemies.
Semi natural areas in the landscape favour lower pest abundance and in-field attacks against pests by natural enemies.
> Review landscape and weeds.

Re- analysis of experiments from SSSUP, AGROS, CNR, JKI, INRA, Rres => Both small-scale landscape elements such as field margins, and larger scale landscape configuration affect weed community composition.

Example: Weed diversity in 126 wheat fields

1. Field properties (parcel size, preceding crop)
2. Landscape composition (% cover 5 aggregated land use types)
3. Landscape structure (n° of fields and n° of land use types)

Best=200m radius

INRA Dijon
Gaba et al., 2010

Gaba et al., 2010 INRA Dijon
What is expert opinion of the potential for landscape management to suppress insect pests by encouraging natural enemies? = Increasing their resources in the landscape

Ferguson and Alomar

No evidence
Some evidence
Strong evidence
Numbers of reviews advocating more research to support different CBC techniques.

- Limiting pesticide use
- Manipulation of behaviour
- Reduced disturbance
- Resources & refugia
- Landscape management
- Increased biodiversity

Number of review papers recommending more research (n=90)

Ferguson and Alomar
Recommendations: design and implementation of pest suppressive landscapes

General trend:
Positive effect:
- of semi-natural areas / diversification in landscape
- of management of resources for pest and pest enemies

Need for research:
- Large-scale/ mid-term studies and combined analysis of data from multiple research groups; agreed, common approaches and methodologies.
- More consideration (i) for measurements of landscape structure and (ii) for knowledge and recording of farmer practices at a landscape scale.
- Modelling of pest and natural enemy behaviour in virtual landscapes to enable the testing of landscape arrangements.
- The spatial scale at which the landscape functions requires the coordination of farmers and non-farmers activities if the type and intensity of land-use is to be modified. 

Biodiversity friendly farming?