



BRAZIL DATA CUBE
brazildatacube.org

TerraCollect

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National Institute for Space Research - INPE

XX SBSR
Simposio Brasileiro de Sensoriamento Remoto

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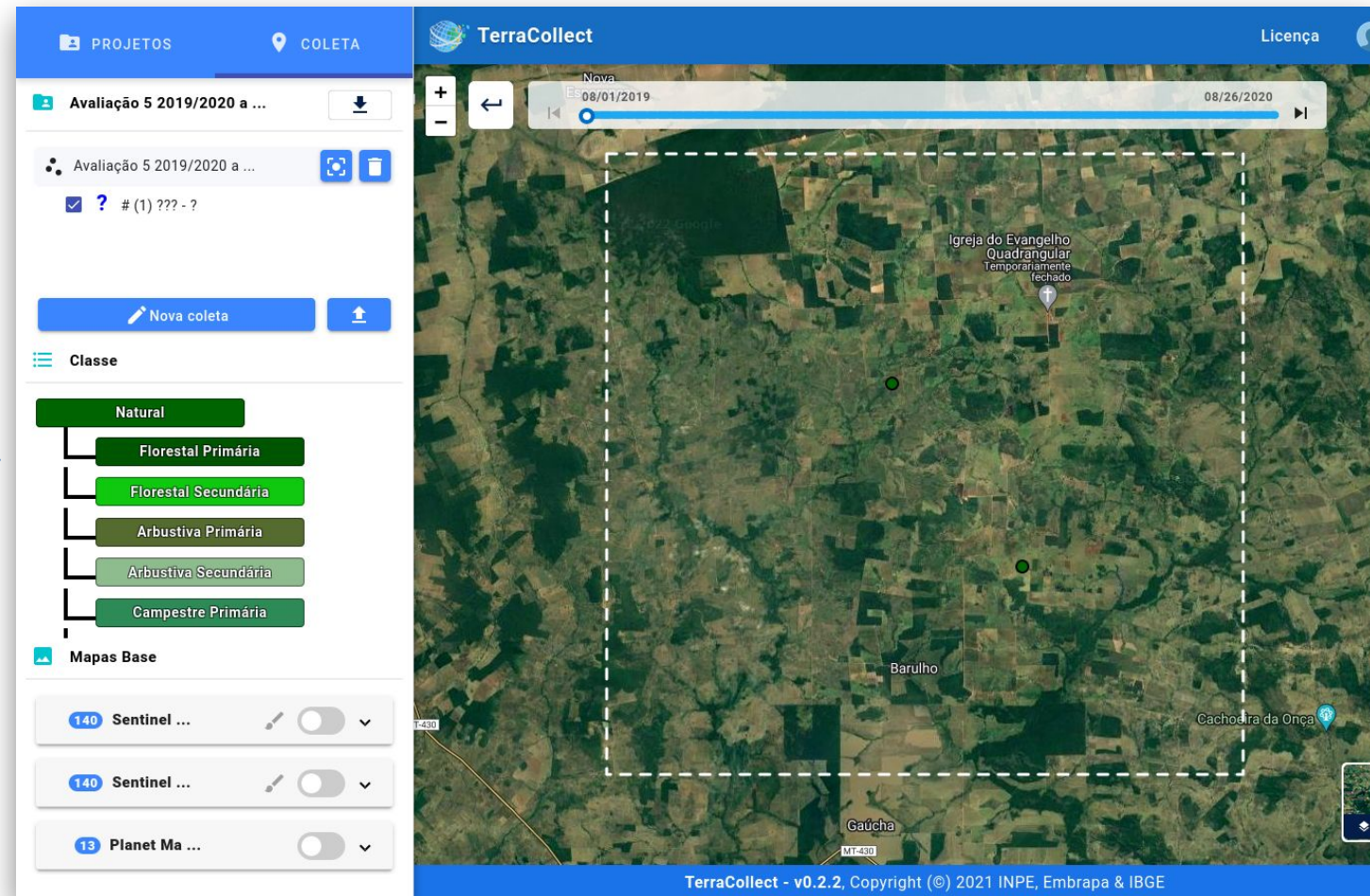


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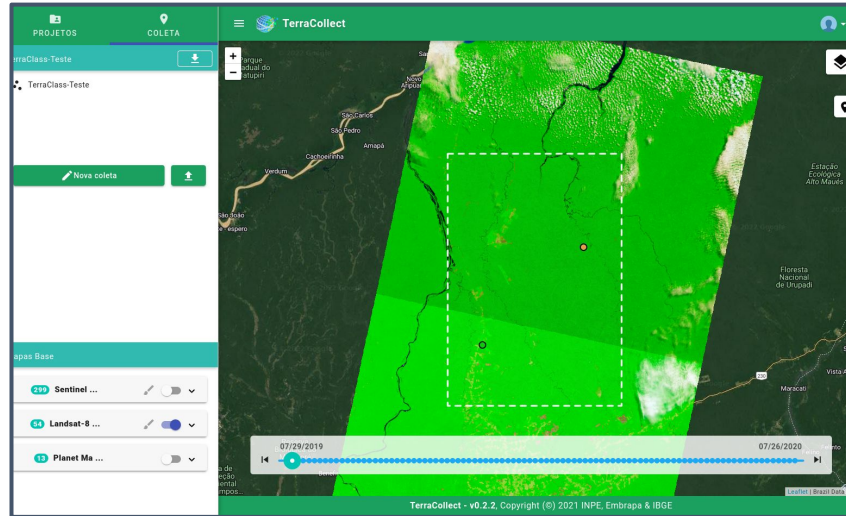
Overview

- TerraCollect is a web tool from Brazil Data Cube for **sample collection and analysis work**.
- It provides **high-resolution multi-temporal images** through image collections from Brazil Data Cube.
- One of the features of it the TerraCollect is the integration with the Brazil Data Cube **earth sample database, the Sample-DB**.

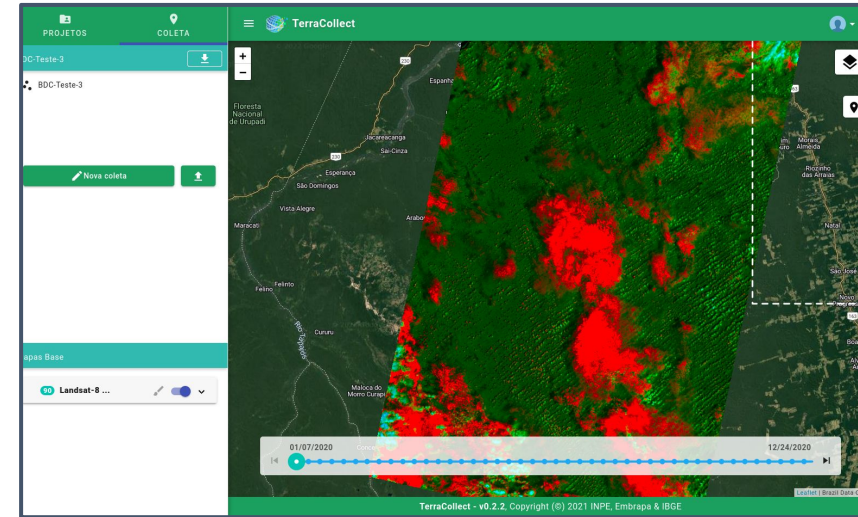


<https://brazildatacube.dpi.inpe.br/dev/terracollect>

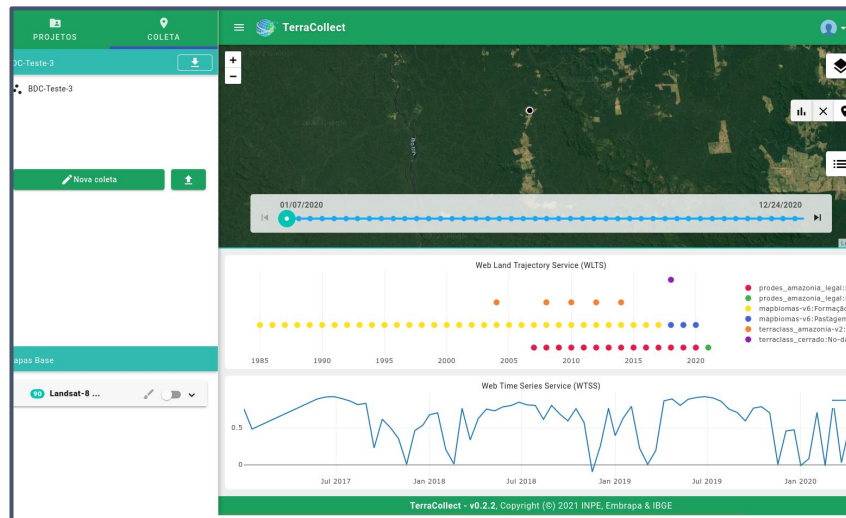
TerraCollect integrated features



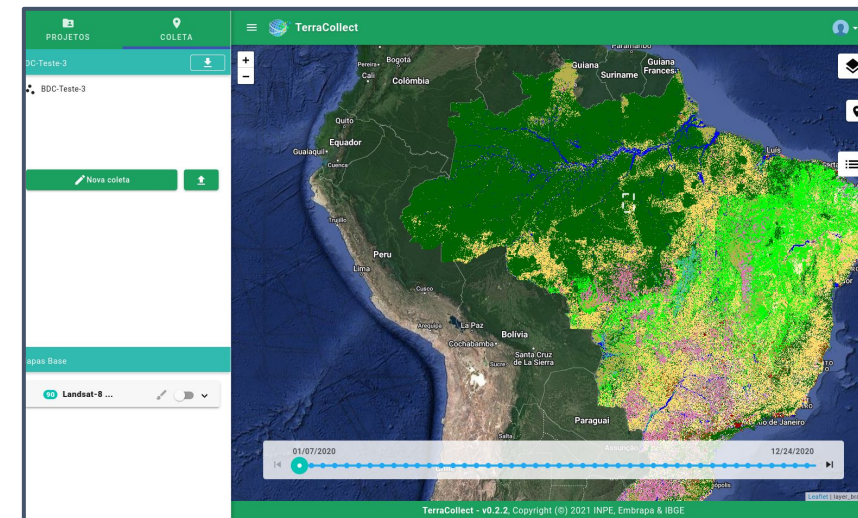
Viewing cubes and image collections, with timeline



Edit the RGB composition from the cubes and image collections



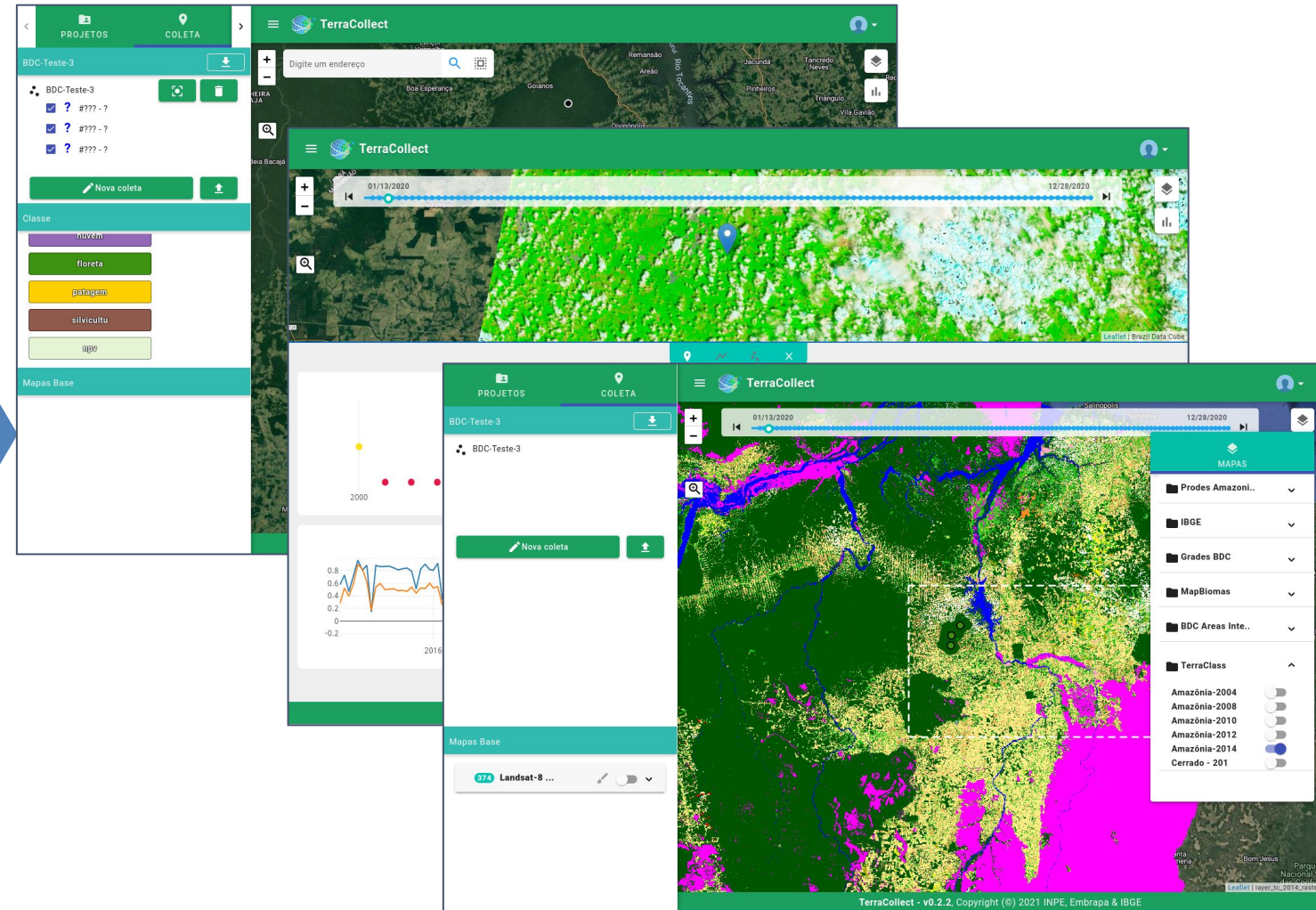
View time series and land trajectory graphs



View external maps such as PRODES, TerraClass e MapBiomias

Summary

1. Project
2. Collect
3. Select Region
4. View Base Maps
5. New Sample
6. Label a Sample
7. Edit Style
8. Time Series
9. Land Trajectory
10. Layers
11. Upload points
12. Download Samples



<https://brazildatacube.dpi.inpe.br/terracollect>

PROJETOS COLETA

Avaliação 5 2019/2020 a ... ↓

Avaliação 5 2019/2020 a ...

Nova coleta ↑

Mapas Base

TerraCollect Licença

Digite um endereço BBOX 🔍

Brasil

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PROJETOS
COLETA

BDC-Teste-3
 ↓

••• BDC-Teste-3

Nova coleta
↑

Mapas Base

374 Landsat-8 ...

☰ TerraCollect
 👤

01/13/2020
 01/13/2020
12/28/2020

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PROJETOS **COLETA**

este Criacao Amostras 

Teste Criacao Amostras  

- ? #??? - ?
- ? #??? - ?
- ? #??? - ?

Nova coleta 

asse

Vegetação- ...

Pastagem-C ...


Pastagem-C ...

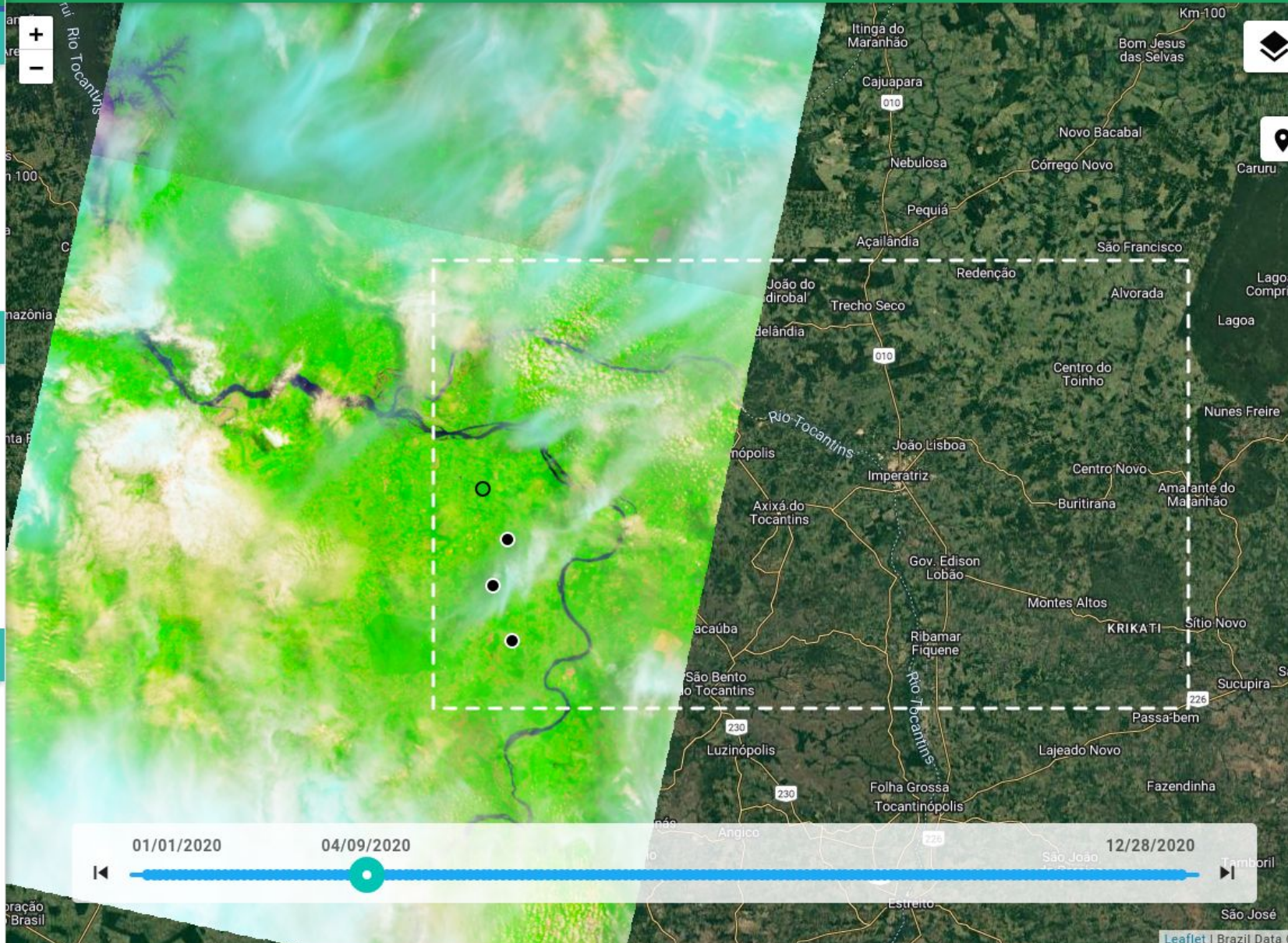
Cultura-Ag ...

Cultura-Ag ...

apas Base

88 Landsat-8 ...   

TerraCollect 



01/01/2020 04/09/2020 12/28/2020

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PROJETOS COLETA

Teste Criacao Amostras

Teste Criacao Amostras

Nova coleta

Mapas Base

425 Sentinel ...

88 Landsat-8 ...

TerraCollect

#3790 - Vegetação-Natural-Florestal-Secundária

Sample ID	3790
Class Name	Vegetação-Natural-Florestal-Secundária
End Date	2020-12-31
Start Date	2020-01-01

01/01/2020 04/09/2020 12/28/2020

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PROJETOS COLETA

BDC-Teste-3

BDC-Teste-3

Nova coleta

Mapas Base

374 Landsat-8 ...

TerraCollect

01/13/2020 12/28/2020

ALTO TURIAÇU

ROSARIO

EDIT CUBE VIEW (LC8_SR-1)

RED	GREEN	BLUE
sr_band7	sr_band5	sr_band4
0 100	0 100	0 100
Saturation: 1.5	Gamma: 2	Sigmoidal: 5

RESET APPLY

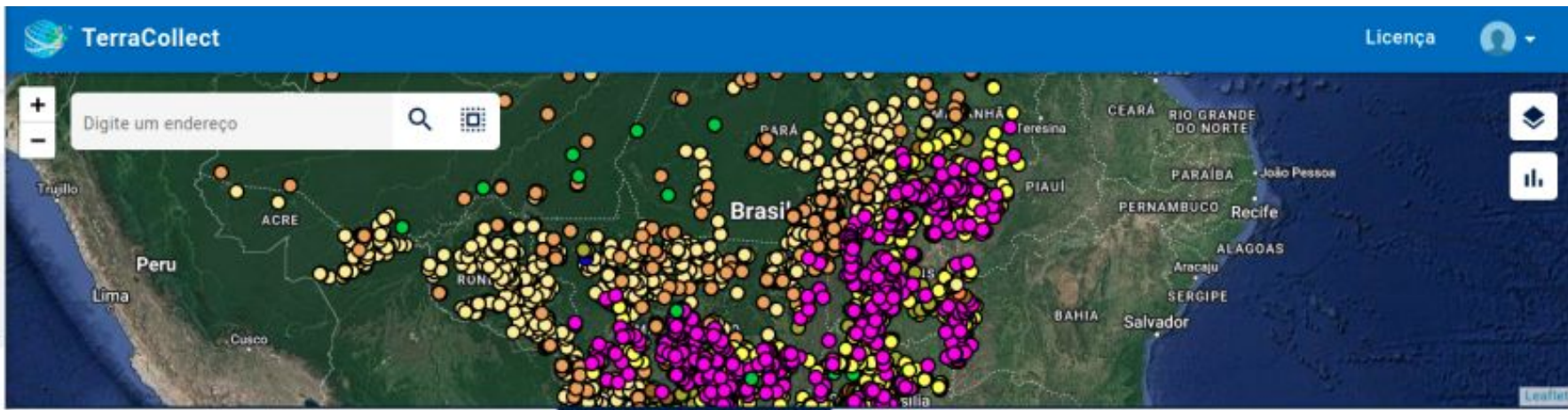
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PROJETOS COLETA

TerraClass-Teste

TerraClass-Teste

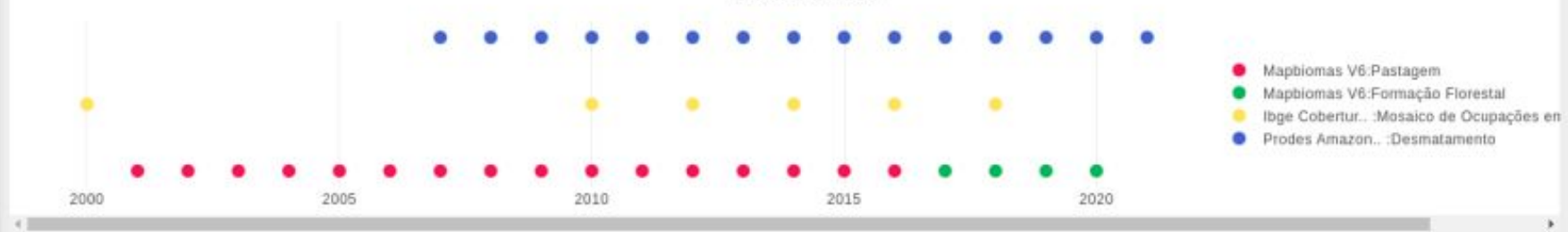
Nova coleta



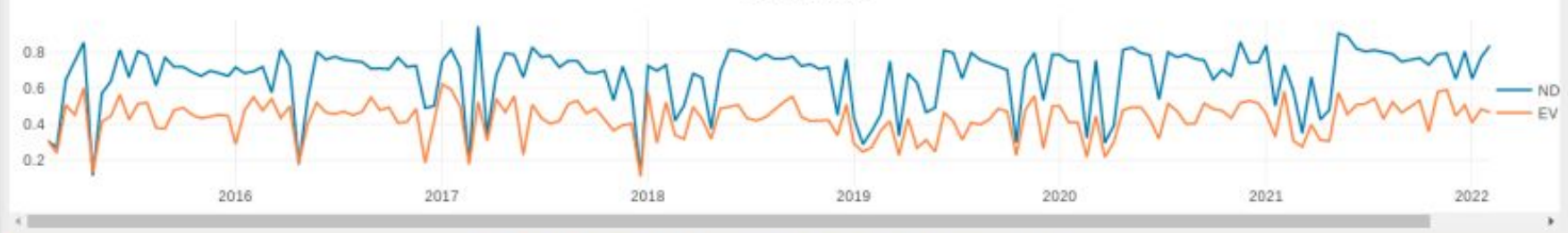
Ponto: -53.83532 -1.78976

Map navigation controls: location pin, zoom in, zoom out, full screen, close.

Trajetória da Terra



Série Temporal



Mapas Base

TerraCollect Licença

PROJETOS COLETA

Area de estudo Abner

Area de estudo Abner

Nova coleta

Mapas Base

Configurações de séries temporais

Select the source

- CBERS4 WFI - Cube 16 days v2
- CBERS-4 - MUX - Cube 2 months ...
- CBERS-4 - MUX - Cube Stack Mon...
- CBERS-4 - WFI - Cube Stack 16 ...
- CBERS WFI - Cube 8 days
- Landsat Collection 2 Mozambiqu...
- Landsat-8 - OLI - Cube Stack 1...
- TERRA - MODIS - MOD13Q1 - C6
- AQUA - MODIS - MYD13Q1 - C6
- Sentinel-2 - MSI - Sen2cor - C...
- Sentinel-2 - MSI - Sen2cor - C...

Filter

Select Bands

Interpolate nodata

Select the period

Start Date End Date

Mapbiomas V
Ibge Cobertur
Terraclass Ce
Prodes Amazc

2015 2020

2016 2017 2018 2019 2020 2021 2022

NDVI:MOD13Q1-6
EVI:MOD13Q1-6

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PROJETOS COLETA

Area de estudo Abner

Area de estudo Abner

Nova coleta

Mapas Base

Digite um endereço

Land Trajectory Settings

Select Resources

- Prodes Cerrado
- Deter Amazonia Legal
- Prodes Amazonia Legal
- Prodes Amazonia Legal Nuvem
- Prodes Pantanal
- Terraclass Amazonia
- Deter Cerrado
- Lapig Areas Pastagem
- Ibge Cobertura Uso Terra
- Prodes Pampa
- Prodes Caatinga
- Mapbiomas Pantanal V5
- Mapbiomas V7
- Mapbiomas Mata Atlantica V5

Ponto: -5

2005

2016 2017 2018 2019 2020 2021 2022

Mapbiomas V6: Formação Florestal
 Ibge Cobertur.: Vegetação Florestal
 Terraclass Ce.: No-Data
 Prodes Amazon.: Floresta

NDVI:MOD13Q1-6
 EVI:MOD13Q1-6

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PROJETOS COLETA

Area de estudo Abner

Area de estudo Abner

Nova coleta

Mapas Base

Mapas

- 9 Grades
- 2 Limites
- 0 Mosaicos
- 6 Mapas Externos ¹

IBGE Cobertura e ... (2000)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MapBiomass - V6 (1985)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PRODES Amazônia L ... (2021)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PRODES Cerrado - ... (2000)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TerraClass Amazôn ... (2004)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TerraClass Cerrad ... (2018)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

0 Camadas Carregadas

Importar nova camada

url do serviço

CARREGAR

Legend

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The screenshot displays the TerraCollect web application interface. The top navigation bar includes the TerraCollect logo, the text "TerraCollect", and a "Licença" dropdown menu. Below the navigation bar, there are two main sections: "PROJETOS" and "COLETA". The "COLETA" section is active, showing a search bar with the placeholder text "Digite um endereço" and a search icon. The main content area is a satellite map of a rural area with a grid overlay. A modal dialog titled "Upload de Pontos" is open in the center of the screen. The dialog contains the following elements:

- A close button (X) in the top right corner.
- The text "Selecione o arquivo CSV com a lista de pontos:" followed by a dark blue button with a white upload icon and the text "Upload".
- The text "Selecione o(s) campo(s) do CSV referentes a latitude e longitude:" followed by two dropdown menus labeled "Latitude" and "Longitude".
- A toggle switch labeled "A geometria está disponível em apenas um campo (WKT)" which is currently turned off.
- A dark blue button with a white cluster icon and the text "Carregar pontos".

The bottom of the interface features a footer with the text "TerraCollect - v0.2.2, Copyright (©) 2021 INPE, Embrapa & IBGE".

TerraCollect Licença

PROJETOS COLETA

Area de estudo Abner

Area de estudo Abner

Nova coleta

Mapas Base

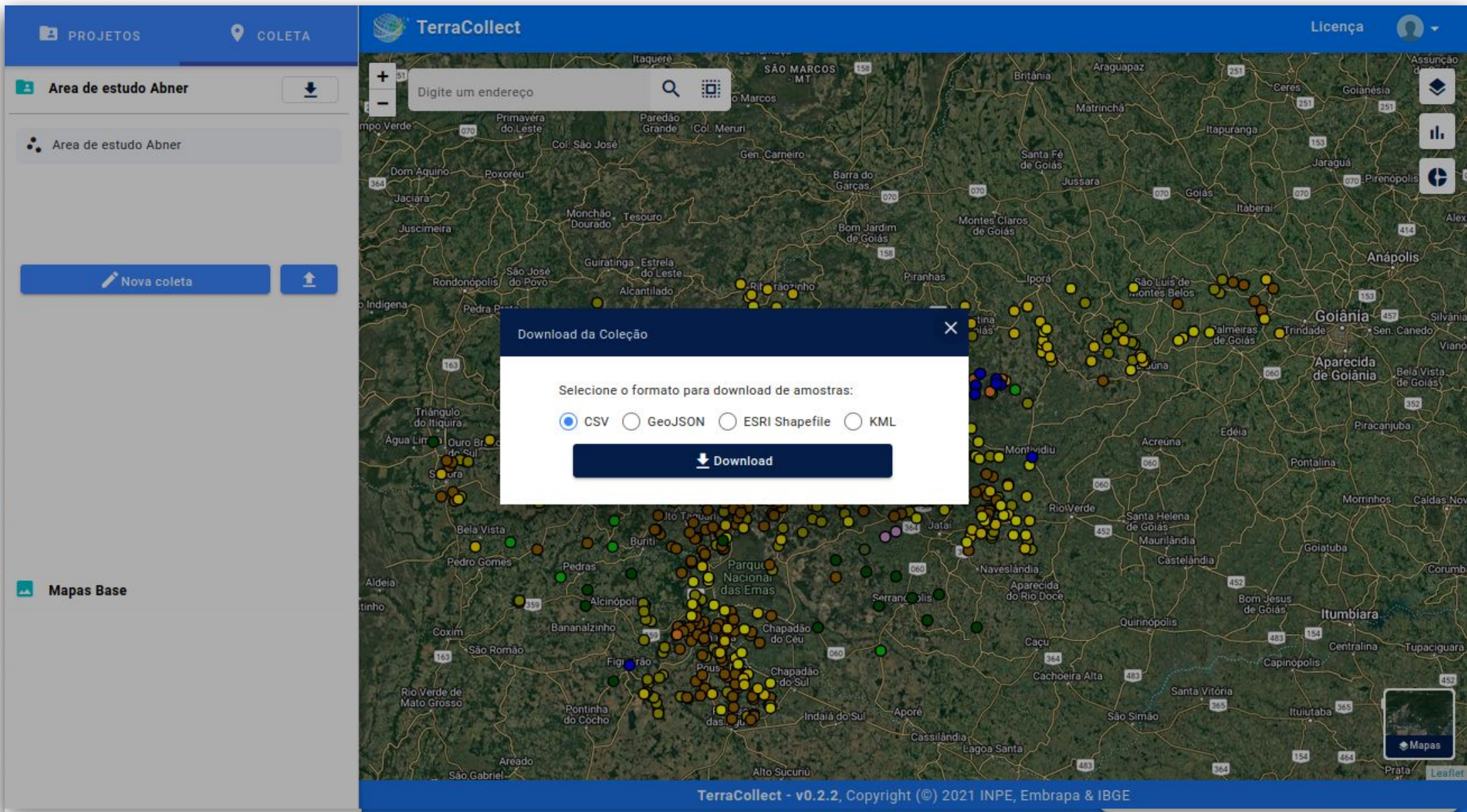
Download da Coleção

Selecione o formato para download de amostras:

CSV GeoJSON ESRI Shapefile KML

Download

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brazildatacube.dpi.inpe.br/portal/explore

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Gabriel Sansigolo

Thank you!

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TerraCollect`s Samples Analysis Plug-in

Gabriel Sansigolo

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Abner Anjos

National Institute for Space Research - INPE

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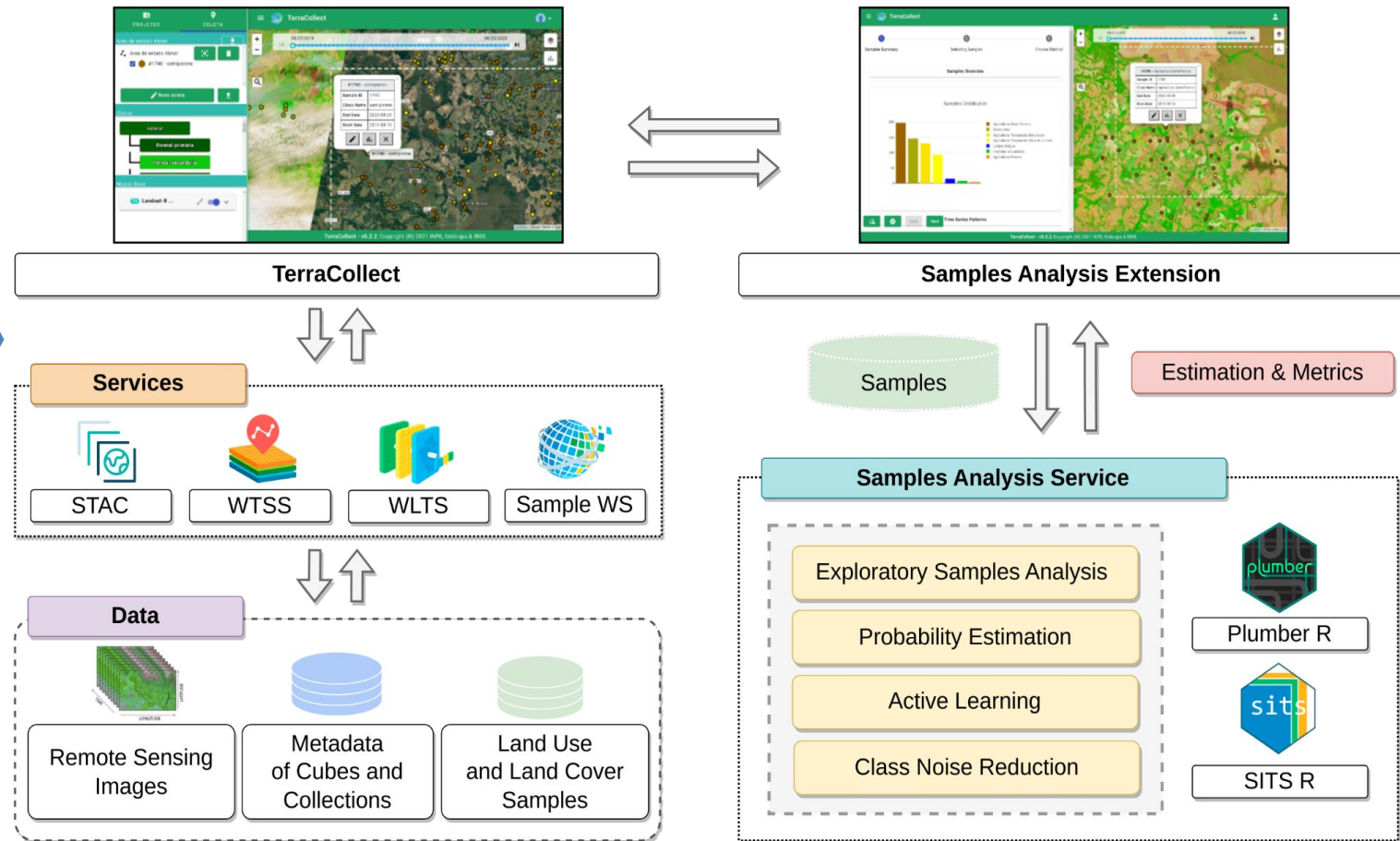
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Overview

- The TerraCollect's sample analysis plug-in is a system extension that seeks to integrate three main approaches for the analysis & assessment of land use and land cover samples;
- This integration seeks to fill the lack of web platforms with analytical tools based on Earth Observation Data;

The System Architecture



Time Series Extraction & Storage

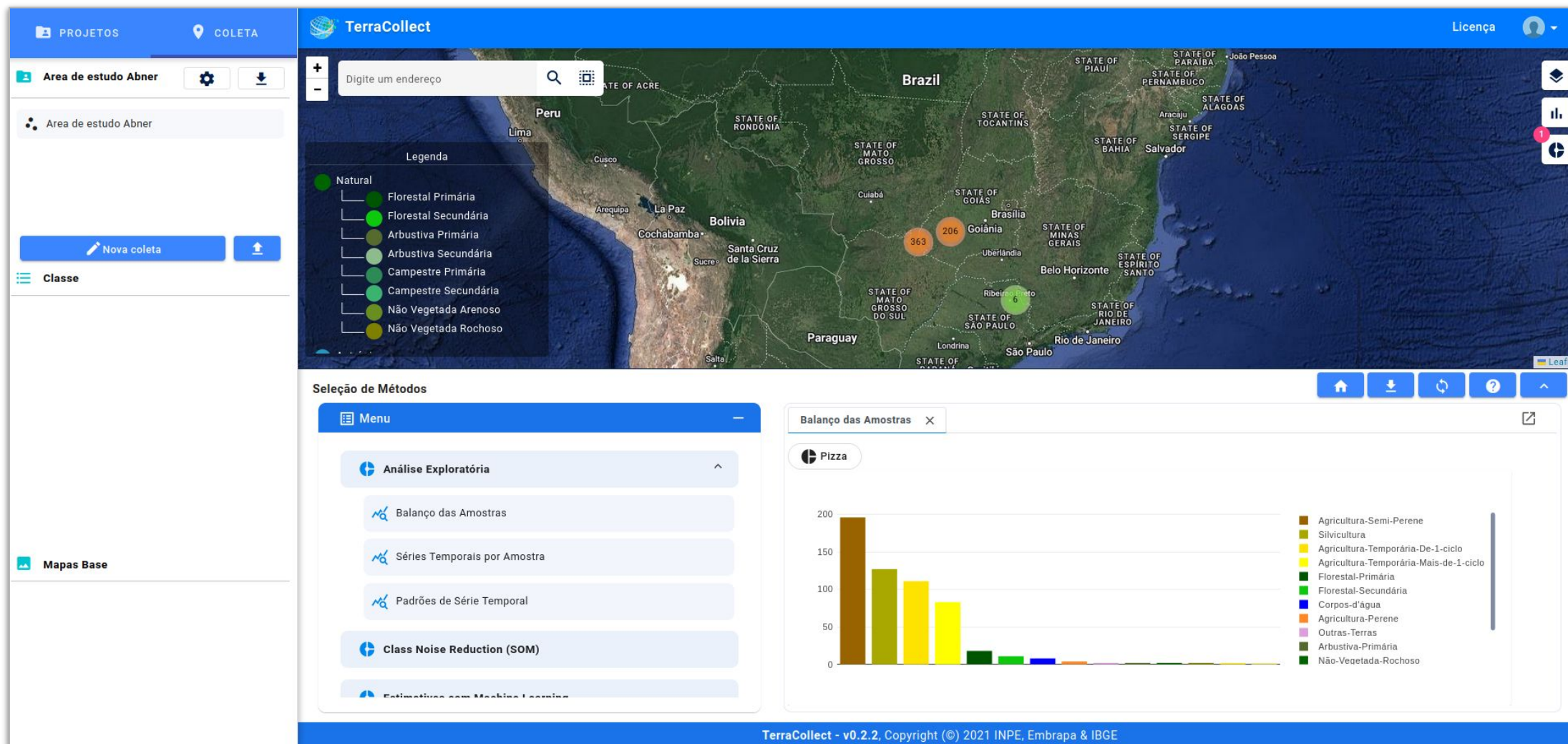
The screenshot displays the TerraCollect web interface. At the top, the header includes the TerraCollect logo, the user's name 'Licença', and a profile icon. The main area is divided into several sections:

- Left Panel:** Contains the study area name 'Area de estudo Abner', a search bar with the text 'Digite um endereço', a 'Nova coleta' button, and a 'Classe' section.
- Map:** A satellite map showing a rural landscape with several green circular markers labeled '3' and '6'. A search bar is overlaid on the map.
- Extraction Status Panel:** Titled 'Exatção de Séries Temporais', it shows a log of the extraction process. The log includes steps such as 'Getting the no saved time series for samples...', 'Checking time series for no saved samples...', 'Extracting time series for no saved samples...', 'Calculating estimated time to conclusion...', 'Extracting time series from S2-16D-2...', 'Regularizing the time series for S2-16D-2...', 'Checking the updates for samples class label...', 'Regularizing the time series for samples...', 'Saving the time series in data base...', and 'Sample analysis is now synchronized with the TerraCollect database!'. A progress bar at the bottom of the log is at 100%.
- Summary Panel:** Displays 'Tempo gasto na última extração: 9min 5s' and 'Atualizado: 2023-03-14 14:42:01'. It includes two buttons: 'Sincronizar Base de Dados' and 'Nova Extração de Séries Temporais'.

The footer of the interface reads: 'TerraCollect - v0.2.2, Copyright (©) 2021 INPE, Embrapa & IBGE'.

The first step to start analyzing LULC samples is to extract and store time series. The plug-in has a component that allows the user to select an image cube and spectral bands and indices. After the selection of the parameters in the form, the user can check the status of the entire process.

Exploratory Samples Analysis



After time series extraction the user is able to execute the methods for samples analysis. The exploratory analysis component allows the users to visualize the samples distribution plot, time series patterns and the time series for each sample.

Exploratory Samples Analysis

The screenshot displays the TerraCollect web interface for sample analysis. The interface is divided into several sections:

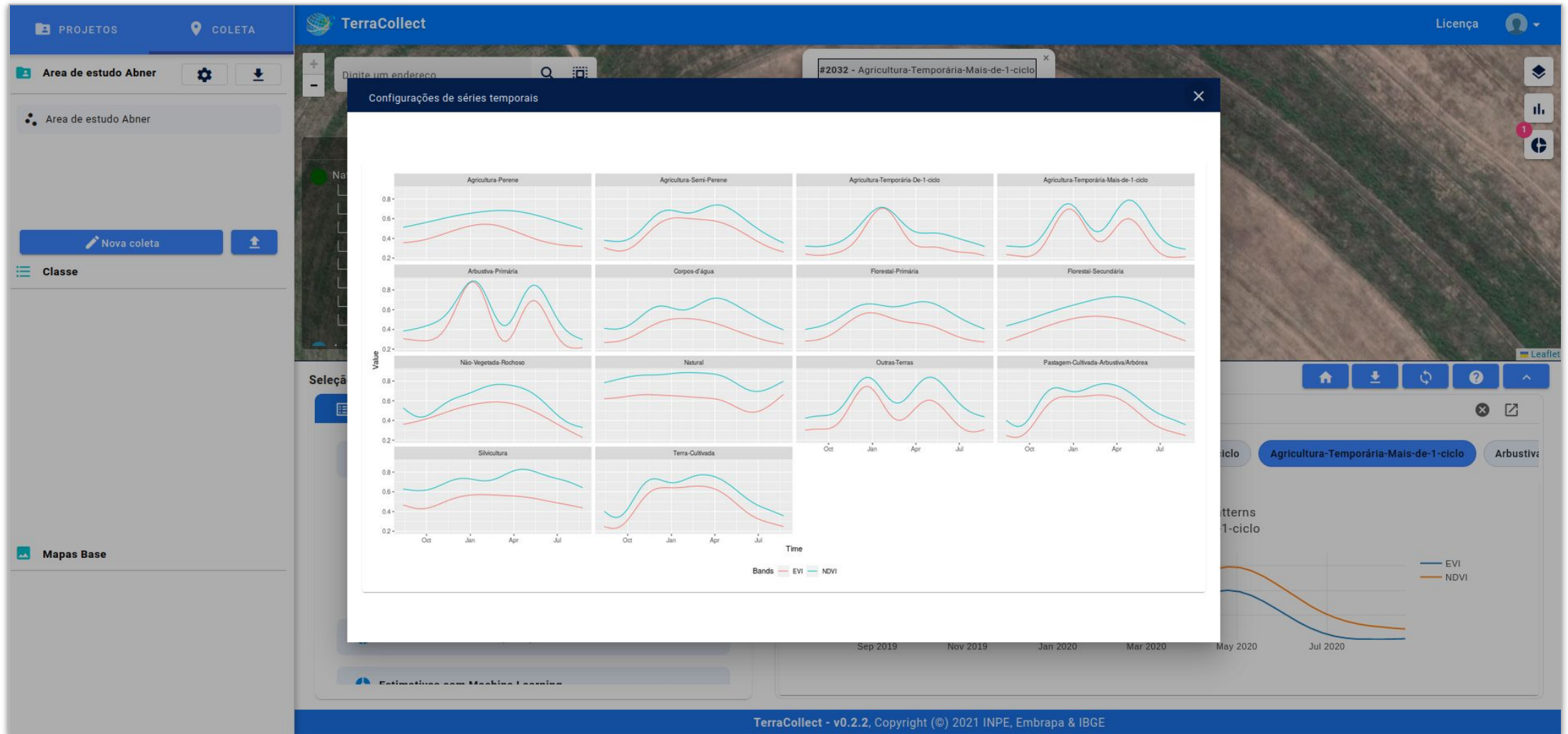
- Top Bar:** Includes "PROJETOS" and "COLETA" tabs, the TerraCollect logo, and a "Licença" dropdown.
- Left Sidebar:** Contains "Area de estudo Abner", a "Nova coleta" button, and "Mapas Base".
- Map:** Shows an aerial view of a field with a search bar "Digite um endereço" and a legend for vegetation types: Natural, Florestal Primária, Florestal Secundária, Arbustiva Primária, Arbustiva Secundária, Campestre Primária, Campestre Secundária, Não Vegetada Arenoso, and Não Vegetada Rochoso.
- Sample Information Popup:** Displays details for sample "#2032 - Agricultura-Temporária-Mais-de-1-ciclo":

Sample ID	2032
Class Name	Agricultura-Temporária-Mais-de-1-ciclo
End Date	2020-08-28
Start Date	2019-08-13
User Name	Abner dos Anjos
User E-mail	abiner.anjos@gmail.com
- Time Series Analysis Panel:** Titled "Seleção de Métodos / Padrões de Série Temporal", it includes a "Formulário" section for selecting a cube (CB4_64_16D_STK-1), filters (Whittaker, S. Goley), and bands (EVI, NDVI). To the right, a "Série Temporal Selecionada" window shows a line graph titled "CB4_64_16D_STK-1 Time Series Patterns for Agricultura-Temporária-Mais-de-1-ciclo". The graph plots EVI (blue line) and NDVI (orange line) from Sep 2019 to Jul 2020. A specific data point is highlighted: (May 3, 2020, 0.7837378) NDVI.

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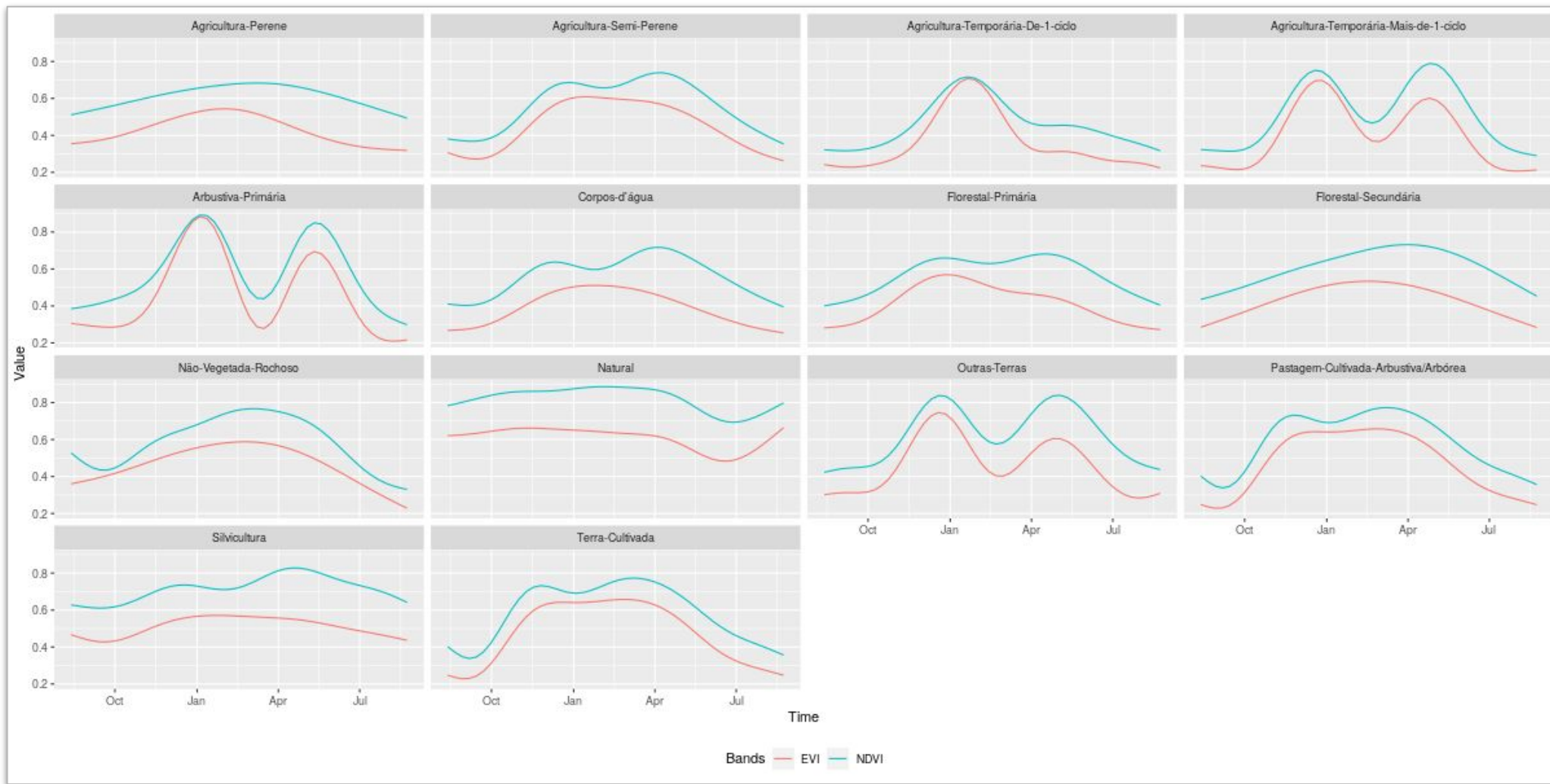
Every method selection opens a form that allows the users to select the parameters like the cube and bands. For example, this screen shows CBERS-4 NDVI time series patterns for class Agriculture.

Exploratory Samples Analysis



The time series patterns can be visualized as a full screen plot with all patterns side by side.

Exploratory Samples Analysis



These time series patterns plot images were generated by the samples analysis plug-in.

Exploratory Samples Analysis

The screenshot displays the TerraCollect web application interface. The top navigation bar includes 'PROJETOS' and 'COLETA'. The main area shows a satellite map of a field with a search bar and a legend. A popup window displays details for sample #2032, including its ID, class name, dates, and user information. Below the map, a table lists several samples, and a time series chart shows EVI and NDVI values over time for sample #2032.

Legenda

- Natural
 - Florestal Primária
 - Florestal Secundária
- Arbustiva Primária
- Arbustiva Secundária
- Campestre Primária
- Campestre Secundária
- Não Vegetada Arenoso
- Não Vegetada Rochoso

#2032 - Agricultura-Temporária-Mais-de-1-ciclo

Sample ID	2032
Class Name	Agricultura-Temporária-Mais-de-1-ciclo
End Date	2020-08-28
Start Date	2019-08-13
User Name	Abner dos Anjos
User E-mail	abiner.anjos@gmail.com

Seleção de Métodos / Formulário / Visualização de Série Temporal por Amostra

Seleção de Amostras

#ID	Class	Start Date	End Date
2031	Agricultura-Temporária-Mais-de-1-ciclo	2019-08-13	2020-08-28
2032	Agricultura-Temporária-Mais-de-1-ciclo	2019-08-13	2020-08-28
2033	Agricultura-Temporária-Mais-de-1-ciclo	2019-08-13	2020-08-28
2035	Agricultura-Temporária-Mais-de-1-ciclo	2019-08-13	2020-08-28
2036	Agricultura-Temporária-Mais-de-1-ciclo	2019-08-13	2020-08-28

Série Temporal Selecionada ...

CB4_64_16D_STK-1 Time Series
#2032 Agricultura-Temporária-Mais-de-1-ciclo

(Nov 1, 2019, 0.874) EVI

— EVI
— NDVI

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The users can visualize the time series for each sample using the component for exploratory analysis. This option allows the users to search by class label and sample id, and select the sample to isolate the analysis.

Exploratory Samples Analysis

PROJETOS COLETA

Area de estudo Abner

Area de estudo Abner

Nova coleta

Classe

Mapas Base

TerraCollect

Digite um endereço

Legenda

- Natural
 - Florestal Primária
 - Florestal Secundária
 - Arbustiva Primária
 - Arbustiva Secundária
 - Campestre Primária
 - Campestre Secundária
 - Não Vegetada Arenoso
 - Não Vegetada Rochoso

#2032 - Agricultura-Temporária-Mais-de-1-ciclo	
Sample ID	2032
Class Name	Agricultura-Temporária-Mais-de-1-ciclo
End Date	2020-08-28
Start Date	2019-08-13
User Name	Abner dos Anjos
User E-mail	abiner.anjos@gmail.com

Seleção de Métodos / Padrões de Série Temporal

Série Temporal Seleccionad ...

Formulário

CB4_64_16D_STK-1 Time Series
#2032 Agricultura-Temporária-Mais-de-1-ciclo

EVI NDVI

Agricultura-Perene Agricultura-Semi-Perene Agricultura-Temporária-De-1-ciclo Agricultura-Tempo

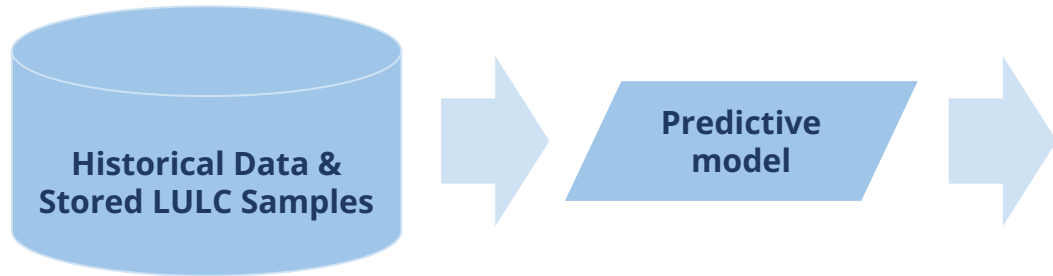
CB4_64_16D_STK-1 Time Series Patterns
for Agricultura-Temporária-Mais-de-1-ciclo

(Apr 25, 2020, 0.7894457) NDVI EVI

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With the selected sample, this component allows the users to use the comparison mode. Comparison mode places graph plots side by side, for example, the screen shows an isolated sample selection compared to time series patterns of its class.

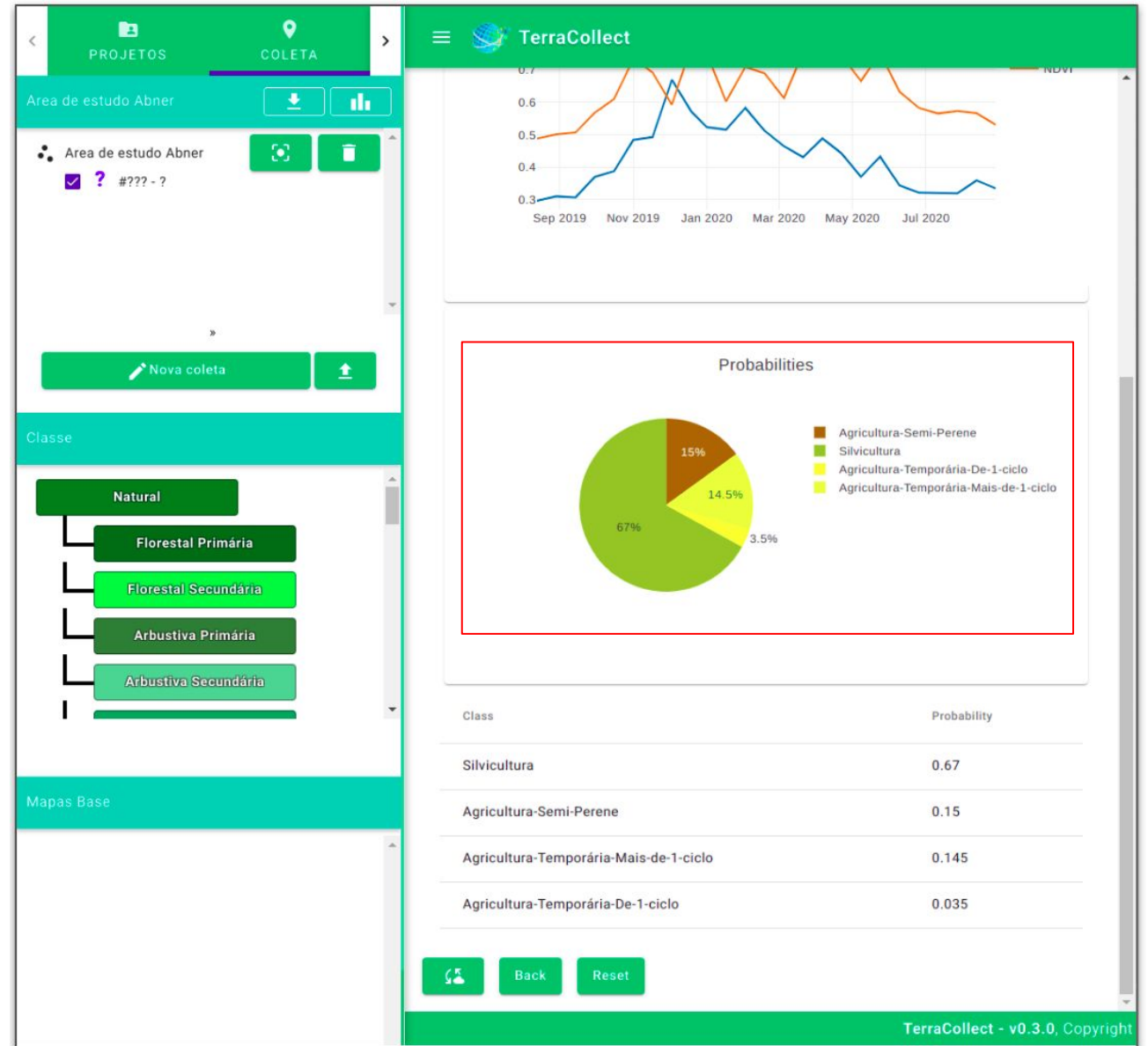
Probability Estimation & Active Learning



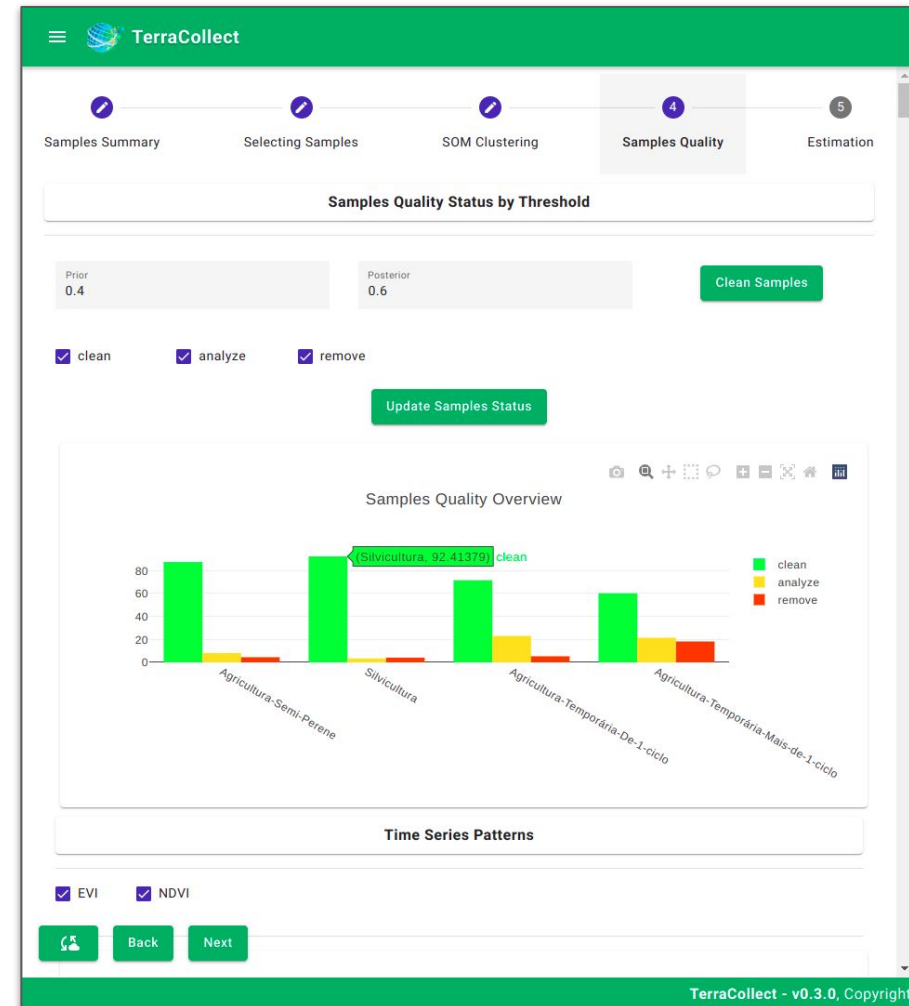
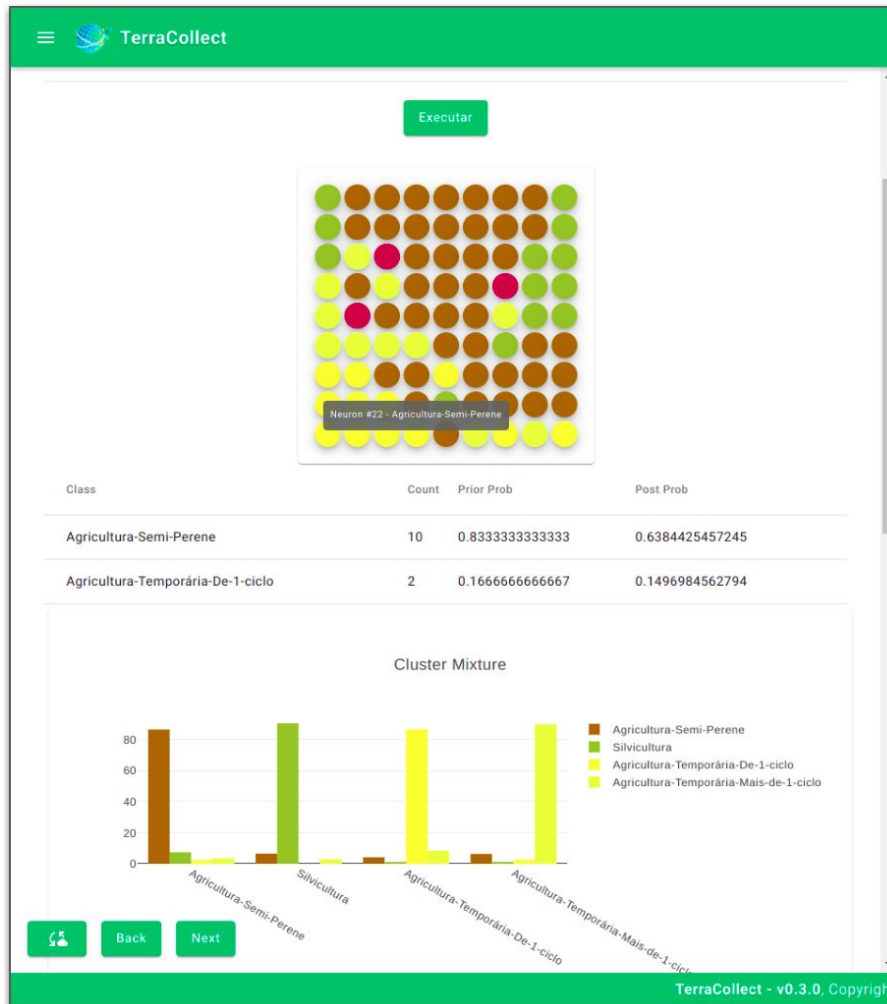
Probability estimation is based on predictive machine learning models.

The samples stored in the TerraCollect database can be used as a training base data set for predictive models based on Random Forest, SVM's and CNN's in a supervised way.

Trained models can predict the probabilities that a sample will belong to a given class.



Class Noise Reduction



Santos et al. 2021 proposed a method that evaluates the quality of LULC samples based on Bayesian inference applied to Self-organizing maps (SOM) clustering method. The component for This method has the visualization of the SOM map where the users can explore the neurons and recover the samples of each cluster.

Final Considerations

- This plug-in allows users who do not have knowledge in building algorithms for analysis methods to visualize the results in an interactive and efficient way;
- One of the objectives of this plug-in is to integrate different approaches for analysis of LULC samples in a web platform;
- For future, it is still necessary to review the probability estimation method and the feasibility of using active learning;



Proceedings XXIII GEOINFO, November 28 to 30, 2022, São José dos Campos, SP, Brazil.

Integrando Métodos de Análise Durante a Coleta de Amostras de Uso e Cobertura da Terra

Abner Ernâni dos Anjos¹, Karine Reis Ferreira¹, Gilberto Ribeiro de Queiroz¹,
Fabiana Zioti¹, Gabriel Sansigolo¹

¹ Instituto Nacional de Pesquisas Espaciais (INPE),
Av. dos Astronautas 1758 – 12227-010, São José dos Campos – SP, Brasil

{abner.anjos, karine.ferreira, gilberto.queiroz,
fabiana.zioti, gabriel.sansigolo}@inpe.br

Abstract. *The Land Use and Land Cover (LULC) mapping based on machine learning requires collecting samples for the training of predictive models. This step is a time-consuming and expensive process, in addition this activity is subject to mislabeling samples. Therefore, several methods for quality assessment have been developed and applied successfully, but attaching the collect process with assessment becomes a challenge on some platforms. This article presents a work in progress that aims to integrate methods for sample analysis during the collection process in the TerraCollect system under development in the Brazil Data Cube.*

Anjos, A.E.; Ferreira, K.R.; Queiroz, G.R.; Zioti, F.; Sansigolo, G. Integrando Métodos de Análise Durante a Coleta de Amostras de Uso e Cobertura da Terra. Em: Simpósio Brasileiro de Geoinformática (GEOINFO-2022), 247-252. Proceedings XXIII GEOINFO, 28 a 30 de novembro de 2022. São José dos Campos, SP, Brasil. INPE, 2022. ISSN 2179-4847.
<http://mtc-m21d.sid.inpe.br/rep/8JMKD3MGP3W34T/488BPNL>