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# Small scale and large scale monitoring of vegetation changes in a restored wetland

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# The hiStory of the Hanság

Lake Fertő

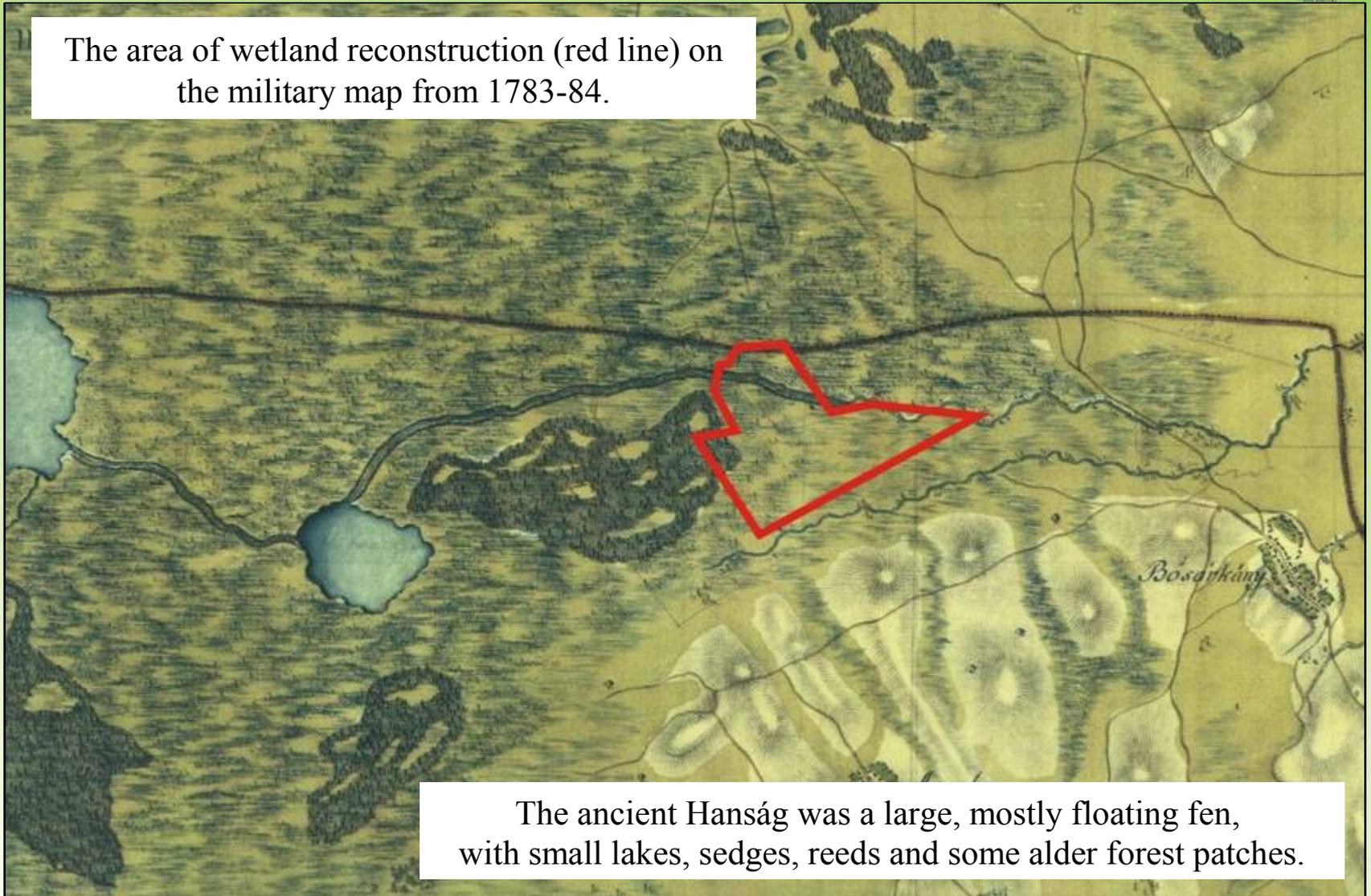
(Neusiedler see)



Till the 19th century Hanság was a 50000 ha large wetland, connected with the Lake Fertő.

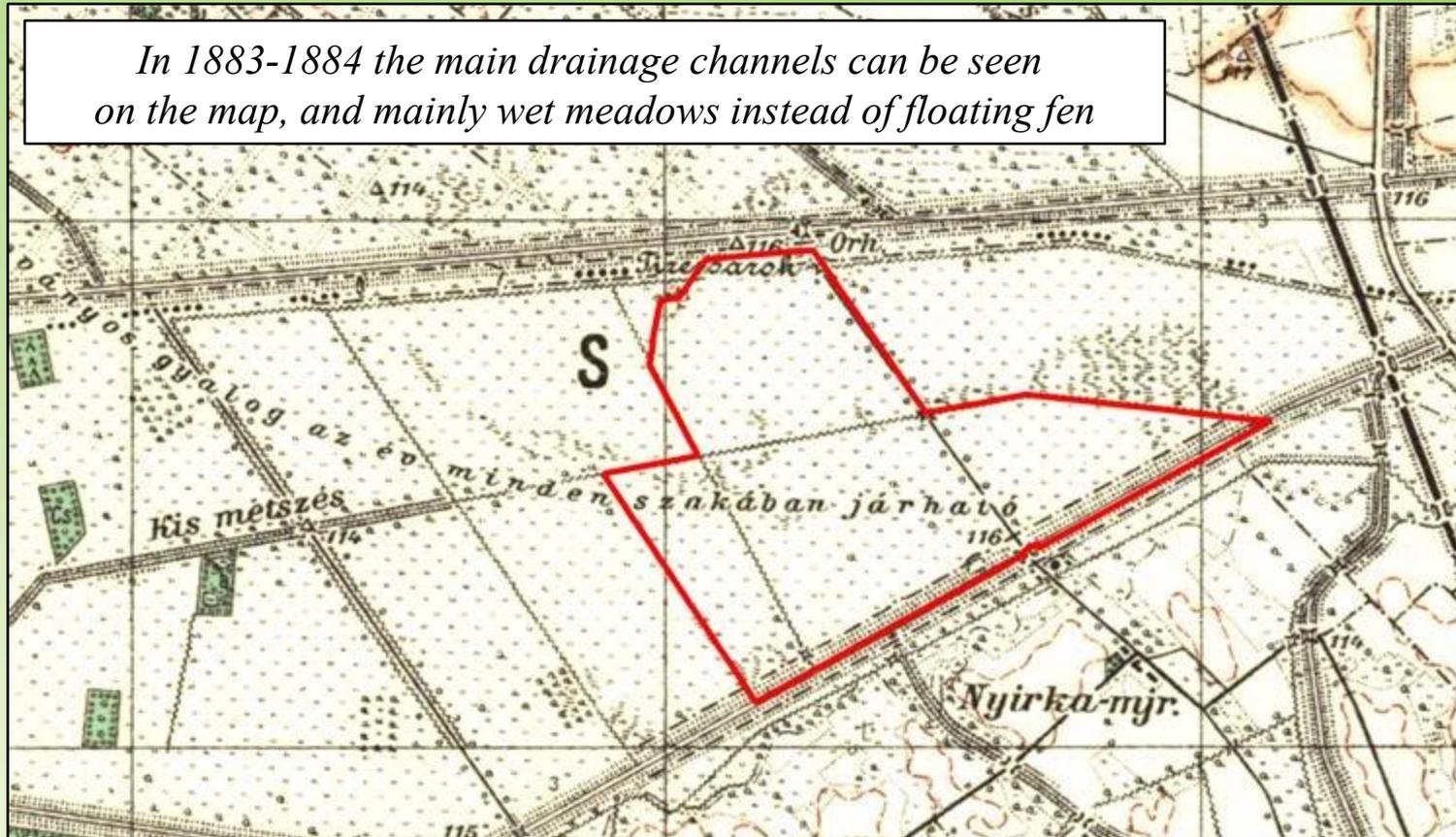
## Hanság

The area of wetland reconstruction (red line) on the military map from 1783-84.



The ancient Hanság was a large, mostly floating fen, with small lakes, sedges, reeds and some alder forest patches.

*In 1883-1884 the main drainage channels can be seen on the map, and mainly wet meadows instead of floating fen*



The drastic drying-out of the fen was „successful” only in the early 20th century, using machines to dig channels. Secondary meadows formed in the place of the fen, and most of the lakes disappeared. A large part of the area was ploughed, afforested, and peat mines were opened.

# The hiStory of the Hanság

Lake Fertő

(Neusiedler see)



Till the 19th century Hanság was a 50000 ha large wetland, connected with the Lake Fertő.

Wien

Bratislava



Today only the Fertő is indicated as wetland on the map.

## Hanság

## Nature protection



- Natural values still exist.
- Patches of
  - fen meadow (Molnietum, Seslerietum),
  - alder forest (Thelypteridi-Alnetum, Carici-Alnetum)
  - Marsh vegetation (in channel)
- Hanság had been a protected landscape in 1976
- It has been a part of the **Fertő-Hanság National Park** since 1994.

# Conditions of restoration

## Biological and physical conditions

- Enough quantity and a good quality water
- Remained original vegetation
- Suitable surface pattern



## Suitable ownership

- The owner must be the state or the national park in all area.
- The contribution of bordering owners

## Financial conditions

- It was sponsored by the Hungarian and Dutch Government

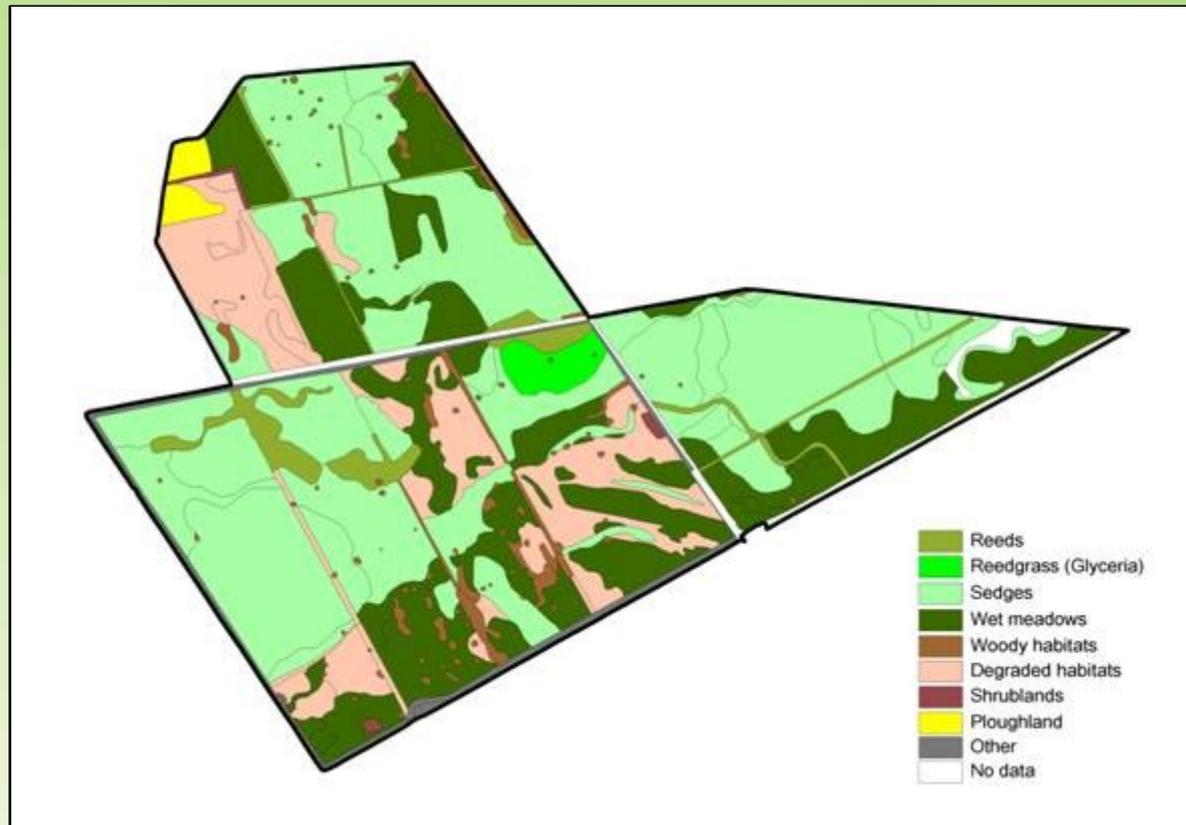
## The main goals of restoration:

- To create wetland with open water, suitable habitat for water-birds and fen-plants.
- To have a model area, and to get experiences of rewetting.
- To decrease invasive plant species (*Solidago gigantea*).



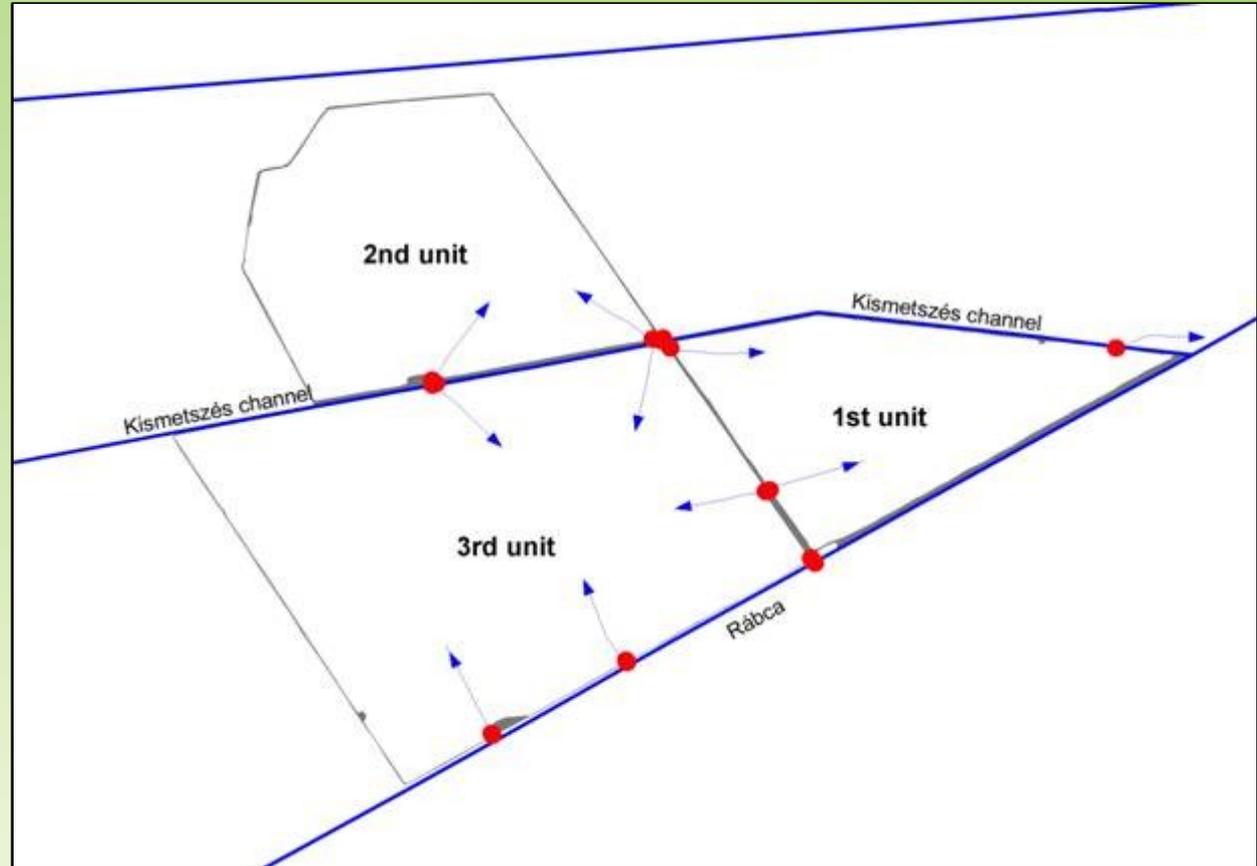
*Hottonia palustris* in a channel

## A habitat map were made before flooding



**Large sedges (57%)** (*Carex riparia*, *C. acutiformis*), and **wet meadows (28%)** (*Alopecurus pratensis*, *Festuca arundinacea*) were the dominant vegetation types and some **reeds (5%)** (*Phragmites australis*, *Glyceria maxima*) also occurred.

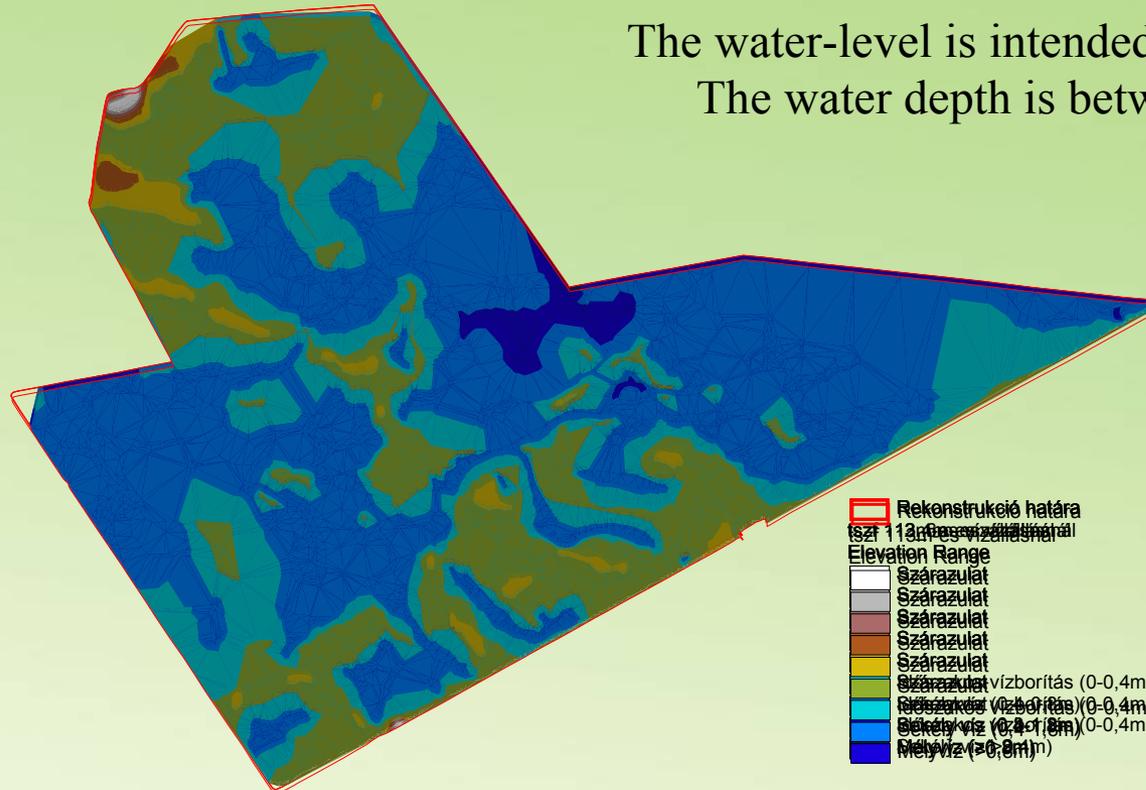
## Technical aspects of reconstruction



Dikes were built around the planned wetland pools (if needed), and water was transported by gravitation through sluices from the river Rábca and the channel Kismetszés. The 1st and 2nd unit was flooded in spring 2001, and the 3rd unit in autumn.

# The water-level

The water-level is intended to keep constant.  
The water depth is between 0-100 cm.



The average water level is 113m above the sea

The year 2001 and 2003 was very dry, so the water level was about 20 cm lower.

## Aerial photos from the first year of flooding.



The landscape of the reconstructed area is really beautiful, it is one of the main „attractions” of the National Park.





# Monitoring methods

## **Small scale monitoring (phytocoenological relevés):**

Aims:

- to follow the changes of species composition
- to examine the relation between vegetation and water level

## **Large scale monitoring (vegetation mapping):**

Aims:

- to follow the changes of vegetation pattern
- to follow the percentage of vegetation types

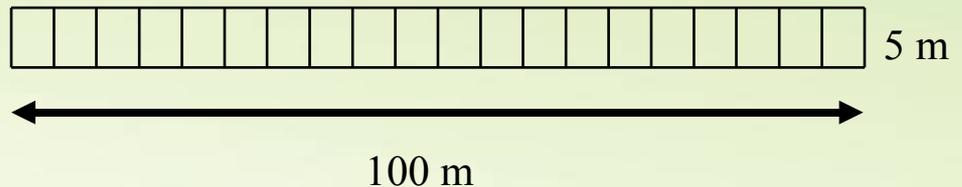
## Small scale monitoring method: permanent transects



The end of the transects were marked by wooden sticks, and positioned using GPS.



The percent cover of plant species were recorded in 20 pieces of 5x5 m quadrates along each transect.



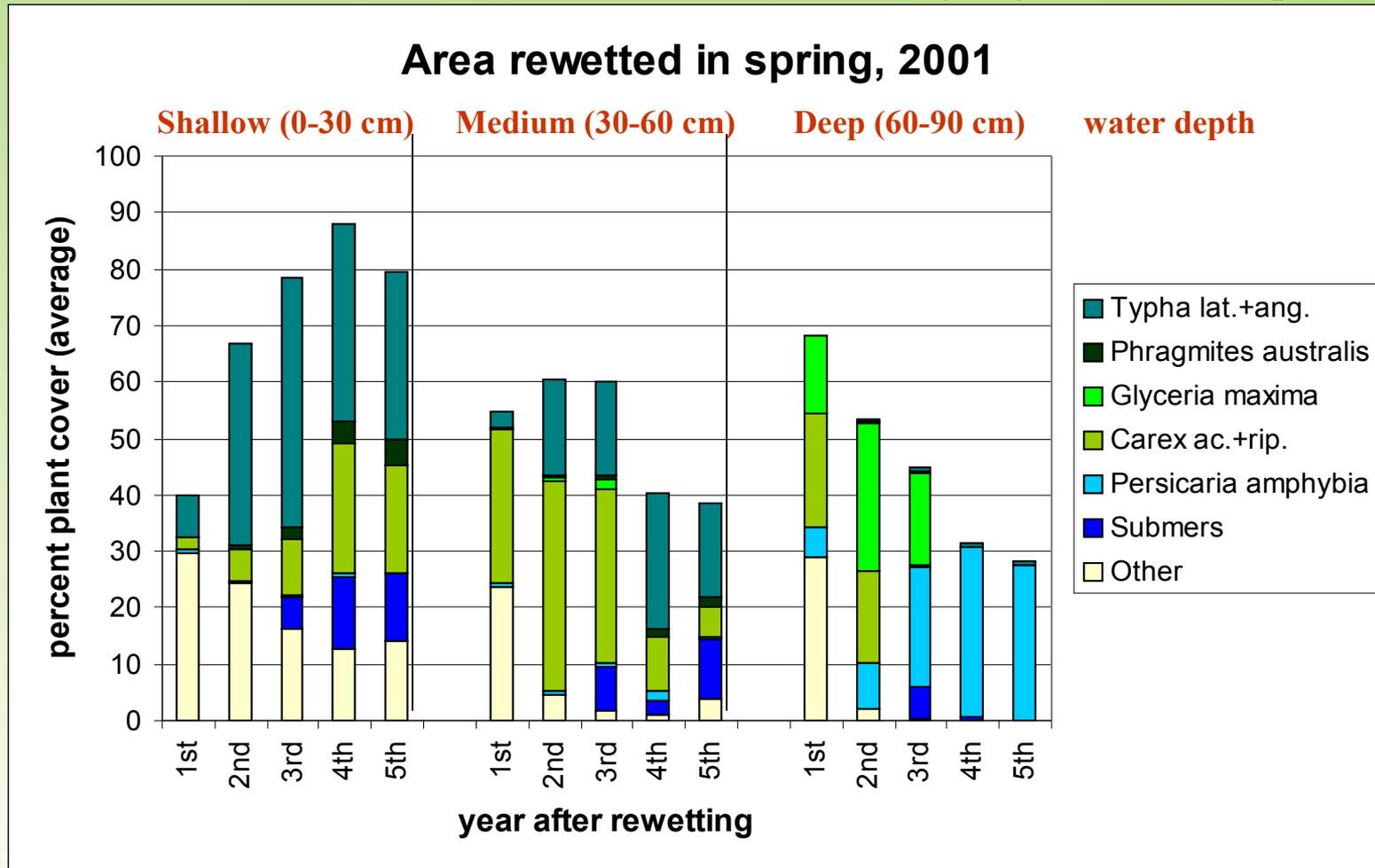
## Location of permanent transects



Takács - Margóczi: Small scale and large scale monitoring of vegetation changes in a restored wetland

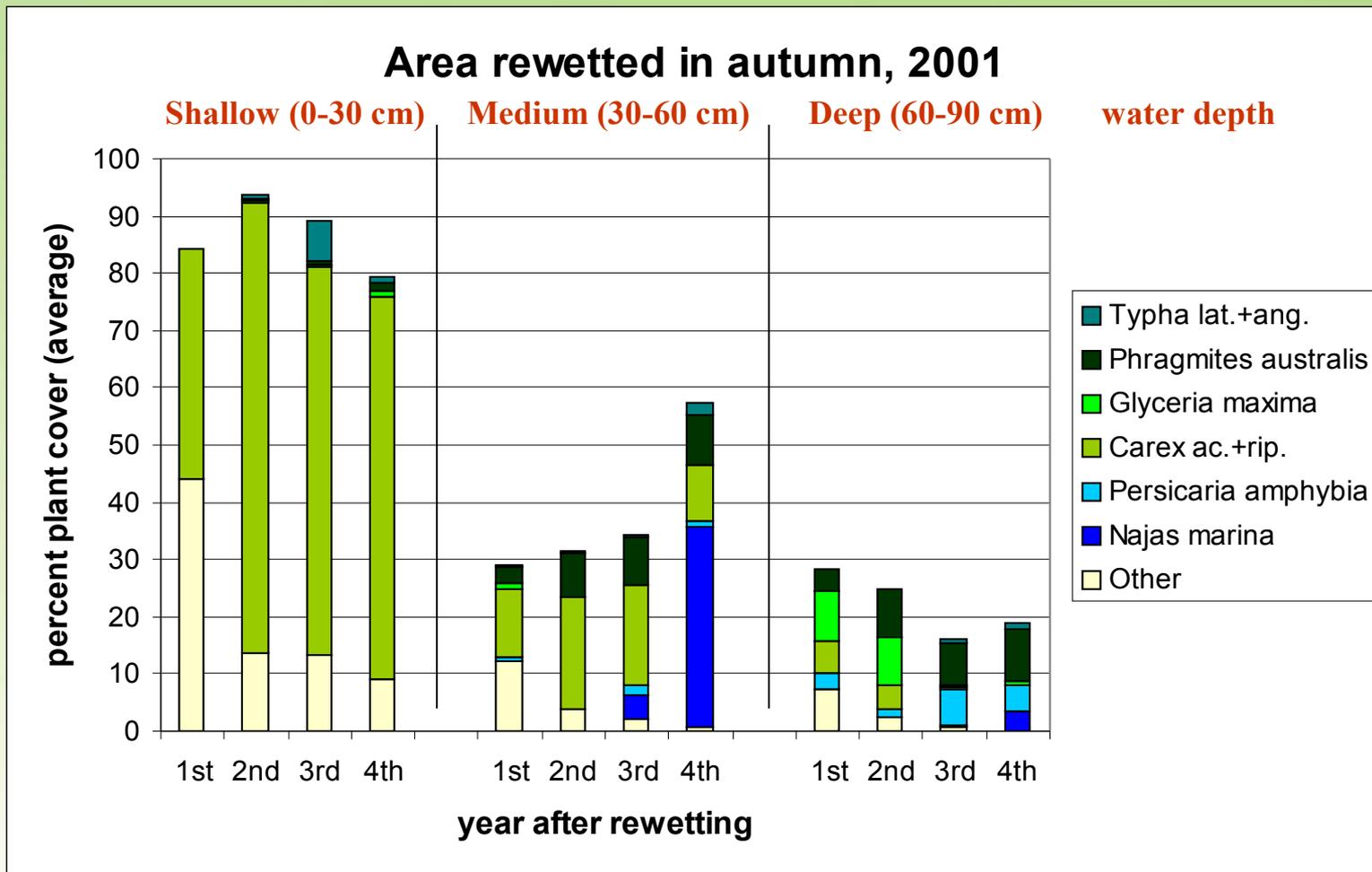
## Result of small scale monitoring

Water is one of the main environmental factor affecting vegetation development.



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Water is one of the main environmental factor affecting vegetation development.



## The pictures of main vegetation categories



*Water-plants*



*Glyceria (maxima)*



*Phragmites (australis)*

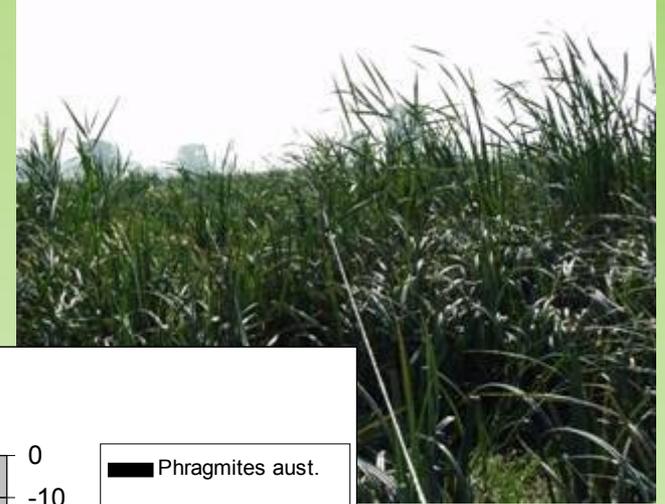
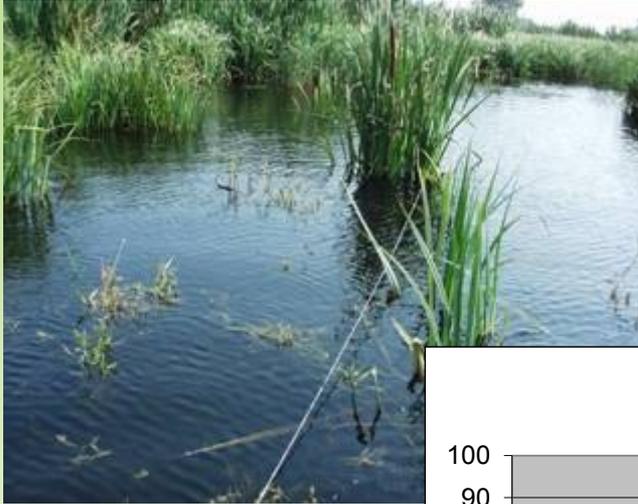


*Typha (latifolia, angustifolia)*

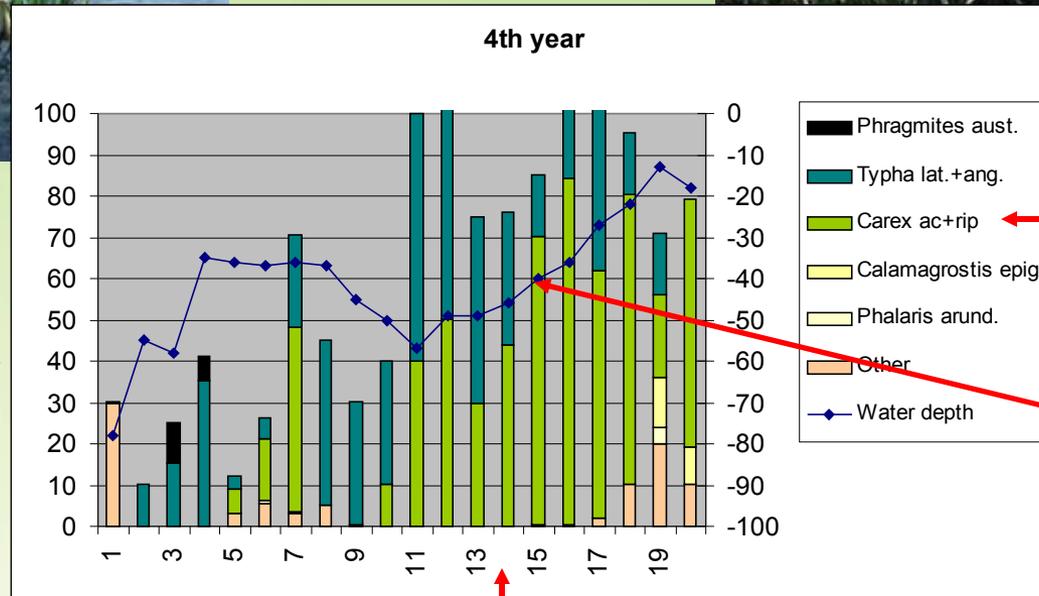


*Sedges (Carex acutiformis, C. riparia)*

## The permanent transect method is suitable for fine detection of local vegetation changes



Percent cover of species

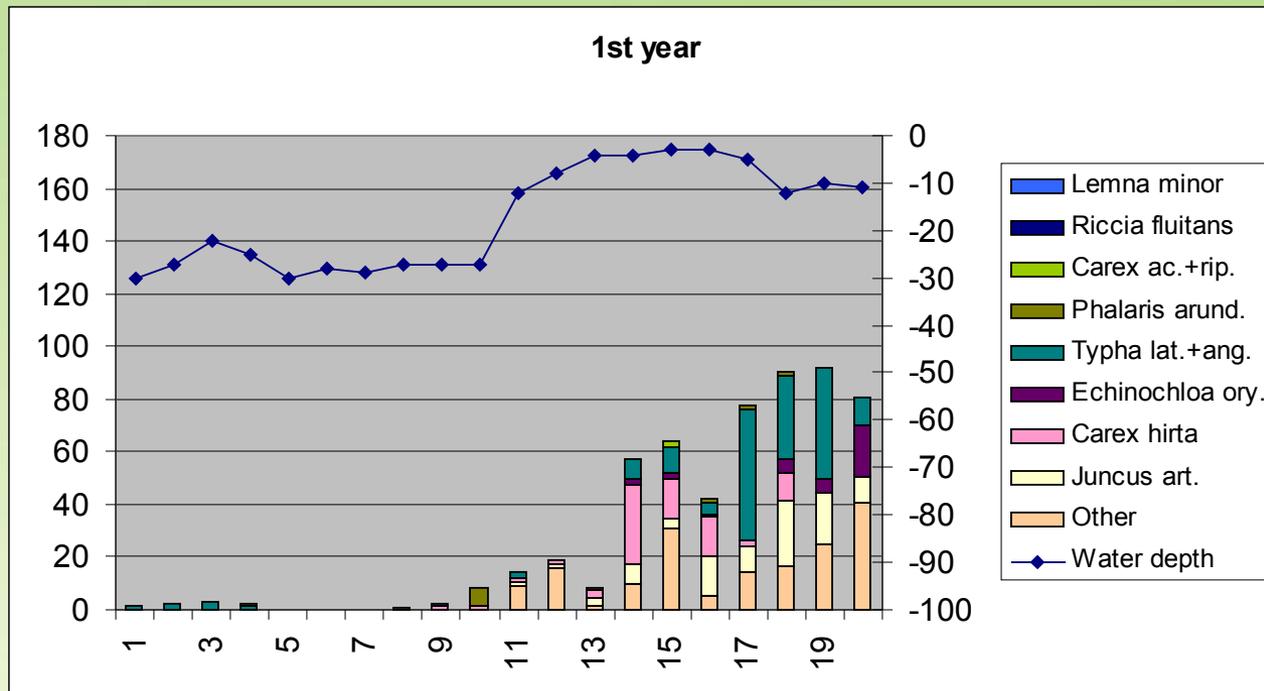


Species,

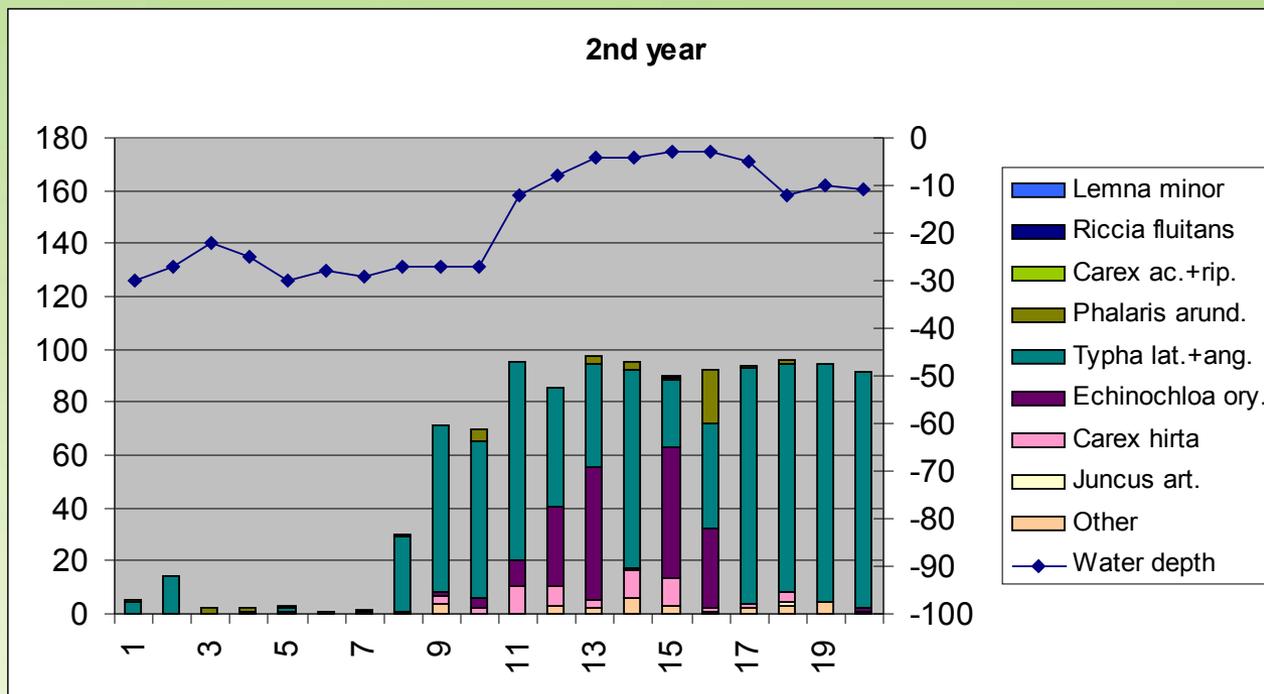
Water depth

Sequence of individual relevés in the transect

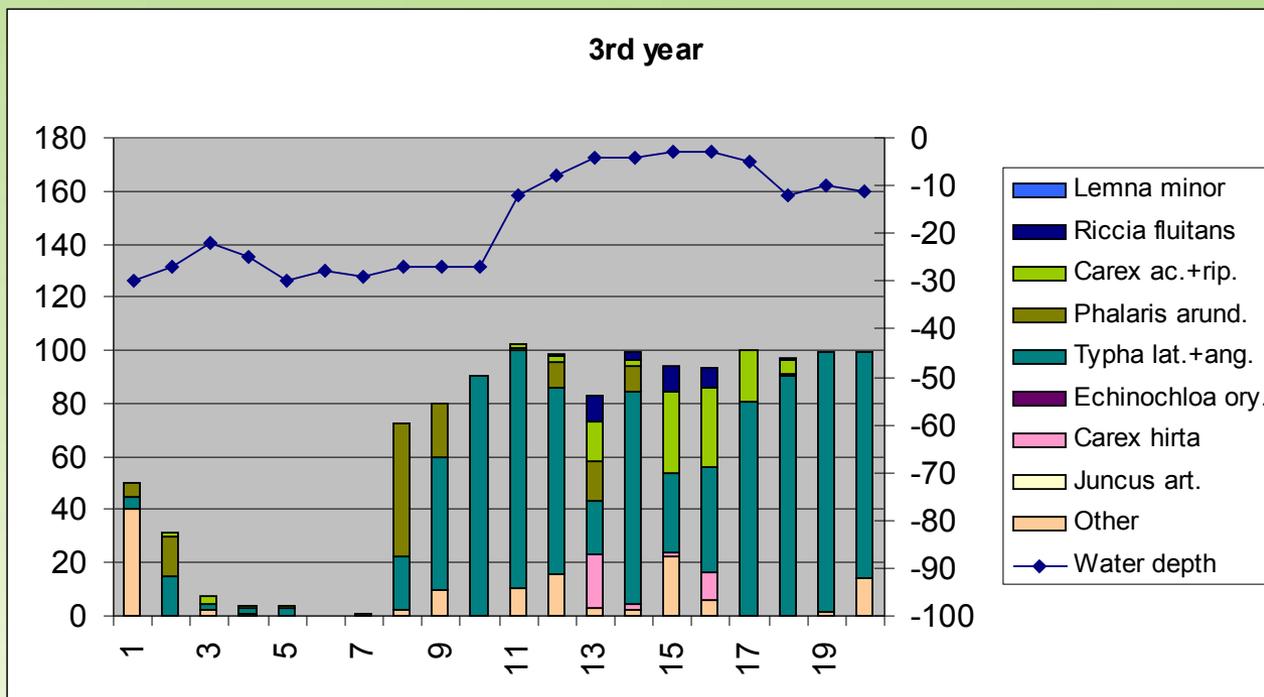
## Transect 161-180, shallow water



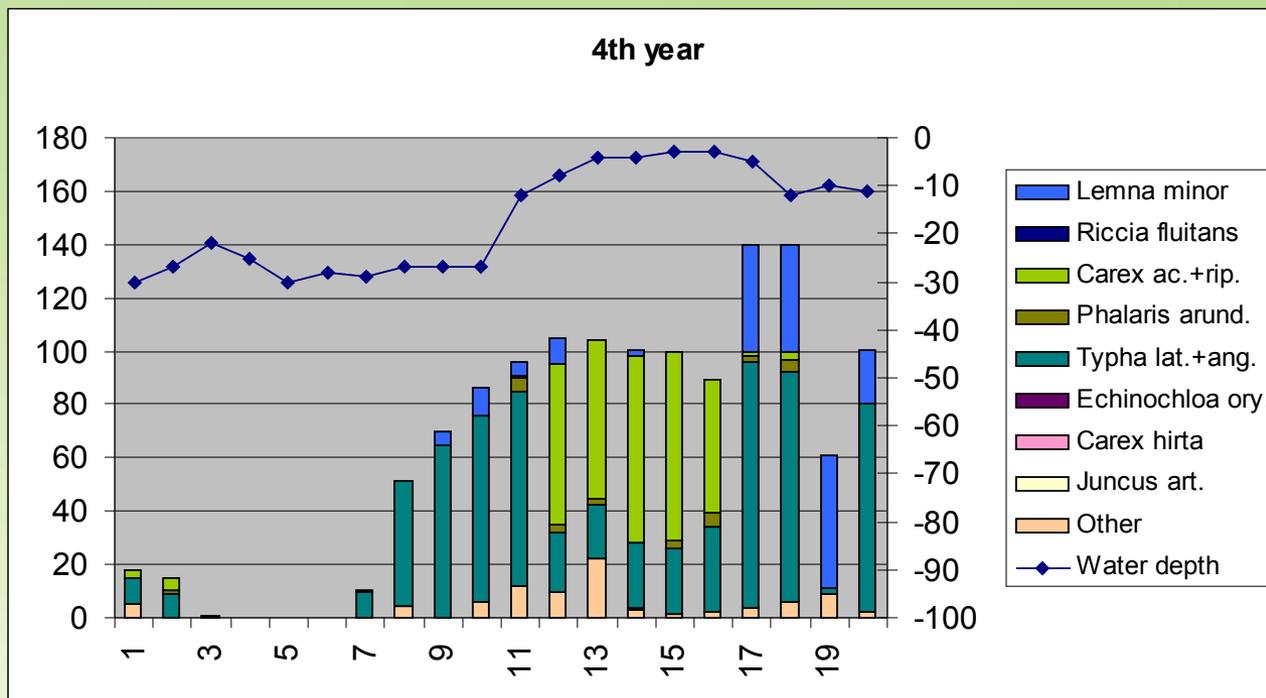
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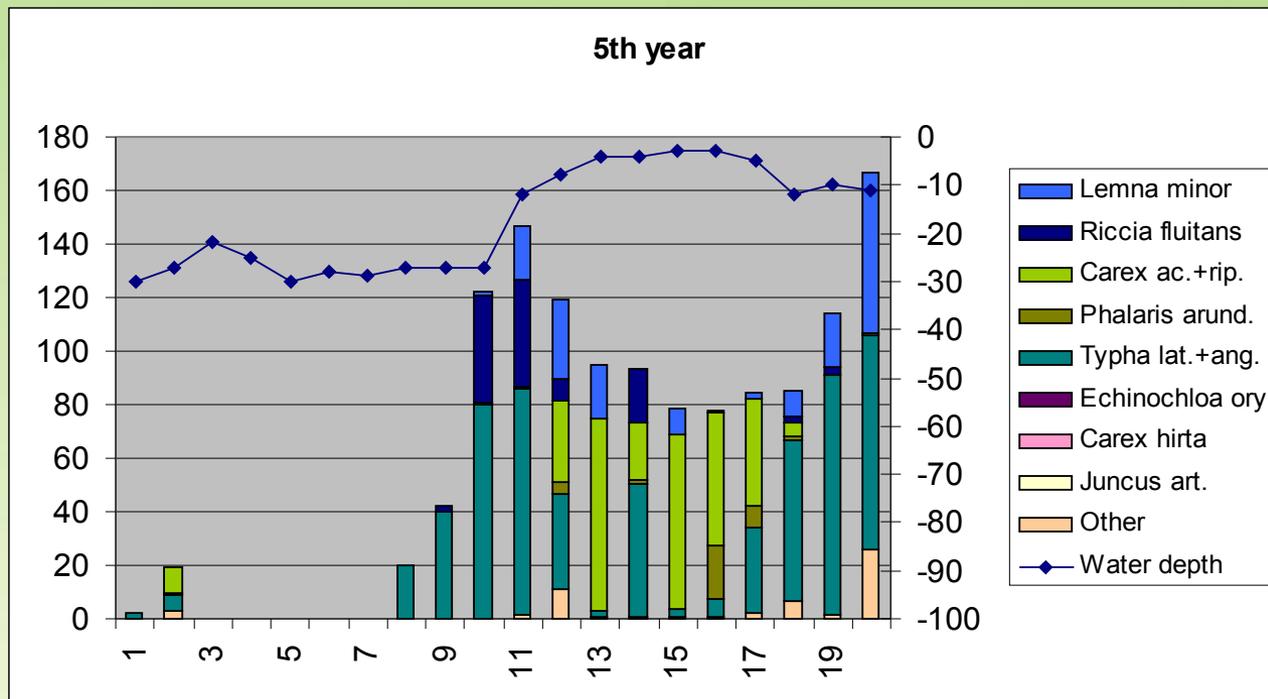
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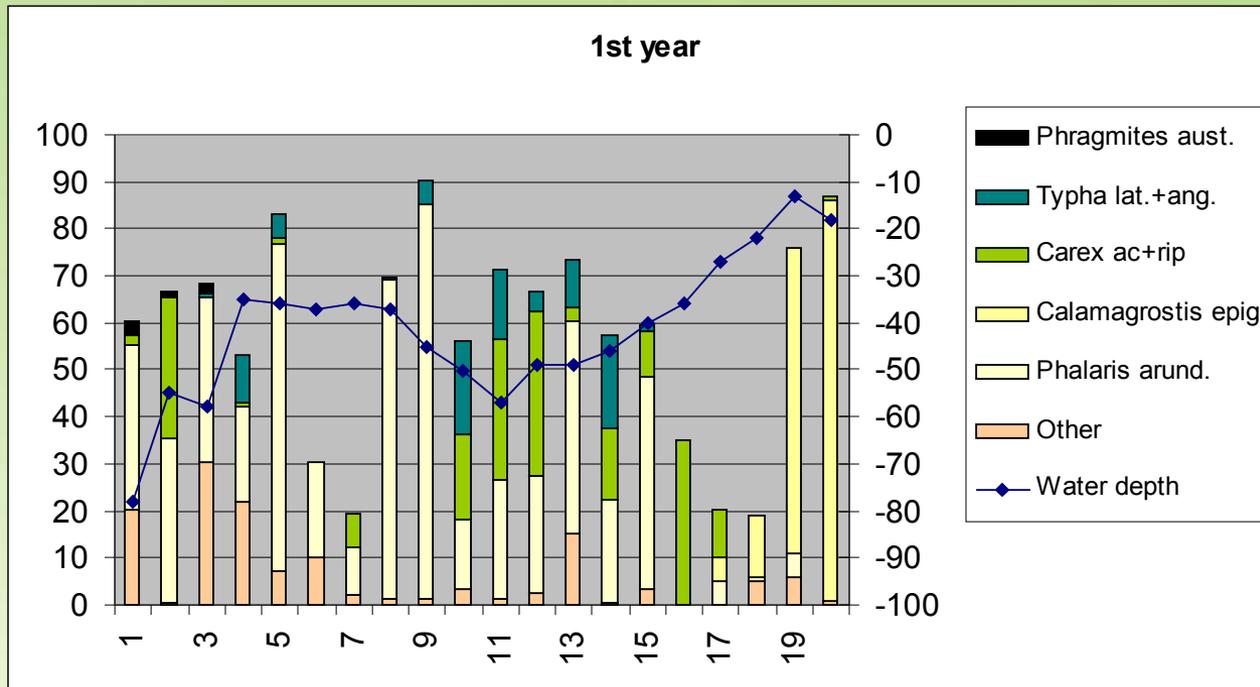
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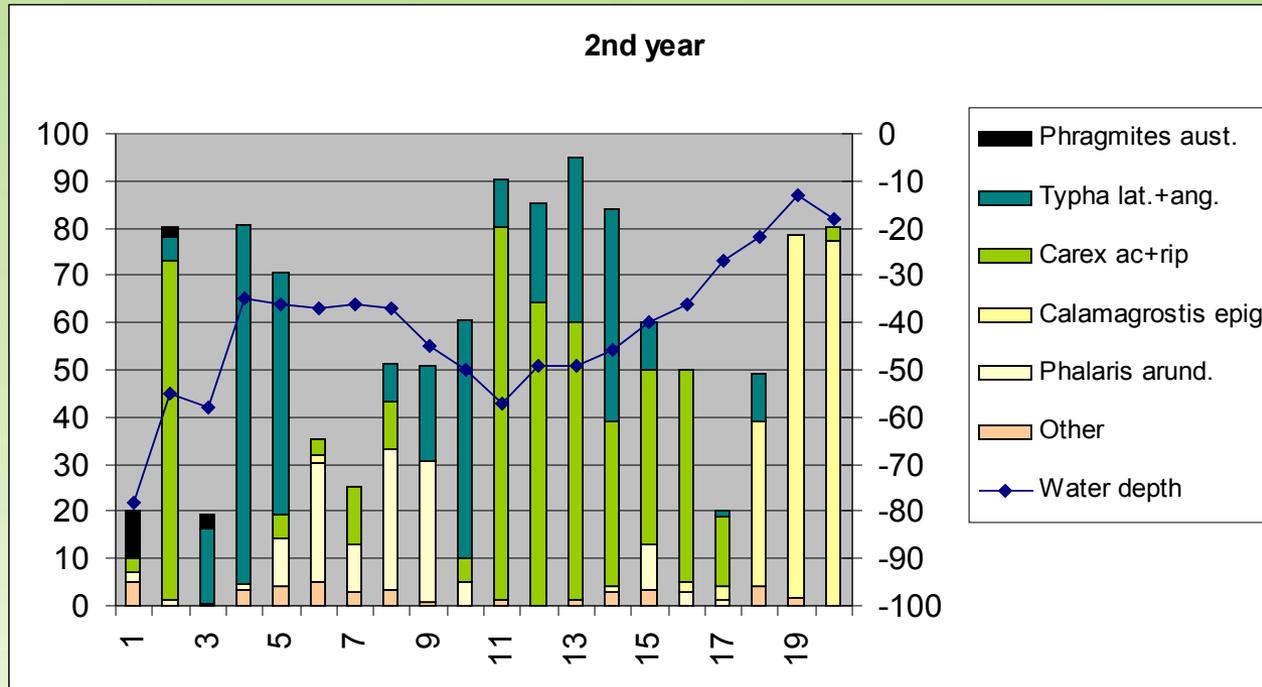
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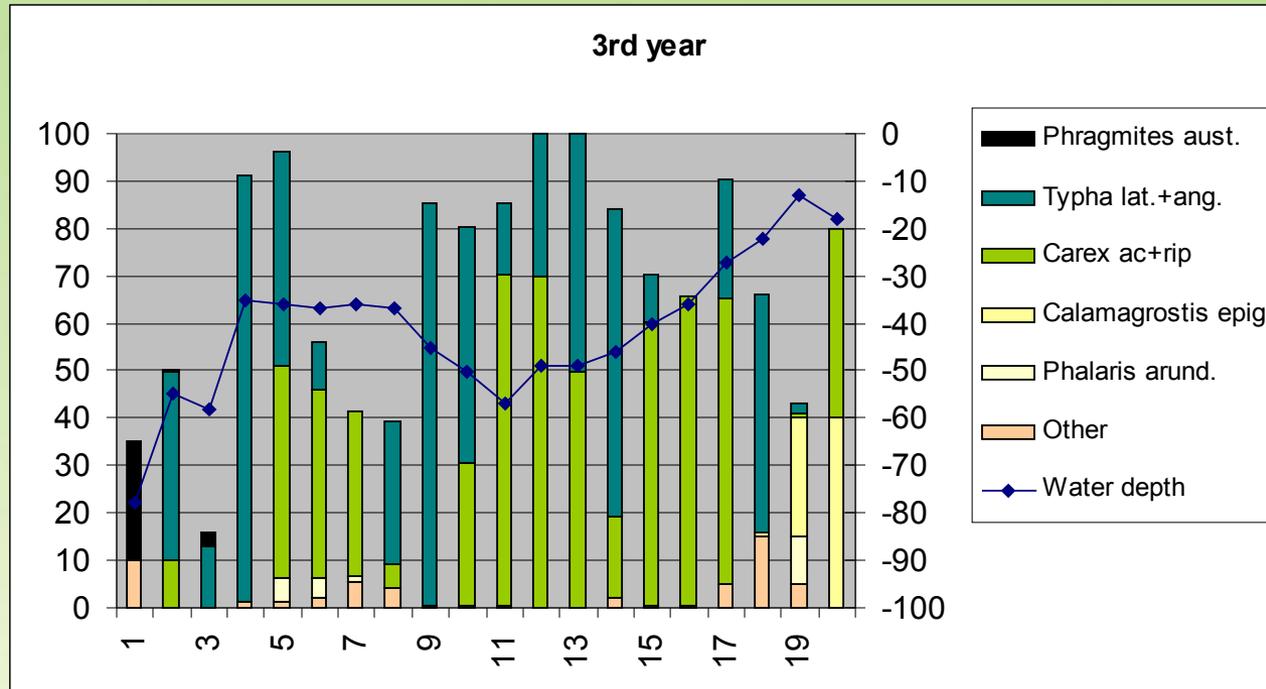
## Transect 221-240, medium water



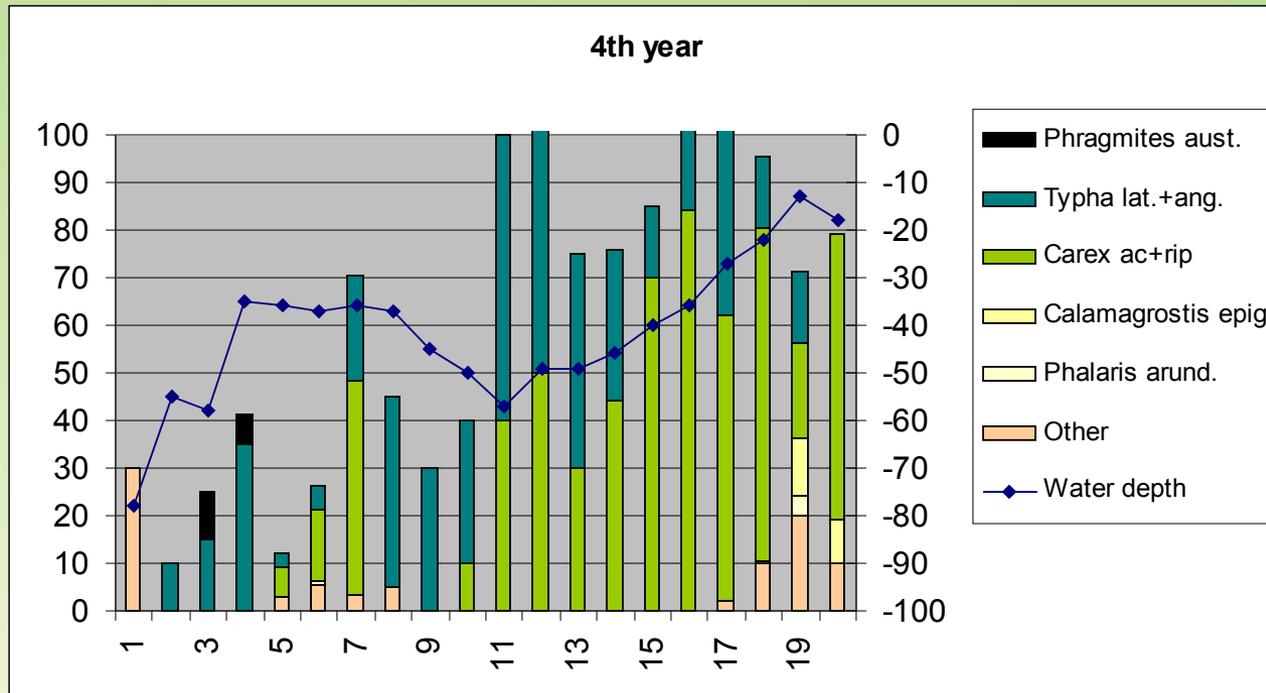
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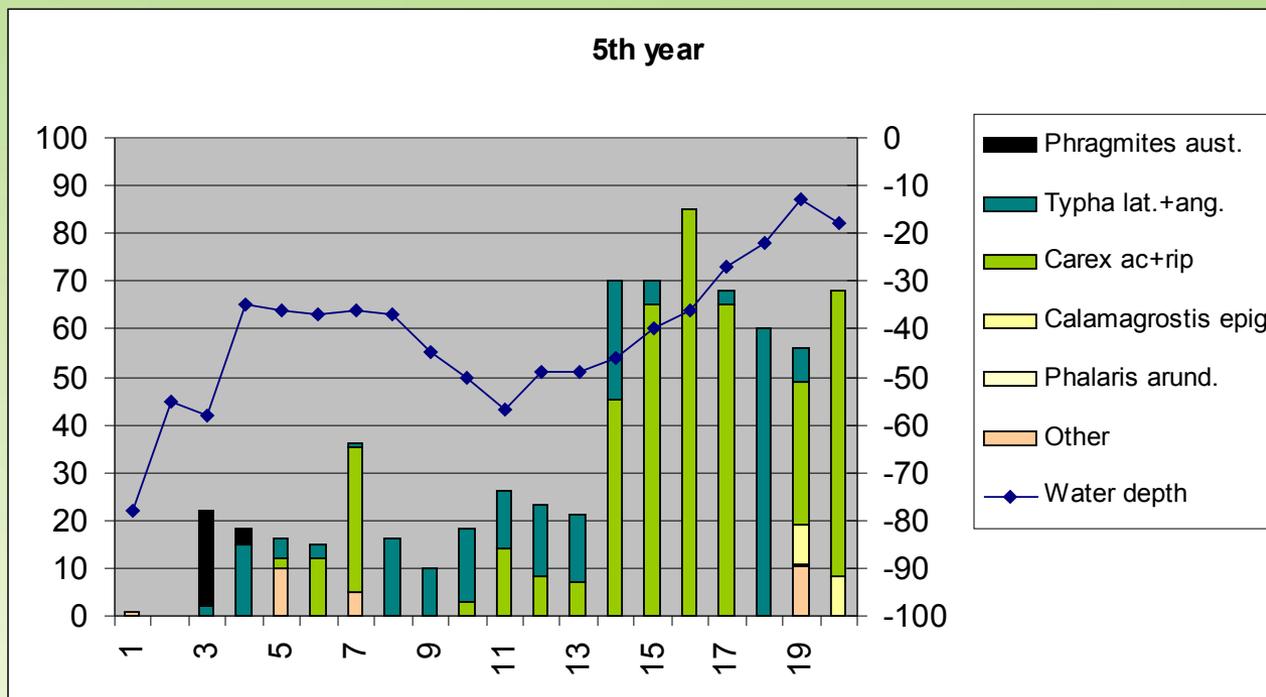
## Transect 221-240, medium water



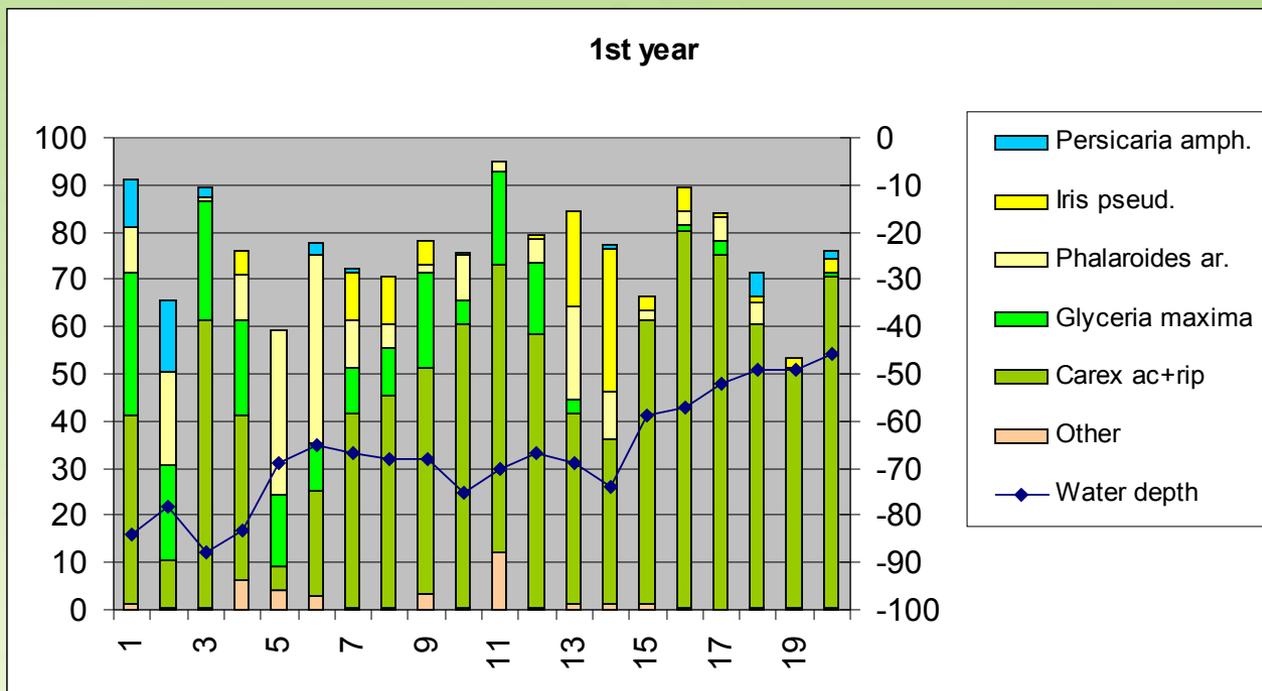
## Transect 221-240, medium water



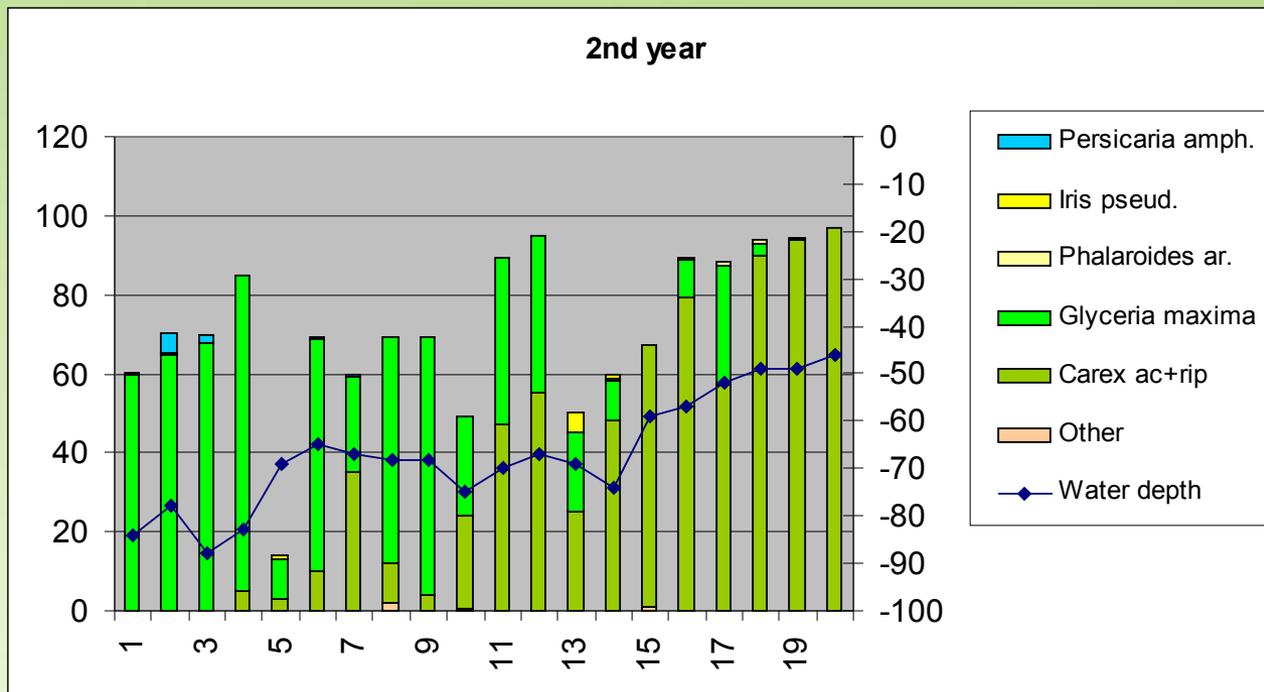
## Transect 221-240, medium water



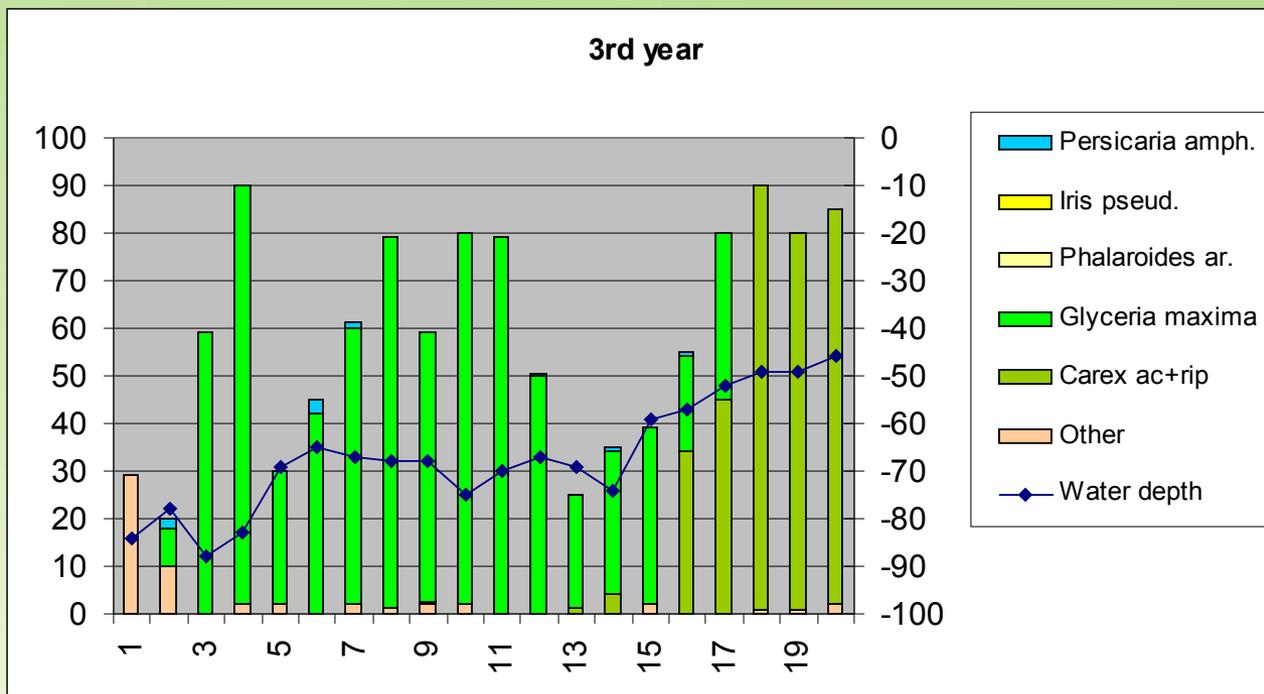
## Transect 21-40, deep water



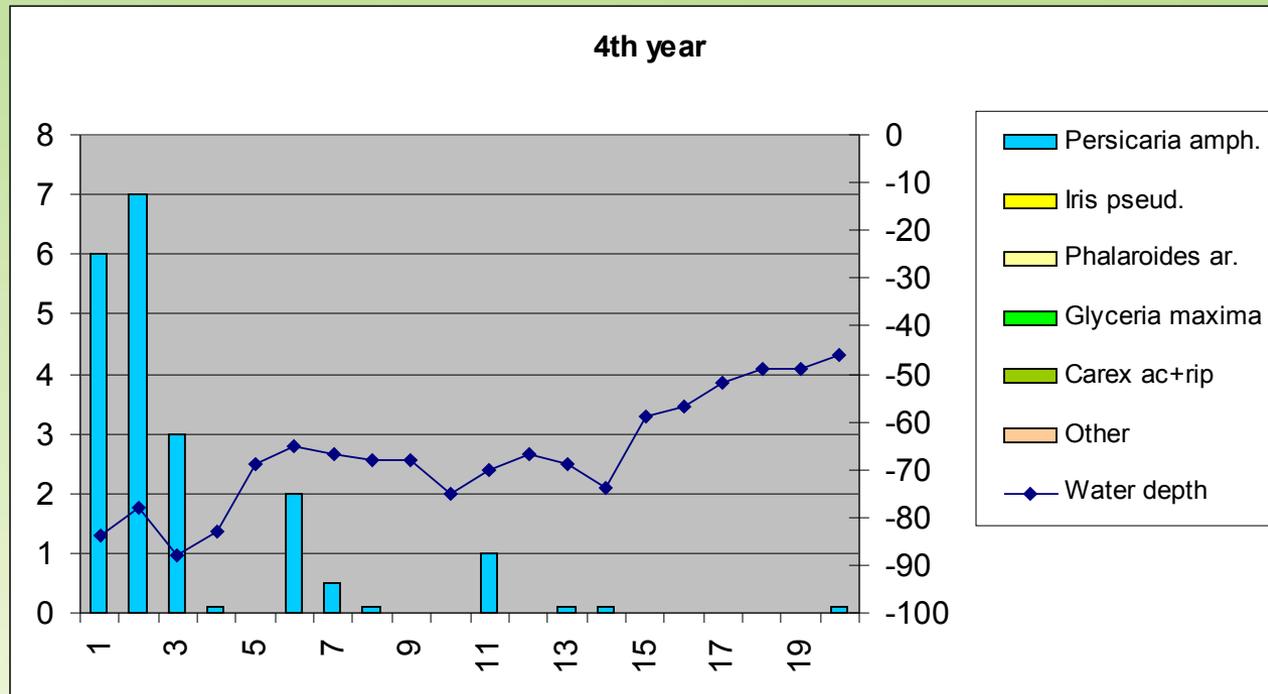
## Transect 21-40, deep water



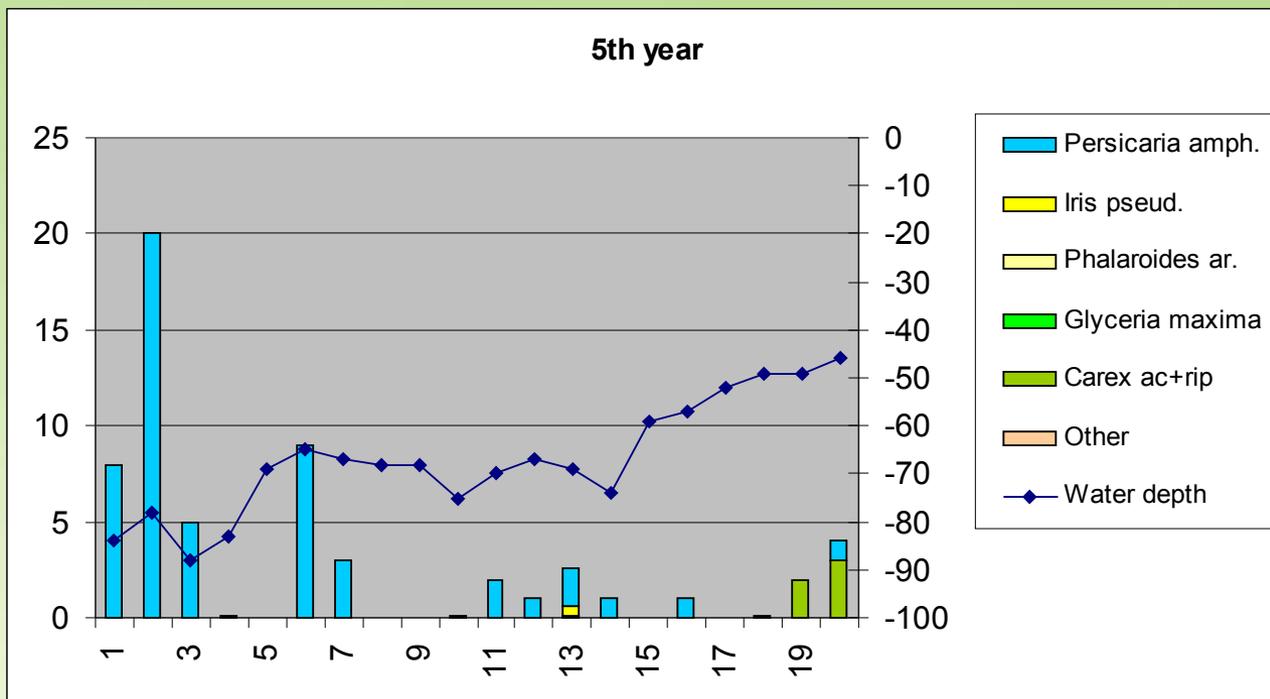
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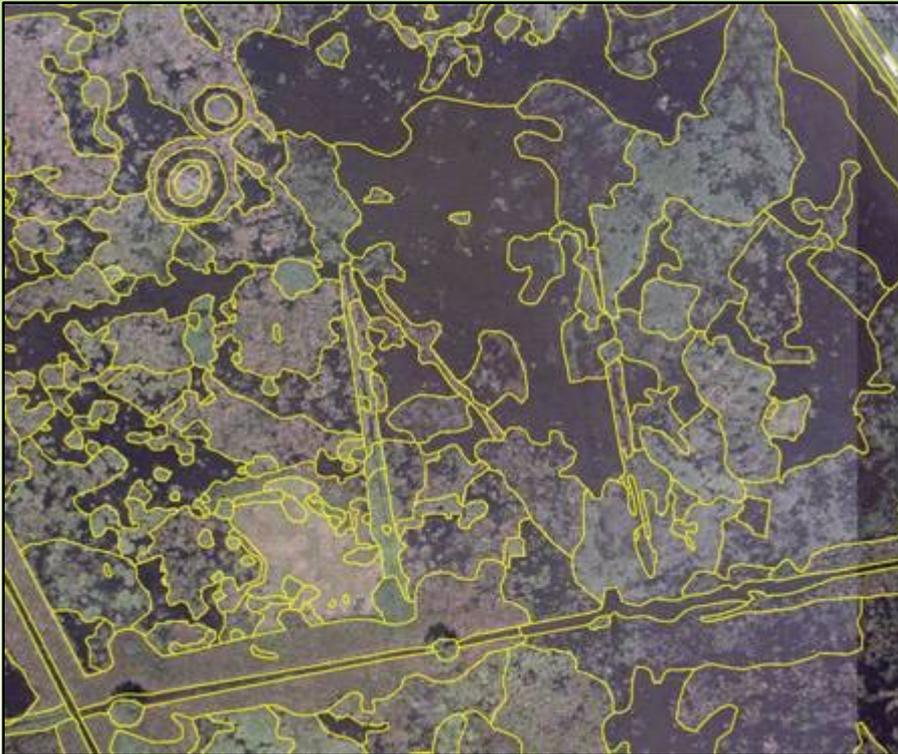
# Large scale monitoring



## Parameters of the aerial photograph:

- Service: Telecopter Kft.
- Date of flight: 2003.07.15. (12:00 – 12:15)
- Film material: K color III 2444
- Flying height: 1200m
- Camera: Wild RC-10 (f=153,1mm)
- Overlap: 60%
- Resolution: 1 m

## Processing of the aerial photograph

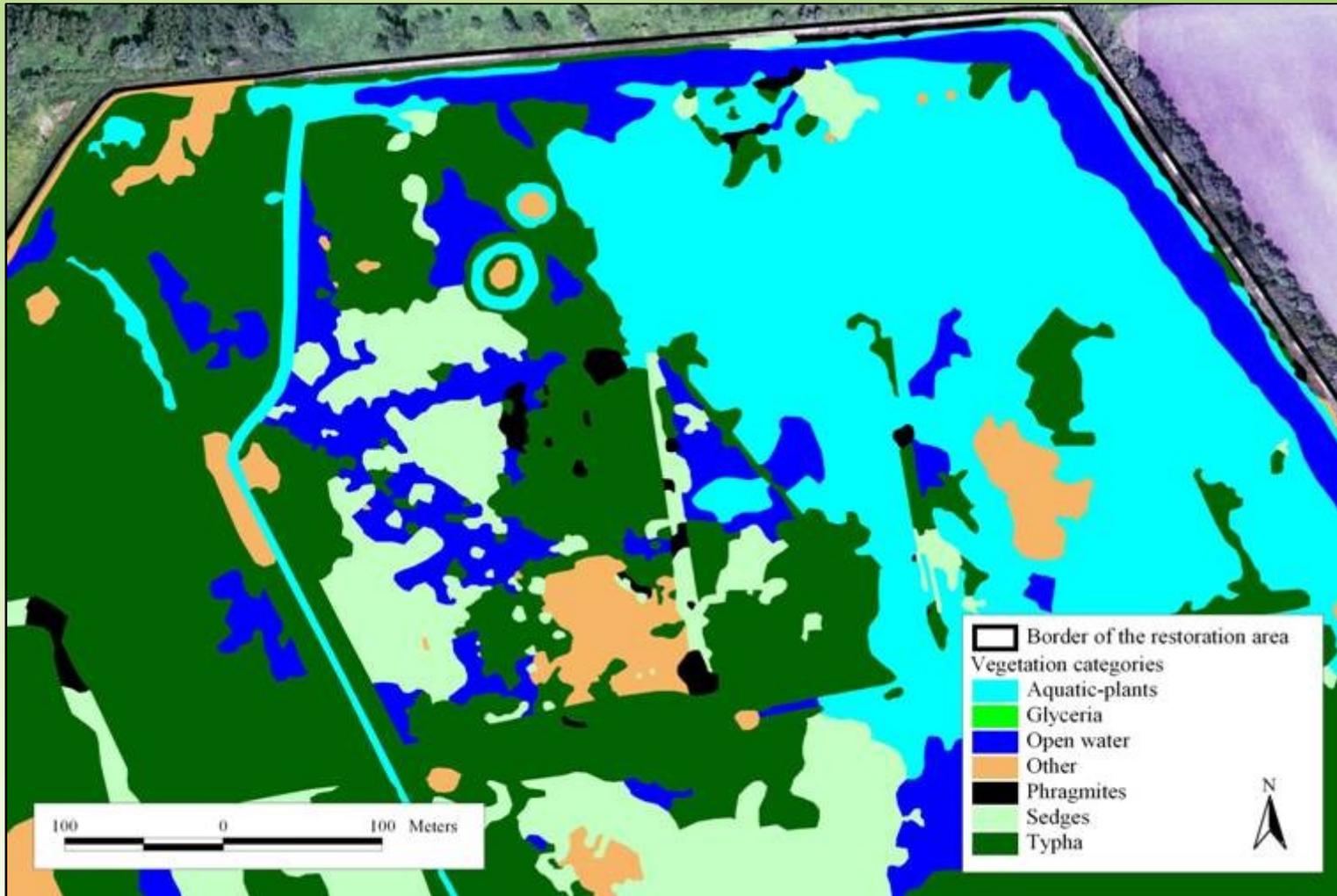


- Scanning with 18 $\mu$ m resolution and 16 bit color depth. Ortorectification with field reference points by ERMAPPER 6.1 and DIGITERRA (Hungary) softwares.
- Outline of the possible patch contours in the computer (manual).

## Field work



- Identification and correction in the field. (vegetation category, main species and their cover, total vegetation cover)
- Build GIS database from the data
- Data processing by raster analysis (One pixel is 1x1 m)
- GRID statistics





## Results of large scale monitoring

- Vegetation map
  - scale 1:5000
  - 1483 patches
- Detailed description of vegetation categories
  - 62 vegetation types were distinguished and described (a lot of transitional categories)



## Detailed description of vegetation categories

<b>Code:</b>	<b>CaCr</b>
<b>National habitat category:</b>	B5
<b>Association:</b>	Caricetum acutiformis és Caricetum ripariae
<b>Alliance:</b>	Magnocaricion
<b>Short description:</b>	Sűrű, általában erősen zárt magassásos (60-100%). A Carex riparia és a Carex acutiformis változó arányban fordul elő. Mellette a gyékények és egyéb fajok csak max. 1-5%-ban fordulnak elő. A sások helyenként zombékolnak.
<b>Species:</b>	
<b>Dominant:</b>	Carex riparia, Carex acutiformis
<b>Subdominant:</b>	Typha angustifolia, Typha latifolia
<b>Abundant:</b>	Lythrum salicaria, Phalaroides arundinacea, Typha angustifolia, Typha latifolia, Phragmites australis

**Sample**



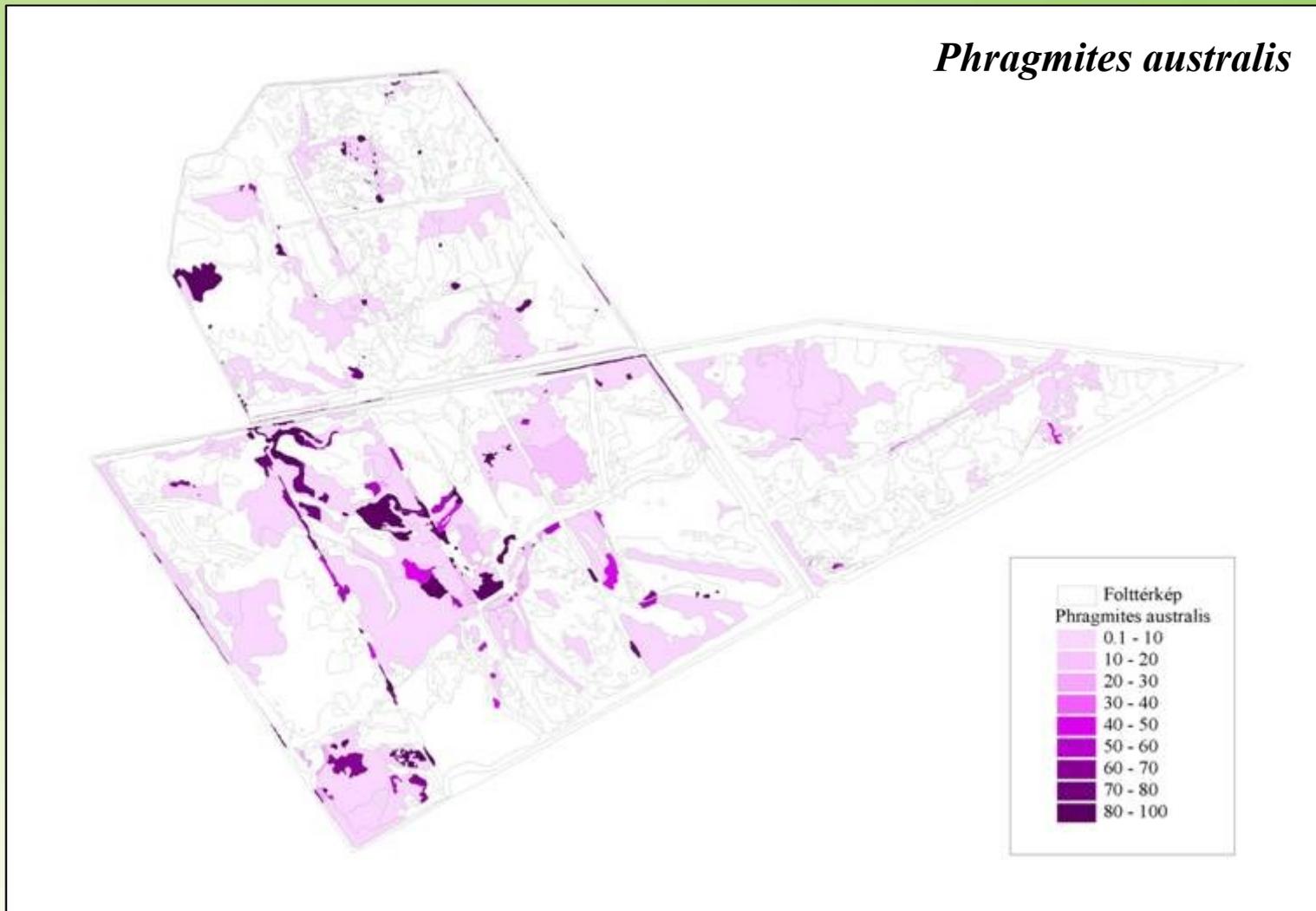
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- Thematic maps about the restored area
  - Spreading of species

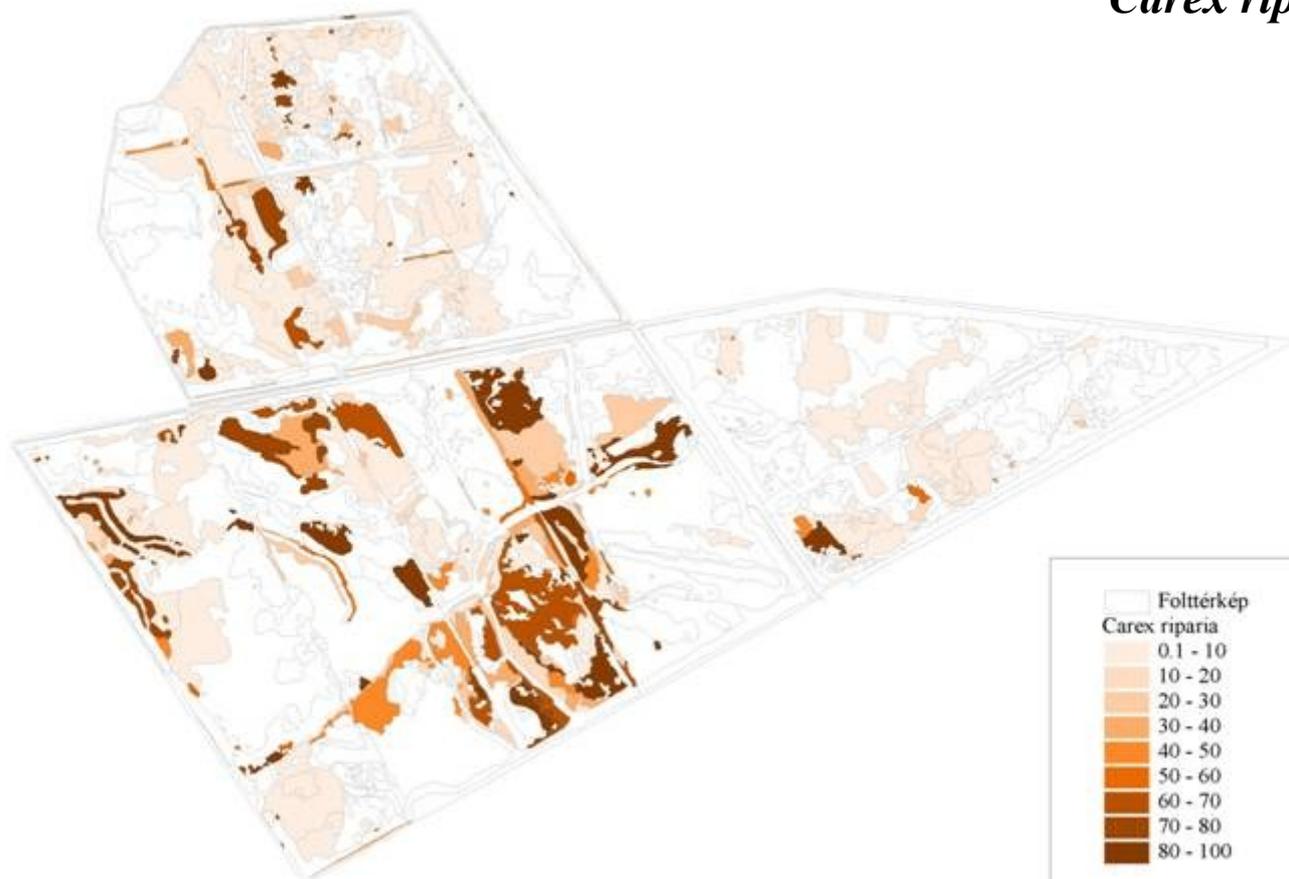
## *Glyceria maxima*



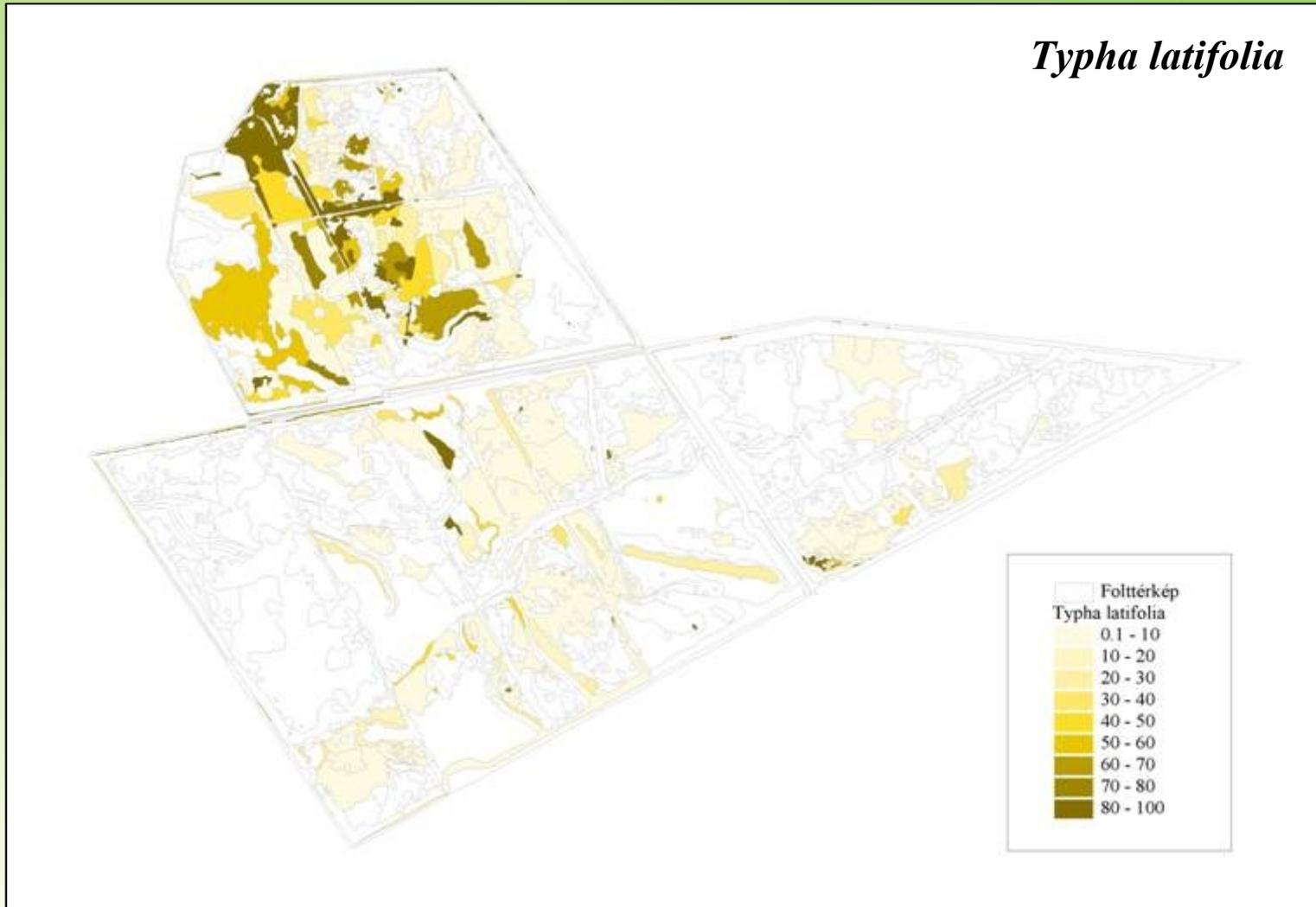
## *Phragmites australis*



## *Carex riparia*



## *Typha latifolia*



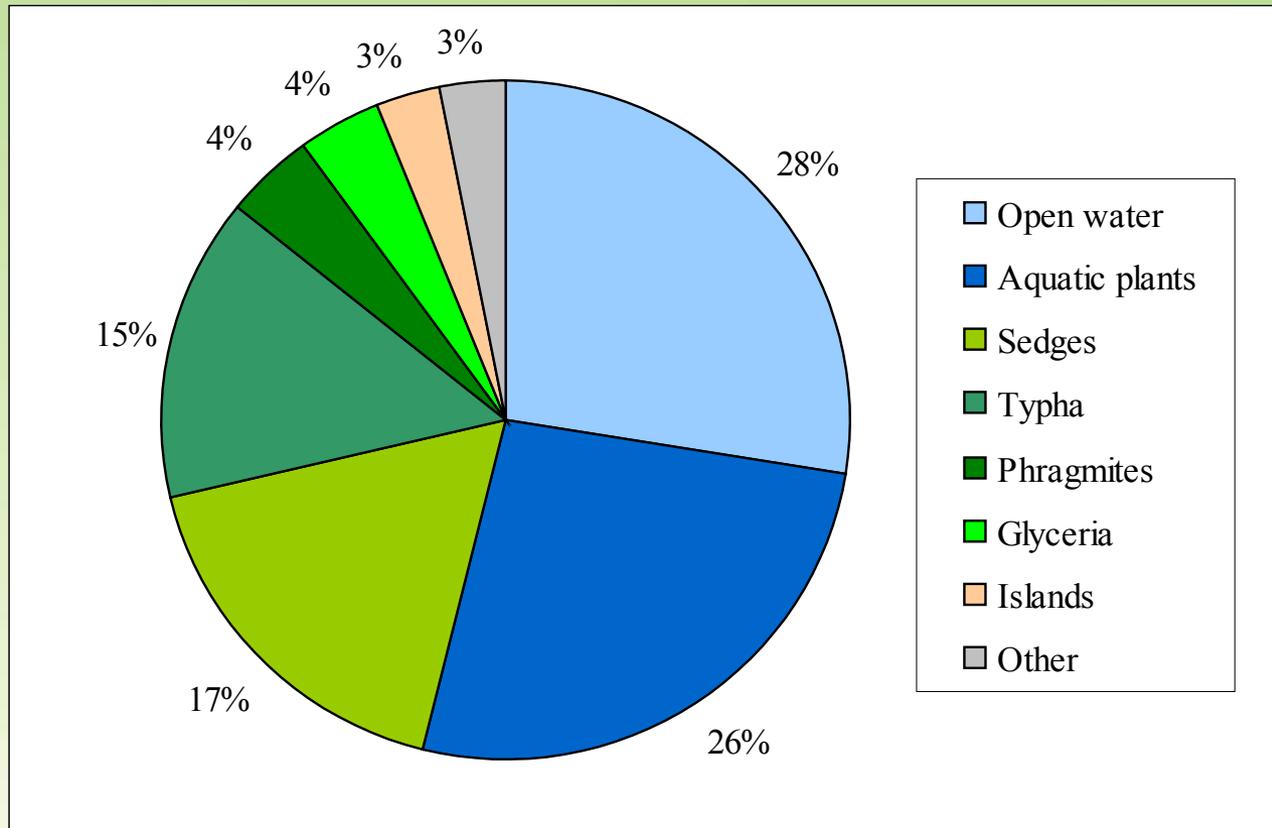


## Results of large scale monitoring

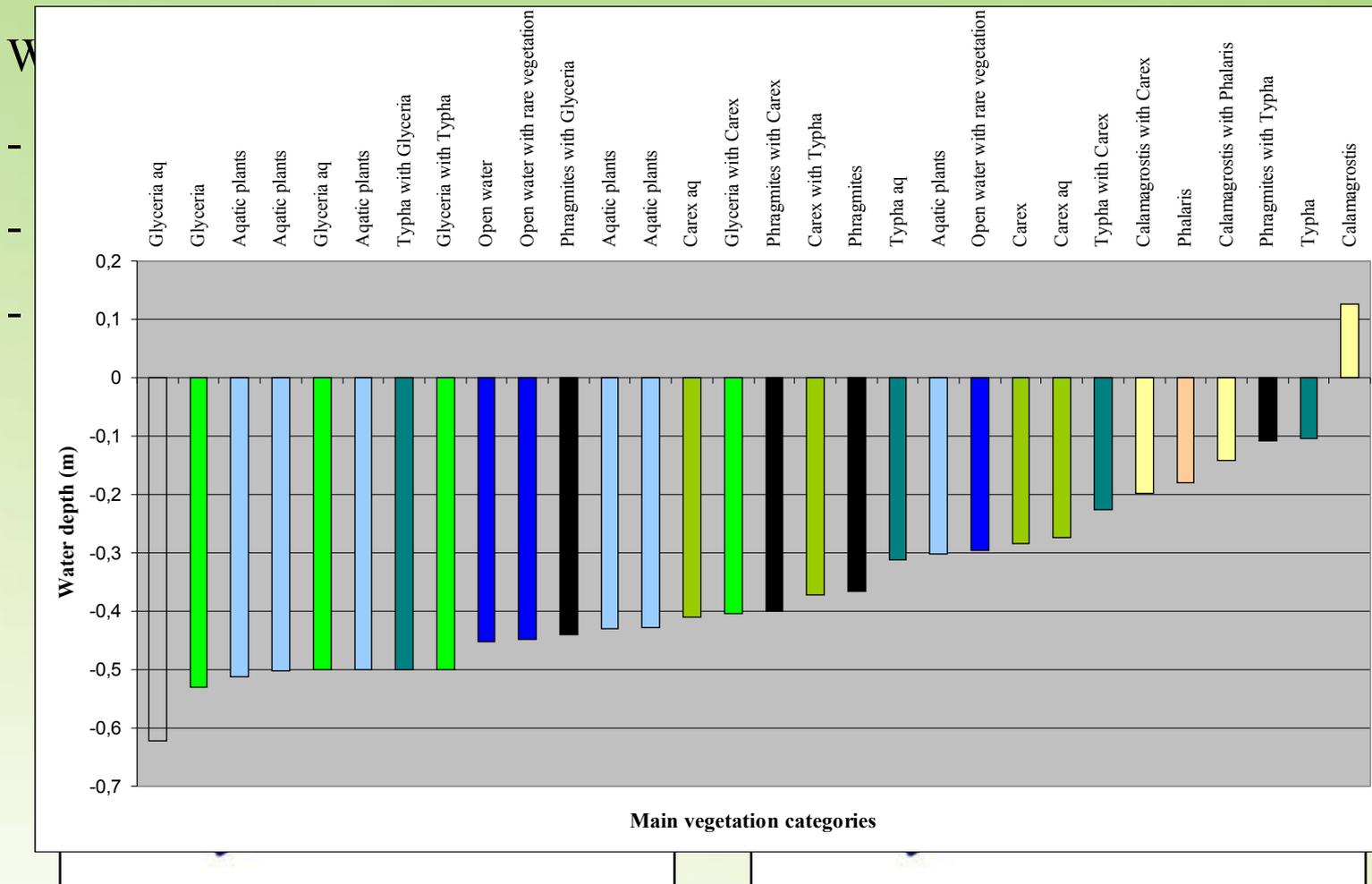
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- Statistics
  - Vegetation types percentage
  - Statistics of patches area
  - Connection between vegetation types and water depth???

## Grid statistics

Area (in percentage) of vegetation categories in the whole restored area in 2003.

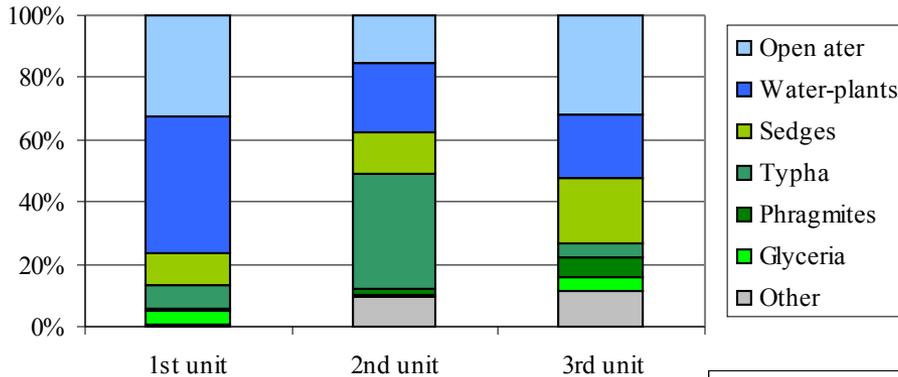


# Connection between water depth and vegetation



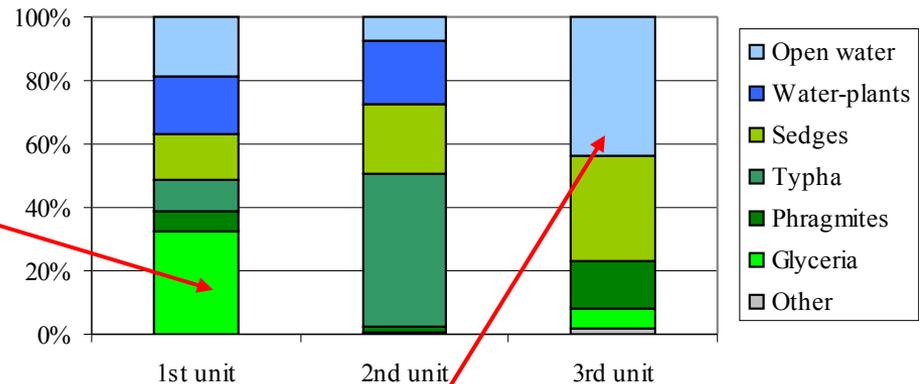
# Do the permanent transects represent appropriately the whole restored area ?

Vegetation map (2003)



**Glyceria is overrepresented**

Transects (2003)



**Water plants are underrepresented**



## Evaluation of the methods

	<b>Large scale method (mapping)</b>	<b>Small scale method (relevés)</b>
Advantages	<ul style="list-style-type: none"><li>- sampled area is total</li><li>- pattern of vegetation types are represented</li><li>- GIS tools can be used</li><li>- patch scale data</li></ul>	<ul style="list-style-type: none"><li>- the field work is relatively few</li><li>- data collection is possible in every year</li><li>- fine representation of temporal changes</li><li>- species scale data</li></ul>
Disadvantages	<ul style="list-style-type: none"><li>- the appropriate aerial photo is expensive</li><li>- the field work is time consuming</li><li>- data collection is not possible in every year</li><li>- crude representation of temporal changes</li></ul>	<ul style="list-style-type: none"><li>- sampled area is small</li><li>- representativeness is not perfect</li></ul>



## **What should we do in different way?**

- We need more exact surface modell.
- We should make more detailed vegetation map in the first year and before rewetting.
- Can we bypass the problem of over- and underrepresentation?
  - No and yes.
  - If we use individual coenological relevés, we can spread it evenly, but the field work will last at least one month (and better statistics).
  - We can't know the vegetation changes in the future, so we can mark the transects to the momentary vegetation.



## **Evaluation of restoration**

- ❖ Natural wetland communities are developing in the area.
- ❖ The landscape is beautiful.
- ❖ It is a very important breeding and feeding area of birds.  
(Zoological monitoring is being made as well!)
- ❖ The hydrology is considerably different from the original situation.
- ❖ Natural communities are not the same, than before drainage of the ancient fen.



## Future

- The National Park is ready to follow wetland restoration!
- Forestry and agriculture cause severe soil degradation in this area, so wetland restoration would become soon the only logic land use in Hanság!
- The change of the water management in the whole area of Hanság is necessary for saving the natural values.

Gábor TAKÁCS



Katalin MARGÓCZI

**Thank you  
for your attention!**