

Bambey area, Djourbel region, Senegal

JECAM/GEOGLAM Science Meeting

Ottawa, Canada

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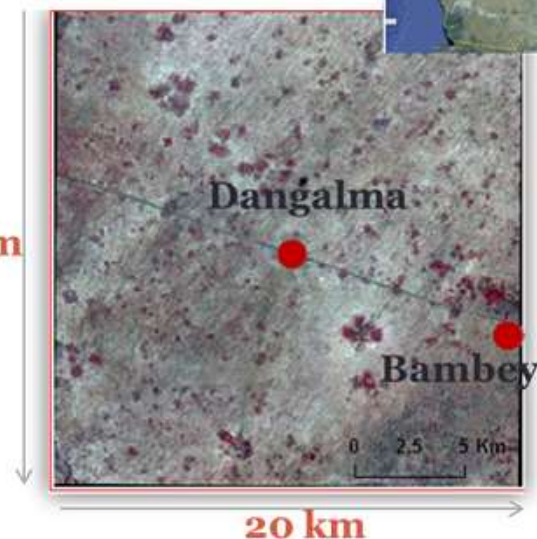
Joint Experiment for Crop Assessment and Monitoring



Site Description

- Dangalma, in the north of the Senegalese Peanut Basin;
- Sandy plain, 30 m mean elevation;
- Ferruginous tropical sandy soils (Joor and Deck soils) with a water table depth at 15 m below the soil surface;
- Agricultural tree parkland, dominated by two species of acacia combining with a millet and groundnuts rotation as cropping system;

Senegalese Peanut Basin



- Family farming : small area cultivation (around 4.65 ha), low productivity, animal traction;
- 20 km x 20 km study area around the Dangalma village (14° 43' 42'' N, 16° 33' 98'' E);
- Semi-arid climate with annual rainfall varying from approximately 200 mm to 600 mm, with more than 85% of the precipitation falling between August and October.

Project Objectives

- 1) Identifying habitat management for enhanced activity of natural enemies of insects pests of millet and groundnuts culture

-> Studying the effect of landscape composition and structure on the spatial distribution and abundance of insect pests in millet and groundnuts cultures.

- 2) Methodology

First step :

- **Crop identification and Crop Area Estimation**
- Crop phenology
- Tree species identification

Second step :

- Identifying the main natural enemies and their “host-plant”
- Measuring the presence and abundance of pest insects and their natural enemies

Third step :

- Studying the effect of landscape variable (composition, structure) on the natural regulation of insect pests in millet and groundnuts culture
- Identifying habitat management enhancing activity of natural enemies at a landscape scale

Earth Observation (EO) Data Received/Used

1) For crop identification and crop Area Estimation

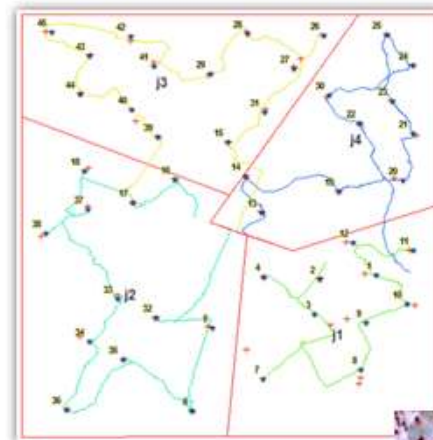
- Optical Pléiades satellite and Terra SARX sensors
- CNES and AirBus industry
- 4 Pleiades and Terra SARX scenes during the rainy season (July to October 2014)
- 1 scenes during the dry season (January or February 2015)

2) For tree species identification

- Optical WorldView2 satellite sensor
- Digital Globe
- 2 scenes during the dry season when trees are leafy

-> Challenges : Acquisition during the rainy season

In situ Data (2013 and 2014)



- **Landscape field data**

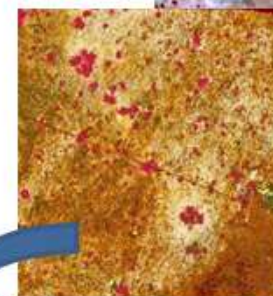
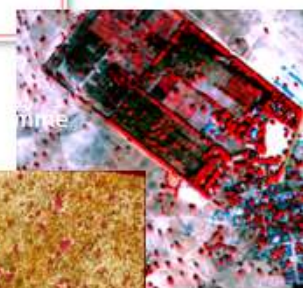
- In February 2013 : 250 crop plots and 427 trees
- In January 2014 : 241 crop plots and 345 trees
- Stratified sampling design close to sandy path

- **Entomological field data collected**

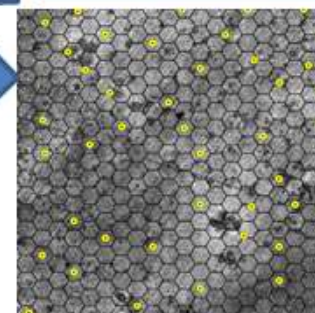
- 50 selected sites (50 millet and 50 groundnut fields)
- Stratified sampling design based on landscape variables
- Data collection during the rainy season into the 100 selected plots : abundance of pests insects, parasitism rates...
- Data collection during the dry season into the fruit of trees suspected to be host plants 5 (*Acacia Sp.*; *Tamarindus indica...*)

- **Farmer practices data :**

- seeding date, seed variety, treatments...



Environnemental index
combinaison



Centre IRLAND
12/08/2013

JECAM

Joint Experiment for Crop Assessment and Monitoring



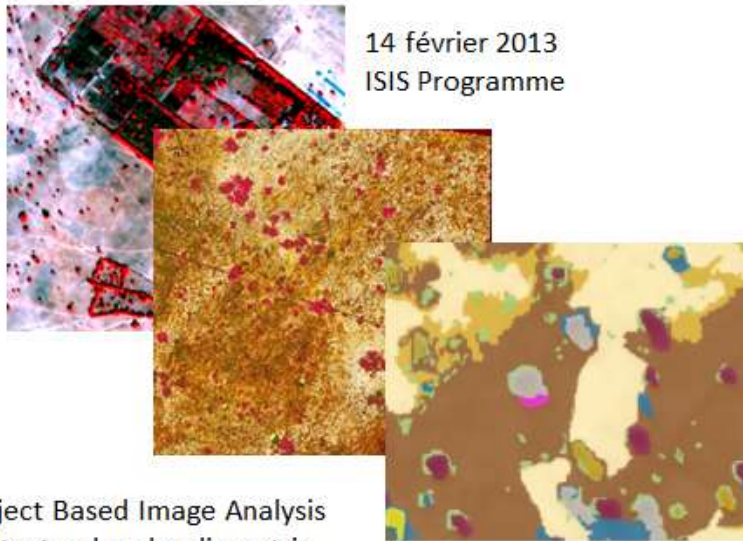
GROUP ON
EARTH OBSERVATIONS

Collaborations

- **Centre de Suivi Ecologique** (CSE) of Dakar
 - > field data collection and image processing
- **IRSTEA** of Montpellier for image processing
 - > image processing
- **ISRA, Thiès, Sénégal**
 - > insects observation and identification
- **Cirad** (UMR TETIS)
 - > modélisation to identify landscape management enhancing natural regulation of millet and groundnuts insect pests.

Landscape map derived from Pléiades

Goal : identifying the type of culture and natural vegetation, in 2013 and 2014, in Bambeï area



14 février 2013
ISIS Programme

Object Based Image Analysis on textural and radiometric index derived from the *Pléiades* Image

- Faidherbia
- Gulera
- Acacia seyal
- Tamarin
- Balanites
- Indéterminé
- Mil
- Arachide
- Sol nu
- Jachère

Map validation with field data



17 classes

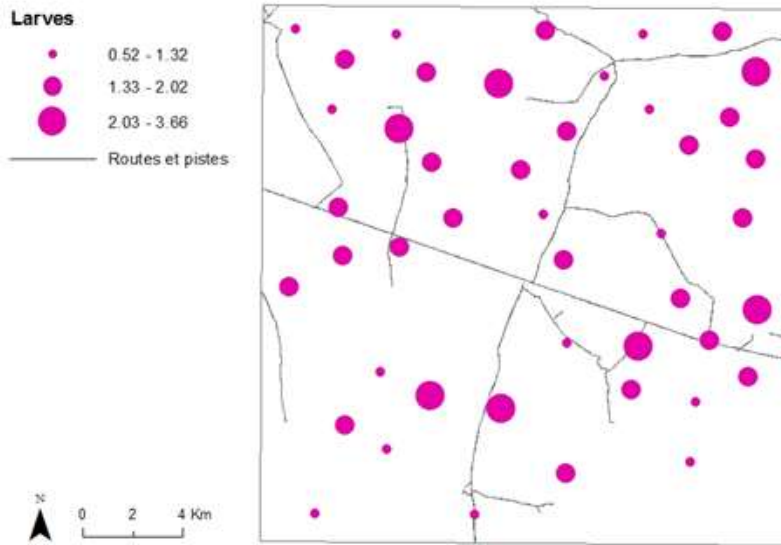
Tree species identification

Relevés de terrain	% de bon classement
<i>Manguier</i>	0 %
<i>Neem</i>	0 %
<i>Faidherbia albida</i>	6 %
Végétation indéterminée	14 %
<i>Tamarin</i>	17 %
<i>Acacia seyal</i>	20 %
<i>Baobab</i>	27 %
Jachère	31 %
<i>Balanites aegyptica</i>	38 %
Ombre	45 %
Arachide	46 %
Maraîchage	54 %
Mil	55 %
Zones urbaines	70 %
<i>Guiera senegalensis</i>	81 %
Pistes	83 %
Sol nu	100 %

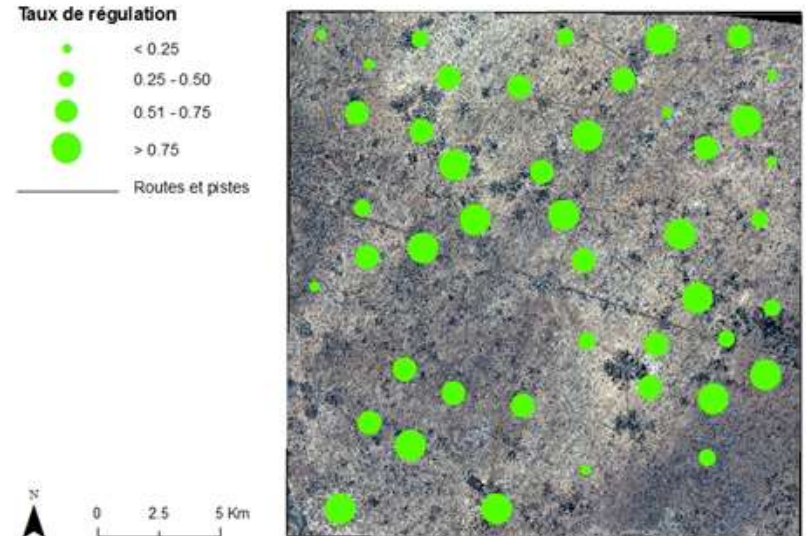
Results are moderately significant for tree species detection, except for *Guiera Senegalensis*, *balanites* and *baobab sp.*

Spatial heterogeneity of insects abundance and regulation in 2013

Nombre moyen de larves par épi *Heliocheilus albipunctella*



Biodiversity Service Index (BSI) *Heliocheilus albipunctella*



Perspectives

- Optical Pléiades image acquisition during the rainy season 2014 and 2015 to separate and map millet and groundnuts cultures (TRECS Project - ISIS Program)
- Terra SAR X acquisition during the rainy season 2014 (TRECS Project – Geosud Program)
- WorldView2 image acquisition to identify the tree species (Safse Project)
- Continue the field data collection of landscape, insects and cultural practices in 2014 and 2015
- Landscape approach to identify landscape variables favorable to the natural regulation of pests in millet and groundnut crops

