GEO-SPATIAL APPLICATION FOR LAND CAPABILITY CLASSIFICATION (LCC) IN KUSHAVATI RIVER BASIN, GOA-INDIA

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ABSTACT:

Land capability classification is a systematic process used to evaluate the potential uses and limitations of land for various purposes, such as agriculture, forestry, urban development, or conservation. This classification helps land planners, resource managers, and policymakers make informed decisions about land use and management.The Khushavati River Basin, a vital geographical area with significant ecological and agricultural importance, has undergone a comprehensive land capability classification utilizing Geo-Spatial technology. This study relies on secondary sources of data, including soil depth, slope map, and soil texture map, to assess the land's suitability for various uses. Geo-Spatial technology plays a pivotal role in processing and analyzing the collected data, providing a robust framework for land capability classification.The objective of this study is to evaluate the land suitability for diverse purposes such as agriculture, forestry, and other land development. The integration of these datasets through Geo-Spatial technology enables a holistic understanding of the region's landscape.The methodology involves the application of Geographic Information System (GIS) tools and techniques to process and analyze the collected data. Spatial overlays are employed to derive meaningful insights into the land's capability for specific uses to enhance the accuracy and reliability of the land capability classification. Results from the land capability classification reveal distinct zones within the Khushavati River Basin, each exhibiting unique characteristics influencing its suitability for different land uses. These findings serve as valuable inputs for sustainable land management practices and informed decision-making regarding agricultural planning, natural resource conservation, and other land development in the region.

Key Words: Land capability classification, land suitability, spatial overlays, sustainable land management etc.

1. Introduction

Land capability classification (LCC) is a crucial tool in assessing the potential uses and limitations of land for various purposes, playing a pivotal role in informed decision-making for land planners, resource managers, and policymakers. The Khushavati River Basin, a region of significant ecological and agricultural importance, has undergone a comprehensive land capability classification utilizing Geo-Spatial technology. Land capability classification is a system of grouping soils primarily on the basis of their capability to produce common cultivated crops and pasture plants without deteriorating over a long period of time. The united state department of Agriculture (USDA, 1973) has given some guidelines to determine the capability of the land. There are classes and sub-classes done under the land capability. There are eight classes in capability analysis which has been determined with the codes as I to VII. In Class I the soils have slight limitations that restrict their use. The Class II Soils are identified as the soil having moderate limitations that reduce the choice of plants or require moderate conservation practices. In Class III the soils have severe limitations that reduce the choice of plants or require special conservation practices, or both. In Class IV soils have very severe limitations that restrict the choice of plants or require very careful management, or both. The Class V soils have little or no hazard of erosion but have other limitations, impractical to remove, that limit their use mainly to pasture, range, forestland, or wildlife food and cover. The Class VI soils have severe limitations that make them generally unsuited to cultivation and that limit their use mainly to pasture, range, forestland, or wildlife food and cover. Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use mainly to grazing, forestland, or wildlife. The Class VIII is identified as the soils and miscellaneous areas have limitations that preclude their use for commercial plant production and limit their use to recreation, wildlife, or water supply or for esthetic purposes. The sub classes are designated in the form of small letters as e, w, s, or c. The letter "e" is depicts the main hazard is the risk of erosion unless close-growing plant cover is maintained. The letter "w" depicts that the water in or on the soil interferes with plant growth or cultivation. The letter "s" shows that the soil is limited mainly because it is shallow, droughty, or stony; and the letter "c", used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry. (Land Capability Classification n.d.)

2. Aim and Objectives

The aim of this study is to conduct a comprehensive land capability classification of the Kushavati River Basin using Geo-Spatial technology. Through the integration of various datasets, the study seeks to evaluate the

suitability of the land for diverse purposes such as agriculture, forestry, and other land development in the river basin.
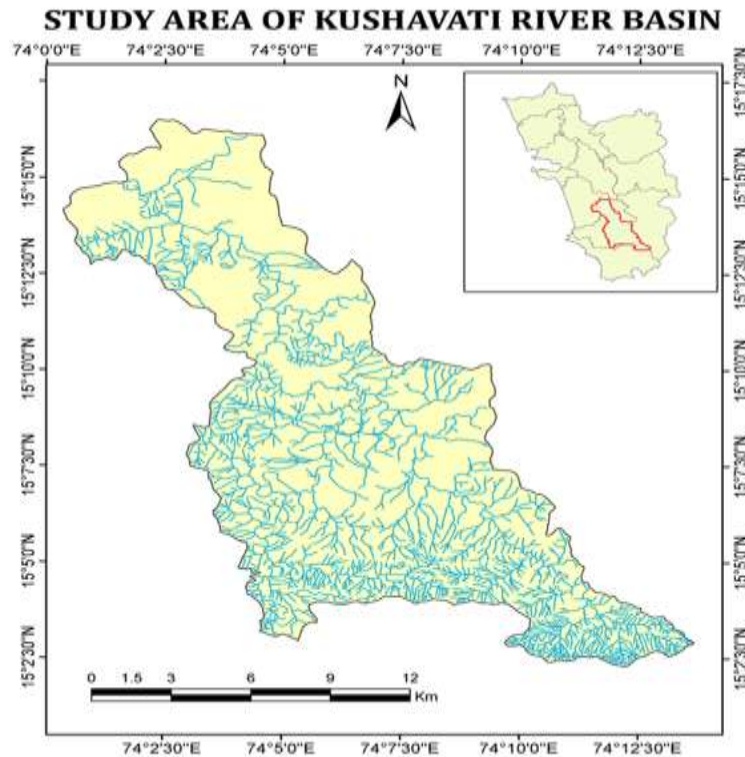
3. Study Area

Figure 1: Location Map of Kushavati River Basin

4. Data and Methodology

The data has been collected from the secondary sources and land capability classification has done based on the data. Soil depth, slope map and soil texture map has been collected using the secondary sources.

Table 1: Soil data used

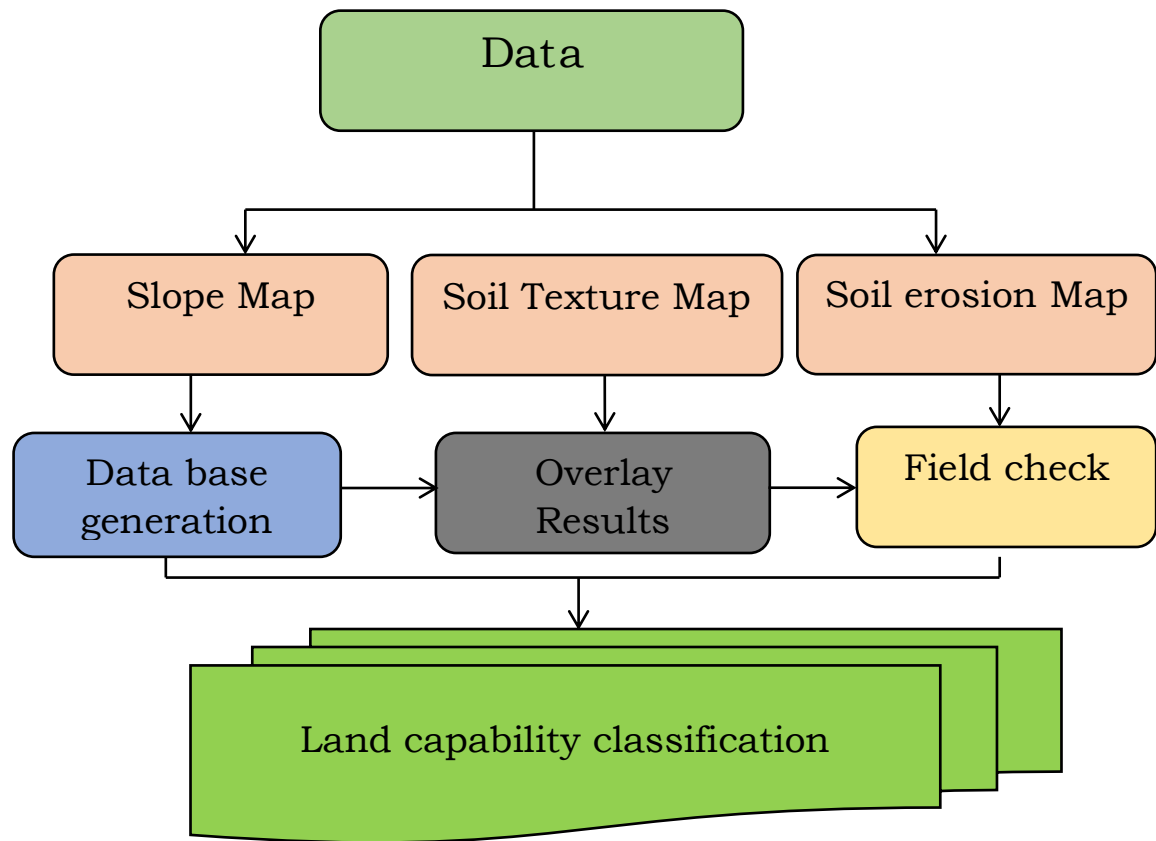| Sl. No.	Data	Source
1.	Slope Map	NBSS & LUP, Banglore
2.	Texture Map	NBSS & LUP, Banglore
3.	Soil Erosion Map	NBSS & LUP, Banglore

Figure 2: Research Methodology chart
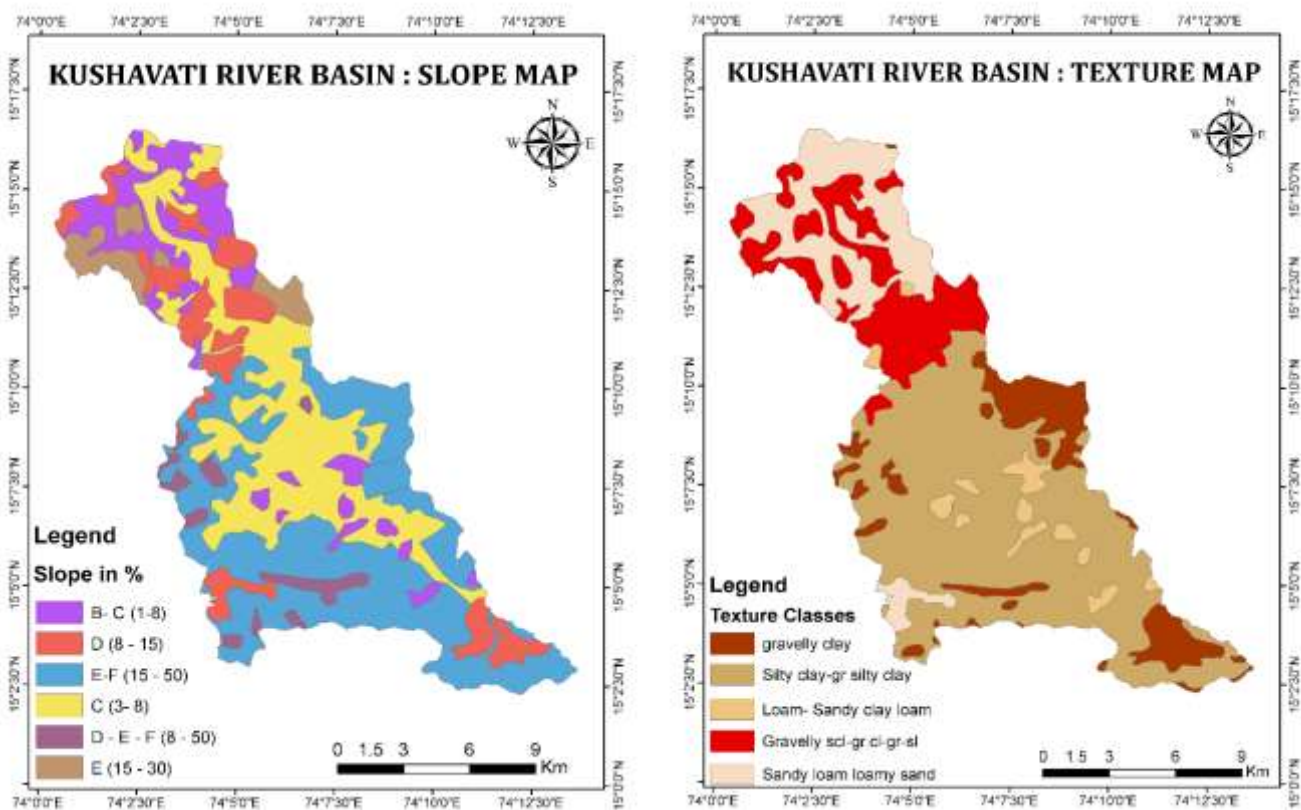
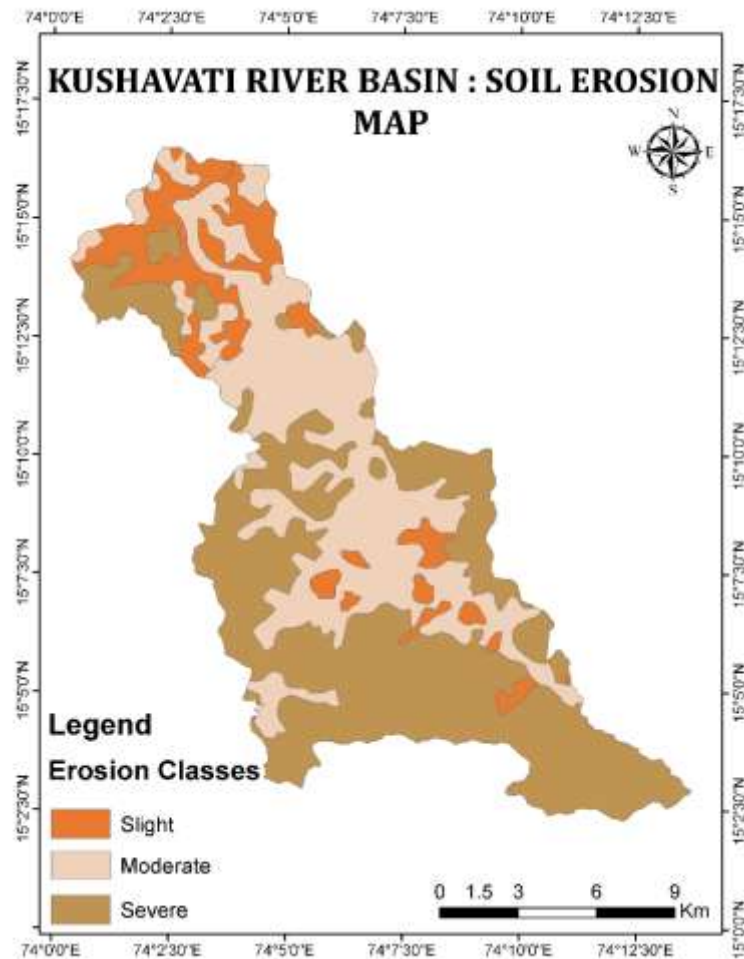*Figure 2: Slope Map*   *Figure 3: Texture Map*

Figure 4: Soil Erosion Map

5. Result and Discussion

- **Land Capability Classification:**

Land capability classification is grouping of soils in different classes which is done on the basis of their capability to produce common cultivated crops and pasture lands without deteriorating over a longer period of time. (Land Capability Classification n.d.). There are four main land capability classes found in the basin area. These land capability classes recognized in the basin area include class – II, class – III, class –IV, and class – VI.

- **Land capability Classes**

Class – II

The analysis reveals that the class-II of land capability has is found in the kushavati River basin. This Class-II of land capability observed in the basin

area covers the area of 68sq.km (31.2%) area. This class is the most suitable for agricultural crop production. The soils in this class require water conservation and soil management practices to prevent deterioration or to improve air and water relations when the soils are cultivated. This type of soil is highly suitable for the production of crops. The land capability class – II type of the soil is mainly found in the central and the Northern part of the Kushavati basin area.

Table 2 Areal extent of land capability classes

Sl.No.	LCC class	Area in sq.km	Area (in per cent)
1.	Class- II	68	31.2
2.	Class - III	93	42.6
3.	Class - IV	47	21.5
4.	Class - VI	10	4.6
	Total	**218**	**100**

Class – III

This type of the soil is majorly found in the Kushavati River basin. The area covered by the land capability class of class-III is 93 sq.km which accounts for 42.6% of the basin area. These types of the soils require the special conservation practices. This type of soil is suitable for cultivated crops. Limitations of soils in class III restrict the amount of clean cultivation; timing of planting, tillage, choice of crops and harvesting. Land capability class-III type of soil is mainly found near the drainage region where the Kushavati river drains in the northern part of the basin area. This type of soil is also found towards the southern western and a small area in the eastern part of the kushavati river basin.

Class – IV

The land capability of class – IV is found require very careful management. This type of soil is found in some portions of the basin area. The soil of class – IV in land capability classification covers the areas of North, and few regions of Eastern and southern regions. This class – IV type of soil occupies the area of 47sq.km which accounts for 21.5% of the Kushavati basin area. This type of the soil requires the careful management and water conservation practices. This type of soil is suitable for woodland, pasture and cropland. The soils atre suitable for growing two or three types of crops. The harvest produced by this type of the soil is low if continually used for the longer period of time.

Class – VI

 The land capability class – VI occupies 10sq.km of the basin area which accounts for 4.6% of the Kushavati River basin. This type of soil cover is very least in the basin area. This type of soil is found in very less proportions in the Northern Part of the basin area. This type of soil is suitable for grazing , pasture, range, forestland, or wildlife food and cover.
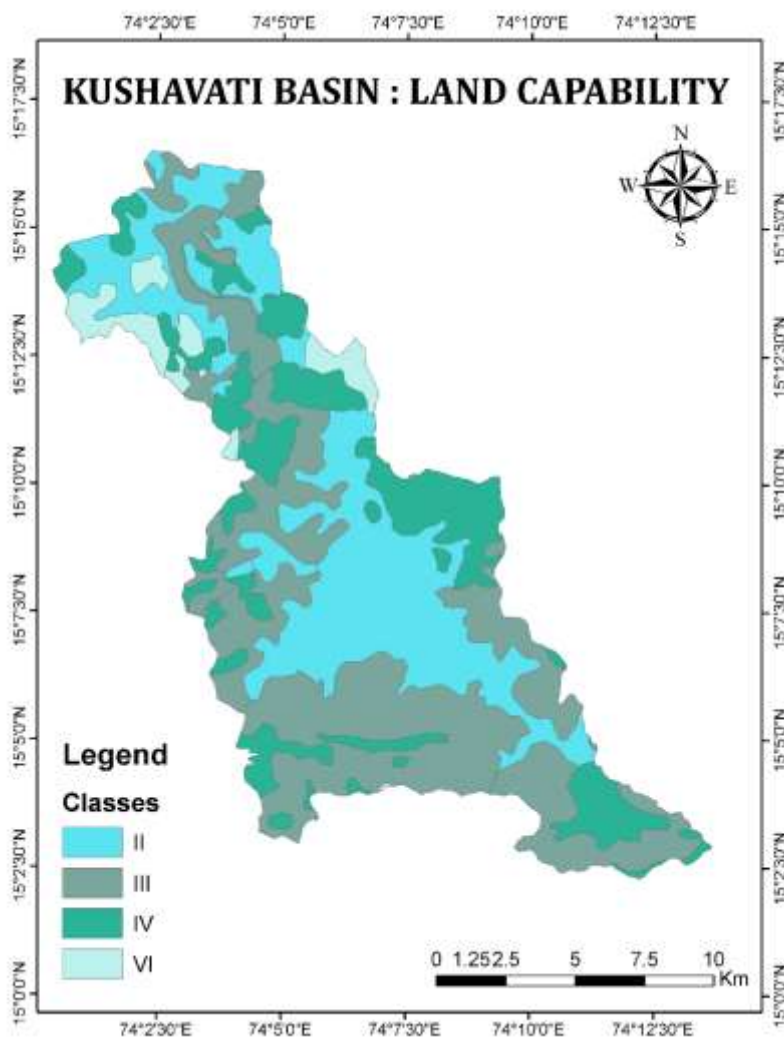

Figure 5: Land Capability Map

6. Major Findings

- The land capability classification provides valuable insights into the suitability of soils in the Kushavati River basin for different purposes.
- Class – II and Class – III dominate the basin area, indicating significant potential for agricultural activities.
- Class – IV and Class – VI, though occupying smaller areas, play important roles in sustaining woodland, pasture, and ecological balance.

7. Recommendations

1. **Agricultural Practices:** Implement water conservation and soil management practices in Class – II areas to sustain crop production. Class – III requires specialized conservation practices to overcome limitations on cultivation and ensure sustainable crop growth.
2. **Land Management:** Class – IV areas need careful management strategies to balance crop cultivation and prevent soil degradation. Class – VI areas should be preserved for non-agricultural purposes, emphasizing conservation for biodiversity.

8. Land Suitability Planning

1. Land Suitability Zoning: Develop a zoning plan based on land capability classes to guide land use and development. Ensure sustainable agricultural practices in Class – II and Class – III areas.

2. Conservation Measure: Implement conservation measures in Class – IV and Class – VI areas to maintain ecological balance and prevent soil degradation.

3. Community Engagement: Involve local communities in planning and decision-making processes to ensure the sustainable use of land resources. Promote awareness about the importance of soil conservation practices.

In conclusion, a comprehensive approach to land use planning and conservation practices is essential to harness the agricultural potential of the Kushavati River basin while preserving its ecological diversity.

References:

1. Bruneau, Richard. Watershed Management Research. March 2005. Https://IdlBnc.Idrc.Ca/Dspace/Bitstream/10625/25832/1/122072.Pdf (Accessed 08 1, 2016)
2. GERHARDT, NIKOLAUS. WATERSHED MANAGEMENT. December 1977.Https://Ir.Library.Oregonstate.Edu/Xmlui/Bitstream/Handle/1957/31087/Ge rhardtnikolaus.Pdf?Sequence=1 (Accessed 08 1, 2016).

3. Grade Stack. N.D. Http://Gradestack.Com/CBSE-Class-8th-Complete/Land-SoilWater-/Water/14829-2938-2355-Study-Wtw (Accessed 8 20, 2016).

4. Kassa Teka,Van Rompaey And Poesen J. Land Suitability Assessment For Different Irrigation Methods In Korir Watershed,. November 25, 2010. Http://Www.Mu.Edu.Et/Jd/Pdfs/V3I2/6%20Kasa's%20final%20E1%20214 - 219.Pdf (Accessed 08 1, 2016).

5. MELAK, SLEHAK. Land Capability, Irrigation Potential And Crop Suitability Analysis Using GIS And Remote Sensing In Upper Kesem (Awash Basin). July 2007. Http://Etd.Aau.Edu.Et/Bitstream/123456789/922/2/SLEHAK%20 MELAK.Pdf (Accessed 8 20, 2016).

6. Mondal, Puja. Watershed Management: Aspects, Objective And Various Measures. N.D. Http://Www.Yourarticlelibrary.Com/Essay/Watershed-ManagementAspects-Objective-And-Various-Measures/30216/ (Accessed 7 30, 2016).

7. Puja, Mondal. Management:Aspects, Objective And Various Measures. 7 30, 2016. Http://Www.Yourarticlelibrary.Com/Essay/Watershedmanagementaspectso bje ctiveandvariousmeasures (Accessed 8 10, 2016).

8. Sachin S. Panhalkar, Sagar P. Mali, C.T. Pawar. "Land Capability Classification In Hiranyakeshi Basin Of Maharashtra (India): A Geoinformatics Approach." International Journal Of Engineering And Technical Research, Volume-2, Issue6, 2014: 18-21.

9. Sonali Bhandari , Santosh T. Jhadav, Suresh Kumar. LAND CAPABILITY CLASSIFICATION AND CROP SUITABILITY ASSESSMENT IN A WATERSHED USING RS AND GIS – A CASE STUDY OF WATERSHED IN DEHRADUN, UTTARAKHAND. 2013. Http://Www.Esri.In/~/Media/EsriIndia/Files/Pdfs/Events/Uc2013/Procee dings/Papers/UCP032.Pdf (Accessed 08 1, 2016).

10. TANAKA, Tadashi. Methodology Of Integrated Watershed Management For Sustainable. October 2007. Http://Www.Ied.Tsukuba.Ac.Jp/Wordpress/WpContent/Uploads/Pdf_Paper s/Tercbull08s2/T8supple2_18.Pdf (Accessed 08 1, 2016).

11. Tiruneh, Gizachew. "Land Capability Classification Using Geographical Information System In Shinfa Watershed, Highlands Of Ethiopia." Journal Of Physical Science And Environmental Studies Vol. 1 (2), 2015: 17-20.

12. Tschinkel, Carlos Perez And Henry. IMPROVING WATERSHED MANAGEMENT IN DEVELOPING. July 2003. Https://Www.Odi.Org/Sites/Odi.Org.Uk/Files/OdiAssets/Publications-Opinion-Files/5196.Pdf (Accessed 08 1, 2016).

13. V.Thangamani And M. Sambasiva Rao. "Land Capability Of Palar River Basin Using Remote Sensing Technique." The Deccan Geographer , June,2007: 9-18