

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



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# Overview

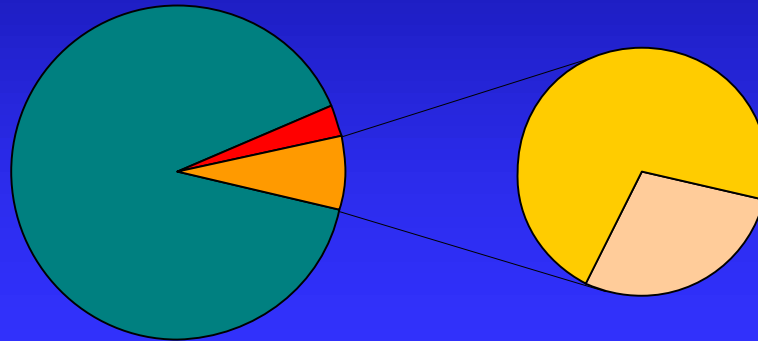
- I) Background — the Swiss situation
- II) The EFM\* concept
- III) Results
- IV) Perspectives for agro-biodiversity in Switzerland

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\* 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 ✓



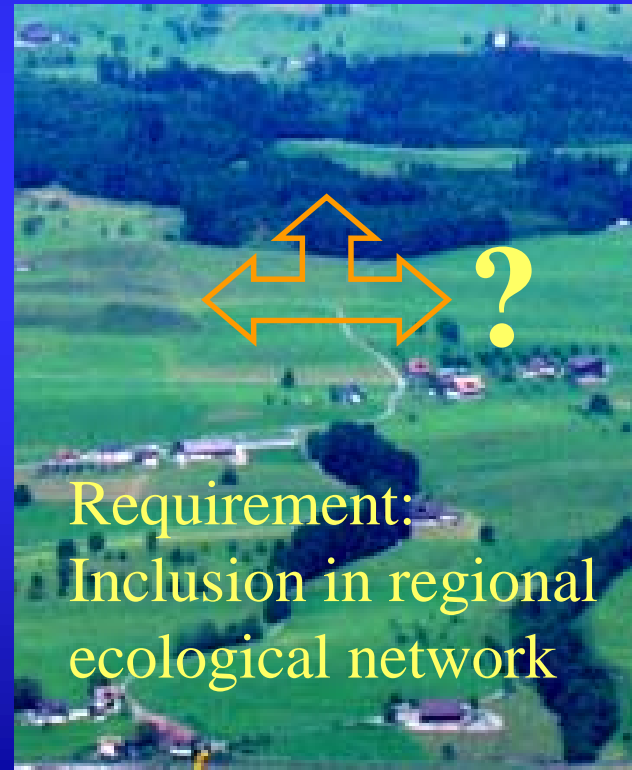
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\* Regulation about Ecological Quality of Compensation Areas

## 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 ✓



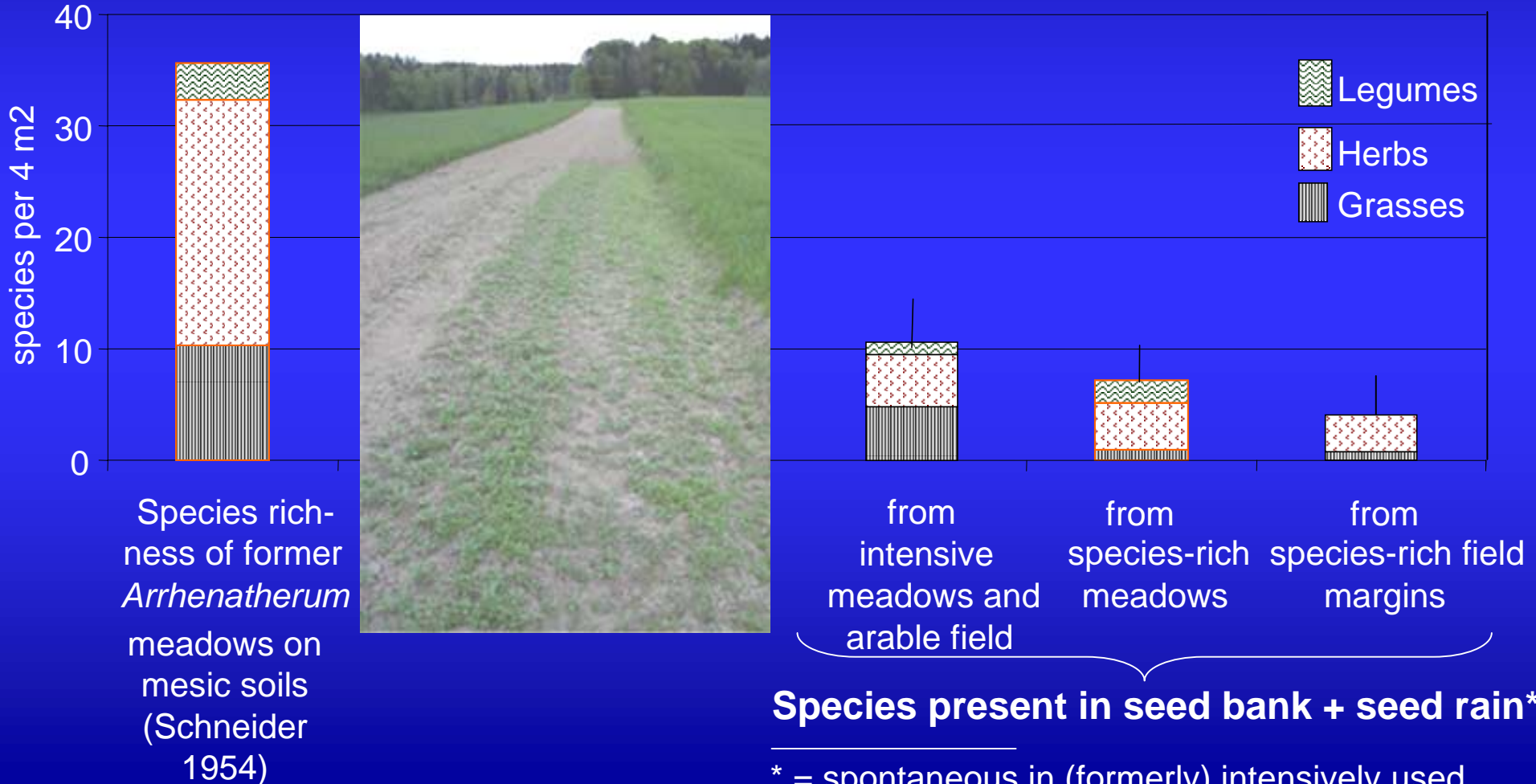
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\* Regulation about Ecological Quality of Compensation Areas

# I) Background - the Swiss situation

## 2 Main challenges in Swiss midland:

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



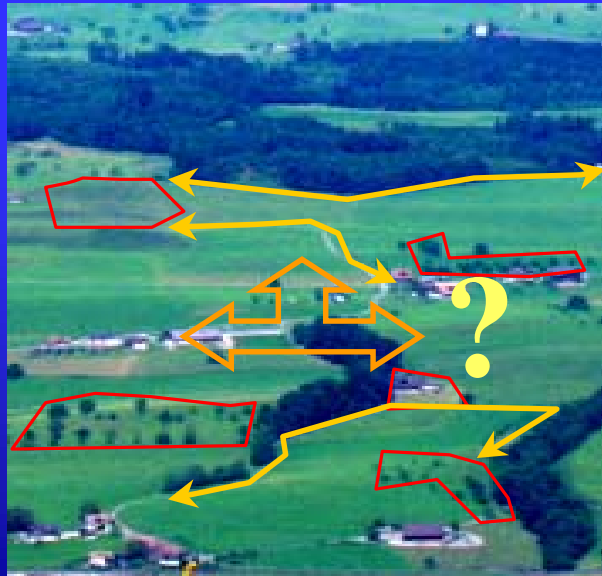
**Species present in seed bank + seed rain\***

\* = 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?

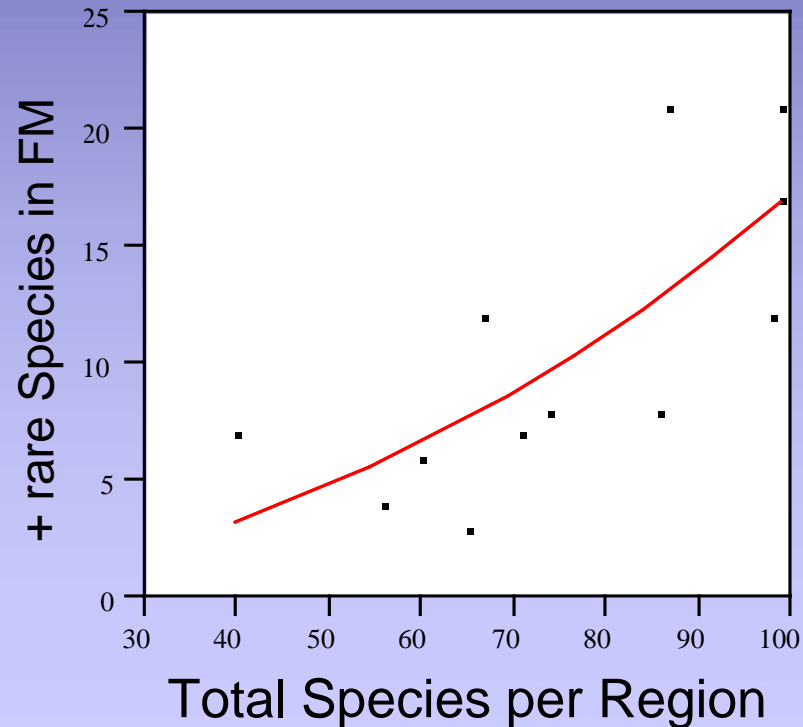
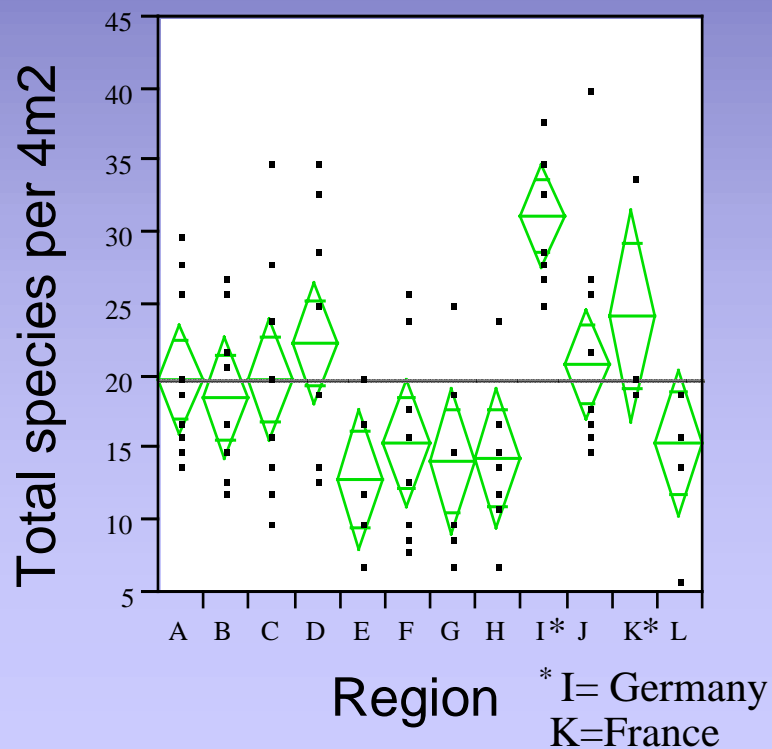
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\* Extended Field Margin

## 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:**

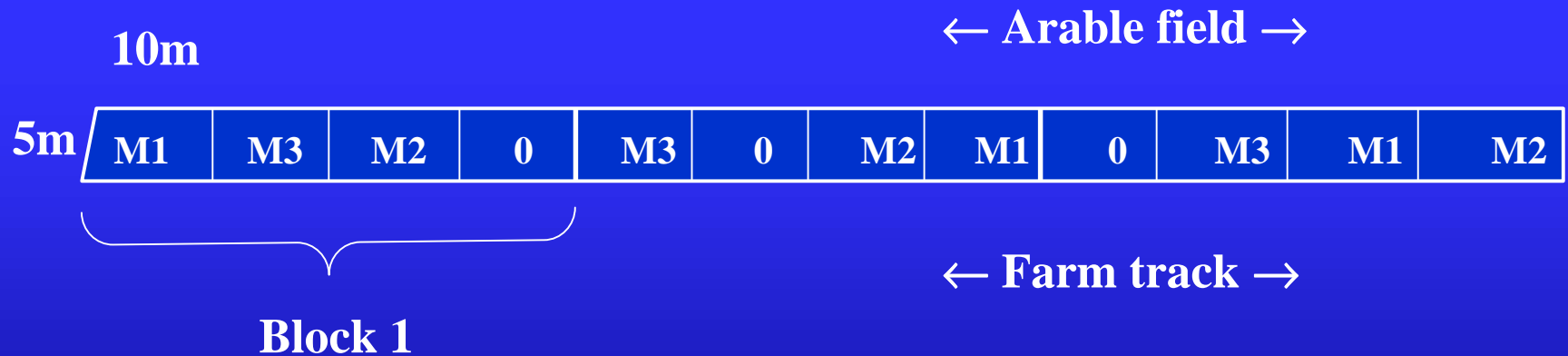
- high floral diversity (>20–25 EFM-specific species/m<sup>2</sup>)
- problematic plant species successfully suppressed (*Agropyron repens*, *Rumex obtusifolius*, *Cirsium arvense*, etc.)
- abundant and continuous flower offer during season
- low management requirements (mowing every second year)
- with 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/100m<sup>2</sup>)

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

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

## II) The EFM concept

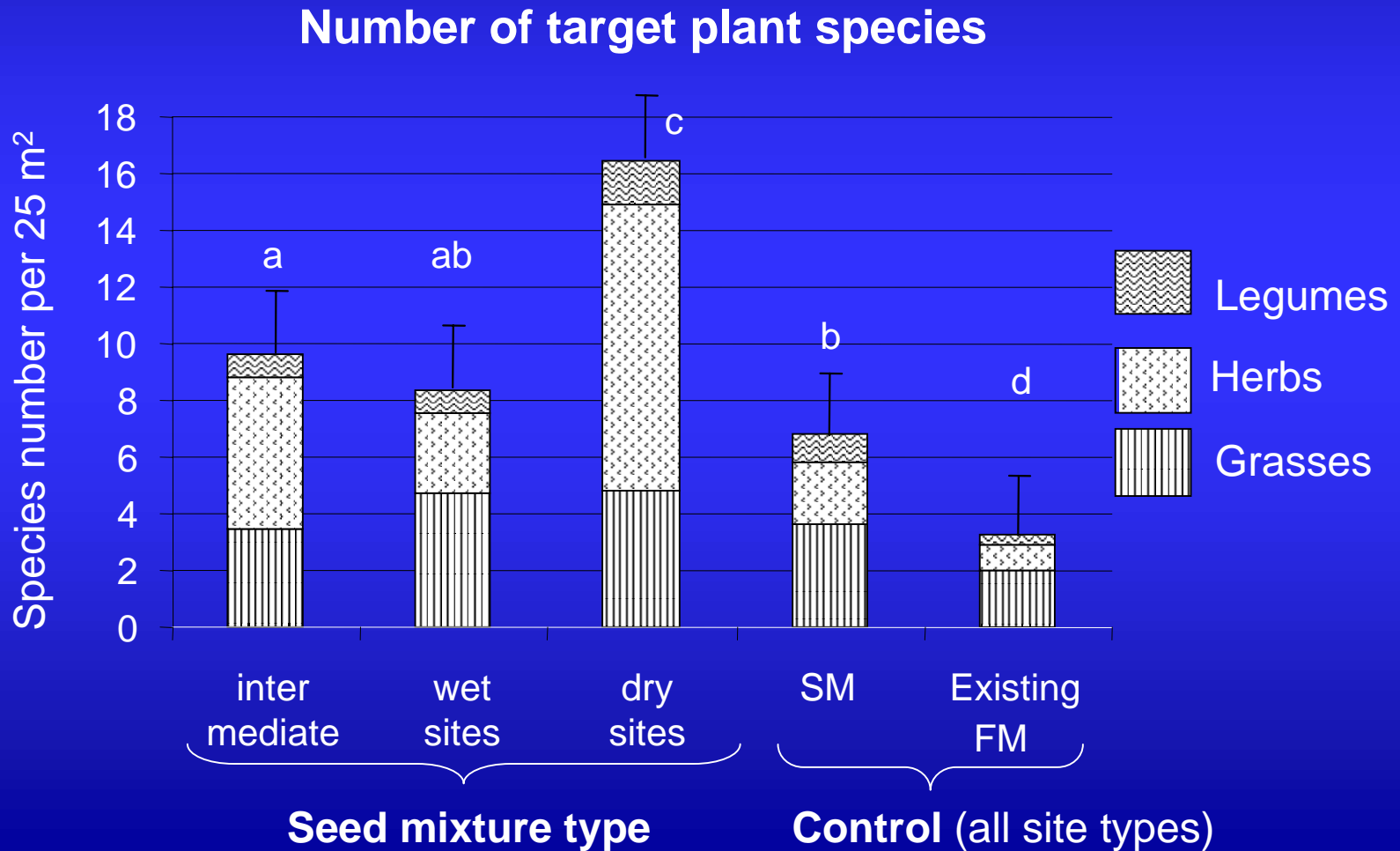
Example:

M1 for  
wet sites

<i>Name</i>	<i>Seeds per m<sup>2</sup></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%
<b>7 Grass species</b>		
Lotus corniculatus	6,95	5,67%
Lathyrus pratensis	0,83	9,04%
Vicia sepium	0,58	9,04%
<b>3 Legume species</b>		
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%
<b>14 perennial herbs</b>		

**Ecotypes of  
regional  
provenance**

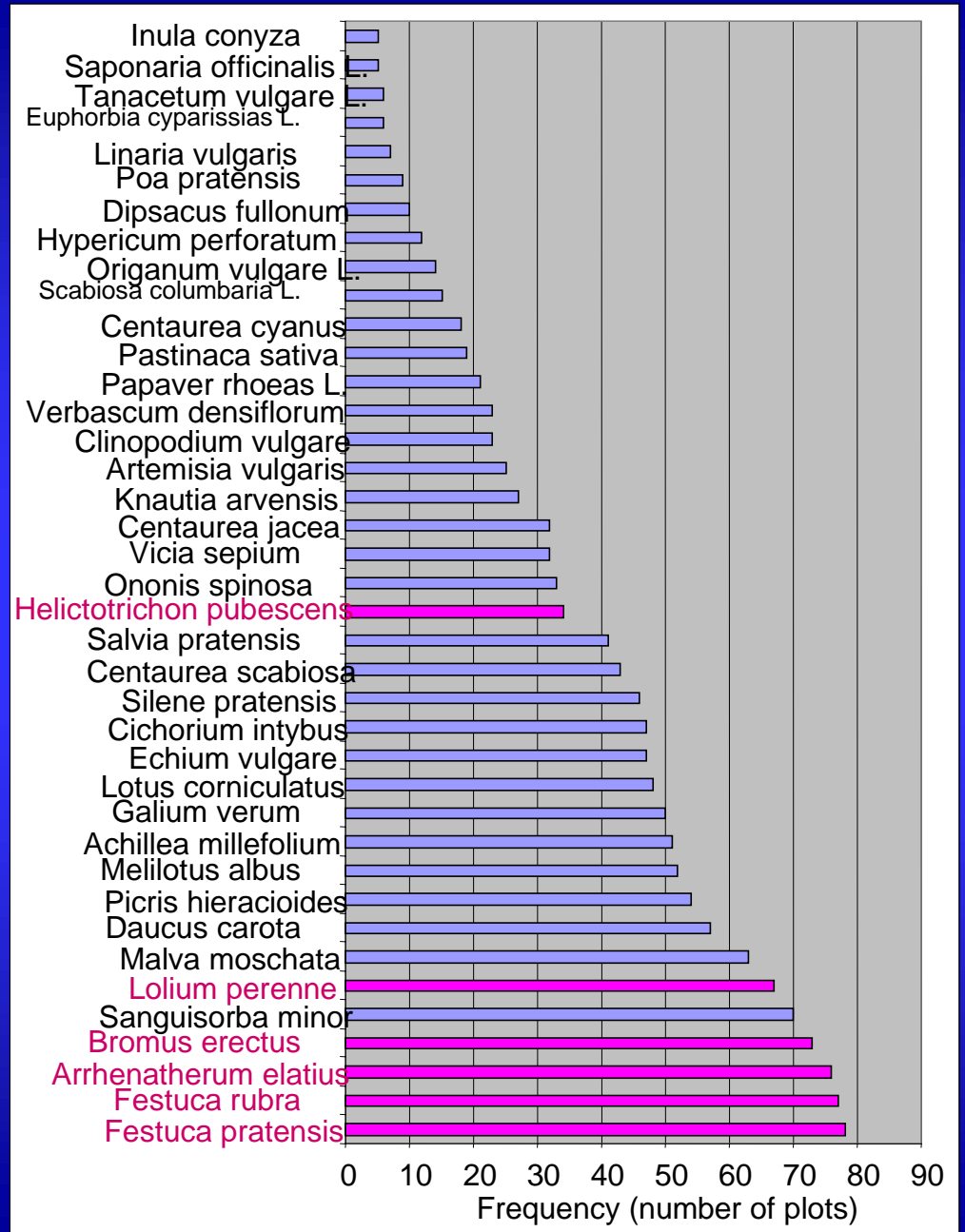
## 1. Botanical Diversity



### III) Results - Floristic aspects

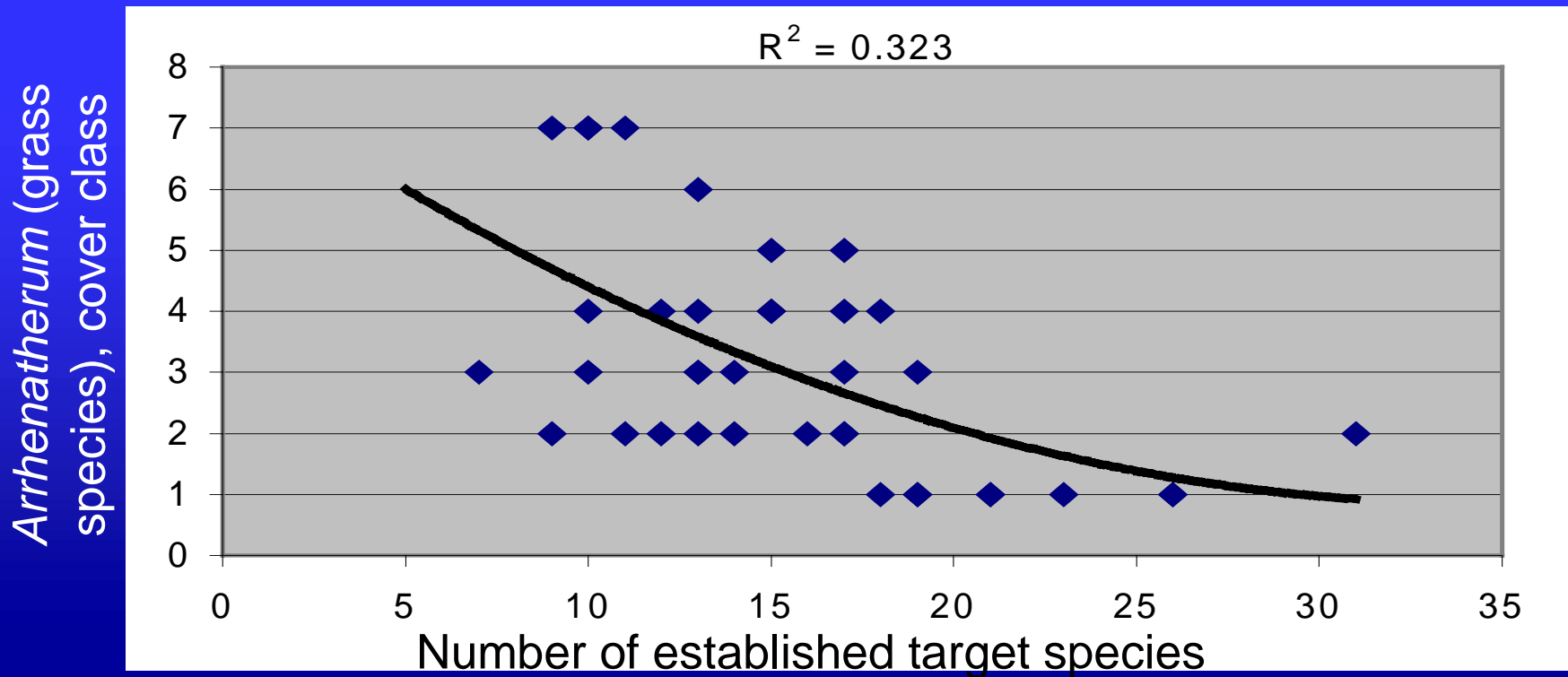
How successfully do  
the seeded species  
establish  
(persistence > 1 yr)?

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

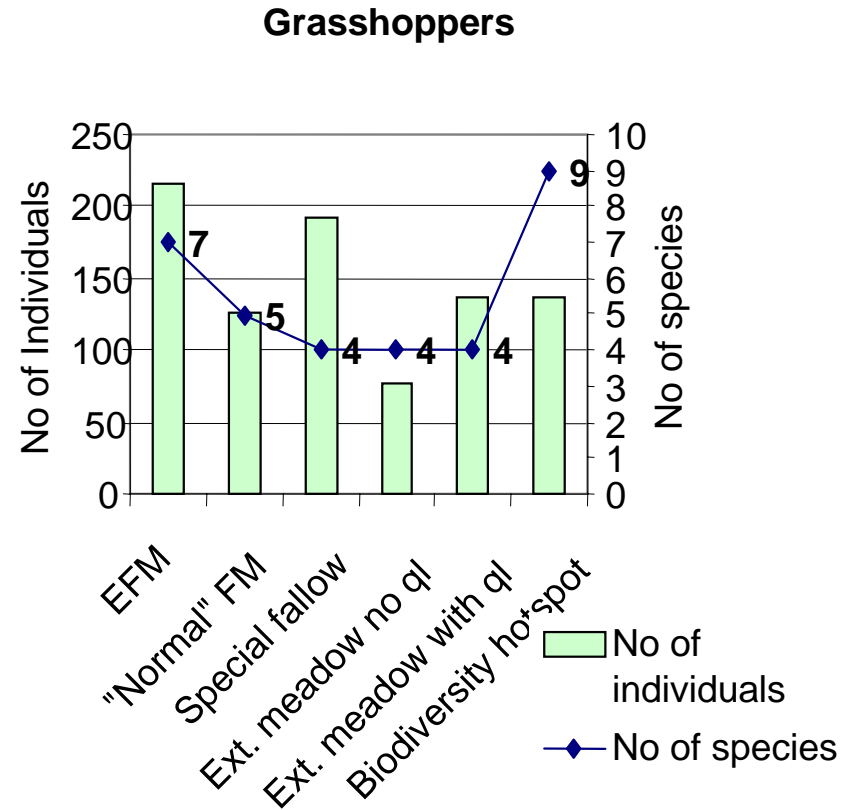
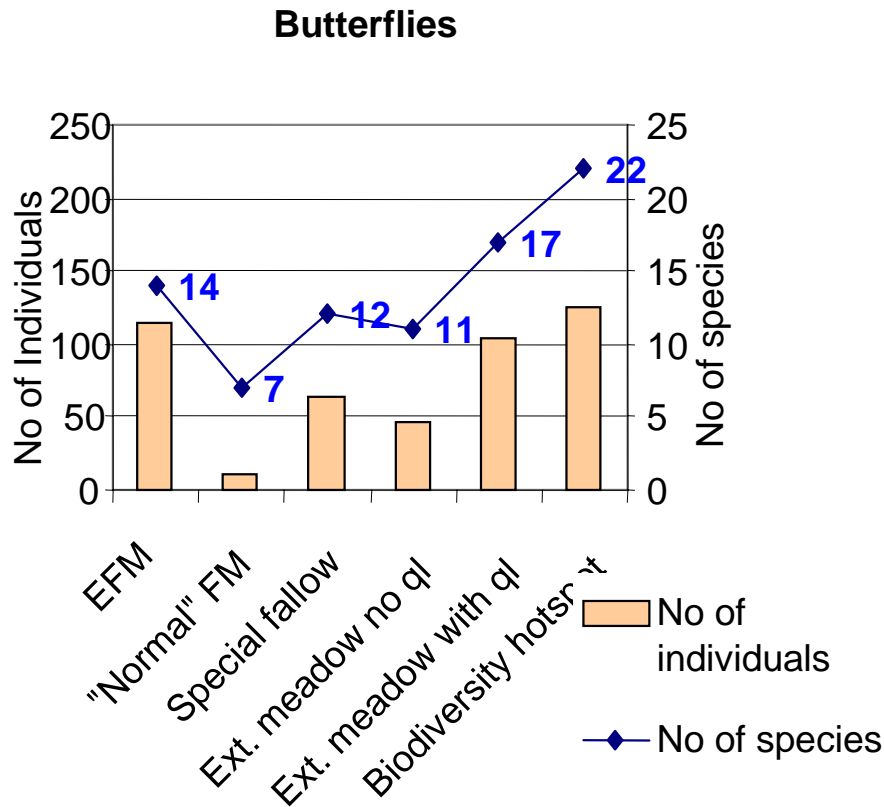
n=72 ( 4 regions, 6 dates, 3 replicates)



\* no ECA

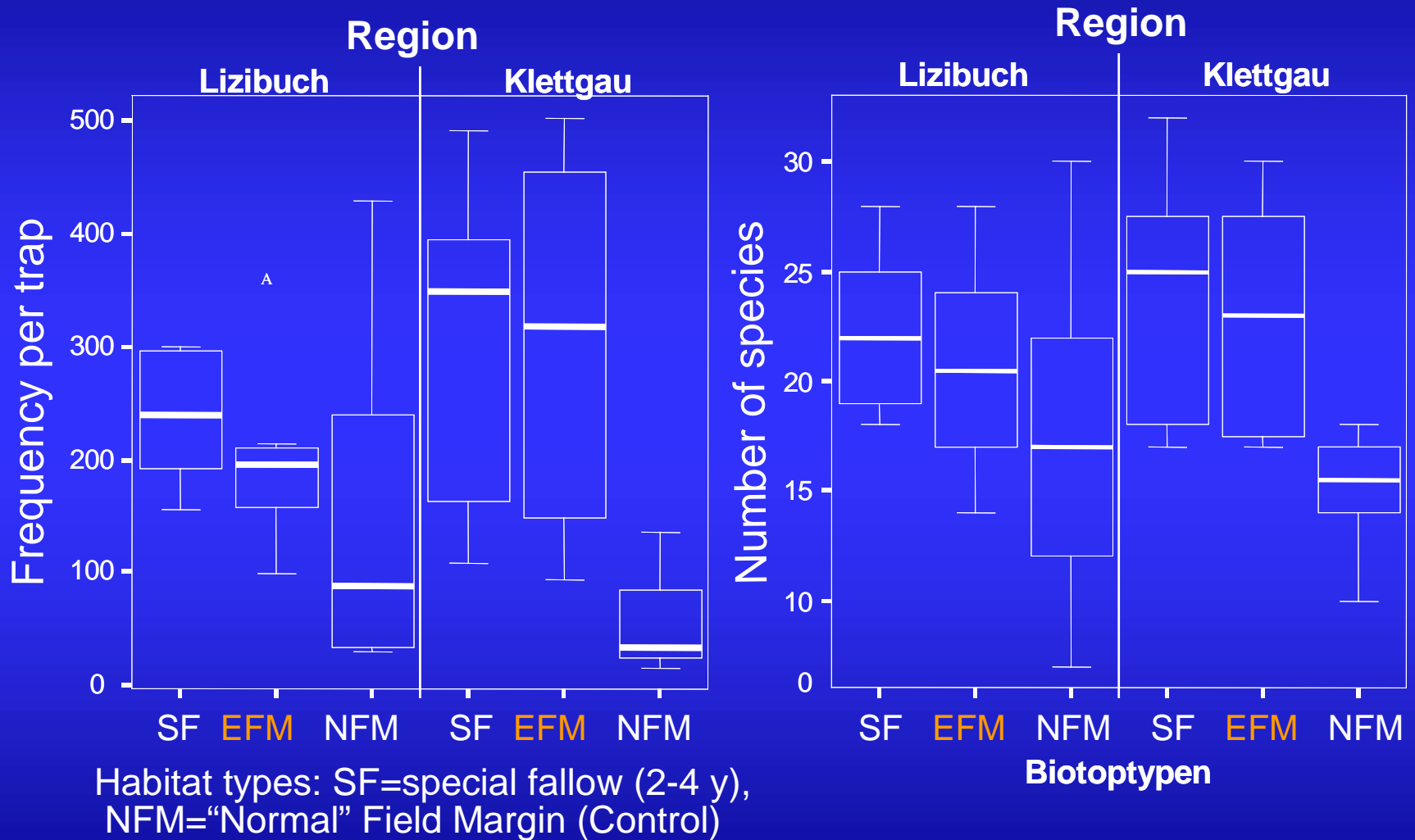
### III) Results - Diversity of flag ship arthropods

## 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).

“Normal” Field Margin (NFM)



EFM

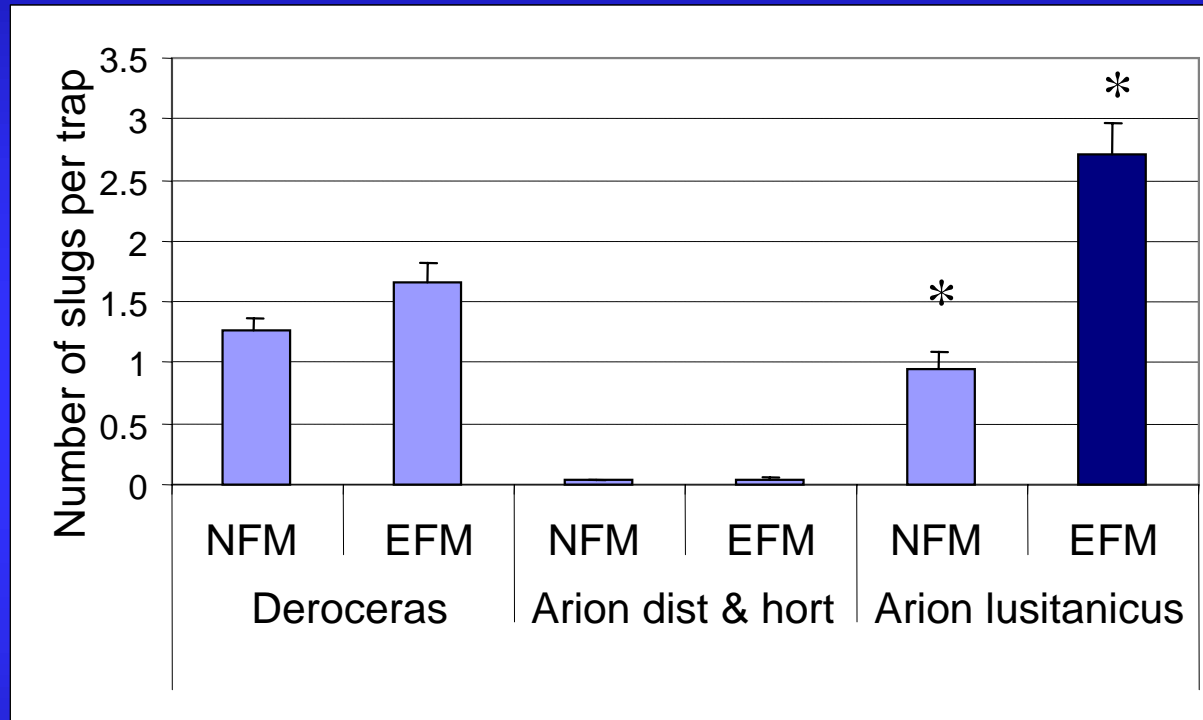


trap  
type



### III) Results - Slugs

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

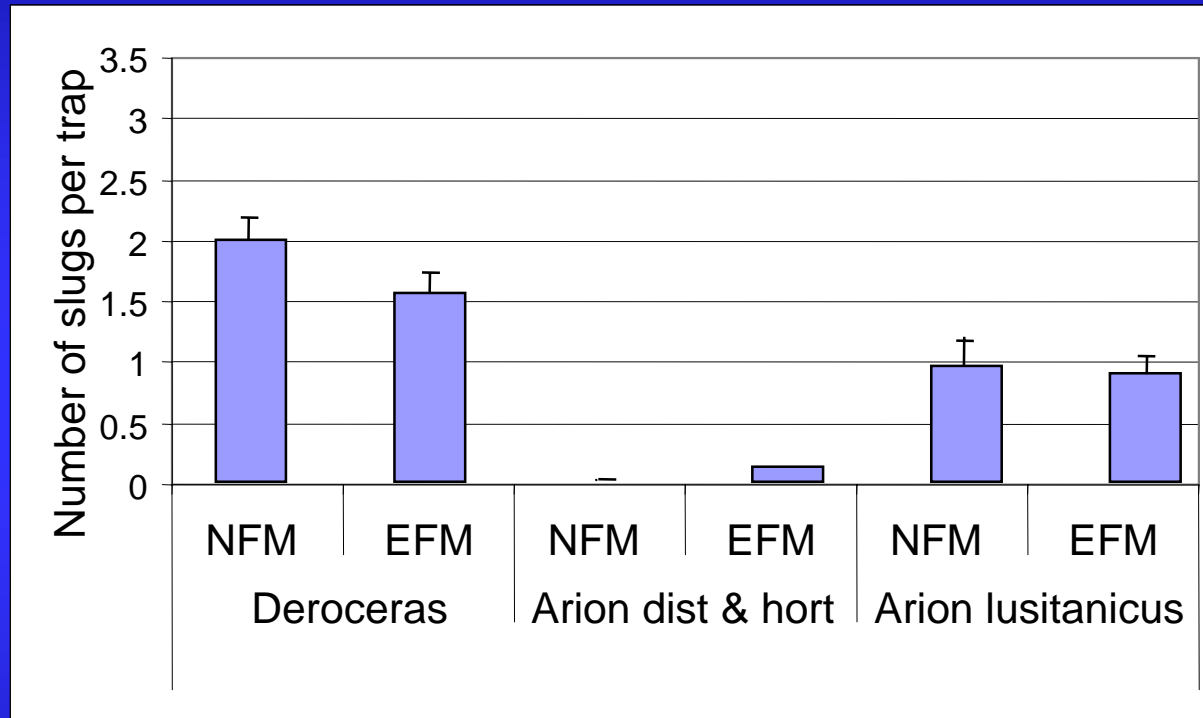


\*  $p < 0.00001$

$p$  (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

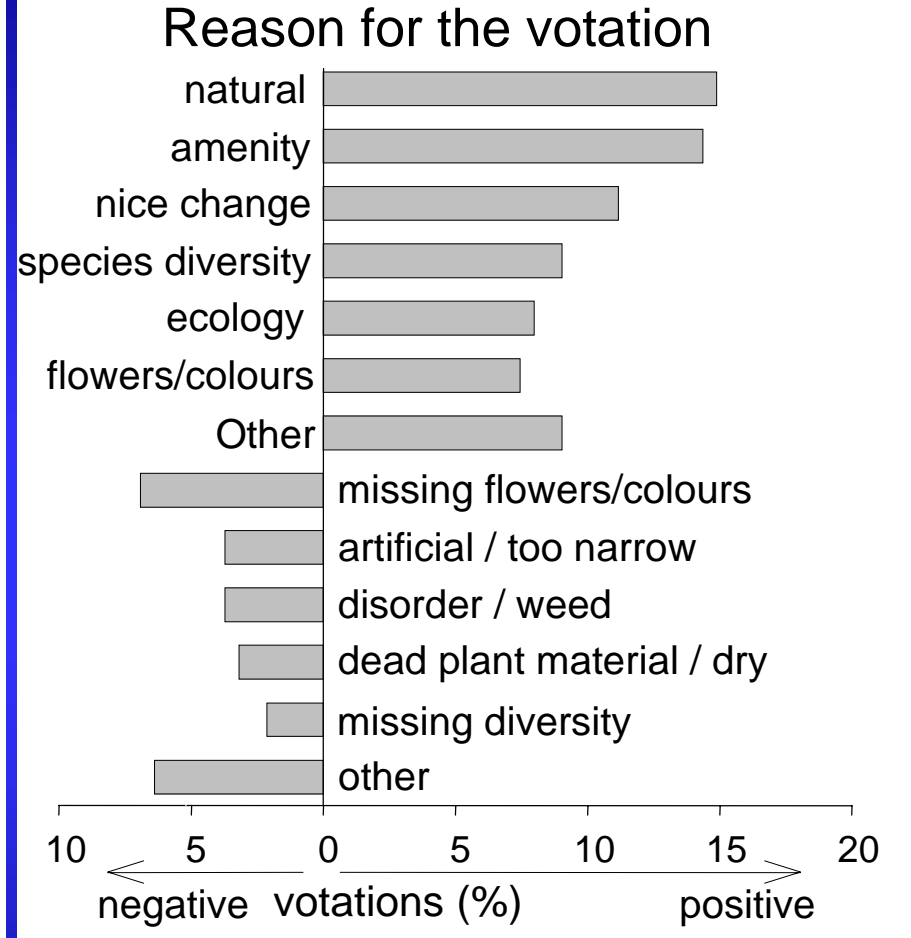
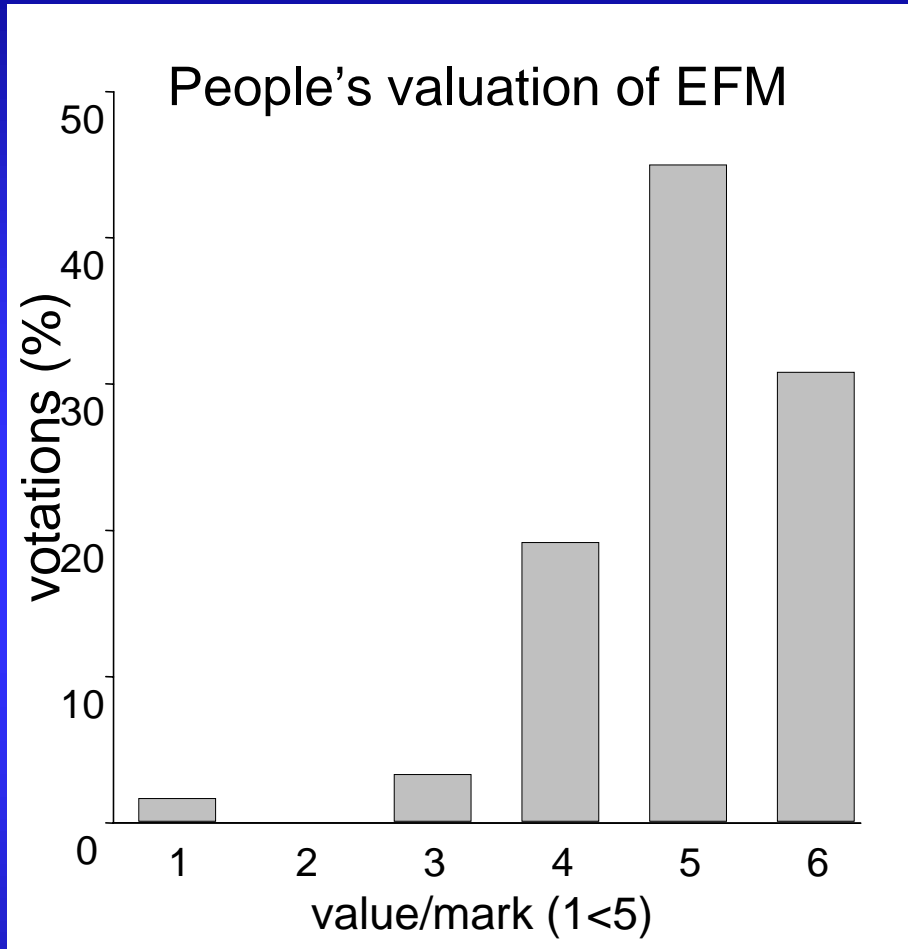
## Do people appreciate EFM's?

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

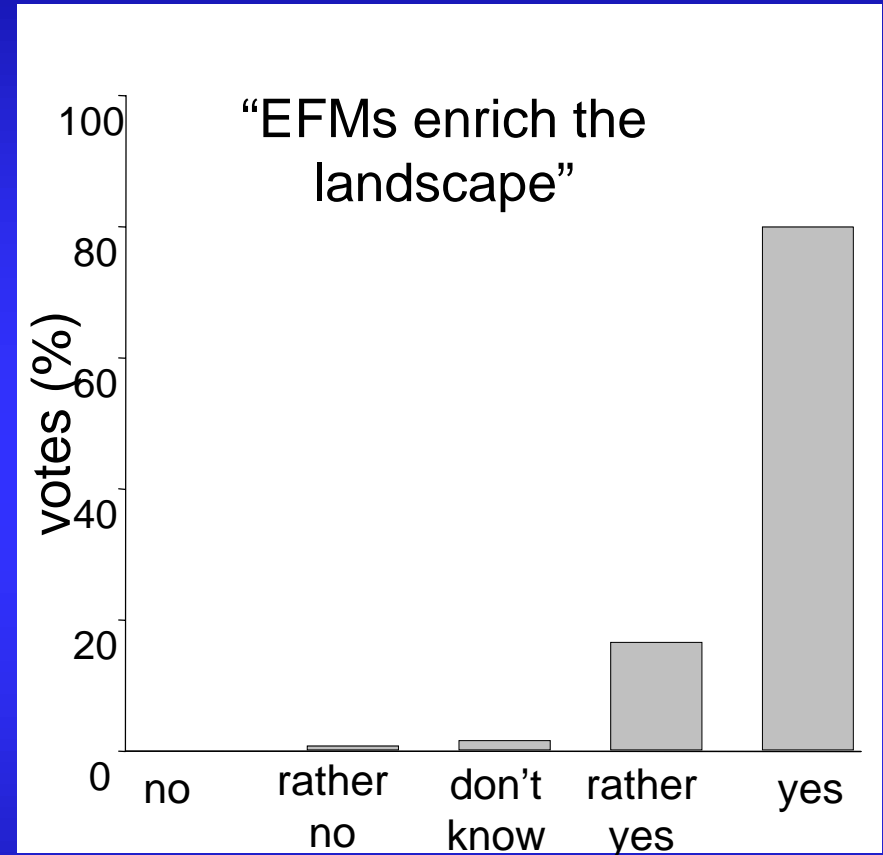
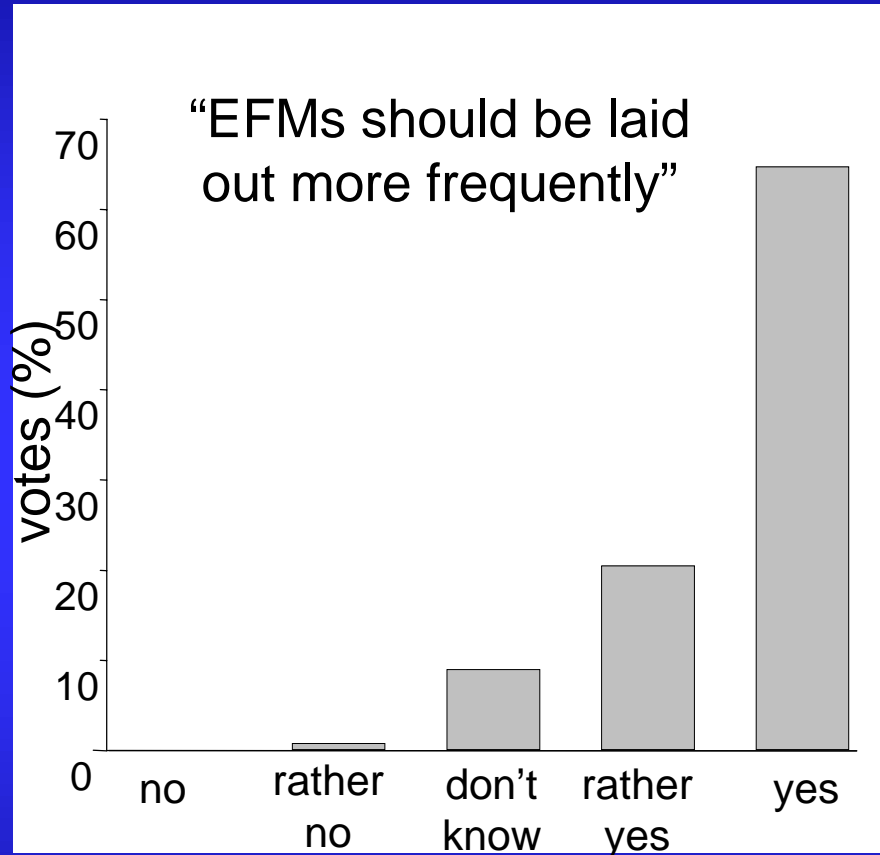


### III) Results - People's acceptance



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



## Thanks to:

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