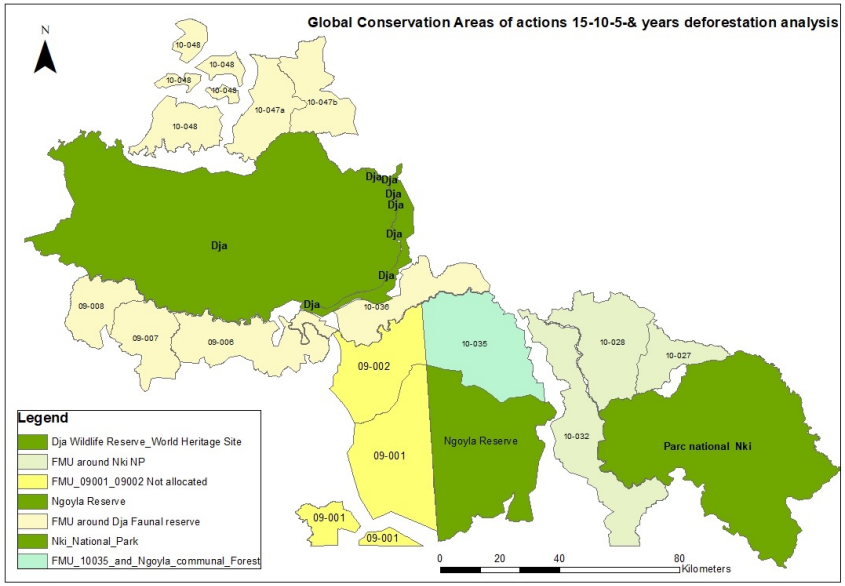
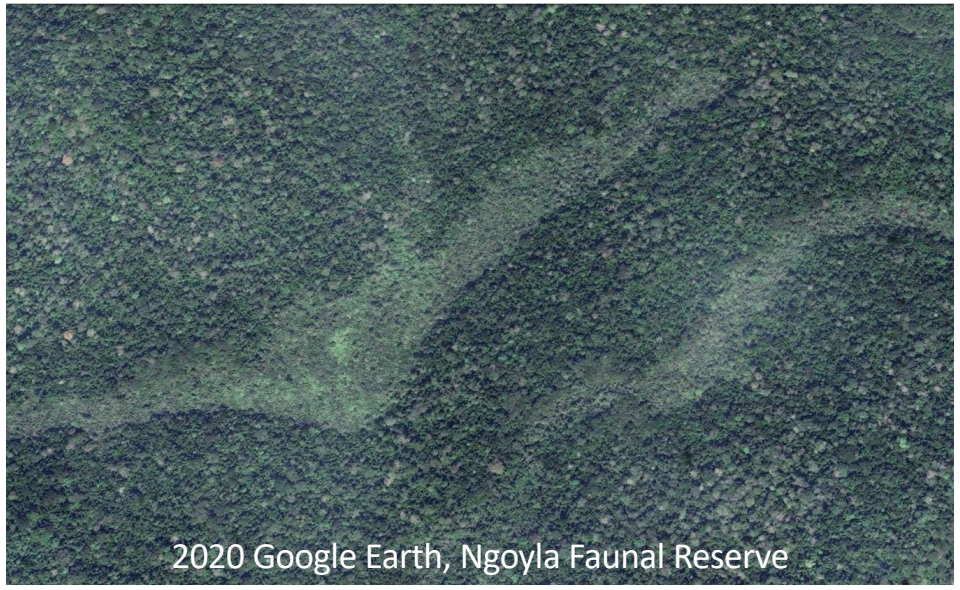
i-CULTIVER
AGRICULTURE FOOD NUTRITION SCIENCE

CLASlite
CLASlite Analysis

Deforestation 2018-2022
(5- and 1-year analysis)





DJA Wildlife Reserve
Nki National Park
Ngoyla Faunal Reserve
Cameroon

i-Cultiver Inc.
Manteca, California

ABOUT

CLASlite Analysis

These protected areas are important for Cameroon, since they have unique ecosystems, protecting important fauna and flora and are large freshwater reservoirs.

The forest type in these protected areas is mostly tropical broadleaf and cloud forests.

Working with Global Conservation, i-Cultiver has monitored the DJA Wildlife Reserve, Nki National Park and Ngoyla Fauna Reserve in Cameroon through the use of remote sensing to determine deforestation for the years 2018-2021 and 2021-2022. Satellite data available for processing the timeline was ESA Sentinel-2 with a space 10-meter resolution. The total number of images used for The data of the process were 19 images, seven for each year approximately.

Notes from Oliver Fankem,

Central Africa Director
Global Conservation, Cameroun

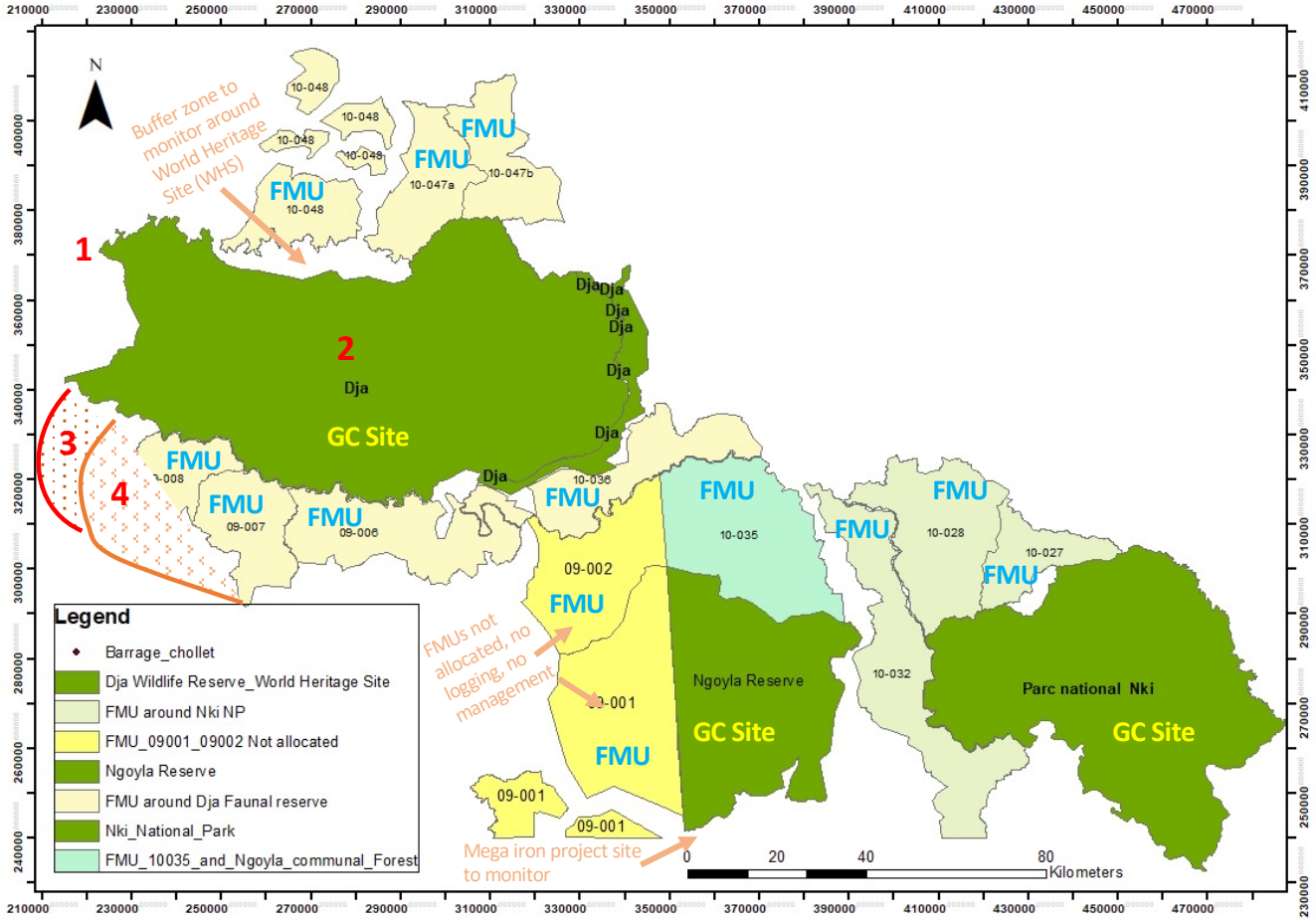
1. North-Western Region
- **Dja Dam (Hydro-mekin Dam)**
  - Serious change in forest cover and water flowing over the last years

2. Green Western Region
- **Dja World Heritage Site**
  - Was forest at its primitive stage, never logged before (Global Conservation site)

3. South-Western Region
- **Shaded (west)**
  - Area clear cut for rubber plantation

4. South-Western Region
- **Shaded (next to #3)**
  - Area left for conservation after appeal campaign on deforestation near a WHS

FMU Sites
- **As marked**
  - FMU = Forest Management Units (Official concessions for logging)



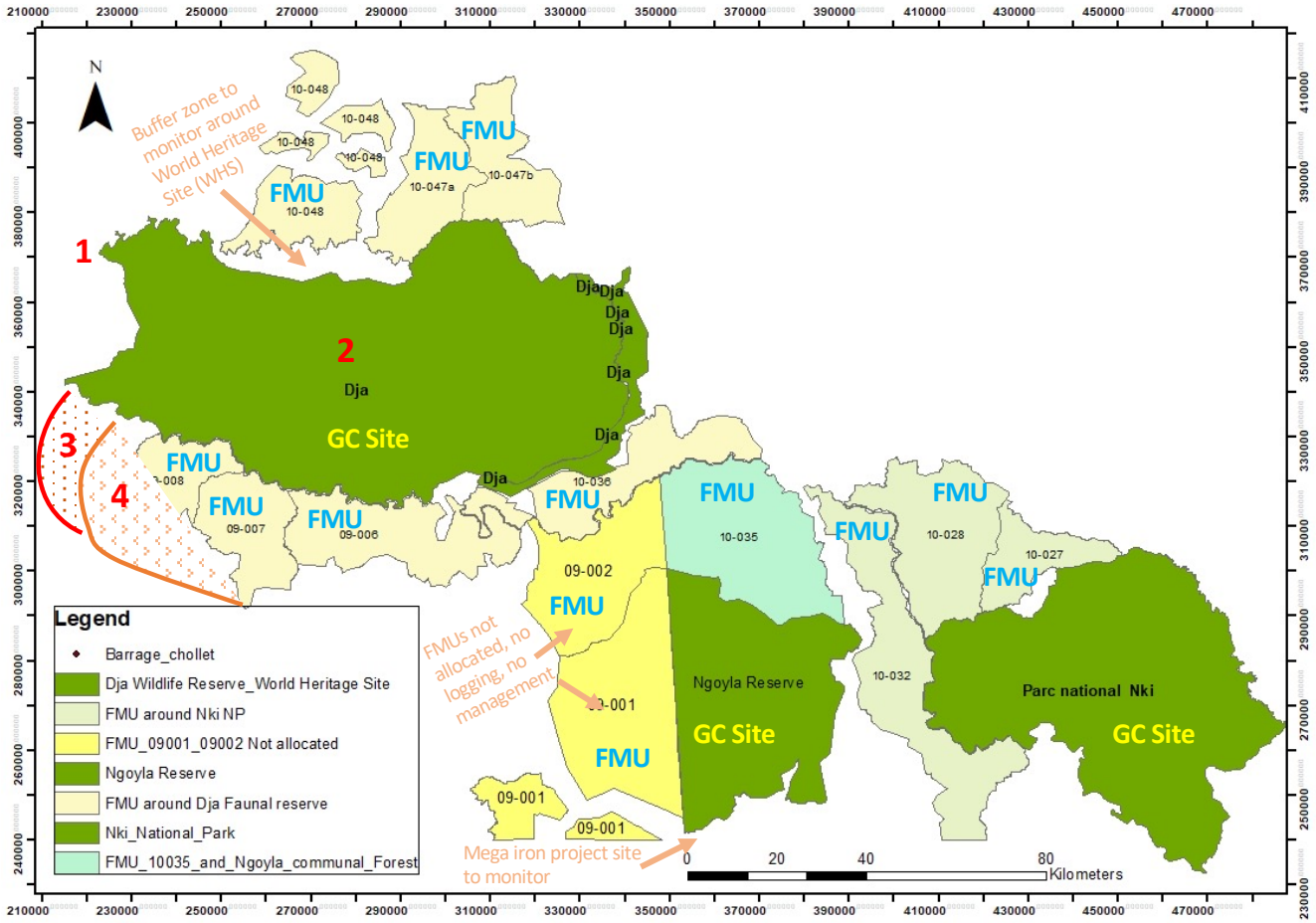
Notes from Oliver Fankem,

Central Africa Director
Global Conservation, Cameroun

Overall activities:
Iron mining, Logging concession, rubber clearing

- **Current Analysis: 5- and 1-year changes**
- **Future Areas to monitor with specific concern:**
  - Iron mining activity, rubber clearing (#3)
  - Western side dam- field reservoir. Things were uncontrollable, animals effected. Python attacks, etc. Bed of the river (water moved/impacted)
  - Green zone Dja (division line on the right)- On the right-hand side of the line in this region is Community Forest- sublet to people
  - Boundary of the 09-002 & 09-001 concessions and logging use in the future
  - **Carbon Business**
    Dja rubber company has now left. Concession is still there. There is a possibility to really manage this area.

Monitor changes every two weeks around certain selected areas - can also lead to a better understanding from the behavior of deforestation and reforestation to predict large animal movement patterns over seasons? In the future, LIDAR Satellite will help with this process and with tree species distribution



SUMMARY

CLASlite Analysis

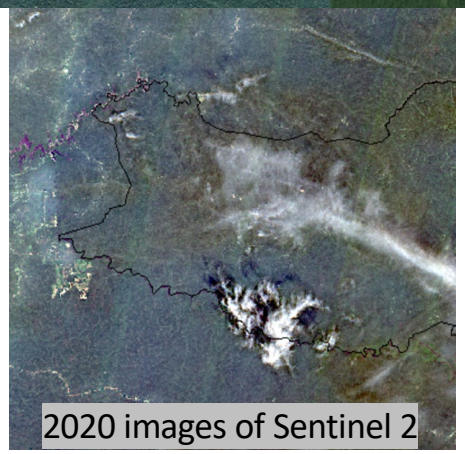
The deforestation analysis was carried out for three protected areas in Cameroon:
1. DJA Wildlife Reserve
2. Nki National Park
3. Ngoyla Faunal Reserve

Each of these protected areas has particular characteristics, its ecosystem being interesting, since it is in a network of forests with high biodiversity and rivers, which run through the areas and their zones of influence.

This causes a high-water recharge and high evapotranspiration processes to occur, causing these ecosystems to be covered by clouds for 95% of the year, making the analysis of deforestation difficult to perform with optical images. We recommend using radar-based analysis, we will have this method available soon.

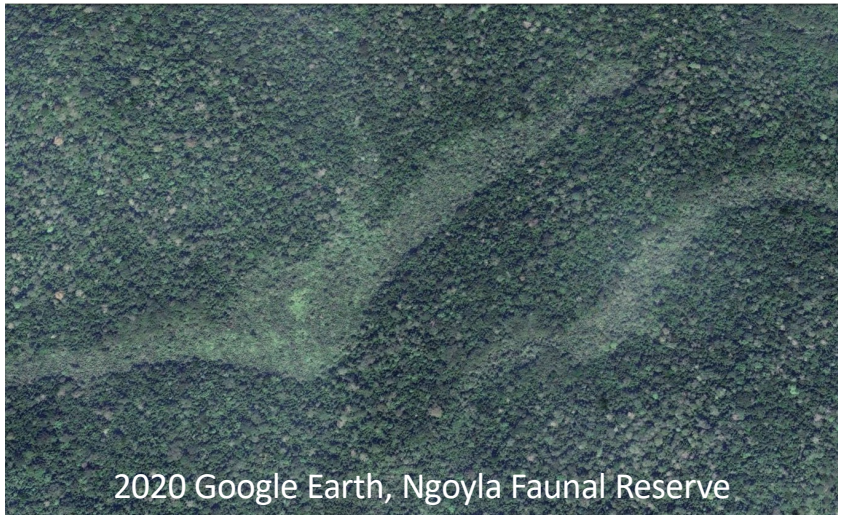
DJA Wildlife Reserve

2016 Google Earth images


2020 images of Sentinel 2

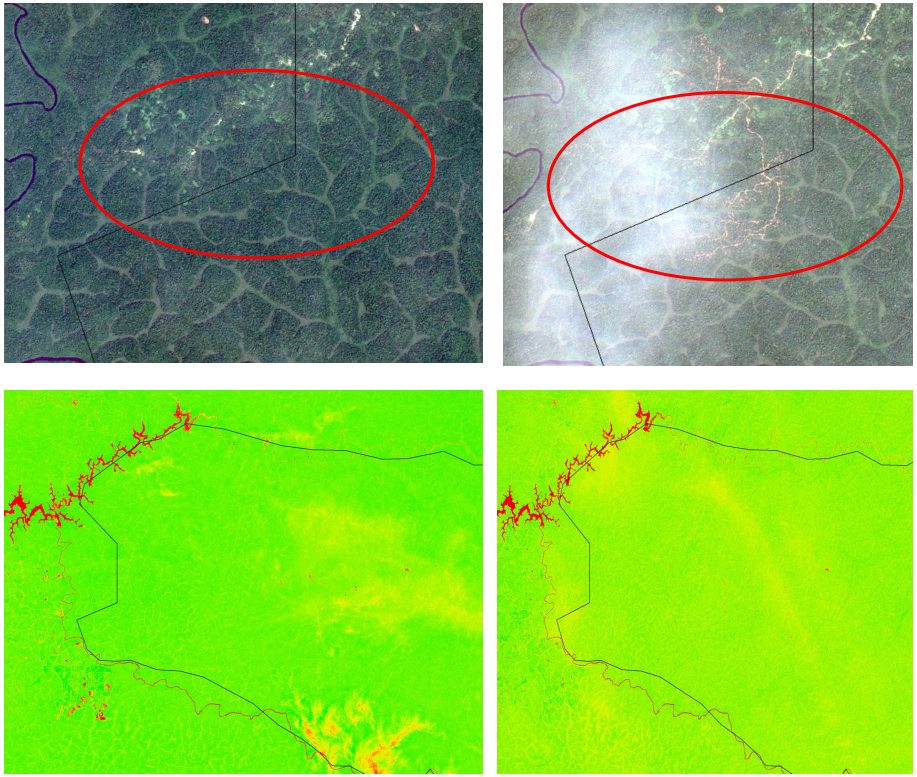
RESULTS

- No visibly major deforestation has occurred for the protected areas.
- However, as can be seen in the figure on the right, selective logging (forest degradation) may be occurring.
- It is possible to notice that some bodies of water have been altered.
- In general, for the three protected areas, it was possible to notice that some bodies of water have been altered.
- Through the analysis with NDVI it was possible to determine that in some areas something is happening with the vegetation, and it is possible that it is only an artifact due to the phenology of the plants in the forest or it may be due to a poor state of the forests due to the alterations that may be occurring in the watercourses within these protected areas.



2020 Google Earth, Ngoyla Faunal Reserve

DJA Wildlife Reserve



2020 2022

RESULTS

CLASlite Analysis

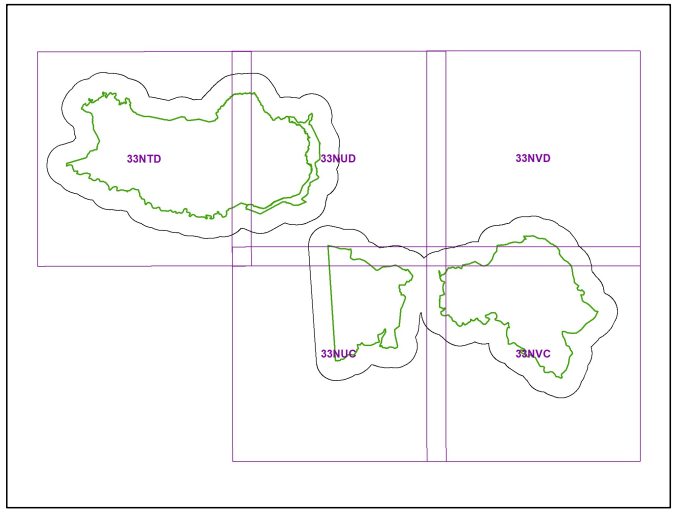
The images on the left show an example in DJA Wildlife Reserve of possible deforestation making a comparison between the year 2020 and 2022, but due to the high cloudiness in the area it is difficult to determine specific deforested areas, and that were not evidenced during the analysis due to the spatial resolution of work; and what happens to the vegetation and the NDVI result.

The green color represents vegetation in good condition, the yellow color represents poor or medium health status of the vegetation, and the red color represents deforestation or other non-forest uses.

We are developing a radar-based method that will be effective even with cloud cover. This method will be available soon.

MATERIALS AND METHODS

CLASlite Analysis



Protected areas (green), Sentinel-2 path/row (purple), and buffer área 10 km (black).

The five-year (2018-2022) and one-year (2021-2022) analysis, it was not possible to use CLASlite with Sentinel-2 images.
from ESA (Table 1).

Although the location had a high number of clouds during the year, it was possible to find at least one usable image. The 2018-2022 schedule (five years) was processed using NDVI (Normalized Difference Vegetation Index) with the respective GIS methodology.

For 2021-2022 (one year), which in some cases was only possible to find 2020-2021 images due to the number of clouds, was also processed using NDVI.

MATERIALS AND METHODS

CLASlite Analysis

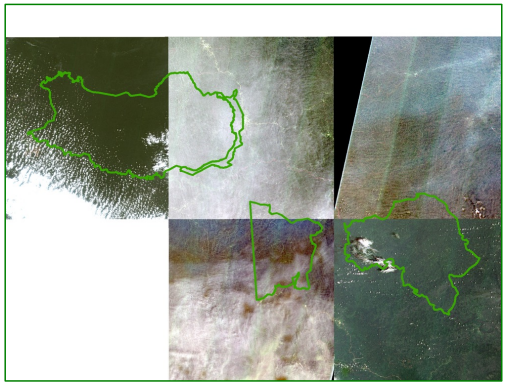
Table 1. List of downloading images form ESA Hub.

Name	Sensor	Path/row	Day
S2A_MSIL2A_20180104T092351_N9999_R093_T33NTD_20230208T152725	Sentinel-2A	T33NTD	4/01/2018
S2A_MSIL2A_20181210T092351_N9999_R093_T33NTD_20230208T152756	Sentinel-2A	T33NTD	1/12/2018
S2A_MSIL2A_20200104T092401_N9999_R093_T33NTD_20230208T152828	Sentinel-2A	T33NTD	4/01/2020
S2A_MSIL2A_20221229T092411_N9999_R093_T33NTD_20230208T152955	Sentinel-2A	T33NTD	29/12/2022
S2A_MSIL2A_20180104T092351_N9999_R093_T33NUC_20230208T161552	Sentinel-2A	T33NUC	4/01/2018
S2A_MSIL2A_20200124T092251_N9999_R093_T33NUC_20230208T161627	Sentinel-2A	T33NUC	24/01/2020
S2A_MSIL2A_20220324T092031_N9999_R093_T33NUC_20230208T161701	Sentinel-2A	T33NUC	24/03/2022
S2A_MSIL2A_20180104T092351_N9999_R093_T33NUD_20230208T164630	Sentinel-2A	T33NUD	4/01/2018
S2A_MSIL2A_20210915T092031_N9999_R093_T33NUD_20230208T164838	Sentinel-2A	T33NUD	15/09/2021
S2A_MSIL2A_20220123T092301_N9999_R093_T33NUD_20230208T164915	Sentinel-2A	T33NUD	23/01/2022
S2A_MSIL2A_20221229T092411_N9999_R093_T33NUD_20230208T164957	Sentinel-2A	T33NUD	29/12/2022
S2A_MSIL2A_20180302T090901_N9999_R050_T33NVC_20230208T173717	Sentinel-2A	T33NVC	2/03/2018
S2B_MSIL2A_20180106T091339_N9999_R050_T33NVC_20230208T173936	Sentinel-2A	T33NVC	6/01/2018
S2A_MSIL2A_20200331T090551_N9999_R050_T33NVC_20230208T173815	Sentinel-2A	T33NVC	31/03/2020
S2A_MSIL2A_20211231T091401_N9999_R050_T33NVC_20230208T173850	Sentinel-2A	T33NVC	31/12/2021
S2B_MSIL2A_20221211T091259_N9999_R050_T33NVC_20230208T174030	Sentinel-2A	T33NVC	11/12/2022
S2A_MSIL2A_20181220T092401_N9999_R093_T33NVD_20230208T191101	Sentinel-2A	T33NVD	20/12/2018
S2B_MSIL2A_20181222T091359_N9999_R050_T33NVD_20230208T191124	Sentinel-2A	T33NVD	22/12/2018
S2B_MSIL2A_20181222T091359_N9999_R050_T33NVD_20230208T191146	Sentinel-2A	T33NVD	22/12/2018

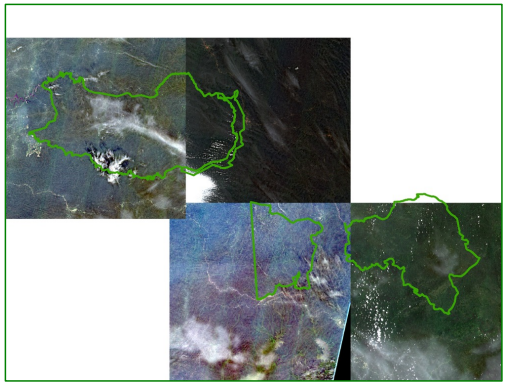
MATERIALS AND METHODS

CLASlite Analysis

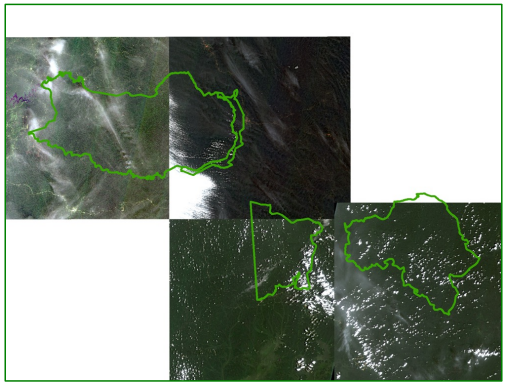
2018 Sentinel-2 mosaic



2020-21 Sentinel-2 mosaic



2021-22 Sentinel-2 mosaic



The deforestation analysis that was carried out for the 3 protected areas in Cameroon implied an exhaustive review of the Sentinel 2 image catalog (ESA) due to the type of ecosystem of the areas (tropical and cloud forest) that presented many clouds throughout the year Therefore, it was difficult to obtain the images to be able to make a mosaic. However, a NDVIanalysis was carried out in which it was possible to analyze the area to determine if deforestation had occurred. In the figures at the top, we can see the respective mosaics of the images that were used.

CONCLUSION

CLASlite Analysis

In the case of analysis of deforestation in these three protected areas, it can be concluded that:

- There has been no major deforestation that can be identified with 20m resolution optical images.
- For the areas that are previously deforested, an extension has been noted around them, that if care is not taken these activities could extend to the parks and reserves.
- However, it is possible to notice that within the protected areas, selective logging is taking place, dead trees are observed, but this cannot be identified as deforestation but rather **forest degradation**, which will have to be monitored.
- However, as can be seen in the figure (DJA Wildlife Reserve), selective logging (forest degradation) may be occurring. Due to the difficulty of finding images without clouds, to carry out periodic analysis of deforestation it is recommended to use Radar images, which penetrate the clouds and it is possible to obtain data without difficulty.

REFERENCES

CLASlite Analysis

1. https://globalconservation.org/projects/dja-biosphere-reserve-cameroon/
2. https://sentinels.copernicus.eu/web/sentinel/home
3. https://www.cameroon.be/en/discover-cameroon/attractions/national-parks
4. https://www.cameroon.be/en/discover-cameroon/practical-information
5. https://discover-cameroon.com/en/cameroon-national-parks/

About i-Cultiver

Rajnish Khanna Ph.D

Founder and CEO

i-Cultiver is a consortium of multidisciplinary professionals working together to improve agriculture, nutrition and conservation through advanced research and easy to use technology.

Our mission is to bring technical solutions for modernizing agriculture, food systems and resource conservation to improve the human condition and its impact on our planet.

For more information visit: i-Cultiver.com