Task 1.2: landscaping features, agricultural practices and connectivities (leader: LARI).

INRGREF is participating :

- Land use.
  - Targets: field delineation, land use and land cover, crop rotation.
  - Methodological innovations: times series of Sentinel satellite data long with object-oriented classification methods, joint use of field surveys and high spatial optical remote sensing (e.g., Spot, Pléiades).
  - Partners: INAT, INRGREF, LISAH, UCAM, CESBIO, LARI.
  - Study areas: Cap Bon, Merguellil, Tensift, Litani.
- Crop biomass.
  - Targets: times series of biophysical variables along with final yield.
  - Methodological innovations: joint use of remote sensing data Sentinel-1 & 2 satellite data and TerraSAR-X satellite data along with statistical analysis.
  - Partners: SUPCOM, INRGREF.
  - Study areas: Cap Bon
- Surface hydrological connectivities.

Managing water ressources within Mediterranean agrosystems bu accounting for spatial structures and connectivities - ALTOS

KOM ALTOS-Tunisie

Actions prévues par INRGREF & collaborations

WP1: Task 1.2 : Land use

April 20-21, 2020

WP1: Task 1.2 : Land use

Décisions d'assolement et distribution spatio-temporelle des cultures dans le paysage

Caractérisation des motifs spatio-temporel de distribution des cultures

- Logiques d'assolement sur le Lebna
- Identification des contraintes/déterminants
- Scénarios réalistes de distribution des cultures
- Objectiver" la spatialisation de scénarios futurs d'assolement qui tiennent comptent d'une structure sociale des agriculteurs que l'on pourrait considérer comme stationnaire et qui se traduit par des règles individuelles ou collectives.

Task 1.2 : Land use

Objectif

Caractériser, la distribution spatio-temporelle des cultures qui résulte des décisions d'assolement des agriculteurs, sur le bassin versant du Lebna

Travaux 2015-2019 (LMI Naila, ANR ALMIRA)

- Impact du morcellement des exploitation sur la localisation des cultures
- Caractérisation des motifs spatiaux à l'échelle du BV
- Thèse (bourse IRD)
  - Suivi de l'assolement agricole à la résolution parcellaire par interactions entre traitement d'images et modèles évolutifs d'assolement. Application au bassin versant du Lebna
  - Démarrage année scolaire 2018-2019

Méthode

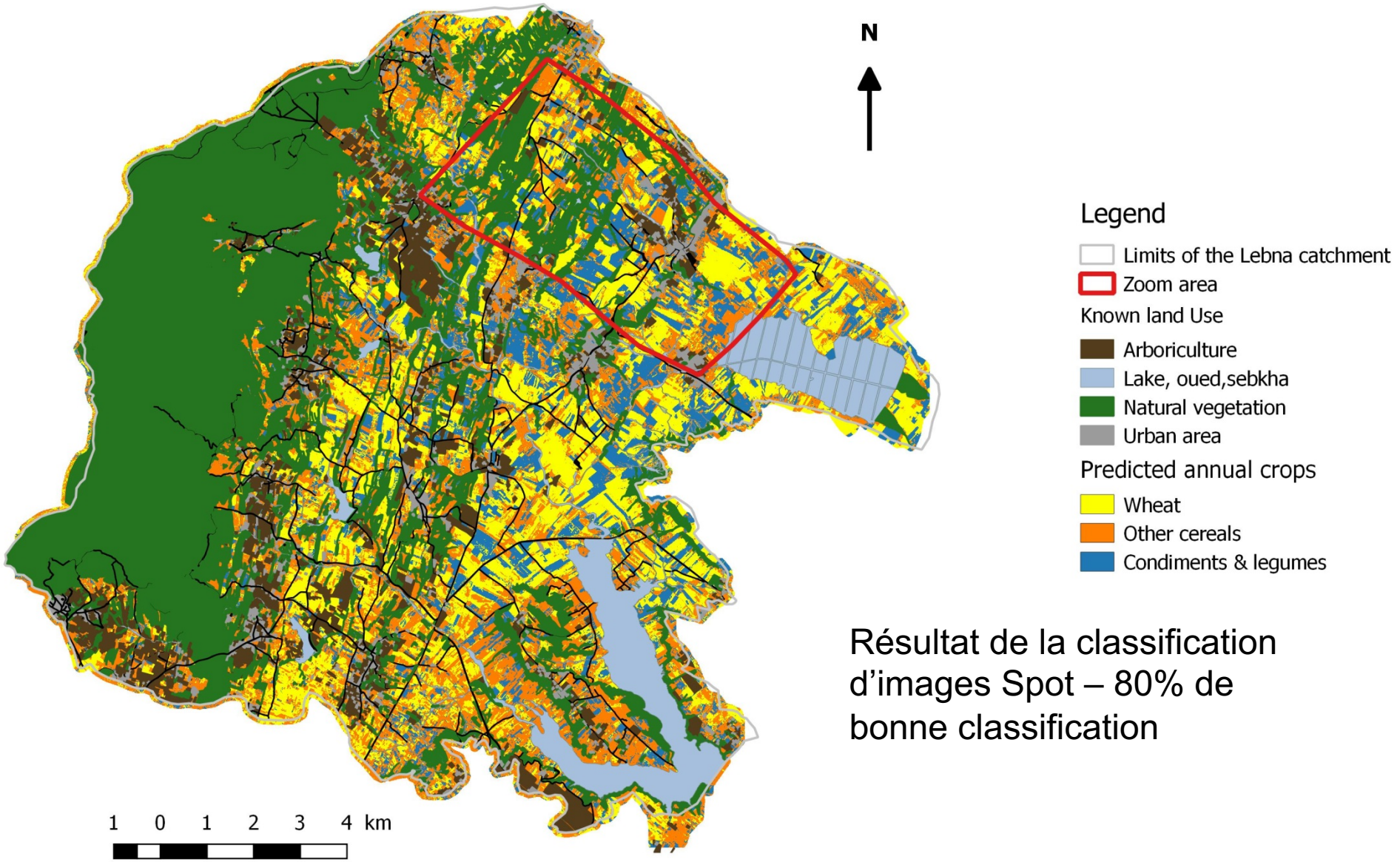
- Relevés de parcellaires (exploitations)

- Observation d'ocs dans ces parcelles (~ 350 parcelles) + leurs voisines, sur trois cycles culturaux (2014-2015 à 2016-2017)
- Nombreux relevés terrain

- Classifications d'images spot à l'aide de l'algorithme Random Forest en cultures sur 4 cycles culturaux consécutifs
  - *Cycles 2015-2016 et 2016-2017, 2017-2018, 2018-2019*

Résultats

- Agrégats de parcelles portant le même type de culture



Résultat de la classification d'images Spot – 80% de bonne classification

Identification des éléments physiques structurels du paysage (infrastructures) qui conditionnent ces mêmes agrégats

Drivers

- Anthropic
- Naturels

Fiche de relevée des linéaires

Nature de l'object:

1. Route
2. Piste
3. Sentier
4. Oued
5. Ravine
6. Végétation naturelle
7. Haie
8. Clôture
9. Clôture avec portail
10. Fossé
11. Fossé avec pont
12. Talus
13. Autres

Observation a noter pour chaque objet:

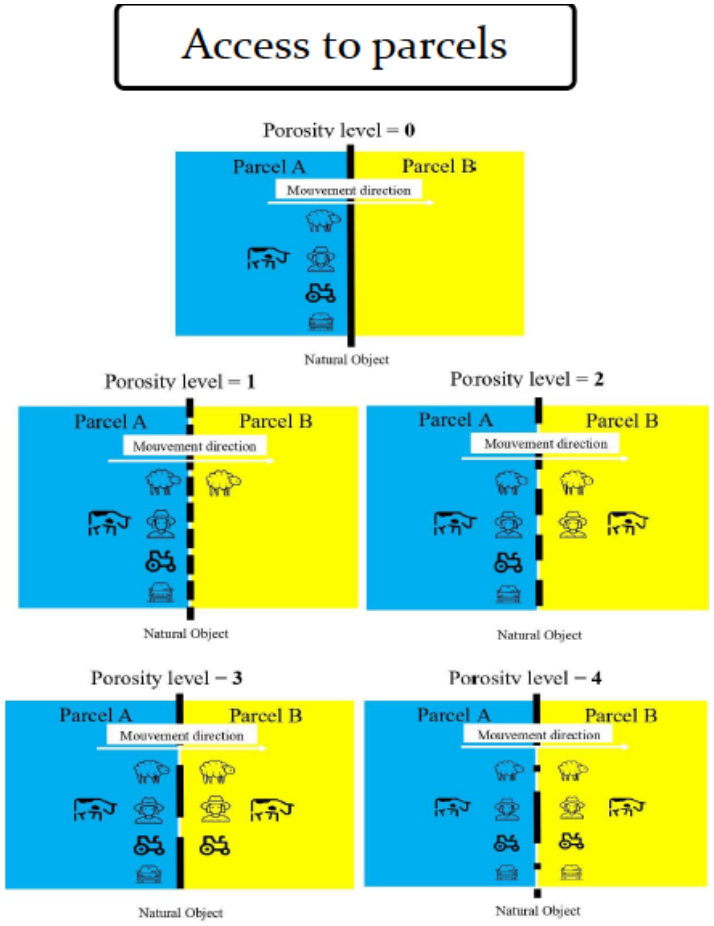
I. Largeur
II. Longueur
III. Porosité
IV. Matériaux (nature du revêtement du sol)

IV. Porosité :

0) Non perméable
1) Perméable pour Bétails.
2) Perméable pour humains
3) Tracteurs
4) Voiture

V. Matériaux:

- Eau
- Arbre/Arbuste
- Roche
- Sol en place
- Autres: a identifier selon la nature de l'objet



Identification des éléments physiques structurels du paysage (infrastructures) qui conditionnent ces mêmes agrégats

Paper project : Linear landscape elements link to crop allocation decision at the parcel level

Lineaire in field Data collelction

Lineaire data cleaning and subdivision

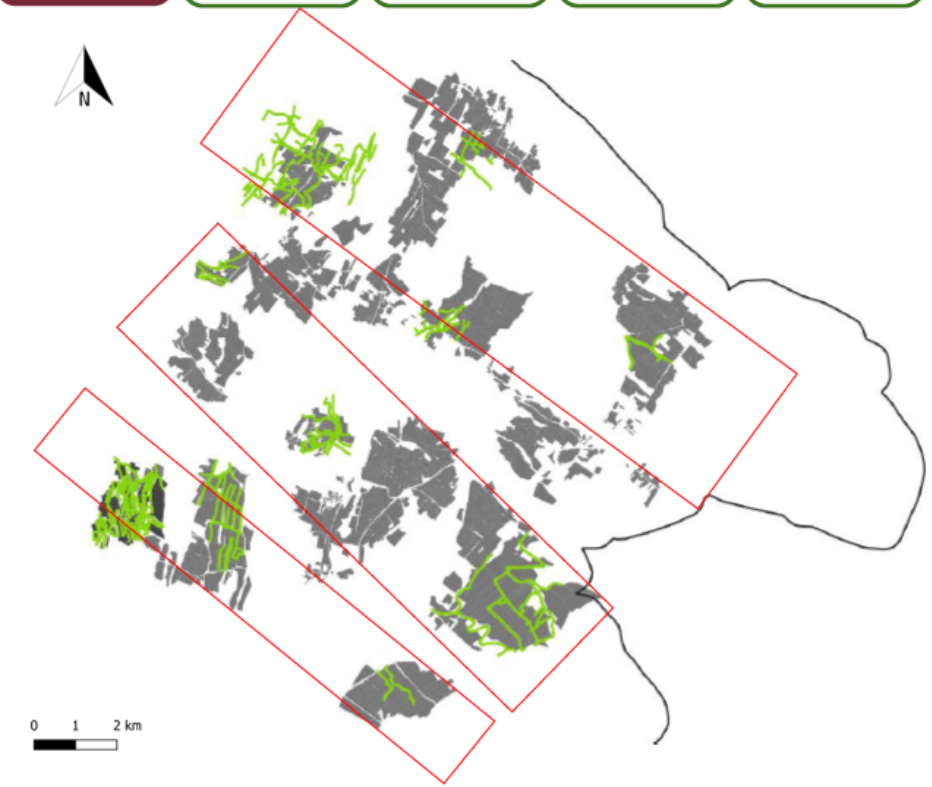
Triplet constitution P1-L-P2

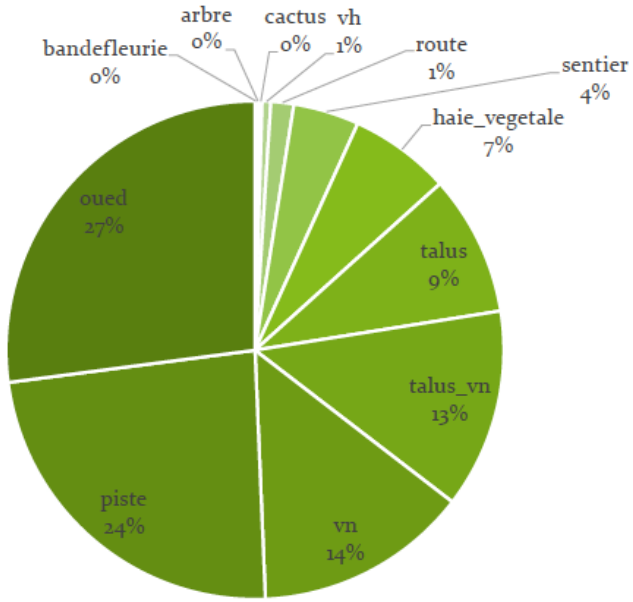
Permutation statistical test (Mental test)

Lineaire link on crop allocation decision

909 elements

Total length 80,057 Km





Perspectives

2020

- Poursuite caractérisation des motifs de distribution à l'échelle du BV
  - *Classification images 2020*
  - *Traitements géostatistiques sur images classées pour les cycles 2015-2016 à 2017-2019*
  - *Identification des éléments physiques structurels du paysage (infrastructures) qui conditionnent ces mêmes agrégats*
  - *Rédaction d'articles*

Task 1.2: landscaping features, agricultural practices and connectivities (leader: LARI).

Task 1.2 : Crop biomass

Crop biomass.

- Targets: times series of biophysical variables along with final yield.
- Methodological innovations: joint use of remote sensing data Sentinel-1 & 2 satellite data and TerraSAR-X satellite data along with statistical analysis.
- Partners: SUPCOM, INRGREF.
- Study areas: Cap Bon

Activities 2019-2020

Valorisation of Almira experiments

model the relationships between NDVI, NDWI and field measurements of aboveground biomass using Sentinel-2A products.

Participating to the M2GARSS 2020 conference

Alaya I., Zitouna-Chebbi R, Mekki I, Jacob F (2020) EVALUATION OF RATIO-BASED VEGETATION INDICES FOR ANNUAL CROPS' BIOMASS ESTIMATION. LEBNA WATERSHED, CAPBON, TUNISIA

Barbouchi, Alaya, Abdelfattah, Mekki, Zitouna-Chebbi, CORRELATION ESTIMATION BETWEEN CEREALS HEIGHT AND INSAR COHERENCE: A CASE STUDY OF THE LEBNA WATERSHED IN CAP-BON,TUNISIA

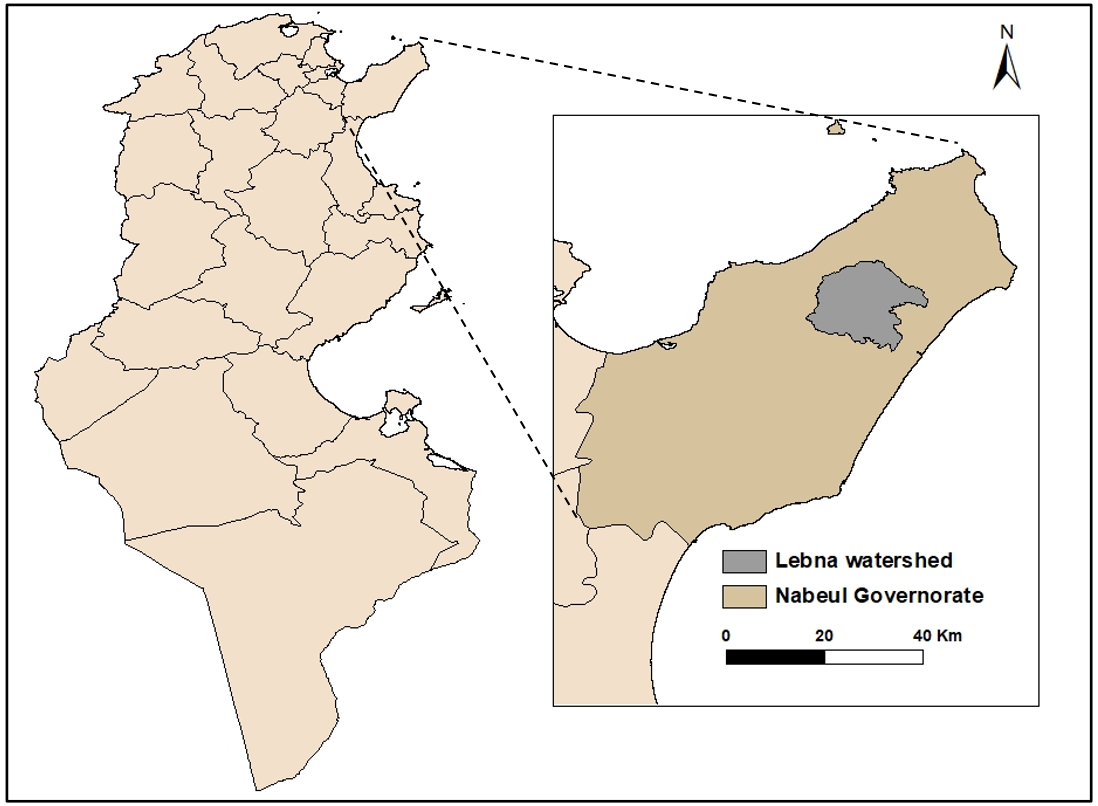
Start of collaboration with Supcom

New field compaign 2019-2020

Study area

Lebna watershed:

-



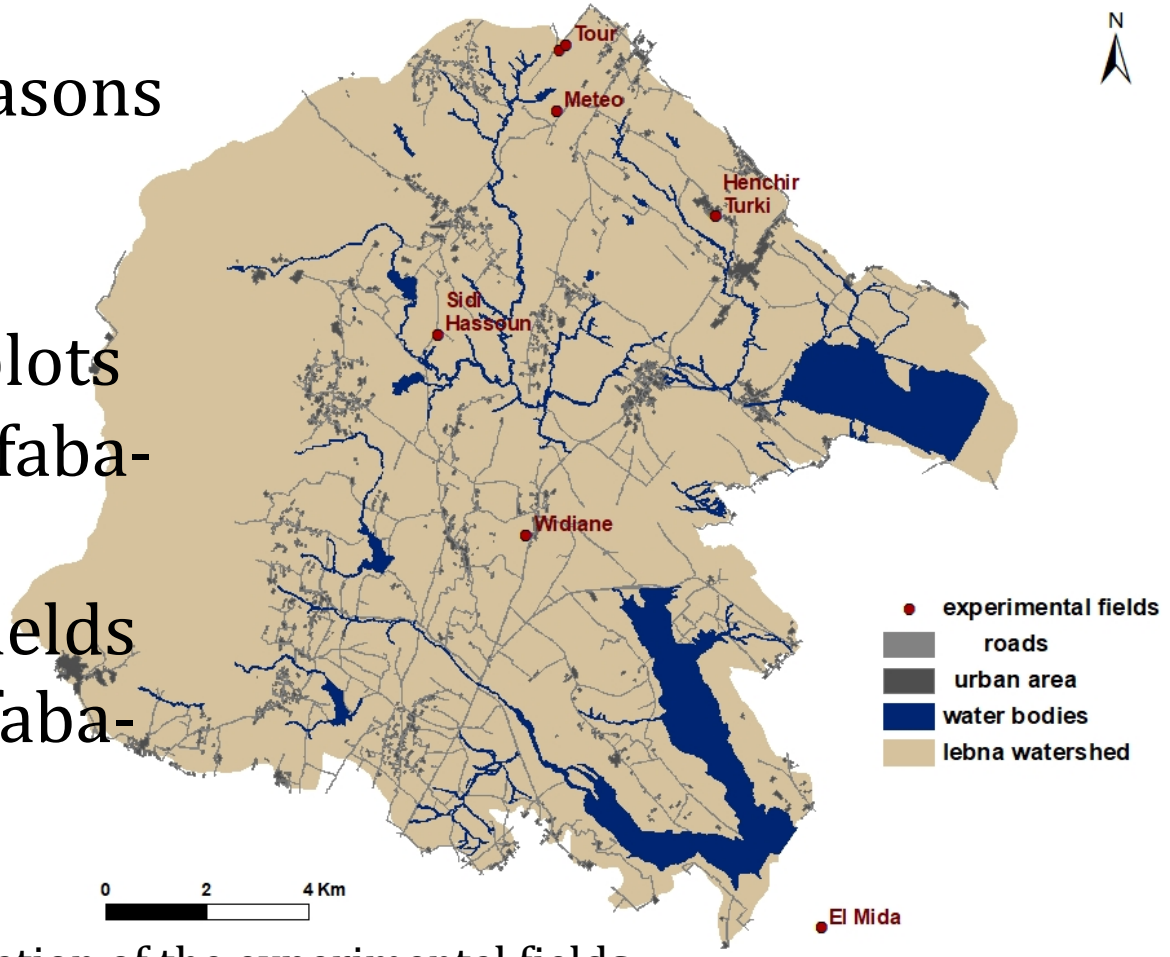
Location of the study area

Experimental fields

Six locations distributed across Lebna arable land with focus on annual crops.

Two agricultural seasons survey:

- ✓"2016/2017" : 4 plots of wheat and 1 of faba-bean
- ✓"2018/2019" : 5 fields of wheat and 1of faba-bean



Location of the experimental fields

Data Collection and Analysis

Observed data in situ:

- ✓aboveground biomass (fresh and dry)
- ✓crops' height
- ✓phenological stages survey

The observed data of fresh biomass were linearly interpolated to cover all the survey period with a daily step.

2-Sentinel-2A data covering the study area: six images for 2016-2017 growing season and four images during the 2018-2019 cropping season.

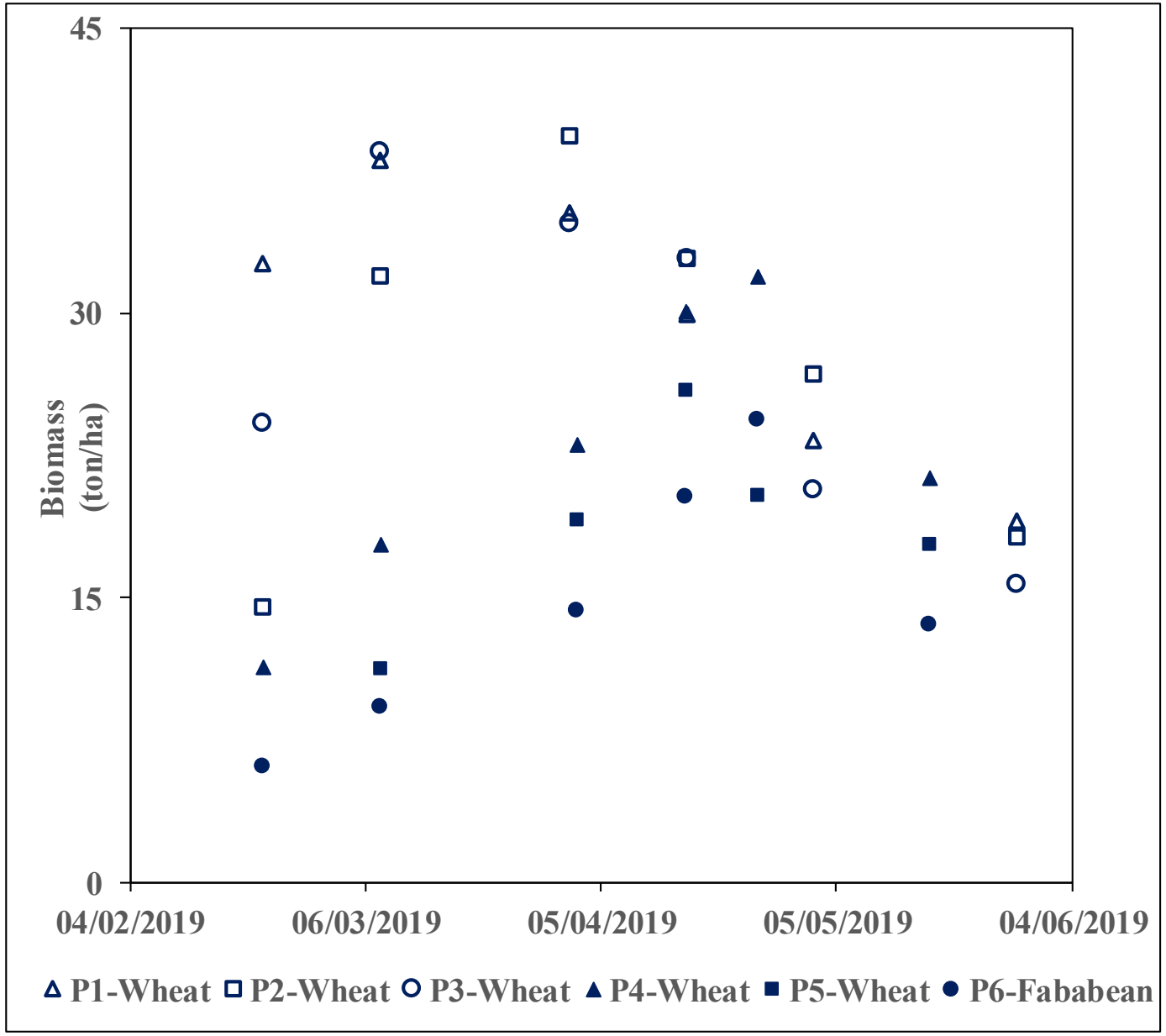
→ Creation of NDVI and NDWI maps for Lebna watershed area using R software

$$NDVI = (B8A - B4)/ (B8A + B4) \quad \text{eq 1}$$

$$NDWI = (B8A - B11)/ (B8A + B11) \quad \text{eq 2}$$

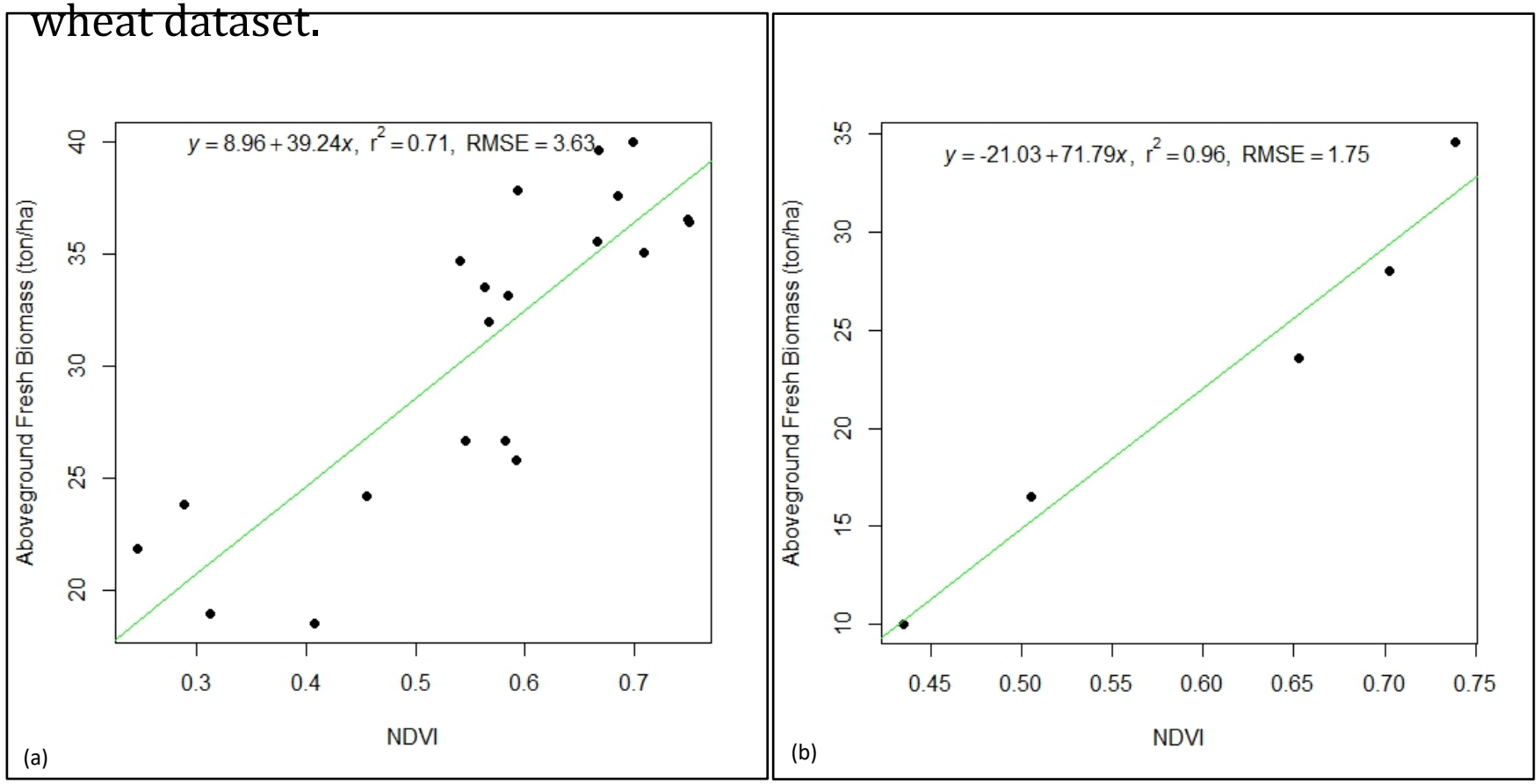
→ Application of a mask to represent only VI for the annual crops area

Temporal variation of fresh biomass during “2018/2019” season



Vegetation Indices-AGB relationship

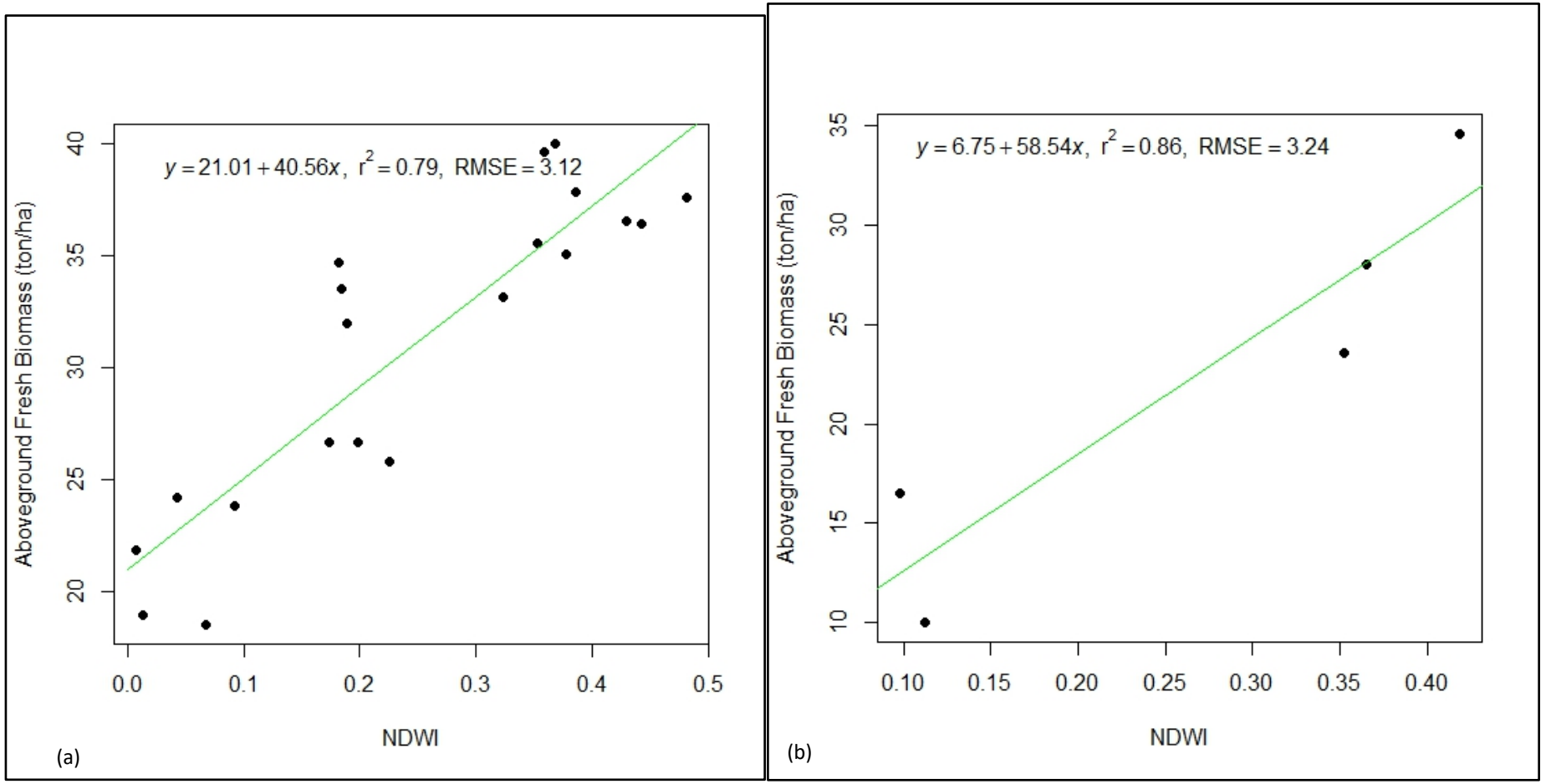
- For wheat plots: good correlation between the fresh AGB and NDVI values, with high RMSE value.
- For faba-bean, more significant correlation with a low RMSE. However, this could be related to the low number of observations compared to the wheat dataset.



Variation of the aboveground fresh biomass
of wheat (a) and faba-bean (b) according to NDVI values

3.3. Vegetation Indices-AGB relationship

Good correlation between the fresh AGB and NDWI values for wheat
and a significant relationship for faba-bean but with higher RMSE values



Variation of the aboveground fresh biomass
of wheat (a) and faba-bean (b) according to NDWI values

- The observed wheat and faba-bean biomass shows a strong correlation with NDVI values and NDWI values. However, an overestimation and an underestimation of crop biomass were detected at initial and later growth stages, which was particularly pronounced with the wheat crops.

- Spectral vegetation indices NDVI and NDWI represent a practical tool to determine the spatiotemporal variation of annual crops' biomass in Lebna watershed. However, the validation of these results might need the use of a larger dataset with more observations and the combination of sensors that may compensate the deficiencies and improve the NDVI prediction performance.

Perspective Altos

Field compaign 2020-2021 (Engineer ALTOS)

Deeper analysis with Sentinel 2 and spatialisation at Lebna watershed (PHD Eya Abdelghaffar 2020-2022)

and Estimation of biomass with both sentinel 1 (collaboration with SupCom)