



Poitevin marsh  
Landsat-8 OLI  
color composite  
2013/09/03

USGS/NASA Landsat

## Multiscale mapping of marshland vegetation: contributions of remote sensing and symphytosociology

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<sup>2</sup> UMR 6554 CNRS LETG, Université Rennes2, France



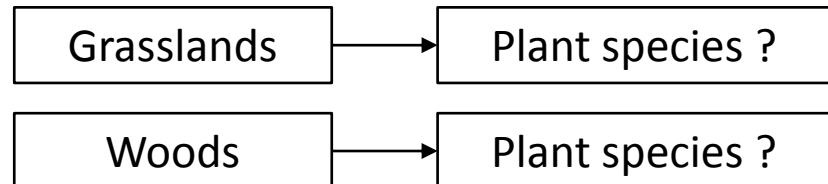
Mapping grassland vegetations from Earth observation, a challenge:

- Small spatial extent of such habitats
- Spectral similarity
- High spatial, structural and temporal diversity of the vegetation composition



To be « Earth observable » semi-natural vegetations need to be aggregated

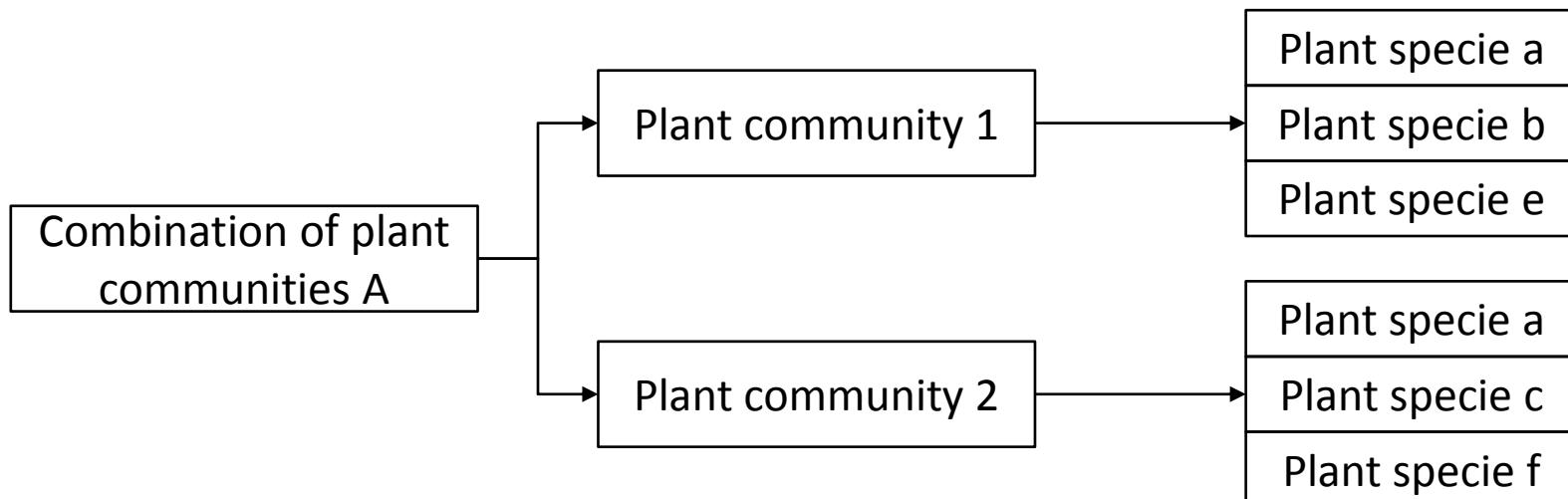
- Aggregation based on **physionomy** did not provide information on plant community species composition, which is decisive for determining conservation state



- Aggregation based on **plant species combinations** may ensure to **scale up and down** and provide access to the specie composition

### Synphytosociology

### Phytosociology

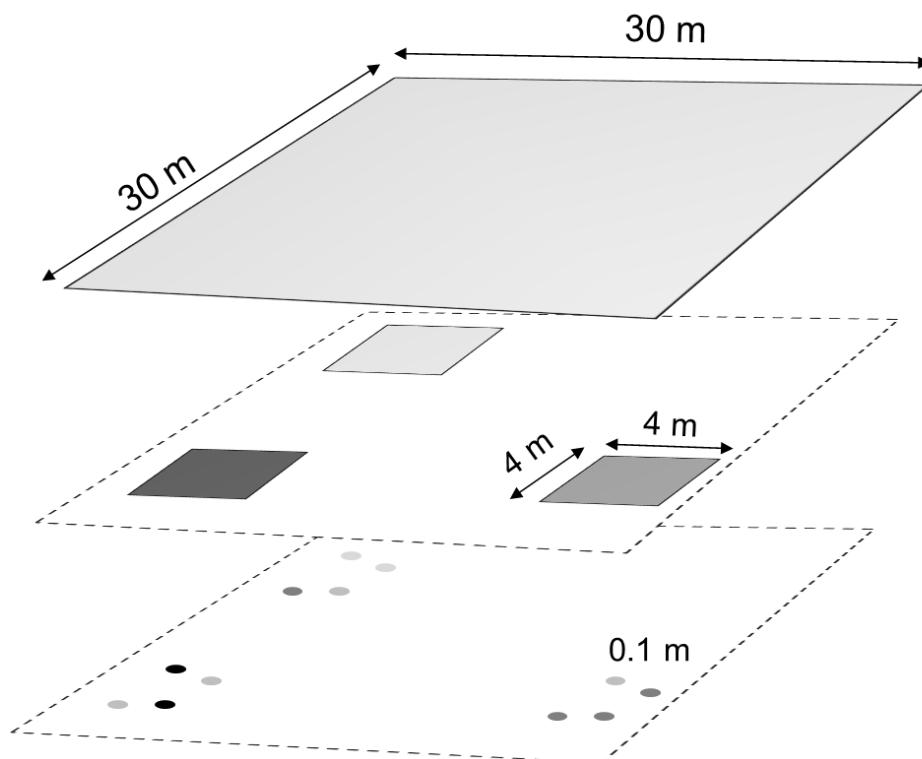


Multi-scalar combinations of vegetation in relation to the spatial resolution of the remote sensing images

## HSR images

SPOT-4

Landsat-OLI...



## VHRS images

SPOT-6

Rapideye

Pléiades...

## Synphytosociology

### Geosigmetum

Combination of plant  
communities

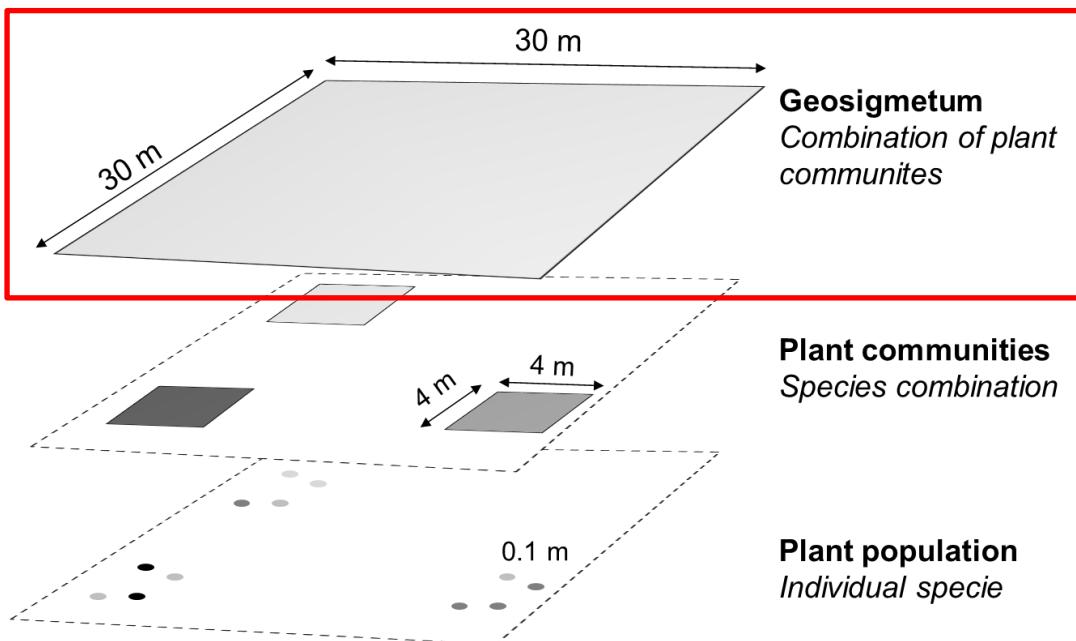
## Phytosociology

### Plant communities

Species combination

## Plant population

Individual specie



## Geosigmetum (plant community combinations)

Synoptic table highlighting combinations of vegetal associations for French Atlantic marshes

(adapted from Géhu et al, 1991)

Expressed as percentage occurrence of plant communities:

- I - 1 to 20 %
- II - 21 to 40 %
- III - 41 to 60 %
- IV - 61 to 80 %
- V - 81 to 100%

CORINE	EUNIS	PLANT COMMUNITIES	MARSH TYPES (GEOSIGMETUM)		Salt		Brackish		Sub-brackish			Fresh	
			SITES		BV	BR	N	BV	BV	BR	P	BV	P
<b>Halophilic associations</b>													
15.21	A2.6543	<i>Spartinetum maritimae</i>					III						
15.622	A2.627	<i>Puccinellio-Arthrocnemetum perennis</i>					III						
15.621	A2.627	<i>Bostrychio-Halimonetum portulacoidis</i>					II						
15.35	A2.611	<i>Beto-Agropyretum pungentis</i>			IV	IV							
15.321	A2.645	<i>Halimione-Puccinellietum maritimae</i>			V	IV	V	III					
15.1112	A2.6513	<i>Salicornietum ramosissimae</i>			IV		V	V					
15.624	A2.627	<i>Puccinellio-Arthrocnemetum fruticosi</i>			I		IV	I					
15.623	A2.614	<i>Agropyro-Suaedetum verae</i>			V	V	V	III					
15.333	A2.63A	<i>Festucetum littoralis</i>			I	III	IV	IV					
15.331	A2.63B	<i>Juncetum gerardii</i>			II	III	V		II				
15.13	A2.653	<i>Parapholiso-Hordeetum marini</i>			III	III	V	V	II	I	V		
<b>Meadows associations</b>													
15.52	A2.623	<i>Alopecuro-Juncetum gerardii</i>					II	V	III	III	V		
15.52	A2.623	<i>Trifolia-Oenanthesetum siliifoliae</i>					I	V	V	III	V		
15.52	A2.623	<i>Ranunculo-Oenanthesetum fistulosae</i>					III	V	III	V			
15.52	A2.623	<i>Carici-Lolietum perennis</i>					V		I	V			
37.21	E3.41	<i>Senecio-Oenanthesetum siliifoliae</i>										IV	IV
37.21	E3.41	<i>Gratiolo-Oenanthesetum fistulosae</i>										III	IV
37.21	E3.41	<i>Hordeo-Lolietum perennis</i>										I	IV
37.21	E3.41	<i>Eleocharo-Oenanthesetum fistulosae</i>											IV
<b>Subaquatic associations</b>													
53.17	B1.84	<i>Scirpetum maritimi compacti</i>					II	V	V	III	V		
53.11	A4.551	<i>Phragmitetum australis</i>					I		IV	V	IV	II	II
53.13	C3.23	<i>Typhaetum angustifoliae</i>					I	V	II	V			
53.145	C3.24	<i>Butometum umbellati</i>						I	I	V		I	III
53.11	A4.551	<i>Scirpetum lacustris</i>						III	III	III		II	II
53.219	D5.21	<i>Althaea officinalis and Carex otrubae community</i>						V	III	V		III	V
53.213	D5.21	<i>Caricetum ripariae</i>						II		III		III	IV
53.16	C3.26	<i>Phalaridetum arundinaceae</i>							III			III	IV
53.15	C3.25	<i>Glycerietum maximaee</i>								I		V	
37.1	E5.421	<i>Sympytyum officinale community</i>											IV

BV: Breton-Vendéen marsh; BR : Brouage marsh; N : Noirmoutier marsh; P : Poitevin marsh

## Geosigmetum (plant community combinations)

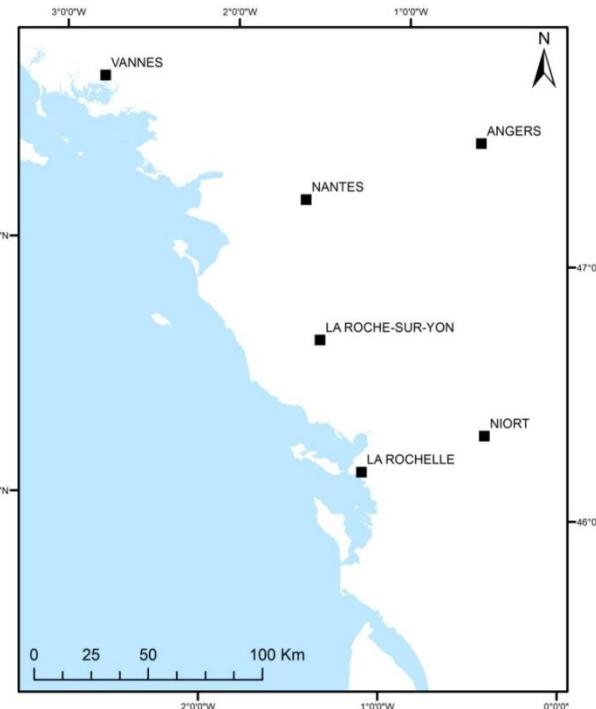
Classes	CORINE Biotope	EUNIS
Water	13 Tidal rivers and estuaries 2 Non-marine waters	A5 Sublittoral sediment C Inland surface waters
<b>Salt marshes</b>		
<b>Brackish marshes</b>		
<b>Sub-brackish marshes</b>		
<b>Fresh marshes</b>		
Reeds	53.1 Reed beds	C3.2 Water-fringing reedbeds and tall helophytes other than canes
Evergreen woods	45 Broad-leaved evergreen woodland	G2 Broad-leaved evergreen woodland
Deciduous woods	44 Alluvial and very wet forests and brush	G1.4 Broadleaved swamp woodland not on acid peat
Crops	82 Crops	I1.1 Intensive unmixed crops
Sands	16.1 Sand beaches	B1.1 Sand beach driftlines
Vegetal dune	16.22 Grey dunes	B1.4 Coastal stable dune grassland (grey dunes)
Impervious	86 Towns, villages, industrial sites	J Constructed, industrial and other artificial habitats
Salt pans	21 Lagoons	X02 Saline coastal lagoons

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15.52	A2.623	<i>Ranunculo-Oenanthesetum fistulosae</i>					III		V	III	V		
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53.13	C3.23	<i>Typhaetum angustifoliae</i>					I	V	II	V			II
53.145	C3.24	<i>Butometum umbellati</i>							I	I	V		I
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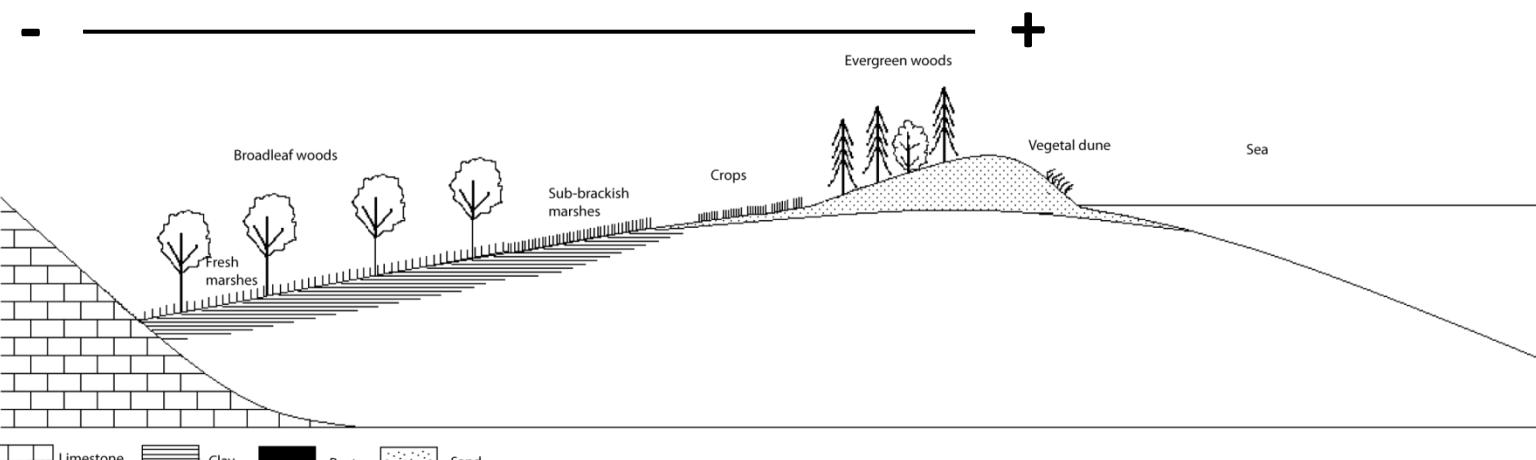
BV: Breton-Vendéen marsh; BR : Brouage marsh; N : Noirmoutier marsh; P : Poitevin marsh

## Study site

Atlantic coastal marshes



## Salinity gradient



## Remote sensing data used

SRTM (90 m)

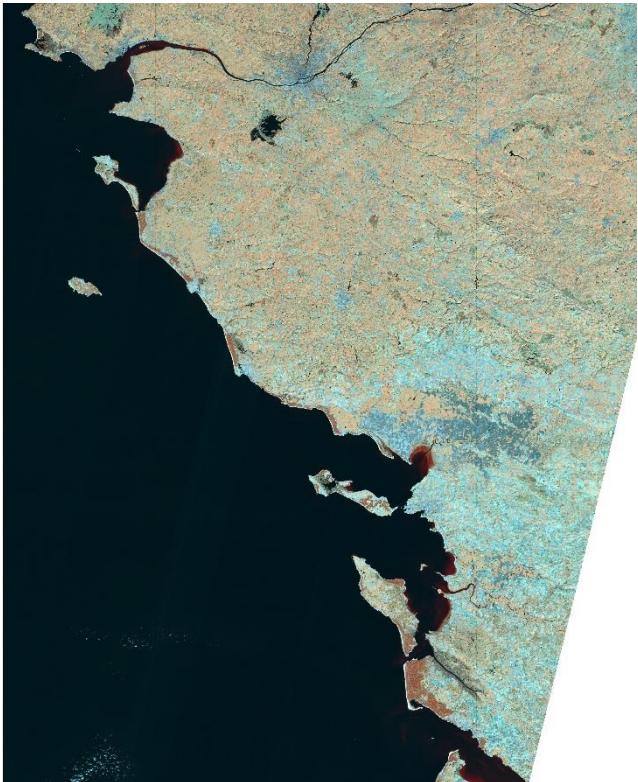


Landsat-8 (30 m / 8 spectral bands / 16 bits)

2013/09/03



2013/12/08





Introduction

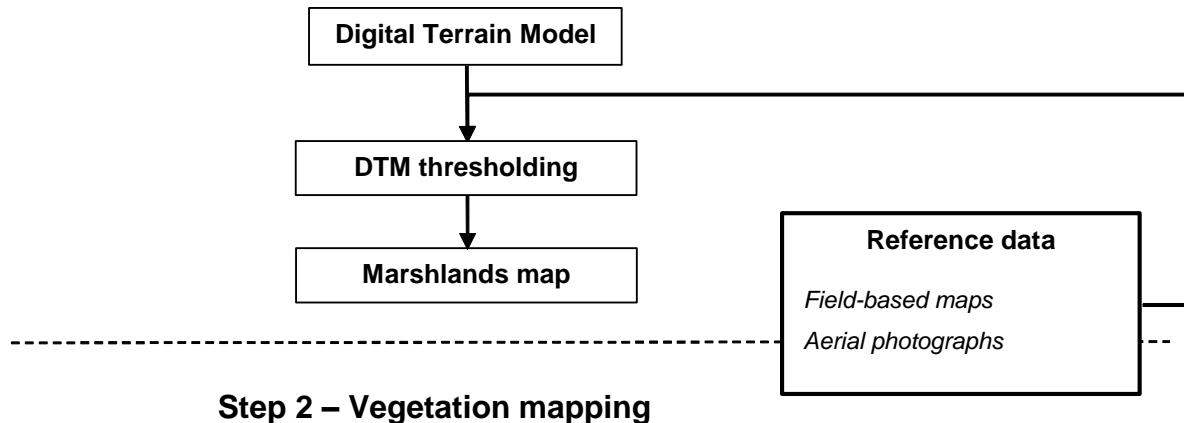
# Geosigmatum mapping

# Plant communities mapping

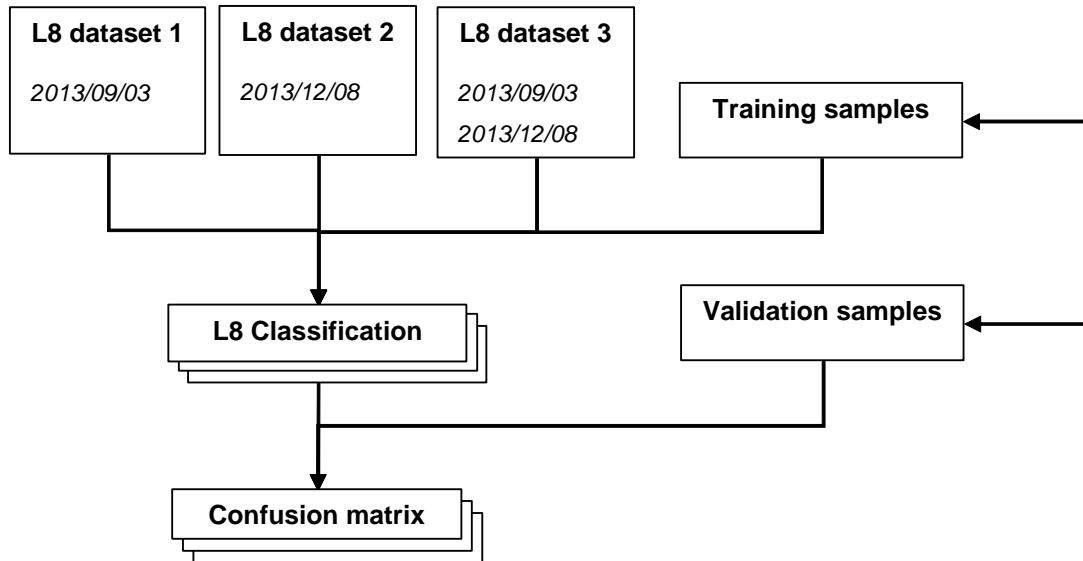
Conclusion

## Classification flowchart

### Step 1 – Marshlands delineation



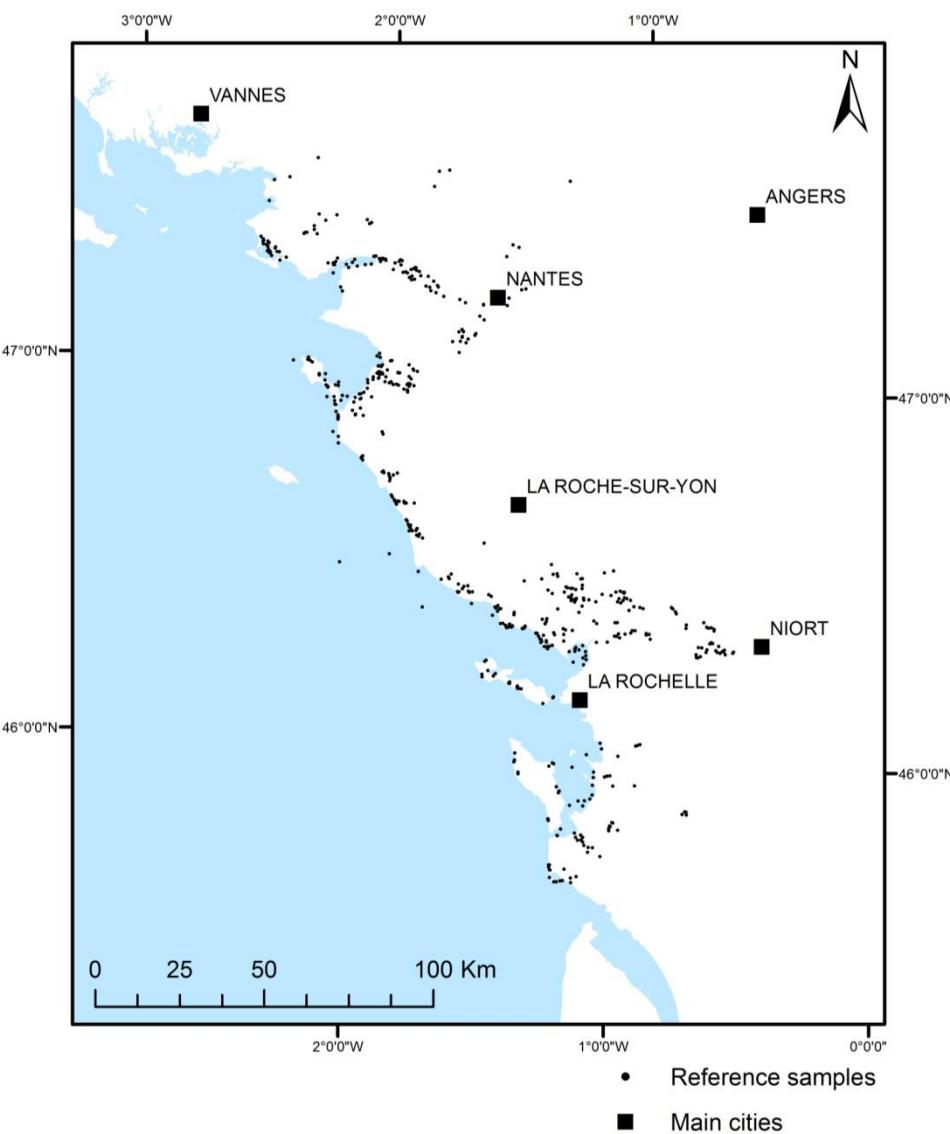
### Step 2 – Vegetation mapping



## Sampling

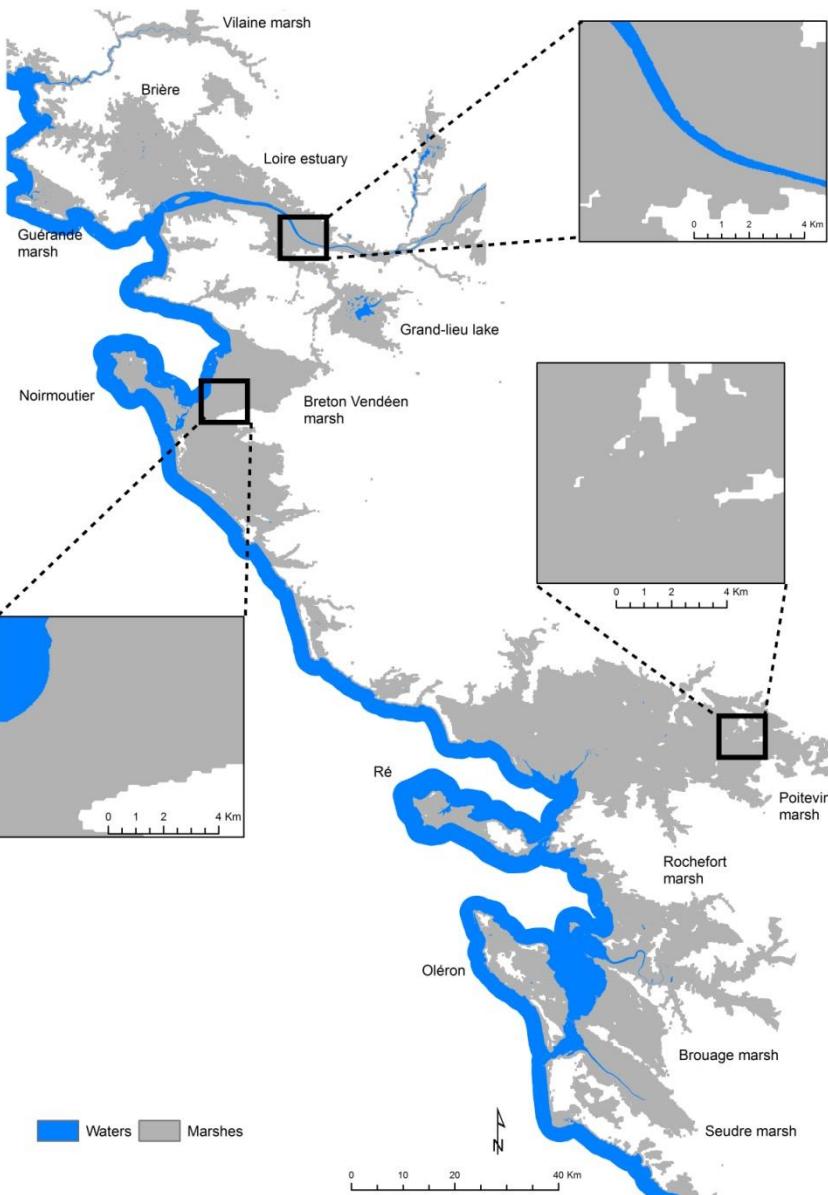


- 169 training samples
- 390 validation samples



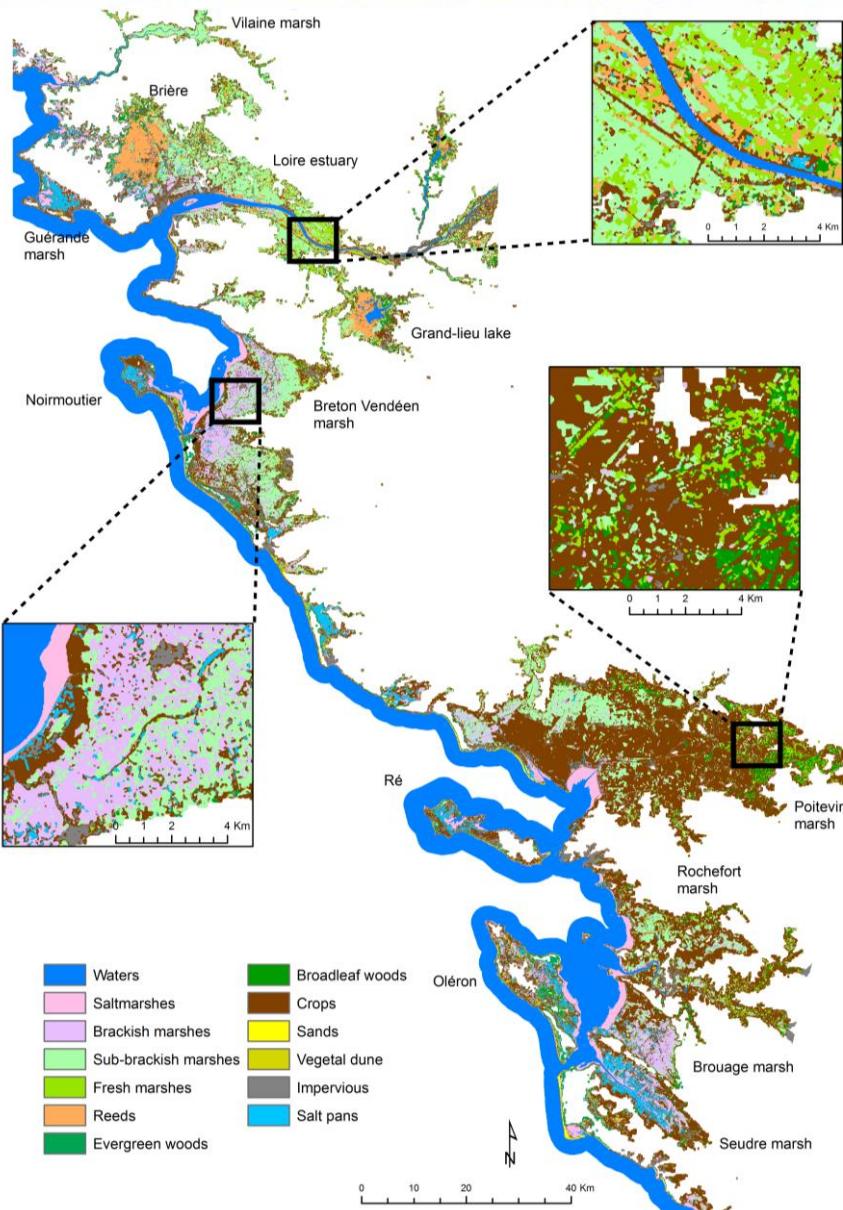
## Marshlands delineation

- Coastal marshes were correctly delineated
- **Ecological mask** based on topographical criteria



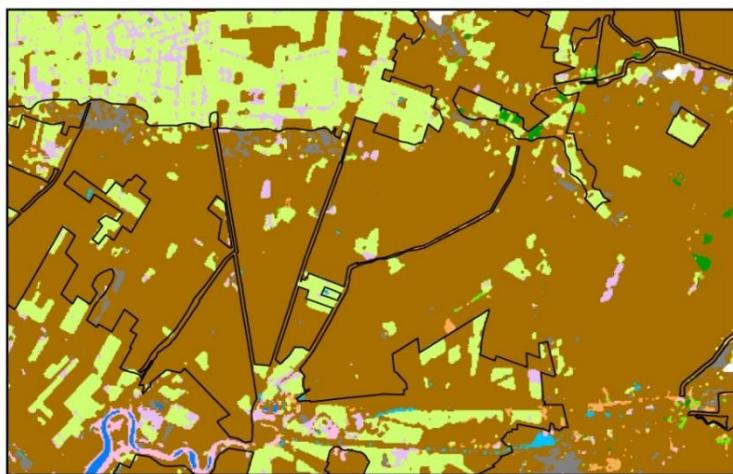
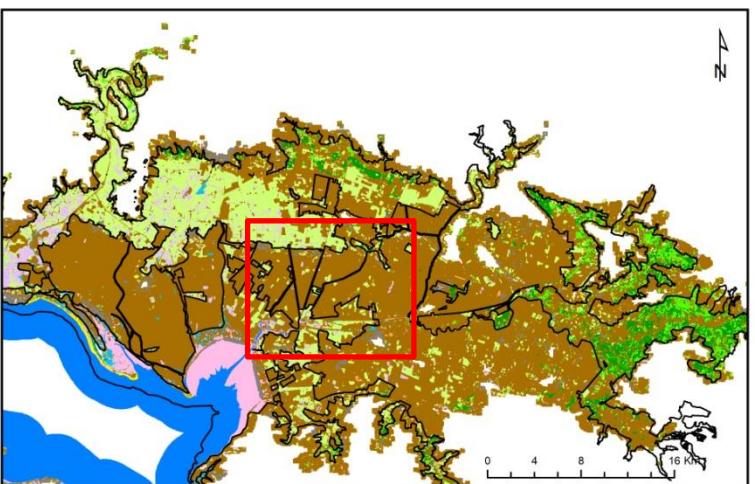
### Vegetation mapping

- Geosigmetum of coastal marshes were automatically mapped at regional scale ( $4632 \text{ km}^2$ )
- Geosigmetum map highlights water management types for each marsh
- Salinity gradient from sea to uplands

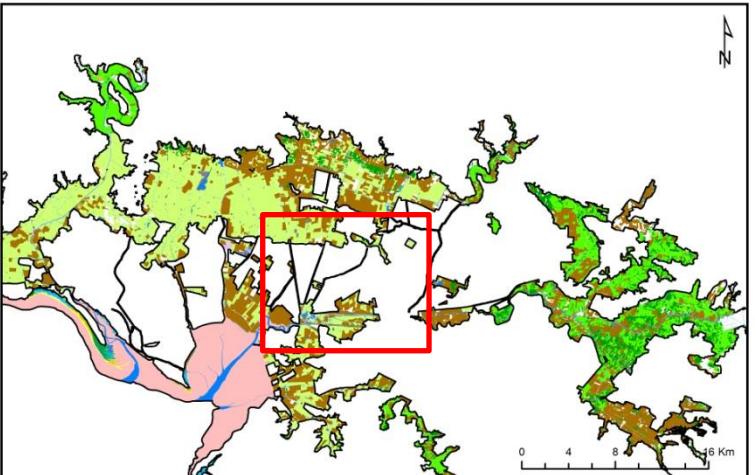


## Comparison between Landsat classification and field based map – Poitevin marsh

Landsat classification



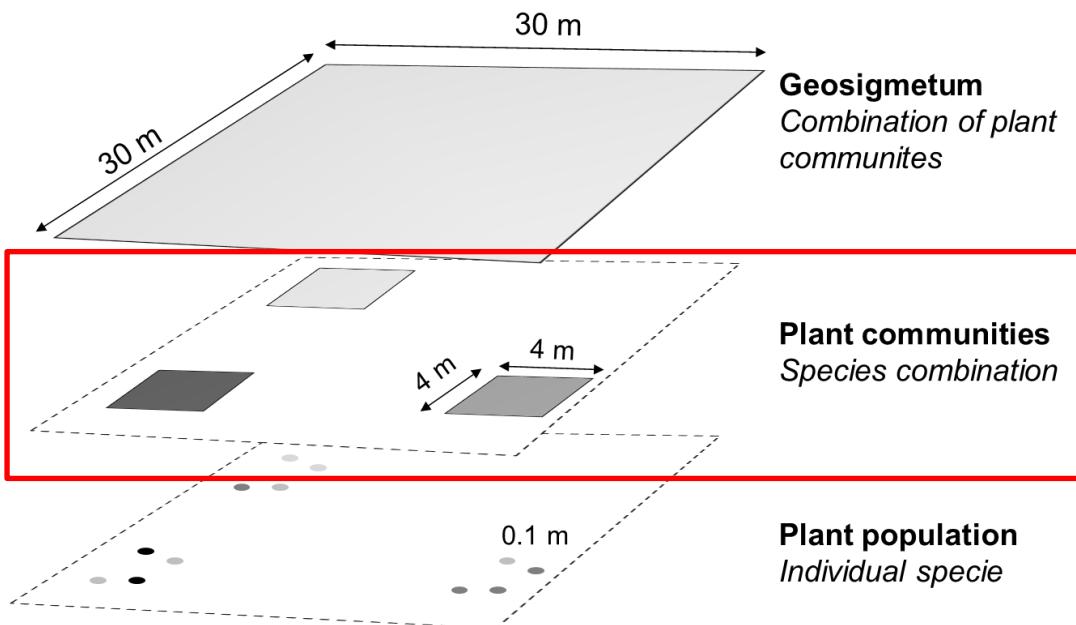
Field-based  
NATURA 2000 map



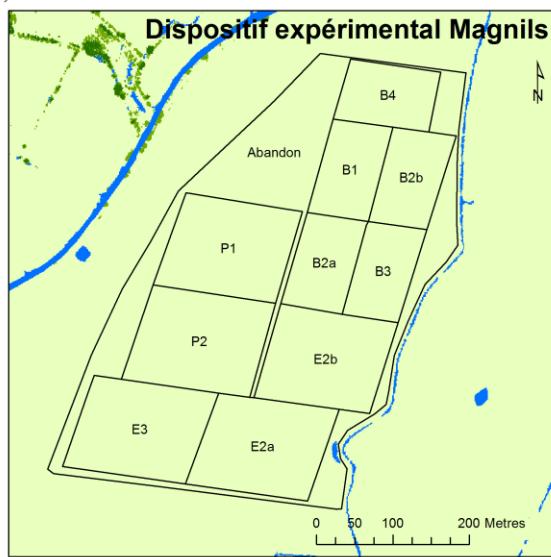
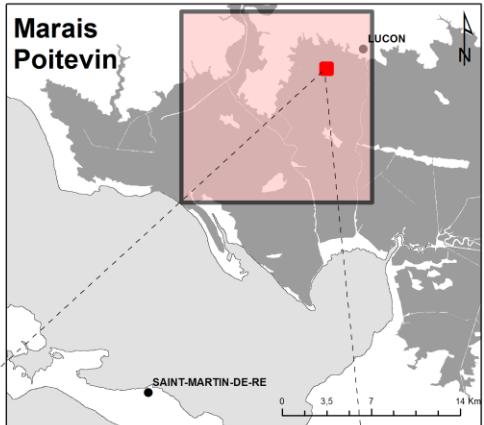
Waters	Fresh marshes	Crops
Saltmarshes	Reeds	Sands
Brackish marshes	Evergreen woods	Vegetal dunes
Sub-brackish marshes	Broadleaf woods	Impervious
		Salt pans

## Geosympytosociology

- Combining geosympytosciology and Landsat-8 image appears a relevant approach for plant community combination mapping at regional scale
- Multiseasonal analysis increases the classification accuracy
- Useful map to further field vegetation surveys (Carhab framework)
- Application to other vegetation types (eg plains vegetations)



2013  
calibration site devoted to the  
fine scale diversity of plant  
associations



**Study site of 35 Ha**

**Sub-brackish marsh**



How much does grazing-induced heterogeneity impact plant diversity in wet grasslands?

### Unsupervised classification of plots

Bouzillé et al., 2010

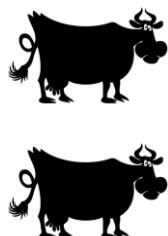
*Alopecuro-Juncetum gerardii*  
variation at *Elytrigia repens*



*Alopecuro-Juncetum gerardii*



*Alopecuro-Juncetum gerardii*  
variation at *Hordeum marinum*



*Alopecuro-Juncetum gerardii*  
variation at *Hordeum marinum and Plantago coronopus*

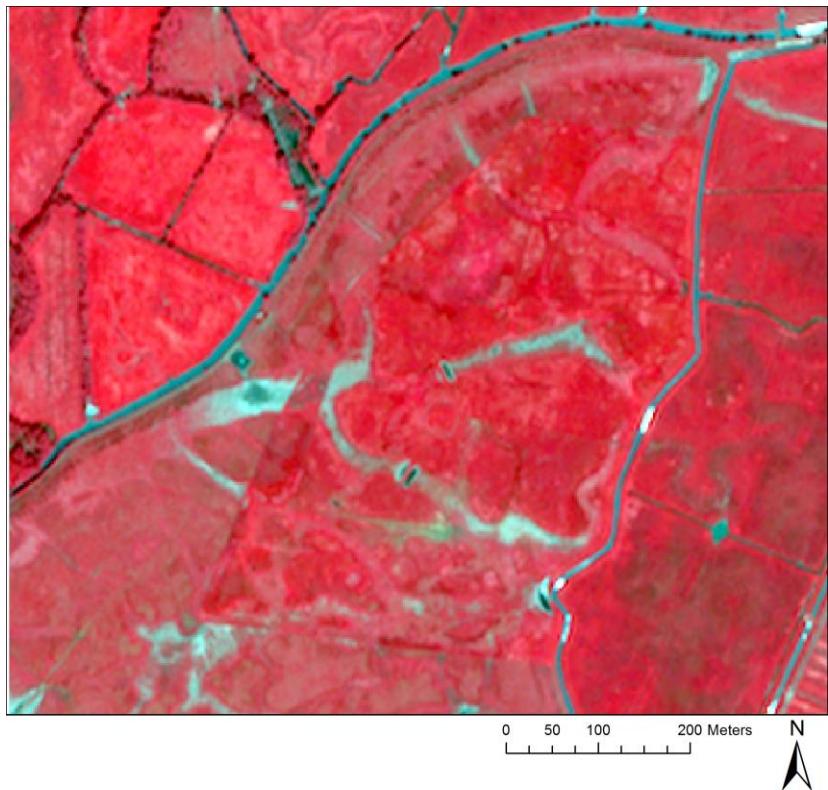


*Alopecuro-Juncetum gerardii*  
variation at *Plantago coronopus*



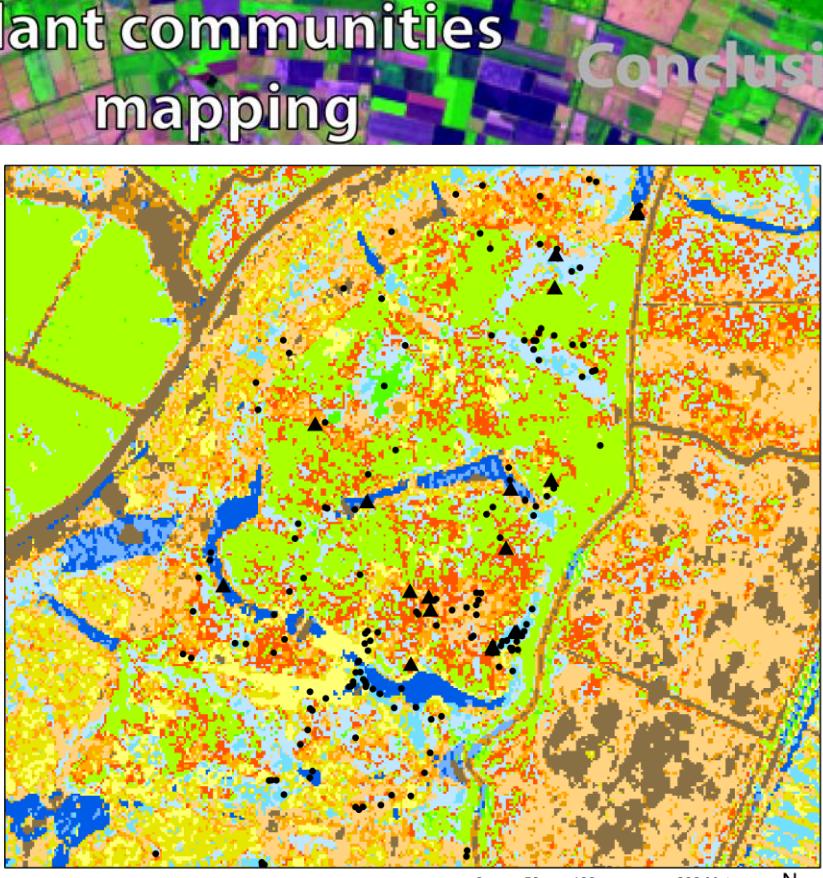
# Introduction Geosigmetum Plant communities Conclusion

## mapping mapping



Pléiades image 27th may 2013  
Field sampling may 2013  
Expert based typology  
Sub-association level

Mahalanobis classification



**Global accuracy 59 %**

### Plant association

- Validation plots
- ▲ Training plots
- Carici-Lolietum perennis variation à *Elytrigia repens*
- Carici-Lolietum perennis
- Alopecuro – Juncetum gerardii
- Groupement à *Carex divisa*
- Alopecuro – Juncetum gerardii variation à *Hordeum marinum*
- Groupement à *Juncus inflexus*
- Alopecuro – Juncetum gerardii variation à *Elytrigia repens*
- Alopecuro – Juncetum gerardii variation à *Plantago coronopus*
- Alopecuro – Juncetum gerardii variation à *Plantago coronopus et Hordeum marinum*
- Ranunculo –Oenanthesetum fistulosae variation à *Juncus gerardi*
- Ranunculo –Oenanthesetum fistulosae
- Ranunculo –Oenanthesetum fistulosae variation à *Agrostis stolonifera*
- Ranunculo –Oenanthesetum fistulosae variation à *Eleocharis palustris*

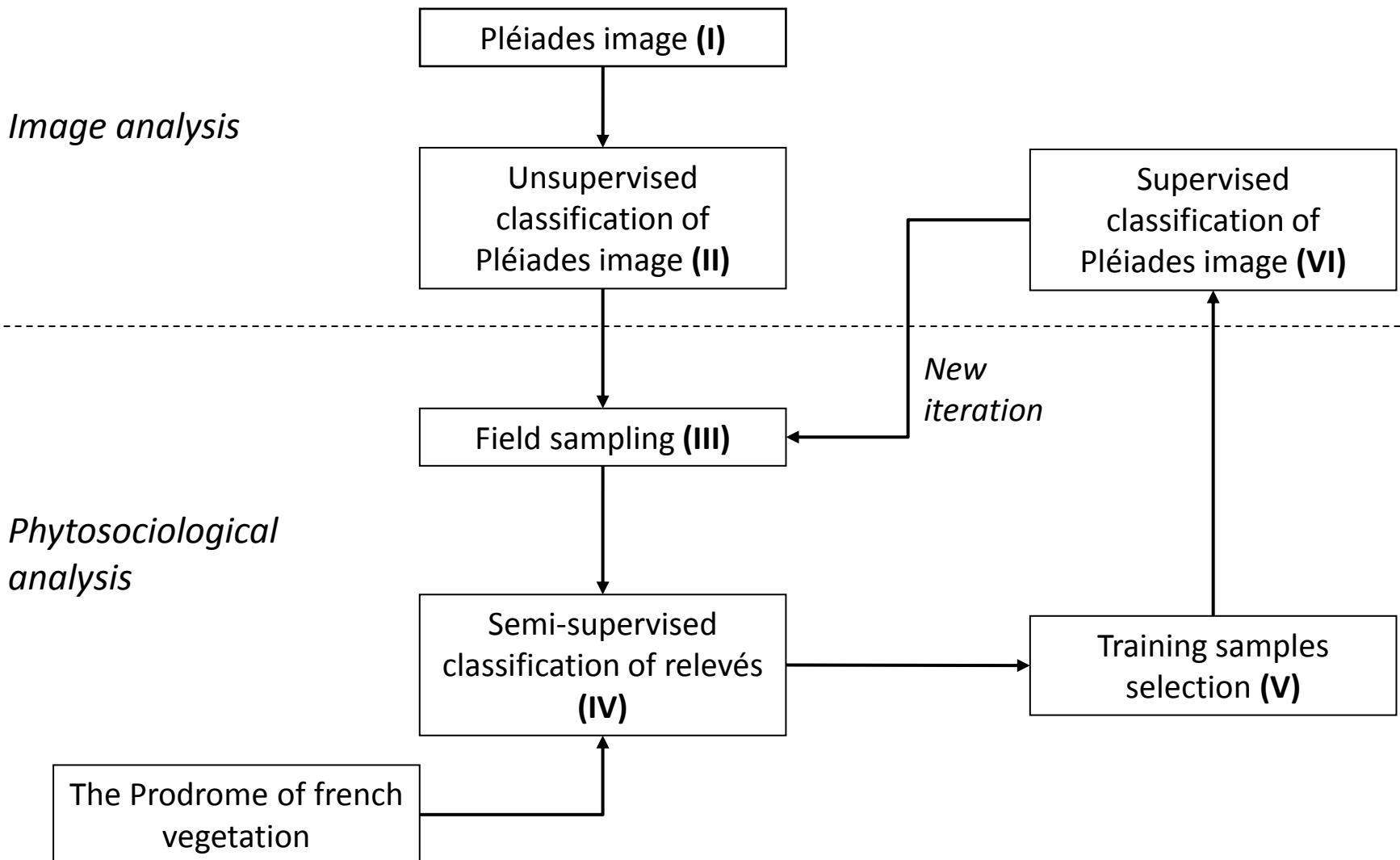
2014  
Larger site  
Plant association level

# Introduction

# Geosigmatum mapping

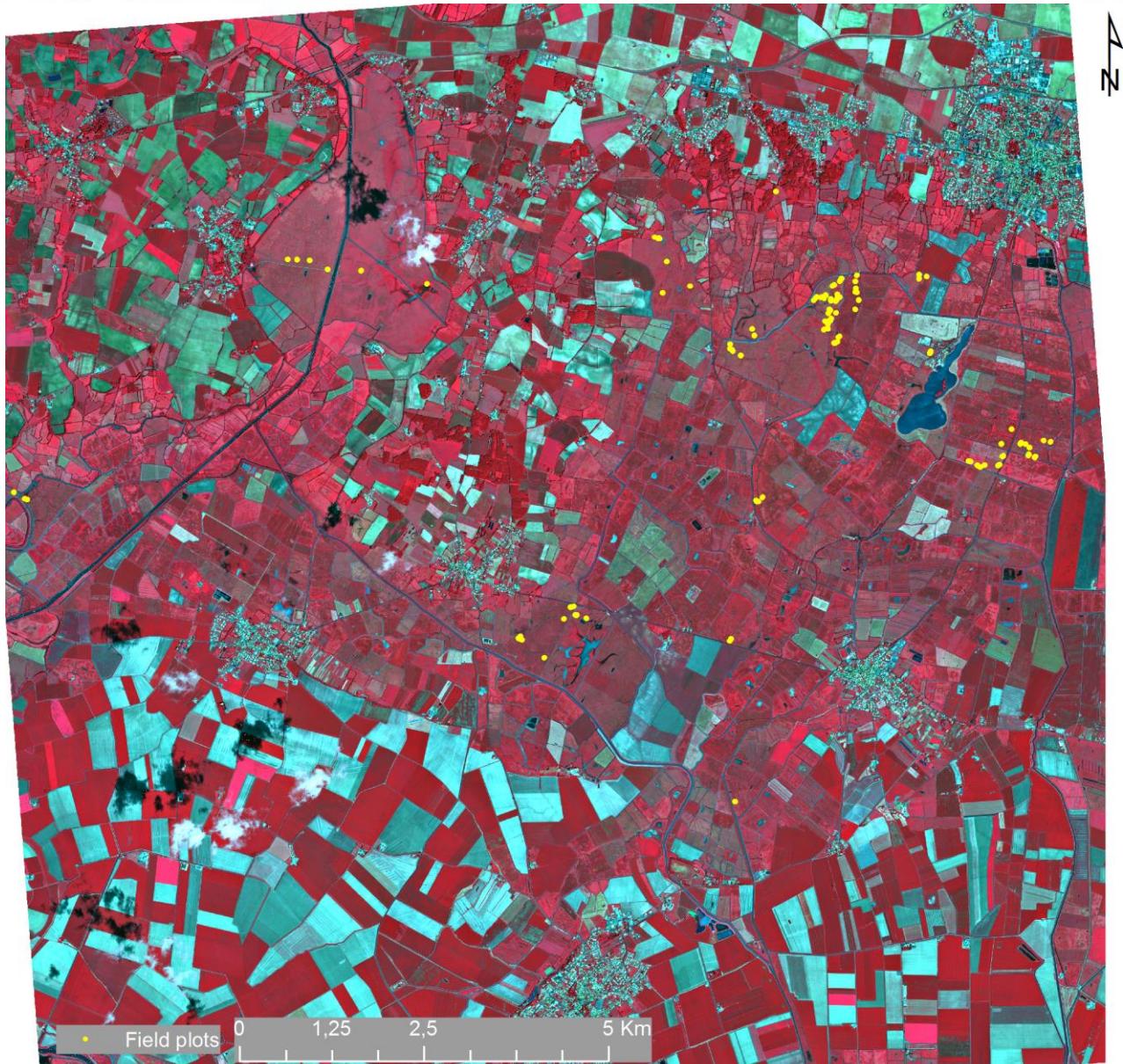
# Plant communities mapping

# Conclusion



# Geosigmatum mapping Plant communities mapping Conclusion

## Study site and field sampling



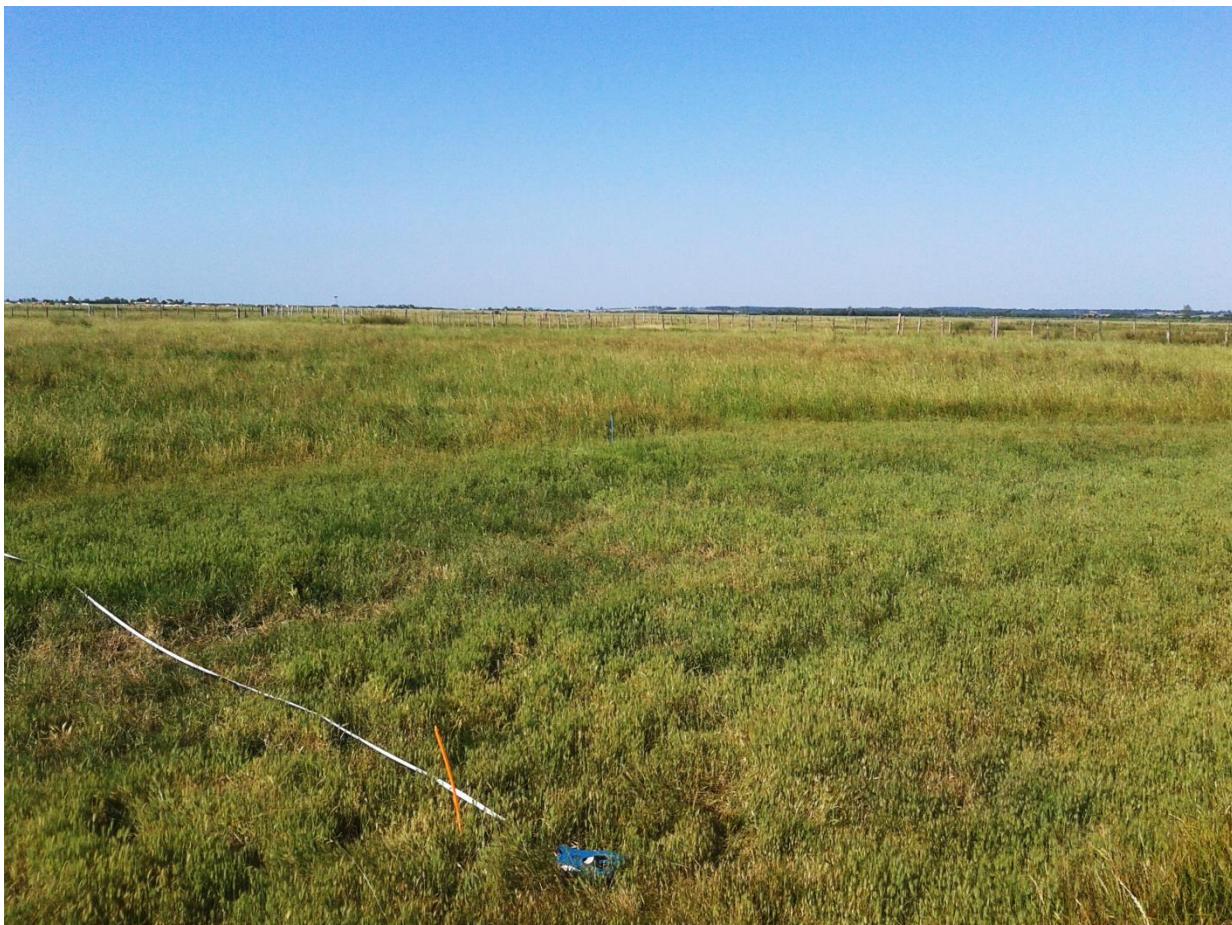
## Data

### Pleiades multispectral image :

- Acquisition date **7th June 2014** (vegetation optimum just before mowing)
- Spatial resolution **2 m**
- Spectral depth **11 bits**
- Projection **UTM 30N** : not reprojected to avoid resampling and keep original pixel value
- **Atmospherical corrections (FLAASH)**
- **Orthorectified (LiDAR DTM)**

### 112 field plots :

- Sampled between **May and June 2014**
- **DGPS** (10 cm horizontal accuracy)
- Floristic composition (Braun-blanquet index)
- Biomass sampling
- Height of vegetation
- Soil cover
- Soil moisture and salinity



Plot delineation criteria :



*Alopecuro-Juncetum gerardii* variation at *Hordeum marinum*

Plot delineation criteria :

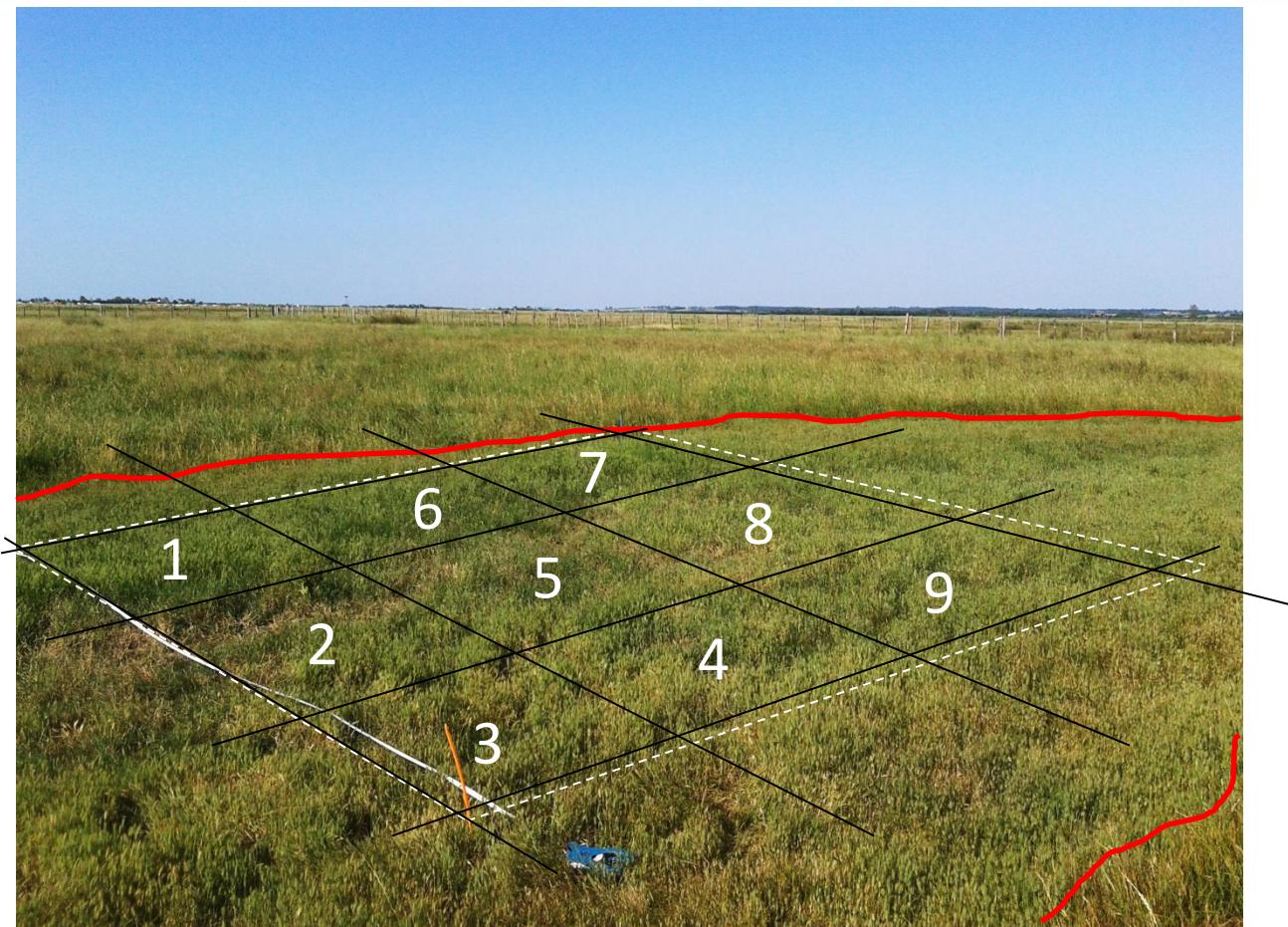
- Homogeneous plant community



*Alopecuro-Juncetum gerardii* variation at *Hordeum marinum*

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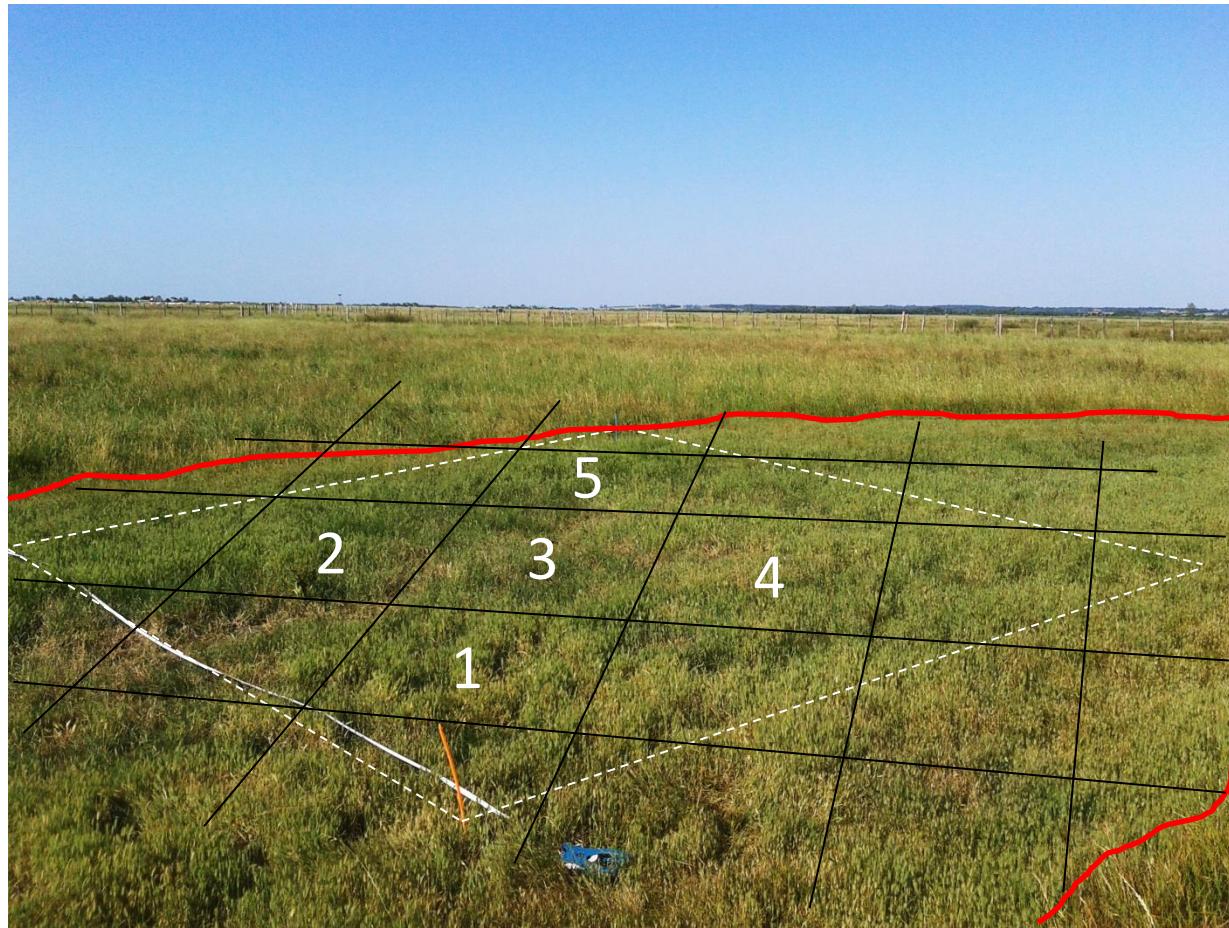
- Homogeneous plant community
- windows size 6 x 6 m ; ie 3x3 pixels



*Alopecuro-Juncetum gerardii* variation at *Hordeum marinum*

Plot delineation criteria :

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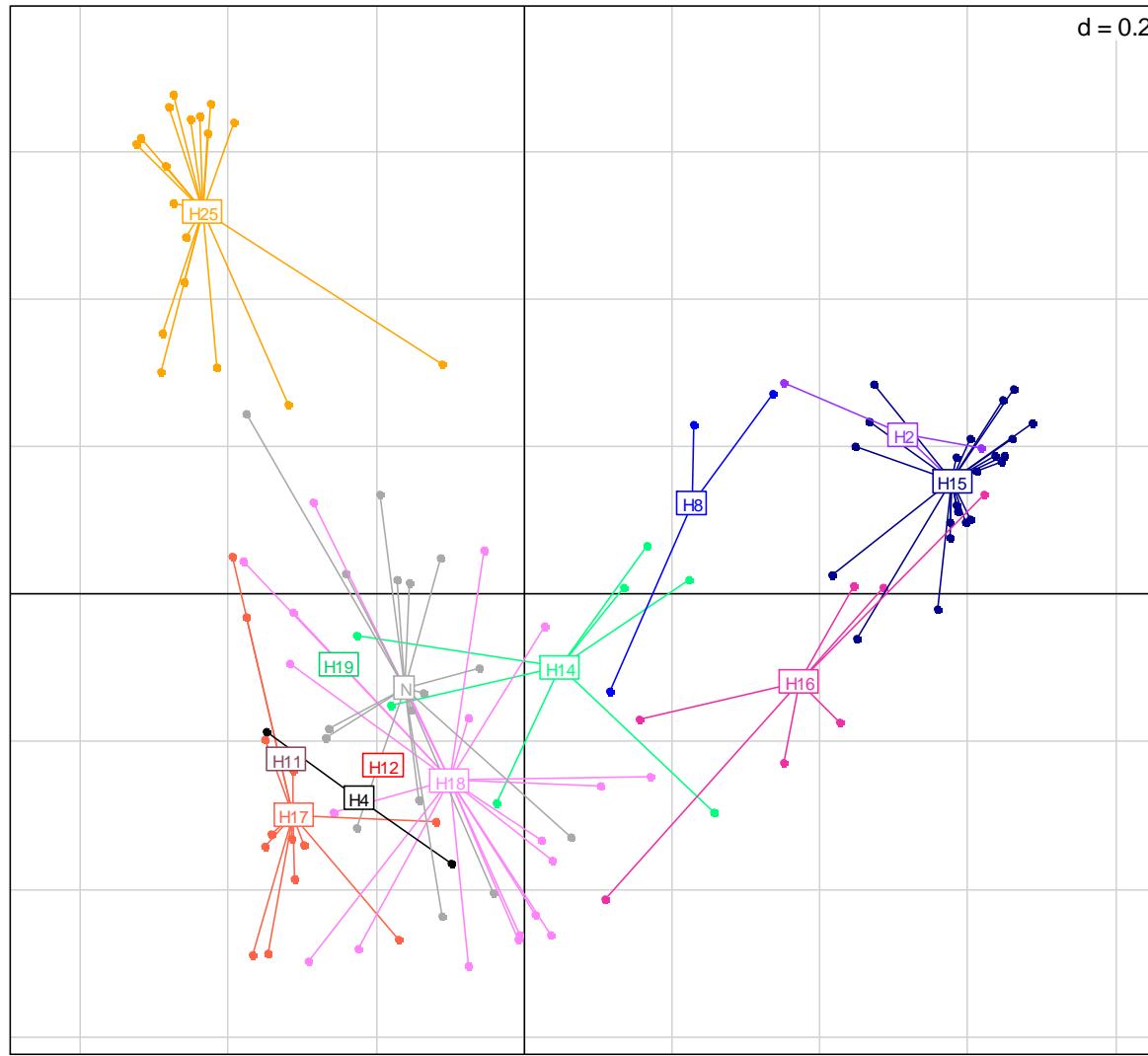
- Homogeneous plant community
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## Semi-supervised classification of field plots / PAM - Partitioning Around Medoids

Tichy et al., 2014 :

- *Each new unsupervised classification yields partitions that are partly inconsistent with previous classifications and change group membership for some sites.*
- *In contrast, supervised methods account for previously established vegetation units, but cannot define new ones.*
- *Therefore, we introduce the concept of semi-supervised classification to community ecology and vegetation science. Semi-supervised classification formally reproduces the existing units in a supervised mode and simultaneously identifies new units among unassigned sites in an unsupervised mode.*

## Semi-supervised classification of field plots / PAM - Partitioning Around Medoids



# Geosigmatum Plant communities mapping Conclusion

## Introduction

## Geosigmatum mapping

## Plant communities mapping

### Percentage synoptic table with fidelity Phi coeff. C

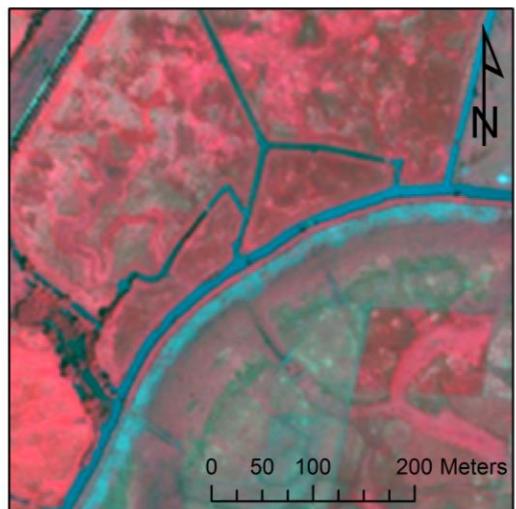
Group No. No. of relevés	1 8	2 16	3 5	4 11	5 2	6 5	7 7	8 19	9 3	10 3	11 2	12 2	13 11	14 18	15 13	16 2	17 9	
<i>Trifolium fragiferum</i>	30	<b>44.4</b>	7.9	---	1.9	15.2	---	19.4	---	24.9	5.4	---	---	---	---	---	---	
<i>Veronica scutellata</i>	4	---	<b>32.3</b>	---	---	---	---	---	---	---	---	---	---	---	---	17.8	---	
<i>Myosotis laxa</i>	4	19.8	<b>31.5</b>	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
<i>Trifolium michelianum</i>	30	12.5	<b>28.7</b>	14.1	23.6	20.6	---	---	---	---	---	---	5.9	---	---	---	---	
<i>Sonchus speciosus</i>	1	---	---	---	29.3	---	---	---	---	---	---	---	---	---	---	---	---	
<i>Lotus corniculatus</i>	1	---	---	---	29.3	---	---	---	---	---	---	---	---	---	---	---	---	
<i>Agropyron repens</i>	1	---	---	---	29.3	---	---	---	---	---	---	---	---	---	---	---	---	
<i>Bolboschoenus maritimus</i>	1	---	---	---	29.3	---	---	---	---	---	---	---	---	---	---	---	---	
<i>Senecio aquaticus</i>	29	15.2	---	---	<b>28.5</b>	---	---	---	---	24.9	15.2	15.2	7.2	---	18.4	---	22.8	
<i>Cardamine parviflora</i>	3	---	---	---	---	<b>56.7</b>	---	---	---	---	---	---	---	---	---	---	---	
<i>Polygonum species</i>	5	---	---	11.7	---	39.9	11.7	---	---	24.2	---	---	---	---	---	---	---	
<i>Leontodon autumnalis</i>	7	4.0	---	---	0.9	<b>38.3</b>	---	---	---	23.0	---	---	---	23.0	---	22.6	---	
<i>Myosotis cespitosa</i>	10	15.1	---	---	17.1	<b>37.7</b>	---	---	---	---	---	---	---	---	---	1.5	---	
<i>Juncus acutus</i>	19	2.7	8.1	---	---	---	<b>77.8</b>	---	---	---	---	---	---	---	---	---	---	
<i>Stellaria palustris</i>	1	---	---	---	---	---	43.6	---	---	---	---	---	---	---	---	---	---	
<i>Equisetum palustre</i>	2	---	---	---	---	43.6	---	---	---	---	---	---	---	---	---	---	---	
<i>Carex diandra</i>	2	---	---	---	---	43.6	---	---	---	---	---	---	---	---	---	---	---	
<i>Leontodon hispidus</i>	3	---	---	---	---	---	44.8	---	---	---	11.7	---	---	---	---	---	---	
<i>Poa pratensis</i>	1	---	---	---	---	---	36.8	---	---	---	---	---	---	---	---	---	---	
<i>Trifolium subterraneum</i>	3	---	---	---	---	---	26.7	18.9	---	---	---	---	---	---	---	---	---	
<i>Carex cuprina</i>	3	---	---	---	---	---	26.8	7.8	---	---	8.5	---	---	---	---	---	---	
<i>Iris spuria</i>	6	---	---	---	21.9	---	21.4	33.2	---	14.1	5.6	21.9	2.7	15.4	5.6	---	---	
<i>Carex divisa</i>	69	---	---	---	15.8	---	9.2	<b>31.2</b>	---	---	---	2.9	---	---	---	---	---	
<i>Cirsium arvense</i>	4	---	---	---	---	---	66.7	---	---	---	---	2.9	---	---	---	---	---	
<i>Cirsium vulgare</i>	1	---	---	---	---	---	56.6	---	---	---	---	---	---	---	---	---	---	
<i>Ceratium species</i>	1	---	---	---	---	---	56.6	---	---	---	---	---	---	---	---	---	---	
<i>Festuca pratensis</i>	3	---	---	---	---	---	3.9	47.0	---	---	---	7.6	---	---	---	---	---	
<i>Phleum pratense</i>	4	---	---	---	---	---	19.3	45.4	---	---	---	---	---	---	---	9.6	---	
<i>Carex hirta</i>	5	---	---	21.2	---	---	38.7	---	56.6	---	---	---	---	---	---	---	---	
<i>Vicia cracca</i>	2	---	---	---	---	---	56.6	---	---	---	---	---	---	---	---	---	---	
<i>Leontodon taraxacoides</i>	1	---	---	---	---	---	56.6	---	---	---	---	---	---	---	---	---	---	
<i>Cynosurus cristatus</i>	35	---	---	---	---	18.3	24.8	4.6	42.9	14.2	16.8	---	3.1	---	---	---	---	
<i>Ranunculus reptans</i>	7	2.1	---	---	---	---	34.8	---	---	16.5	8.0	3.8	---	---	---	---	---	
<i>Vulpia bromoides</i>	12	---	---	---	---	7.5	14.3	<b>26.9</b>	---	20.5	4.3	0.9	---	---	---	---	---	
<i>Festuca rubra</i>	3	---	---	---	---	---	69.6	---	---	---	---	---	10.1	---	10.1	---	---	
<i>Scorzonera humilis</i>	5	---	---	---	---	---	62.3	---	---	---	---	---	22.8	---	22.8	---	---	
<i>Galium verum</i>	2	---	---	---	---	---	62.3	---	---	---	---	---	12.8	---	12.8	---	---	
<i>Rumex acetosa</i>	4	---	---	---	---	1.4	---	57.8	---	6.3	1.8	---	---	21.0	21.0	---	---	
<i>Silene silaus</i>	4	---	---	---	---	---	56.7	---	---	---	---	---	10.8	---	10.8	---	---	
<i>Lathyrus pratensis</i>	3	---	---	---	---	---	56.7	---	---	---	---	---	4.6	---	4.6	---	---	
<i>Poa trivialis</i>	9	3.9	---	10.8	---	10.8	---	---	38.1	---	0.8	---	---	1.8	---	3.8	---	---
<i>Alopecurus pratensis</i>	7	---	---	---	---	---	21.0	21.0	35.5	---	---	---	---	---	---	---	---	
<i>Taraxacum officinale</i>	8	---	---	---	---	4.0	---	20.2	20.2	<b>34.4</b>	---	---	94.5	---	---	---	---	
<i>Poa annua</i>	3	---	---	---	---	---	69.6	---	---	---	---	---	69.6	---	69.6	---	---	
<i>Pionia echinoidea</i>	1	---	---	---	---	---	69.6	---	---	---	---	---	69.6	---	69.6	---	---	
<i>Medicago hispida</i>	1	---	---	---	---	---	69.6	---	---	---	---	---	69.6	---	69.6	---	---	
<i>Trifolium resupinatum</i>	2	---	---	---	---	---	63.5	7.7	---	---	---	---	32.4	38.2	38.2	38.2	---	
<i>Plantago major</i>	6	5.1	---	12.3	---	12.3	---	---	41.3	1.8	---	---	2.7	---	3.8	---	---	
<i>Alopecurus bulbosus</i>	50	---	---	0.8	8.3	---	9.6	---	14.5	14.5	6.0	31.7	17.7	23.1	---	---	---	
<i>Trifolium maritimum</i>	37	---	---	---	---	---	22.0	6.3	---	7.4	---	17.6	42.6	17.6	10.6	---	---	
<i>Lotus tenuis</i>	3	---	---	---	14.9	---	---	---	---	---	---	33.0	---	---	---	---	---	
<i>Vulpia alopecuroides</i>	1	---	---	---	---	---	---	---	---	---	29.3	---	---	---	---	---	---	
<i>Lathyrus nissolia</i>	1	---	---	---	---	---	---	---	---	29.3	---	---	---	---	---	---	---	
<i>Hypochaeris species</i>	1	---	---	---	---	---	---	---	---	---	29.3	---	---	---	---	---	---	
<i>Vicia sativa</i>	1	---	---	---	---	---	---	---	---	---	29.3	---	---	---	---	---	---	
<i>Hordeum marinum</i>	19	---	---	---	---	---	---	---	---	---	2.4	76.8	8.8	---	---	---	---	
<i>Parapholis strigosa</i>	6	---	---	---	---	---	---	---	---	---	56.6	---	---	---	---	---	---	
<i>Spergularia media</i>	2	---	---	---	---	---	---	---	---	---	32.4	---	---	---	---	---	---	
<i>Epilobium hirsutum</i>	2	---	---	---	---	---	---	---	---	---	---	38.2	---	38.2	38.2	38.2	38.2	
<i>Sonchus asper</i>	2	---	---	---	---	---	---	---	---	---	---	35.6	---	35.6	35.6	35.6	35.6	
<i>Rumex species</i>	5	---	---	11.7	---	5.2	---	---	---	---	---	27.0	---	27.0	27.0	27.0	27.0	
<i>Tragopogon porrifolius</i>	1	---	---	---	---	---	---	---	---	---	---	27.0	---	27.0	27.0	27.0	27.0	
<i>Silene viscaria</i>	1	---	---	---	---	---	---	---	---	---	---	27.0	---	27.0	27.0	27.0	27.0	
<i>Lathyrus species</i>	1	---	---	---	---	---	---	---	---	---	---	27.0	---	27.0	27.0	27.0	27.0	
<i>Allium species</i>	1	---	---	---	---	---	---	---	---	---	---	27.0	---	27.0	27.0	27.0	27.0	
<i>Carex distans</i>	2	---	---	---	---	---	---	---	---	---	---	27.0	---	27.0	27.0	27.0	27.0	
<i>Galium aparine</i>	1	---	---	---	---	---	---	---	---	---	---	27.0	---	27.0	27.0	27.0	27.0	
<i>Festuca arundinacea</i>	3	---	---	---	---	---	---	---	---	---	---	2.7	---	95.5	95.5	95.5	95.5	
<i>Anthoxanthum odoratum</i>	5	---	---	---	---	---	---	---	---	---	---	0.2	---	0.2	0.2	0.2	0.2	

## Number of relevés per phytosociological class

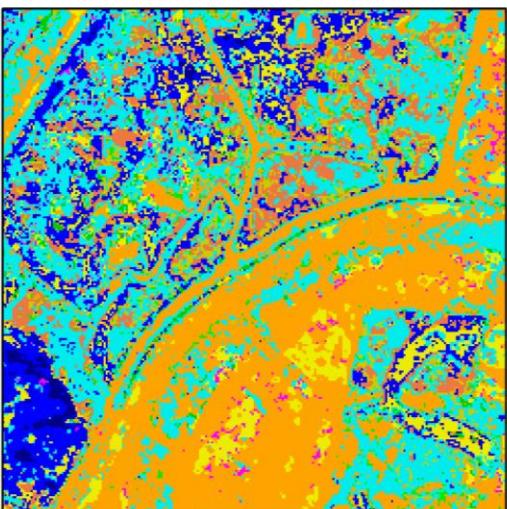
Holotype	Number of relevés
H15: <i>Ranunculo-Oenanthesum fistulosae</i> ; <i>Menthetosum pulegii</i>	23
H16: <i>Ranunculo-Mementum pulegii</i>	4
H14: <i>Ranunculo-Oenanthesum fistulosae</i> ; <i>Eleocharietosum uniglumis</i>	10
H8 : <i>Gratiolo-Oenanthesum fistulosae moyen</i> ; <i>Ranunculotesum ophioglossifolii</i>	1
H2: <i>Eleocharo-Oenanthesum fistulosae</i> at <i>Eleocharis Palustris</i>	4
H18: <i>Carici divisae-Lolietum perennis</i>	25
H12 : <i>Hordeo-Lolietum perennis</i>	2
H4 : <i>Senecio-Oenanthesum mediae occidentale I</i>	2
H11: <i>Senecio-Oenanthesum mediae occidentale I typicum de niveau moyen</i>	1
H19: <i>Plantagini-Trifolietum resupinati</i>	1
H17 : <i>Trifolio-Oenanthesum silaifoliae</i> ; <i>Trifolietosum resupinati</i>	10
H25 : <i>Alopecuro-Juncetum gerardii</i>	17
N : unclassified	12

# Introduction Geosigmatum Plant communities Conclusion

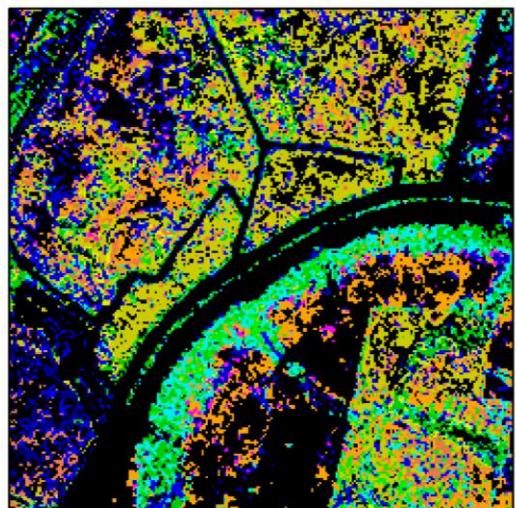
## mapping mapping



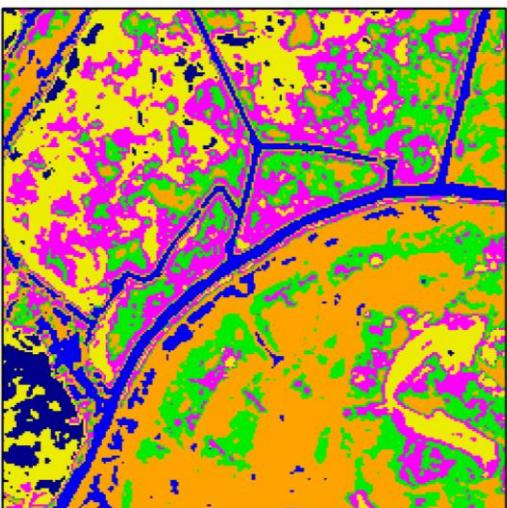
Pléiades false composite



Maxlike classification



Mahalanobis classification



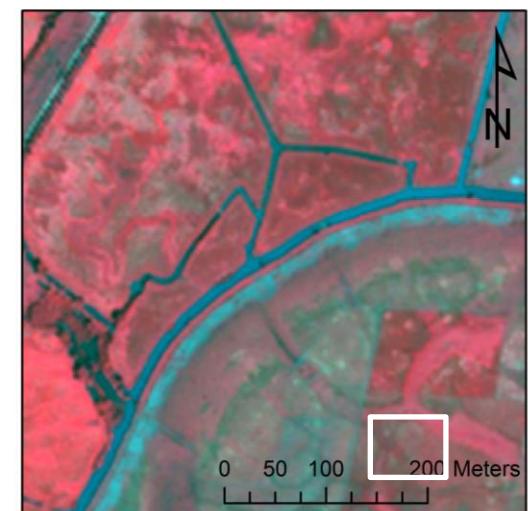
SVM classification

Three **supervised classifications** were assessed for plant communities mapping

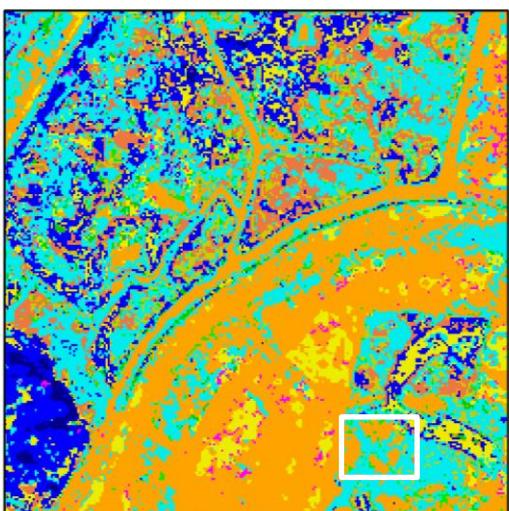
### Plant communities

- Unclassified
- Gratiolo-Oenanthesum fistulosae ; Ranunc ophioglossifolii
- Senecio-Oenanthesum mediae occidentale typicum
- Ranunculo-Mentum pulegii
- Ranunculo-Oenanthesum fistulosae ; Menthetosum pulegii
- Senecio-Oenanthesum mediae occidentale I
- Alopecuro-Juncetum gerardii
- Carici divisae-Lolietum perennis
- Hordeo-Lolietum perennis
- Plantagini-Trifolietum resupinati
- Ranunculo-Oenanthesum fistulosae; Eleo uniglumis
- Trifolio-Oenanthesum silaifoliae; Trifolietosum resupinati
- Eleocharo-Oenanthesum fistulosae A Eleocharis Palustris

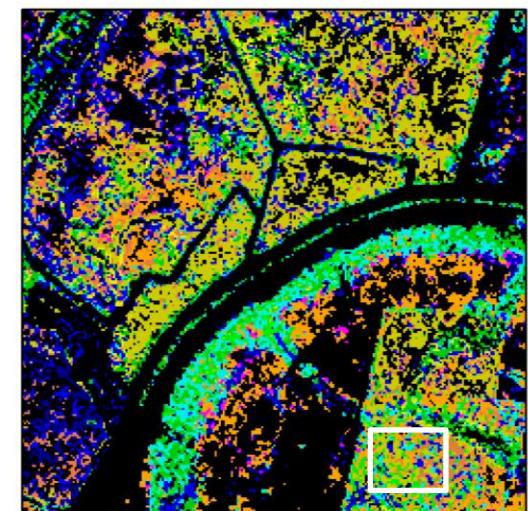
# Geosigmatum mapping Plant communities mapping Conclusion



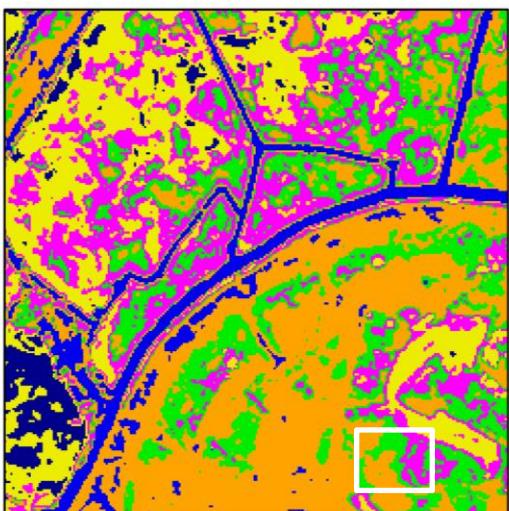
Pléiades false composite



Maxlike classification



Mahalanobis classification



SVM classification

**Mahalanobis classification was chosen :**

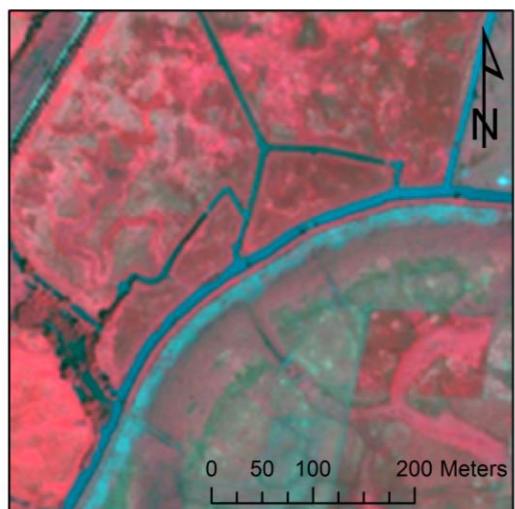
- Fine-grained vegetation patterns were preserved

## Plant communities

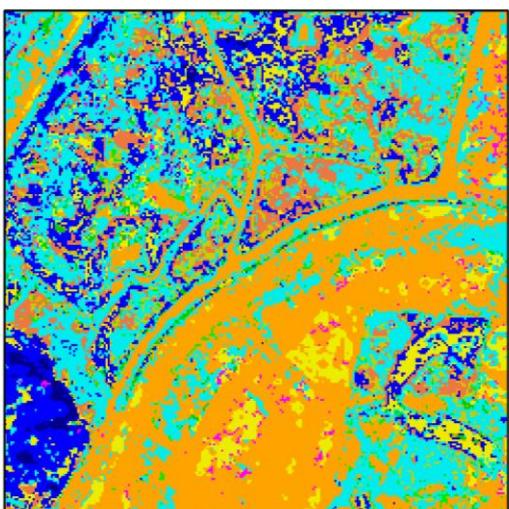
Unclassified
Gratiolo-Oenanthesum fistulosae ; Ranunc ophioglossifolii
Senecio-Oenanthesum mediae occidentale typicum
Ranunculo-Mementum pulegii
Ranunculo-Oenanthesum fistulosae ; Menthetosum pulegii
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Carici divisae-Lolietum perennis
Hordeo-Lolietum perennis
Plantagini-Trifolietum resupinati
Ranunculo-Oenanthesum fistulosae; Eleo uniglumis
Trifolio-Oenanthesum silaifoliae; Trifolietosum resupinati
Eleocharo-Oenanthesum fistulosae A Eleocharis Palustris

# Introduction Geosigmatum Plant communities Conclusion

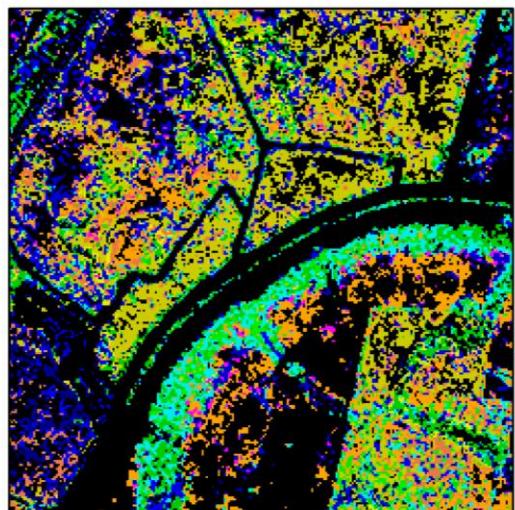
## mapping mapping



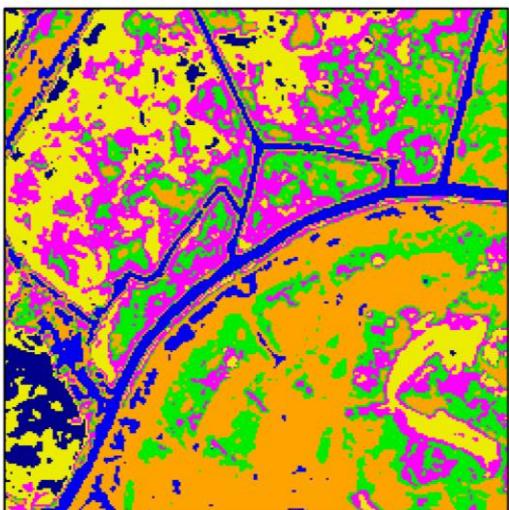
Pléiades false composite



Maxlike classification



Mahalanobis classification



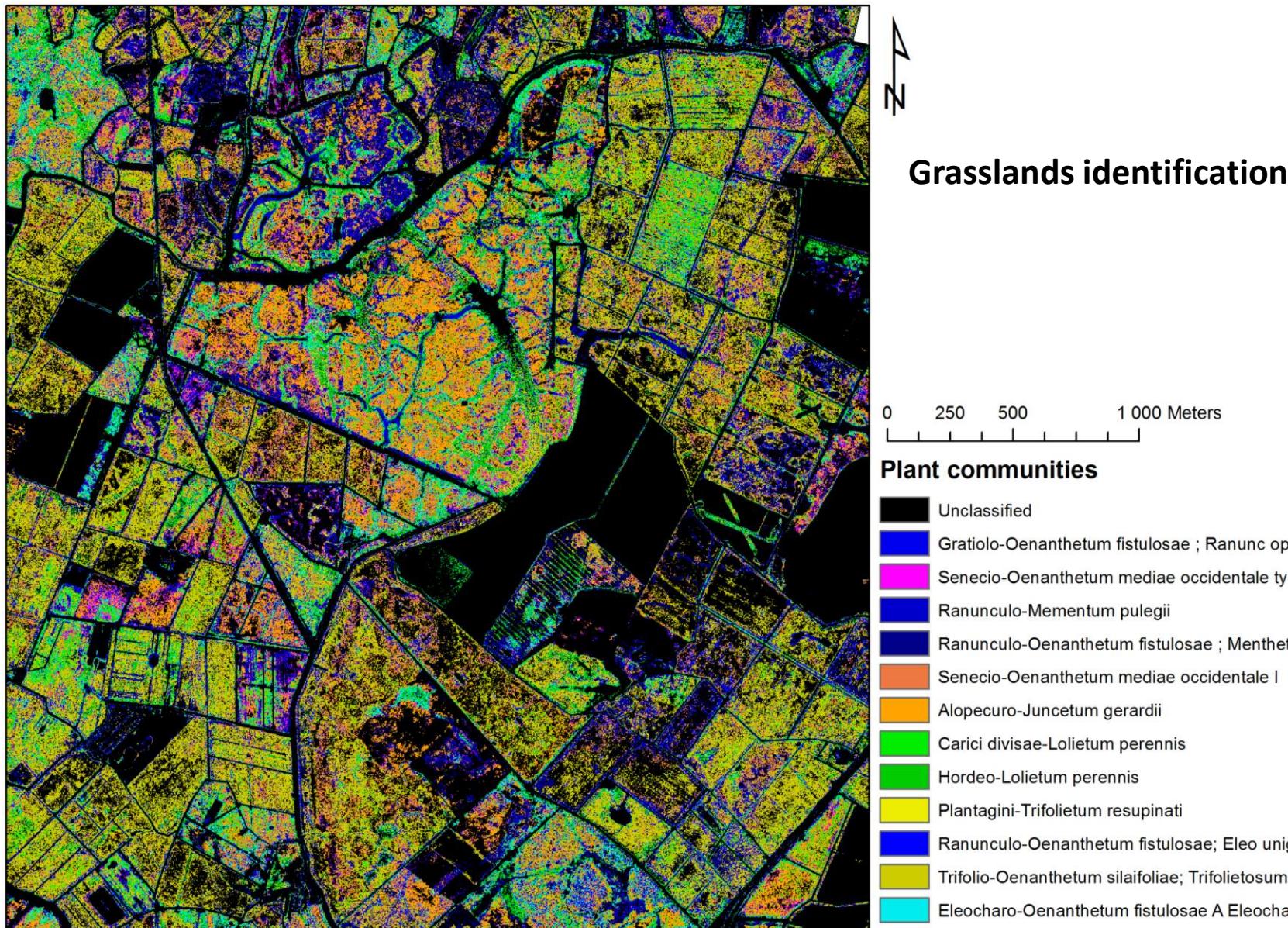
SVM classification

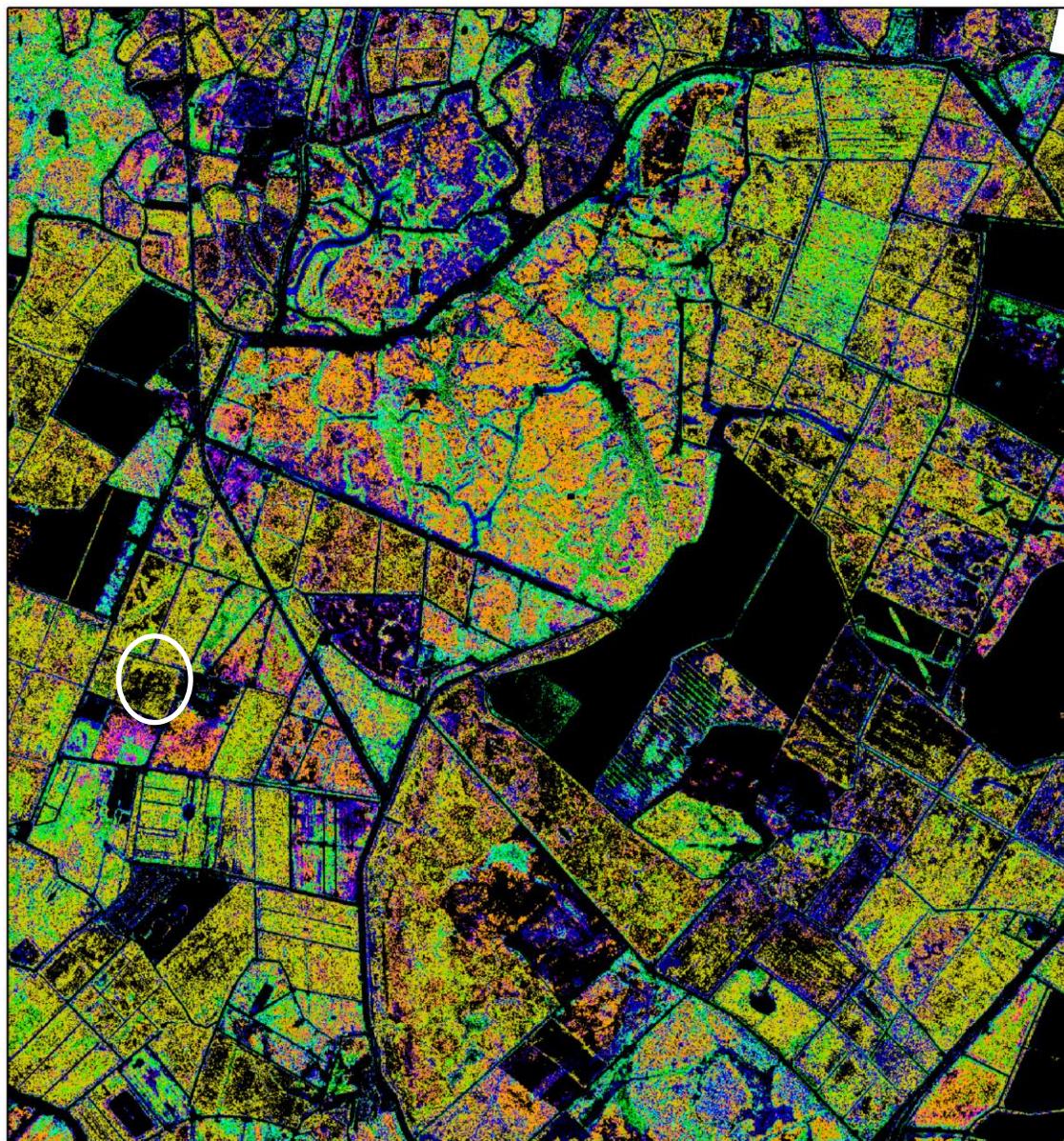
**Mahalanobis classification was chosen :**

- Fine-grained vegetation patterns were preserved
- Unclassified pixels = trees; waters; crops or **new plant communities**

### Plant communities

Unclassified
Gratiolo-Oenanthes fistulosae ; Ranunc ophioglossifolii
Senecio-Oenanthes mediae occidentale typicum
Ranunculo-Mentum pulegii
Ranunculo-Oenanthes fistulosae ; Menthetosum pulegii
Senecio-Oenanthes mediae occidentale I
Alopecuro-Juncetum gerardii
Carici divisae-Lolietum perennis
Hordeo-Lolietum perennis
Plantagini-Trifolietum resupinati
Ranunculo-Oenanthes fistulosae; Eleo uniglumis
Trifolio-Oenanthes silaifoliae; Trifolietosum resupinati
Eleocharo-Oenanthes fistulosae A Eleocharis Palustris





## Grasslands identification

Further field surveys will be performed on the unclassified areas

Plant communities

- Unclassified
- Gratiolo-Oenanthesum fistulosae ; Ranunc ophioglossifolii
- Senecio-Oenanthesum mediae occidentale typicum
- Ranunculo-Mementum pulegii
- Ranunculo-Oenanthesum fistulosae ; Menthetosum pulegii
- Senecio-Oenanthesum mediae occidentale I
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- Carici divisae-Lolietum perennis
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- Ranunculo-Oenanthesum fistulosae; Eleo uniglumis
- Trifolio-Oenanthesum silaifoliae; Trifolietosum resupinati
- Eleocharo-Oenanthesum fistulosae A Eleocharis Palustris

## Challenges in plant communities mapping from satellite image :

- Field protocol (close to the vegetation optimum, spatial extent of plot, consistency with satellite acquisition date)
- Habitat typology (classification of vegetation relevés)
- Satellite image acquisition parameters (close to the vegetation optimum, spectral depth)
- Image processing (training sample, algorithm classification)

## Phytosociology and multispectral remote sensing

### Strengths

Plant species aggregation

Multiscalar approach

Habitat typology suitable for legislative requirements (eg Directive habitat)

### Weaknesses

Expert classification

Plant assemblage is still in survey

Finding of large plots (3x3 pixel size)

Spectral signal of vegetation is a combination of different species mixture and characteristics (biomass, rugosity...)

## Outlook

- Relation between plant composition, biomass, plant height and canopy reflectance (Feilhauer and Schmidlein, 2011)
- Relation between specie dissimilarity (Bray-Curtis index) and spectral dissimilarity (Jeffris-Matusita distance)
- Impact of training sample selection on classification accuracy



**Thank you for your attention !**

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