Using of Remote Sensing Technique to Monitor The Status of The Plant and Change Detection for Three Different Periods in Western Region in Baghdad/ Iraq

Ahmed Asaad Z. Najeeb
Remote Sensing Unit, College of Science, University of Baghdad, Baghdad, Iraq
Ahmed_a_z@yahoo.com

Abstract

Data of multispectral satellite image (Landsat- 5 and Landsat-7) was used to monitoring the case of study area in the agricultural (extension and plant density), using ArcGIS program by the method of analysis (Soil adjusted vegetative Index). The data covers the selected area at west of Baghdad Government with a part of the Anbar and Karbala Government. Satellite image taken during the years 1990, 2001 and 2007. The scene of Satellite Image is consists of seven of spectral band for each satellite, Landsat-5(TM) thematic mapper for the year 1990, as well as satellite Landsat-7 (ETM+) Enhancement thematic mapper for the year 2001 and 2007. The results showed that in the period from 1990 to 2001 decreased land area exposed (bare) and increased the space of land covered by vegetation in percentage (31.06%), while this was a slight increase in the period between 2001 to 2007 in percentage (17.22%).

Keywords: Remote sensing and Soil Adjusted vegetative Index.

استعمال تقانة الاستشعار عن بعد لمراقبة الحالة النباتية وكشف التغيير لثلاث فترات زمنية مختلفة لمنطقة غربي بغداد/العراق

أحمد أسعد زعين نجيب
وحدة الاستشعار عن بعد , كلية العلوم, جامعة بغداد, بغداد, العراق

الخلاصة

استخدمت البيانات الفضائية للقمر الصناعي المتعدد الأطياف (لاندسات-5 ولاندسات-7) لغرض دراسة حالة المنطقة من الجانب الزراعي (الامتداد والكثافة النباتية), باستخدام برنامج ArcGIS بطريقة تحليل (المعامل الخضري المعدل مع التربة) التي غطت المنطقة المختارة الواقعة غرب محافظة بغداد مع جزء من محافظة الانبار وكربلاء. الصورة الفضائية التقطت خلال السنوات 1990 و 2001 و 2007. يتكون المشهد من سبعة حزم طيفية لكل قمر صناعي, Landsat-5 نوع الراسم الفرضي لسنة 1990 وكذلك القمر الصناعي Landsat-7 نوع الرسم الغرضي المحسن لسنة 2001 و 2007, بينت النتائج أن في الفترة من 1990 إلى 2001 انخفضت مساحة الأرض المكشوفة (الجرداء) وازدادت المساحة الخضرية بنسبة (31.06 %), في حين كانت هذه الزيادة طفيفة للفترة ما بين 2001 إلى 2007 و بنسبة (% 17.22).

1-Introduction

Soil Adjusted Vegetation Index

Achieving maximum crop yield at minimum cost is one of the goals of agricultural production. Early detection and management of problems associated with crop yield indicators can help increase yield and subsequent profit. Remote sensing and global positioning systems (GPS) can be used to assess spatial variability in crop yield. Visible red, green, and blue band and near infrared (NIR) regions of the electromagnetic spectrum have been used successfully to monitor crop cover, crop health, soil moisture, nitrogen stress, and crop yield. More recently, aerial images have been widely used for crop yield prediction before harvest. These images can provide high spatial cloud free information of the crop's spectral characteristics. Analysis of vegetation and detection of changes in vegetation patterns are important for natural resource management and monitoring, such as crop vigor analysis. Healthy crops are characterized by strong absorption of red energy and strong reflectance of NIR energy. The strong contrast of absorption and scattering of the red and near-infrared bands can be combined into different quantitative indices of vegetation conditions [1].

A vegetation index that accounts for and minimizes the effect of soil background conditions. The **SAVI** equation [2] introduces a soil brightness dependent correction factor, **L** that compensates for the difference in soil background conditions (equation 1). As in the (**NDVI**) Normalized Different Vegetation Index, (**NIR**) Near Infrared is the reflectance from the near-infrared band, and **(R)** red is the reflectance from the red visible band. Applying the correction for the soil provides more accurate information on the condition of the vegetation itself. When **L**=**0**, **SAVI** = **NDVI**. In areas where vegetative cover is low (i.e., < 40 %) and the soil surface is exposed, the reflectance of light in the red and near-infrared spectra can influence vegetation index values.

This is especially problematic when comparisons are being made across different soil types that may reflect different amounts of light in the red and near infrared wavelengths (i.e., soils with different brightness values).

The soil adjusted vegetation index was developed as a modification of the Normalized Difference Vegetation Index to correct for the influence of soil brightness when vegetative cover is low. The SAVI is structured similar to the NDVI but with the addition of a "soil brightness correction factor,"

$$SAVI= \frac{NIR - RED}{NIR + RED + L} *(1+L)\ldots 1... [1]$$

Where NIR is the reflectance value of the near infrared band, RED is reflectance of the red band, and L is the soil brightness correction factor. The value of L varies by the amount or cover of green vegetation: in very high vegetation regions, L=0; and in areas with no green vegetation, L=1. Generally, an L=0.5 works well in most situations and is the default value used. When L=0, then SAVI = NDVI. [1]. the output of SAVI is a new image layer with values ranging from -1 to 1. The lower the value, the lower the amount/cover of green vegetation. The burning procedure has been used in tropical areas as an easy and economical procedure for cleaning the terrain surfaces for agricultural or cattle raising activities. This extensive practice, when performed in forested areas, contributes for the climatic unbalance in a regional and global level, loss of soil potentiality in a medium term, and loss of local biodiversity. Forest fires, starting in the savanna areas (as occurred in the state of Roraima, northern Brazil) and advancing in the direction of open and dense tropical forest, have evidenced the need for monitoring the existing biomass in this transition vegetation zones. Satellite data, provided by optical and microwave sensors [2] with the optimization of the information extraction procedures, has been utilized as a tool for forest inventory. Inside this context, the present work has the objective to evaluate the synthetic image, generated by the SAVI (Soil Adjusted Vegetation Index) model using TM Landsat data, for estimating biomass of forest and savanna formations. Linear regression analysis was utilized to verify the relationship between SAVI and biomass variables.

The spatial distribution of vegetation types associated with biomass values was generated. [4] In the past there a tremendous effort has been made by using remotely sensed vegetation indices (VIS) for accurate description of land cover, vegetation classification and vegetation phenology. It also effective for monitoring rainfall and drought, estimating net primary production of vegetation and crop yields, detecting weather impacts and other events important for agriculture, ecology and economics [5]. The advantage of using remote sensing system its ability to provide both synoptic view and the economical[6]. Vegetation indices derived from satellite image data become one of the primary information sources for monitoring vegetation conditions and mapping land cover change. Many remote sensing studies utilized vegetation indices to study vegetation, with assuming that the properties of the background are constant or soil variations are normalized by the particular vegetation index used [7].

Mangroves have a wide geographical distribution. Mangrove vegetation has a vital function in maintaining the equilibrium and secondary productivity of coastal lagoons and estuaries and forms the base of most coastal tropic structures by means of a constant organic matter production throughout the year [8]. The application of vegetation indices in mangrove forest has been well documented in most literature [9]. Vegetation indices have typically been obtained from spectral.

1.1-Turning Point

To make comparison between three different period and change detection by this index.

2-Study Area

The study site is located at central-west of Baghdad City (Iraq), with geographical coordinates longitude (38º33) to (36º91) northwards and latitude (44º18) to (36º37) eastwards, has area of (318846.8) hectare Studied area has been dominated by agriculture, Irrigation channels, drainage, besides bare land influenced by salts (salt affected soils). The climate of this region is semi arid, with an average yearly rainfall of 2.00 mm. shown in Figure 1.

3 -Data Acquisition

Satellite image captured from Landsat-5 (TM) in march (1990) , Landsat-7 (ETM+) in march (2001) and Landsat-7 (ETM+) in march (2007) respectively with six bands ranging from first to the seventh except the sixth band in following wave length (0.45-0.515), (0.525-0.605), (0.63-0.69), (0.76-0.90), (1.55-1.75) and (2.09-3.35) Micrometer, with pixel size (28.5 × 28.5) m. The geometric correction was doing with correct coordinate system (WGS_1984_UTM_Zone_38N).measure unit in meters. were used to monitor the patterns of annual changes in plant cover using ArcGIS V.9.3 software package was used, shown in Figure 2.

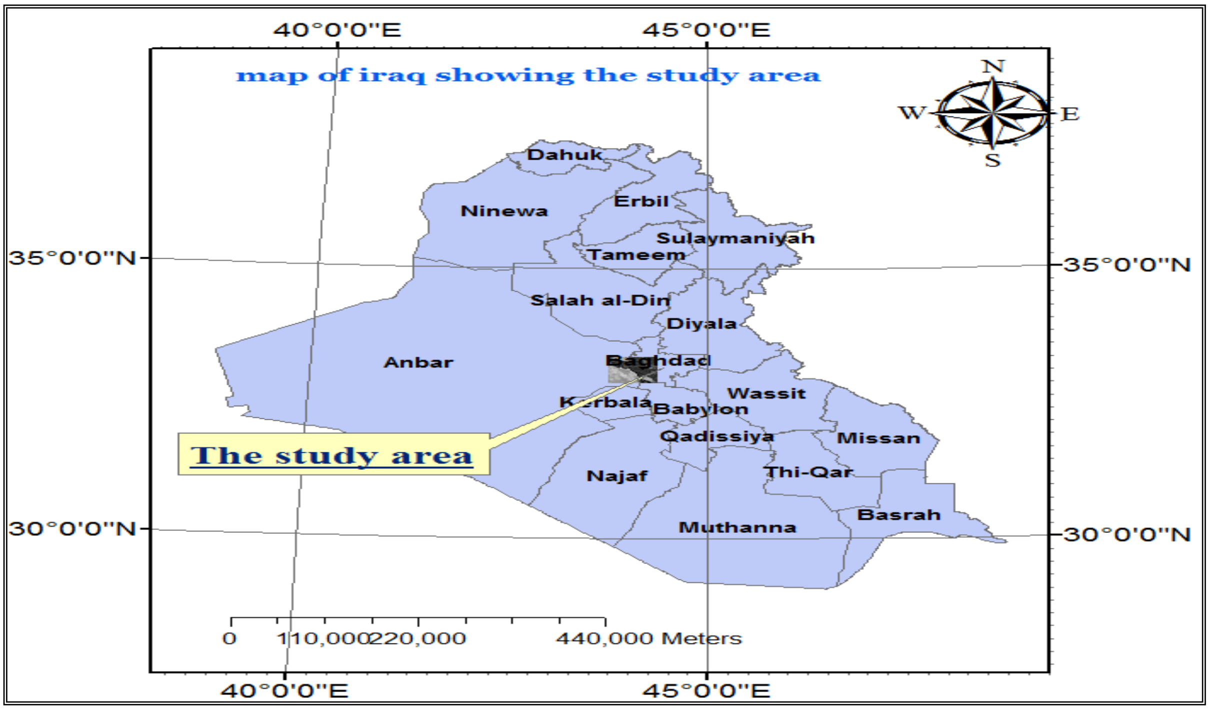
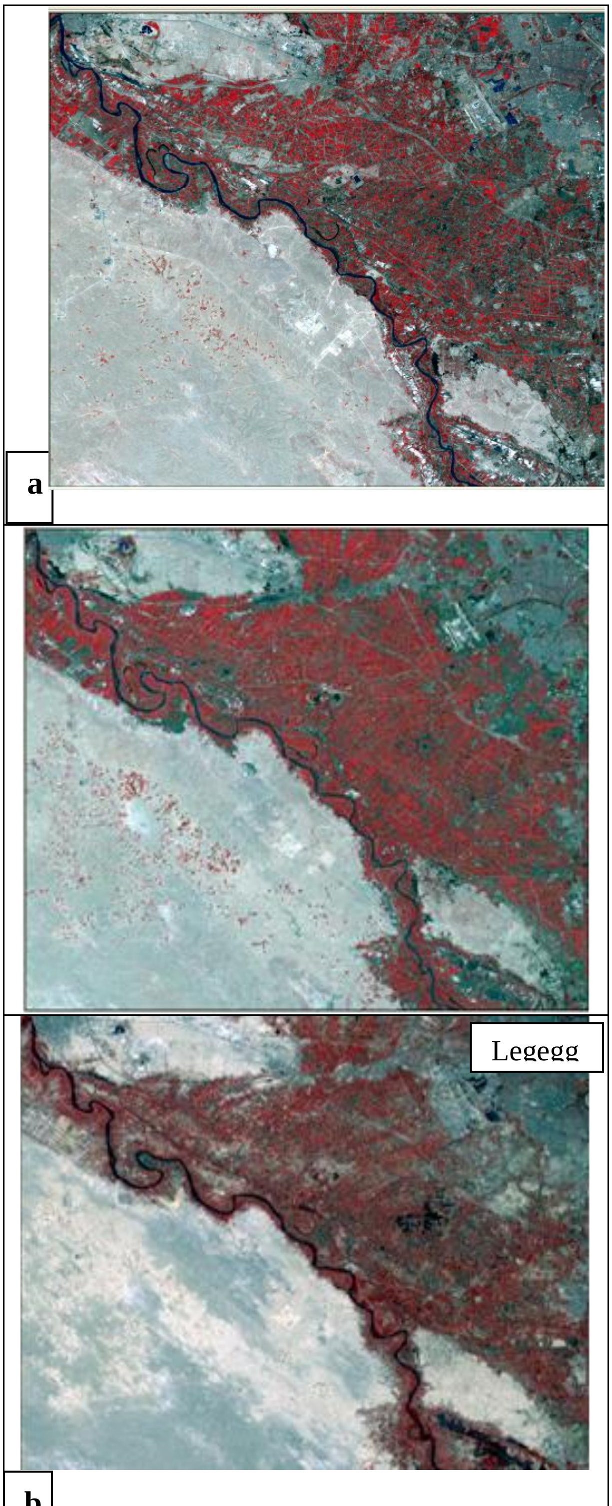
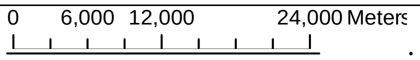
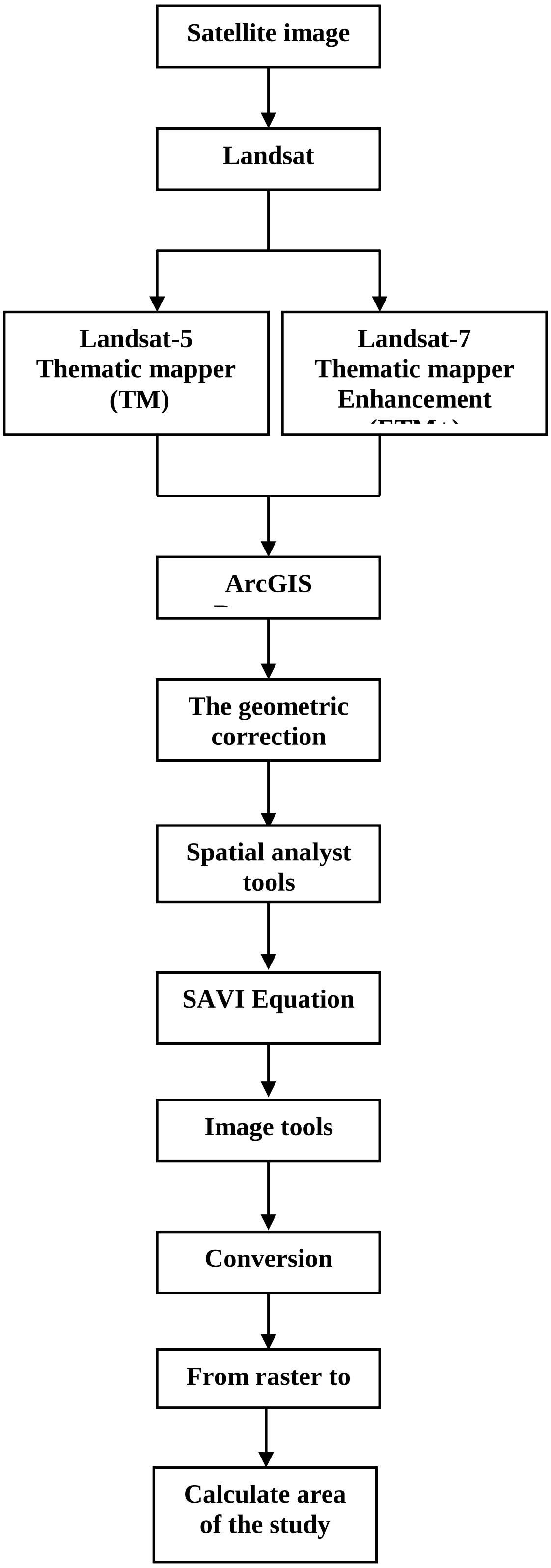


Figure 1- Map of Iraq shows the study area



ure 2- Satellite image of study area acquired on :
(a)Landsat image satellite(TM) for the year march 1990
(b) Landsat image satellite (ETM+) for the year march2001
(c) Landsat image satellite (ETM+) for the year March 007





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The chart explains the steps of the steps analysis

4- Methods

The TM digital numbers were converted to reflectance values according to [10] before generating the synthetic SAVI image [2]. This synthetic image has the purpose to minimize the influence of soil in the spectral characterization of the canopy cover, and is expressed by the following equation:

$$SAVI= \left[\frac{NIR - RED}{NIR + RED + L}\right] \times (1+L) \quad ...1$$

Where:

TM4 = Reflectance value of band 4 (near infrared) of TM sensor;

TM3 = Reflectance value of band 3 (red) of TM sensor; and

L = constant.

This equation applied to satellite images for the three years using the program ArcGIS 9.3 to calculate the coefficient of variation of natural vegetation (SAVI) as amended. Then were compared with three years as compared to the results of satellite image for 2007 with each of the satellite image for the year 2002 and satellite image of 1990 to know the status of soil and vegetation in terms of intensity and quantity. Figures 3,4,5.

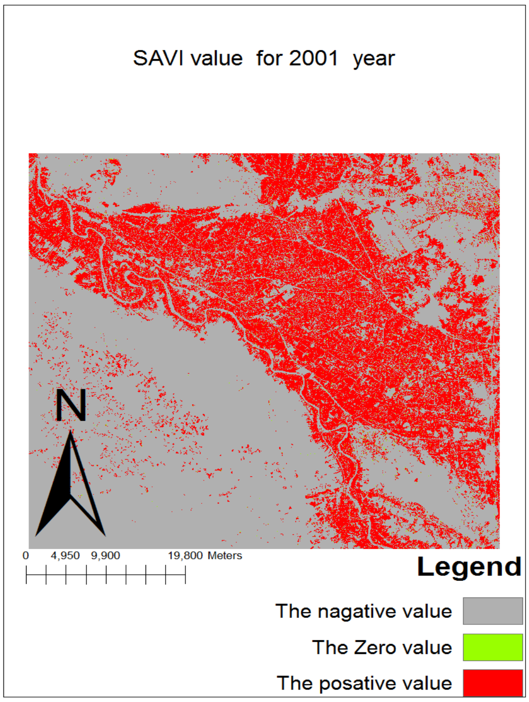

Figure 4- Satellite image (2001) after apply SAVI analysis.

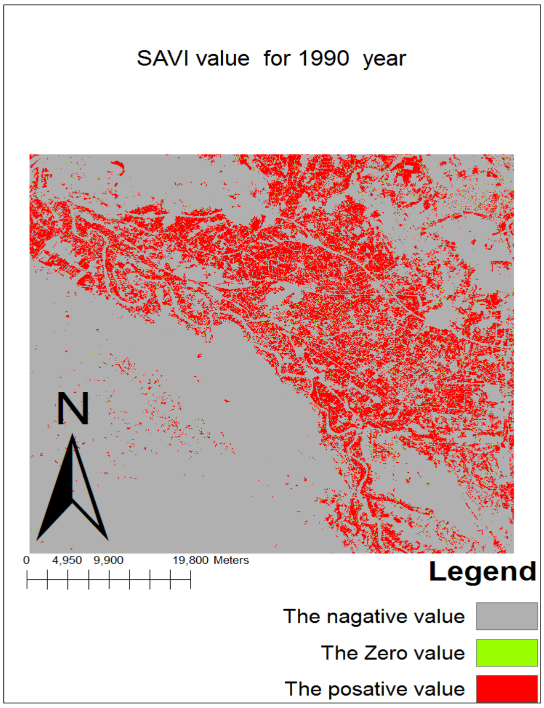

Figure 3- Satellite image (1990) after apply SAVI analysis**.**

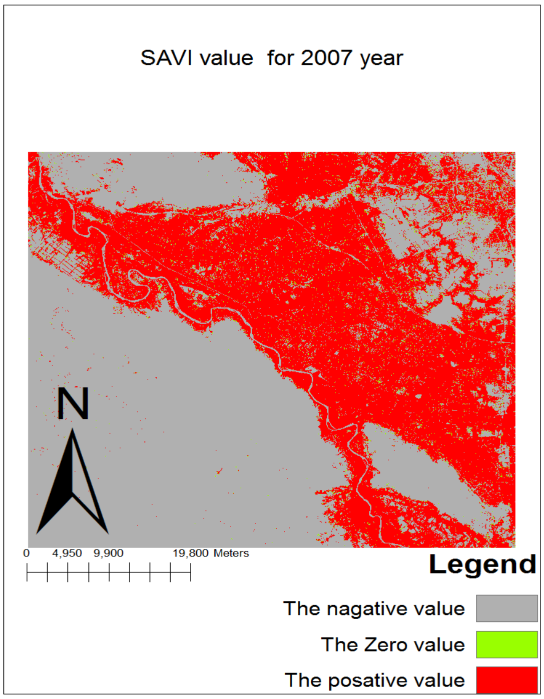

Figure5- Satellite image (2007) after apply SAVI analysis.

5 –Results and Discussion

After processing and analyzing satellite image of the study area using geographic information systems, then apply mathematical equation (SAVI), the results indicate that the condition of vegetation of the study area during the period between 1990 and 2001 to 2007 was a varying. They are as follows, that the vegetation covers during the period 1990, the situation is not good (bad) as the value of the number of pixels representing an area of vegetation during that period (869433 pixels), Table 1.

Now we will consider this value to scale of this year, a basis for comparison with the years to coming, as for the results of the case of vegetation of the study area during the period 2001, the value of the pixels increased significantly (1261152 pixel) with percentage (31.06%). But this increase was very slight during the period 2007 when compared with the state of vegetation with the period 2001 which was (1523563 pixel) by (17.22%) Figure 6. For the purpose of the explanation for variation in the nature of the distribution of vegetation we will starting from the period 1990 and 2001, the study area had experienced a situation like drought climate for rainfall and high temperatures, all these factors helped on the activity the situation of desertification and degradation of vegetation. On the other hand, this period and the period that followed was a victim of the economic blockade imposed by the United States on our country (Iraq), Which leads to low purchasing power (financial) of the state in general and farmers in particular, so what he needs from raw materials (machines agricultural, seeds and pesticides). As for the period (2001-2007), the condition of vegetation had expanded (Horizontally), but in very slightly case when compared it with the period (1990-2001), which resulted from the migration of peasants to their land after the events of the war on the country in 2003, which caused the destruction of the infrastructure of the country and activity a case of theft of machinery and agricultural equipment, and exposure of the trees to cutting, so the operations of overgrazing.

Generally, I would like a recommendation to the ministries and government institutions to intervene to prevent aggravation this phenomenon (desertification) and its great effect on the productive activity or income of the state and the farmer. Also must on responsible institutions to provision of equipment agricultural (agricultural machinery, seeds and fertilizers), as well as provide a water of irrigation by drilling wells to increase agricultural production and the expansion of vegetation.

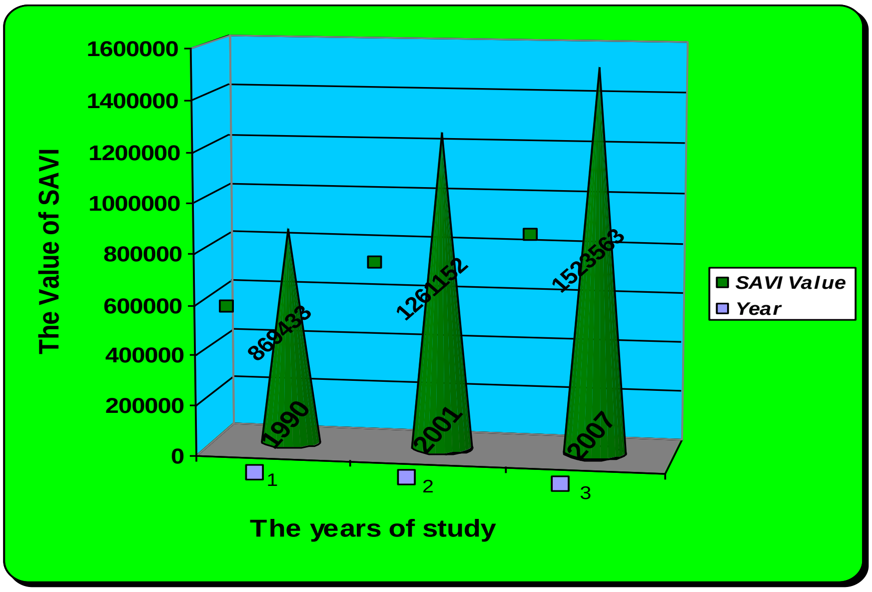

Figure 6- The values of SAVI and the deferent between the three years

Table 1- The values of SAVI and the deferent between the three years.

The Period	SAVI Value (Pixel)	The deferent between 1990 and 2001	The percentage of deferent between 1990 and 2001	The deferent between 2001 and 2007	The percentage of deferent between 2001 and 2007
1990	869433	391719	31.06 %	262411	17.22 %
2001	1261152				
2007	1523563				

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