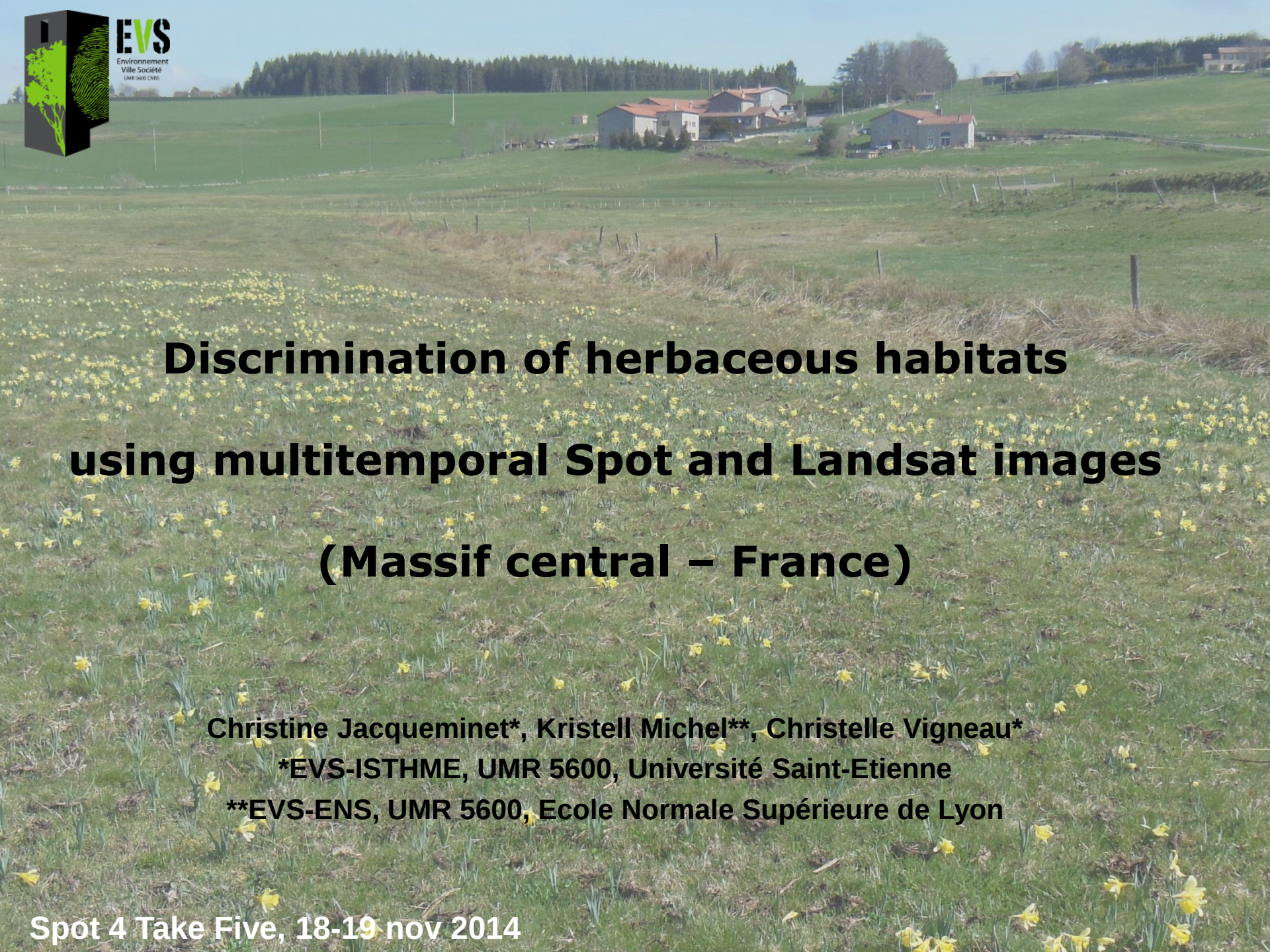




Discrimination of herbaceous habitats using multitemporal Spot and Landsat images (Massif central – France)

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Context and Objectives

CarHab : Mapping of natural and semi-natural habitats of France at a scale of 1/25 000 (MEDDE)

CarHAB Framework		
STEP 1	STEP 2 : base map	STEP 3 : final map
Phytosociological surveys on test areas	Combinaison of: Physiognomic mapping of vegetation by remote sensing Ecological mapping with environmental data	Extrapolation of field surveys thanks to the base map

- Mapping of open vegetation of lowland areas on a departmental scale

Distinguish permanent herbaceous vegetation from crops
 Differentiate herbaceous habitats

Department of Loire

87 % of the UAA of the department occupied by permanent grasslands
and forage crops (3/4 temporary grasslands)



Methodology

- **Multitemporal HRS imagery**

- Recognize ploughed plots to distinguish crops of permanent grasslands
- Grasslands: highlight vegetative cycles and impact of agricultural practices (mowing, grazing)

What physiognomic indicators can we use to distinguish herbaceous types / vegetation with similar values (thanks to favourable ecological conditions) and disturbed by agricultural practices ?

- Accumulated NDVI values over a year : impact of mowing and grazing !
- Start peak of the growing season of each type : adequation of images dates ?
- Temporal variations of herbaceous types signatures



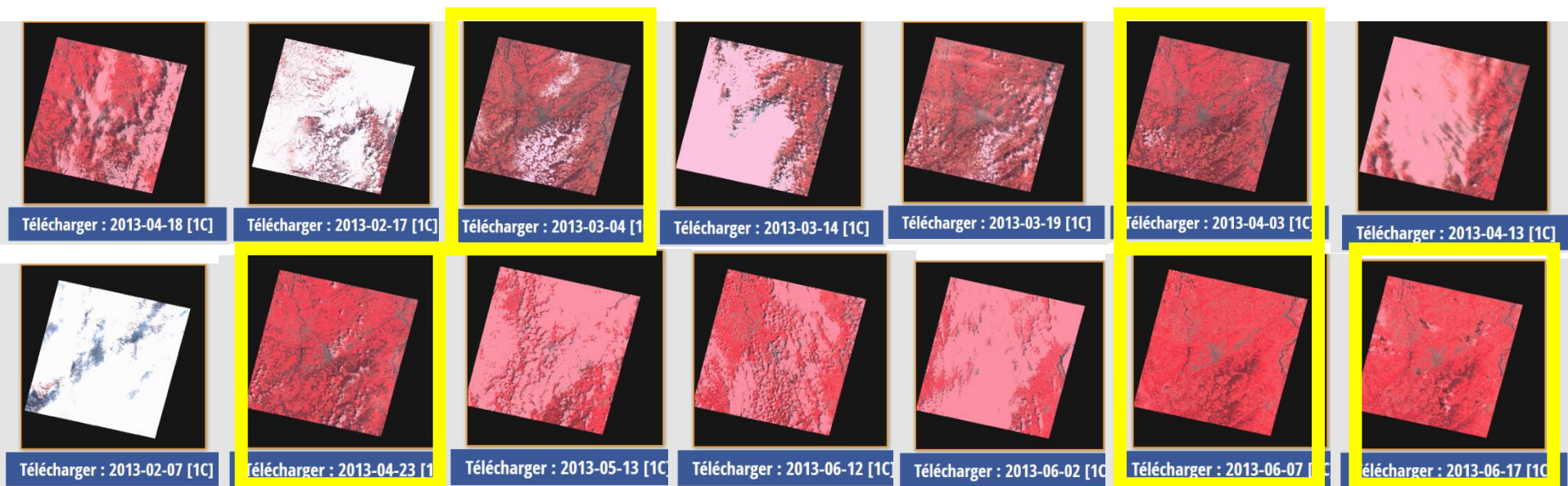
Field data (CBNMC)

Description of herbaceous habitats as:

Floristic composition / Uses	Nb	Trophic gradient	Hydromorphy
Hay meadow	374	Eutrophic	Dry wet
Pasture	703	Meso-eutrophic Mesotrophic	
Temporary grassland	116		
Crops and temporary grassland	448		
Crops	63		

3 campaigns of field surveys from 2012 to 2014 (about 1700 parcels)

Imagery data

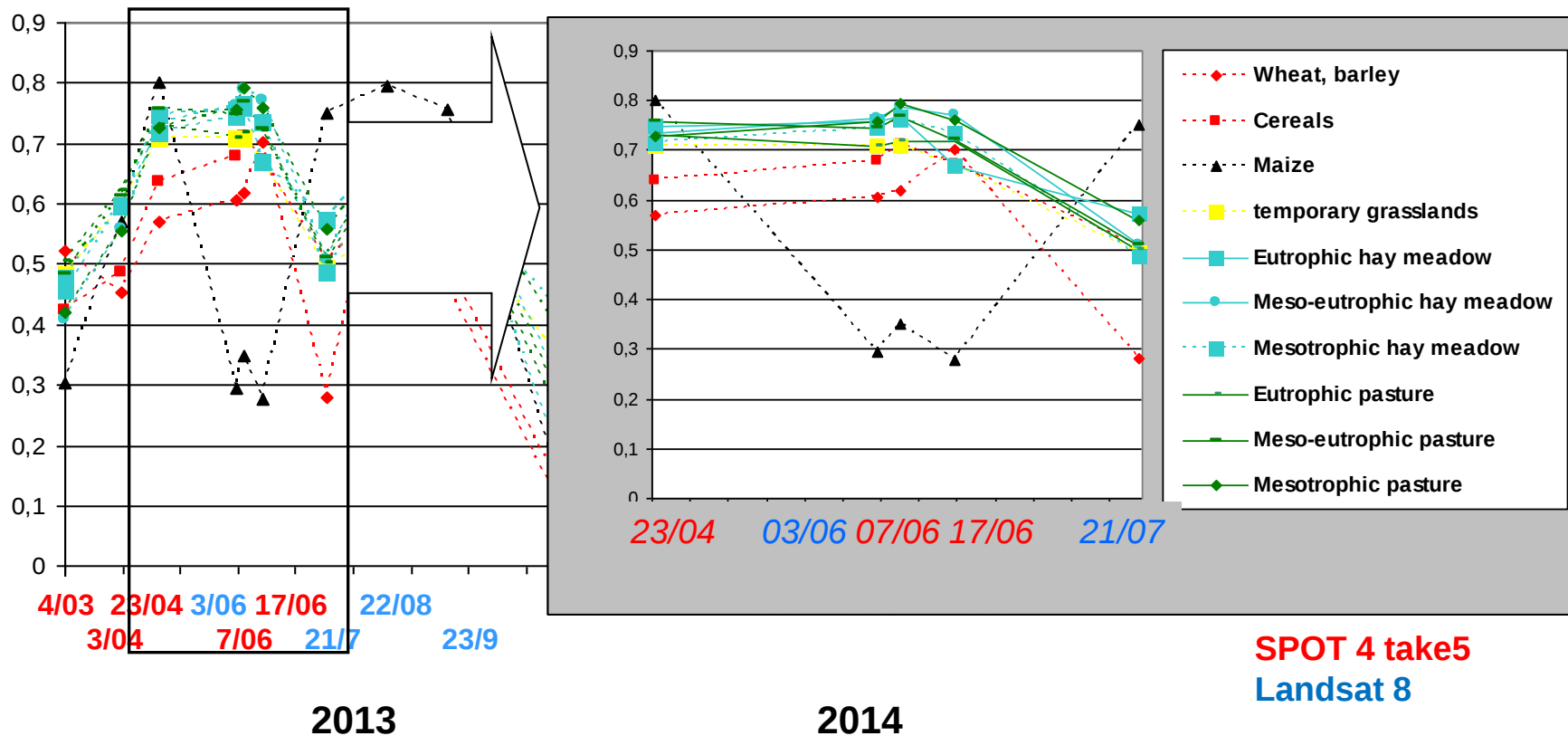


	2013												2014								
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03	04	05	06	07	08	09
Spot4			04 *	03		07															
				23		17															
Landsat8						03	21	22	23			12			18		05	11			26

* The day in the month

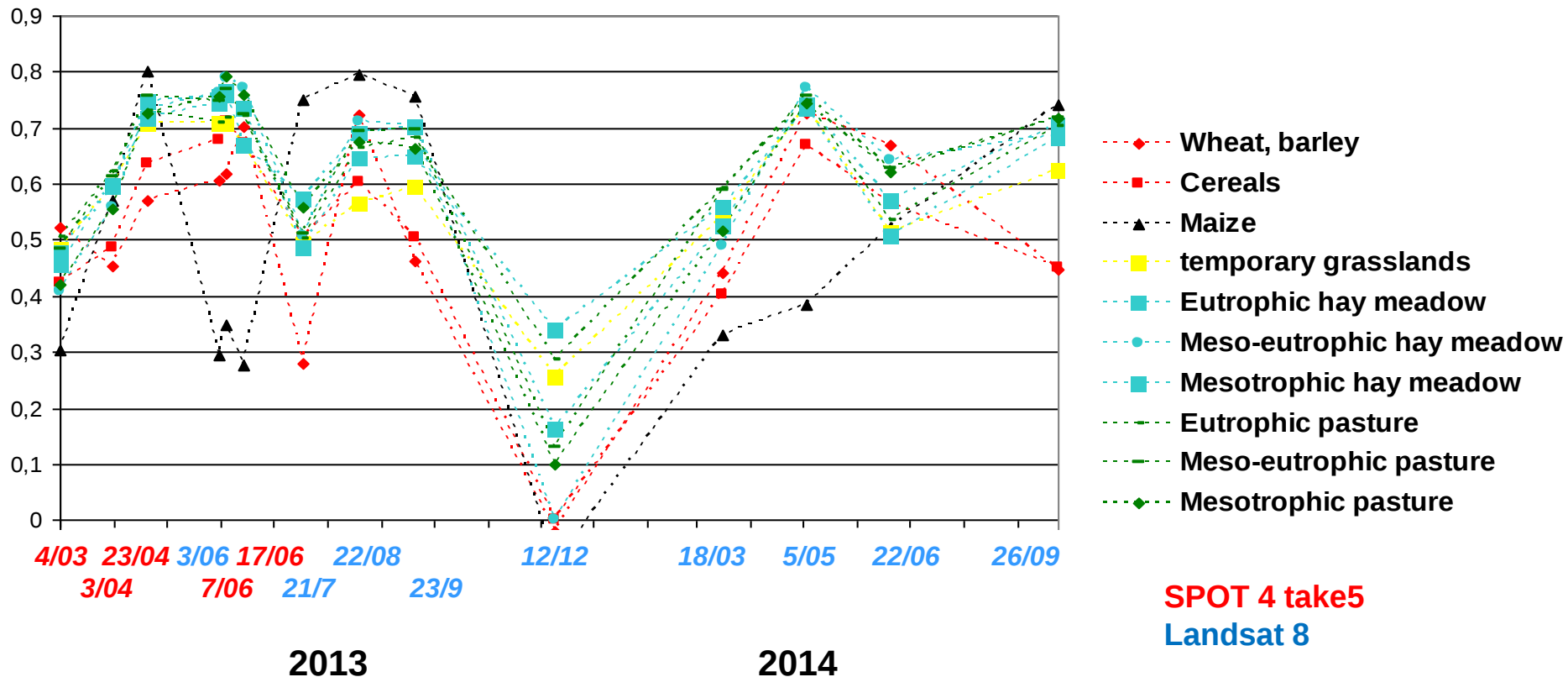
Analysis of field data signatures on time serie

NDVI average measured on **Spot 4** and **Landsat 8** images (level 2A)



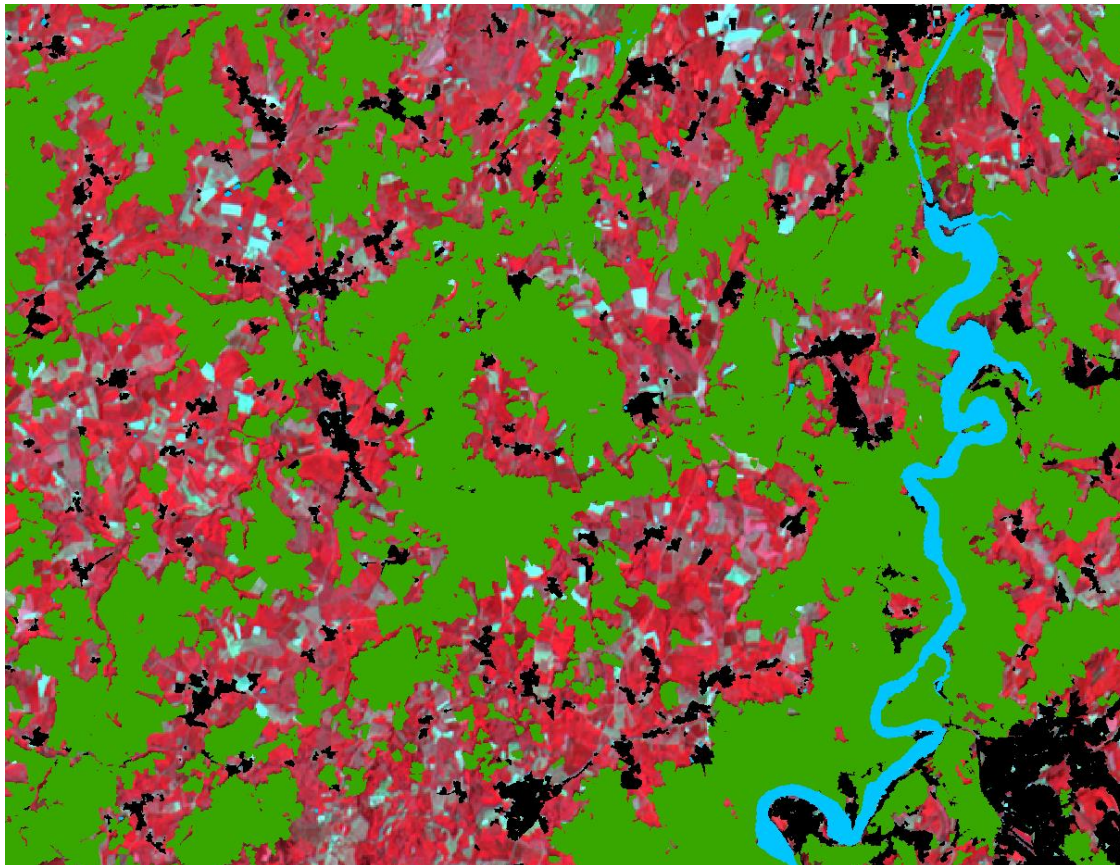
Analysis of field data signatures on time serie

NDVI average: Crops and grasslands signatures are different on several dates
Grasslands signatures are very close



Delimitation of herbaceous areas

Masks using vectorial database



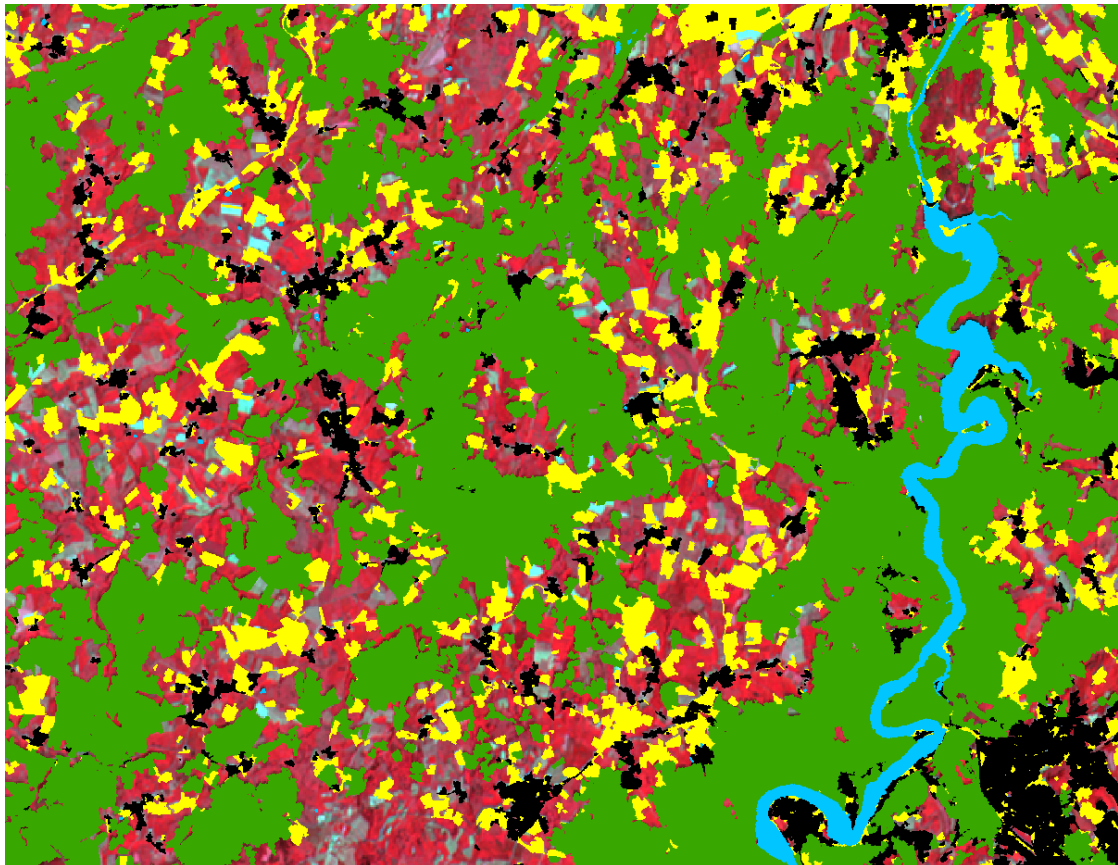
- Water areas
- and Built-up areas (BD TOPO®IGN)
- Woodland (BD Forêt V.2®IGN)

Crops mapping

NDVI measure and extraction of bare soils at each date

Crops = pixels classified as bare soil at least once a year

Kappa index values (0.66 to 0.83) depending on area and images serie

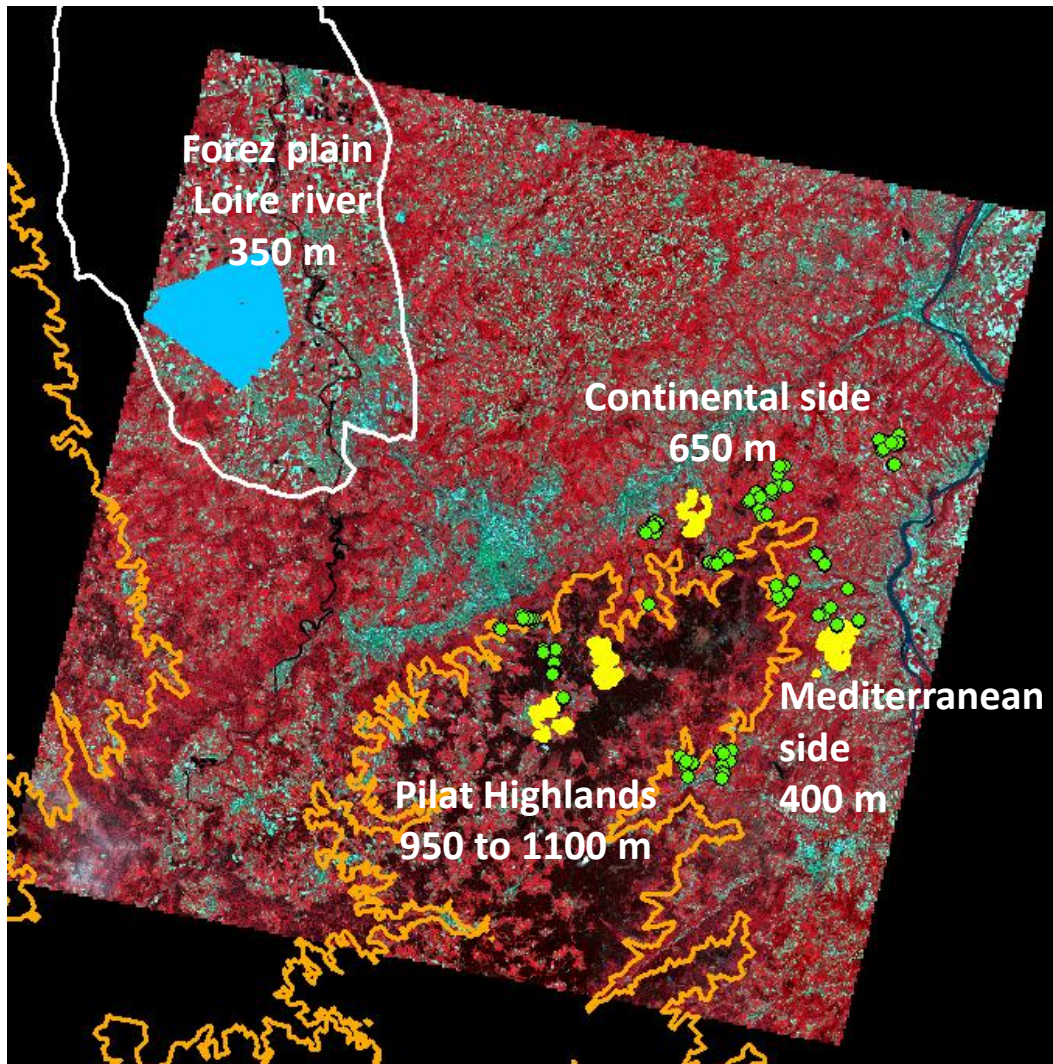


- Water areas
- and Built-up areas (BD TOPO®IGN)
- Woodland (BD Forêt V.2®IGN)
- Crops areas

Limit : spectral confusion between plowing and recent mowing

Discrimination of herbaceous habitats

Department of Loire: altitudes from 140 to 1432 m



Delimitation of 4 areas
from:



Hydro- Eco-Régions
(IRSTEA)



Mountain zone
(EVS-ISTHME)

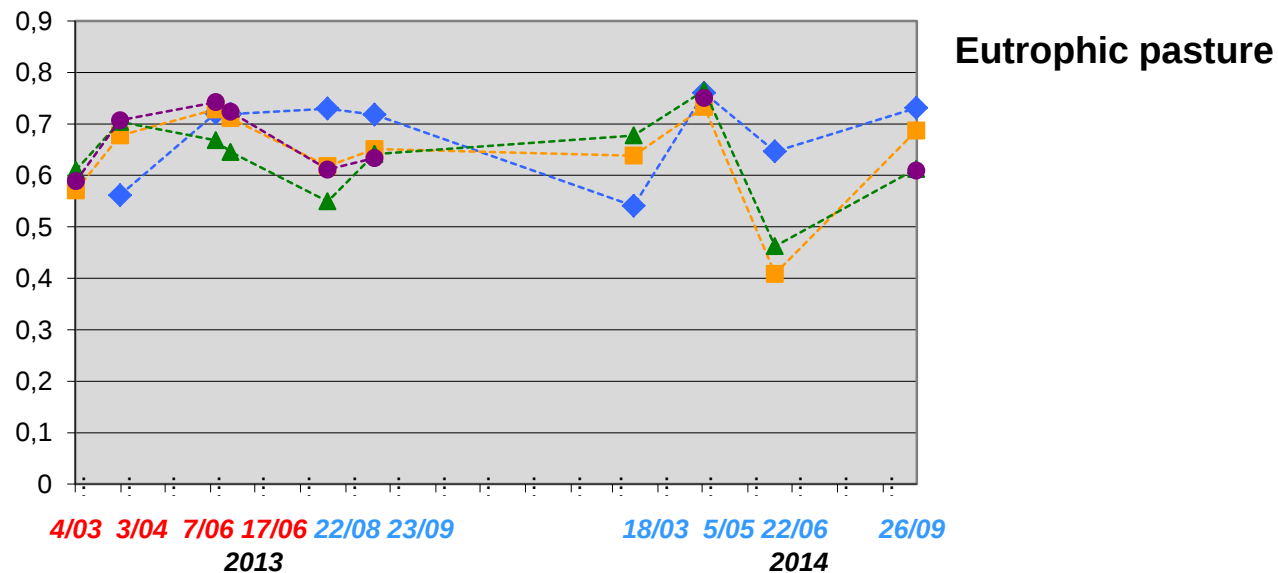
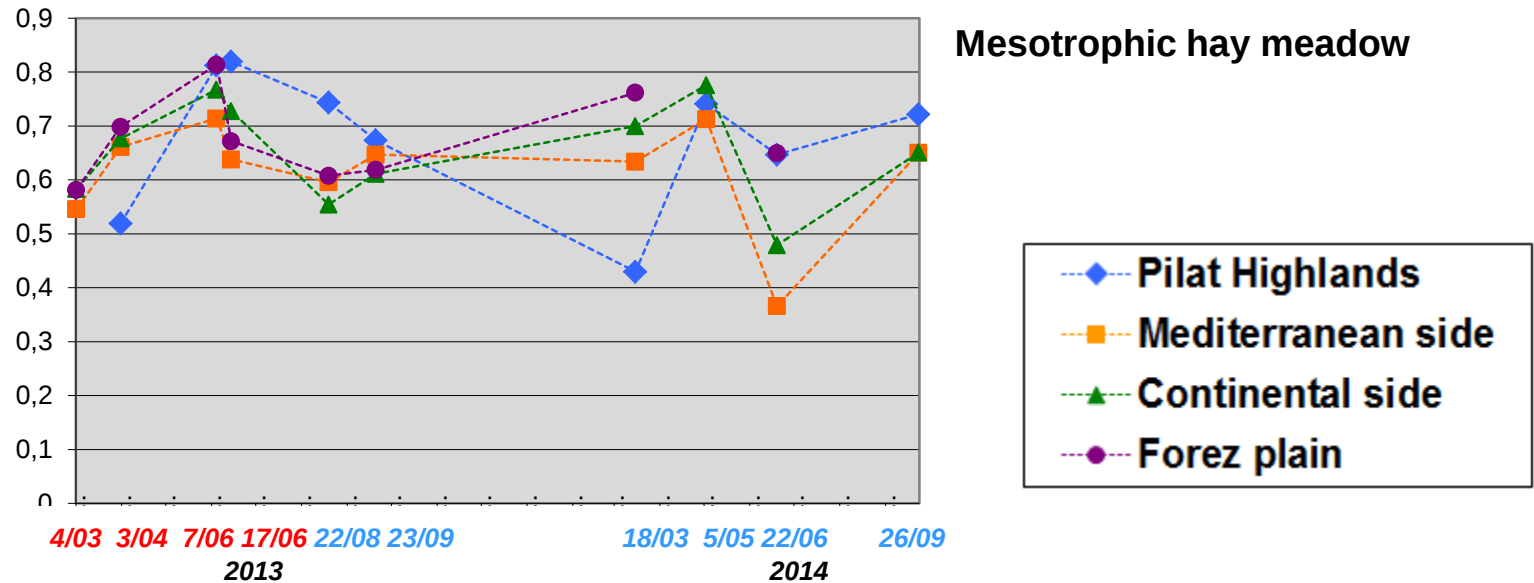


Field surveys
(CBNMC)

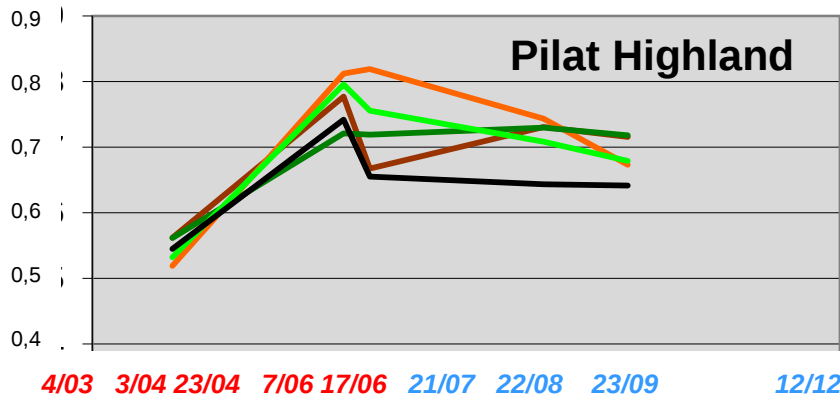


2012 to 2014

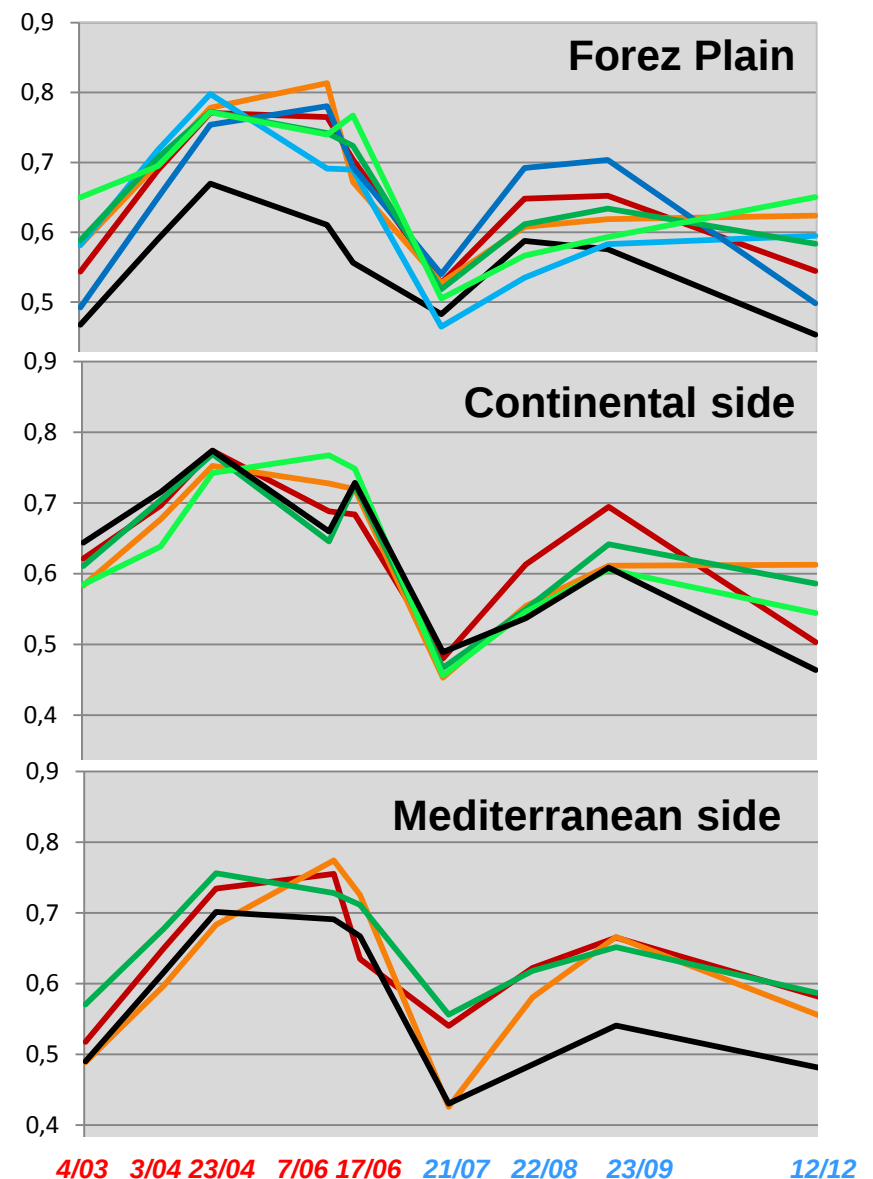
Field data : comparison of NDVI average / test area



Field data: comparison of NDVI average / test area



- Temporary grassland
- Eutrophic hay meadow
- Mesotrophic hay meadow
- Wet eutrophic pasture
- Wet mesotrophic hay meadow
- Eutrophic pasture
- Mesotrophic pasture

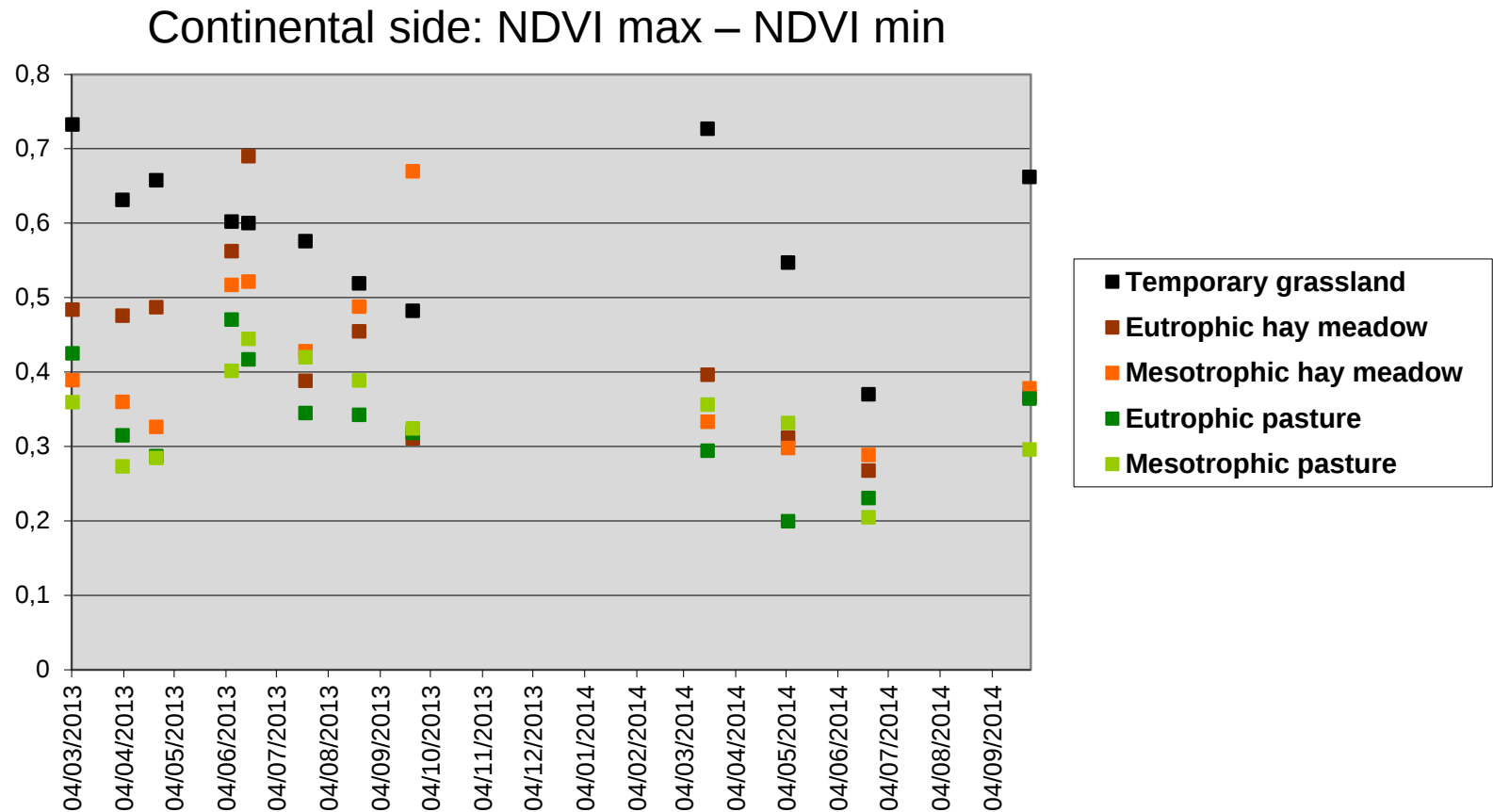


Relevant dates to distinguish grasslands ?

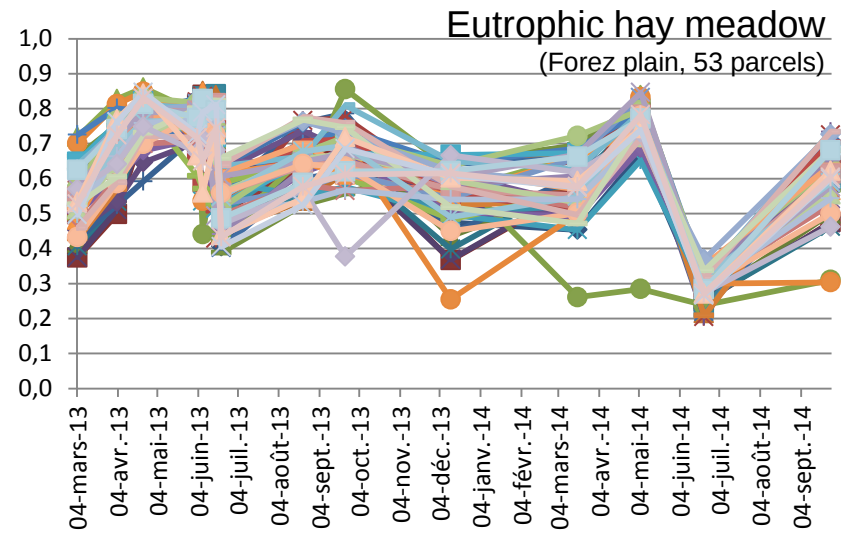
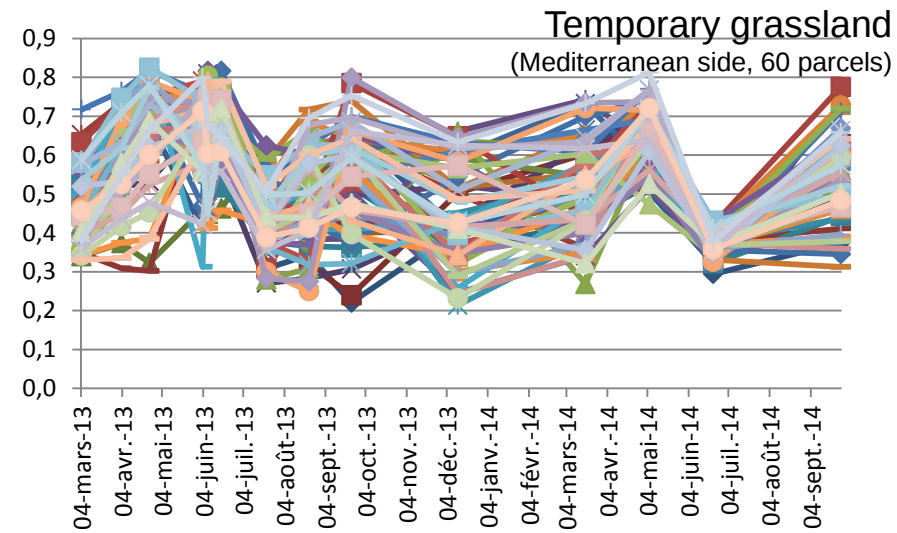
Average NDVI	2013		
	April	June	August-sept
Pilat Highlands		Start peak of all grasslands	
Continental side	Start peak of all grasslands	Mesotrophic P > others grasslands	Eutrophic HM > others grasslands
Mediterranean side	Start peak of pastures	Start peak of hay meadows	
Forez plain	Start peak of all grasslands	Mesotrophic HM > others grassland	Wet mesotrophic HM > others grassland

All permanent grasslands
 Hay Meadow
 Pasture
 Wet grasslands

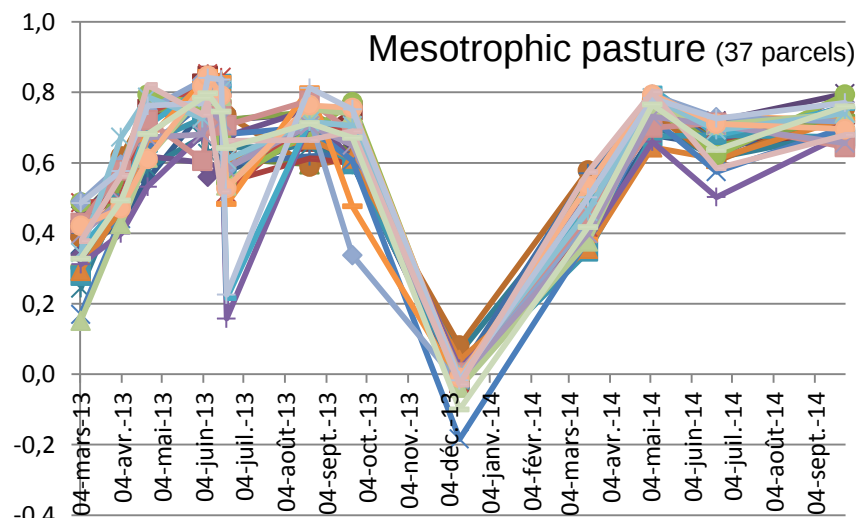
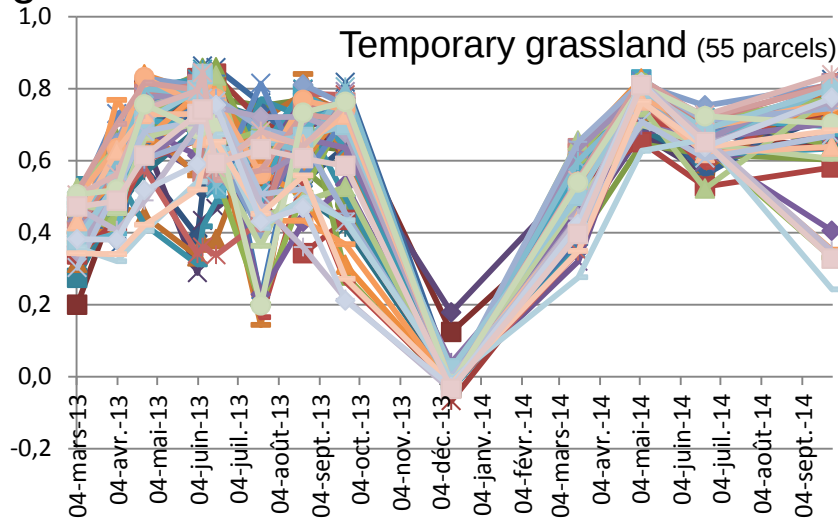
Spread of NDVI values / uses and trophic gradients



Spread of NDVI values / each parcel of field data



Pilat highland



Conclusion

Spot 4 (Take five) images : better adequation to little plots size / Landsat 8 data

Temporal information compensates spatial resolution

Atmospheric and geometric corrections have greatly facilitate the study

Temporal information reveals some specific signatures on some dates in 2013

but these signatures appear to be greatly affected by agricultural practices

Because of their temporal irregularity, agricultural practices introduce heterogeneity in signatures

A detailed field information and knowledge about agricultural systems and their local variations are required

The distinction between temporary and permanent grasslands on one or two years is not possible

These observations are valid for the year 2013 and the studied areas

Thanks to

Spot 4 Take Five by CNES

*

The French Ministry of Ecology, Sustainable Development and Energy
(MEDDE)

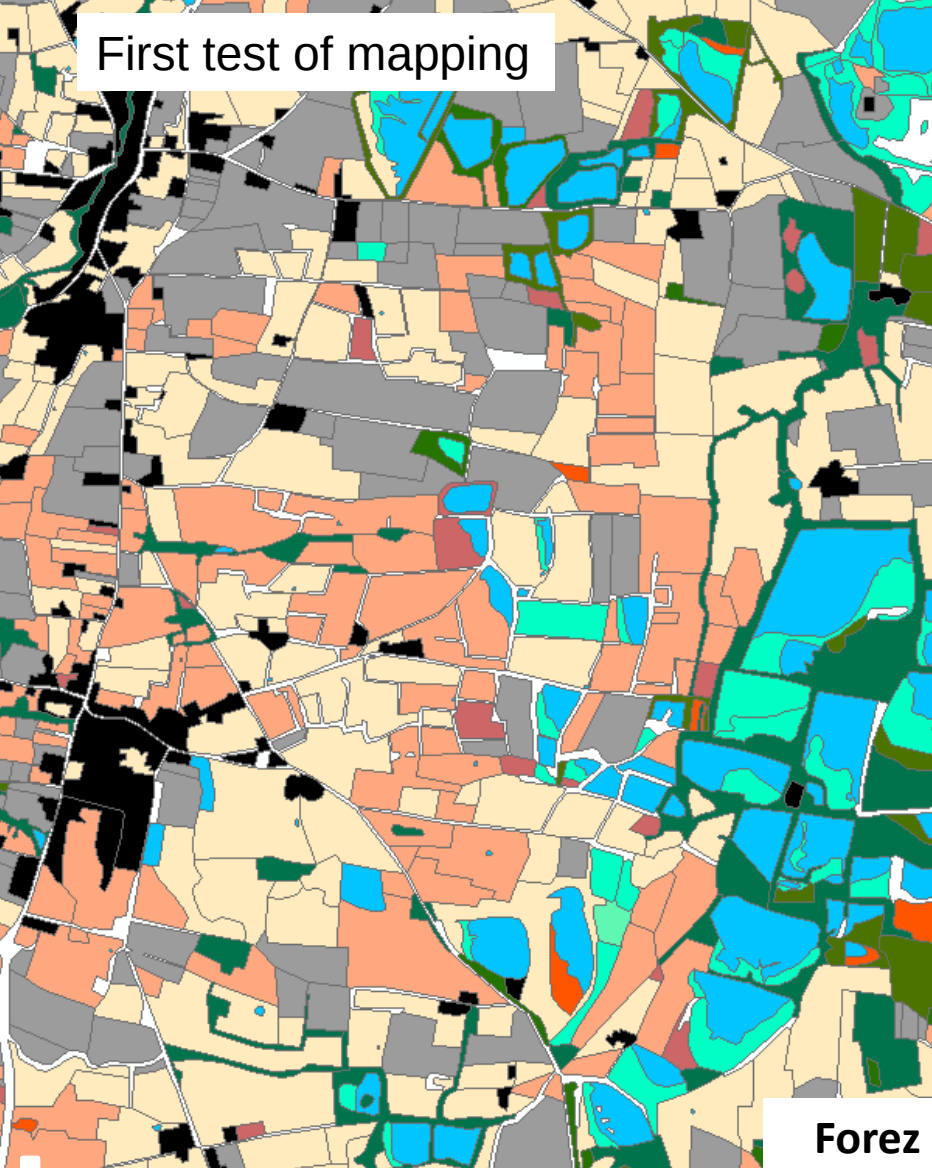
*

and CarHab project partners :

IGN, IRSTEA Grenoble, IRSTEA Montpellier, LETG (Université de Rennes II), EVS-ISTHME (Université Jean Monnet), CEREMA Sud Ouest
Conservatoires Botaniques Nationaux (Massif central, Alpes...), Muséum
d'Histoire Naturelle, Herbiers Universitaires de Clermont Ferrand,
Fédération CBN, Université de Bretagne Occidentale

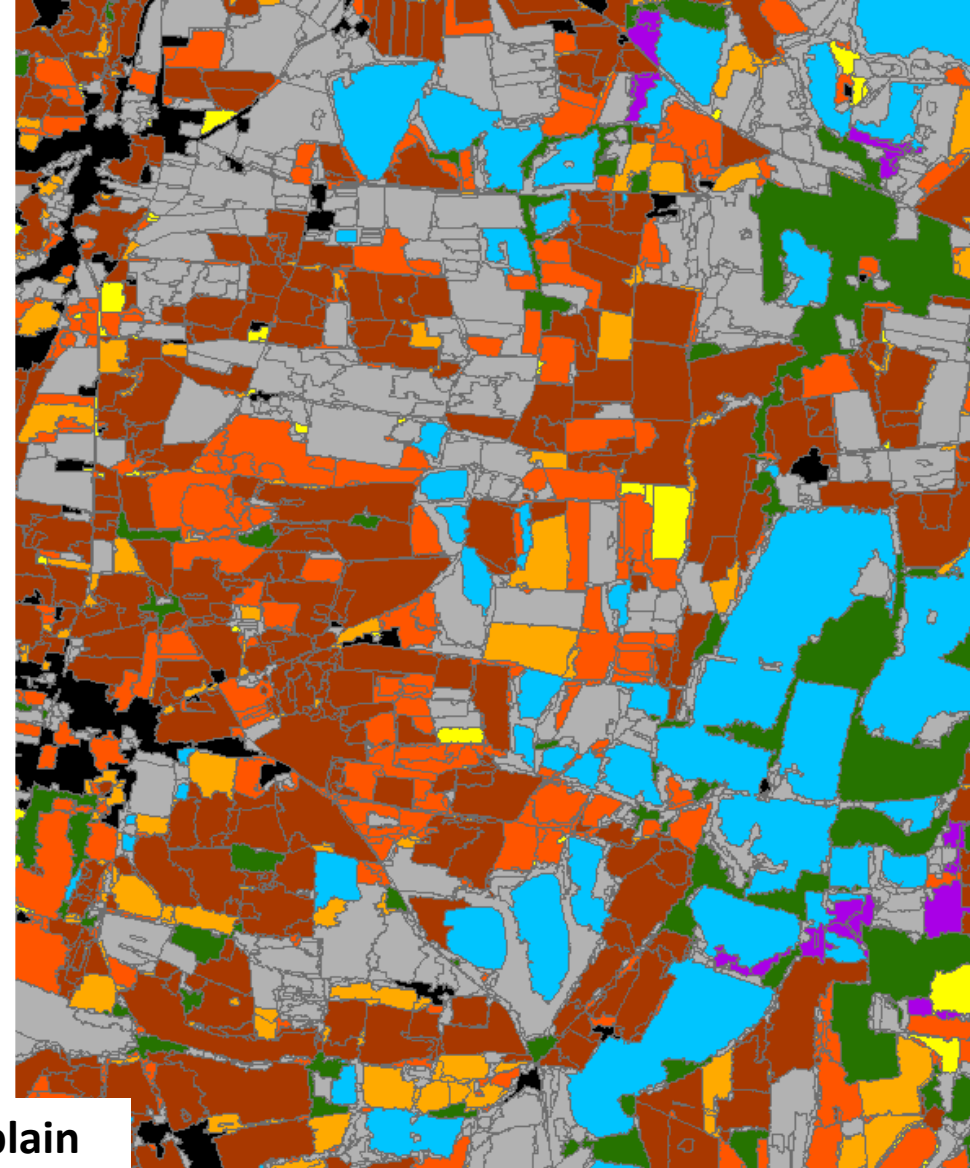


First test of mapping



Forez plain

- Cultures et prairies artificielles
- Prairies pâturées
- Prairies de fauche
- Prairies humides
- Ourlets et friches
- Végétations aquatiques



EVS-ISTHME, 2014

- Cultures
- Eau
- Forêt
- Herbacées a productivite faible
- Herbacées a productivite forte
- Herbacées a productivite moyenne constante
- Herbacées a productivite moyenne variable
- LA4 (Lande ligneuse) IGN
- LA6 (formation herbacée) IGN
- Surfaces artificialisées

CBNMC, 2013