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Monitoring of Sugarcane Plantation Conditions Utilizing Enhanced Vegetation Indice for Donga Fadama Lands Nigeria

Chuma Obiamaka Vivian*

Department of Hospitality and Tourism management, Federal University of Wukari, Taraba State, Nigeria

***Corresponding Author:** Chuma Obiamaka Vivian, Department of Hospitality and Tourism management, Federal University of Wukari, Taraba State, Nigeria.

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Abstract

This research examined the necessity of the use of the Raster calculator tool of the map algebra in ArcGis for calculating the indices for enhanced and soil adjusted vegetation indices. The values acquired will then be used to cautiously observe the growth of sugarcane from the planting stage to harvesting stage. maps will be generated, green and red colors will be used to show bad health and good health of sugarcane. Additionally, after adequate examination, it was realized that when these broad band indices are made into maps it can be used in monitoring the growth of sugarcane in these regions

Keywords: Enhanced Vegetation Indices; Fadama

Introduction

The vegetation indices are important algorithms used to extract the information of vegetation condition Salas et al 2014. Vegetation indices are employed to enhance the vegetation conditions and they represent a single value for converting the reflectance spectrum for measuring vegetation characteristics Pettorelli N 2013.

Satellite vegetation index (VI) products are commonly used in a wide variety of terrestrial science applications that aim to monitor and characterize the Earth's vegetation cover from space (e.g. Myneni et al., 1997a; Saleska et al., 2007). Selection of vegetation indices in plant mapping is needed to provide the best information of plant conditions. Susantoro el al 2001.

The aim of this study is to show that EVI can be used to monitor the stages in sugarcane growth form planting to harvesting for required years, depending on what it is used for, also when atmospheric results are minor or insignificant. Additionally, if the acquired data has very good quality.

This paper is patterned briefly to explain how these indices can be produced in maps for sugarcane monitoring.

The formulas of the used vegetation indices were inputted in the appropriate software of which the stages will be further explained in subsequent paragraphs. The advantages of using this is to enhance yield, detect issues such as disease invasion on time, also avoid or minimize drought.

The study areas are Donga (Southern Taraba).

Materials and Method

This research majorly used secondary data. Which includes but not limited Landsat imagery at 30x30m resolution and existing maps. Additionally, some primary data was used mainly coordinates from Global positioning system of the research area.

The Landsat images of the study area for some years such as 2003, 2006, 2013, 2015, 2017 and 2018 was acquired by downloading, georeferencing, digitizing before putting them into appropriate use. Erdas software and ArcGIS was used in indices generation and monitoring.

S/N	*Data Type*	*Acquisition*	*Actual Spatial Resolution/ Scale*	*Acqusition Source*
1	Landsat ET-M+p187r55	June-2013 Mar-2013 Apr-2006 Jan-2006 May-2003 Jan-2003	30 x 30	USGS Earth explorer website
2	Landsat OLIp187r55	Dec-2017 Apr-2018 Feb-2018	30 x 30	USGS Earth explorer website
3		2-Mar-2012	0.7 x 0.7	Google Earth
4	Administrative map		ESRI Shapefiles	The Surveyor Generals Office. Abuja, Nigeria.
5	Co-ordinates of points	2018	± 5m	Field survey/GPS Receiver

Source: Author 2018.

Table 1: Data Qualities.

EVI - Enhanced Vegetation Index

EVI = 2.5 * (NIR - RED) / (NIR + 6*RED - 7.5*BLUE + 1).

The formula for calculating EVI which is 2.5 * (NIR - RED) / (NIR + 6*RED - 7.5*BLUE + 1) was inputted in the Erdas software and this software automatically computes the EVI value, then the readings recorded.

EVI was developed as a standard vegetation index product for the MODIS sensor to provide improved sensitivity in high-biomass areas and to provide corrections for soil background effects and atmospheric aerosol effects. Inputs should have reflectance values between 0 and 1. (Liu and Huette, 1995).

Pre-processing of Landsat Images

The preliminary processing of the acquired data was all carried out making use of the tools in Erdas Imagine 9.2 and ArcGIS 10.3.

Results and Discussion

The spatial analyst tool of ArcGis was used in calculating the two broad band greenness indices for the sugarcane farms for Donga and Lau starting from when the sugarcane was planted in December 2017 to the harvesting season in April 2018.

Appropriate data processing and examination was done, it was observed that the sugarcane farms changed from red to orange and eventually to green. The red color from the imagery depicts unhealthy sugarcane, the green shows healthy plantations. Therefore,

there was a subtle change in the health of sugarcane from the planting stage to harvesting. It was visible after examination that it gradually changed from bad to good for most farms, which signifies that when enhanced vegetation indice and soil adjusted vegetation indice are prepared `in maps it can be used to keep track of the growth of sugarcane for Donga North-Eastern Nigeria. Which will assist in proper scheduling to improve sugarcane growth as well as efficient forecasting of crop production.

Furthermore, after the sugarcane farm plots have been carefully overlaid on the two vegetation indice, and then the generation of the mean value of the indices for each farm plot, the following maps were produced and then adequate ground truth done for verification.

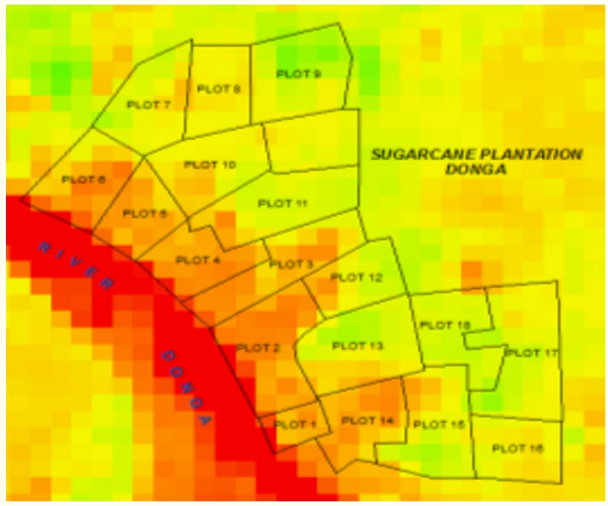

Figure 1: EVI December 2017 (Planting) Donga.

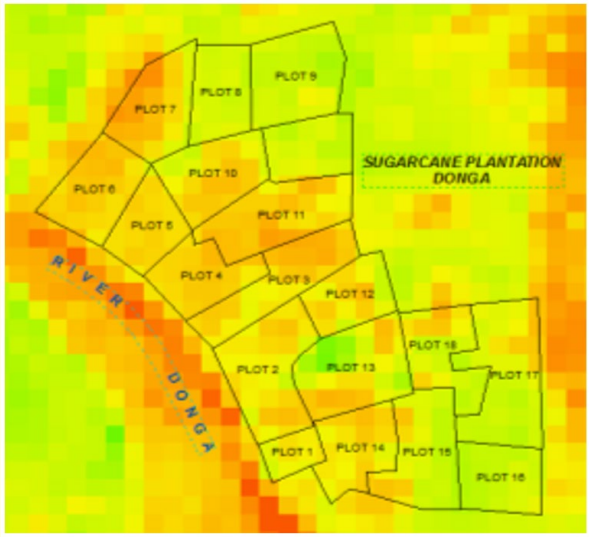

Figure 2: EVI FEB 2018 (Growth) Donga.

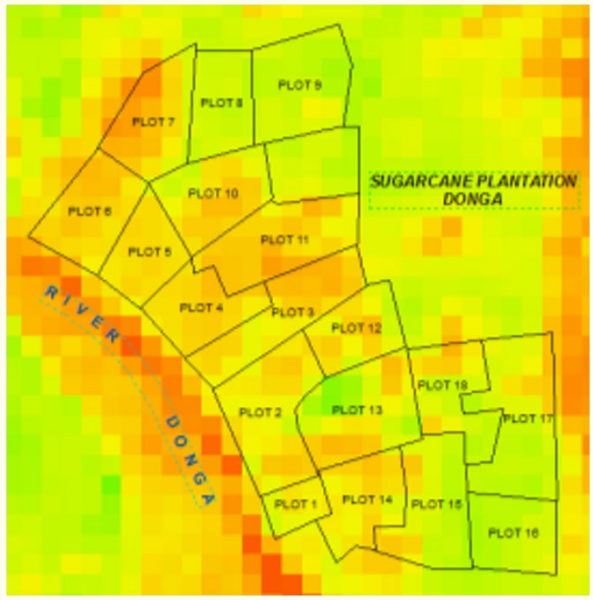

Figure 3: EVI FEB 2018 (Growth) Donga.

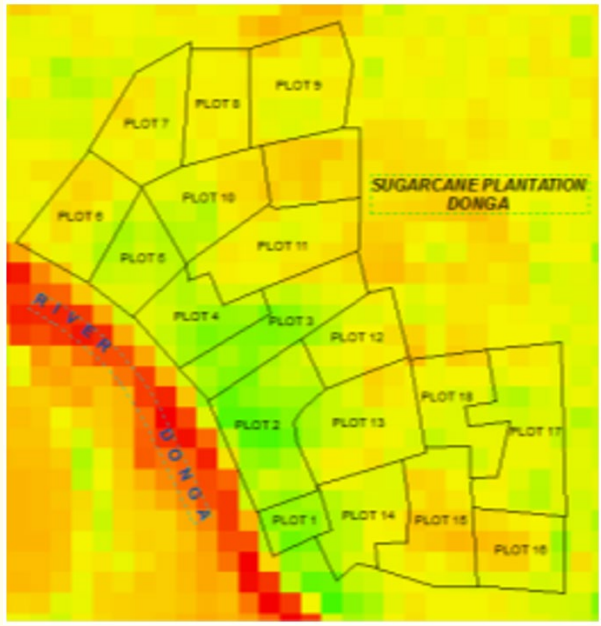

Figure 4: EVI Apr. 2018 (Maturity) Donga.

	Name	*EVI*	*SAVI*
	Planting		
Dec 2017	PLOT 1 (Donga)	0.15	0.16
	PLOT 2 (Donga)	0.13	0.14
	PLOT 3 (Donga)	0.15	0.17
	PLOT 4 (Donga)	0.14	0.15
	Mid-Season		
Feb 2018	PLOT 1 (Donga)	0.13	0.14
	PLOT 2 (Donga)	0.12	0.13
	PLOT 3 (Donga)	0.11	0.12
	PLOT 4 (Donga)	0.11	0.12
	Maturity		
April 2018	PLOT 1 (Donga)	0.23	0.23
	PLOT 2 (Donga)	0.22	0.22
	PLOT 3 (Donga)	0.19	0.19
	PLOT 4 (Donga)	0.20	0.20

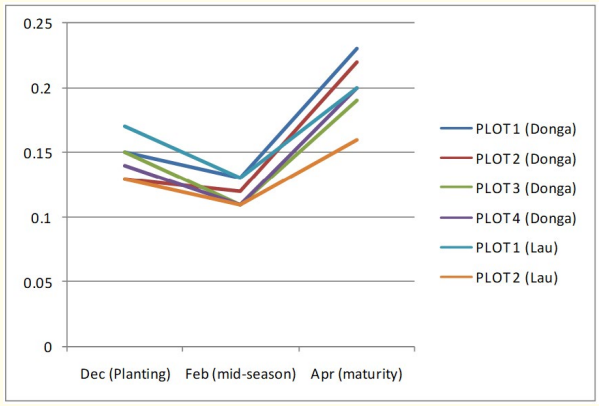

Figure 5: EVI Index indicative of sugar cane condition from planting to harvesting.

Conclusion

In this study, it was observed that vegetation indices can be generated using geospatial technology to fit into sugarcane monitoring which can assist in yield estimation. EVI I when generated using appropriate software and produced in maps can assist precision agriculture, pest control and invasion for farms.

References

1. Marek Mróz Anna Sobieraj. "Comparison of several vegetation indices calculated on the basis of a seasonal spot xs time series, and their suitability for land cover and agricultural crop identification". 7 (2004).

2. Myneni BR., et al. "Increased plant growth in the northern high latitudes from 1981 to 1991". Nature 386.17 (1997): 698-702.
3. Salas EAL and Henebry GM. "A new approach for the analysis of hyperspectral data: Theory and sensitivity analysis of the moment distance method". Remote sensing 6 (2014): 20-41.
4. Pettorelli N. "The Normalized Difference Vegetation Index". First Edition (United Kingdom: Oxford University Press) (2013): 193.
5. Saleska RS., et al. "Amazon forests green-up during 2005 drought". Science 318 (2007): 612.
6. Tri Muji Susantoro., et al. "Selection of vegetation indices for mapping the sugarcane condition around the oil and gas field of North West Java Basin, Indonesia". IOP Publishing IOP Conf. Series: Earth and Environmental Science 149.1 (2018): 012001.

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