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# EVALUATION OF LANDSAT 8 AND SENTINEL-2A DATA ON THE CORRELATION BETWEEN GEOLOGICAL MAPPING AND NDVI

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***Abstract-*** **This paper presents an experimental evaluation of the Normalized Difference Vegetation Index (NDVI), comparing results obtained with images from the Operational Land Imager (OLI) onboard Landsat 8 satellite, Multispectral Instrument (MSI) onboard Sentinel-2A satellite, and data acquired through field surveys applied in a semi-detailed geological mapping of the Campo Formoso region in Brazil. Large areas of vegetation have predominantly been determined by climatic factors but this classification changes when zones of smaller dimensions are considered, as they may share similar climatic characteristics. Within the framework of the thematic mapping performed, the aspect with the greatest influence in forming associated vegetation is the nature of the lithotypes, whose influences determine the direct interferences of soil genesis. From a comparison of the results, it was possible to effectuate a quantified correlation between NDVI values of the distinct sensors and qualitatively suggest the magnitude of the proximity between the distribution of different phytophysiognomies and their intrinsic relationship with lithogeological expressions. Index Terms Normalized Difference Vegetation Index (NDVI), Sentinel-2-A, Landsat 8, geological mapping**

## I INTRODUCTION

Remote sensing is the science that by means of devices and sensors to obtain information about a distance target Currently, this branch has gained a significant momentum in its development with the functionality of the new generation of resolution satellites between 10 m and 30 m capable of producing broadly applicable radiometric and spectrometric data in the extraction of information. The OLI sensors Sentinel-2Aexecution of oriented to the theme of vegetation . There are many methods to map and monitor the land cover
with remote sensing data. Mapping and monitoring have both become the areas of application in the remote sensing However, the use of conventional techniques to verify changes in standards, in some cases, may be inadequate .

TABELA I
BANDAS ANÁLOGAS CONSIDERADAS NESTE ESTUDO

| OLI Landsat 8 | Nomenclatura das Bandas | MSI Sentinel-2A |
|---|---|---|
| B 02 (0,450-0,510 µm) | Azul | B 02 (0,458-0,523 µm) |
| B 03 (0,530-0,590 µm) | Verde | B 03 (0,543-0,578 µm) |
| B 04 (0,640-0,690 µm) | Vermelho | B 04 (0,650-0,680 µm) |
| B 05 (0,850-0,880 µm) | Infravermelho próximo | B 08 (0,698-0,713 µm) |

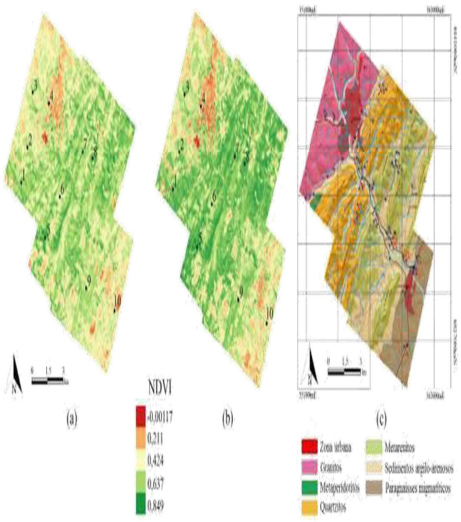
The use of remote sensing images and, in particular, particular, the calculation of the Vegetation Index by Standard
Difference (NDVI), shows that it is a very important and convenient tool for both temporal dynamics and in more simplified analyzes of the vegetation . One of the most common applications relation between the spatial and temporal distribution of climatic conditions, which indicate that there are patterns directly bound between precipitation and NDVI.

The effectiveness of this resource is due to the contrasting effects of reflectance of the vegetation and the possibility of obtaining biophysical parameters covering large areas and in different scales In this work, the NDVI calculation is used in a slightly alternative approach to its typical function. Scenes of the same date and different sensors were processed to examine how the behavior of the vegetation cover responds in respect

to the different litotipias of an area with climatic

## II METHODOLOGY

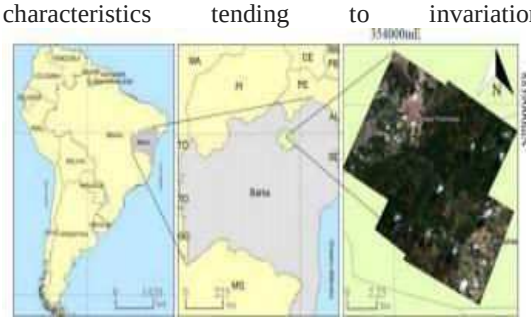
Initially, the orbital products were used in order to observe the differences between the results given by the sensors approached in the production of this work. For this, quantified NDVI standards were created, which were compared so that there was a distinction between more discrepant values or possible anomalies among the data obtained in strategically selected sample points. This procedure sought to determine if incompatibilities in the values offered for equal points would be associated to different levels of experimental effectiveness in the final results. Finally, a qualitative evaluation was done with respect to the results of cross referencing of the images and the geological mapping, so that it would be feasible to create categories of lithology




*Study Area*

The study area is located in Campo Formoso, Brazil and covers an area of approximately 113.4 km2 If within the Caatinga biome and it is a region of great complexity in relation to the context of eventsgeological features

characteristics tending to invariation.



### A. *Field Data*

The data collected in the field were synthesized to generate some thematic maps, which supported the elaboration of of a geological map at the half-scale or 1: 25000 scale, produced by academics of the Institute of Geosciences of Federal university of Bahia. In this mapping, possible to identify and classify six large units geological processes: the health complex, the and alluvial deposits. From there, the main lithological subgroups in terms of spatial range: the group of granite (granites a two micas), the groups of rocks of character sometimes clay-organic, resulting in part of the product of rock weathering adjacent areas. In what it refers to vegetation cover, we highlight the presence of savannas forests; woody savannas in different stages of development; of the gallery forests and areas used for agro-forestry purposes.

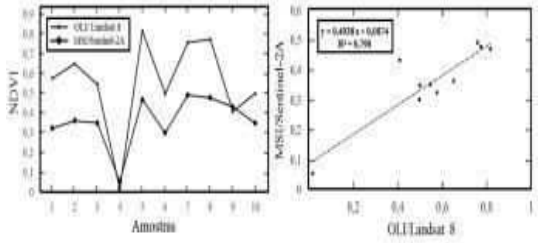
### B. *Orbital Sensors Data*

The Landsat 8 and Sentinel-2A images used in this were purchased free of charge from the Agency's website. American Space Agency (NASA), with access through the http://earthexplorer.usgs.gov. The Sentinel- 2A's spectral bands were designed to which could offer superior performance in analog bands of the Landsat 8 sensors and SPOT . This detail, which shows a in the Sentinel- 2A instruments, however, causes deviations in the values resulting from index calculations such as NDVI, for example, when compared with these others satellites in operation. Similarly, such deviations may arise when conducting even with data from the same sensor. Therefore, it is necessary to implement certain adjustments, such as the application of atmospheric corrections, the purpose of which is to of the final values obtained in ensure the

generation of more faithful results in different jobs. In this work, however, only one scene was used orbital of each of the two sensors: OLI and MSI, both acquired . Given that the experiment data to be classified are in the the same relative scale, with values not corrected or partially corrected, the implementation of the atmospheric correction will have little effect on the accuracy of final classification . In this way, it was decided to execute the corrective procedure of the atmospheric scattering factor, after which satisfactory results were achieved to the context of the work. The ratio of NDVI can be determined from the the values of visible wavelengths and near infrared. The relationship of NDVI to Landsat 8 is demonstrated

## III RESULTS AND DISCUSSION

The comparative experimental analysis of the behavior of NDVI between scenes of the Landsat-8 satellites and Sentinel-2A was performed by means of the data response obtained by sampling with a strategic choice of 10 monitoring. The arrangement of these points in the study area was set according to the location of the subgroups presented . The behavior of the resulting NDVI can be compared in a simplified way based on the of the curves in the sample chart as a function of NDVI. Phytophysiognomies with higher vegetative vigorabsorb most of the visible wavelengths and reflect a large proportion of the radiation equivalent to near infrared. The opposite occurs with less mature plant physiologies. In this way, there is an established proportionality between NDVI values,vegetative development and substrate quality Soils are the basis for vegetation development and the environment where soil genesis occurs is extremely complex. This process is due to the rocks and by the action of a set of factors, such as the material of origin, climate, living organisms, topography and time geological It is known that the vegetable domains of large extensions are determined fundamentally by factors climatic conditions. The study area, however, presents conditions similar climatic conditions, since their dimensions




exceed 114 km2. In this case, the aspect of greater influence on vegetation formation is the physical-chemical character of lithotypes. It is important to point out that the localities concentrations of settlements, urban perimeters and the presence of activities were integrally identified, as well as their interactions with the topography and rainfall factors. Those data, which were obtained during the field survey were reaffirmed in the images. The regions in red in the images, for example,

are equivalent to areas of deforestation urban areas or small areas anthropogenic concentrations. Only sample 4 was positioned in this field. The portions of vegetable cover intensely deforested or with significant anthropogenic influences were discarded from the study, since it is necessary to identify coverage at stages closer to development natural vegetation. In evaluating the samples, it was possible to establish at least three categories of correspondence physiognomy. At granitic portions and those, comprise the savanna leafy vegetation with intermediate development. It includes small trees and some shrub species. The areas where metarenites and quartzites are found with shales and subordinate filitos, in green and orange, respectively; are located in the tops of the beleaguered savannah. Finally, the portions found in the extension of the associated with the gallery forests, which includes the recent sedimentary deposits and the rock groups of character in intrusions parallel to the direction NE (northeast). In the points analyzed, it was found that the vegetative vigor is shown by two main factors: the topographical arrangement and the chemical nature of the sediments carried from tops, which function as the best substrate for the development of vegetation.shows the information about the correspondence between lithotypes and vegetation

## IV CONCLUSION

This work suggests the use of an accessible segment extremely useful in the production of reliable data generated by from the satellite matrix information: the index NDVI. The cross-data between vegetation indexes not only allow the direct evaluation of the behavior of the vegetation as well as the consequent implications for their characteristics. Based on the estimates generated in the processing of average spatial resolution images, It is concluded that the accuracy of the index in relating the physico-chemical behavior of the rocks to vegetative vigor can be satisfactory. The process of inference of lithology by means of influences in the configuration of the variety of formations was

relevant.to the Institute of Geosciences Federal University of Bahia for the support of the scientific research and the promotion of field internships, which provide the systematized thematic mapping, ostensible and regular in areas of the Brazilian territory.

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