ALLUVIAL MEADOWS UNDER CHANGING MANAGEMENT: THEIR DEGRADATION AND RESTORATION

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Great decline of the area of alluvial meadows over the whole Europe, decrease of ecological value of the remaining.

For example, in England & Wales historically
1 200 000 ha of wet grasslands, nowadays
app. 220 000 ha (Treweek et al. 1997); in Hungary, decline from app. 600 000 ha in 1950 to 200 000 ha in 1990 (Joyce & Wade 1998).

Conversion into arable land
Degradation following eutrophication, absence of management, overexploitation, or drainage. These usually resulted into expansion of strong competitors, including woody species and invasion of aliens, or to selection of a few resistant species. Usual consequence: **decrease of species diversity and ecological functions.**


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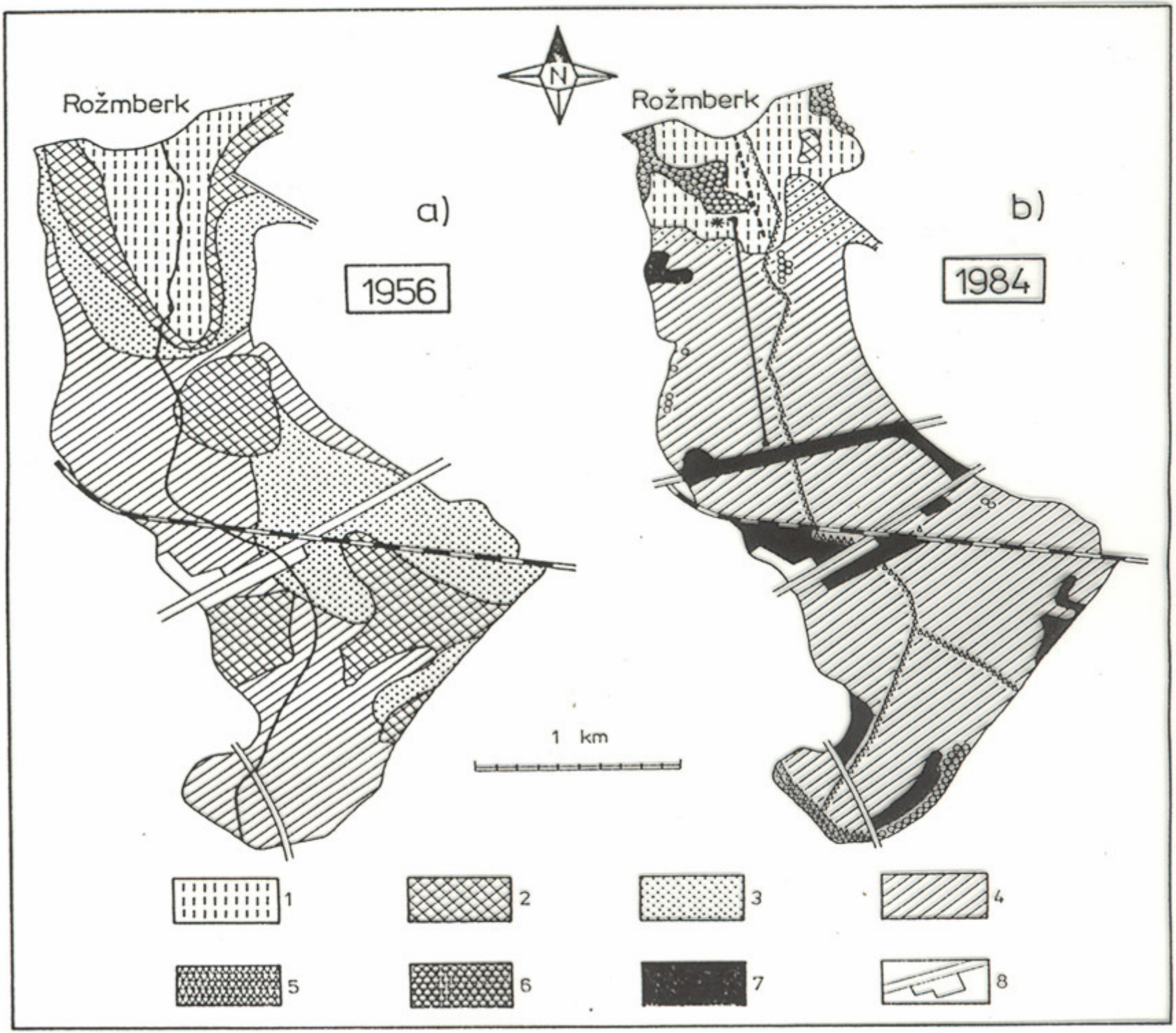
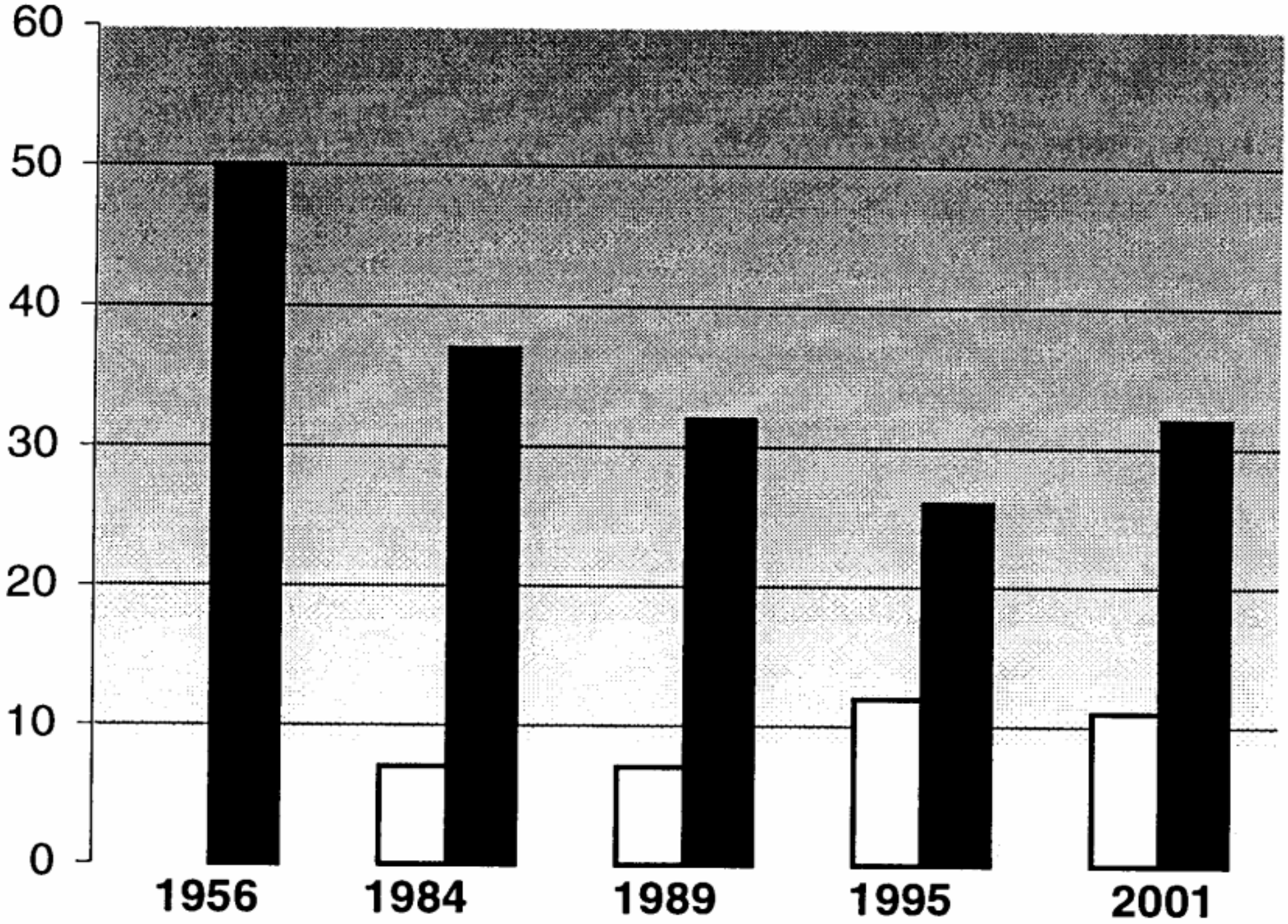
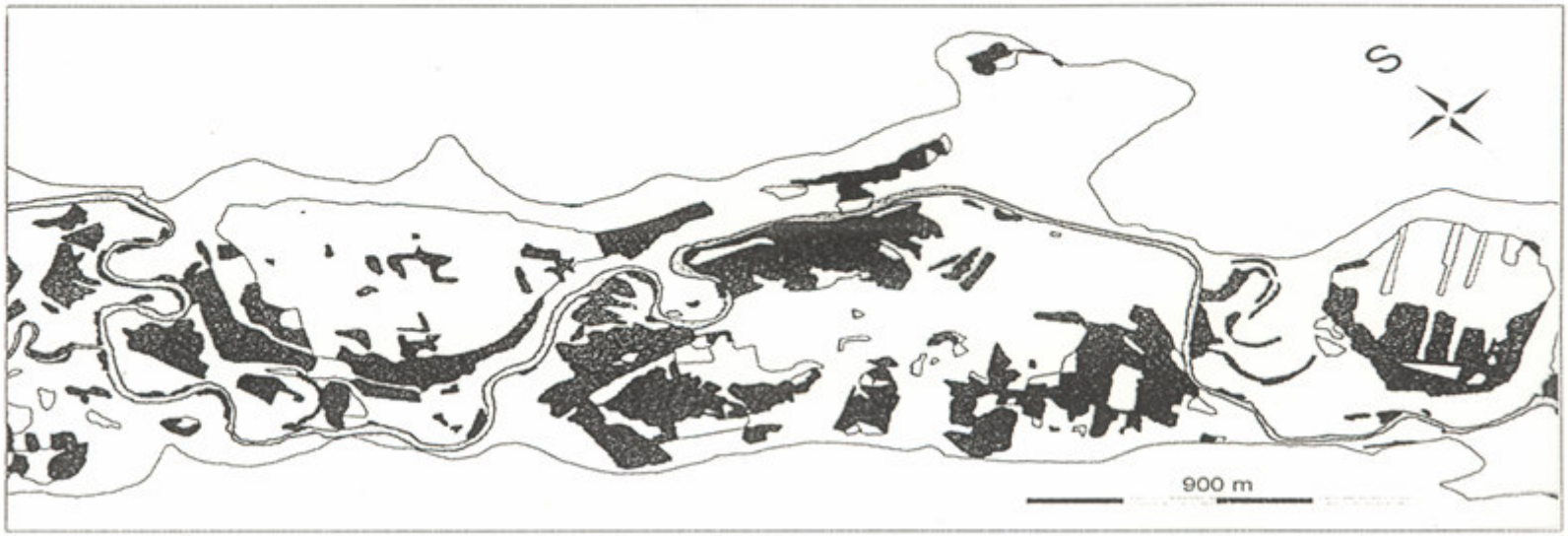
5151


Rožmberk
a)
1956
Rožmberk
b)
1984
N
1 km
1
2
3
4
5
6
7
8

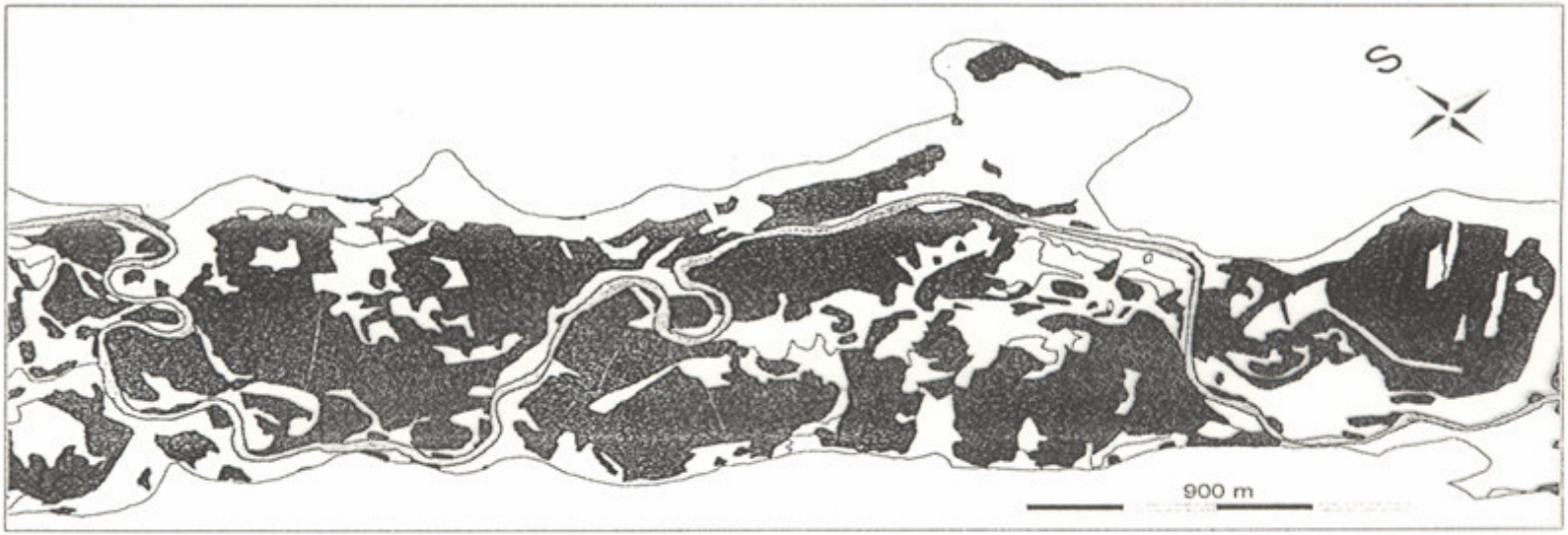
Meadow vs. ruderal species



Changes in a cover of woody vegetation since 1947 to 1993 (floodplain section II)



1947



1993

woody vegetation up to 50%

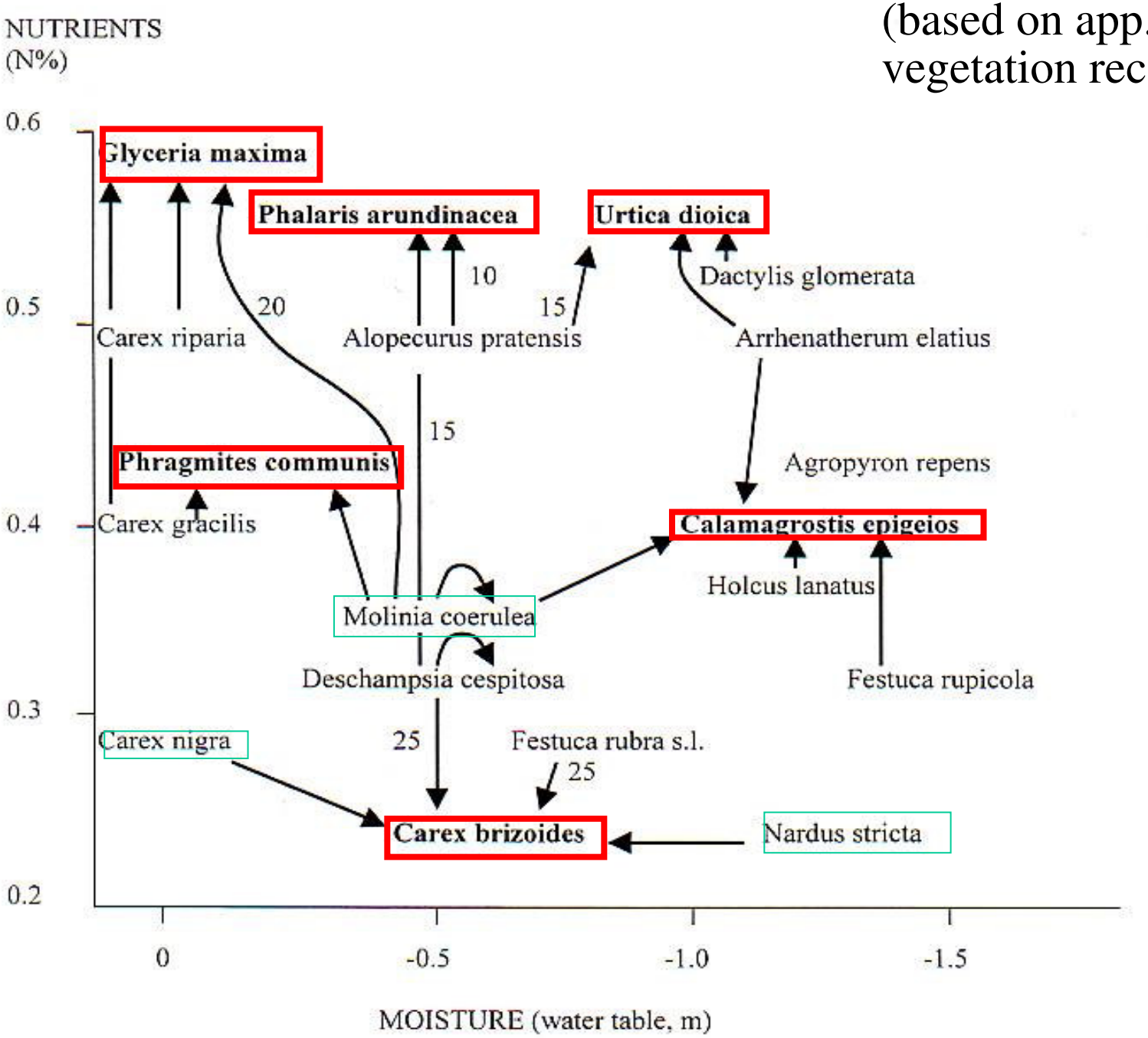
woody vegetation between 50-100%

Bufková et al. (2005)

Dominants of alluvial meadows

Main transitions in the process of abandonment

(based on app. 600 vegetation records)



Restoration:

(Most studies in England, The Netherlands, Germany)

Approaches:

- Re-establishment of traditional management (mowing, grazing)
- Rewetting (re-establishment of flooding and/or ground seepage regime)
- Top soil removal (sod cutting) to decrease nutrient content
- Direct sowing
- Application of mown plant material from nearby species-rich reference site

Positive examples:

81% of sown species (Alopecurus pratensis-Sanguisorba officinalis com., river Thames, UK) established during 5 yrs (McDonald 2001).

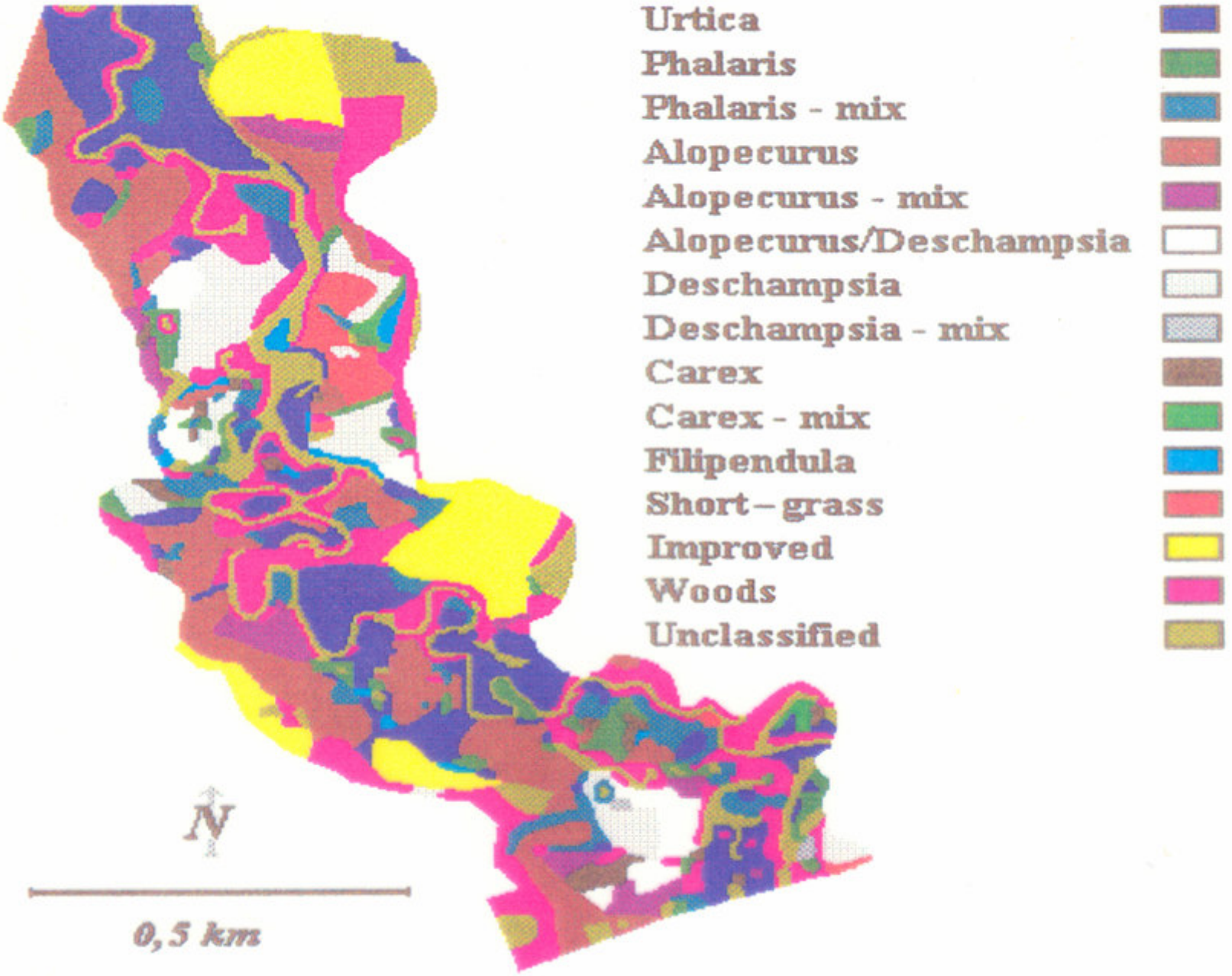
Between 74 and 91% of sown species established during 1 yr in experiments of Manchester et al. (1998) in river Ray, UK.

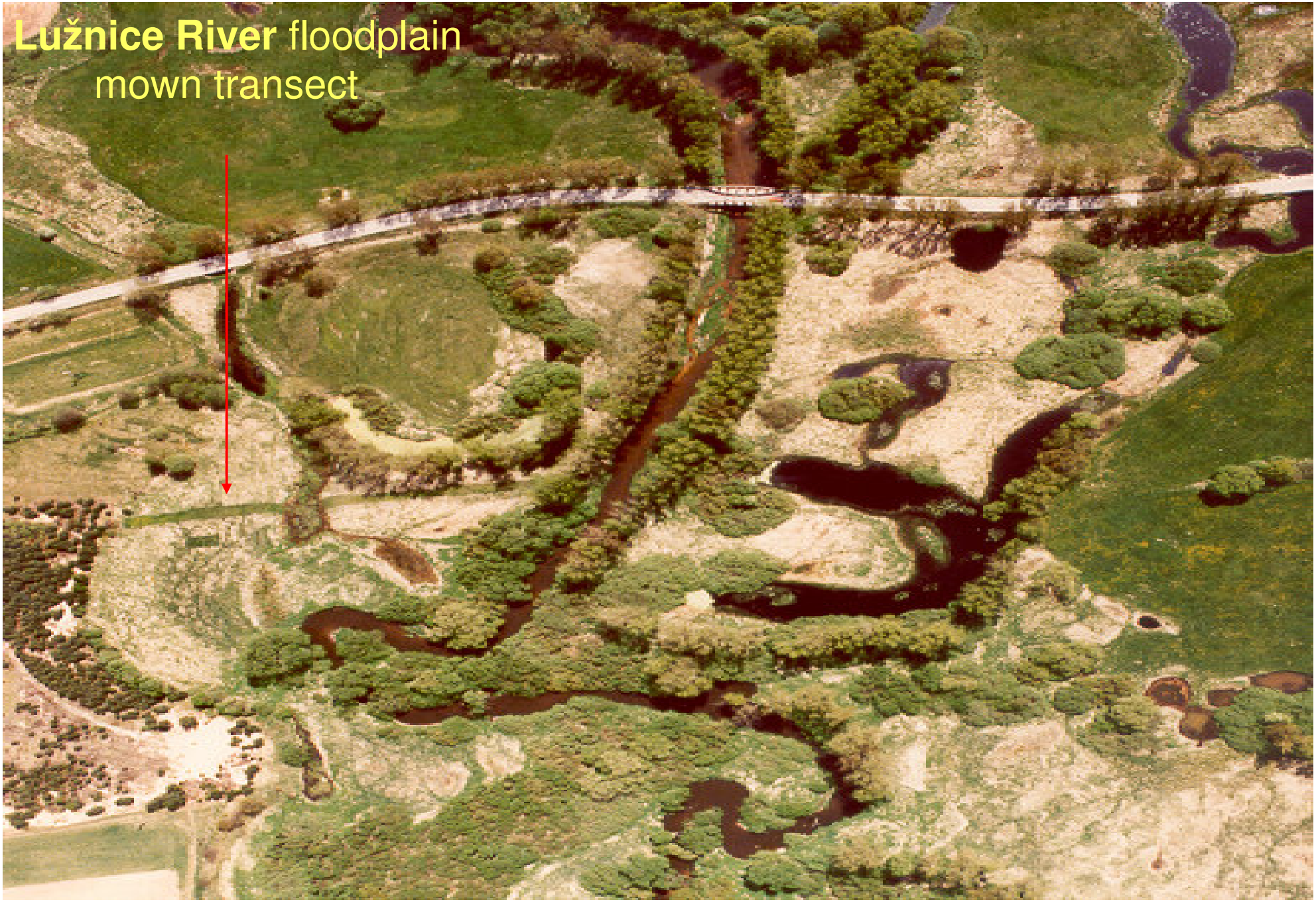
About 60% (102) of target species established during 4 yrs when cut material was applied (Hölzel & Otte 2005, Rhine River, Germany)

Obstacles:

Depletion of soil seed bank; lack of diaspore sources (Hölzel et al.); eutrophication and different water quality (difficult to restore especially ground water seepage - Grootjans et al.)

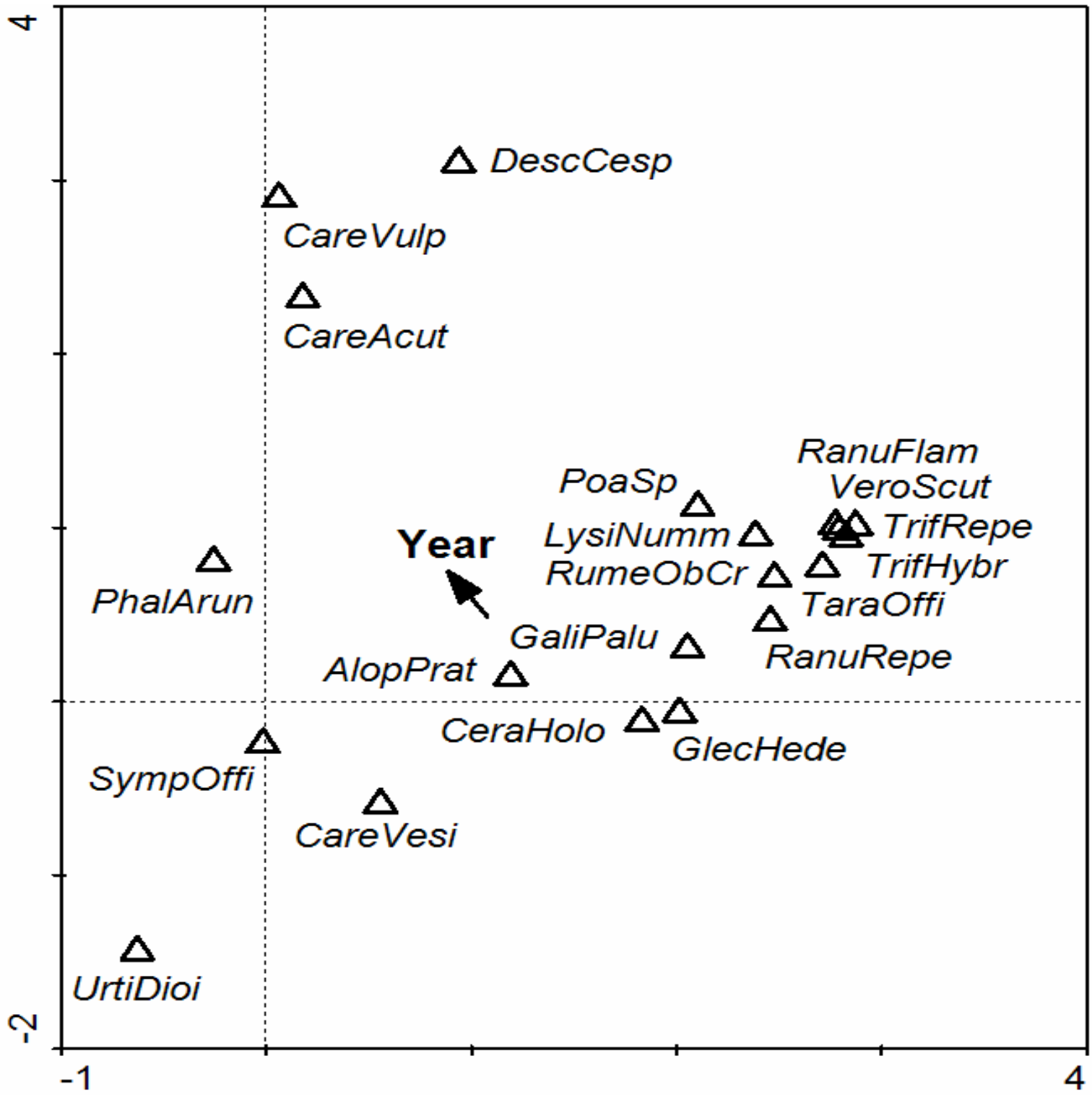
Studies in the Lužnice R. floodplain, southern Czech Republic

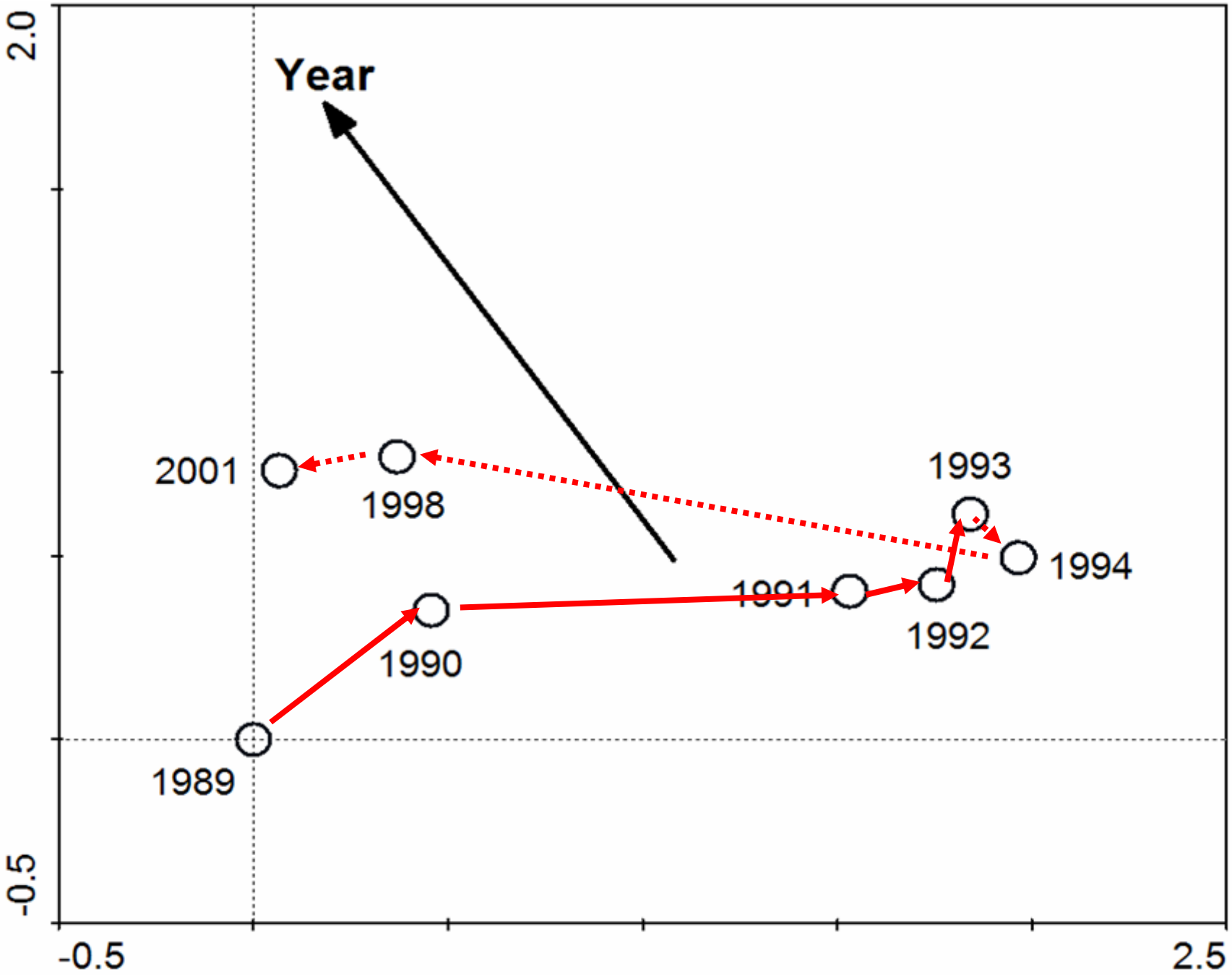



Lužnice River floodplain
mown transect

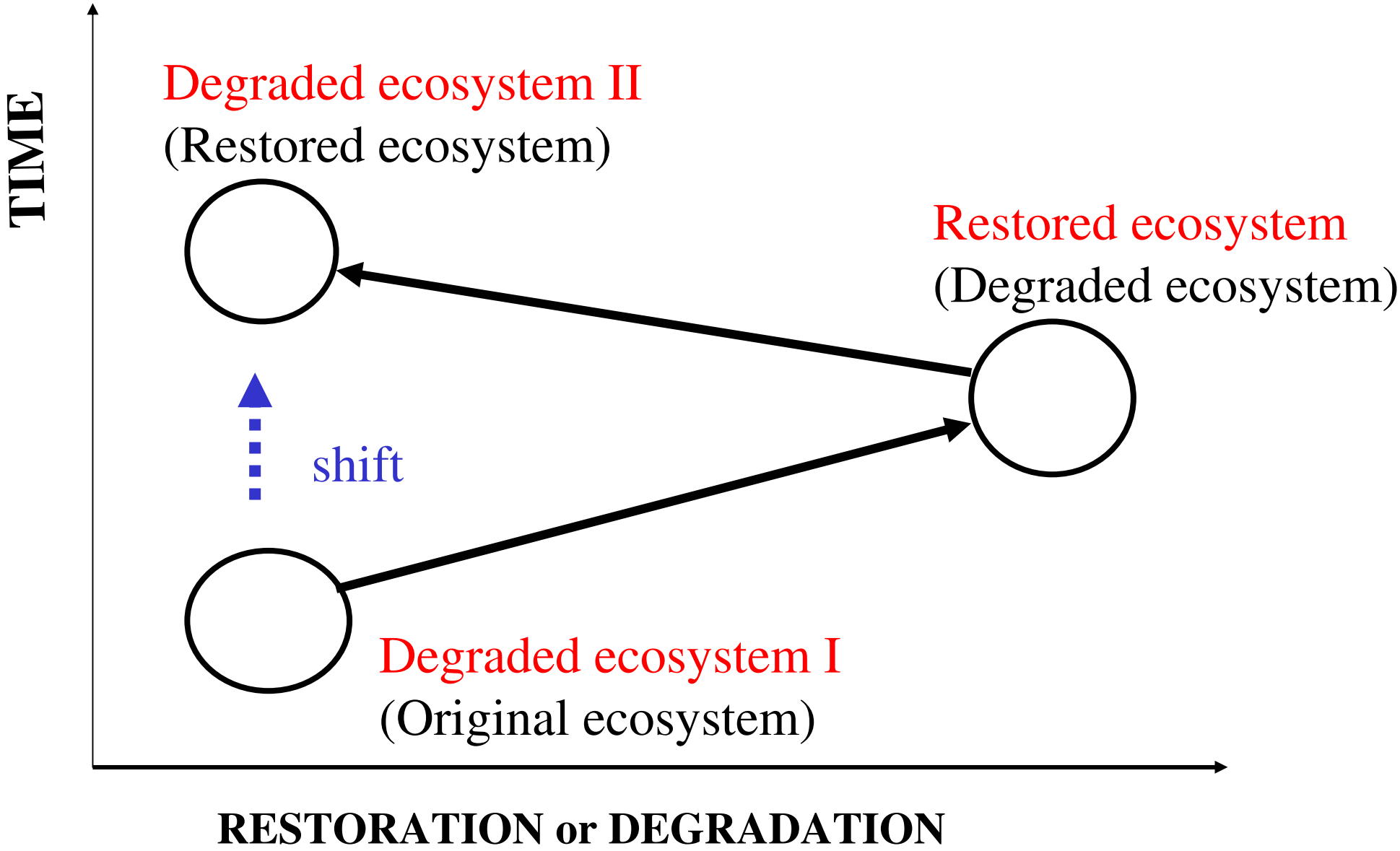
Restoration ——— Degradation

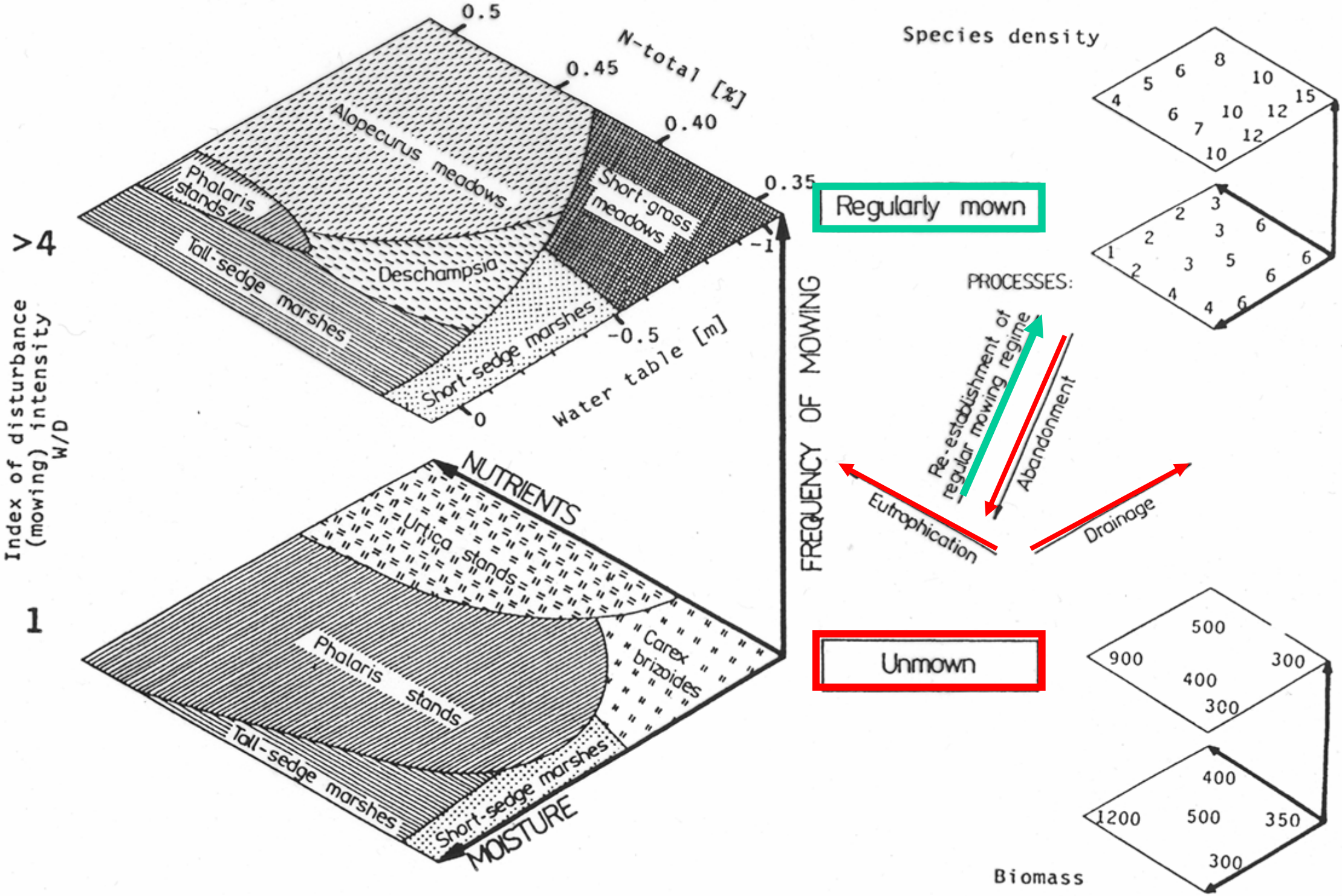
	1989	*1990*	*1991*	*1992*	*1993*	*1994*	*1998*	*2001*
Alopecurus pratensis	14.4	20.3	21.8	26.5	33.1	30.4	23.5	11.6
Phalaris arundinacea	28.0	35.1	9.5	4.4	0.7	0.9	32.8	37.0
Ranunculus repens	0.0	5.8	25.8	29.2	34.3	43.5	0.9	0.0
Urtica dioica	18.4	7.8	2.6	0.2	0.1	0.0	1.8	13.6
Average species density per 1m^2	4.0	7.3	8.9	6.9	8.1	8.2	5.0	4.5
Number of species in sampling plot	23	35	55	60	62	57	27	27
Number of target species	3	4	14	17	19	18	6	6
Number of ruderal species	5	6	12	10	10	8	4	5
Total number of species along the transect	28	48	61	71	79	70	31	29

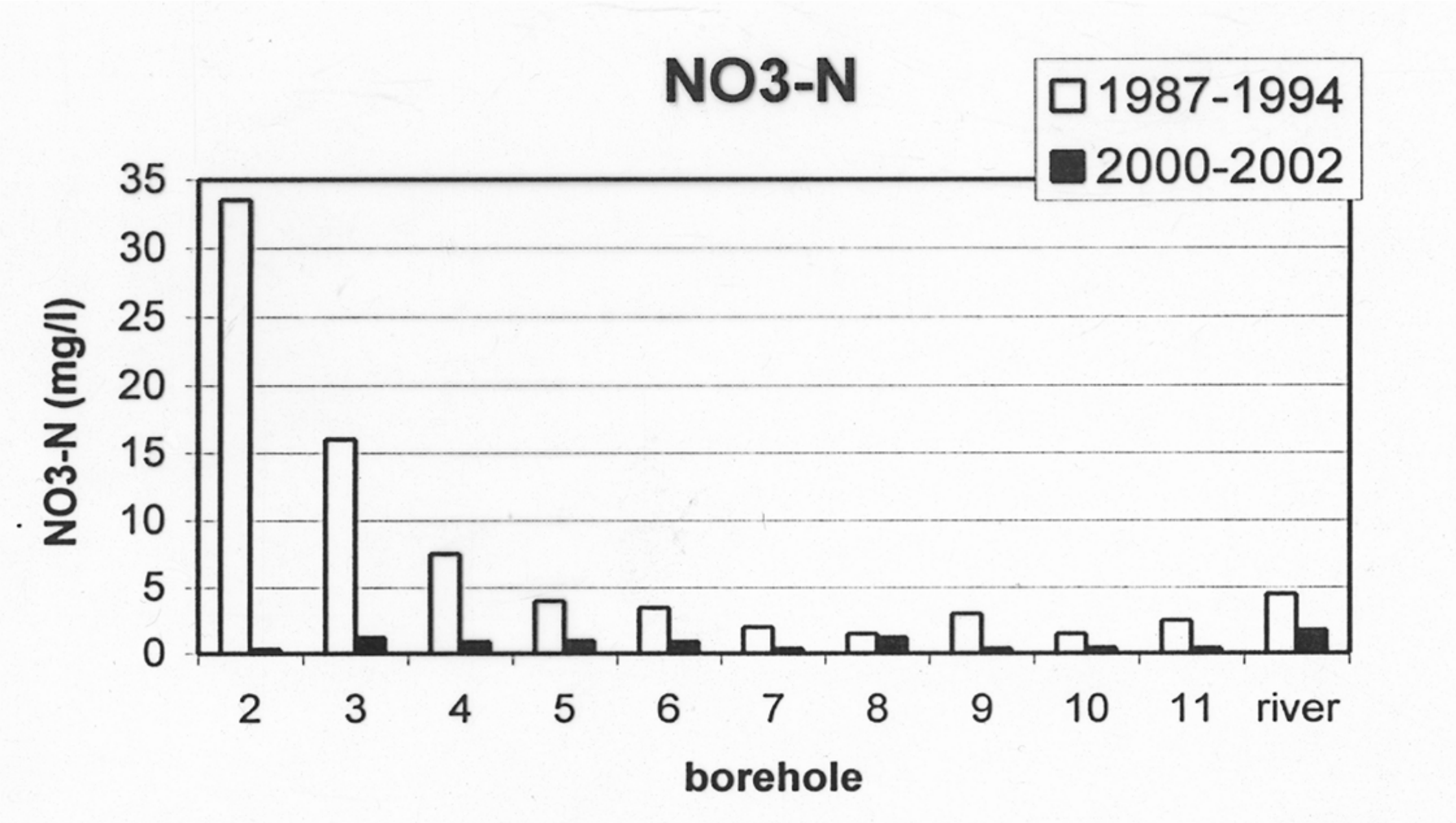

4
-2
-1
4
DescCesp
CareVulp
CareAcut
RanuFlam
PoaSp
VeroScut
TrifRepe
LysiNumm
Year
TrifHybr
RumeObCr
PhalArun
TaraOffi
GaliPalu
RanuRepe
AlopPrat
CeraHolo
GlecHede
SympOffi
CareVesi
UrtiDioi


2.0
-0.5
Year
2001
1998
1993
1994
1991
1992
1990
1989
-0.5
2.5

(partly based on Harris & van Diggelen 2005)




0.5
N-total [%]
0.45
0.40
0.35
Alopecurus meadows
Phalaris stands
Short-grass meadows
Deschampsia
Tall-sedge marshes
Short-sedge marshes
-1
-0.5
0
Water table [m]
>4
Index of disturbance (mowing) intensity W/D
1
NUTRIENTS
Urtica stands
Phalaris stands
Carex brizoides
Tall-sedge marshes
Short-sedge marshes
MOISTURE
FREQUENCY OF MOWING
Regularly mown
Unmown
PROCESSES:
Re-establishment of regular mowing regime
Abandonment
Eutrophication
Drainage
Species density
8
10
15
5
6
4
6
10
12
7
12
10
2
3
3
6
2
1
3
5
6
2
4
4
6
500
900
300
400
300
400
1200
500
350
300
Biomass


NO3-N
1987-1994
2000-2002
NO3-N (mg/l)
35
30
25
20
15
10
5
0
2
3
4
5
6
7
8
9
10
11
river
borehole

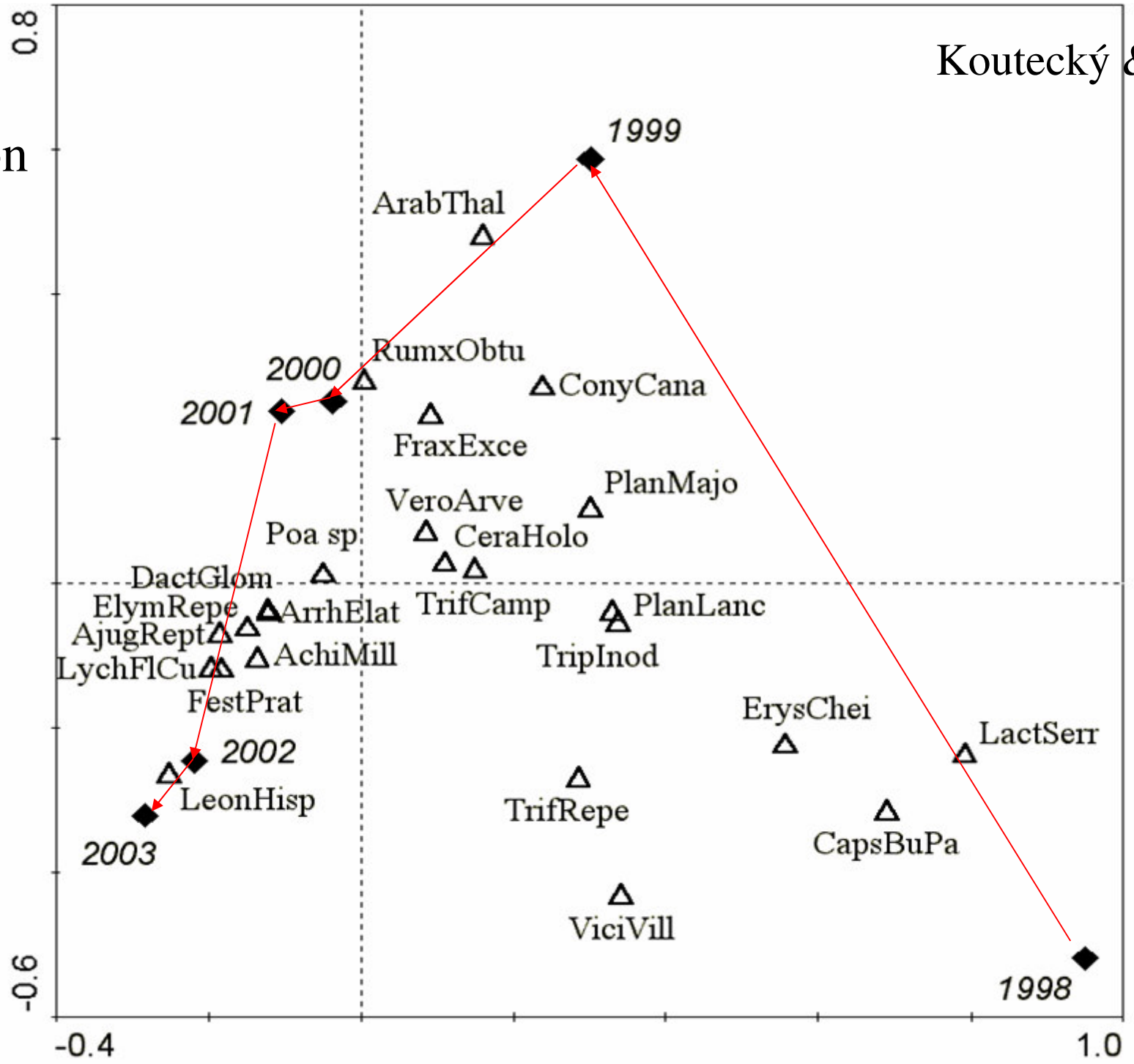
Recovery of alluvial meadows after excessive flooding:

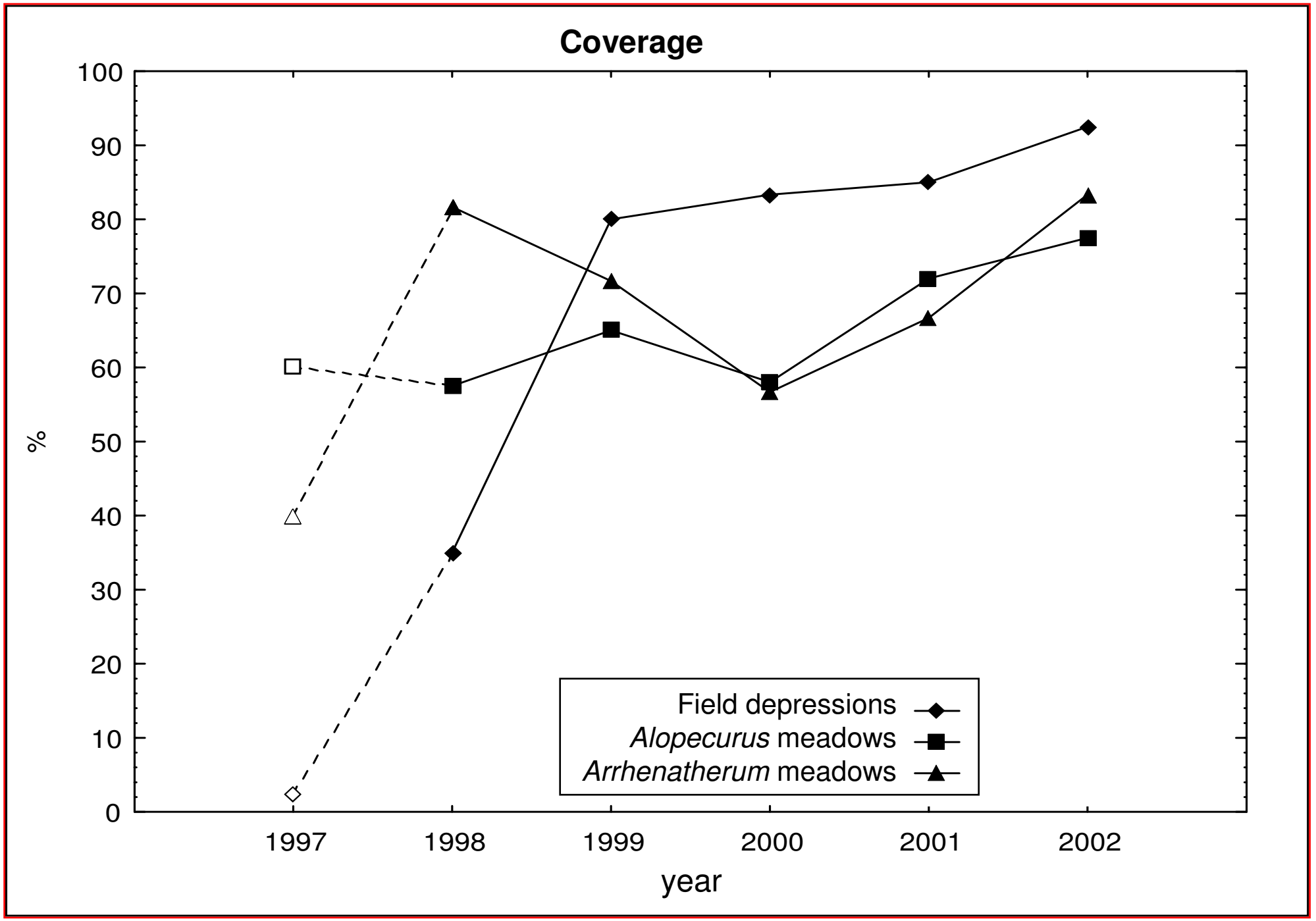
July 1997, the Morava River floodplain flooded for 1 month


Polygonum amphibium -
the only species survived
23 species (20%) of all species recorded during the study (117) regenerated vegetatively in the same year

CCA ordination

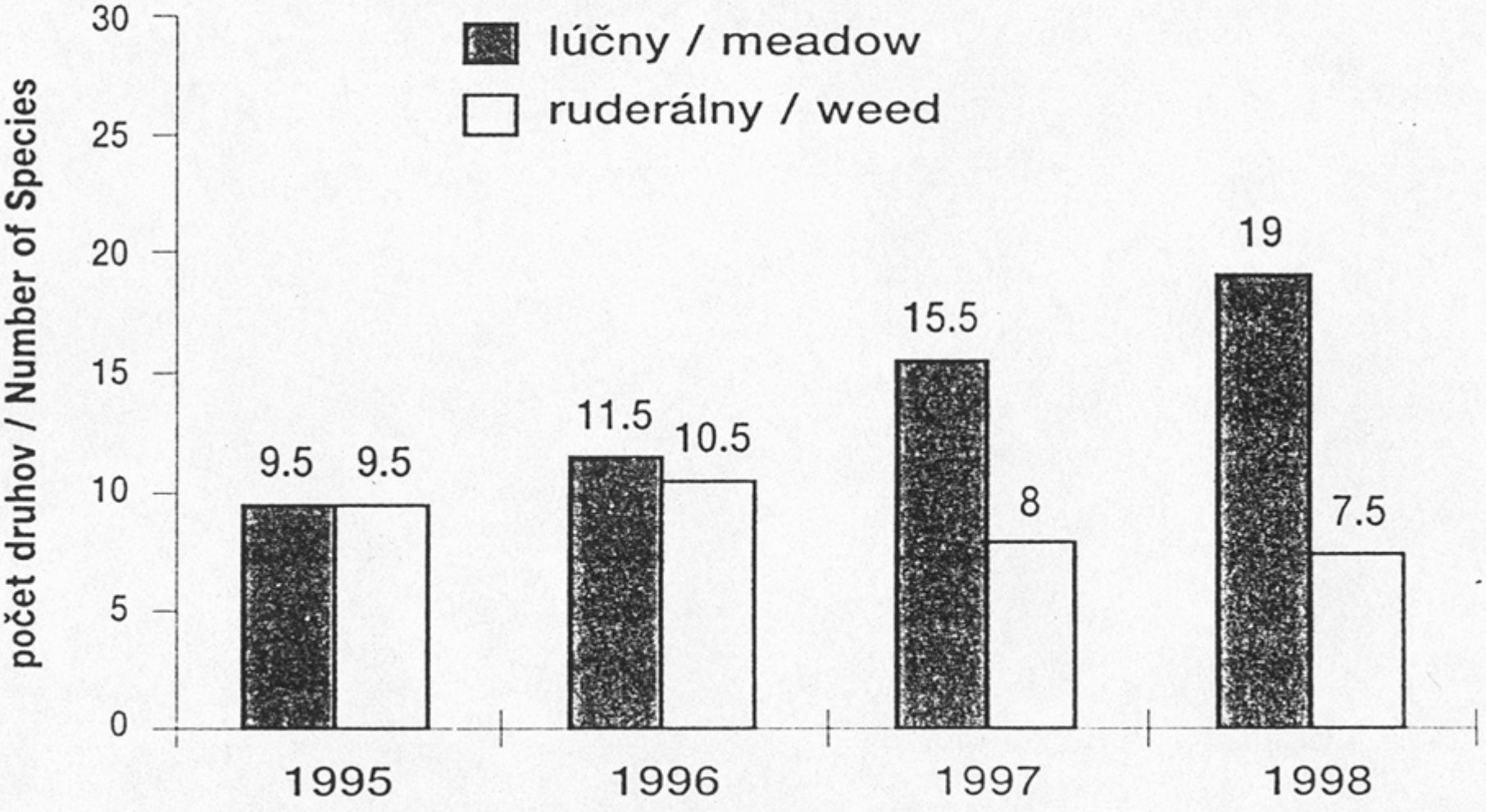
Koutecký & Prach (2005)



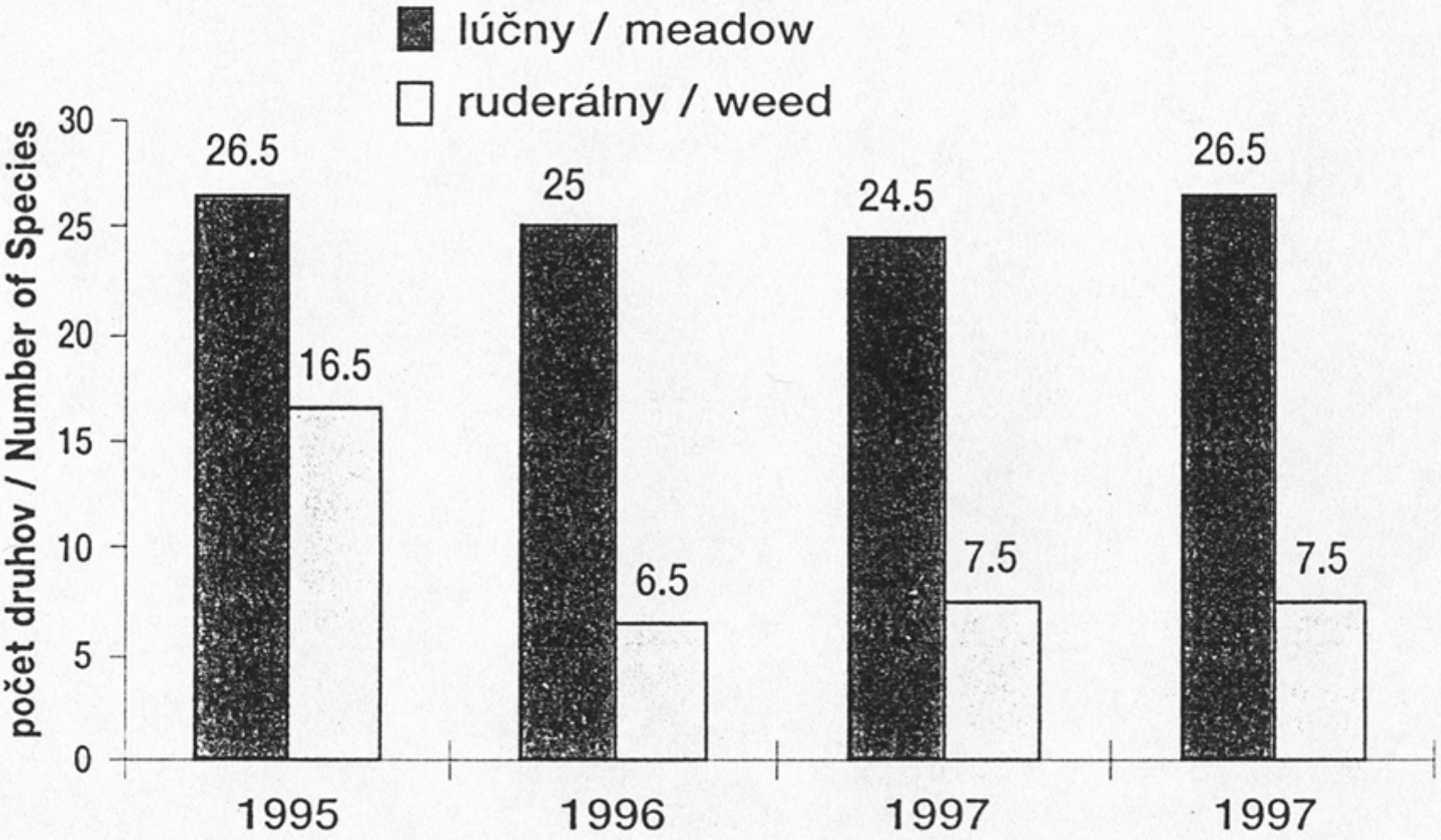

Coverage
100
90
80
70
60
50
40
30
20
10
0
%
1997
1998
1999
2000
2001
2002
year
Field depressions
Alopecurus meadows
Arrhenatherum meadows

Šeffer & Stanová (1999)

Obr./Fig. 6. Druhová diverzita (priemerný počet na plochu) na výsevových experimentálnych plochách A, D v 1995-98
Species diversity (mean number per plot) of sowing experimental plots A, D in 1995-98



Obr./Fig. 5. Druhová diverzita (priemerný počet na plochu) na prenosových experimentálnych plochách B, C v 1995-98 / Species diversity (mean number per plot) of transfer experimental plots B, C in 1995-98

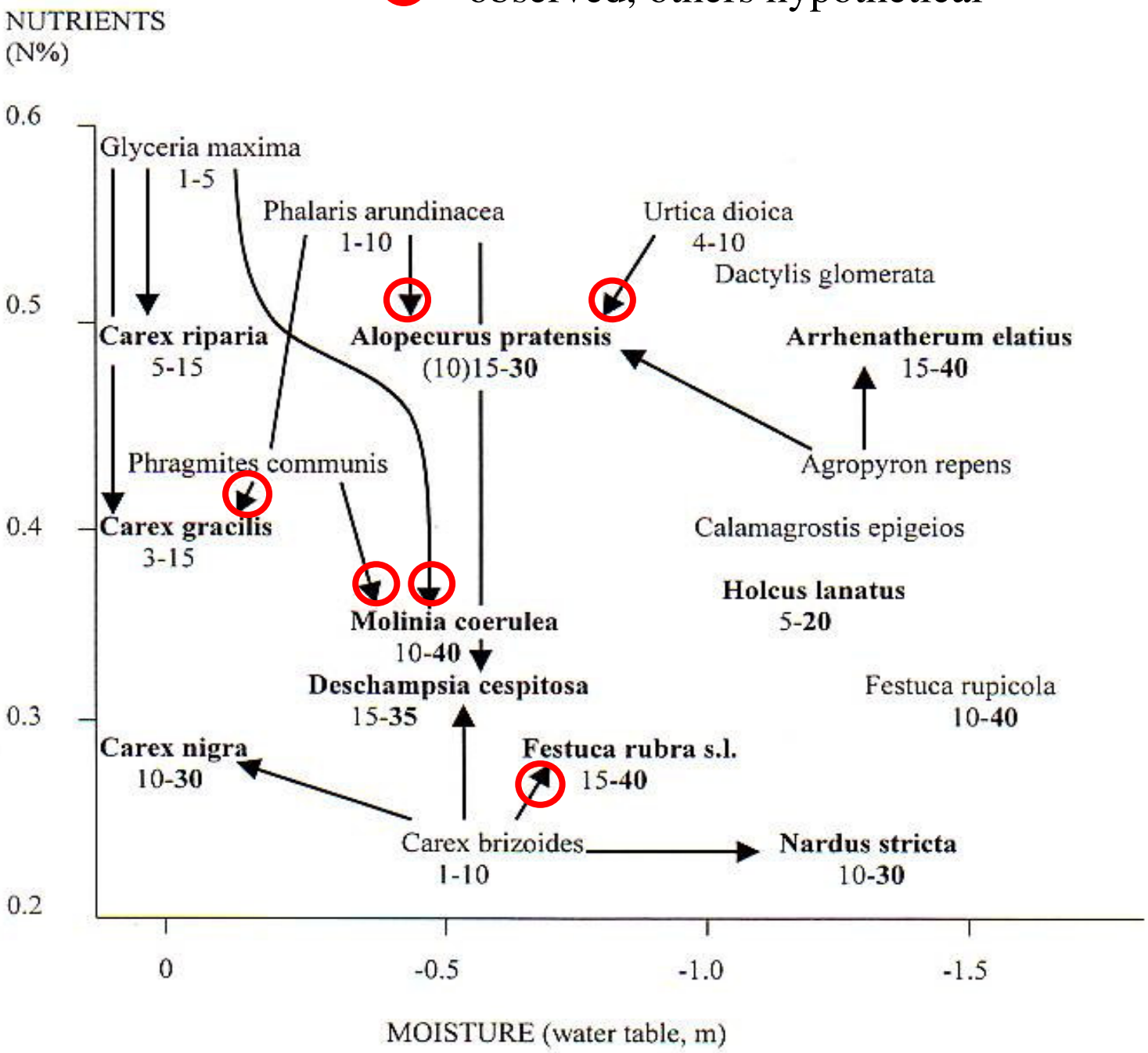


Šeffer et al. (1999) in Šeffer et Stanová [eds.] – p. 124

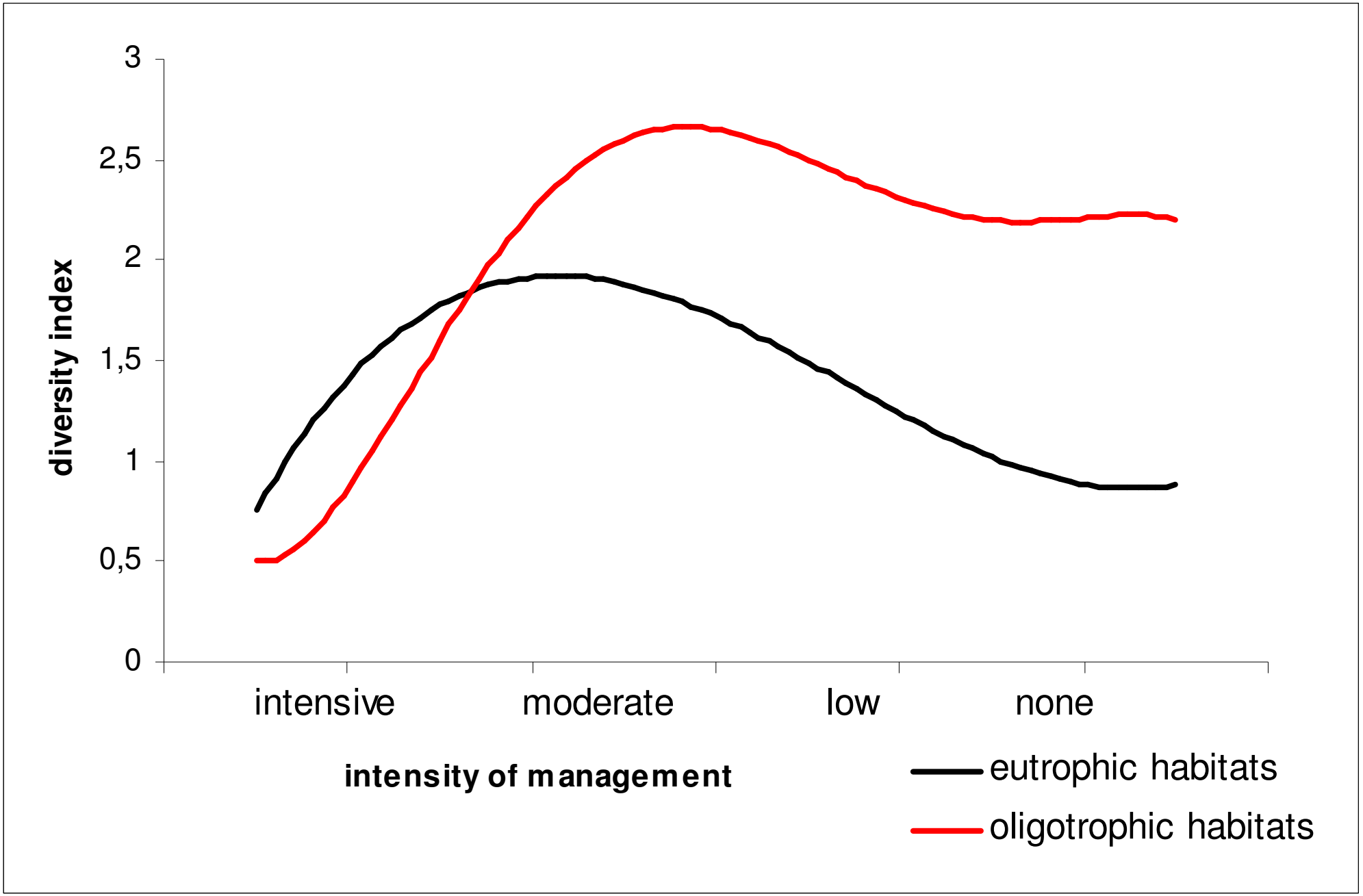
Dominants of alluvial meadows

Main transitions in the process of restoration

○ - observed, others hypothetical



Clément & Maltby (1996)



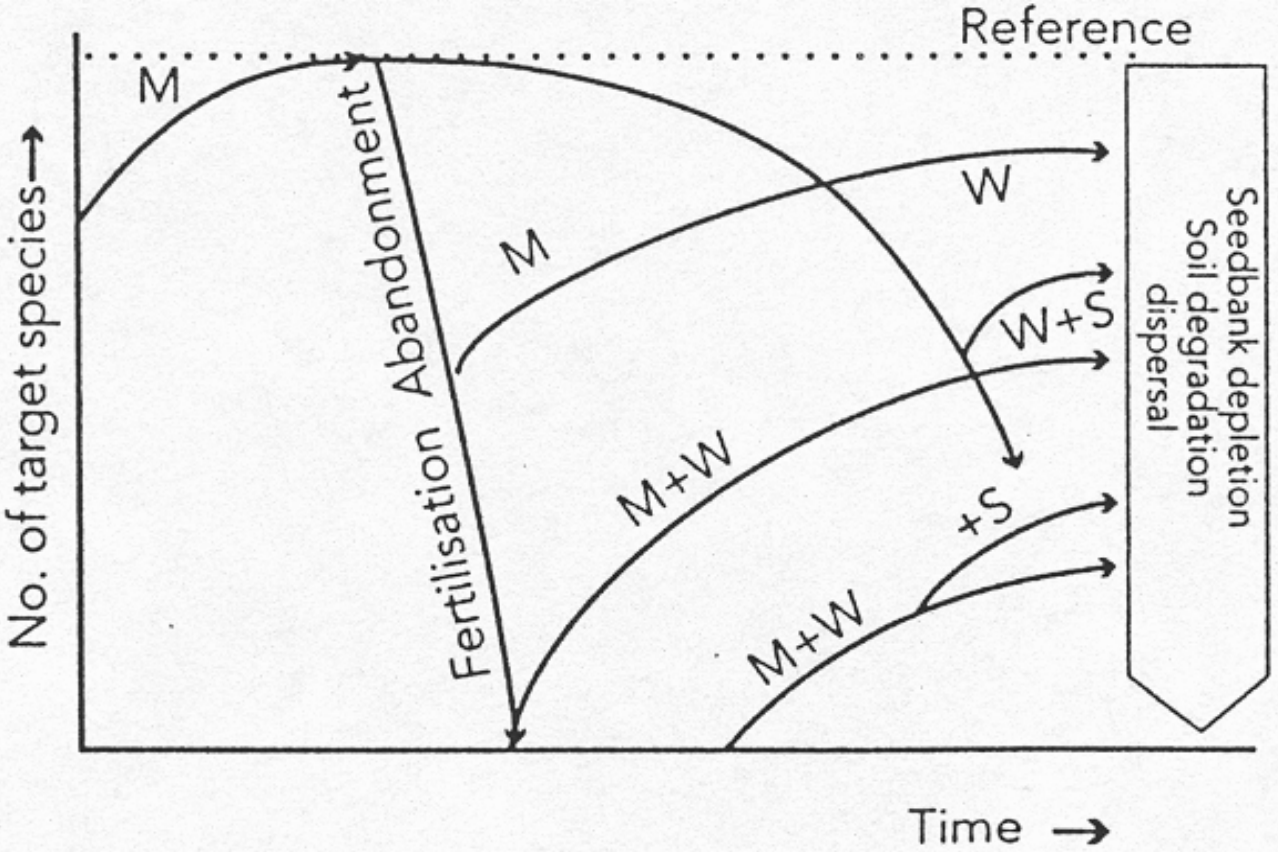


Figure 5. A conceptual model of the occurrence of target species in wet meadows under restoration management. *Adapted from Grootjans and others 2002.*

Grootjans et Verbeek (2002) – p. 8

Conclusions:

Reviewing the literature and based on own experience, the following conclusions can be done concerning degradation and restoration:

(a) Degradation is faster under fertile site conditions.

(b) Degradation is accelerated if potential dominants of degraded stages are already present in vegetation, or occur in the close vicinity. The latter is especially serious if a site under concern is small in its area.

(c) Restoration of alluvial meadows is easier in floodplains with a fully functional flooding regime.

(d) Restoration is accelerated if reference stands, i.e. still non-degraded meadows, are present nearby, preferably upstream.

(e) It is better to restore several large, instead of many small portions of degraded meadows.

(f) If water and/or nutrient regimes have been deeply altered, it is usually impossible to restore the original state and alternative target vegetation must be accepted.

(g) Restoration of natural flooding regime is profitable for biota typical of alluvial meadows, and helps to eliminate undesirable species non-adapted to floodplain

environment.


Thanks for your attention.