

LAND COVER GROUND REFERENCE DATA IN SÃO PAULO STATE, BRAZIL, TAKEN IN 2015

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INTRODUCTION

This document is meant as a guide to the dataset and gives an insight into the methodology of the acquisition of the measurements. If there are any questions, one can email me on r.a.molijn@tudelft.nl or ramolyn@gmail.com.

FOLDER AND FILE DESCRIPTION

For description of the methods and meaning of the measurement taken, see next section.

- /Validation data/
 - Directories with the ground reference data of land covers. Each directory contains three shapefiles and accompanying GIS files:
 - *Points Collected Mogi Guacu.csv: spreadsheet as created by the EpiCollect website (after renaming). See below how to obtain these spreadsheets.
 - *Points Collected Mogi Guacu.xlsx: the Excel version of the previous spreadsheet.
 - *Points Collected Mogi Guacu: this contains the reference data taken in the fields with the location taken by the mobile app EpiCollect (see next section for the description regarding this app), which is usually on or close to the road. The attribute table contains all the information taken in the field.
 - *Points Collected Mogi Guacu - Relocated: this contains the reference data taken in the fields with the location of the points manually relocated to the field of interest.
 - *Digitized fields: the field polygons manually digitized (see next section for more information). Note that these polygons are valid for the crop growth time span during which the reference data was acquired.
 - *Digitized fields_attributes: the digitized fields combined with the attribute information from the point shapefiles (spatial join), such that every field polygon contains the corresponding information as taken in the field.

The first shapefile (points) can be reproduced by taking the following steps.

Download the spreadsheets (.csv) of interest from:

- http://epicollectserver.appspot.com/project.html?name=LULC_Mogi (EpiCollect app)
- <http://epicollectserver.appspot.com/project.html?name=LULC> (EpiCollect app)
- http://plus.epicollect.net/LULC_TUdelft/LULC (EpiCollect+ app)

For the spreadsheets from the EpiCollect app:

- open the spreadsheet and if necessary make the selection based on the date (if multiple dates are present)

- change the format of the dateCreated to 'dd/mm/yyyy hh:mm:ss
- save as csv file and xlsx file
- upload the csv file to <http://converter.mygeodata.eu/> and simply convert the file to shapefile
- if necessary delete or modify any entry that has a lat and lon of 0 and does not contain the additional fields.

For the spreadsheets from the EpiCollect+ app:

- open the spreadsheet and replace the datetime column with a copy of the column from the copy-pasted table from the website
- the latitude and longitude columns should be renamed equal to the corresponding columns from EpiCollect
- the consecutive steps are similar to EpiCollect steps described above.

STUDY SITE AND DATA DESCRIPTION

The map delineating the overview of the land cover study area is illustrated in FIGURE 1. TABLE 1 shows the details of the reference data acquisition.

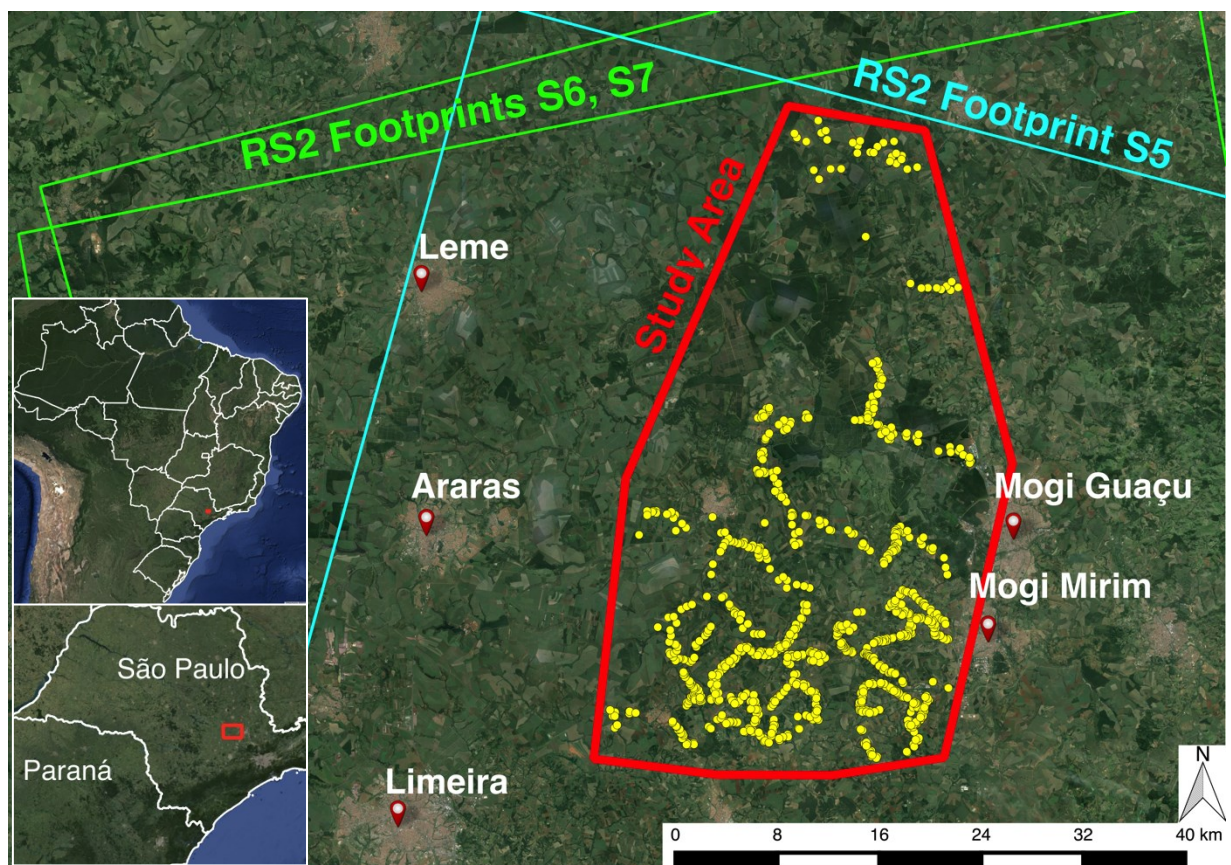


FIGURE 1: OVERVIEW OF STUDY AREA 1 WITH THE RADARSAT-2 (RS2) FOOTPRINTS USED FOR THE TRAINING AND VALIDATION OF THE LAND COVER-MONITORING MODEL. THE YELLOW DOTS INDICATE THE VISITED FIELDS.

DATE	FIELDS	DOMINANT LAND COVERS
06/05/2015	90	CITRUS, CORN, EUCALYPTUS, NATIVE FOREST, PASTURE, SUGARCANE
13/05/2015	62	CITRUS, CORN, MANDIOCA, PASTURE, SOIL, SUGARCANE
15/05/2015	106	CITRUS, CORN, MANDIOCA, PASTURE
27/05/2015	107	CITRUS, CORN, PASTURE, SUGARCANE

29/05/2015	103	CITRUS, MANDIOCA, PASTURE, SOIL, SUGARCANE
01/06/2015	140	CITRUS, CORN, MANDIOCA, NATIVE FOREST, PASTURE, SUGARCANE
19/10/2015	51	CITRUS, MANDIOCA, PASTURE, SOIL, SUGARCANE
17/11/2015	89	CITRUS, CORN, EUCALYPTUS, PASTURE, SOIL, SOYBEAN, SUGARCANE
19/11/2015	38	CORN, SOYBEAN
24/11/2015	18	CITRUS, PASTURE, SUGARCANE
TOTAL	804	

TABLE 1: OVERVIEW OF LAND COVER REFERENCE FIELD VISITS

The following information was captured at each reference field measurement:

- Location (GPS point)
- Crop type:
 - Sugarcane
 - Corn
 - Grassland
 - Citrus
 - Eucalyptus (also from shapefile)
 - Mandioca
 - Native
 - Bare soil
 - Others: banana, flowers, potato, avocado/mango, coffee
- Vegetation stage (Seeding, Vegetative, Mature/Flowering, Ripening)
- Height
- Notes
- Photo

On the EpiCollect websites mentioned earlier the maps can also be loaded (may take a while) to see the unprocessed collected points spatially. From the acquired tables a shapefile is constructed, which is then used in GIS software (QGIS) for drawing the borders of the fields using Google Earth imagery and recent Landsat-8 NDVI scenes. An example of one digitized field campaign is illustrated in FIGURE 2.

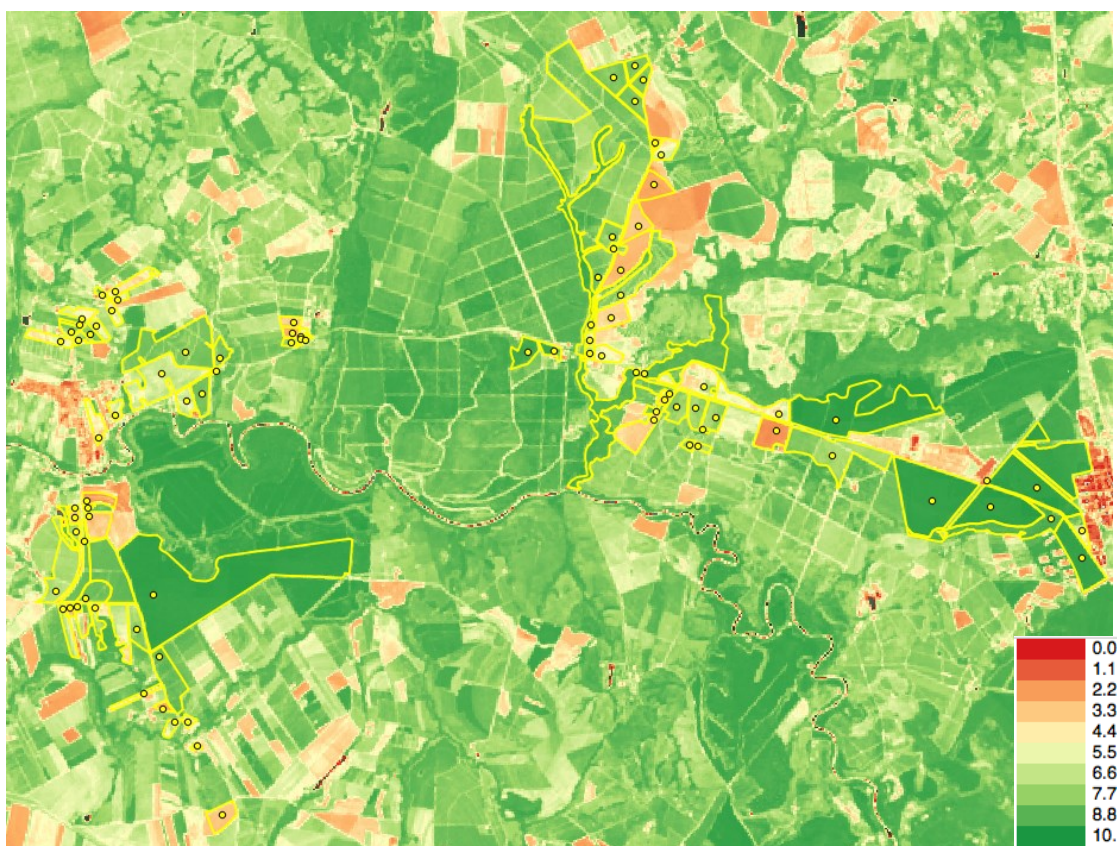
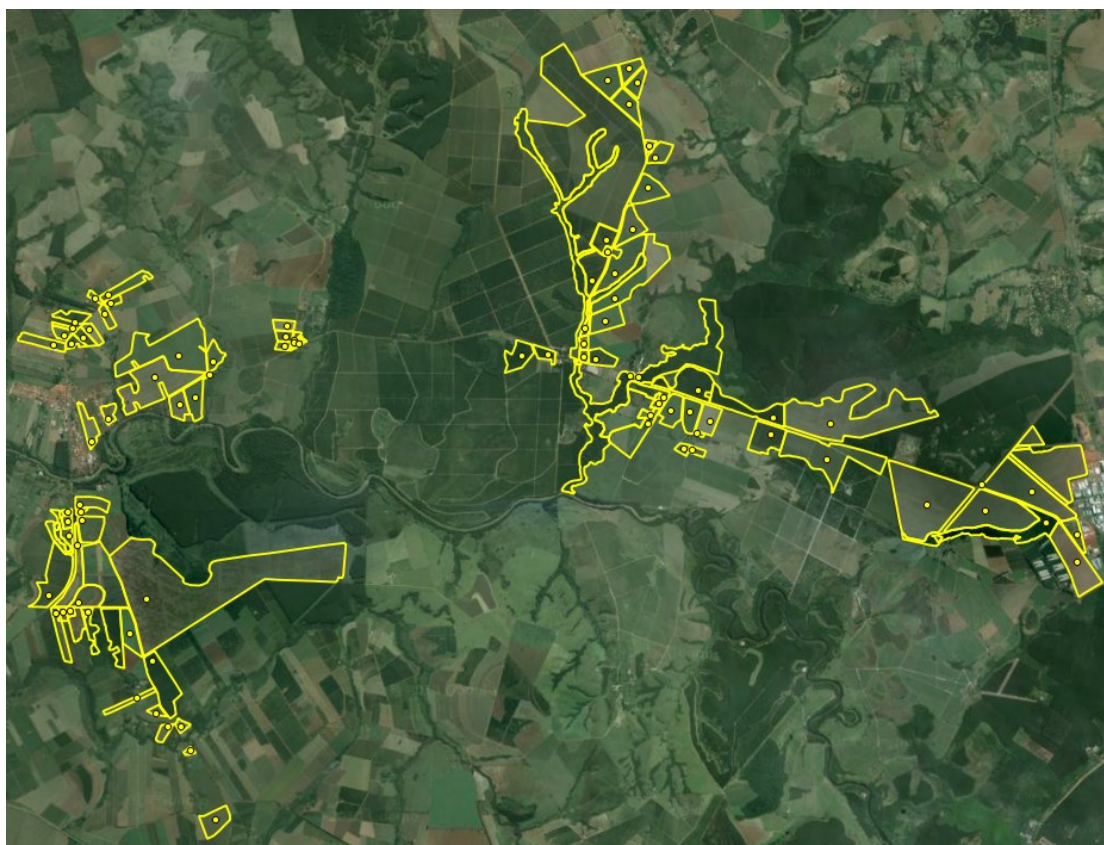


FIGURE 2: DIGITIZED FIELDS (TOP) BASED ON VISUAL INTERPRETATION OF THE IN-FIELD COLLECTED DATA, LANDSAT NDVI IMAGES (AN EXAMPLE IS SHOWN AT THE BOTTOM) AND GOOGLE EARTH IMAGERY (BACKGROUND IMAGE IN THE TOP IMAGE). THE NDVI COLORBAR IS SHOWN IN THE LOWER RIGHT OF THE BOTTOM IMAGE.

After digitalization the time span has to be defined for which the ground validation data is valid (i.e. start of growth and end of growth). Also the historic land use (2003-2014) has to be identified for every polygon in order to make a long temporal training and validation set. For these two parts we developed a MATLAB tool, see FIGURE 3.

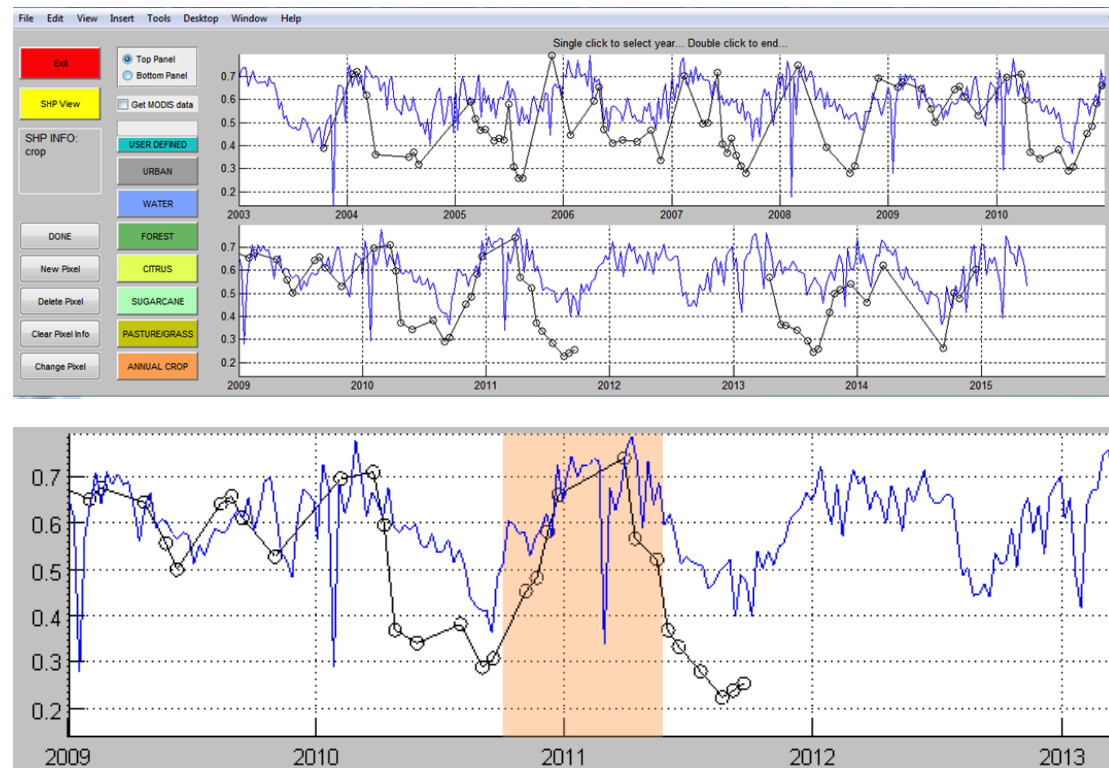


FIGURE 3: MATLAB TOOL DEVELOPED FOR MANUAL CREATION OF TRAINING AND VALIDATION DATA. THE TRAINING TOOL WITH USER BUTTONS (TOP) AND AN EXAMPLE OF AN ANNUAL CROP ASSIGNMENT (BOTTOM) WHEREBY THE SPECIFIED TIME SPAN IS HIGHLIGHTED IN ORANGE.

The tool shows the Landsat (blue line) and MODIS (black line) NDVI data from 2003 to 2015. For every period in time a class can be assigned. We are currently in the process of doing this for a large number of fields.

The remote sensing acquisition scheme, along with the field campaign dates, is shown in FIGURE 4. The ESA granted 20 standard Dual Pol (DP, HH+HV) Radarsat-2 images, with the first image acquired on 04 April 2015. In principle, one beam was selected (S7) with a revisit period of 24 days. However, for the transition between summer crops and winter crops in April and September also beam S6 was ordered to improve the temporal coverage. From the 20 DP images 2 UltraFine single pol (UF, HV) images were requested and approved. These were acquired over a sugarcane study area in the west of São Paulo state for comparing very high-resolution radar backscatter values with very high-resolution harvest yield information. Since each of these UF images count for two DP images in total 16 Radarsat-2 DP images were acquired over the land cover study area.

In addition to the Radarsat-2 images, Sentinel-1 images are also acquired from 26 October 2014 onwards. Sentinel-1 has a planned revisit time of 12 days and acquires in ExtraWide mode (EW) over this specific study area.

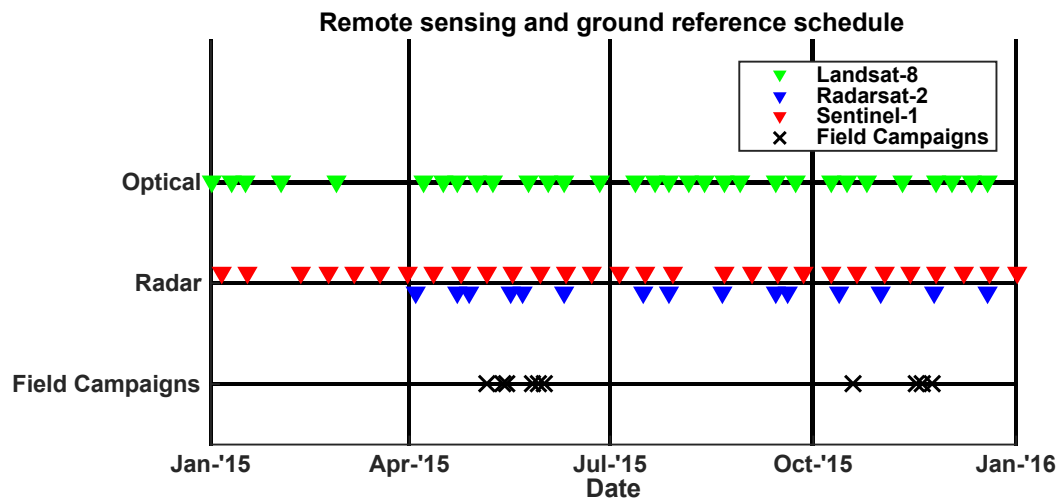


FIGURE 4: REMOTE SENSING AND FIELD CAMPAIGNS ACQUISITIONS SCHEME FOR THE LAND COVER RESEARCH.