

Extended Field Margins EFM — A key habitat for restoration of intensively cultivated landscapes



Andreas Bosshard¹⁾, Katja Jacot²⁾, Bernhard Schmid¹⁾

1) Institute of Environmental Sciences, University of Zurich

2) Agroscope FAL Reckenholz, Zurich, Switzerland



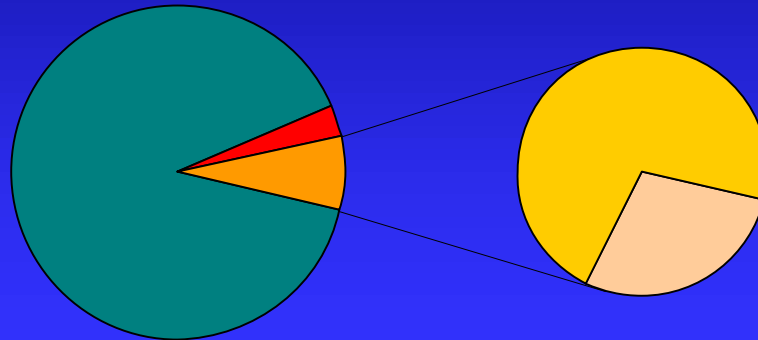
Overview

- I) Background — the Swiss situation
- II) The EFM* concept
- III) Results
- IV) Perspectives for agro-biodiversity in Switzerland

* Extended Field Margin

I) Background - the Swiss situation

Agriculturally used areas in Swiss midland



- Intensively cultivated 90%
- Nature reserves 3%
- Ecological Compensation Areas (ECAs) with „good quality“ 2%
- ECAs with insufficient or "no" quality 5%

→ Quality of ECAs not yet satisfactory

→ Quantity of ECAs +30%

I) Background - the Swiss situation

→ New direct payments since 2001*:

- for Ecological Quality: +300 US \$/hectare ✓

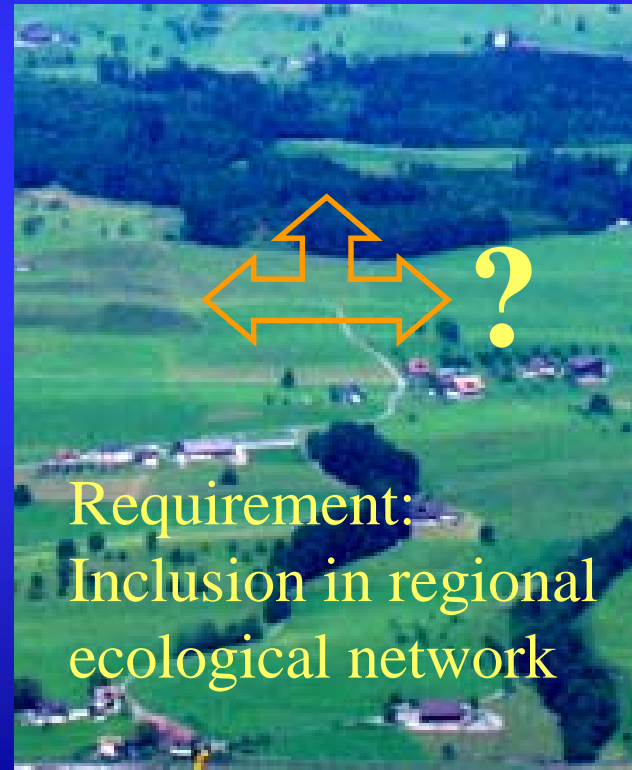


* Regulation about Ecological Quality of Compensation Areas

I) Background - the Swiss situation

→ New direct payments since 2001*:

- for Ecological Quality: +300 US \$/hectare ✓
 - for Ecological Connectivity: +300 US \$/hectare ✓
- = +600 US \$/hectare total ✓

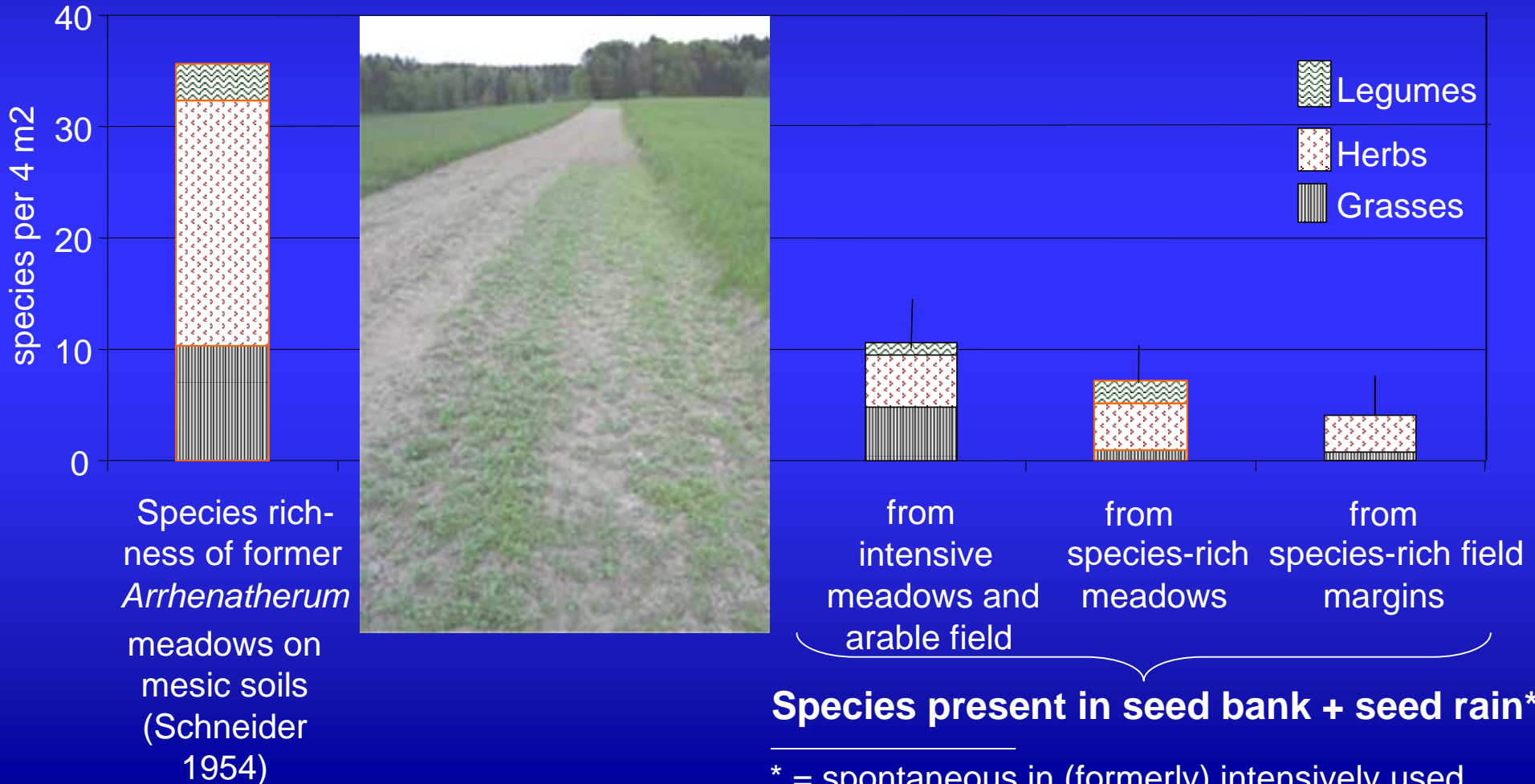


* Regulation about Ecological Quality of Compensation Areas

I) Background - the Swiss situation

2 Main challenges in Swiss midland:

1. Ecological Quality cannot be restored from seedbank and natural colonization



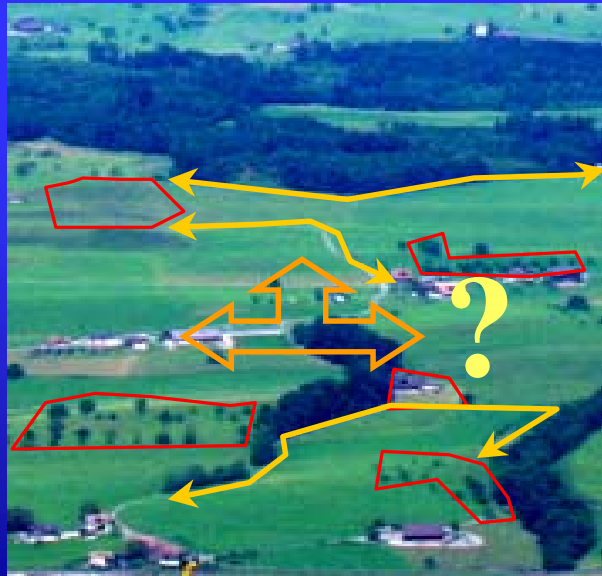
Species present in seed bank + seed rain*

* = spontaneous in (formerly) intensively used arable fields and meadows. n=478. Bosshard 1999

I) Background - the Suisse situation

2 Main challenges in the midland of Switzerland:

1. Ecological Quality cannot be restored from seedbank and natural colonization
2. Ecological Connectivity difficult to achieve with existing mostly non-linear, isolated ECAs (different meadow types, special fallows, trees, hedgerows)



II) The EFM* concept

Hypothesis:

Challenges can be resolved by seeding EFMs* that provide both Ecological Quality AND Ecological Connectivity

→ **Research project questions:**

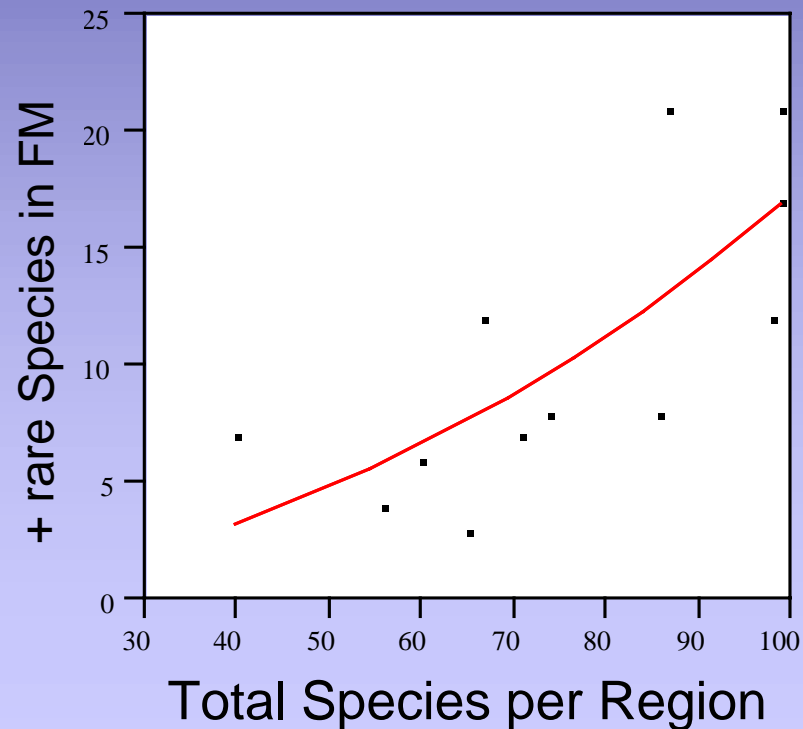
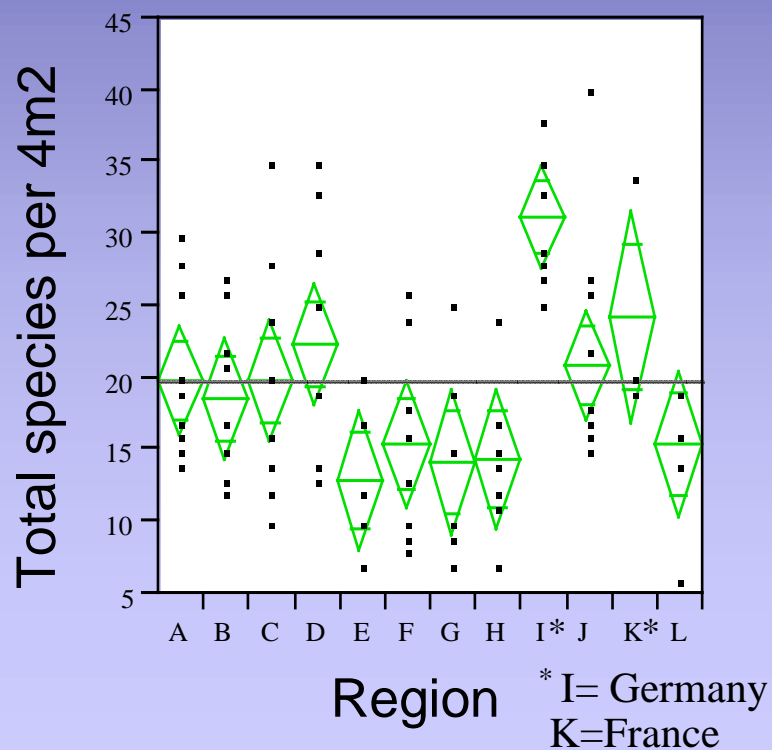
- How to **establish** species-rich EFMs?
- Do EFMs **increase** biodiversity at landscape level?
- How are EFMs **accepted** by farmers and public?

* Extended Field Margin

II) The EFM concept

Designing EFMs — Examples of existing FMs:

- a) No information about former FMs in Switzerland
- b) Low diversity of existing FMs in Switzerl. and adj. Regions(*)



II) The EFM concept

Designing EFMs — Targets:

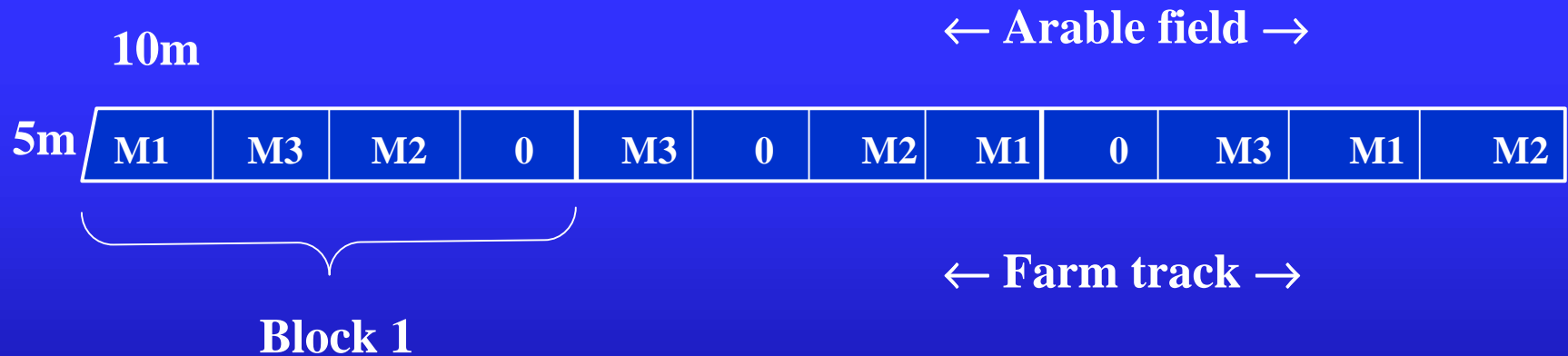
- high floral diversity (>20–25 EFM-specific species/m²)
- problematic plant species successfully suppressed (*Agropyron repens*, *Rumex obtusifolius*, *Cirsium arvense*, etc.)
- abundant and continuous flower offer during season
- low management requirements (mowing every second year)
- with stable species composition
- high faunal diversity (EFM-indicator species)

II) The EFM concept

→ Extensive on farm-experiments

Design

- 55 experimental fields (strips) in 10 regions in the Swiss Midlands
- 3 new test seed mixtures each for wet, intermediate and dry sites
- Block-design with 3 replicates per strip



M1, M2, M3: Types of seed mixtures

0 = Control (either seed mixture for species rich meadows or existing field margin)

II) The EFM concept

Abundance of different components in seed mixtures
M1, M2, and M3 (gr/100m²)

Component	M1	M2	M3
Grasses	normal (122)	low (42)	normal (127)
Herbs	normal (21)	normal (21)	low (13)
Legumes	normal (7)	normal (7)	missing
Arrhenatherum	normal (15)	low (7)	missing
total seed amount	(150)	(70)	(140)

Seed costs: between 800 and 1900 US \$ per ha

II) The EFM concept

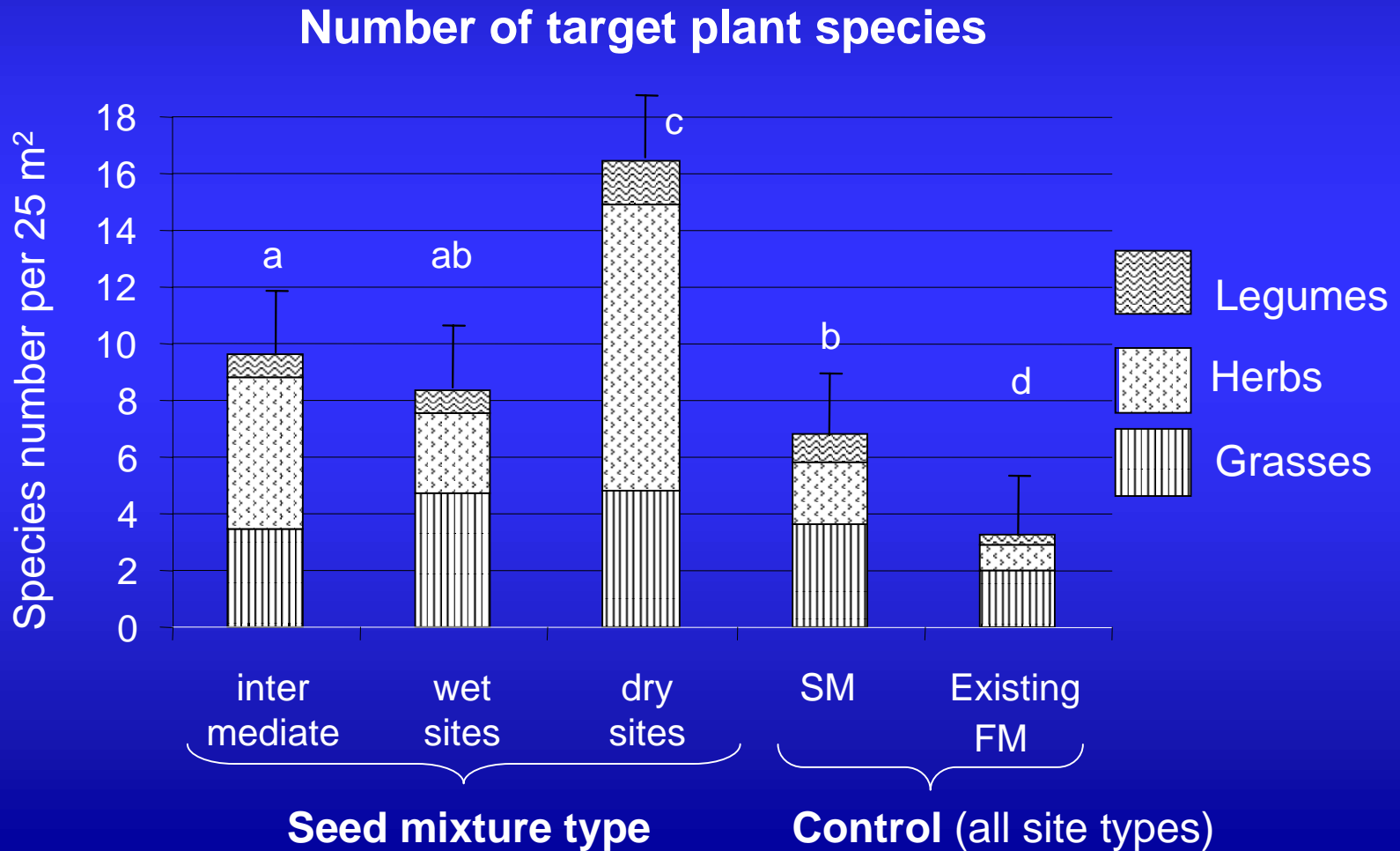
Example:

M1 for
wet sites

<i>Name</i>	<i>Seeds per m²</i>	<i>%</i>
Agrostis alba Kita	400,00	4%
Arrhenatherum elatius	49,15	12%
Festuca arundinacea Barcel	96,59	19%
Festuca pratensis Preval	121,43	23%
Festuca rubra r Echo	255,00	23%
Lolium perenne Baristra	100,28	15%
Phalaris arundinacea	33,33	4%
7 Grass species		
Lotus corniculatus	6,95	5,67%
Lathyrus pratensis	0,83	9,04%
Vicia sepium	0,58	9,04%
3 Legume species		
Alliaria petiolata	3,06	21,28%
Centaurea cyanus	5,12	14,18%
Centaurea jacea	2,48	3,55%
Cirsium oleraceum	0,97	2,84%
Filipendula ulmaria	0,48	1,77%
Galium verum	9,22	3,19%
Lycopus europaeus	10,13	1,42%
Lysimachia vulgaris	2,09	2,48%
Lythrum salicaria	23,83	1,42%
Mentha longifolia	18,51	0,71%
Papaver rhoeas	43,49	2,84%
Pimpinella major	2,59	10,64%
Pulicaria dysenterica	16,53	1,06%
Scrophularia nodosa	23,58	1,06%
Stachys officinalis	2,03	7,09%
Valeriana officinalis	1,02	0,71%
14 perennial herbs		

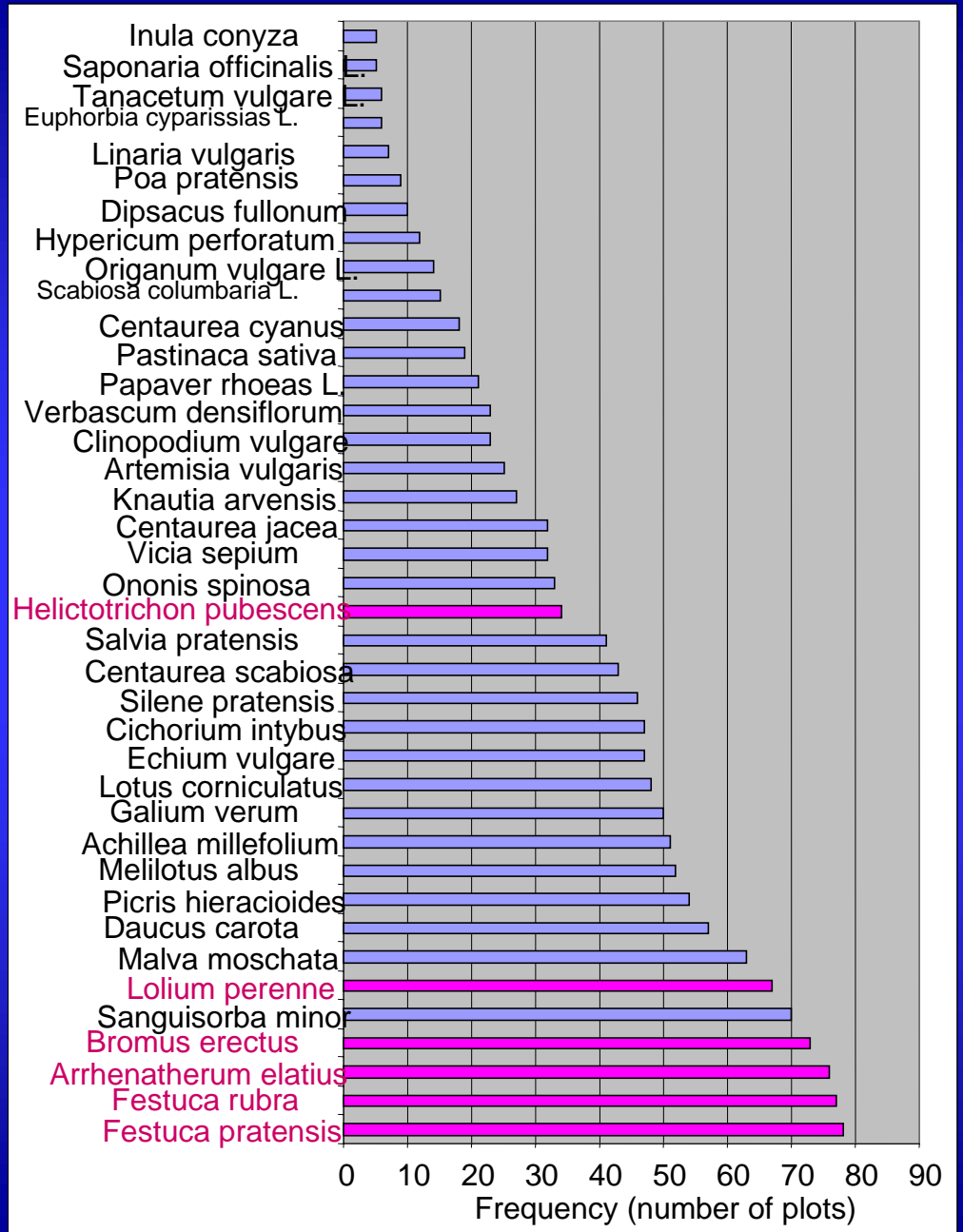
**Ecotypes of
regional
provenance**

1. Botanical Diversity



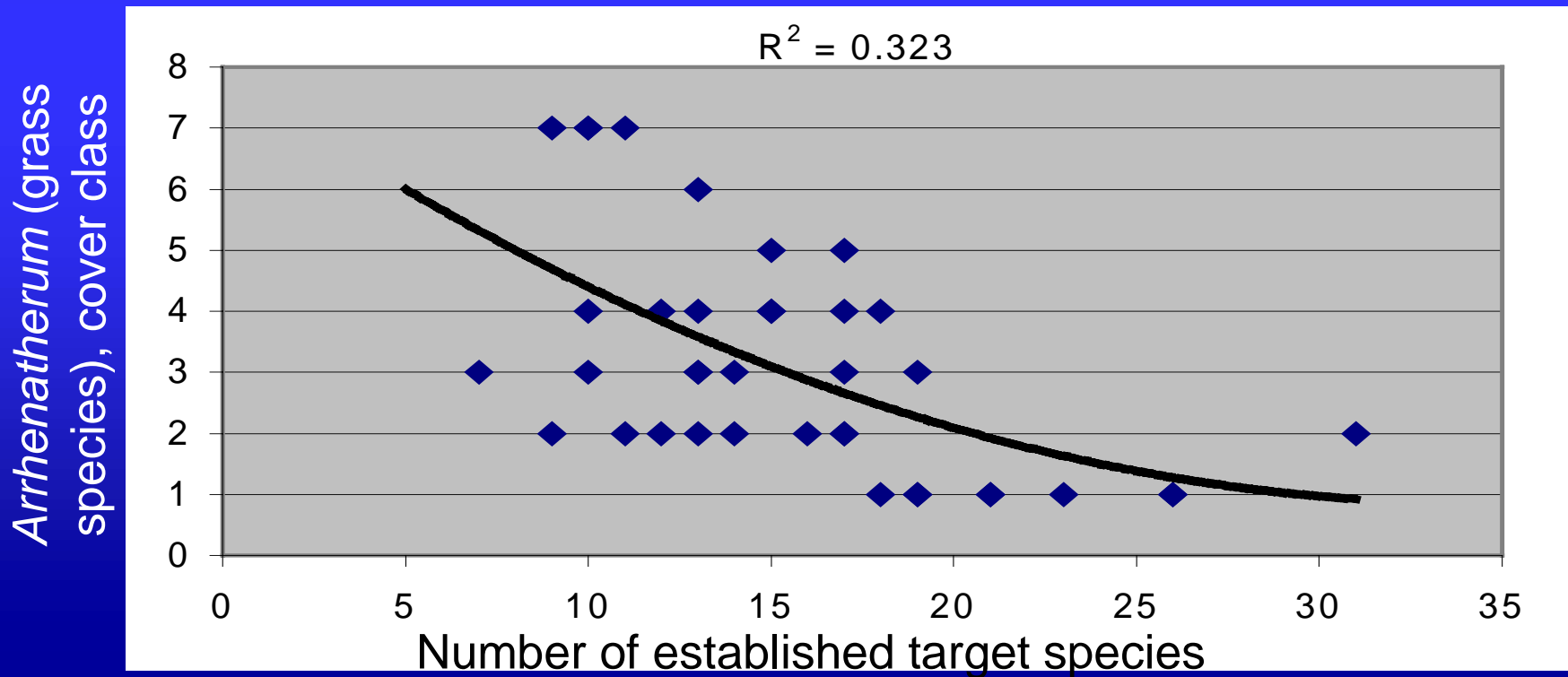
III) Results - Floristic aspects

How successfully do
the seeded species
establish
(persistence > 1 yr)?
Example of seed mixture
type for dry sites



III) Results - Floristic aspects

- In > 60% of the cases, with improved seed mixture even >80% of the minimum target values reached
- Site condition: shadow of hedgerows or trees reduced the species richness and particularly the herb portion in EFM drastically!
- Weeds are successfully suppressed
- Negative influence of *Arrhenatherum* grass in the mixture:



Conclusions

- Establishment of EFM as a new eco-element in respect to defined floristic targets realistic and recommendable
- Success on shady sites to be improved (less grass portion!)
- Portion of herbs generally to be increased (→ higher seed mixture costs)

III) Results - Diversity of flag ship arthropods

Methodology

Selected flag ship taxa: butterflies and grasshoppers

Comparison of (1) EFM, (2) „normal“ Field Margin*,

(3) special fallow,

(4) species rich and (5) poor extensively used meadow, (6) biodiversity hotspot

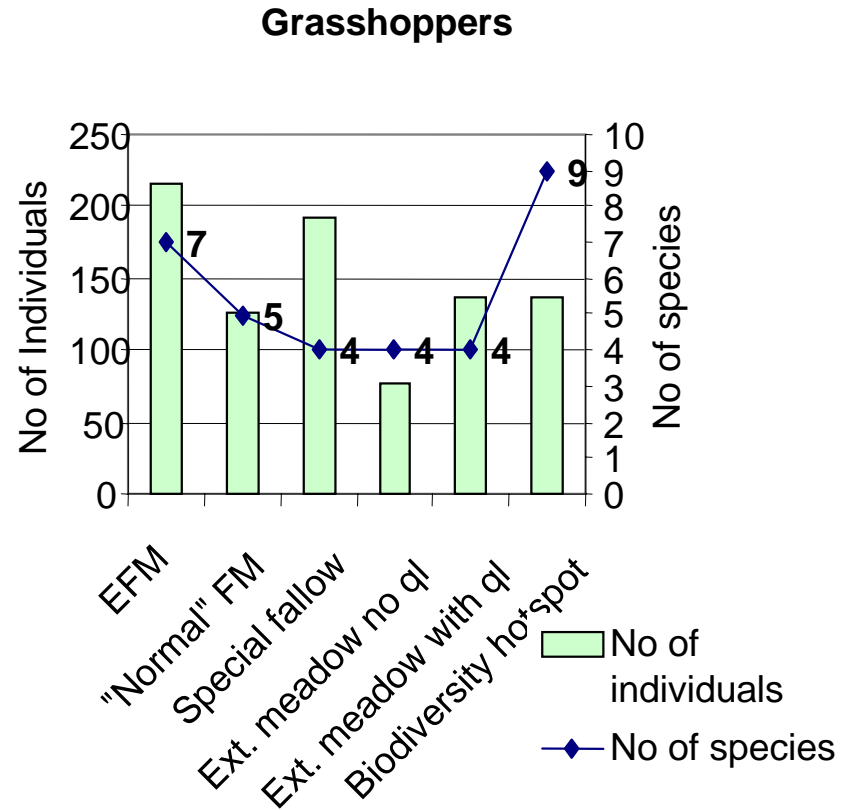
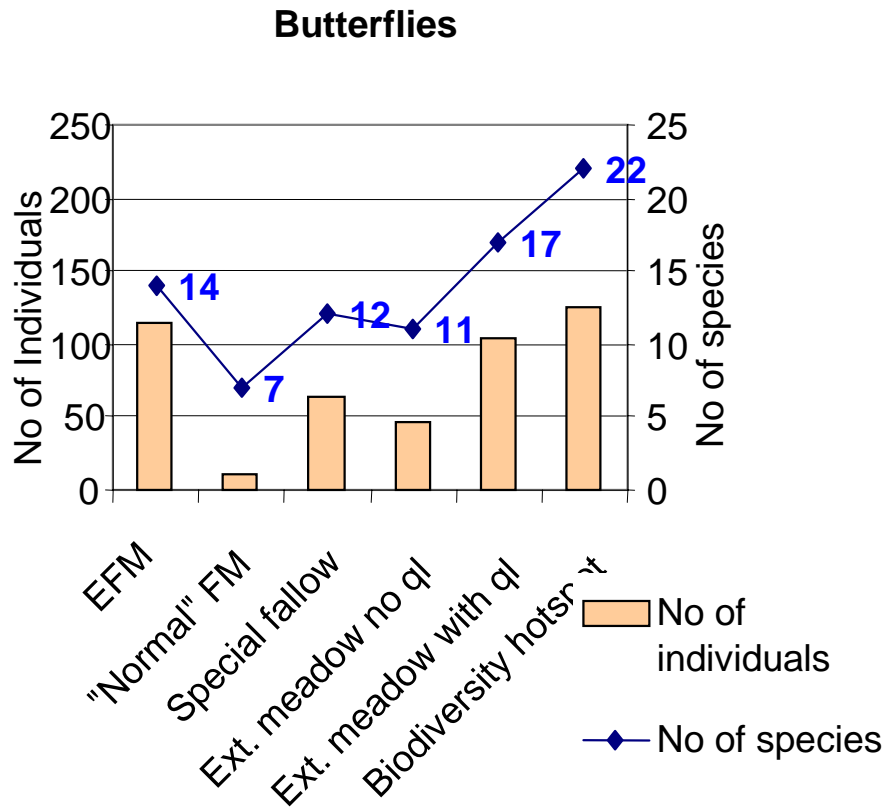
n=72 (4 regions, 6 dates, 3 replicates)



* no ECA

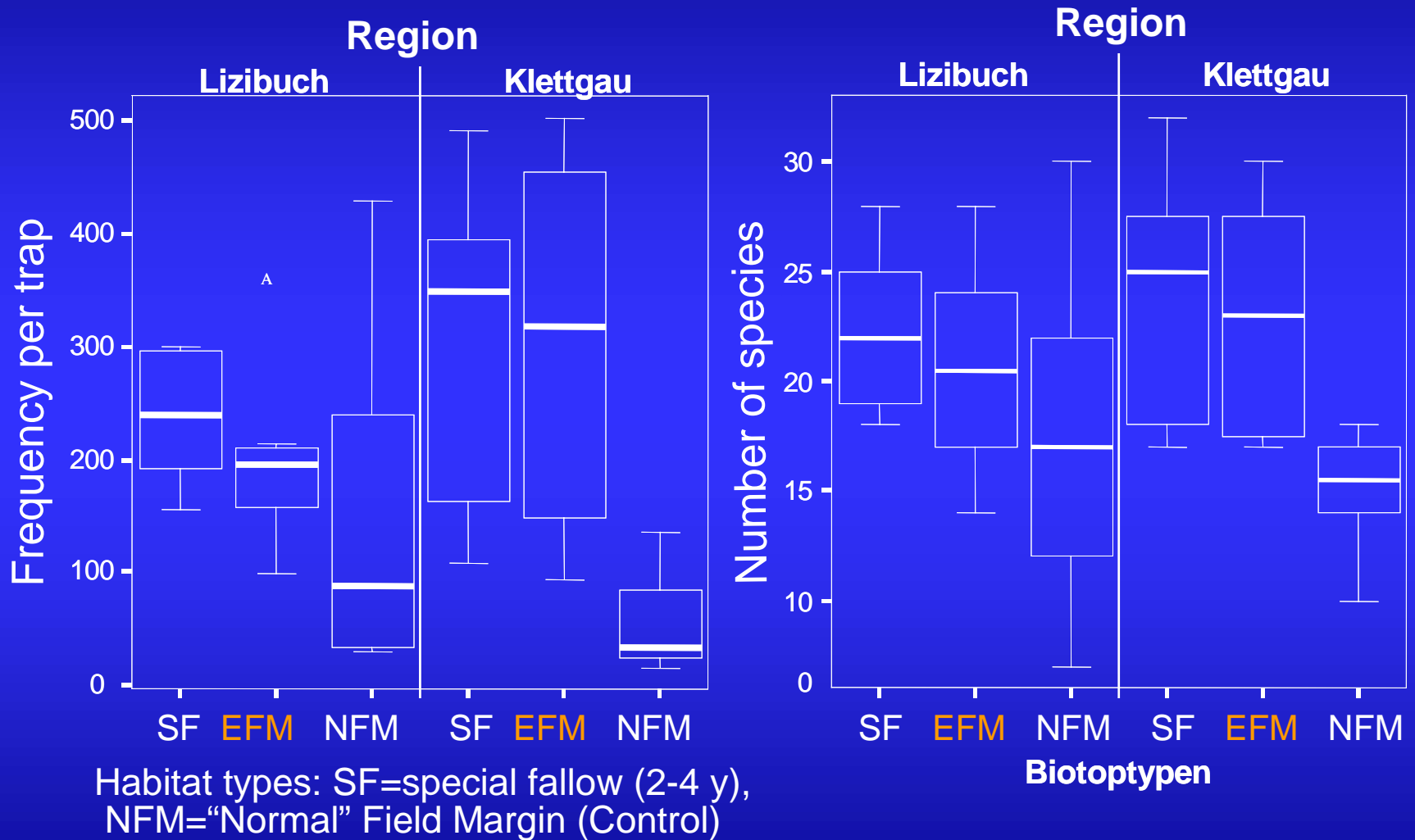
III) Results - Diversity of flag ship arthropods

Results



→ Species diversity of EFM's after 1 year comparable with best ECA's (special fallows, 2-4 yr.) and old local biodiversity hotspots

3. Effects on beneficial Arthropods: Example Carabidae



→ (1 year old) EFM provide habitat quality comparable with (2-4 year old) special fallow!

III) Results - Slugs

4. Effects on Slugs

Main species (pest potential in crop fields)



**Deroceras
reticulum**



Arion lusitanicus



Arion distinctus / hortensis

III) Slugs

Methodology

n=240 (5 regions, 2 dates, 3 field margin pairs, 8 traps).

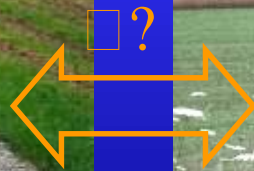
trap
type



“Normal” Field Margin (NFM)

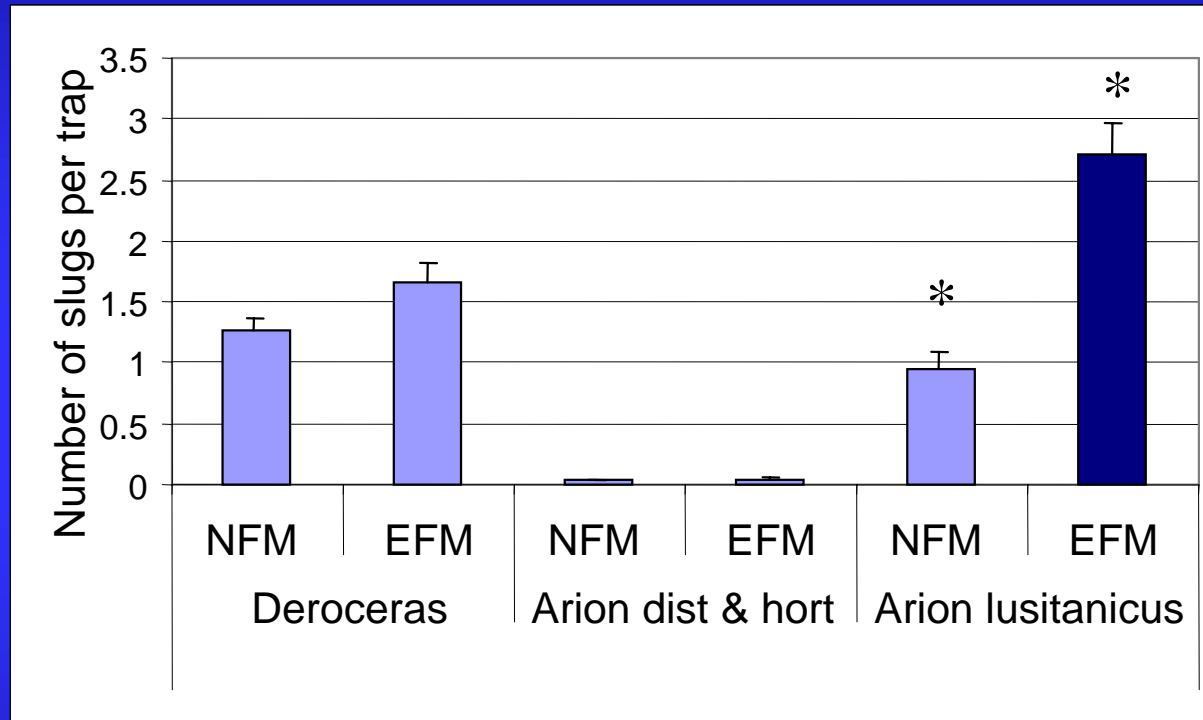


EFM



III) Results - Slugs

Frequency of slugs in „normal“ Field Margins (NFM) and EFM

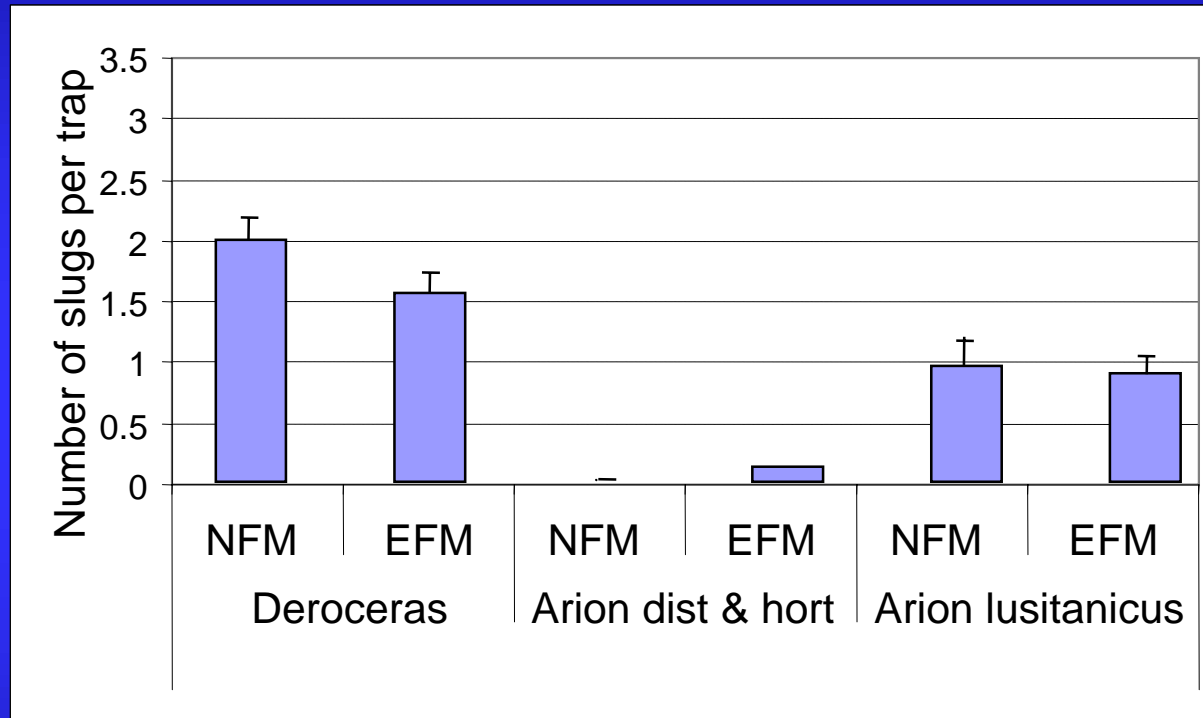


* $p < 0.00001$

p (type of FM x slug species) < 0.00001

III) Results - Slugs

Frequency of slugs in adjacent crop fields



(no significant differences)

→ EFM do not negatively influence adjacent crop fields

III) Results - People's acceptance

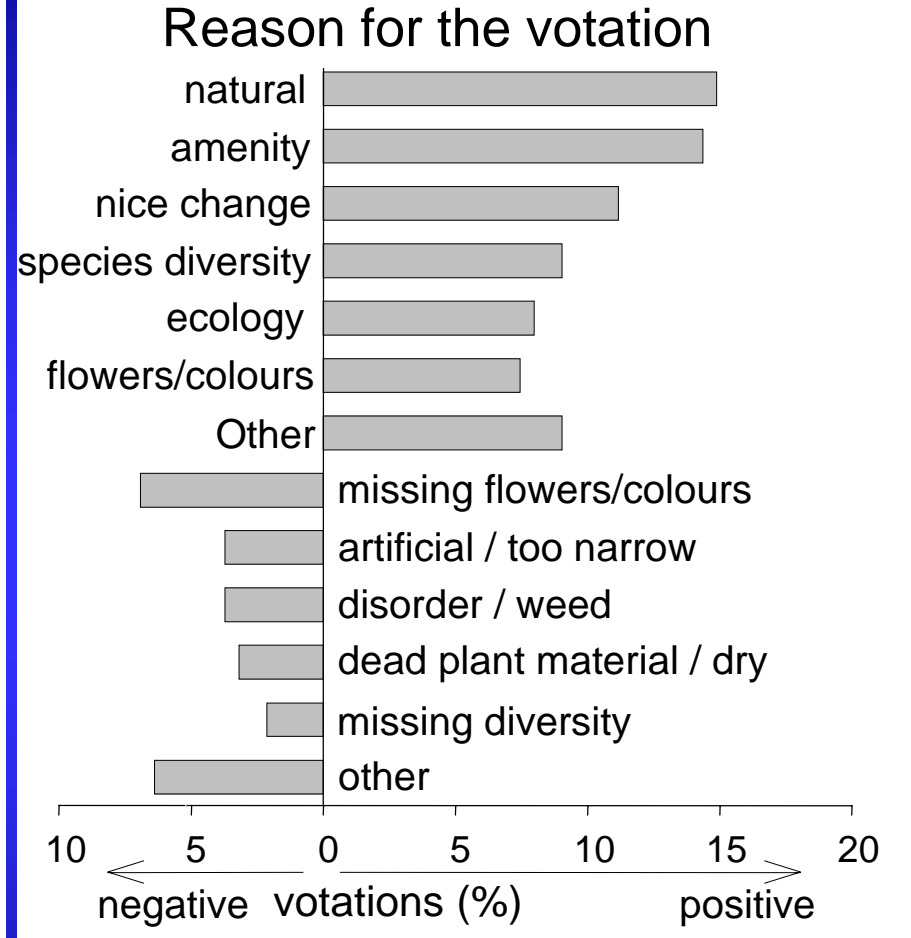
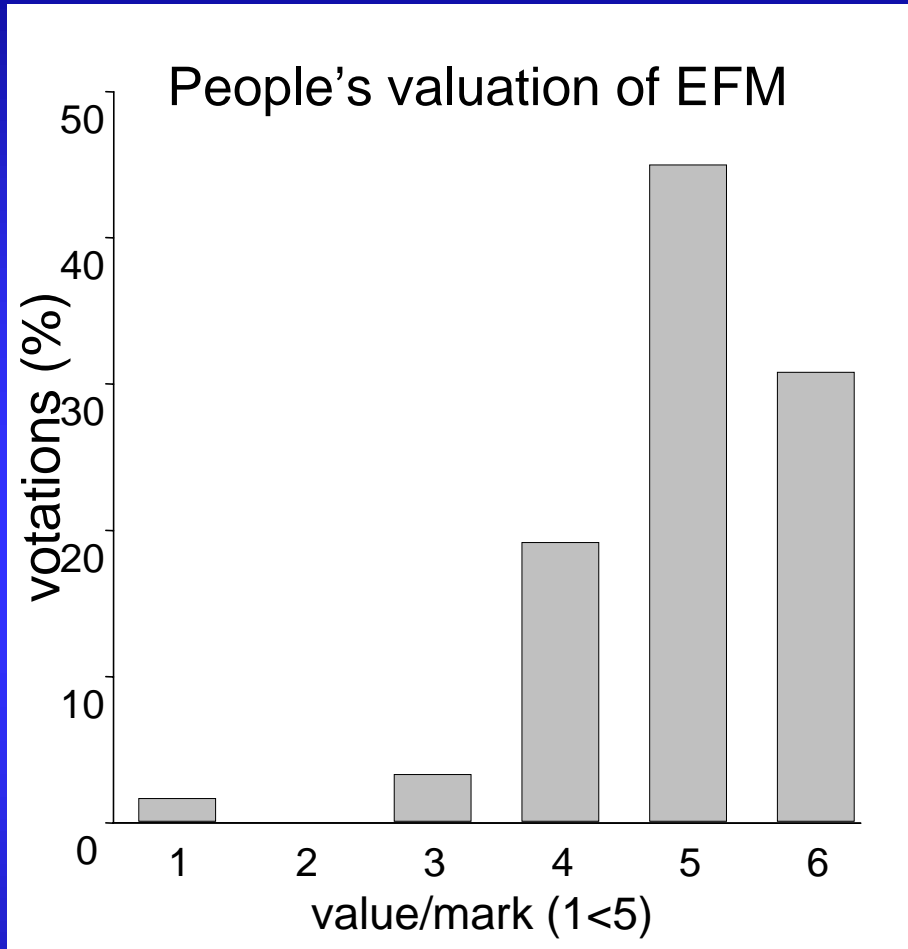
Do people appreciate EFM's?

Study participants were asked to:

- estimate the number of plant species in EFM's, other ECAs and normal FM's
- assess each type (1 = least attractive, 6 = most attractive) and explain their decisions

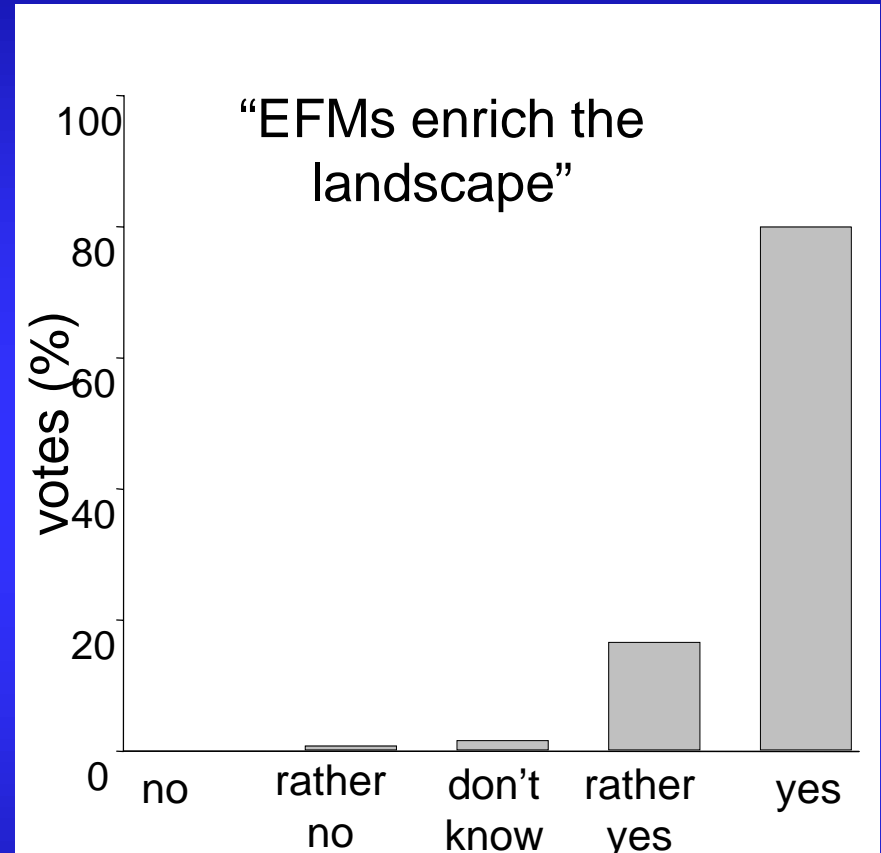
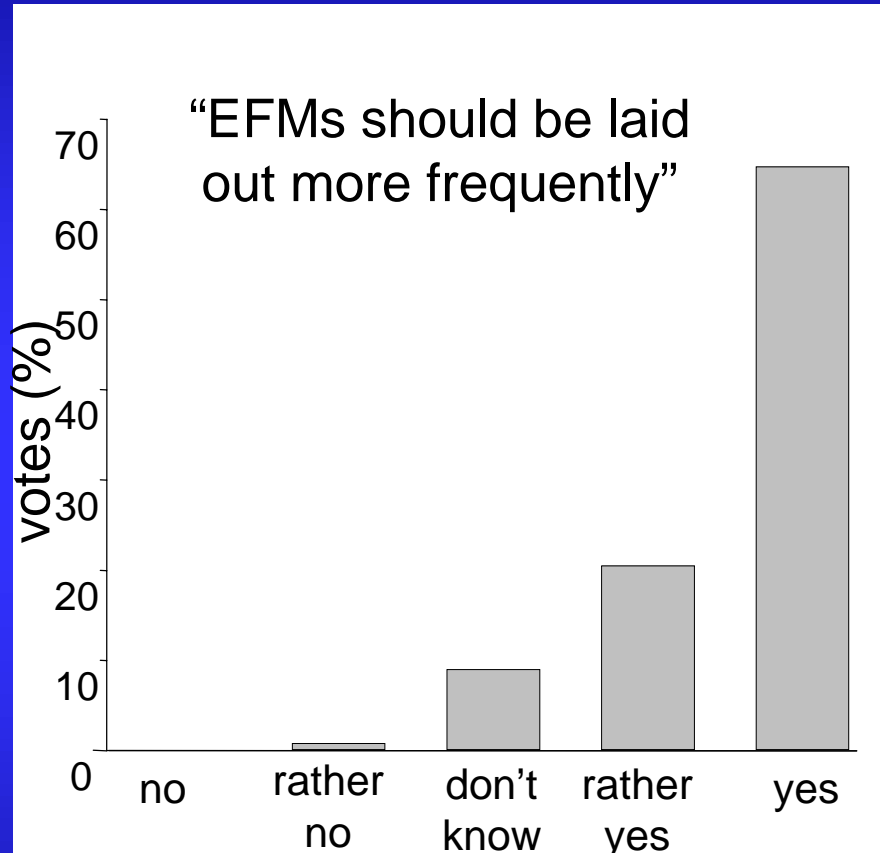


III) Results - People's acceptance



1 = least attractive, 6 = most attractive
Average = 4.8, Median = 5.0

III) Results - People's acceptance



→ **More than 80% support an introduction of EFMs as new ECA-type**

IV) Perspectives for agro-biodiversity in Switzerland

→ EFM's will provisionally be introduced as new ECA-type in 2006



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- Federal Office for Agriculture, Fonds Landschaft Schweiz, Federal Office for Environment and fenaco for financial support
- Farmers for experimental sites and co-operation