Yearly changes in herbaceous vegetation composition in relation to grazing intensity in Riparian ecosystem of Axios river.

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RIPARIAN VEGETATION RESPONSES TO GLOBAL CHANGES
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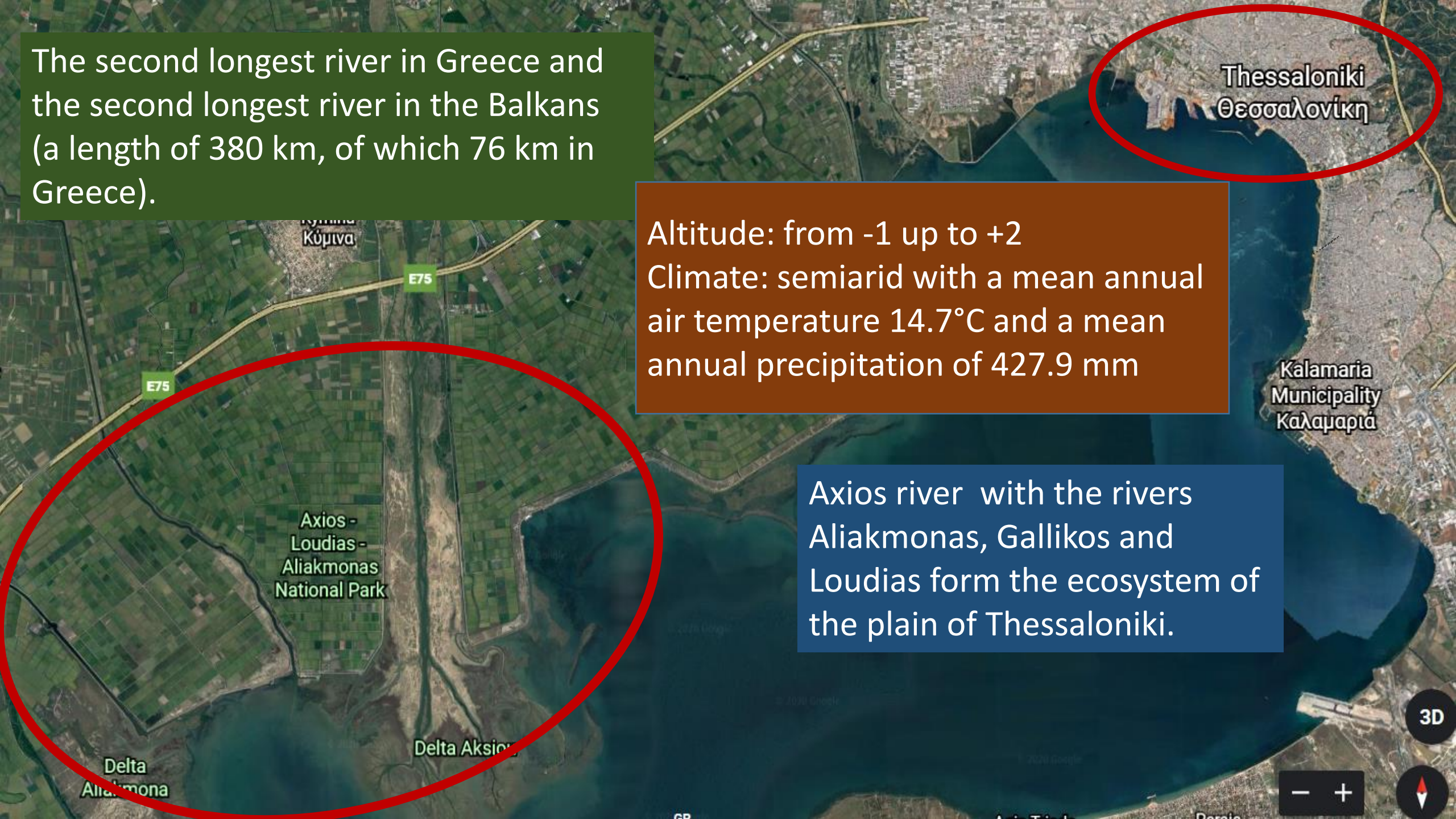
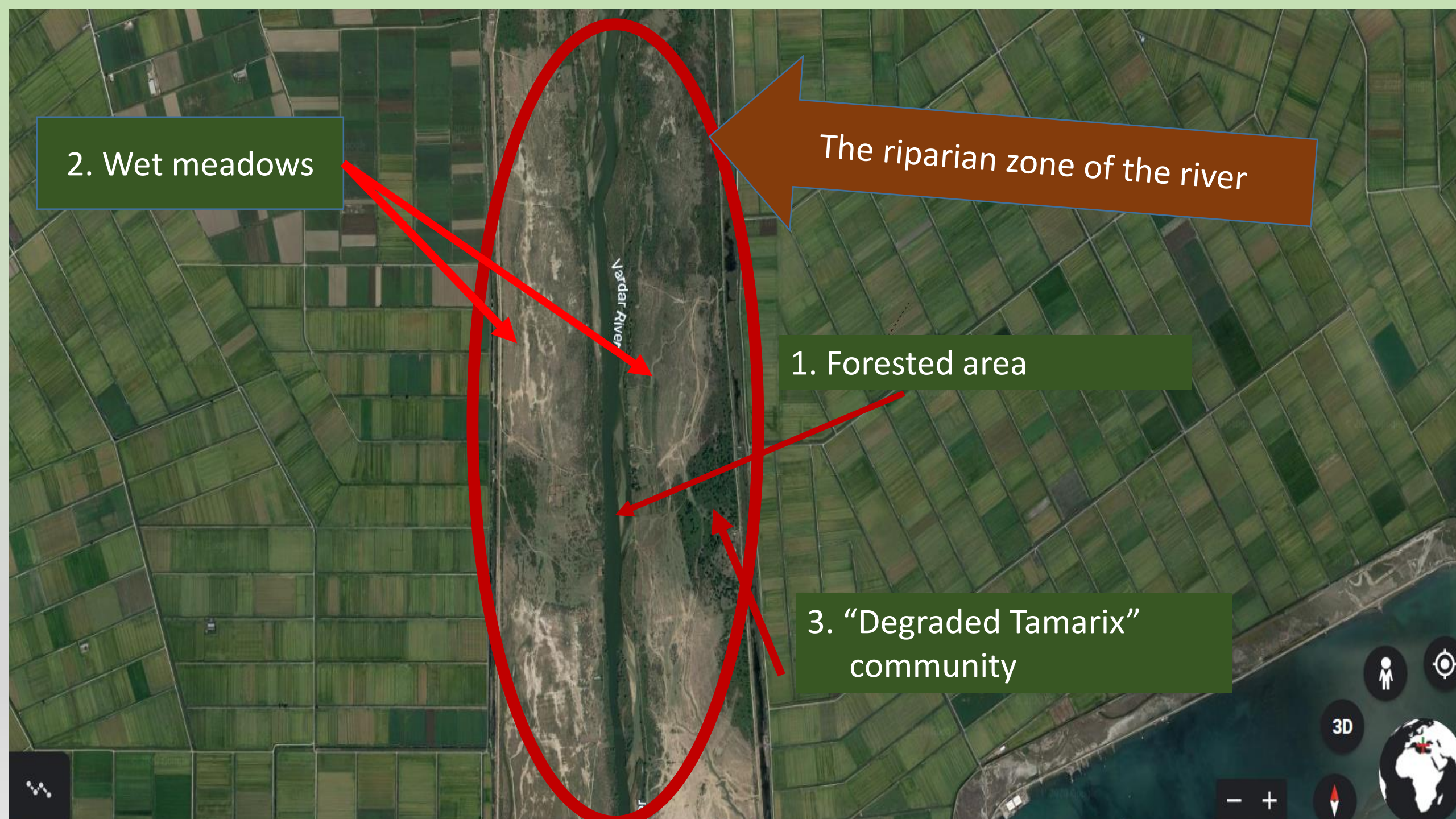

The second longest river in Greece and the second longest river in the Balkans (a length of 380 km, of which 76 km in Greece).
Altitude: from -1 up to +2
Climate: semiarid with a mean annual air temperature 14.7°C and a mean annual precipitation of 427.9 mm
Axios river with the rivers Aliakmonas, Gallikos and Loudias form the ecosystem of the plain of Thessaloniki.
Thessaloniki
Θεσσαλονίκη
Κύμινα
E75
E75
Axios - Loudias - Aliakmonas National Park
Kalamaria Municipality
Καλαμαριά
Delta
3D

The wetland in numbers

A large wetland has been created by the rivers with great ecological values that is now protected by international conventions.

- 295 species of birds, (66% of the species observed in Greece today), of which 106 nest
- 350 species and subspecies of plants
- 40 species of mammals
- 18 species of reptiles
- 9 species of amphibians
- 7 species of invertebrates
- 25 habitats


2. Wet meadows
The riparian zone of the river
1. Forested area
3. “Degraded Tamarix” community
3D

The main tree species in the area:

Salix sp.
Alnus glutinosa
Populus nigra
Fraxinus sp
Platanus orientalis

Source:Thermaikos Gulf Protected Areas Management Authority

Vegetation types (Natura 2000)

It is covered by three vegetation types of European Community Interest (Council Directive 92/43/EEC):

i) 1420 Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi)*

ii) 92D0 Southern riparian galleries and thickets (*Nerio-Tamaricetea and Securinegion tinctoriae)*

iii) 1310 *Salicornia* and other annuals colonising mud and sand


92D0 Southern riparian galleries and thickets
(*Nerio-Tamaricetea)*


1420 Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi)*

Wet meadows are covered by characteristic plant communities composed of species adapted to periodically flooded soils along the river flood.

Despite their limited extent, they constitute valuable habitats for the wild flora and fauna and important resource for extensive animal husbandry

- The main drivers that shape the plant communities composition and structure in these ecosystems are flooding and grazing.
- Both factors are unpredictable and temporality variable.
- Generate local environmental conditions leading to small scale heterogeneity.

Flooding	Grazing
Affect the available light for plants	Affect plants through defoliation and trampling
Modifies nutrient availability	Change plant-to-plant interactions
Inhibits oxygen diffusion	Modifies nutrient by feces and urine
Affect water availability	

Water availability is highly depended on management (grazing) and climatic variability

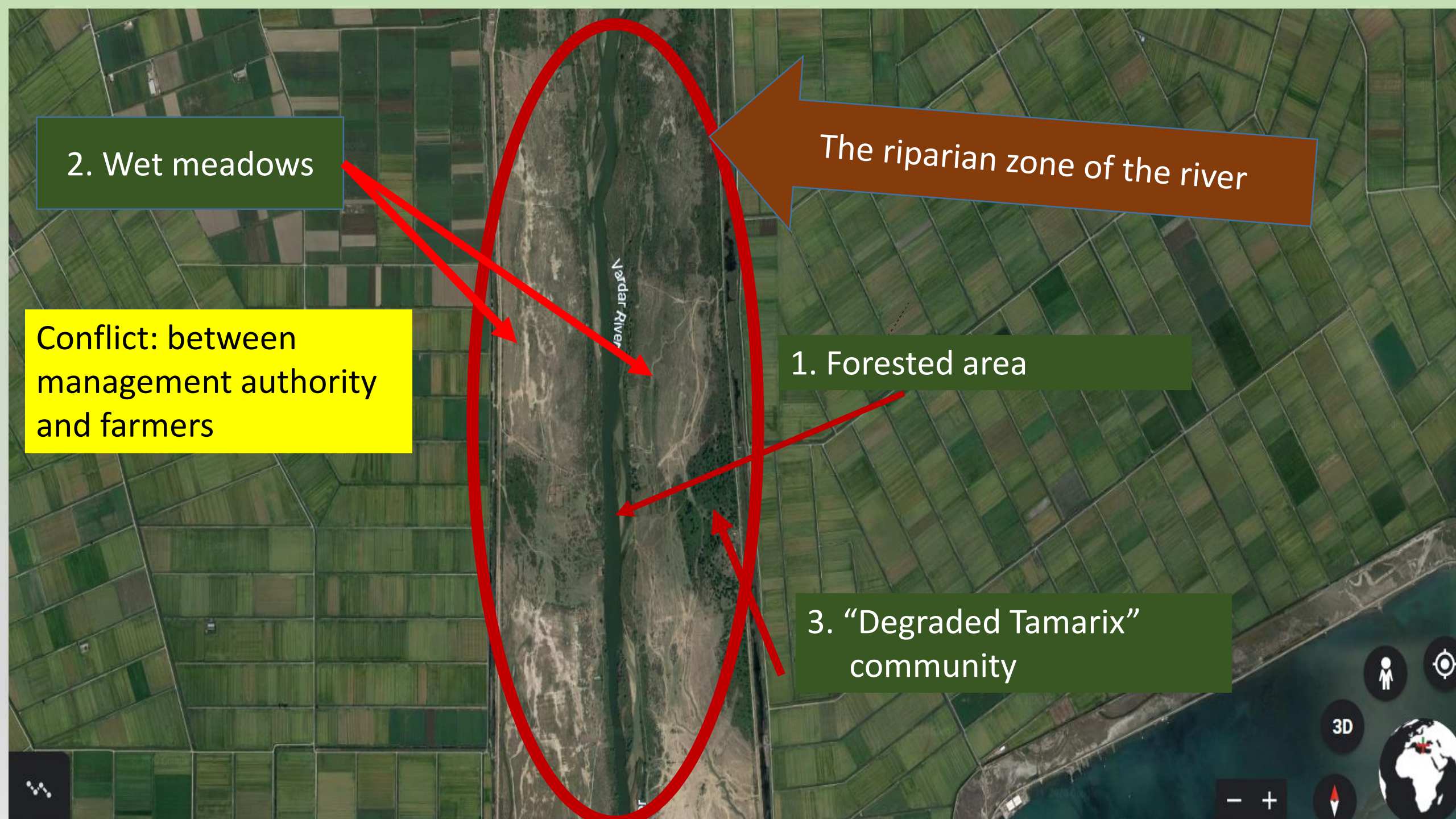
The wet meadows during a wet summer

The wet meadows during a dry summer

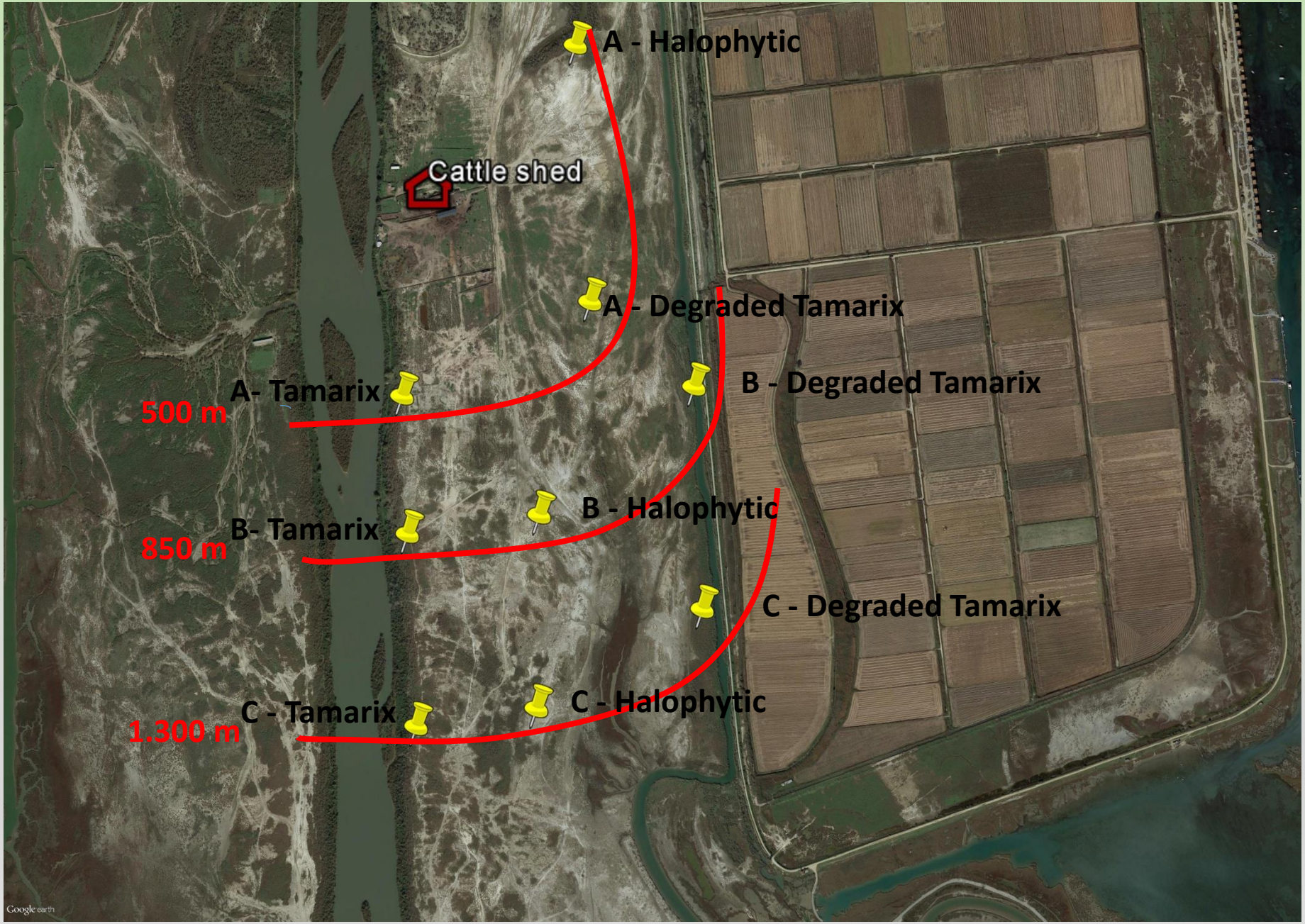
- The grazing of free-ranging cattle is a traditional management practice suitable for wet meadows for several reasons
- constant supply of freshwater,
- high forage productivity even during the dry summer periods
- flat terrains

The area is grazed mainly by cattle and few semi-wild horses – About 400 cattle free grazed in the area

- Overgrazing is mentioned as a potential threat for the majority of Greek wetlands sites, indicating the need of constant monitoring of their conservation status could be achieved by a variety of measurements (Papaporfyriou *et al*., 2014) .


2. Wet meadows
The riparian zone of the river
Conflict: between management authority and farmers
1. Forested area
3. “Degraded Tamarix” community
3D

- 3 areas were selected in a distance of 500 m, 850 m and 1.300 m away from the cattle shed;
  - i) Riparian - 500 m,
  - ii) Riparian - 850 m and
  - iii) Riparian - 1,300 m
- Measurements of cover and vegetation composition were performed in three plots, eight transects per plot (area 1.050 m^2 each one) by the line point method (Cook and Stubbendieck, 1986) in 2015, 2016 and 2017 (May-June), except for the Riparian - 500 m (only in 2016 and 2017) which was fenced
- Eight transects of 25 meters long were placed vertically along a measure tape of 50 m, every 6 meters, starting from 0 m to 42 m.


A - Halophytic
Cattle shed
A - Degraded Tamarix
A- Tamarix
B - Degraded Tamarix
500 m
B - Halophytic
B- Tamarix
850 m
C - Degraded Tamarix
C - Halophytic
C - Tamarix
1.300 m
Google earth

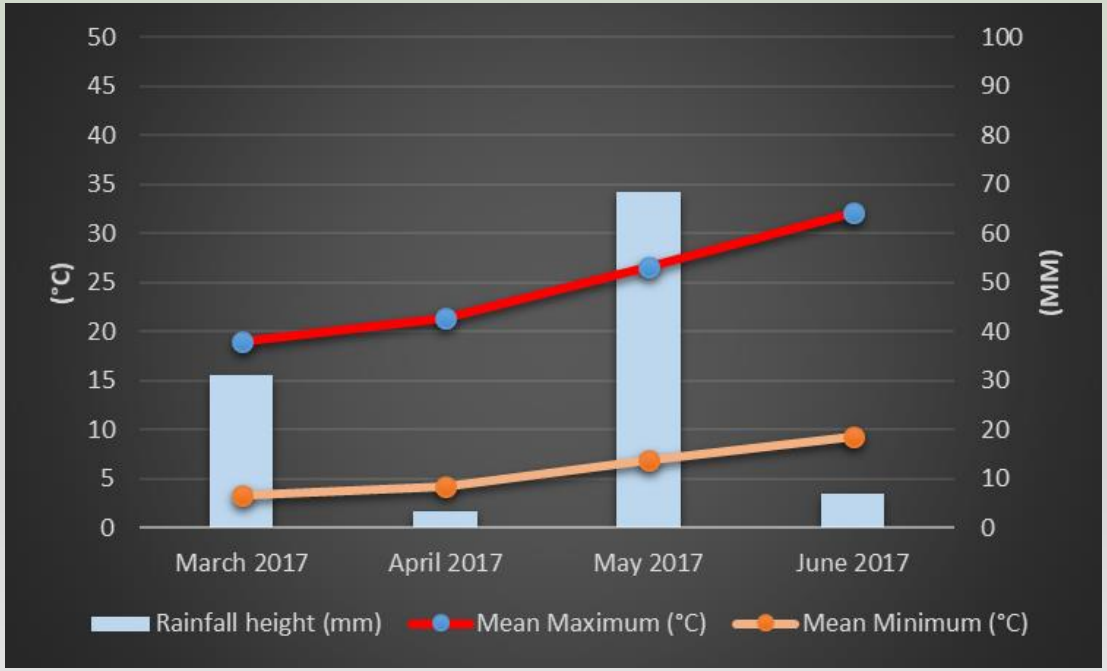
A/A	Family	Plant species
1	Tamaricaceae	Tamarix sp.
2	Rosaceae	Rubus sp.
3	Chenopodiaceae	*Sarcocornia perennis*
4		*Halocnemun strobilaceum*
5		*Suaeda maritima*
6		*Suaeda splendens*
7		*Salsola soda*
8		Salsola kali ssp. kali
9		*Halimione portulacoides*
10		Chenopodium sp.

11	Ranunculaceae	Ranunculus muricatus
12		Ranunculus sardous
13	Caryophylaceae	Spergularia salina
14	Gentianaceae	Centaurium pulchellum
15	Primulaceae	Anagallis arvensis
16	Brassicaceae / Cruciferae	Lepidium sp.
17	Apiaceae / Umbelliferae	Bupleurum sp.
18		Torilis sp.
19		Eryngium campestre
20		Daucus sp.
21	Plantaginaceae	Plantago coronopus
22		Plantago lanceolata
23		Plantago major
24	Boraginaceae	Heliotropium sp.
25	Plumbaginaceae	Limonium sp.
26	Malvaceae	Malva nicaeensis
27	Asclepiadaceae	Cynanchum acutum
28	Polygonaceae	Polygonum sp.
29	Juncaceae	Juncus acutus
30	Euphorbiaceae	Euphorbia helioscopia

31	Poaceae / Gramineae	*Lolium perenne*
32		*Cynodon dactylon*
33		*Aeluropus littoralis*
34		*Hordeum marinum*
35		*Hordeum murinum*
36		*Bromus hordeaceus*
37		*Bromus squarrosus*
38		*Puccinellia festuciformis*
39		Setaria sp.
40		*Parapholis incurva*
41		Avena sp.
42		Poa sp.
43		*Dasypyrum villosum*
44		*Taeniatherum caput-medusae*
45		*Polypogon monspeliensis*
46	Fabaceae / Leguminosae	*Trifolium repens ssp. repens*
47		*Trifolium physoides*
48		*Melilotus indicus*
49		*Medicago arabica*
50		*Medicago minima*
51	Compositae / Asteraceae	Anthemis sp.
52		Chamomila sp.
53		*Crepis setosa*
54		*Carlina lanata*
55		*Cirsium cf vulgare*
56		*Xanthium spinosum*
57		Bellis sp.
58		*Cardus pycnocephalus*
59		*Silybum marianum*
60		Sonchus sp.
61		Cynara sp.


50
45
40
35
30
25
20
15
10
5
0
(°C)
100
90
80
70
60
50
40
30
20
10
0
(MM)
March 2015
April 2015
May 2015
June 2015
Rainfall height (mm)
Mean Maximum (°C)
Mean Minimum (°C)


50
45
40
35
30
25
20
15
10
5
0
(°C)
100
90
80
70
60
50
40
30
20
10
0
(MM)
March 2016
April 2016
May 2016
June 2016
Rainfall height (mm)
Mean Maximum (°C)
Mean Minimum (°C)


50
45
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25
20
15
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5
0
(°C)
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90
80
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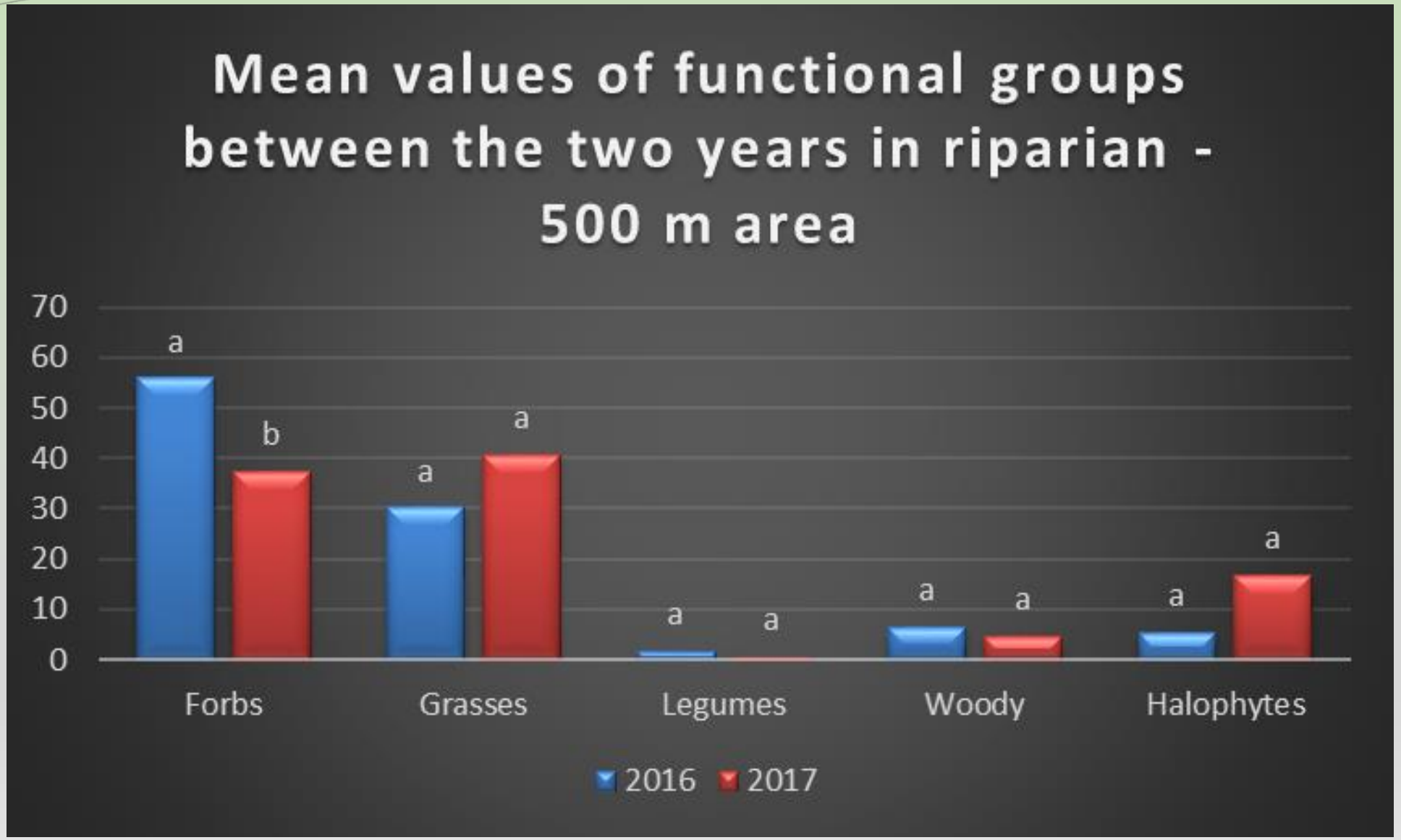
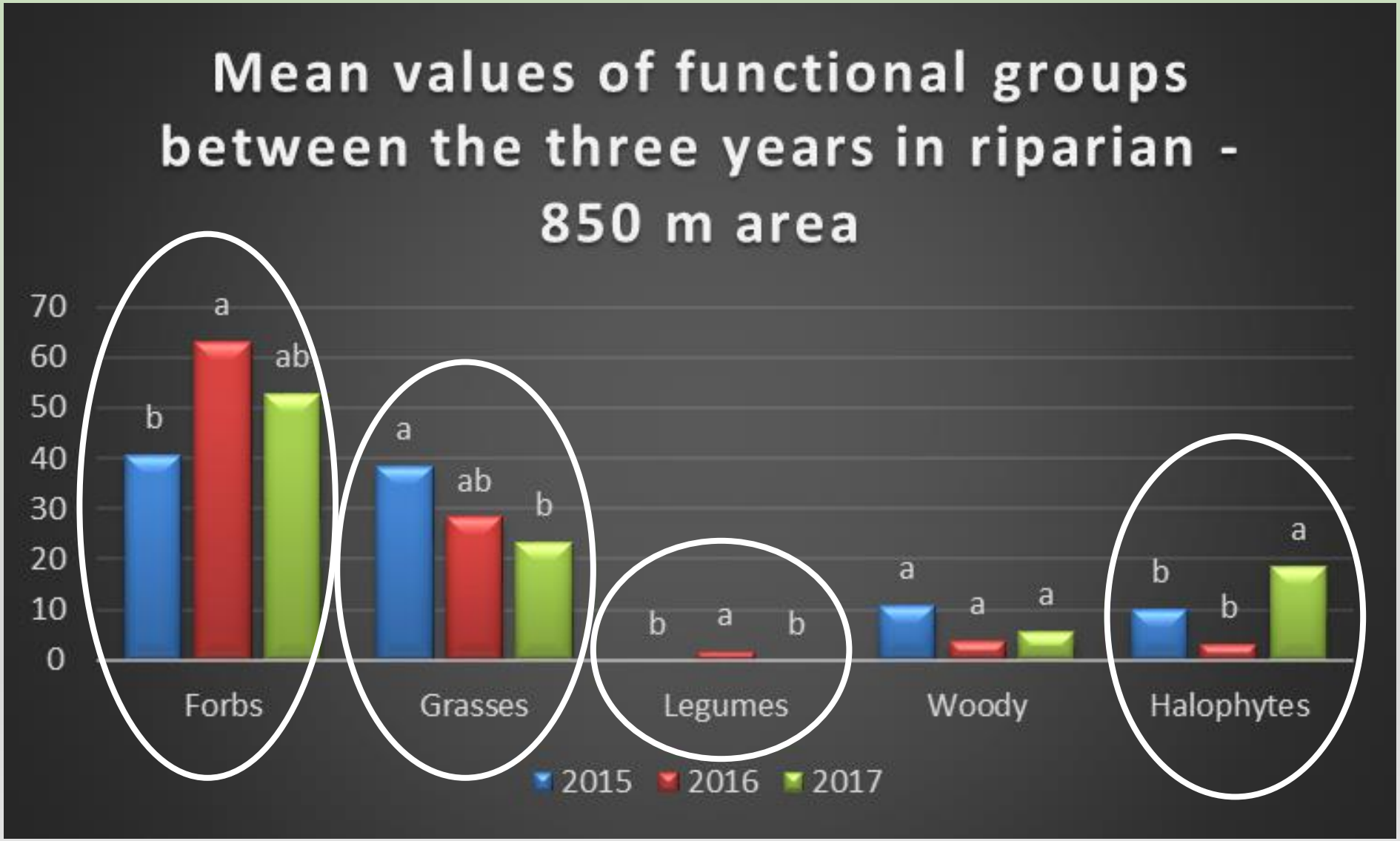
10
0
(MM)
March 2017
April 2017
May 2017
June 2017
Rainfall height (mm)
Mean Maximum (°C)
Mean Minimum (°C)


Mean values of functional groups between the two years in riparian - 500 m area
70
60
50
40
30
20
10
0
a
b
a
a
a
a
a
a
a
a
Forbs
Grasses
Legumes
Woody
Halophytes
2016
2017

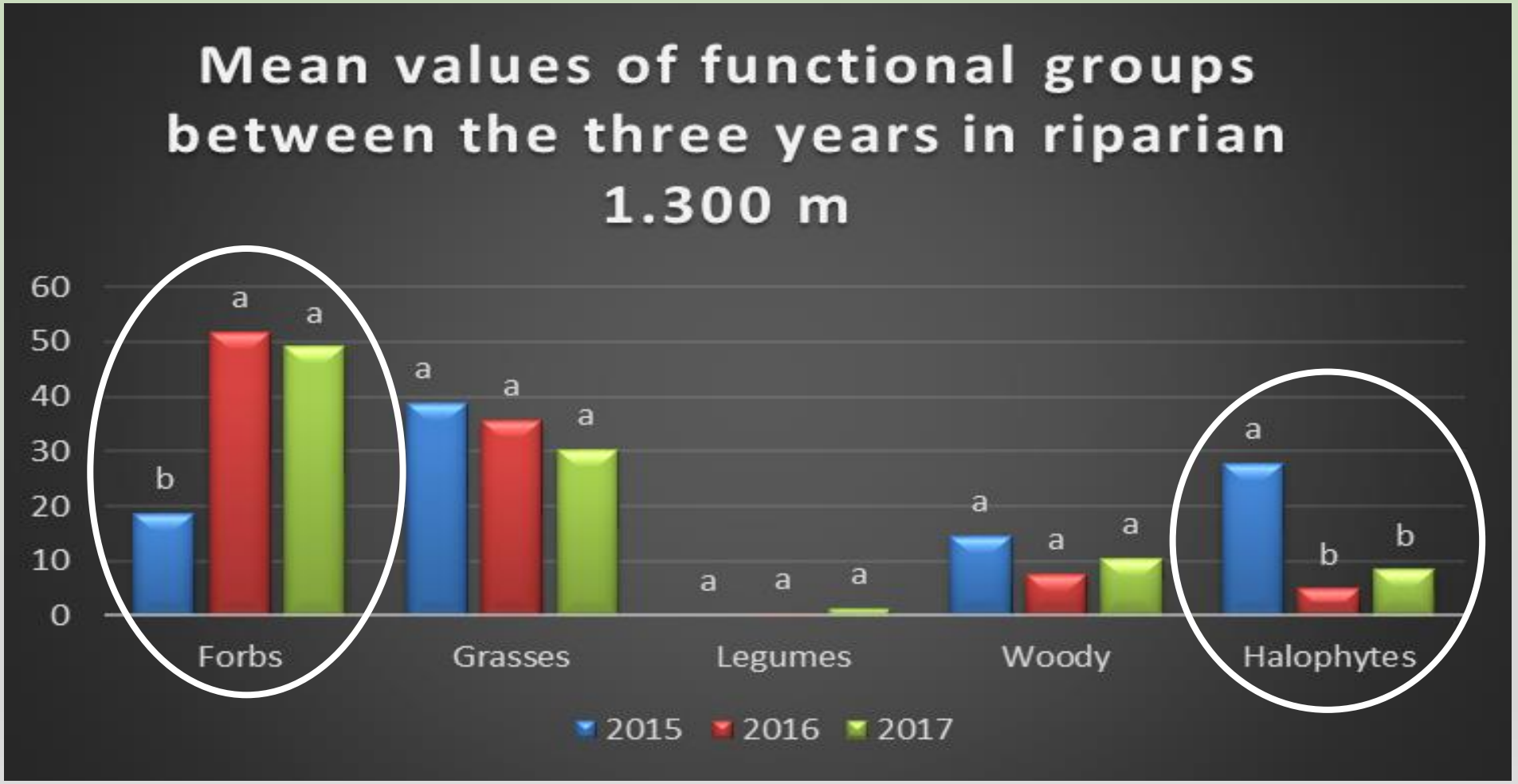
The dominant species in each functional group in riparian -500 m area

Years	Forbs	Grasses	Legumes	Woody	Halophytes
2016	*Plantago coronopus*	*Cynodon dactylon*	*Trifolium sp.*	*Tamarix hampeana*	*Chenopodium polyspermum*
	Anthemis cotula	*Lolium rigidum ssp. rigidum*	*Medicago arabica*		*Suaeda splendens*
	Spergularia marina	*Aeluropus littoralis*	*Trifolium repens*		*Suaeda maritima*
2017	*Plantago coronopus*	*Cynodon dactylon*	*Trifolium physodes*	*Tamarix hampeana*	*Chenopodium polyspermum*
	Spergularia marina	*Dasypyrum villosum*			*Suaeda maritima*
	Anthemis cotula	*Juncus acutus*			*Chenopodium bonus-henricus*


Mean values of functional groups between the three years in riparian - 850 m area
70
60
50
40
30
20
10
0
b
a
ab
a
ab
b
b
a
b
a
a
a
b
b
a
Forbs
Grasses
Legumes
Woody
Halophytes
2015
2016
2017

The dominant species in each functional group in riparian -850 m area

Years	Forbs	Grasses	Legumes	Woody	Halophytes
2015	*Anthemis cotula*	*Hordeum marinum*	0	*Tamarix hampeana*	*Suaeda maritima*
	Plantago coronopus	*Lolium rigidum ssp. rigidum*			*Suaeda splendens*
	Lepidium graminifolium	*Cynodon dactylon*			*Chenopodium polyspermum*
2016	*Anthemis cotula*	*Hordeum marinum*	*Medicago arabica*	*Tamarix hampeana*	*Chenopodium bonus-henricus*
	Lepidium graminifolium	*Lolium rigidum ssp. rigidum*			*Chenopodium polyspermum*
	Carduus pycnocephalus ssp. pycnocephalus	*Hordeum murinum ssp. murinum*			*Suaeda maritima*
2017	*Lepidium graminifolium*	*Hordeum marinum*	0	*Tamarix hampeana*	*Chenopodium bonus-henricus*
	Silybum marianum	*Cynodon dactylon*			*Suaeda maritima*
	Anthemis cotula	*Lolium rigidum ssp. rigidum*			*Salsola soda*


Mean values of functional groups between the three years in riparian 1.300 m
60
50
40
30
20
10
0
b
a
a
a
a
a
a
a
a
a
a
a
a
b
b
Forbs
Grasses
Legumes
Woody
Halophytes
2015
2016
2017

The dominant species in each functional group in riparian -1.300 m area

Years	Forbs	Grasses	Legumes	Woody	Halophytes
2015	*Plantago coronopus*	*Hordeum marinum*	0	*Tamarix hampeana*	*Salsola kali ssp. kali*
	Anthemis cotula	*Puccinellia festuciformis*			*Suaeda splendens*
	Crepis setosa	*Lolium rigidum ssp. rigidum*		*Rubus sp.*	*Suaeda maritima*
2016	*Anthemis cotula*	*Lolium rigidum ssp. rigidum*	*Trifolium repens*	*Tamarix hampeana*	*Suaeda maritima*
	Plantago coronopus	*Hordeum marinum*			*Chenopodium polyspermum*
	Crepis setosa	*Hordeum murinum ssp. murinum*		*Rubus sp.*	*Chenopodium bonus-henricus*
2017	*Plantago coronopus*	*Hordeum murinum ssp. murinum*	*Medicago arabica*	*Tamarix hampeana*	*Suaeda maritima*
	Silybum marianum	*Cynodon dactylon*			*Salsola soda*
	Torilis arvensis	*Hordeum marinum*		*Rubus sp.*	*Chenopodium bonus-henricus*

Conclusions

- The climatic fluctuation through the years affect the species composition of wet meadows and as consequent the available forages for animal feeding.
- Grazing is also influenced species composition and interact with the changes that are caused by climatic conditions.
- Grazing could be a management tool for the control of vegetation changes in order to ensure the ecosystem function.
- The stakeholders, managers, farmers have to understand this….


Thank you