Vol 2 Issue 10 April 2013

Impact Factor : 0.1870

ISSN No :2231-5063

Monthly Multidisciplinary Research Journal

GoldenResearch Thoughts

IMPACT FACTOR : 0.2105

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RNI MAHMUL/2011/38595 **ISSN No.2230-7850**

Indian Streams Research Journal is a multidisciplinary research journal, published monthly in English, Hindi & Marathi Language. All research papers submitted to the journal will be double - blind peer reviewed referred by members of the editorial Board readers will include investigator in universities, research institutes government and industry with research interest in the general subjects.

Address:-Ashok Yakkaldevi 258/34, Raviwar Peth, Solapur - 413 005 Maharashtra, India
Cell : 9595 359 435, Ph No: 02172372010 Email: ayisrj@yahoo.in Website: www.isrj.net

Golden Research Thoughts
Volume 2, Issue. 10, April. 2013
ISSN:-2231-5063
Available online at www.aygrt.isrj.net

ORIGINAL ARTICLE

AGRICULTURE DROUGHT MONITORING IN SOLAPUR DISTRICT USING SATELLITE TECHNOLOGY

D.G.GATADE AND AMOL M. PAWAR

Associate Professor and Head, Department of Geography, Arts, Science and Commerce College Ramanandnagar (Burli) Tal-Palus, Dist-Sangli.
Research Scholars, Dept. of Geography, Shivaji University Kolhapur..

Abstract:

Drought is one of the major natural hazards affecting the environment and economy of countries worldwide. Droughts occurring every year over the India different parts have great impacts on human society, nature, and the global economy for example in declining crop yields, reduction of water supplies, and concerned vegetation. The main objective of this research paper is to Normalized Difference Vegetation Index (NDVT) to augment agriculture drought-monitoring techniques. The NDVI is used, in this case, by comparing the deviation of the current satellite observation from the historical average within a certain time period, or window, of interest. In rainfall dependent agriculture production areas, seasonal rainfall variability is reflected in both highly variable production levels and in the risk livelihoods of local farmers. Remote sensing and Geographical Information Science has been used to monitor agro-climatic conditions, vegetation cover, and to estimate crop drought in study area. The study was conducted with 10 years (2001-2011) of Advanced Very High-Resolution Radiometer (AVHRR) satellite images NDVI information has been used in vegetation monitoring, crop yields assessment, and forecasting. The results show that in several Tehsils regions, there is a statistically significant correlation between Crop production and rainfall and the water balance parameters, indicating an unacceptable performance in detecting crop drought stress conditions. The impact of dry periods on crops is clearly observed in both arid land and wet land, and it is found that arid land presents a higher sensitivity.

KEYWORDS:

Drought, GIS, RS, NDVI, Classification, Model, Map composition, Satellite Images, Metro logical data.

INTRODUCTION

Drought is defined as "the naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalances that adversely affects land resource production systems" (UNCCD, 1999). Generally, the most noticeable meteorological and hydrological drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, and reduced ground water or reservoir levels. Agricultural drought occurs when there is not enough water available for a particular crop to grow at a particular time. Climate change and drought has become a regular phenomenon in several countries across

Title : AGRICULTURE DROUGHT MONITORING IN SOLAPUR DISTRICT USING SATELLITE TECHNOLOGY
Source:Golden Research Thoughts [2231-5063] D.G.GATADE AND AMOL M. PAWAR yr:2013 vol:2 iss:10
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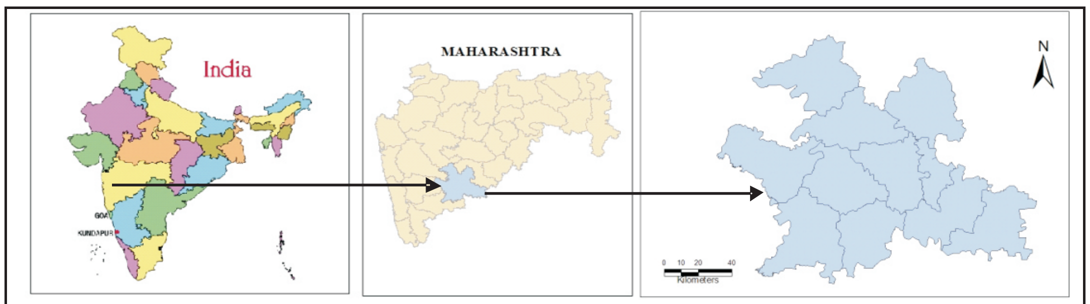
the globe. It is displayed in erratic and uncertain rainfall distribution in rainfall dependent farming areas, especially in arid and semi-arid ecosystems. Frequent and severe drought has become one of the most important natural disasters in sub-India and often results in serious economic, social, and environmental crises marked by the creation of uncertain agricultural economics (Tadesse et al., 2008). The satellite techniques provide accurate techniques for the study of agriculture cropping pattern various methods have used. Agriculture contributes a high share of net domestic product by sectors in India. In the agricultural context, crop seasonal drought analysis can be performed using Remote sensing and Geographical information system.

STUDY REGION

Solapur district is one of the districts of Maharashtra state of India. It is located between 17.100 N. to 74.420E and 18.320 N. to 76.150E. It is located on the south east edge of the state and lies entirely in the Bhima and Seena basins. It is basically on the south-eastern border of Maharashtra state and touches the border of Karnataka state. According to the 2011 Census, district has a population of 4,315,527; with a density of 290 persons per sq. km.Total covering of drought prone area is 14,845 km2 The climate is averagely temperate.



Location map of study region in solapur district

Fig.1: Study region map in the Solapur District

2.2 Materials

Using study purpose, satellite data from Meteosat Second Generation (MSG) and National Oceanic and Atmospheric Administration (NOAA) AVHRR were used. The data from every year since 2001 to 2011 was used; 25 basic images file were obtained. The Normalized Difference Vegetation Index (NDVI) can eliminate some effects and Arc-tool box such as shown change of solar zenith angle, satellite viewing angle, atmospheric effect, water vapor, aerosol, view flowing direction of wind and cloud etc. (http://www.imd.gov.in/section/dwr/dynamic/dwr.htm) The other data include the precipitation and averagely temperature meteorological observation station.
(http://www.imdpune.gov.in/weather_forecasting/weather_index.html) The precipitation data include the sessional data of meteorological observation station.

Spatial Data

Sr. #	Data Type	Scale	Source of data
01	Topo-sheets	1:50,000	SOI
02	DGPS	$^{+}$- 1M	Trimble
03	IRS-P6 LISS-III	23.5M. resolution, swath141km (band,20,30,40,50)	NRSC
04	Landsat-7 ETM+ images	30M. Resolution, Swath180km (band 20,30,40,50)	USGS

Table No.01 Spatial observation data station.

Non-Spatial Data

Annual collected of agriculture statistical data in solapur district (2001 to 2011).
(Source: - http://agcensus.dacnet.nic.in/statesummarytype.aspx)

Software Used

For project work following software were used,

ArcGIS 10.1	AutoCAD 2012
ERDAS 9.2	DGPS (Trimble)
Envi 3.2	Microsoft office Excel 2010

OBJECTIVES

1.Analysis of crop (agriculture) drought in Solapur district
2.To find out crop drought region using Images classification and NDVI index
3. Study of spectral characteristics of several copes using satellite technology

CROP DROUGHT MONITORING METHOD

The process of monitoring agricultural (i.e., vegetative) drought usually requires satellite technologies and a large amount of temporal data. This research particularly focuses on agricultural drought analysis. In rainfall dependent agriculture production areas, seasonal rainfall variability is certainly reflected in both highly variable production levels and in the risk livelihoods of local farmers. Satellite data has been used to monitor agro-climatic conditions, the agricultural fields, vegetation cover, and to estimate several maps in study region. In particular, the Advanced Very High Resolution Radiometer (AVHRR) NDVI information has been used in vegetation covering, crop yields assessment, and forecasting. Method of analysis agricultural drought monitoring

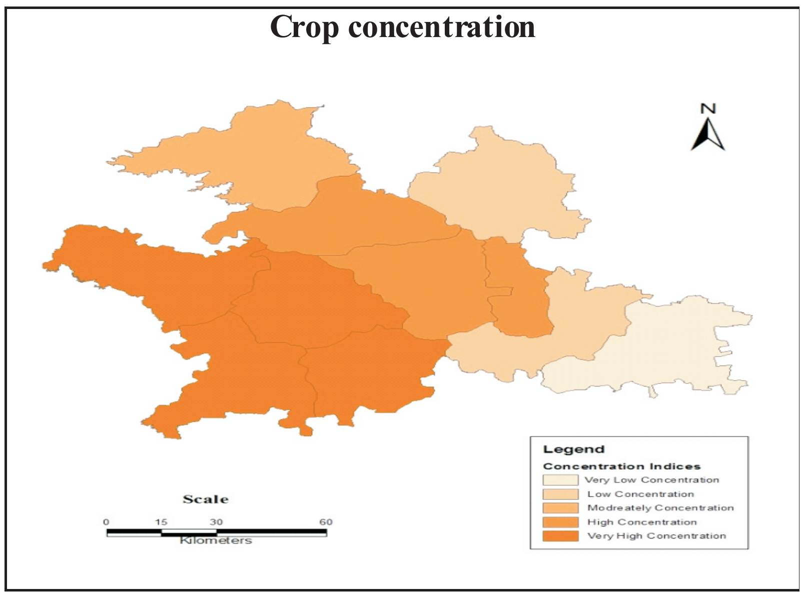
Model consists of menus namely Rainfall, Evaporation, Vegetation status, Agro-drought, and Crop area. The crop and vegetation cover status during the drought year was compared with normal year to assessment of the agricultural drought. Also rainfall distribution map were used and analyzed for both the study basins and recovered through the rainfall menu. NDVI analysis was performed using IRS WiFS data can be obtained through Vegetation status maps. Cluster wise agricultural drought maps were developed using by NDVI geo-statistics and supervise and unsupervised classification. Visual interpretation compared with numerous sensors images developed for accessing, organizing, manipulating, querying, analyzing and displaying the actual drought related information about the study period.

Crop Concentration Index

Bhatia (1965) developed a formula based on the gross cropped area. Crop concentration like that crop diversification, have great relevance in the agricultural land use studies. Analysis we meanly used location amount technique for the delineation of crop concentration lies in the fact that it enables to understand the area of specialization different crop grown in a region (2001-2011).

Tehsil Name	CCI
N. Solapur	0.23
S. Solapur	0.34
Pandarpur	1.51
Mangal wedha	1.01
Malshiras	1.29
Karmala	0.46
Barshi	0.13
Akklkot	0.111
Mohol	0.86
Sangola	1.40
Madha	0.80

Table No.02: Crop Concentration Index Values across Tehsil in District



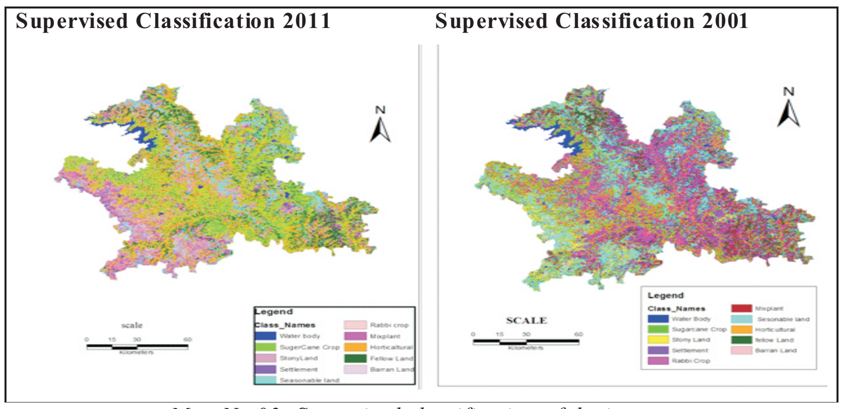
Map No. 02: Crop concentration in the Solapur District

Interpretation of the Images

The technology is used electromagnetic radiation by the satellite images. In this study the remote sensing images used are the LISS III, LANDSAT ETM+. both images are occupied at different dates to see the differences in the cropping areas. Startled Geometrically and Radio-metrically correction of the images. Then the false colures composite was generated and the interpretation of the images were carried out using the various interpretation keys (shape, size, pattern, tone, texture, shadows, location, and association). The crop pattern studies categorized into healthy, moderately and diseased based on the smooth and rough surfaces showing the higher and lower reflectance respectively. For this project a study was selected in the Solapur district region. Four LULC tiles were selected form the LULC shape file which comprised 10 different land classification types. There are two approaches for classification. One is the pixel based image analysis and the object oriented image analysis approach.

a. Supervised Classification

Image analyst supervises where used of global positioning system (GPS), and LANDSAT, LISS III could be amylases to various landuse/landcover maps. Maximum Likelihood Classification (MLC) technique has been applied for the images classification it is good results. The LISS III and LANDSAT 7ETM+ image was classified into same ten classes (crop land, water body, Fellow land, barren land, Stony, Rabbi Crops, orchard and settlements) as shown in Map No.03. The overall accuracy for the classified image was found to be 86.78%.



Map No.03: Supervised classification of the images

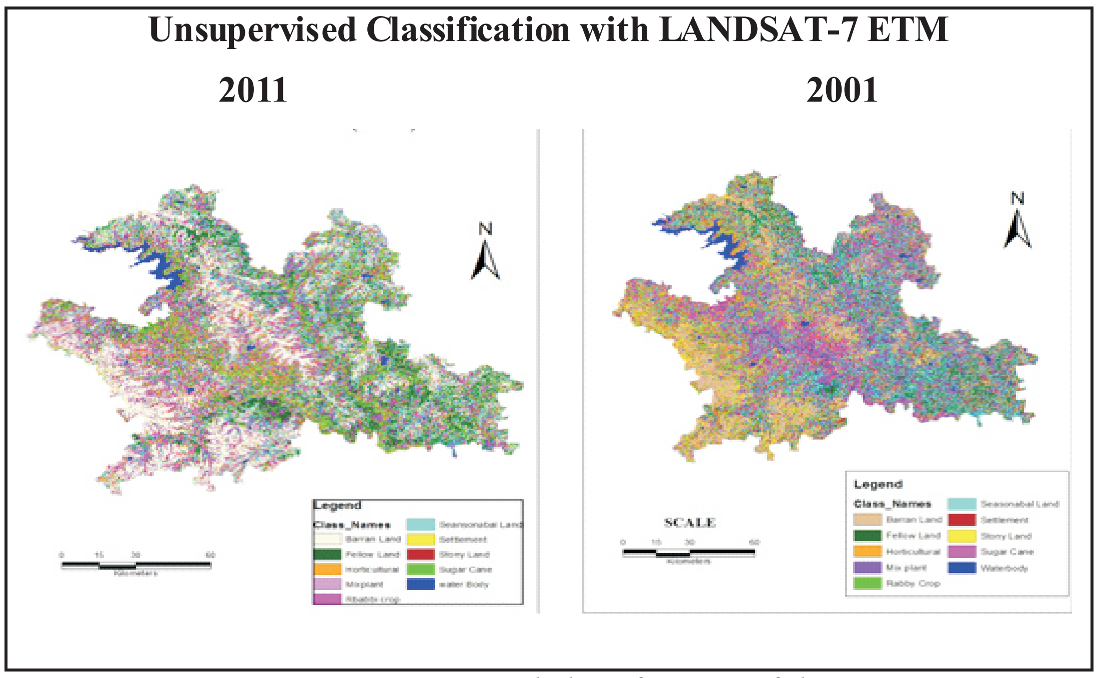
Accuracy assessment Supervised classification

Class Name	LISS-III		LANDSAT ETM+	
	Producer Accuracy	User Accuracy	Producer Accuracy	User Accuracy
Water body	100.00%	100.00%	100.00%	100.00%
Fellow land	58.14%	99.00%	69.23%	81.82%
Seasonable land	61.00%	96.00%	100.00%	65.67%
Horticultural	86.10%	88.00%	92.00%	67.56%
Sugarcane	99.50%	95.00%	73.91%	100.00%
Rabi Crop	79.50%	85.24%	76.00%	62.00%
Orchard	100.00%	60.00%	32.33%	36.33%
Stony land	100.00%	68.00%	82.77%	87.50%
Barren Land	100.00%	100.00%	100.00%	100.00%
Settlement	89.35%	54.44%	82.77%	86.50%

Table No.03: Accuracy assessment Supervised classification

b. Unsupervised Classification

The success of the unsupervised methods is based on the premise that the input raster dataset includes natural statistical groups of spectral patterns that represent particular types of physical features. (http://www.naarm.ernet.in/virtual/erdas13.htm) The meanly two techniques is available K-mans and ISODATA (Interactive self-Organizing data analysis techniques) hear the classification used ISODATA technique. The LISS III and The LANDSAT 7ETM+ Image was classified into same ten classes (crop land, water body, Fellow land, barren land, Stony, Rabbi Crops, orchard and settlements) as shown in Map No. 04. The overall accuracy for the unsupervised classified image was found to be 92%.



Map No.04: Unsupervised classification of the images

Accuracy assessment Unsupervised classification

Class Name	LISS-III		LANDSAT ETM+	
	Producer Accuracy	User Accuracy	Producer Accuracy	User Accuracy
Water body	100.00%	99.30%	100.00%	100.00%
Fellow land	86.71%	86.71%	100.00%	81.00%
Seasonable land	75.47%	73.22%	68.66%	100.00%
Horticultural	68.67%	74.56%	100.00%	100.00%
Sugarcane	94.44%	79.88%	87.55%	84.33%
Rabi Crop	--	--	79.78%	88.50%
Mixplant	61.00%	76.00%	63.00%	74.55%
Stony land	100.00%	60.00%	65.44%	56.22%
Barren Land	75.56%	99.20%	100.00%	84.62%
Settlement	76.57%	85.62%	----	----

Table No.04: Accuracy assessment Unsupervised classification

c. Sub-pixel based classification

Image Sub-pixel Classifier successfully identifies a specific material when materials other than the target are present in a pixel. It discriminates between spectrally similar materials, such as individual plant species, specific water types, or distinctive building materials (www.erdas.com). Based on combination of multi-temporal, multi-sensor or multi-scale remote sensing imagery, so for this study use the multispectral data, LISS-III and LANDSAT 7ETM+ images.

Normalized Difference Vegetation Index (NDVI)

The Normalized Difference Vegetation Index (NDVI) has been in use for many years to measure and monitor plant growth (vigor), vegetation cover, and biomass production from multispectral satellite data (http://ivm.cr.usgs.gov/whatndvi.php). Vegetation indexes are algorithms aimed at simplifying data from multiple reflectance bands to a single value correlating to physical vegetation parameters (such as biomass, productivity, leaf area index, or present vegetation ground cover).

The NDVI is calculated from these individual measurements as follows:

$$\mathrm{NDVI} = \frac{(\mathrm{NIR} - \mathrm{VIS})}{(\mathrm{NIR} + \mathrm{VIS})}$$

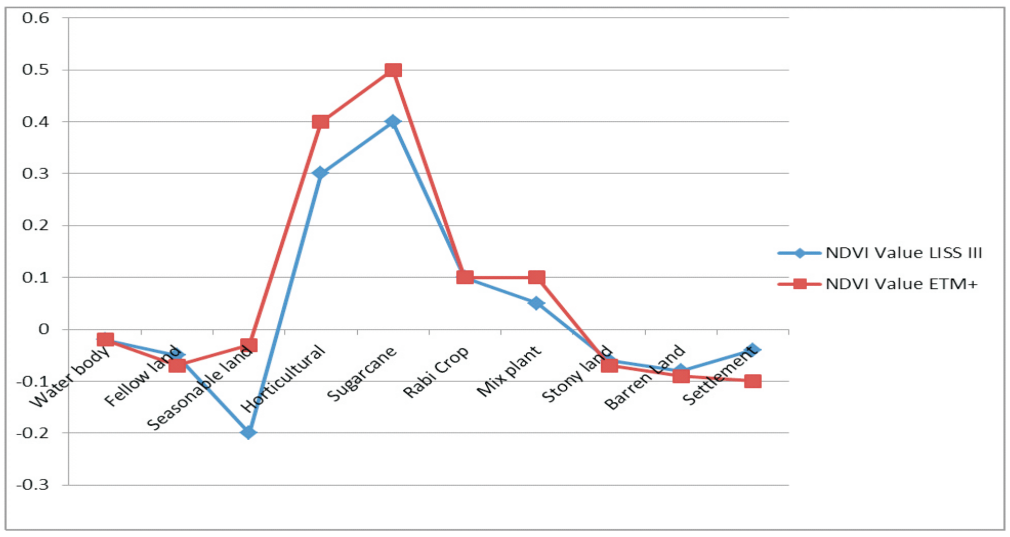
Where Red and NIR stand for the spectral reflectance measurements acquired in the visible (red) and near-infrared regions, respectively
(http://earthobservatory.nasa.gov/Features/MeasuringVegetation/measuring_vegetation_2.php)

Normalized Difference Vegetation Index (NDVI)

CLASS NAME	NDVI Value LISS III	NDVI Value ETM+
Water body	-0.02	-0.03
Fellow land	-0.05	-0.07
Seasonable land	-0.2	-0.03
Horticultural	0.3	0.4
Sugarcane	0.4	0.5
Rabi Crop	0.1	0.1
Mix plant	0.05	0.1
Stony land	-0.06	-0.07
Barren Land	-0.08	-0.09
Settlement	-0.04	-0.1

Table No.05: Normalized Difference Vegetation Index (NDVI)

LISSIII AND ETM+ DATD NDVI ANAYALISIS



Map No. 05: Geo-statistic graph of NDVI

In this analysis crop (agriculture) region shows the (0.3) NDVI value, LISS III and ETM + is indicate the same NDVI value so both of data is good for the NDVI analysis. And Negative values of NDVI (values approaching -1) correspond to water body.

RESULTS AND CONCLUSIONS

Based on the detailed analysis of the study area, the major portion of the area experienced severe agriculture drought which is depicted by remote sensing techniques.
A result shows the drastic change in precipitation which is the main cause for the draught.
Analysis of relationship between crop and water.
Concentration index easily find out the zonal pattern of particular crop.
Normalized difference vegetation index (NDVI) has been used to categorize various crops where high and low NDVI value of 0.4, 0.1it show the crop indicator.
The rainfall of two areas with different rainfall characteristics can be compared in terms of how badly they are experiencing drought conditions since the long era.

REFERENCES:

1.E. M. ABDEL-RAHMAN and F. B. AHMED* (2008). The application of remote sensing techniques to sugarcane (Saccharum spp. hybrid) production: a review of the literature. International Journal of Remote Sensing.Vol. 29, No. 13, 10 July 2008, 3753–3767
2.J.Hayes, M.(2003).Drought Indices
3.Perez, E. and P. Thompson.(1995).Natural Hazards: Drought
4.http://www.imdpune.gov.in/research/drought/drought.html#map
5.http://www.pvts.net/pdfs/ndvi/3_3_ndvi.PDF
6.http://www.gisknowledge.net/topic/imagine_training/erdas_imagine_vegetation_indices.pdf
7.http://www.landmap.mimas.ac.uk/index.php/Learning-Materials/IDRISI-Kilimanjaro/Vegetation-Mapping-Idrisi
8.http://www.arpnjournals.com/jeas/research_papers/rp_2012/jeas_0112_623.pdf
9.http://www.utsa.edu/lrsg/Teaching/EES5053-06/project/Ritter_Drought%20Analysis.pdf
10.http://solapur.gov.in/
11.http://www.solapurcorporation.com/index.asp
12.http://www.en.wikipedia.org
13.http://www.imdpune.gov.in
14.http://www.earthobservatory.nasa.gov

15.http://www.ivm.cr.usgs.gov
16.www.erdas.com
17.http://www.naarm.ernet.in
18.http://www.imdpune.gov.in
19.http://www.manojmisra.blogspot.in
20.http://www.agcensus.dacnet.nic.in
21.http://www.censusindia.gov.in
22.http://www.solapur.gov.in/htmldocs/geog.pdf
23.http://www.censusindia.gov.in/2011-prov-results/data_files/maharastra/10%20-%20Part%20-%20III%20Table%20&%20Statements.pdf
24.http://www.americanscience.org