



Vichada PR 2024
eligibility analysis report

25/07/2024

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1 DEFINITIONS

1.1 Remote Sensing Data

Data referred to as *remote sensing data* in this study is solely information acquired by orbiting satellites. No drone imagery was used to analyze the differentiation between forested and non-forested land cover or other land use.

1.2 Area of interest

The *area of interest* of the analysis was derived from the provided polygonal area, which shows the boundaries of project properties.

1.3 Forest

According to Colombia's national definition, a forest is an area of at least 1 hectare, with trees taller than 5 meters covering a minimum of 30% of the area.

1.4 Minimum Mapping unit

The *minimum mapping unit* (MMU) defines the smallest mapped element of the analysis. In this case, it was 90 m². This size is determined by the spatial resolution of the sensor data used in this exercise. The MMU changed according to the postprocessing steps of the analysis.

1.5 Eligibility

Areas declared as 'eligible' result from a two-step temporal forest change analysis and a subsequent wetland – non-wetland analysis. Area which was mapped as deforestation in the first step (forest to non-forest), or as stable forest (forest to forest) was considered non-eligible. Area mapped as stable non-forested, or forest regrowth (non-forest to forest) on the other hand, was therefore defined as 'eligible area', according to the eligibility criteria.

Additionally, according to the Annex C of Gold Standard LUF activity requirements, the second analysis defined area as non-eligible where surface water was detected in the last decades.

2 INTRODUCTION

This document refers to a two-layered analysis consisting of a remote sensing-based forest change analysis and a wetland, non-wetland analysis. This approach was performed to determine the eligibility of the project area according to the [Gold Standard requirements](#). For the forest change analysis, one dataset of medium resolution was classified as forest / non-forest for the project year (2011) and the reference year (2021) each. After this, a change in forested area was calculated based on these classifications. Finally, this area was assessed further to determine existing surface water in the project area.

3 DATA USED FOR THE ANALYSIS

3.1 Project data

The vector data provided by the project proponents included property data and planted area in which forest activities were and are carried out. Information of specific relevance are the planting years in the project area. The data shared was used to delimit the area in with the eligibility analysis was carried out and to understand the afforestation activities. Fig.1 shows the planted project area which was assessed during the eligibility analysis based on medium resolution imagery.

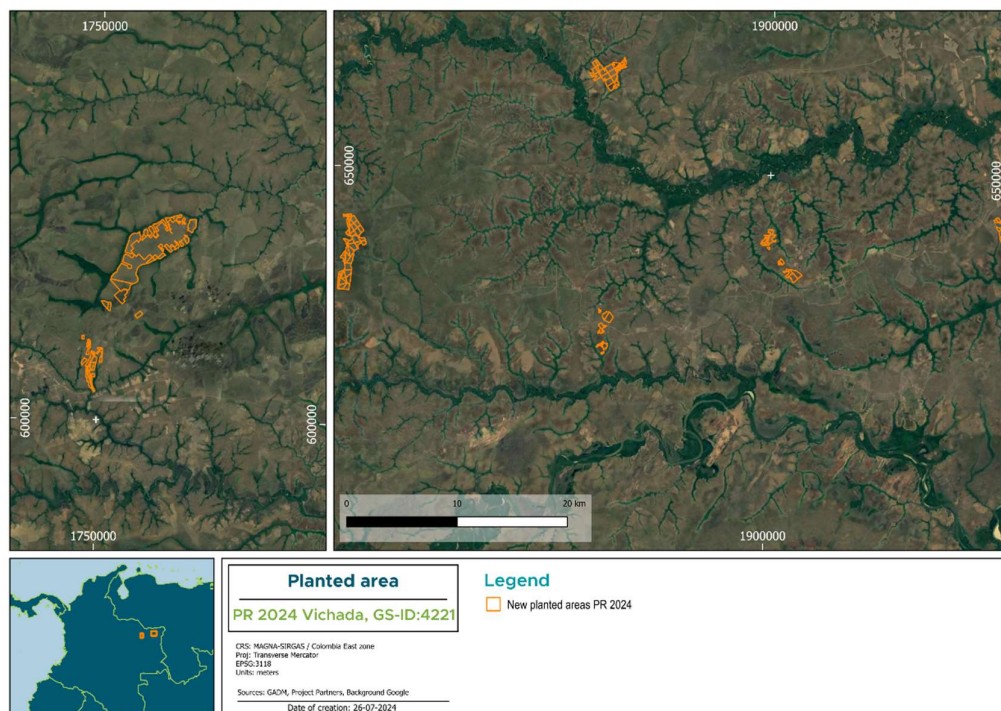


Figure 1: Project planted area assessed

3.2 Remote sensing data

3.2.1 Data used for first analysis

The first part of the eligibility analysis formed a multi-temporal forest change analysis based on publicly available Landsat imagery provided by NASA. Due to data scarcity in the project region, multiple sensors were utilized to assemble a comprehensive dataset for both the reference and project year.

It is important to note that in project areas in the Global South, not only a high coverage of clouds, but also a general lack of availability of historic satellite imagery can limit remote sensing analyses, as most of the archived global coverage has a strong bias to the Northern hemisphere. To address the data scarcity, a compositing approach was chosen which uses several images (before the respective year, **not** after) and produces a cloud-free image of best observation in the specified timeframe. This process was performed in Google Earth Engine and is visualized in Figure 2, the following table lists the used data and its specifications.

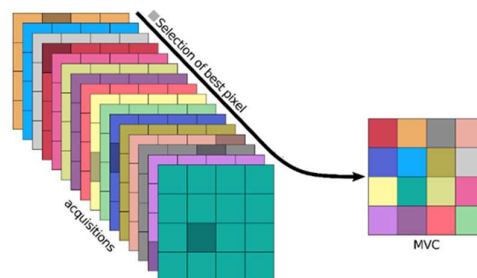
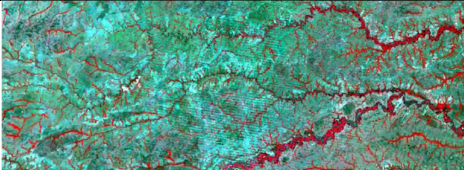



Figure 2: Quality compositing process of imagery

Table 1: List of used dataset and specifications

Classification	Satellite	Spatial Resolution	Spectral Resolution	Acquisition Period	Preview
2012	Landsat 7 composite	30m	7 Bands	2011-2012	
2022	Landsat 8 composite	30m	8 Bands	2021-2022	

3.3 Additional data

To contextualize the spatial analyses, additional data of public domain was utilized including administrative data, land use and infrastructure, etc. This was used for a deeper understanding of the results. Publicly available land use data was used to understand the area around the assessed project area¹.

The data included Open Streetmap, Satellite imagery provided by Google Earth Pro and land use data provided by the Government of Colombia.

4 WORKFLOW & METHODS

In this chapter the remote sensing workflow and methods used to conduct the eligibility analysis are described.

4.1 Flowchart

The following flowchart shows the processing workflow of the satellite imagery analysis which was carried out on medium resolution imagery to assign forest/non forest classes to the planted area of the project.

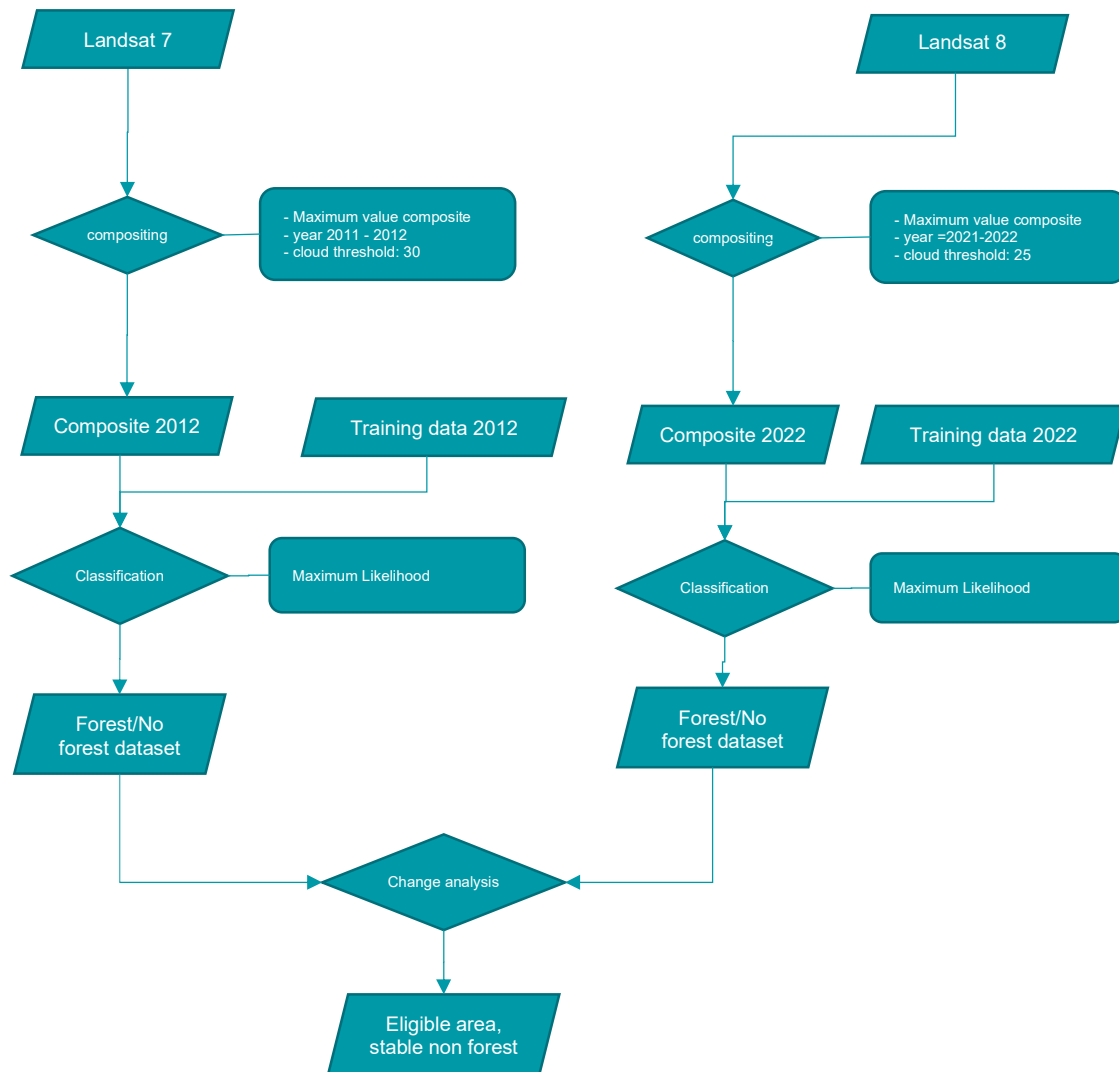


Figure 3:Procedural workflow of the eligibility analysis

4.2 Methods of the remote sensing based forest-no forest analysis

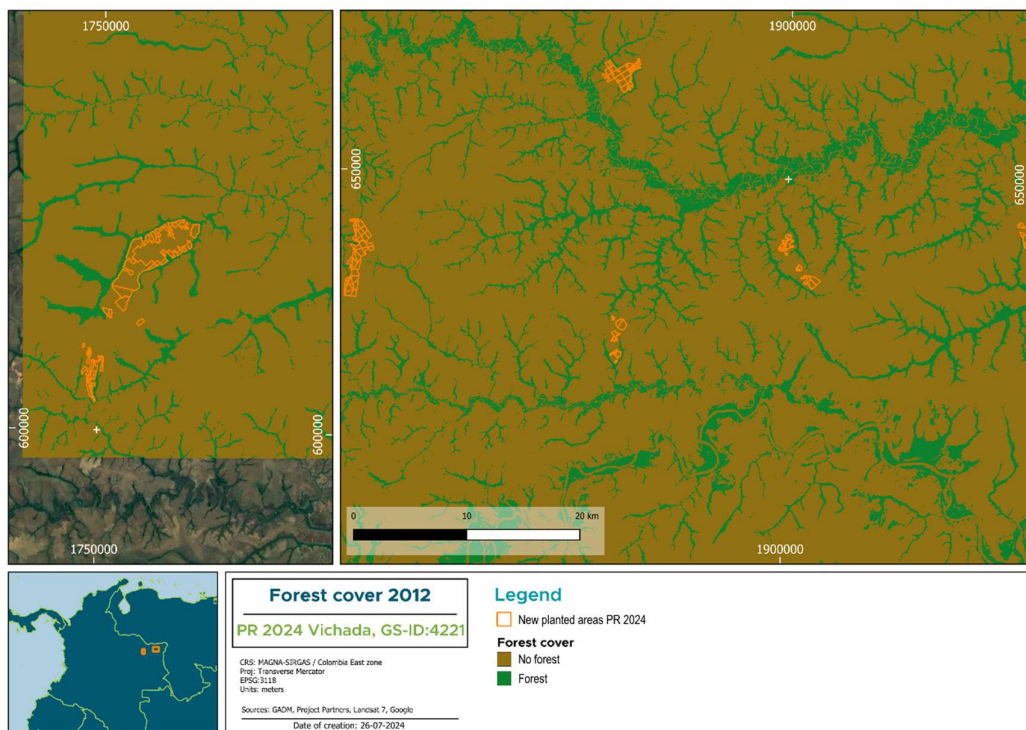
4.2.1 Forest – Non Forest classification

All imagery (see data source chapter) was displayed in QGIS. Additionally, Google Earth data was displayed to understand the context of the area better. It became very apparent that the project area is non forest and clearly distinct from riverine forest outside of the planted area. Manually, by interpreting the multispectral Landsat data and the more recent Google Earth imagery, training polygons were set to train the classifier with the respective reflectances.

- **Non Forest** was defined as a class including any visible and identifiable land cover which does not meet the forest criteria. For the Vichada project area, these are mainly grassland dominated ecosystems and bare soils.
- **Forest** was assigned to vegetated areas with a minimum height of 5 meters, a minimum patch size of 0,5 ha and a crown coverage of more than 30%. Forest patches with a part of the area outside the proposed project area were still classified as forest, even if the area inside the proposed project area was smaller than 0.5 ha. Following this conservative approach, a result of high accuracy and without a negative bias was produced.

After this, a maximum likelihood classification was run for each year to produce a forest/non forest dataset for each year. Both results were investigated manually by two remote sensing experts individually to confirm the accuracy within the planted area. Small patches of forest edges were considered as non-eligible, following the connectivity criteria described in the forest class above.

The following pictures show the results of the maximum likelihood classification for 2012 and 2022 respectively.



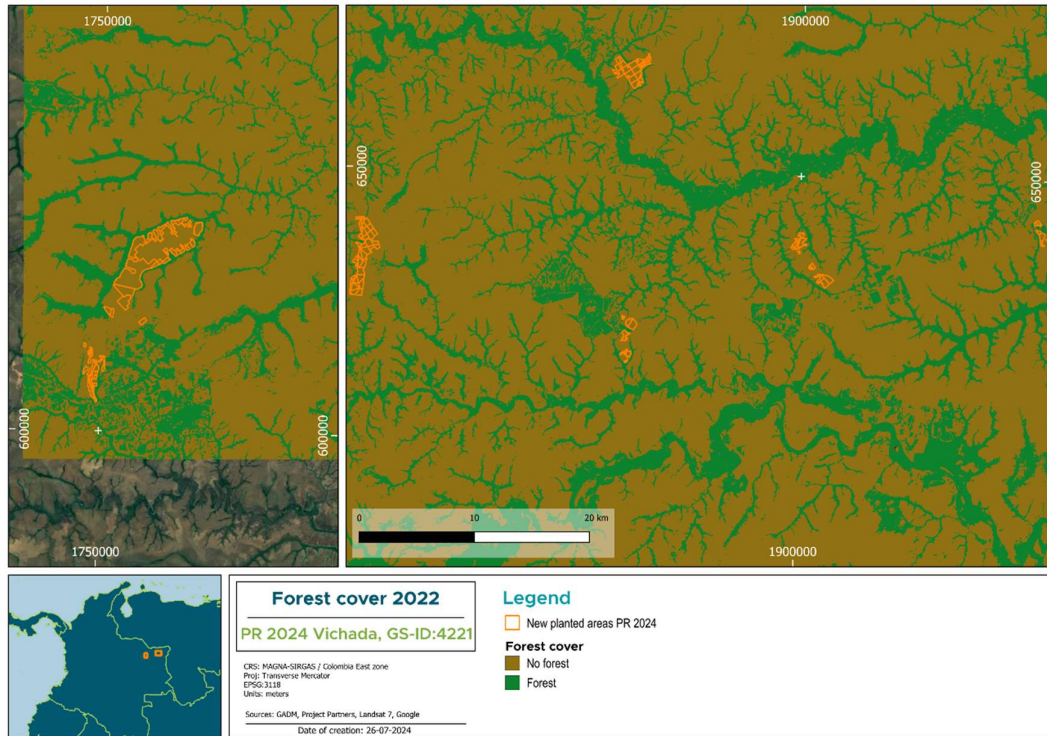


Figure 3: Forest cover map for 2012 and 2022 (the left part shows only part of the classification)

4.2.2 Accuracy assessment

To evaluate the performance of the maximum likelihood classification process, a traditional point-based accuracy assessment was carried out in addition to the manual check. 300 points were randomly distributed in the 2012 and 2022 classifications. A stratified random sampling distribution following Olofsson et al. 2012 was chosen to determine number and distribution of points.

The assessment revealed very high accuracies, over estimation of forest occurred especially for 2022 which was considered a conservative bias. The following tables show the accuracy for 2009 and 2019.

Table 2: Confusion Matrix forest classification 2012

		Reference			
		Forest	No forest	Totals	
Classification	Forest	138	12	150	92%
	No forest	2	148	150	99%
Totals		140	160	300	
		Producer			
		Acc	99%	93%	

Table 3: Confusion Matrix forest classification 2022

		Reference			
		Forest	No forest	Totals	
Classification	Forest	128	22	150	85%
	No forest	5	145	150	97%
Totals		133	167	300	

Producer
 Acc 96% 87%

4.2.3 Forest eligibility analysis

The two forest - non-forest datasets for 2012 and 2022 were used to produce a dataset of eligibility according to the Gold Standard Guidelines. This was achieved by calculating a forest cover change analysis. Pixels that were determined as 'no forest' in both years were classified as eligible. If any Pixel within the proposed project area was classified as 'forest' in 2012 (class value 1) this part was classified as non-eligible.

The result was vectorized and clipped to the PR project area to determine the accurate area of eligibility for the planted area shown in figure 1. This dataset was then further processed to exclude wetlands in the area.

4.3 Wetland analysis

4.3.1 Method wetland analysis

For the wetland- non wetland analysis, the planted are was overlayed with the Global Surface Water extent dataset provided by Joint Research Center (JRC) of the European Union. The surface water extent dataset is a raster which maps area covered with water at any point in time between 1984 and 2021 and summarizes all surface water observations in that period the maximum extent of surface water. Surface water detected in this dataset was vectorized, buffered with 15m and removed from the planted area

5 FINAL ELIGIBILITY RESULT

In general, the classifications are characterized by very high accuracy values. This is due to the characteristics of the project landscape which is not covered by trees, only riverine gallery forests which are very distinct spatially and spectrally, can be found in the area. This leads to clear forest-non forest classification results and a very stable landscape with almost no deforestation detected. Using a conservative approach, some pixel patches showing water covered area were removed despite being most probably an error in mapping.

The result of both eligibility analyses, forest-non forest and wetland-non wetland, shows two classes: Eligible and Non-eligible according to the Gold Standard methodology. Figure 4 shows the eligibility map with these classes and the areal figures calculated for the planted area included in the PR.

As the non eligible area is negligible and limited to two surface water occurrences, the reader is referred to the zoomable pdf showing the same result.

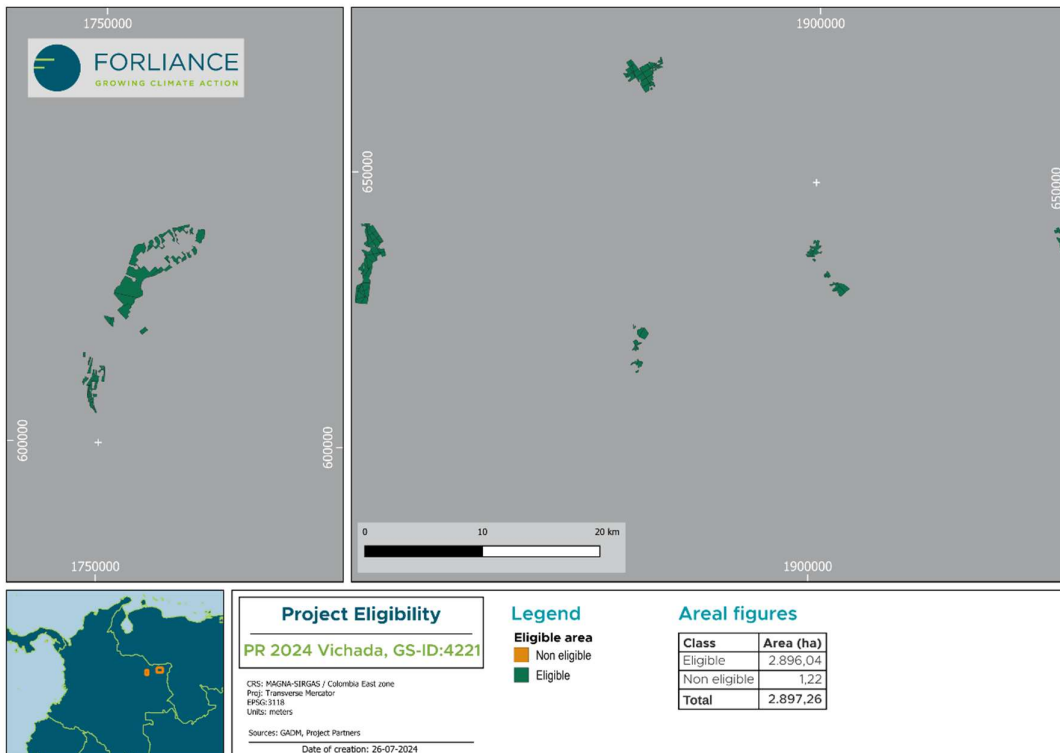


Figure 4: Final eligibility analysis result with areal figures.

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