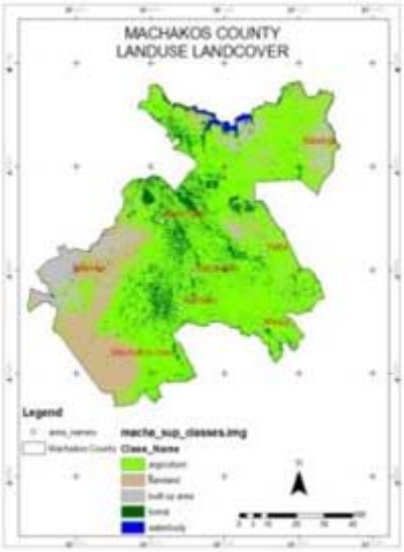

Figure 5: Machakos Land Use Land Cover classification

Supervised classification was done, this brought out agriculture as the main land use in the region, and areas around Machakos town and Mavoko are drier with sparse vegetation. Out of total area, Agriculture occupies 64% which is 3942 sqaure kilometers of the total land mass (See Figure 6): Environmental officers from the region informed this study that the main crops grown in the area include: Cereals (maize, sorghum, millet); Pulses (beans, pigeon peas, cowpeas, chicken peas, greengrams); Root and tubers (sweet potatoes, Irish potatoes, cassava, arrow roots). To a small extent some industrial crops are grown which include: Coffee, Cotton, tobacco and sisal.

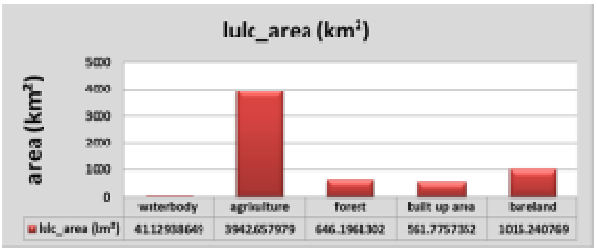

Figure 2: Machakos Land Use Land Cover (%) NDVI

NDVI (Normalized Difference Vegetation Index) from SPOT VGT satellite data was used to monitor the trend of biomass health and vigor. NDVI Maps area useful resource to view crop health variability, identify possible areas of poor plant stand, or show crop development status, helping advisors and producers to identify problem areas, and to make timely decisions.

NDVI = (NIR - RED)/(NIR + RED)

As can be observed in figure 8, the region has NDVI value of 0.22 - 0.42 (normal) and 0.12 - 0.22 (poor) occupying almost the whole region. In 2010, 'poor' NDVI was more distributed than in 2011. This means that crop vigor/health slightly improved in that period of 2010 and 2011. This could be attributed to an increase in crop moisture and nutrients. Sites were selected for comprehensive NDVI trend analysis of the region, these include Machakos town, Mavoko, Matungulu, Kathiani, Masinga and Yatta. These sites were selected based on their potential for Agriculture whereby some fall in high while others low production zones. Matungulu area is illustrated in Figure 9:

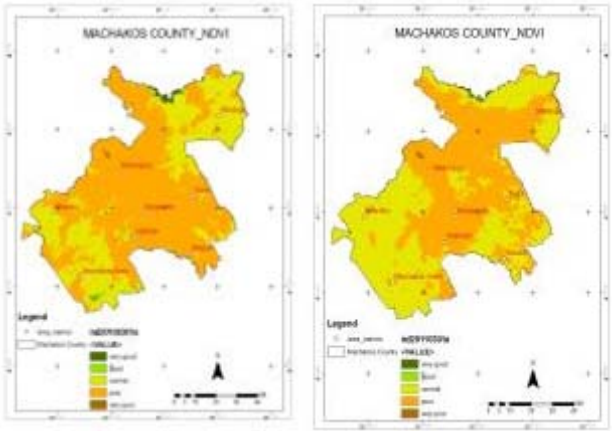

Figure 8: Machakos NDVI Maps (March 2010 & March 2011)

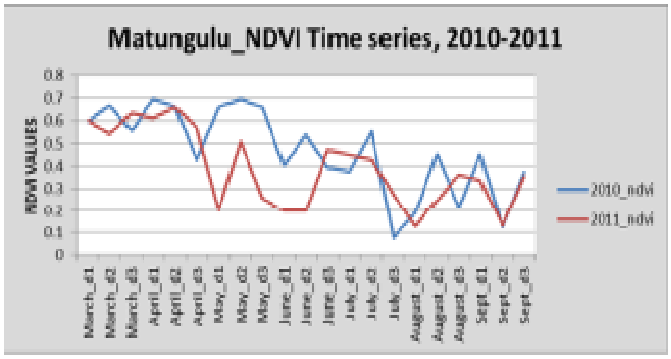

Figure 9: NDVI Time Series, 2010-2011

Predominant crop types in Matungulu are basically cereals and pulses. From figure 9, it's vivid that there is a steady increase of NDVI at the beginning of the growing season, as the crop begins to grow then a sharp decline towards crop harvest. The difference between NDVI trend in 2010 and 2011 is attributed to moisture content, nutrients, pests and diseases, whose increase or decrease affects biomass health and maturity. The results in figure 10 shows that the cumulative rainfall amount in 2010 cropping season was ranging between 215-324mm while in 2011 the amount was 81-251mm, this is lower compared to the previous year. It can therefore be argued that rainfall contributed greatly to better crop health/vigor as was witnessed earlier in the 2010 NDVI graphs. Also rainfall seems evenly distributed in 2010 from the Mua Hills flowing down to Mavoko and Machakos Town. In 2011 rainfall was scanty with little showers being experienced in Mavoko and North West Matungulu. Kenya Meteorological Officer informed this study that the County experiences erratic and unpredictable rains of less than 500mm annually, with short rains in October through to December and the long rains in late March to May. Well from the previous rainfall and NDVI figures, this is true, and it can be argued that the area receives low rainfall that is unsustainable for agriculture. Agriculture production is through rain fed agricultural system. The County is largely semi-arid and the amount and frequency of precipitation is quite irregular.

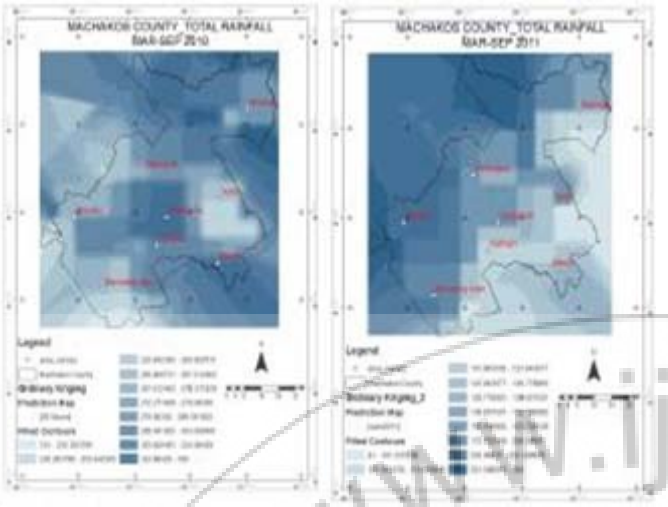

Figure 10: Total Rainfall Amounts (March-Sept 2010 and 2011)

The Harmonized World Soil Database (HWSD) raster data was used to derive soil texture. Figure 11 shows Soil texture Map of Machakos. From the soil texture it's clear that the land is mainly characterized by fine texture soil (clays, silty clays, sandy clays, clay loams and silty clay loams with more than 35 percent clay.) Medium texture soil comes second and basically refers to sandy loams, loams, sandy clay loams, silt loams, silt, silty clay loams and clay loams. This classification is very important for crop production since Soil texture strongly influences the infiltration of water, the ability of the soil to retain moisture (water holding capacity), its general level of fertility, the tendency to form clods and ease of cultivation.

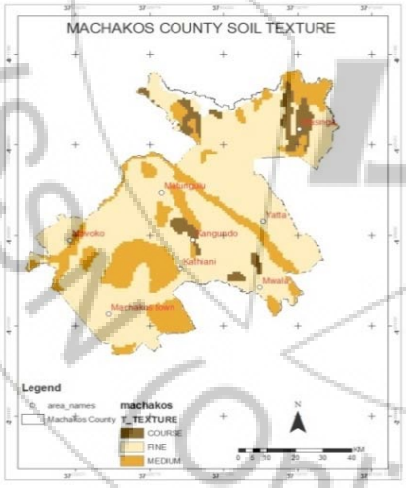

Figure 3: Soil Texture for Machakos County

5. Conclusion

Monitoring NDVI is very essential in crop assessment since the trend can be analyzed to observe when periods of dryness or drought stress occurred during the growing season. These could be caused by reduced moisture content, nutrients, or pests and diseases infestation. Vegetation index is not only useful in past and current growth assessment but also forecasting and early warning. The area has a predominant non mechanized rain-fed agriculture as opposed to irrigated agriculture; this has posed great challenge to crop production as the amount, frequency and distribution of rainfall is not sufficient. Remote sensing and GIS is a useful tool in assessing agriculture crop production especially in large areas where immediate results are needed. Spatial resolution of satellite imagery is important when details are needed, therefore this study proposed use of higher resolution satellite imagery for a more detailed crop assessment. This will give room for individual crop assessment and monitoring thus give more comprehensive result. Long term change detection (ten to thirty years ago) of land use and land cover with keen interest on agriculture land use in Machakos would enhance understanding of current and future trends in crop production. Crop yield forecasting could also be generated from the NDVI time series analysis presented above together with current data on crop yield. This would be useful for food security plans. With geospatial analysis farmers may have the ability to visualize their land, crops, and management practices in unprecedented ways for precise management of their businesses. Today, accessing spatial data has become an essential farm practice. Governments may need to host web sites that deliver valuable information to help farmers better understand their land and make more informed decisions. This data can be accessed on the Internet and used to create intelligent maps for better farm business practices.

6. Acknowledgement

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