A systematic review of research on biodiversity in European livestock systems

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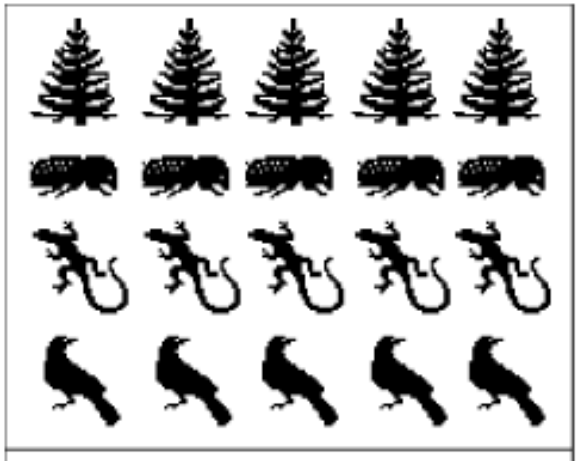
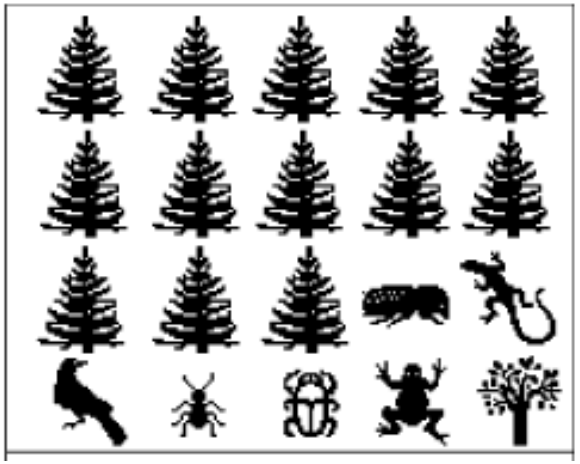
MAGIC NEXUS

“Which landscape do you consider to have a higher biodiversity?”

A



B



Duelli and Obrist 2003

Biodiversity

"Biodiversity" is a concept rather than a simple variable
Pollock et al. 2013

Introduction

- Biodiversity in EU is declining
- EU biodiversity strategy: halt loss by 2020

Overview EU 2020 Targets and actions	Progress
Target 3a – Increase the contribution of agriculture to maintaining and enhancing biodiversity	 No significant overall progress

  - Intensification: ↑ production ↓ biodiversity
  - Abandonment: ↓ biodiversity

- How does livestock affect biodiversity?

Aim

A systematic review of scientific literature about impacts of livestock on biodiversity in the EU

1) Indicators for biodiversity

2) Effects of livestock

Methods: literature search

- Search September 2017 in Scopus, Web of Science

biodiversity

farm/ feed/ graz*

livestock

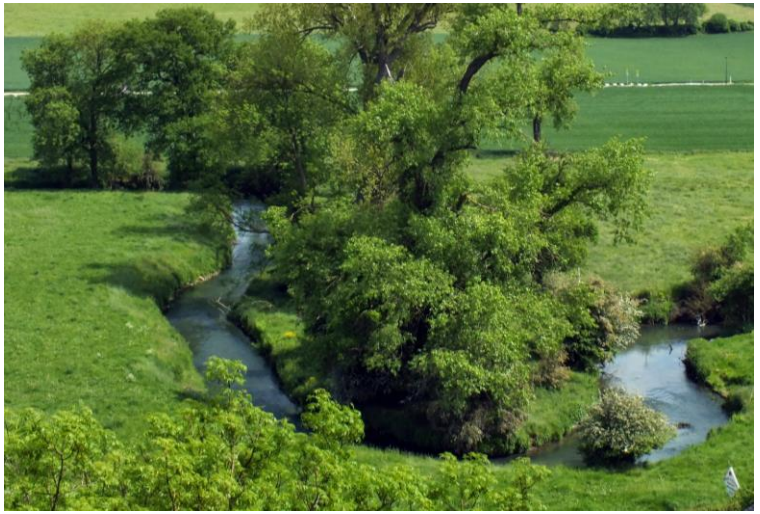
assess / indicator

EU-28, Norway, or Switzerland

- 857 articles after deduplication
- **131 articles** on impacts of livestock on biodiversity

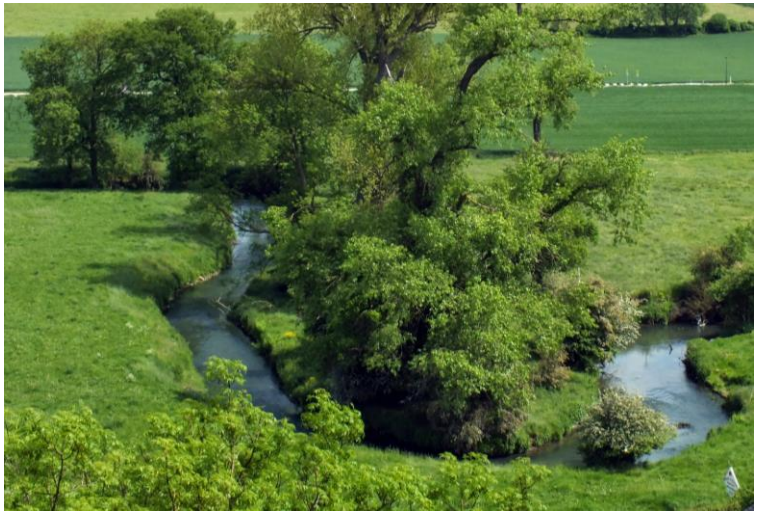
Indicators for biodiversity

- Abundance and richness
  - Abundance: number of individuals per species
  - Richness: number of species



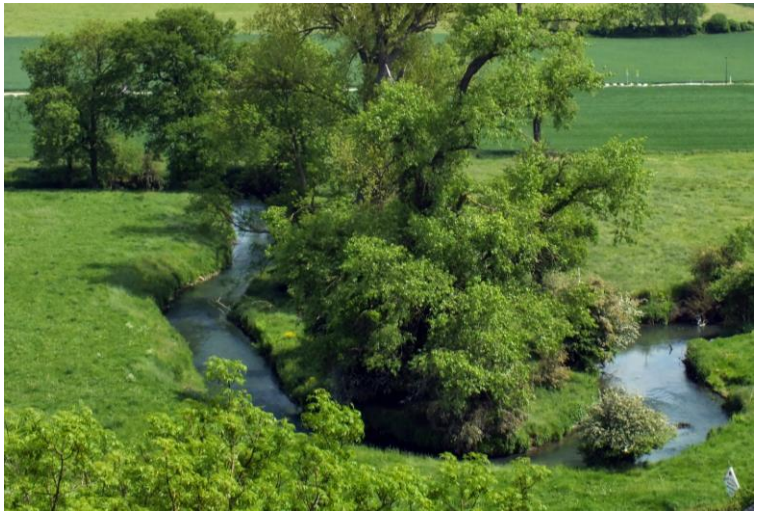
Indicators for biodiversity

- Abundance and richness
- Diversity indices that combine abundance and richness
- Functional diversity & structural heterogeneity
  - Pollinators, herbivores
  - Variation in plant height



Indicators for biodiversity

- Abundance and richness
- Diversity indices that combine abundance and richness
- Functional diversity & structural heterogeneity
- Rare/ endemic species
- Habitat diversity
- Linear elements
    - Rivers, hedges



Indicators: abundance & richness

- Used in 87 articles each (59 reported both)

	Abundance	Richness
Plants	53	65
Animals	38	29
• Invertebrates	28	23
○ Coleoptera	15	10
○ Lepidoptera	11	12
○ Hymenoptera	7	6
○ Araneae	7	6
• Vertebrates	13	10
○ Birds	11	8

- Local relevance, feasibility

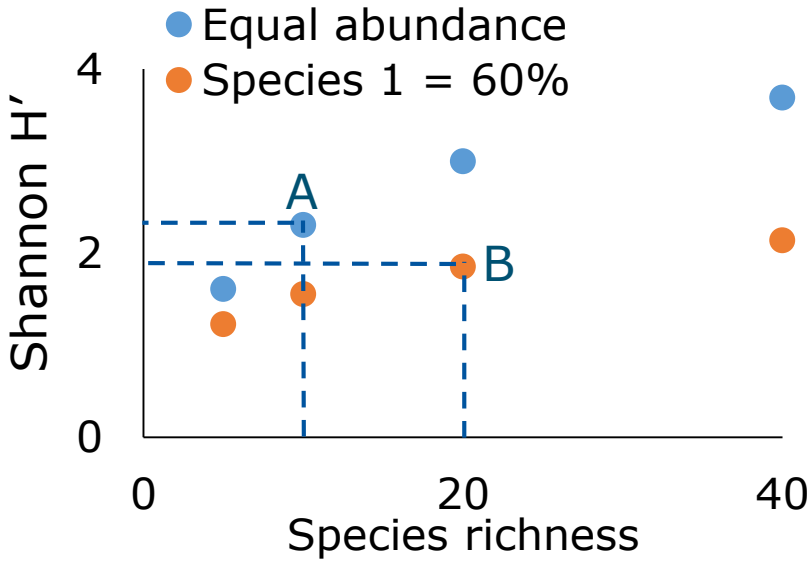
Indicators: a common diversity index

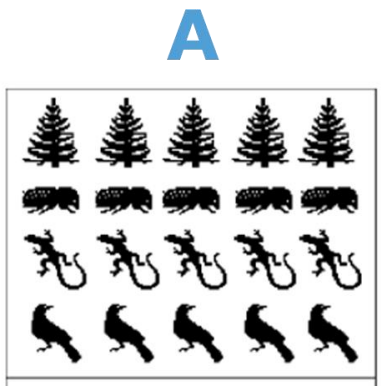
- Shannon diversity (H′); 33x

$$H' = -\sum_{i=1}^{S} p_i \ln p_i$$

Species richness

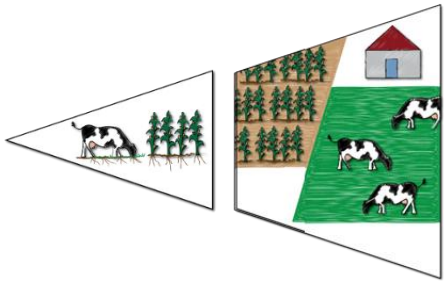
Relative abundance





Equal abundance

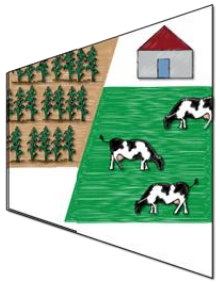
Effects (1)

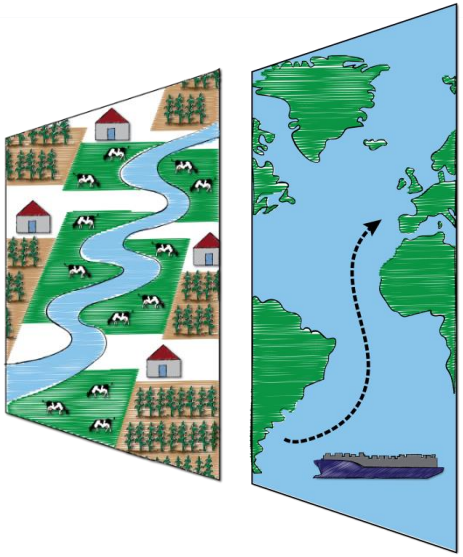


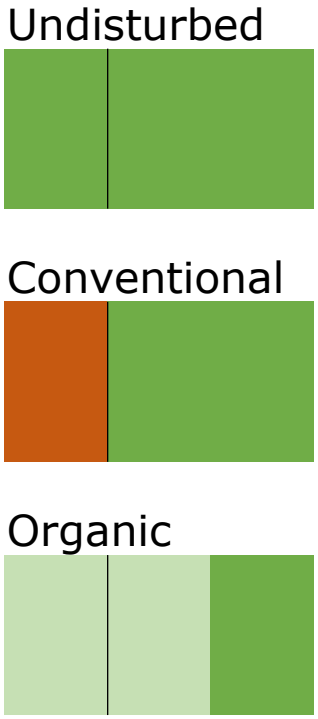
- Focus often on local biodiversity, grazed/ungrazed plot
  - Purpose: farming / conservation
- Biodiversity ↑ extensive and organic; ↓ abandonment
- Species composition affected by grazed vs ungrazed
  - Endemic species by extensive grazing
- Spatial heterogeneity: edges most diverse

Illustration: Birgit Boogaard

Effect (2)







- 8x dairy farm:
  - Scoring system: organic > conventional
  - Impact on species richness in LCA:
    - **(off-farm) arable land use**
    - **Impact per kg milk**

  → Smaller land use may compensate larger impact

- 3x pigs/ poultry: NH_3 emissions only
- ≥ region: ecosystem monitoring; trends; EU policy

Illustration: Birgit Boogaard

Discussion

- Limited consistency within indicators
  - Context dependent
  - Feasibility
- Focus on grazing, dairy and grassbased farms
  - Monogastrics mostly indirect impact
- Context of food production
  - Biodiversity per unit product
  - Arable land

Thank you!

Many indicators for biodiversity that answer different questions

Link to land use is essential

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