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Agroscope Reckenholz-Tänikon Research Station ART



# Which are the best indicators ?

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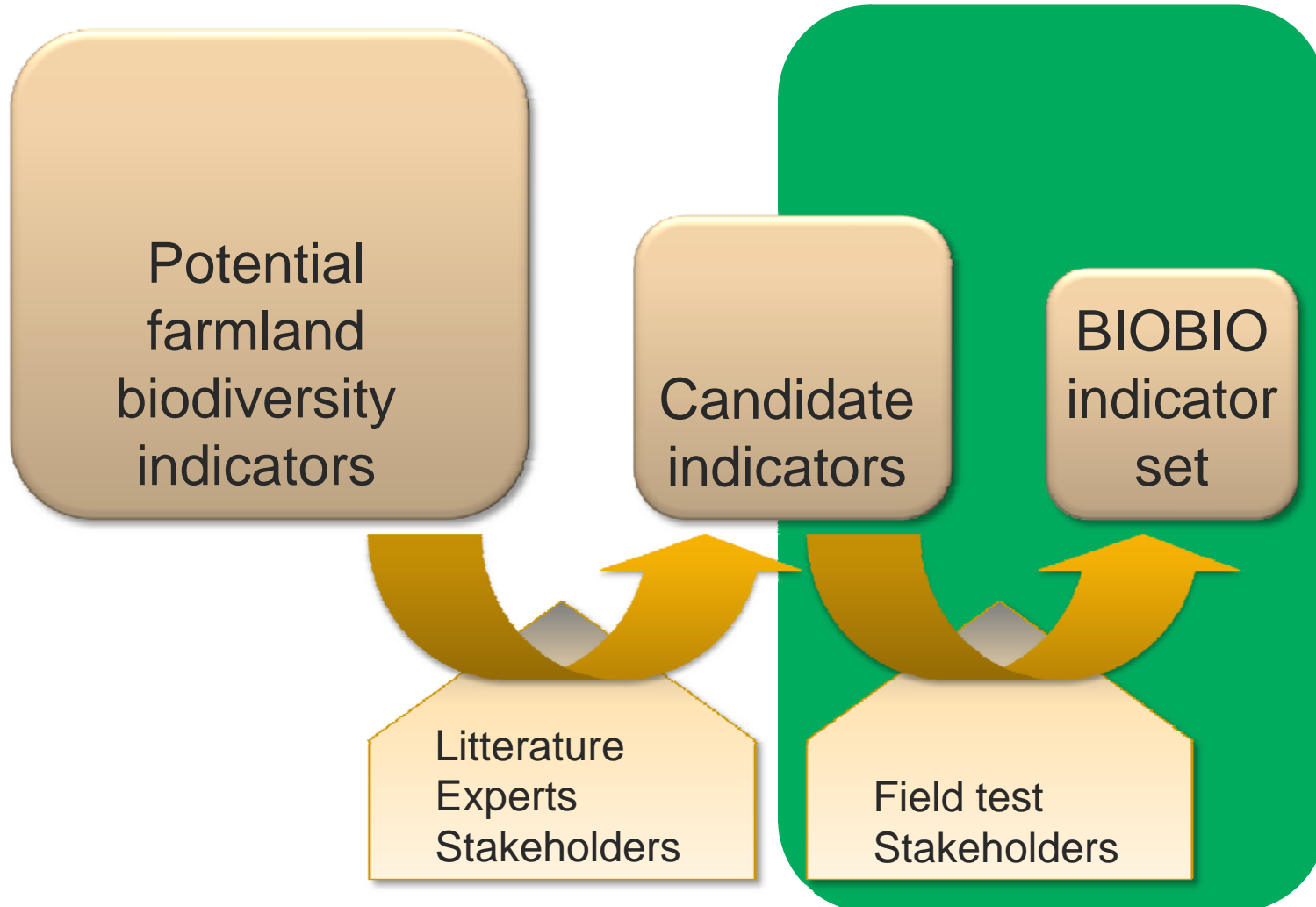
**BIOBIO Conference, 21.-22.06.2012**

# Context



- Indicators ? Depends on the **context**
- Reflect the **status of a system**
- “Indicators help you understand where you are, which way you are going, and how far you are from where you want to be“ (Hart 1995)
- Biodiversity: No threshold value for the number of species or of habitats in a region or on a farm
- Biodiversity indicators should be selected that express or **represent both biodiversity AND that are sensitive to environmental conditions** resulting from, for instance, land use and agricultural management practices

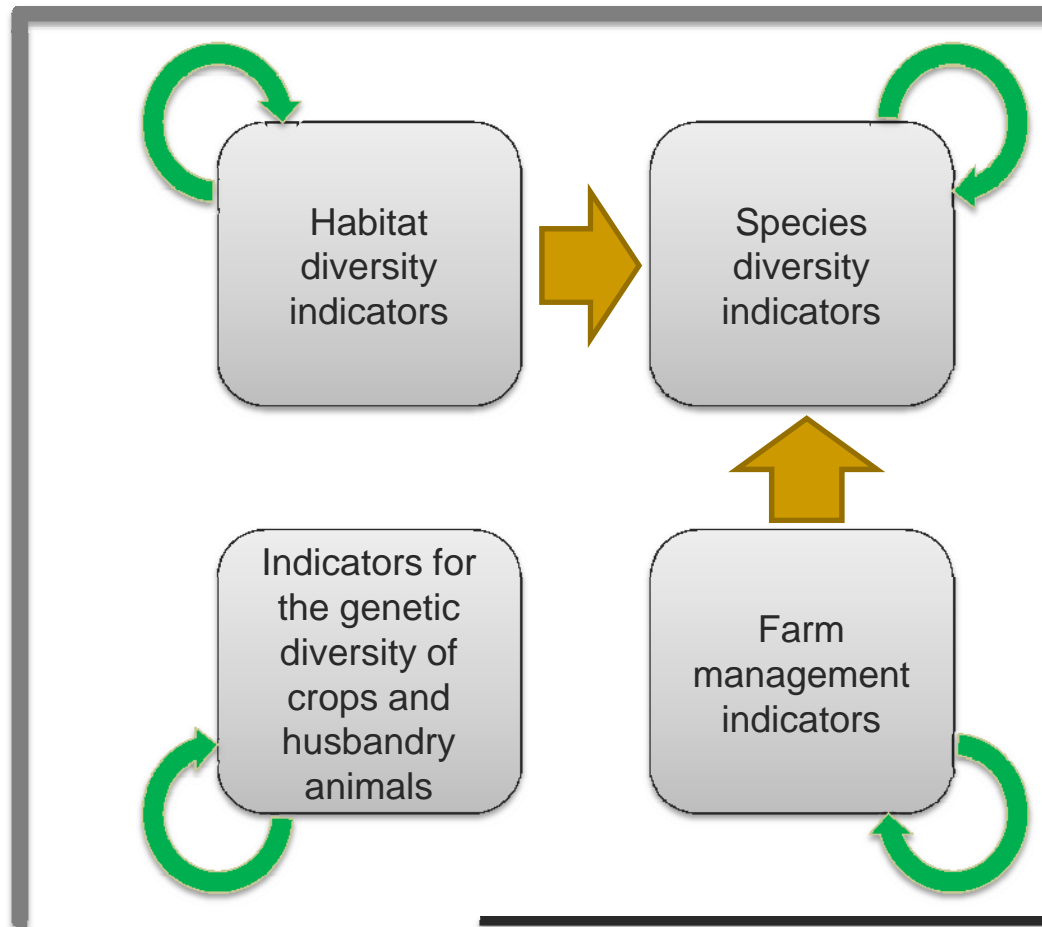
# [ Approach



# Indicator groups



State indicators



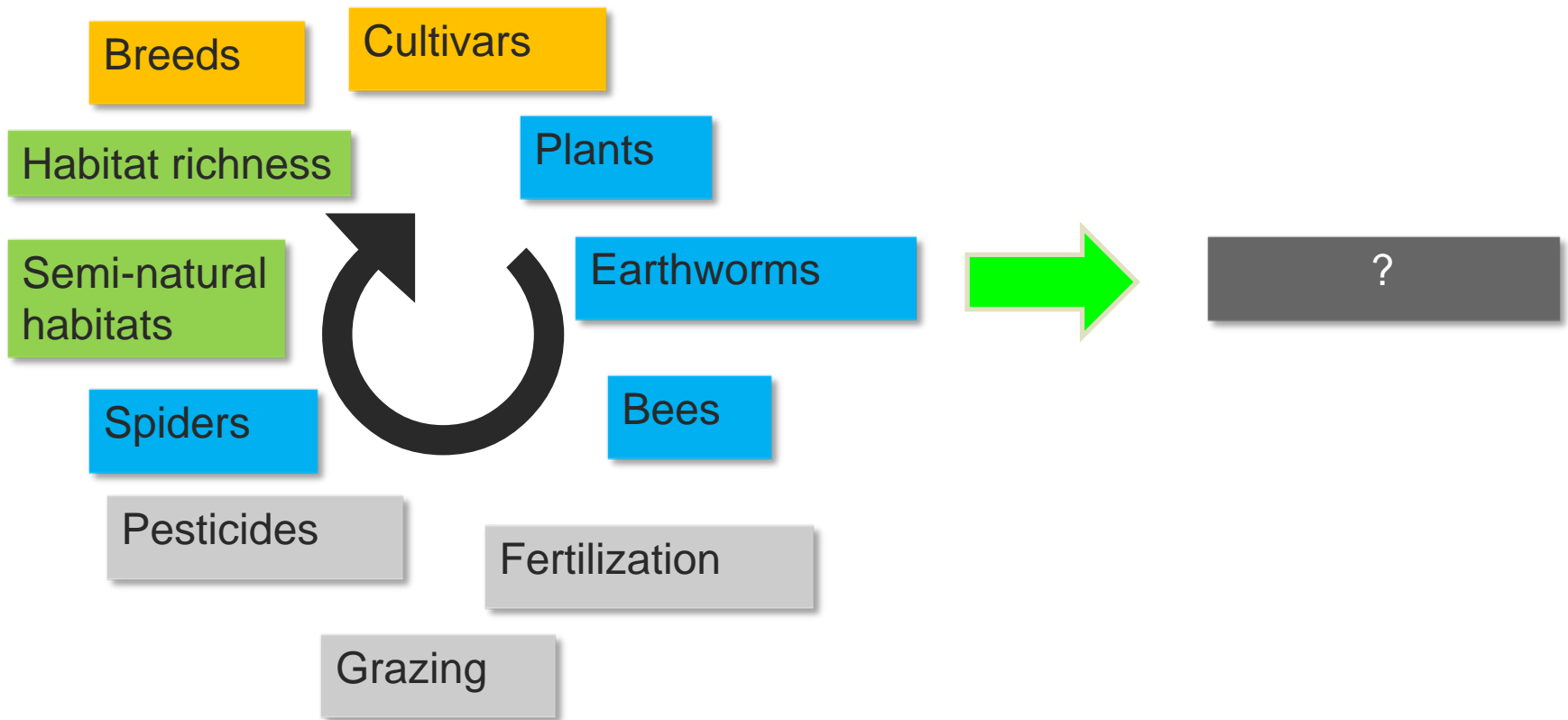
Pressure / response indicators

# Indicators

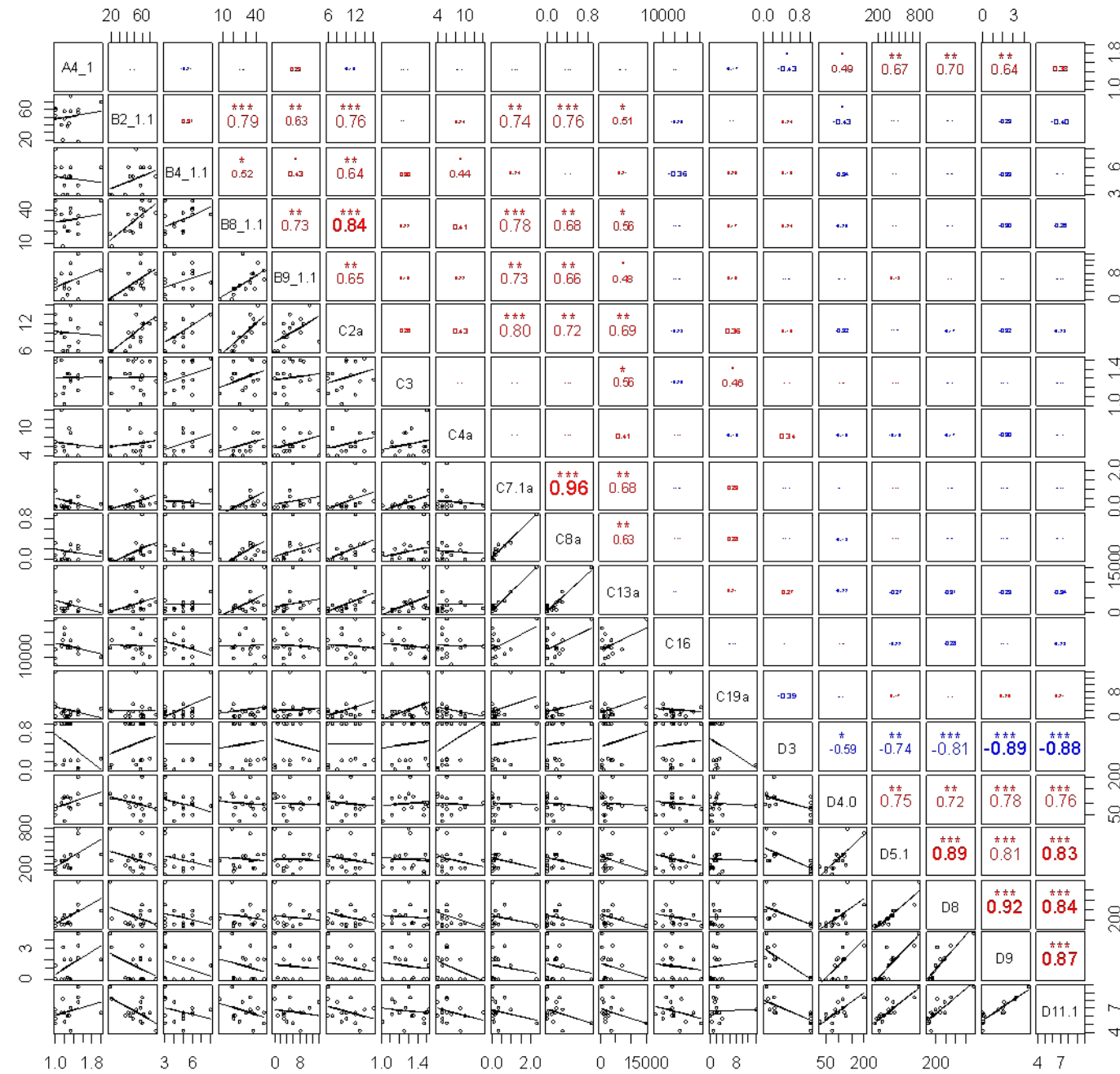


Habitat diversity indicators		Species diversity indicators	
HabRich	Habitat richness	Plants	Flowering plants of farmland habitats
HabDiv	Habitat diversity	Bees	Wild, domestic and bumble bees of farmland habitats
CropRich	Crop richness	Spiders	Spiders of farmland habitats
TreeHab	Tree cover	Earthworms	Earthworms of farmland habitats
ShrubHab	Share of farmland with shrubs		
LinHab	Length per hectare of linear elements		
Patch size	Average size of habitat patches on the farm		
SemiNat	Share of semi-natural habitats		
Indicators for genetic diversity of livestock and crops		Farm management indicators	
Breeds	Number and amount of different breeds per species	AvStock	Average stocking rate per ha forage area
CultDiv	Number and amount of different varieties per species (Cultivar diversity)	MinFert	Area without use of mineral N-fertiliser
CropOrigin	Origin of crops	NitroIn	Total nitrogen input
		EnerIn	Total direct and indirect energy input
		IntExt	Intensification/Extensification Expenditures on fertiliser, crop protection and concentrate feed stuff
		PestUse	Pesticide use
		FieldOp	Field operations
		Graze	Grazing Intensity

# Surrogate indicators ?

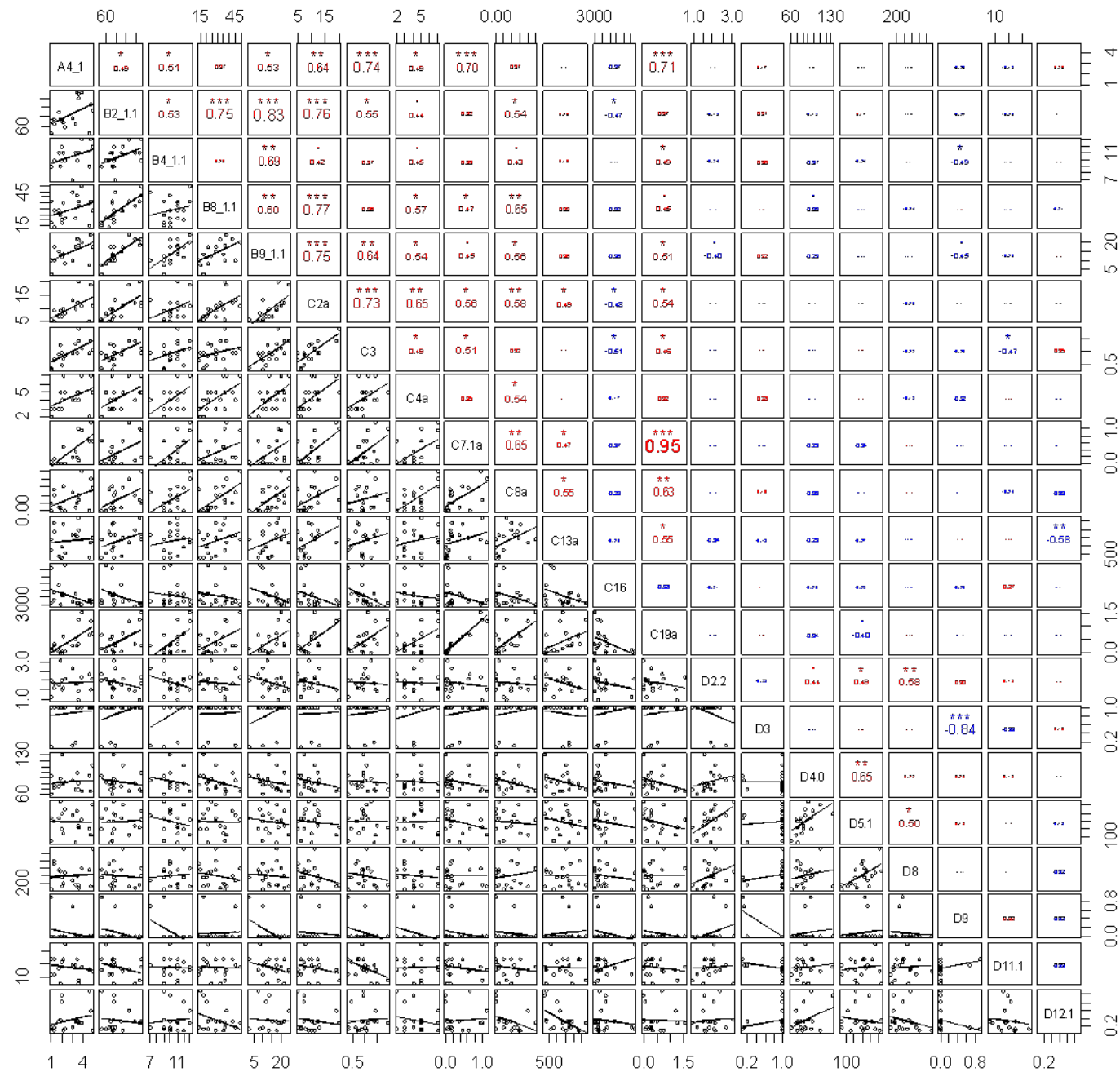


# ARA Austria



- High correlations among farming indicators
- Good correlations among species groups
- A few correlations among habitat indicators

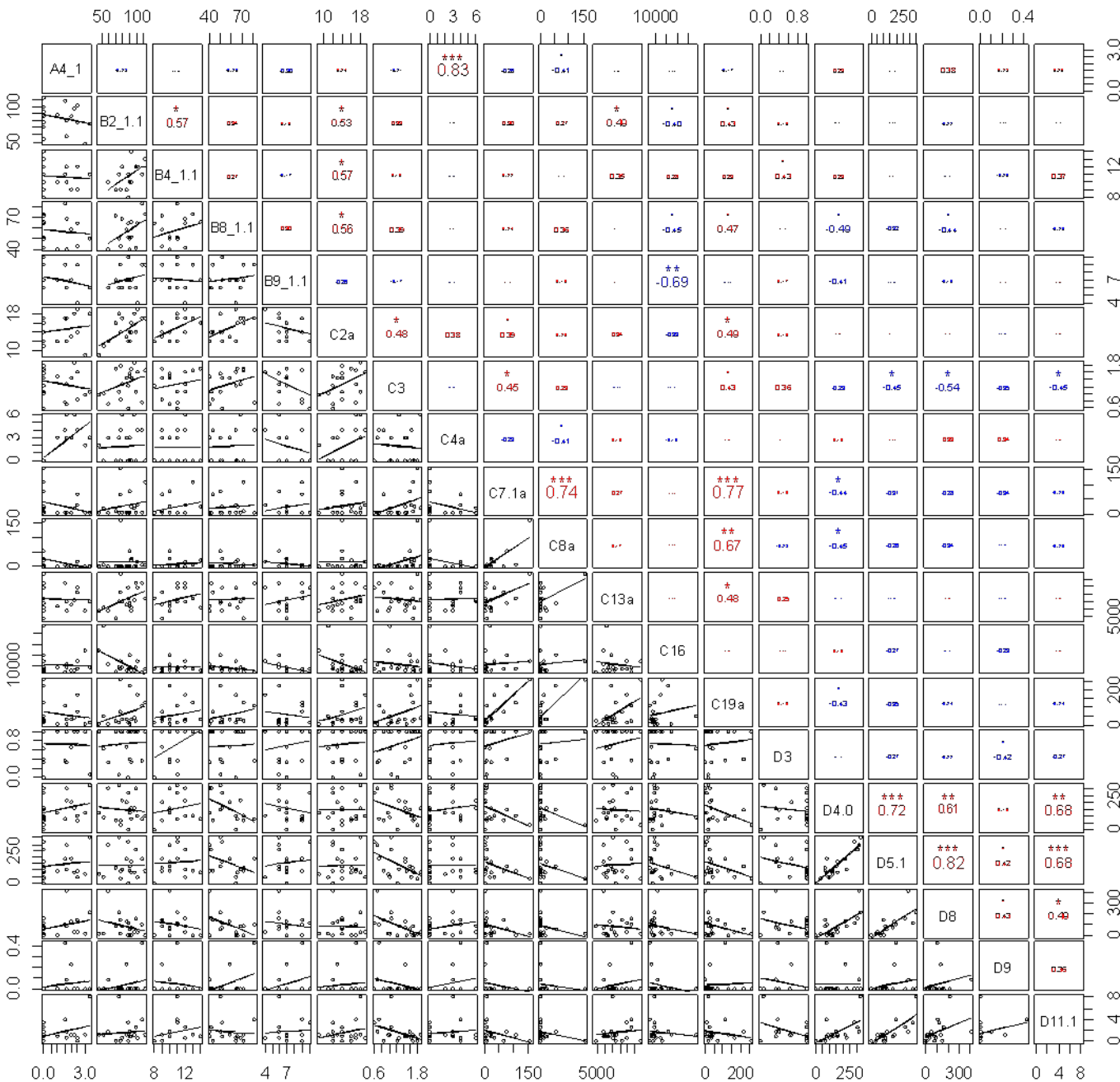
# GRA Switzerland



- High correlations among species groups
- A very few correlations among farming indicators
- A few correlations among habitat indicators



# GRA Wales



- One correlation among species groups
- A few correlations among farming indicators and among habitat indicators

# First conclusion



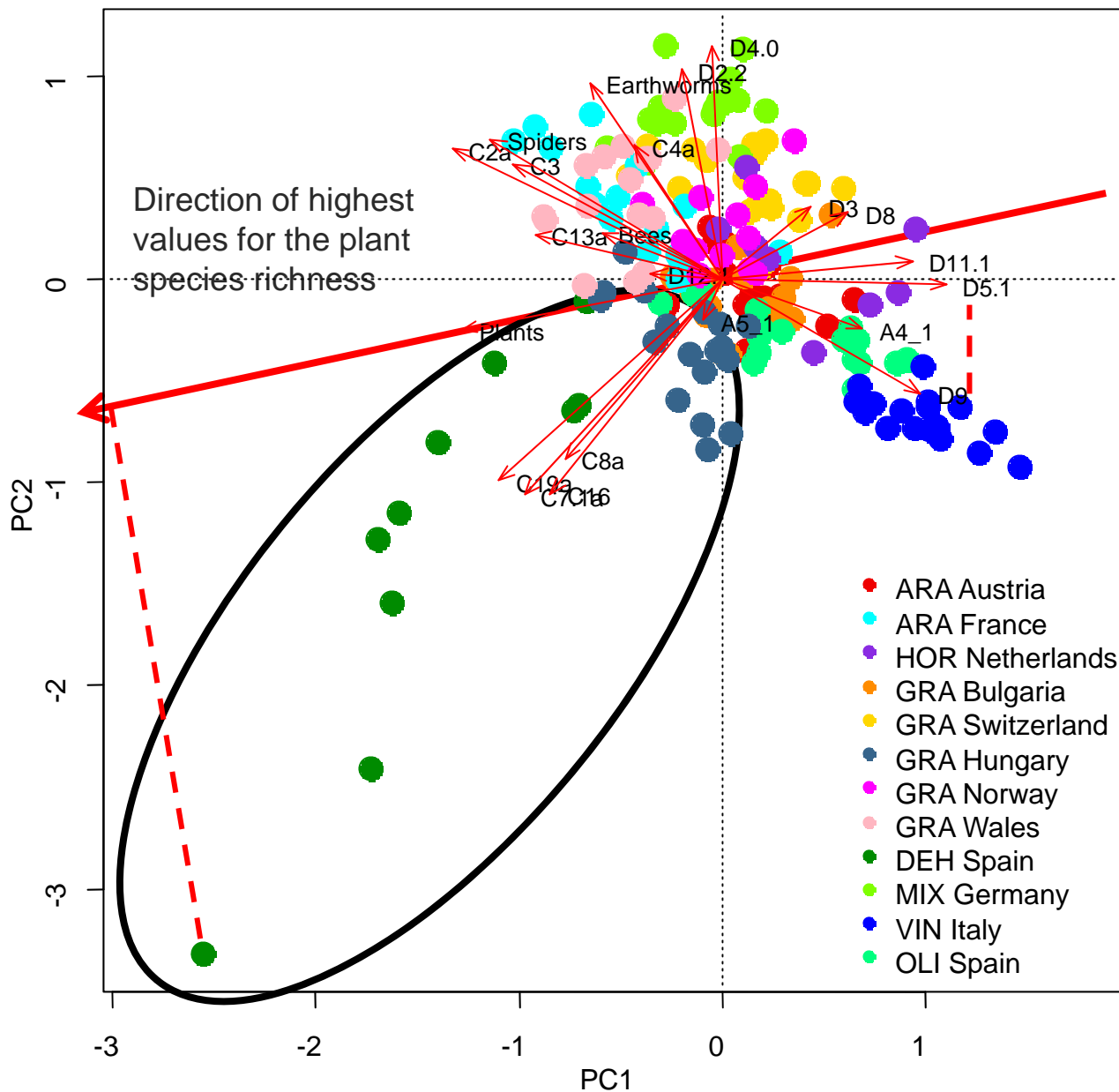
- Indicators can be reliably measured across Europe
- No general pattern of correlations among and within indicators across the case studies

[ Further considerations



What do the  
indicators  
indicate ?

# Ordination (PCA) of 185 BioBio farms and 22 biodiversity and farming indicators



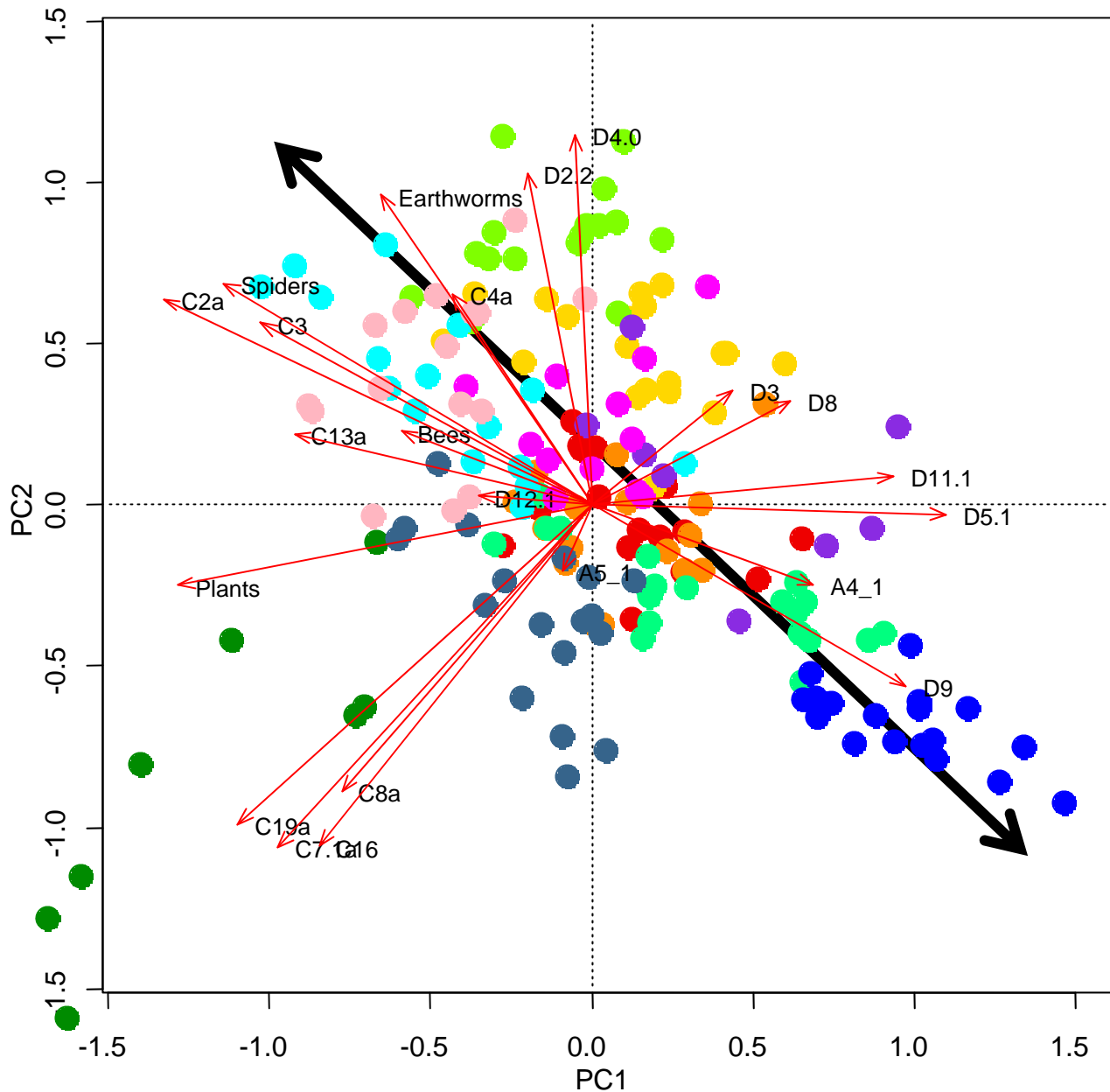
## Habitat diversity indicators :

- Tree cover,
- Shrubs,
- Patch size,
- Share of semi-natural habitats

... are indicators for Spanish Dehesas.

Champion of plant species richness is one Spanish Dehesa farm with 214 species !

# Ordination (PCA) of 185 BioBio farms and 22 biodiversity and farming indicators



- **Fauna**
- **Habitat diversity (C2a, C3)**
- **Pesticide use (D9)**

... are indicators for case studies in

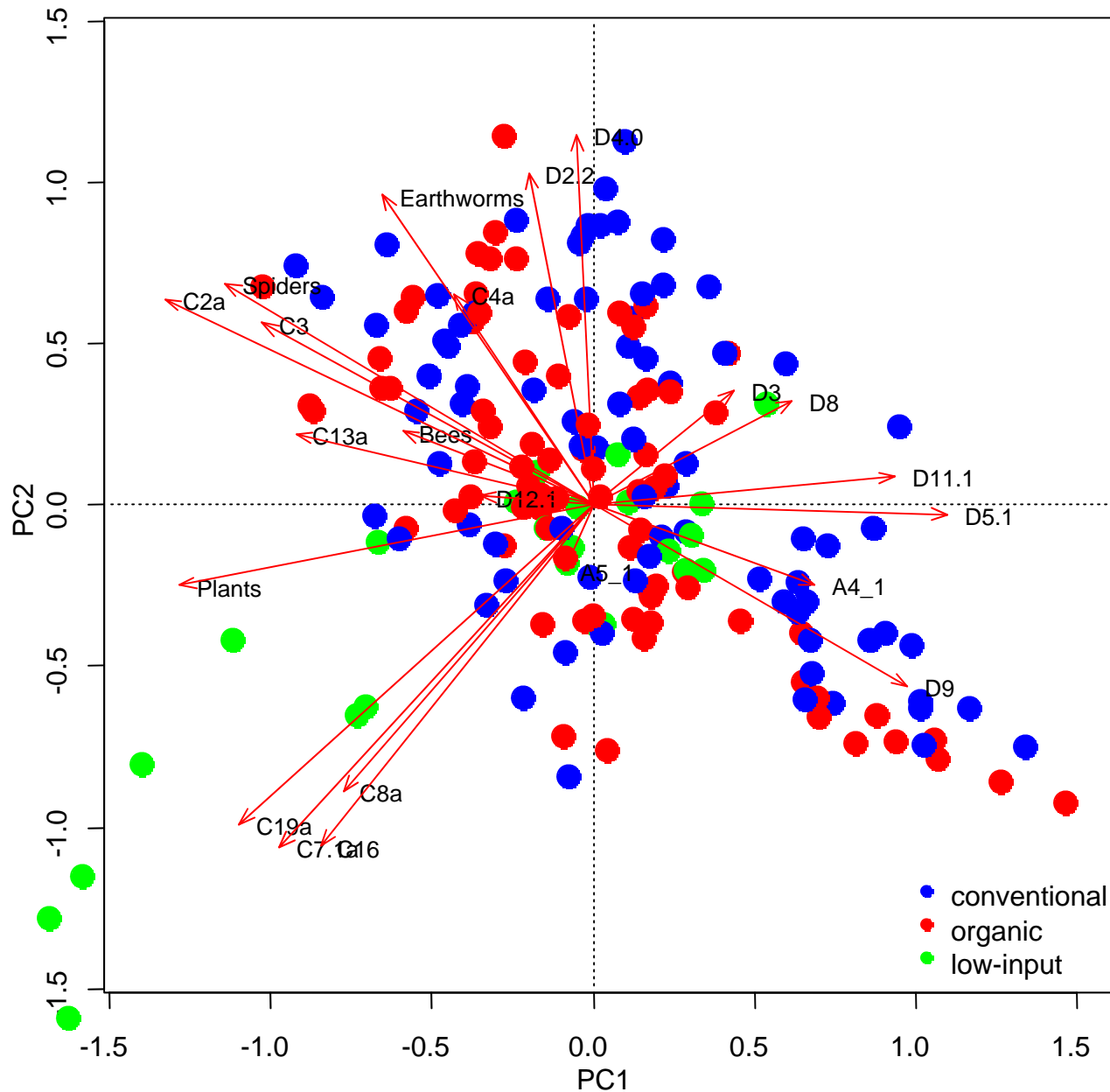
- **France**
- **Germany**
- **Wales**

versus

- **Olive plantation** in Spain and
- **Vineyard** in Italy.

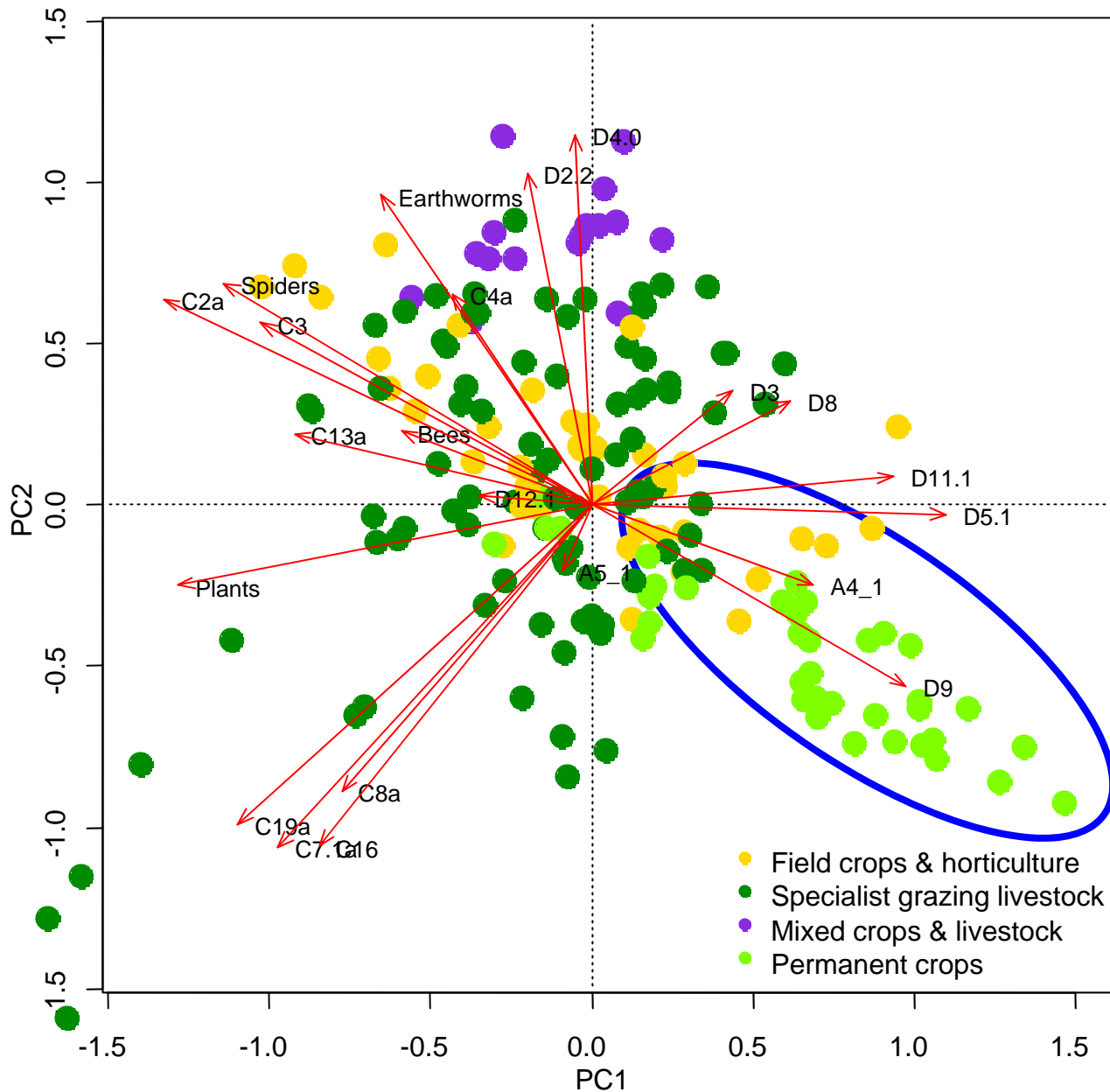
■ **Champion of spider species richness is one farm in Wales with 82 species !**

# Ordination (PCA) of 185 BioBio farms and 22 biodiversity and farming indicators



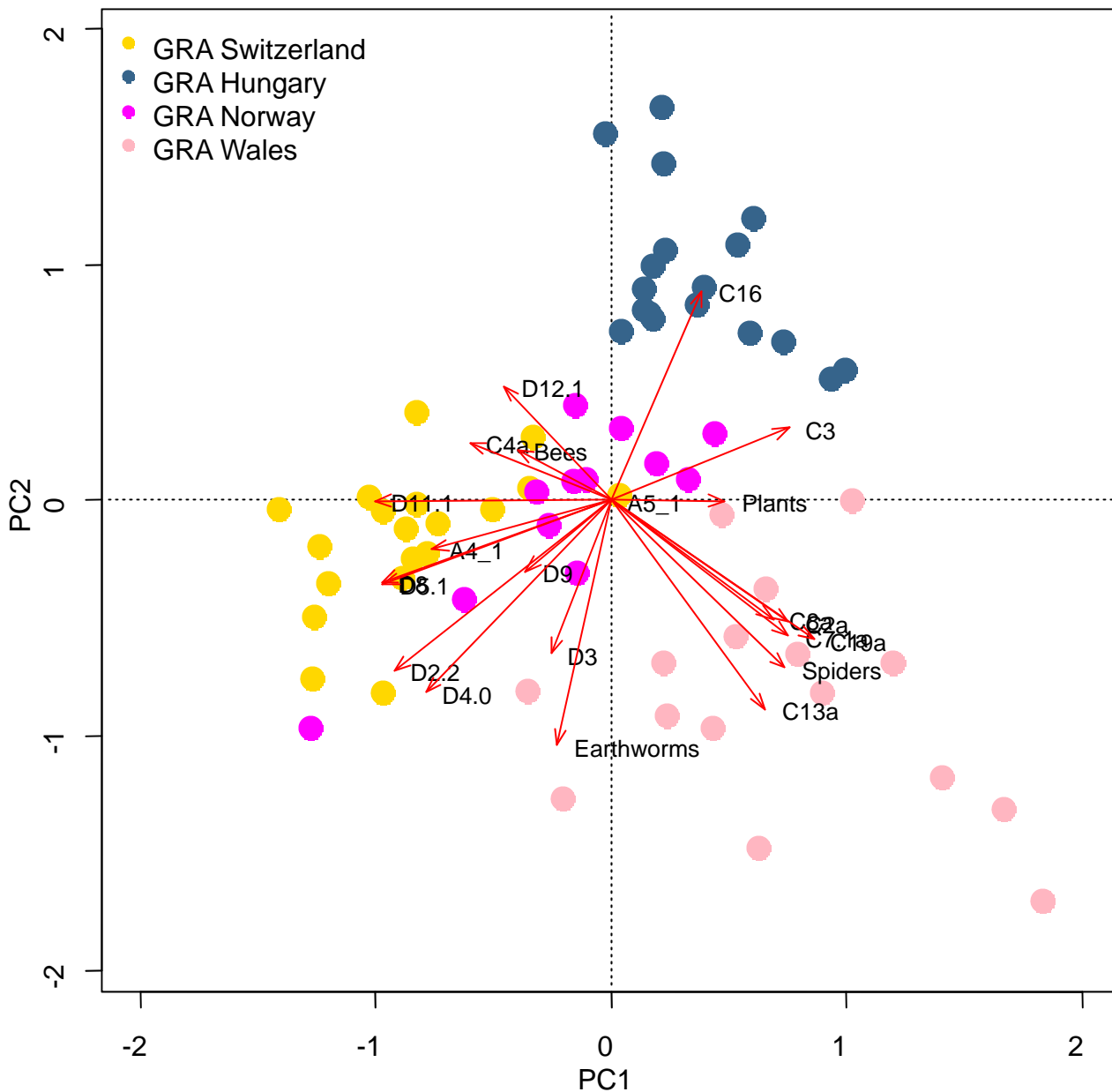
■ No obvious indicator to distinguish between the farming systems.

# Ordination (PCA) of 185 BioBio farms and 22 biodiversity and farming indicators



- Species (-)
  - Habitat diversity (-) (C2a, C3)
  - Varieties (A4\_1)
- ... are indicators for farm types with **permanent crops**

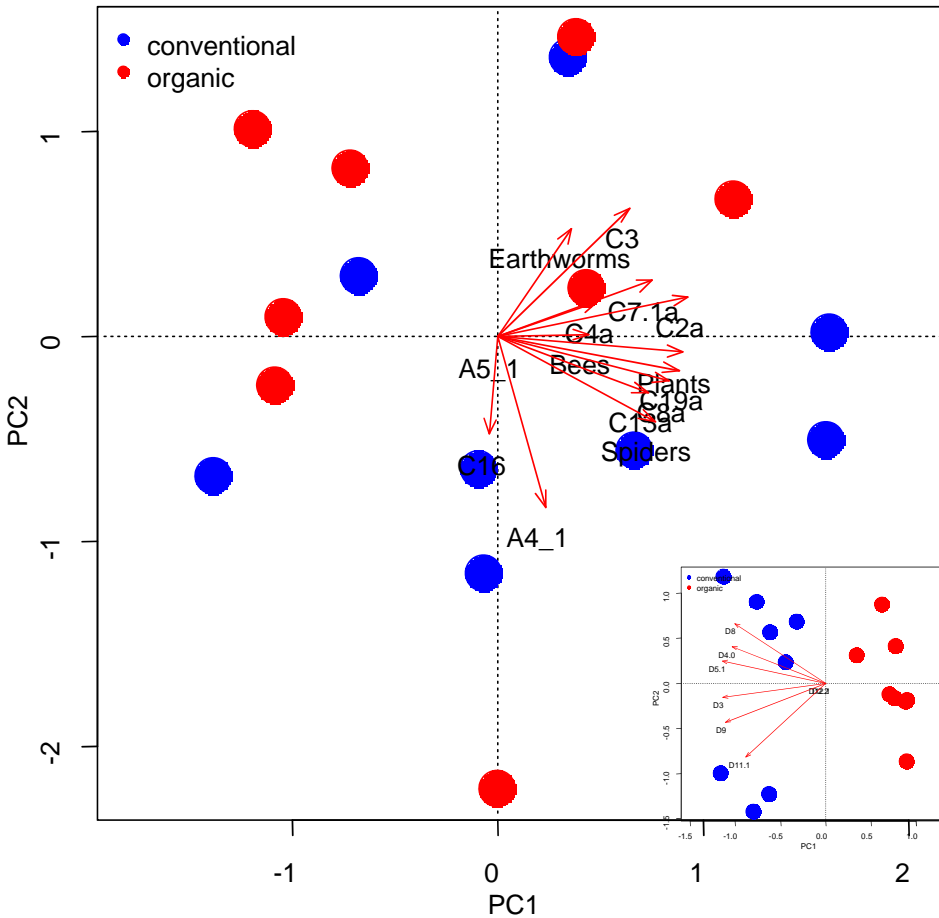
# Ordination (PCA) of 65 BioBio farms and 22 biodiversity and farming indicators



- **Patch size (C16)**  
... is indicators for the grassland case study in Hungary
- **Habitat diversity**
- **Habitat richness**
- **Tree cover**
- **Shrubs**
- **Linear elements**
- **Share of semi-natural habitats**
- **Spiders**  
... are indicators for the case study in Wales.

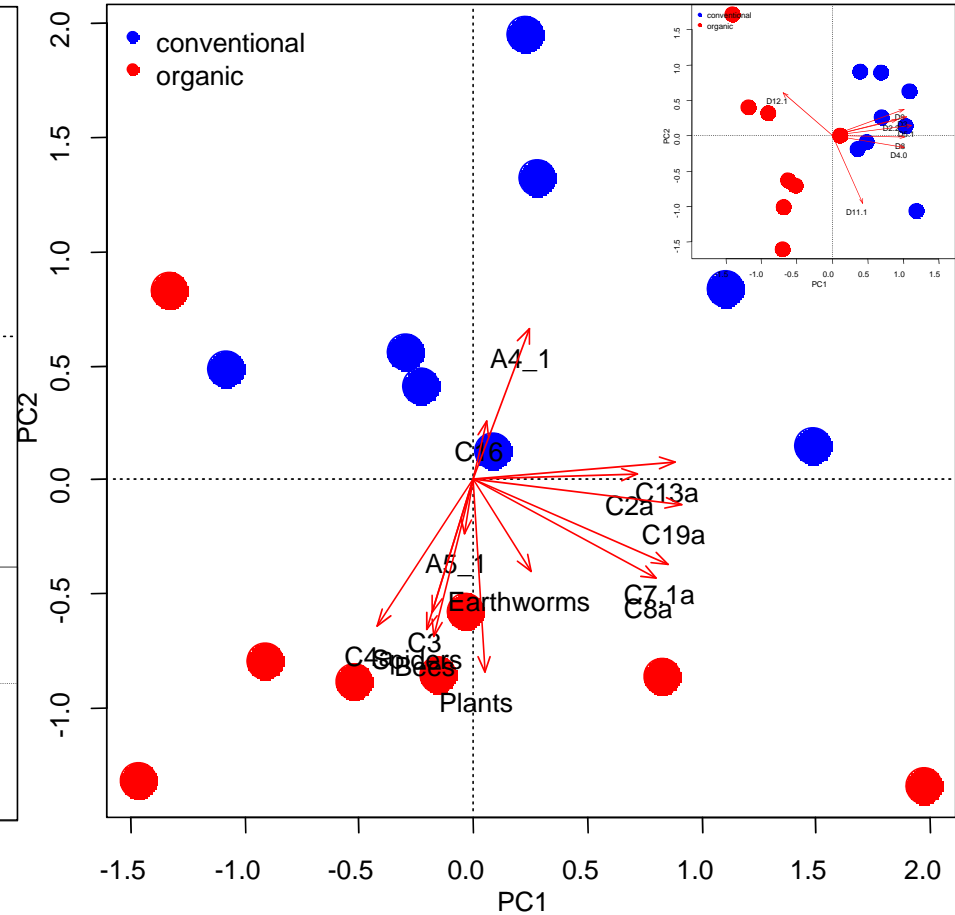


## Arable farming in France



- Clear difference organic vs. non organic for the management indicators
- No clear difference organic vs. non organic for the genetic, species and habitats indicators
- Nitrogen input in organic = 44 kg N /ha
- Nitrogen input in non organic = 119 kg N /ha

## Mixed farming in Germany



- Clear difference organic vs. non organic for the management indicators
- Organic are richer in habitats, plants, spiders and bees
- Nitrogen input in organic = 176 kg N /ha
- Nitrogen input in non organic = 254 kg N /ha

# Indicator system



<b>All farm types</b>	Genetic diversity	CultDiv			
	Species diversity	Plants, Bees, Spiders, Earthworms			
	Habitat diversity	HabRich, HabDiv, ShrubHab, LinHab, PatchSize, SemiNat			
	Farm management	MinFert, NitroIn, EnerIn, IntExt, FieldOp			
<b>Specific farm types</b>		<b>Field crops &amp; horticulture</b>	<b>Specialist grazing livestock</b>	<b>Mixed crops - livestock</b>	<b>Permanent crops</b>
	Genetic diversity	CropOrigin	Breeds	Breeds CropOrigin	
	Species diversity				
	Habitat diversity	CropRich TreeCover	TreeHab	CropRich TreeHab	
Farm management	PestUse	AvStock Graze	AvStock PestUse Graze	AvStock PestUse	

# [ Take home message ]

- The BioBio indicator set indicates differences between case studies, farming systems, farm types and farms
- No single indicator can be derived
- Given the results, no aggregated index is recommended
- There is no general pattern of differences between organic farming and the baseline (non organic farming) but difference in particular case studies
- Interpretation for monitoring purposes makes sense



Thank you !

