

METADADOS DO ENTREGÁVEL 2.2 – BASE DE DADOS DE REFERÊNCIA EM FORMATO GEOPACKAGE PARA UMA TILE SENTINEL-2 SOBRE PORTUGAL CONTINENTAL

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1 Introduction

In this document, we present the metadata related to the Deliverable 2.2 of the project "Desenvolvimento de mapas de perdas recentes de floresta e mato em Portugal derivados de imagens de satélite." This project is conducted under Contract No. 3044, an agreement between the Direção Geral do Território and the Instituto Superior de Agronomia. Deliverable 2.2 focuses on creating a reference database in ESRI Shapefile or Geopackage format for a Sentinel-2 tile over mainland Portugal. The data discussed herein relates specifically to the Geopackage and includes a detailed description of the original database provided by The Navigator Company.

The deliverable consists in this report (metadata) of the reference database which consists in the 4 following files (which are described in detail in Section 3). The file names are a concatenation of "BDR" (for "base de dados de referência"), with "NVG" (which stands for The Navigator Company), "S2" for Sentinel-2 since the data base

includes information derived from the Sentinel-2 collection over the NVG parcels, “V01” which indicates the product version, and a suffix that describes the contents of the “csv” file. The geopackage file contains the geographic location of all subparcels. Each subparcel is identified by an “id” attribute that permits to relate the geopackage with each one of the three csv tables.

Name	Status	Date modified	Type	Size
 BDR_NVG_S2_V01.gpkg	 	04/07/2024 10:30	GPKG File	29 272 KB
 BDR_NVG_S2_V01_all_events.csv	 	04/07/2024 10:31	Microsoft Excel Com...	17 258 KB
 BDR_NVG_S2_V01_all_events_tile29TNE.csv	 	04/07/2024 10:32	Microsoft Excel Com...	2 376 KB
 BDR_NVG_S2_V01_median_NDVI.csv	 	04/07/2024 10:31	Microsoft Excel Com...	43 123 KB

In Section 4, several identified limitations of the current database version (version V01) are identified and discussed. The goal is to reduce the temporal uncertainty on the change detection reference dates in the next version of this product. Instead of improving V01 only for a specific tile, we analyze overall limitations of the current product and directions for improvement to be applied to the whole mainland Portugal towards future deliverable E2.3.

2 Input Data

2.1 The Navigator Company Database

The original dataset primarily consists of geospatial information encapsulated within a geopackage format. This geopackage includes several key components, including a polygon shapefile delineating forested areas in Continental Portugal, and two tabular datasets to complement the geospatial information.

The dataset is structured around parcels, with each parcel being uniquely identified by an attribute referred to as ‘id_gleba’. This attribute serves as a primary key for linking geospatial and tabular data.

2.1.1 Geospatial component

NVG_2015_2023_Proprios_clean shapefile: this shapefile contains features representing forest areas. Each feature is associated with information regarding plantation dates, cycle, rotation, and types of occupation – Eucalipto, Pinheiro manso, Pinheiro bravo and Outros Pinheiros – as well as the area of each parcel. The attributes of the features are presented in Table 1.

Table 1- Attributes of the NVG_2015-2023_Proprios_clean shapefile from the original database

Attribute	Data type	Description
cod_un	String	Management unit code
cod_talhao	String	Parcel code
id_gleba	String	Unique identifier (Management unit code + parcel code)
ciclo	Integer	Plantation cycle
rotacao	Integer	Nr of rotation within the plantation cycle

dt_referen	Date	Start date of rotation
dt_plant	Date	Start date of the plantation cycle
ocupacao	String	Dominant species and form of plantation
idade_ref	Float	Years since reference date (age of trees)
idade_plant	Float	Years since plantation date (plantation cycle age)
area_ha	Float	Parcel's area in hectares
geometry	MULTIPOLYGON	multipart geometries

2.1.2 Tabular datasets

Exploracao_NVG_2015-2023_Proprios_clean table: details about clear-cut events that have occurred within the forest parcels. Each entry includes the operations dates and description. The operation in this table includes clear-cuts and transport of the cut wood (annex 2, table 2). The attributes of this table are presented in Table 2.

Table 2 - Attributes of the Exploracao_NVG_2015-2023_Proprios_clean from the original database

Attribute	Data type	Description
Id Projeto	Integer	Management unit code
Talhão	String	Parcel code
Id Gleba	String	Unique identifier (Management unit code + parcel code)
Data Real	String	Operation start date
Atividade	String	Type of operation
Manejo	String	Operation management

Silvicultura_NVG_2015-2023_Proprios_clean table: provides comprehensive information on forestry operations events conducted within forest parcels. Encompassing 68 operations, the dataset delineates activities like plantation, plowing, furrowing, selection of rods, clearing, and vegetation cleaning (annex 2, table 3). The attributes of this table are presented in Table 3.

Table 3 - Attributes of the Silvicultura_NVG_2015-2023_Proprios_clean from the original database

Attribute	Data type	Description
Id	Integer	
Data Operação	String	Forestry operation start date
Id Projeto	Integer	Management unit code
Talhão	String	Parcel code
Id_gleba	String	Unique identifier (Management unit code + parcel code)
Desc. Atividade	String	Type of forestry operation

2.2 Sentinel-2 Image Collections

For the specified time and spatial frame, data from the Copernicus Sentinel-2 (S2) image collection was retrieved, focusing specifically on the Normalized Difference Vegetation Index (NDVI). The "COPERNICUS/S2_HARMONIZED" image collection

from the Earth Engine Datasets was utilized, employing the "Cloud Score+" filter to minimize cloud interference. Additional details can be found in Annex 1.

3 Product

This section provides an in-depth overview of the tables associated with our deliverable. It includes detailed descriptions of the following tables:

BDR_NVG_S2_V01 (fid, id_gleba, ocupacao, id, first_start_date, first_end_date, nr_empty_cells, nr_non_empty_cells, nr_s2_dates, date_of_biggest_drop, first_estimated_date, area_ha_su)

BDR_NVG_S2_V01_median_NDVI (cod_un, cod_talhao, id_gleba, id, date, median)

BDR_NVG_S2_V01_all_events (id_gleba, id, data{i}, data_estimada{i}, atividade{i})

3.1 NDVI from S2 Image Collections

This deliverable contains a csv file with the NDVI median values for each sub-parcel per available date. This data was sourced from Google Earth Engine (Annex 1).

3.1.1 BDR_NVG_S2_V01_median_NDVI.csv

The CSV file has the following attributes.

Table 4 - Attributes of the Median_NDVI_Per_Polygon_All_Glebas.csv

Attribute	Data type	Description
cod_un	String	Management unit code (e.g., 50002)
cod_talhao	String	Parcel's unique identifier (e.g., T001_EG)
id_gleba	String	Parcel's identifier (Management unit code + parcel code)
Id	String	unique identifier of each sub-parcel (based on id_gleba) The suffix after the id_gleba is dependent on the number of sub-parcels (e.g., 50002-T001_EG)
Date	String	Date of Sentinel-2 image (format 'YYYY-MM-DD')
median	Float	Median values of NDVI (1)

(1) NoData values: NULL

3.2 Joined Data from The Navigator Company and Sentinel-2 Image Collection

To enhance the original database, it was decided to integrate Sentinel-2 NDVI median values for each sub-parcel. The deliverable comprises a geopackage containing 13418 polygons in ESRI Shapefile vector format, representing all subparcels from The Navigator Company's database that now includes NDVI data. The files included are:

BDR_NVG_S2_V01.gpkg

- Nvg_singlepart_sub_talhao.shp

CSV files:

- BDR_NVG_S2_V01_all_events.csv

3.2.1 BDR_NVG_S2_V01.gpkg

The geographical data set “Nvg_singlepart_sub_talhao.shp” includes all subparcels of The Navigator Company dataset. More precisely, each feature of this dataset corresponds to a subparcel of the input geographic dataset. The attributes of the singlepart polygons are described in Table 5. The coordinate reference system is EPSG:3763 ETRS89-PT-TM06.

Table 5 - Attributes of the nvg_singlepart_sub_talhao shapefile

Attribute	Data type	Description
Fid	Integer	unique identifier of each row on the attribute table (from 1 to 13418)
Id_gleba	String	Parcel's unique identifier (Management unit code + parcel code) (e.g., 50002-T001_EG)
Ocupacao	String	Dominants vegetation species in each parcel (2)
Id	String	unique identifier of each sub-parcel (based on id_gleba) The suffix after the id_gleba is dependent on the number of sub-parcels (e.g., 50002-T001_EG_01)
First_start_date	String	date of the first clear cut from The Navigator Company for the parcel (format 'YYYY-MM-DD')
First_end_date	String	date of the last clear cut from The Navigator Company for the parcel (format 'YYYY-MM-DD')
Nr_empty_cells	String	number of Sentinel-2 dates for which NDVI median is null (from 0 to 29)
Nr_non_empty_cells	String	number of Sentinel-2 dates for which NDVI median is not null (from 1 to 194)
Nr_s2_dates	String	total number of Sentinel-2 dates for each parcel within the defined time interval (from 1 to 205) (3)
Date_of_biggest_drop	String	Sentinel-2 date where the biggest drop in NDVI median values occurred. (format 'YYYY-MM-DD') (4)

First_estimated_date	String	Date on the Navigator dataset right before the date of biggest NDVI drop (format 'YYYY-MM-DD') (5)
Area_ha_su	Float	sub-parcel's total area, in hectares (from 0.001 to 45.27)
geometry	POLYGON	single part geometries in EPSG:3763 ETRS89-PT-TM06 coordinates.

(2) Attributes: Eucalipto dalrympleana; Eucalipto delegatensis; Eucalipto globulus; Eucalipto globulus + Acácias; Eucalipto globulus + Afloramentos Rochosos; Eucalipto globulus + Medronheiro; Eucalipto globulus + Pinheiro Bravo; Eucalipto globulus + Sobreiro; Eucalipto globulus disperso + Matos; Eucalipto grandis x viminalis; Eucalipto gunnii; Eucalipto maidenii; Eucalipto nitens; Eucalipto não identificado; Eucalipto viminalis

(3) This interval is defined based on the first and last clear-cut dates from The Navigator Company adding 60 days to the last date and subtracting 60 days to the first day to ensure that S2 images cover all the clear cuts time intervals.

$$\text{Nr_s2_dates} = \text{nr_empty_cells} + \text{nr_non_empty_cells}$$

Note that the number of S2 dates is equal for the sub-parcels of the same parcel. However, the number of empty and non-empty cells may vary depending on the sub-parcel.

(4) This date is determined by calculating the differences between NDVI values on consecutive S2 image dates and identifying the largest drop among them. The biggest drop date is the most recent date of the two dates (Figure 1).

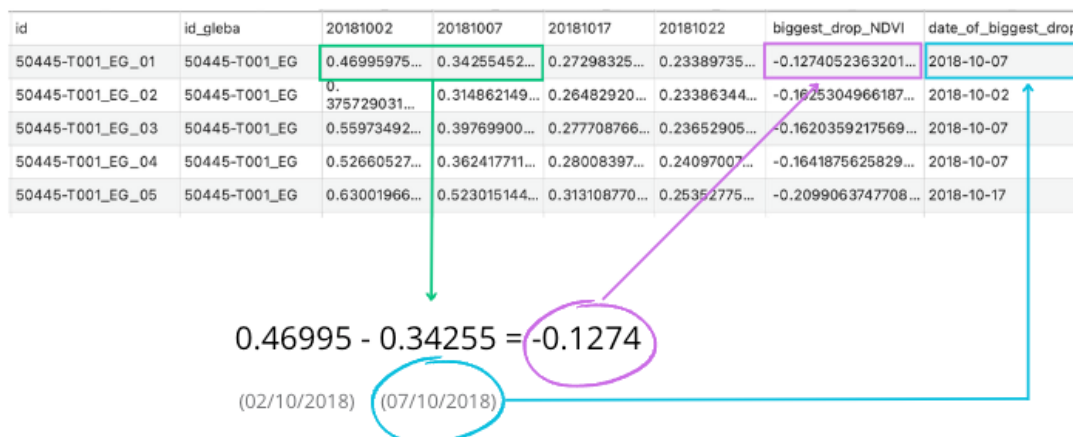


Figure 1 - Diagram of the calculation process of the date of biggest NDVI drop. As an example, is the NDVI table for id_gleba 50445-T001

The ideal scenario is for the date of the largest NDVI drop to fall within the time interval of the start and end dates provided by The Navigator Company. However, there are some particular cases where either there is not enough spectral information from Sentinel-2 to identify precisely the date of the largest drop, or that date does not match with the information provided by The Navigator Company. We discuss those cases below.

- 1) Empty date of biggest NDVI drop – this field is empty when specific conditions within the sub-parcel are met. Lack of clear Sentinel-2 signal may prevent the computation of the median NDVI for the subparcel. Additionally, if there are no NDVI values available for two consecutive dates within the sub-parcel, we consider that the signal is not clear enough and, as a result, the biggest_drop_ndvi field remains empty (Table 6).

Table 6 - NDVI table for id 53002-T013_EG_86, as an example of empty date of biggest NDVI drop. There are no consecutive NDVI values, so it is impossible to calculate the NDVI drop and respective date.

	id	date_20190917	date_20190919	date_20190927	date_20190929	date_20191002	biggest_drop_NDVI	date_of_biggest_drop
119	53002-T013_EG_86	0.188505747...		0.212401055...		0.21765498...		

- 2) Drop of NDVI before first clear-cut date - when the date of the biggest drop occurs before the first clear-cut date provided by The Navigator Company, the estimated clear-cut date is null because the drop is outside the clear-cut time interval (Table 7).

Table 7 - NDVI table for id_gleba 53010-T001_EG where the first clear-cut date is 2018-04-30 and the last clear-cut date is 2018-05-28. There is no estimated date for 3 of the sub-parcels below because the date of biggest NDVI drop occurs before of the first clear-cut date – dates inside the red rectangle.

	id	date_20180721	date_20180724	date_20180726	biggest_drop_NDVI	date_of_biggest_drop	estimated_date
3	53010-T001_EG_03	0.23324421...	0.24320454...	0.23728073...	-0.1172637912189742	2018-07-11	2018-05-28
4	53010-T001_EG_04	0.22993093...	0.23868272...	0.249169014...	-0.06464741593720452	2018-04-17	
5	53010-T001_EG_05	0.225608117...	0.23906248...	0.232919307...	-0.1815523354383865	2018-04-20	
6	53010-T001_EG_06	0.26271304...	0.27601880...	0.26440653...	-0.11231142863341581	2018-04-20	

- 3) Drop of NDVI after the last clear-cut date – If the largest drop in NDVI occurs after the last clear-cut date provided by The Navigator Company, an estimation of the clear-cut date is made. However, this estimated date may not accurately reflect reality, particularly if it is significantly later than the end date given by The Navigator Company (Figure 4). This suggests that the parcels are being cut later than the reported last clear-cut date.

(5) This attribute is one of the dates from The Navigator Company's dataset. The first estimated date is the date on the original dataset right before the date of biggest NDVI

drop (Table 8). When the date of biggest drop is null, the estimated clear-cut date is also null. Figure 2 represents a flowchart for estimating clear-cut dates using the NDVI data available.

Table 8 - NDVI table for id_gleba 50002-T001_EG. The dates of biggest NDVI drop are S2 dates and estimated dates are dates from the original Navigator Company's dataset

id	first_start_date	first_end_date	date_of_biggest_drop	first_estimated_date
50002-T001_EG_06	2021-09-06	2022-01-10	2021-12-30	2021-12-27
50002-T001_EG_07	2021-09-06	2022-01-10	2021-12-30	2021-12-27
50002-T001_EG_09	2021-09-06	2022-01-10	2021-12-30	2021-12-27
50002-T001_EG_10	2021-09-06	2022-01-10	2021-12-30	2021-12-27
50002-T001_EG_01	2021-09-06	2022-01-10	2021-11-05	2021-11-01
50002-T001_EG_02	2021-09-06	2022-01-10	2021-10-26	2021-10-25
50002-T001_EG_03	2021-09-06	2022-01-10	2021-10-26	2021-10-25

dates S2 ←
 dates Navigator ←

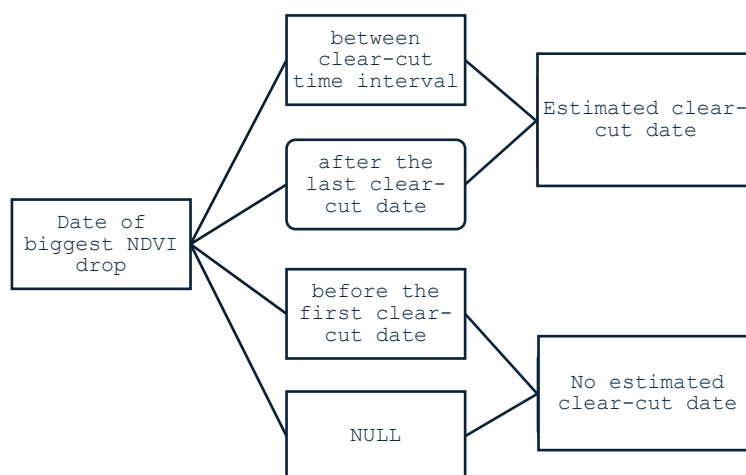


Figure 2 - Flowchart for Estimating Clear-Cut Dates Using NDVI Data

3.2.2 BDR_NVG_S2_V01_all_events.csv

The data frame BDR_NVG_S2_V01_for_all_events.csv compiles tabular data from the Navigator Company regarding clear-cuts and forestry operations. Organized chronologically by parcel identifiers (id_gleba), it details events on specific dates. This structured format allows for comprehensive tracking and analysis of forestry activities over time. Table 9 shows the attributes of this table.

Table 9 - attributes of df_expanded_updated_for_all_id_glebas.csv

Attribute	Data type	Description
Id_gleba	String	Parcel's unique identifier (Management unit code + parcel code) (e.g., 50002-T001_EG)
Id	String	unique identifier of each sub-parcel (based on id_gleba) The suffix after the id_gleba is dependent on the number of sub-parcels (e.g., 50002-T001_EG_01)
Data{i}	String	date of the forestry and cutting activities from The Navigator Company. As this dataset is organized chronologically, the {i} represents the index of the activities (format 'YYYY-MM-DD')
Data_estimada{i}	String	represents the estimated clear-cut date of each sub-parcel. The value 1 means the clear-cut happened on the corresponding date {i}. (format 'YYYY-MM-DD') (6)
Atividade{i}	String	type of forestry activity from The Navigator Company database (7)

(6) This date is the same as the 'first_estimated_date' attribute on the nvg_singlepart_sub_parcel.shp.

(7) The attributes of the 'atividade{i}' columns are described in tables 1,2 and 3.

Note: data{i} and atividade{i} represent pairs of date and forestry activities per parcel. As an example, data1 is the date on which atividade1 happened. As the goal is to have the database on a sub-parcel level, the data_estimada column will be created based on Sentinel-2 imagery to associate a clear-cut date to each sub-parcel.

4 Product Limitations

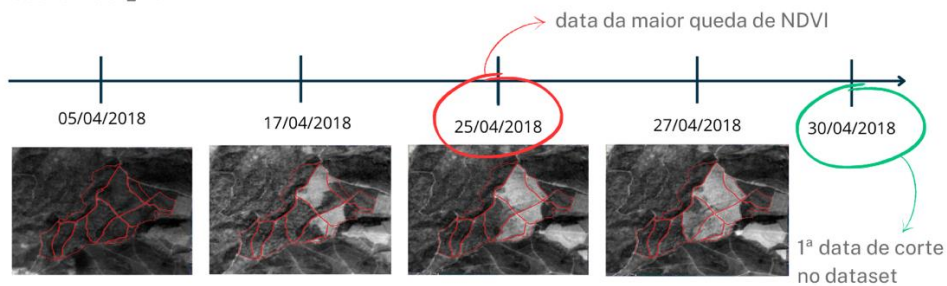
Due to limitations on the data provided by The Navigator Company, the database presents some shortcomings that are discussed in this section. Further investigation is required to improve the product by narrowing down the uncertainty intervals for vegetation loss events. More specifically, the goal will be to redefine variable First_start_date and First_end_date in Table 5 by analyzing further Sentinel-2 time series, as described in the subsections below.

4.1 Clear-cuts before the first recorded clear-cut date

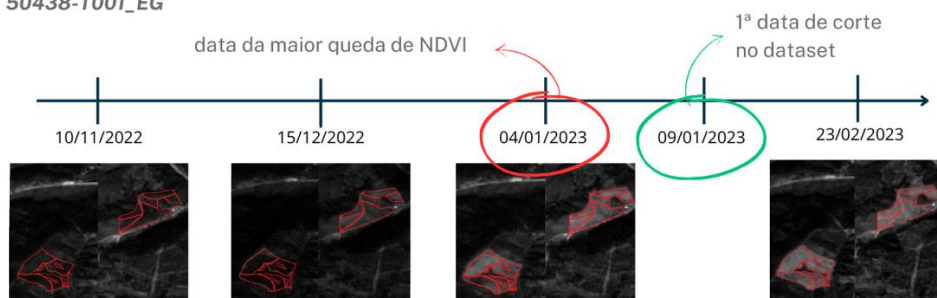
In the case where the date of the most significant NDVI drop preceded the first recorded clear-cut date for a given parcel in the dataset, an estimated clear-cut date could not be determined. This stands on as a limitation and highlights the uncertainty of the clear-cut dates recorded by The Navigator Company. Figure 3 shows some examples where the NDVI drop occurred before the first clear-cut date and, by looking at Sentinel-2 imagery, this indicates that the first clear cut happened before the recorded date.

Suggestion: based on S2 images, broaden the time interval between first estimated date and last.

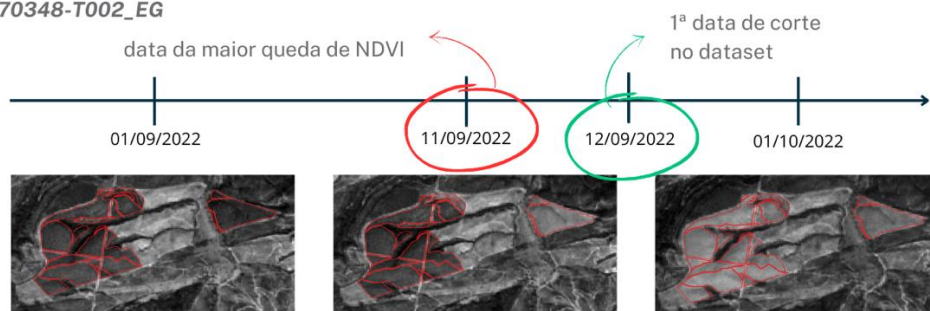
53010-T001_EG



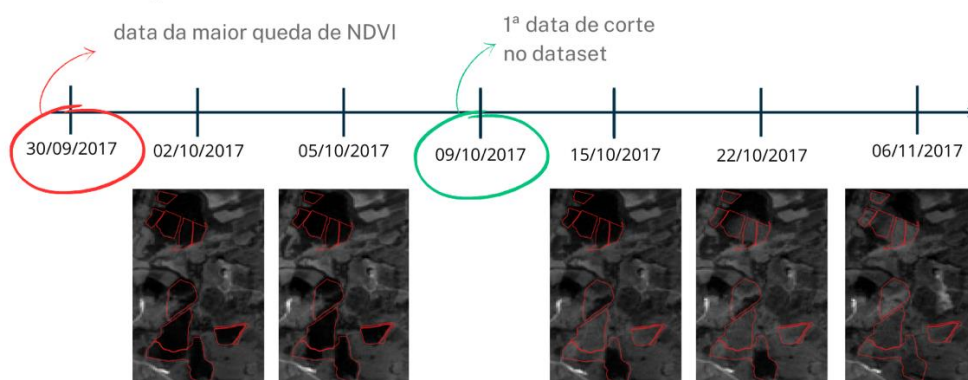
50438-T001_EG



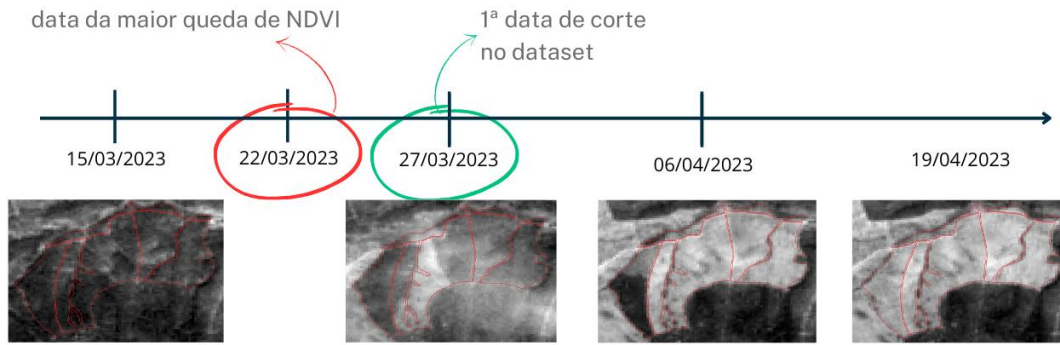
70348-T002_EG



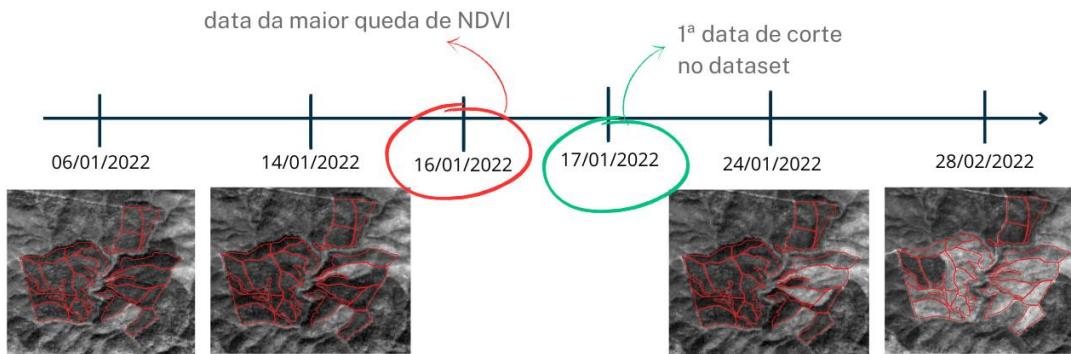
50497-T002_EG



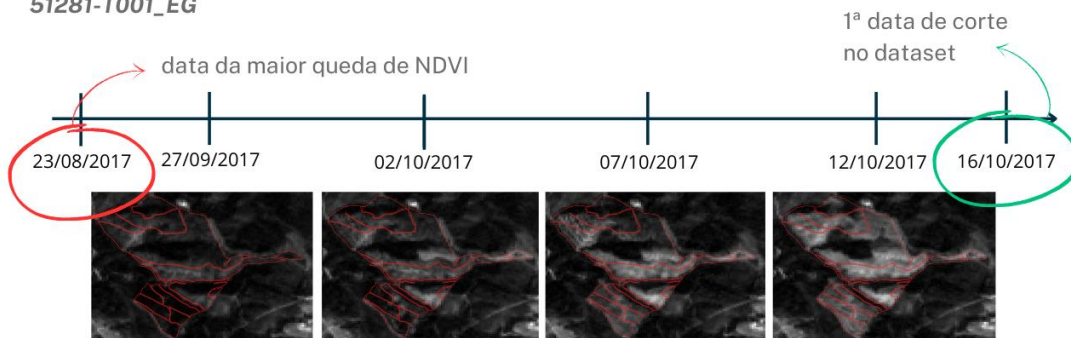
53013-T005_EG



53017-T002_EG



51281-T001_EG



50002-T007_EG

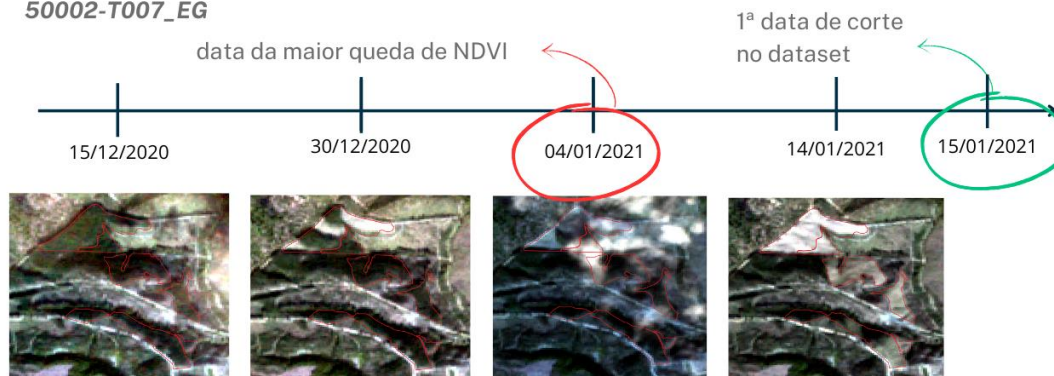


Figure 3 – Examples of parcels where clear-cuts happened before first recorded clear-cut date

4.2 Clear-cuts after the last recorded clear-cut date

It is expected that some sub-parcels will have the biggest NDVI drop after the last clear-cut date. However, if the drop happens a long time after the last clear-cut date recorded, it might indicate that the cutting activities are not yet done. In the example below, we identify one parcel being partially cut in between 6/11/2016 and 16/11/2016.

Suggestion: based on S2 images, broaden the time interval between first estimated date and last.

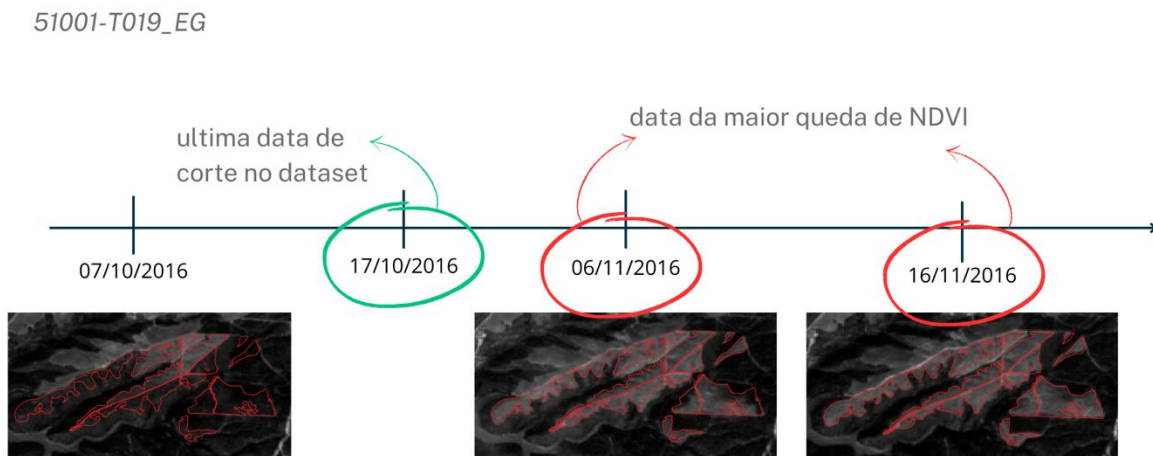


Figure 4 - Parcel cut after the last recorded clear-cut date by The Navigator Company

4.3 When not all sub-parcels are cut within the given period

The example illustrates a parcel where, even one month after the last recorded clear-cut date, only two of the sub-parcels have been cut.

Suggestion: Add a confidence level to parcels where this occurs. Another solution is to broaden the clear-cut period based on S2 imagery to find an interval where all the sub-parcels were cut.

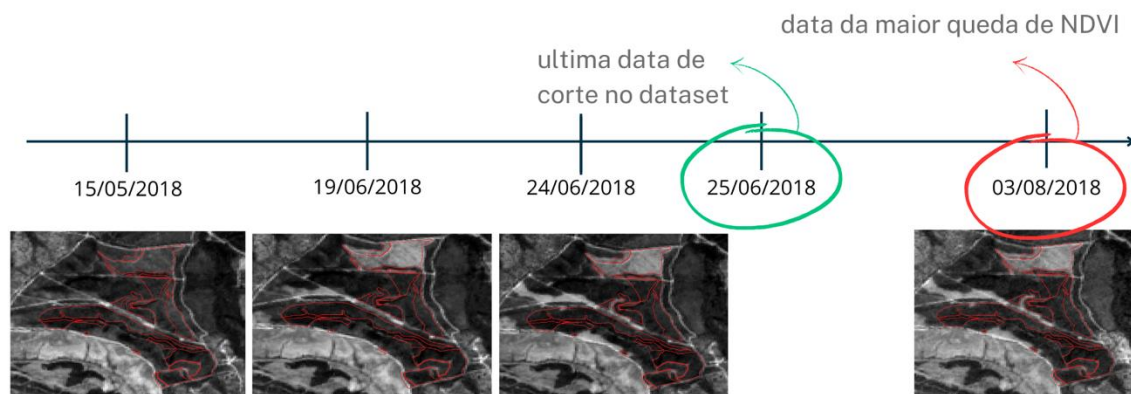


Figure 5 - Parcel where only part of the total sub-parcels was cut within the clear-cut period recorded by The Navigator Company

4.4 When none of the sub-parcels are cut within the given period

The following example counts with 377 small sub-parcels where none of them appears to be cut. The four images on Figure 6 represent just a small part of the parcel where a clear cut outside the parcel's boundaries is identified between 6/11/2017 and 21/11/2017.

Suggestion: not to consider these parcels to estimate clear-cut dates

50023-T014_EG

cortes entre 23-10-2017 e 30-11-2017

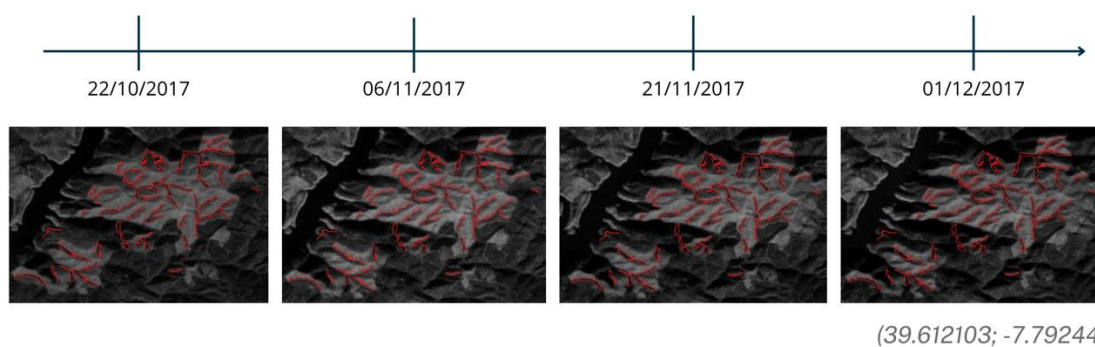


Figure 6 - Parcel where none of the sub-parcels were cut within the clear-cut period recorded by The Navigator Company

5 Annex

5.1 Annex 1

Java Scrip code used in Google Earth Engine to retrieve NDVI median values. Uses 'COPERNICUS/S2_HARMONIZED' Image Collection and the Cloud Score+ cloud filter.

```

// Get unique id_gleba values
var uniqueGlebas = nvg_dates.distinct('id_gleba');

// Initialize a list to accumulate all results
var allResults = ee.FeatureCollection([]);

// Define a function to process each id_gleba
var processGleba = function(glebaFeature) {
  var id_gleba = glebaFeature.get('id_gleba');

  // Filter the nvg_dates table for the current id_gleba
  var nvg_talhao = nvg_dates.filter(ee.Filter.eq('id_gleba',
id_gleba));

  // Get the first feature to obtain start and end dates
  var feature = nvg_talhao.first();
  var startdate = feature.get('start_date');
  var enddate = feature.get('end_date');

  // Cloud Score+ image collection
  var csPlus =
ee.ImageCollection('GOOGLE/CLOUD_SCORE_PLUS/V1/S2_HARMONIZED');
  var QA_BAND = 'cs_cdf';
  var CLEAR_THRESHOLD = 0.65;

  // Load Sentinel-2 TOA reflectance data
  var dataset = ee.ImageCollection('COPERNICUS/S2_HARMONIZED')
    .filterDate(startdate, enddate)
    .filterBounds(nvg_talhao.geometry())
    .linkCollection(csPlus, [QA_BAND])
    .map(function(image) {
      return image.updateMask(image.select(QA_BAND)
        .gte(CLEAR_THRESHOLD))
        .set('system:time_end',
image.get('system:time_end'))
        .set('system:time_start',
image.get('system:time_start'))
        .set('system:id', image.get('system:id'))
        .set('system:version',
image.get('system:version'))
        .set('system:asset_size',
image.get('system:asset_size'))
    });

```

```

        .set('system:footprint',
image.get('system:footprint'))
        .set('system:index',
image.get('system:index'));
    });

    // Add NDVI band
    var addNDVI = function(image) {
        var ndvi = image.normalizedDifference(['B8',
'B4']).rename('NDVI');
        return image.addBands(ndvi);
    };

    // Apply across the whole collection
    var S2_NDVI = dataset.map(addNDVI);

    // Calculate median NDVI for each image and each polygon
    var calculateMedianNDVI = function(image) {
        var medianNDVI = image.select('NDVI').reduceRegions({
            collection: nvg_talhao,
            reducer: ee.Reducer.median(),
            scale: 10
        });
        return medianNDVI.map(function(feature) {
            return ee.Feature(feature).set('date',
image.date().format('YYYY-MM-dd'));
        });
    };

    var medianNDVI = S2_NDVI.map(calculateMedianNDVI).flatten();

    // Add properties to the median NDVI features
    var medianNDVIWithProperties = medianNDVI.map(function(feature) {
        var properties = feature.toDictionary();
        return ee.Feature(feature.geometry(), properties);
    });

    // Accumulate the results in the allResults collection
    allResults = allResults.merge(medianNDVIWithProperties);
};

// Map the processGleba function over all unique id_gleba values
uniqueGlebas.evaluate(function(glebasList) {

```



```

glebasList.features.forEach(function(gleba) {
  processGleba(ee.Feature(gleba));
});

// Export the combined results as a single CSV file
Export.table.toDrive({
  collection: allResults,
  description: 'Median_NDVI_Per_Polygon_All_Glebas',
  folder: 'Navigator_NDVI_median',
  fileFormat: 'CSV',
  selectors: ['id', 'cod_talhao', 'cod_ug', 'date', 'id_gleba',
'median']
});
});

```

5.2 Annex 2

Tables 1, 2 and 3 referring to the original database

Table 10 - attributes from original NVG table used in df_expanded_updated, and their respective code in the df_expanded_updated dataframe

Attributes from NVG table	Code in 'atividade{i}' columns
Dt_referen	REF
Dt_plant	PLANT

Table 11 - attributes from original Exploracao table used of df_expanded_updated

Group	Attributes of 'atividade{i}' columns
Corte	CORTE C/ CASCA
	CORTE S/ CASCA
Rechega	RECHEGA C/ CASCA
	RECHEGA S/ CASCA

Table 12 - attributes from original Silvicultura table used on df_expanded_updated

Group (?)	Attributes of 'atividade{i}' columns
	ADENSAMENTO C/ ADUBAÇÃO
	APLICACAO HERBICIDA (INSTALACAO)
	APLICAÇÃO DE HERBICIDA
	ARRANQUE CEPOS

Construção	CONSTRUCAO DE ACEIROS
	CONSTRUCAO DE CAMINHOS
	CONSTRUCAO DE TERRACOS
	CONSTRUCAO VALA COMORO
	DESBASTE
	DESRAMA
	DESTROCAMENTO MECANICO DOS CEPOS
Gradagem	GRADAGEM
	GRADAGEM (MC)
Limpeza Manual	LIMP. MATO MANUAL S/INCORPORACAO
	LIMP. MATO MECANICA C/INCORPORACAO
	LIMP. MATO MECANICA S/INCORPORACAO
	LMMAN 26-50% DA ÁREA
	LMMAN 51-75% DA ÁREA
	LMMAN 76-100% DA ÁREA
	LMMAN ATÉ 25% DA ÁREA
	LM 75% MECÂNICA E 25% MANUAL
Limpeza Mecânica	LMMEC C/ INC 1 ROTACAO TRATOR BORRACHEIRO
	LMMEC C/ INC 1ª ROTACAO TRATOR RASTOS
	LMMEC C/ INC TALHADIA TRATOR BORRACHEIRO
	LMMEC C/ INC TALHADIA TRATOR RASTOS
	LMMEC C/ INC TRATOR BORRACHEIRO 1 PASSAGEM
	LMMEC C/ INC TRATOR BORRACHEIRO 2 PASSAGEM
	LMMEC C/ INC TRATOR RASTOS 1 PASSAGEM
	LMMEC C/ INC TRATOR RASTOS 2 PASSAGEM
	LMMEC S/ INC 1 ROTACAO TRATOR BORRACHEIRO
	LMMEC S/ INC TALHADIA TRATOR BORRACHEIRO
	LMMEC S/ INC TRATOR BORRACHEIRO
Plantação	PLANTACAO (1000 PL – TERRAÇOS)
	PLANTACAO (1250 PL)
	PLANTACAO (600 PL)
	PLANTACAO EUC MANUAL
	PLANTACAO OUTRAS FOLHOSAS

	PLANTACAO (1000 PLT-TERR)C/ADUB LOC 30G
	PLANTACAO (1000 PLT-TERR)C/ADUB LOC 60G
	PLANTACAO (1250 PLT) C/ADUB LOC 30G
	PLANTACAO (1250 PLT) C/ADUB LOC 60G
	PLANTACAO EUC +DE 1400 PL C/AD LOC 30G
	PLANTACAO EUC 1001-1400 PL C/AD LOC 30G
	PLANTACAO EUC 1001-1400 PL C/AD LOC 60G
	PLANTACAO EUC 601-1000 PL C/AD LOC 30G
	PLANTACAO EUC 601-1000 PL C/AD LOC 60G
	PLANTACAO EUC ATÉ 600 PL C/AD LOC 30G
	PLANTACAO EUC ATÉ 600 PL C/AD LOC 60G
	PLANTAÇÃO RESINOSAS
Seleccção de varas	PRIMEIRA SELECCAO DE VARAS
	SEGUNDA SELECCAO DE VARAS
Retancha	RETANCHA
	RETANCHA 26% - 50%
	RETANCHA 51% A 75%
	RETANCHA <25%
	RETANCHA >=76%
	RETANCHA C/ADUB-ATE 25% PLT/HA
	RETANCHA C/ADUBAÇÃO 16-25% PL/HA
	RETANCHA C/ADUBAÇÃO 26-50% PL/HA
	RETANCHA C/ADUBAÇÃO 51-75% PL/HA
	RETANCHA C/ADUBAÇÃO 76-100% PL/HA
	RETANCHA C/ADUBAÇÃO ATÉ 15% PL/HA
Ripagem	RIPAGEM 1D
	RIPAGEM 2D
	RIPAGEM 3D
	RIPAGEM P/RETANCHA (MC)
	SACHA E AMONTOA MANUAL
	SEMENTEIRA