IMPORTANCE OF VETIVER SYSTEM TO REDUCE THE IMPACTS OF LANDSLIDE HAZARD IN ARUNACHAL PRADESH IN CONTEXT OF GIS AND REMOTE SENSING TECHNOLOGY.

Rakesh Kumar Singh[1], P.R.Gajurel[2], Kh. Ronald[3], B. Singh[4]

North Eastern Regional Institute of Science and Technology

Deemed University under the MHRD, Govt. of India

Nirjuli – 791109, Arunachal Pradesh

Email: rakesh9835@hotmail.com

Abstract: Land slide is a very common disturbance in Mountain ecosystem all throughout in India. The state of Uttarakhand and Arunachal Pradesh are most severely affected by this phenomenon due to change in land use pattern. In the study we took a small part of Papumpare district in Arunachal Pradesh to identify, mapping the landslide prone areas and use the Vetiver grass system to reduce the effect of landslide area. Vetiver System is a very simple, practical, inexpensive, low maintenance and very effective means of soil and water conservation, sediment control, land stabilizations and rehabilitation, and Phyto-remediation. Cartosat- 1 data and GPS survey have been used for identify the landslide area by using the Arcgis 10.1 and Erdas 2013 software. After identified the landslide area, Vetiver grass can be planted these area and the main objective of the study to reduced the landslide hazard using this Vetiver grass system.

Key word: (Landslide, Vetiver system, GIS, Cartosat – 1)

1.Introduction

Landslide results in highly severe destructive outcomes in relation to human life and the overall economic system of many nations around the globe. Landslide hazard assessment and risk reduction can be accomplished by providing the risk managers with easily accessible and accurate information about landslide points of occurrences. Thus, an accurate susceptibility mapping can provide key information for a large variety of users from both private and public sectors, from governmental departments and the scientific community. According to records, in Southeast Asia, steep hill slopes, seasonally dry spells, excessive rainfall intensities and unstable soils are the main causes of frequent occurrences of landslides.

Since 1970s, geographic information system (GIS) technology has given the distinctive capability of automating and analyzing varieties of spatial data. Recently, the availability of varieties of remote sensing (RS) information and their interpretation using GIS has made the landslide susceptibility mapping quite realistic. It has also evolved into a mature research and application area concerning various fields, namely geography, civil engineering, computer science, land-use planning, and environmental science (Church, 2002). At present, the GIS is the most powerful tool in spatial modeling (Peuquet andMarble,1990; Klosterman,1995; Yaakup et al., 2004).GIS has been called as an “enabling technology “because of the potential it offers for the wide variety of disciplines which deal with spatial data such as geography, civil engineering, photogrammetric, remote sensing and many more. GIS brings many of the related fields together by emphasizing integration, modeling and analysis.

Vetiver system is based on the application of vetivar grass and it is first used by in 1980s by the World Bank. This system widely used to protect the landslide, erosion and flood control, so we can apply this grass system to the landslide areas for prevent the landslide hazard.

2. Study area

The present study is based on land suitability in order to identify the land slide prone area. The study area comes in the state of Arunachal Pradesh (AR) which encompasses between the latitude of 93°27'00" E to 93°48'00" E and longitude of 27°00'00" N to 27°18'00" N (see Figure 1). The elevation of the area varies between 59 m to 2425 m. AR is one of the states in north eastern part of India surrounded by hilly tracts with deep valleys and high mountains peak traversed by many rivers and small streams. AR is also known as land of rising sun and it covers a vast variety of tropical and temperate forest. The climate is humid and hot in summer but snow fall can be seen during winter in upper part of Arunachal Pradesh. The region experiences heavy rainfall in May to September. Vast areas of rich forest lands belonging to the indigenous people with more than hundred communities which lead to a vast cultural diversity. Arunachal Pradesh, due to its location in Himalayan region, comes under measure tectonic plates causing earth quake; and loose earth materials receiving heavy rainfall causes landslides which is vulnerable to the population and infrastructures and wildlife habitats. There were many such past events occurred which have killed so many lives. The 1950 earthquake which is also called as 6th largest earthquake of 20th century killed 1500 people and the induced landslide blocked several drainage paths of rivers causing floods, death of lives and other damages in the region. Due to heavy and prolonged rainfall, landslide occurs every year and so causes the damages and loss of lives.

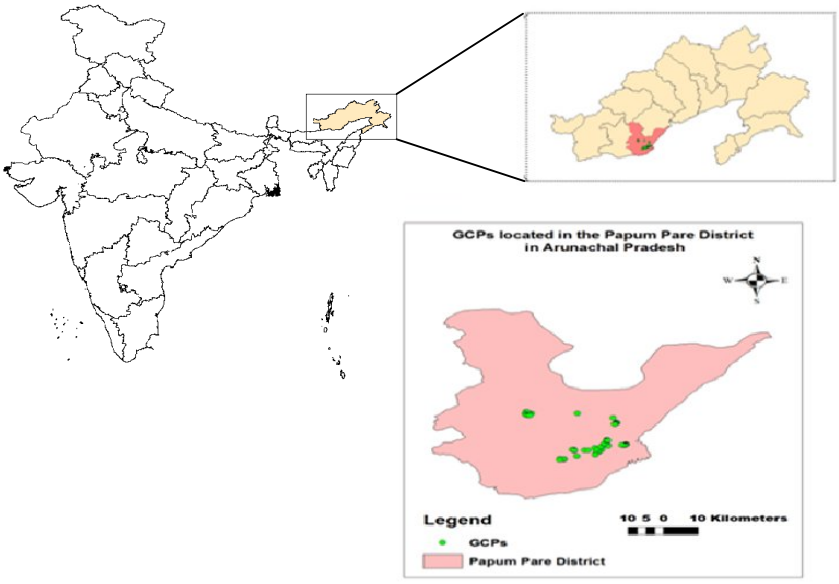

Figure 1: GCPs located in the Papumpare district of Arunachal Pradesh

2. Objectives

The main objective of the study is to develop a GIS based Landslide risk management and planning using RS data in the selected area. Different sub components of the project include:

- Processing of CARTOSAT-I images of the area
- Modeling and prediction of landslides.
- Developing a Vativer grass system to prevent the landslide.

4. Methodology

Cartosat-I, LISS- IV PAN satellite imagery have been used to interpret and analyze the geological structure, drainage pattern, slope, contour, of the area in integration with the Arc GIS10.1 and Erdas 2013 software. Figure 2 represents the flow chart for the detail methodology to be followed during the project work.

4.1 Digitization of data

Digitization of ground maps is the first step to analyze the features in the study area. Hard copies of the SOI toposheets, topological and geological maps will be scanned and imported into GIS software and will be digitized using Arc GIS software for the raster and vector data structures.

4.2 Image processing

Image processing will be performed on the satellite products. This processing will involve digital enhancement (manipulating the contrast between objects) and spatial filtering (to detect the edges between features, thereby defining boundaries), in order to improve the interpretation of the images.

Image processing will also entail the geo-referencing of the satellite imageries and scanned photographs. All images will be spatially referenced to UTM Projection. Ground control points (GCPs) will be collected using the GPS, which will be used to geo-correct the images.

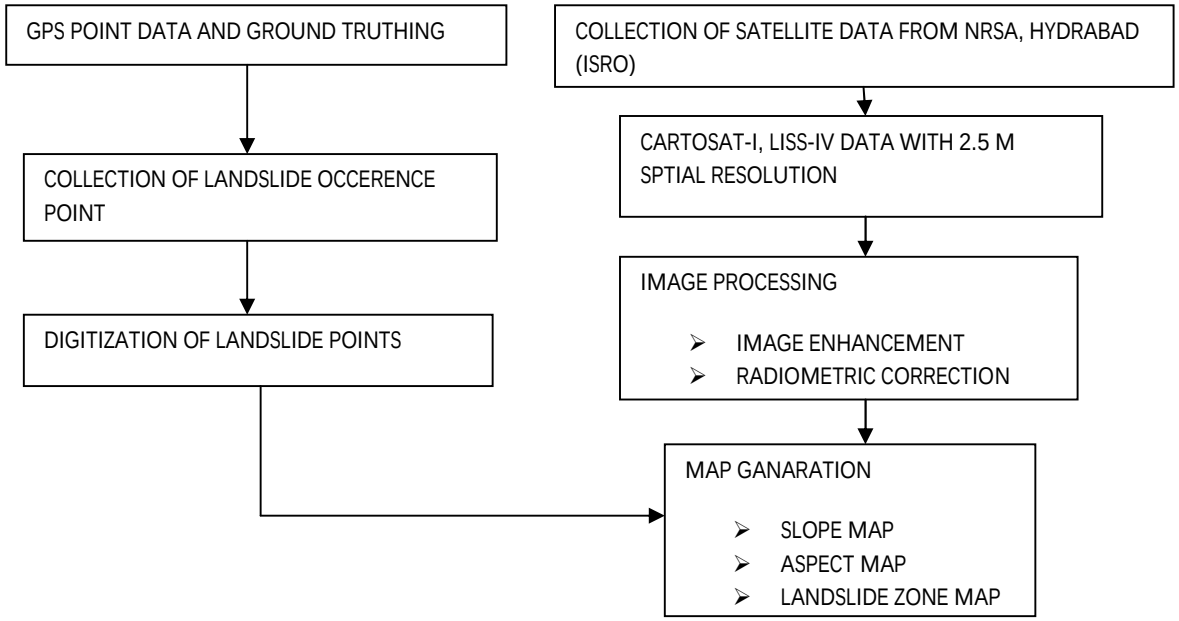

Figure 2. Flowchart showing the methodology

4.3 Plantation of Vetiver grass

the study area is coming under the Kimin formation which mostly made by coarse sand and clay the rocky particulars are not formed properly so the area have the good ideal conditions for the plantation and growing for the Vetiver grass so the after the mapping an identify the landslide prone areas, the Vetiver grass can be planted to control the erosion and landslide

Figure no 3: roots of Vetiver grass and the planted grass to prevent the landslide and erosion.

5. Results

In the study we have found three results first the elevation of the study area, second the aspect of the slope and third the landslide area and also got the water streams. In figure no- 3 the landslide areas are just near to 4 and 5 streams order that shows that the mostly landslide are happened near the water stream or hilly river. And the numbers of highest landslide occurrence in between the 60 to 500 meters from the mean sea level. Figure no- 4 shown the aspect of the study area, the aspects of the area is highest recorded in north, northwest west and south. All the landslide area are mainly situated in the southwest and northwest aspect. The geologically formation of the area is Kimin formation and The Kimin Formation is dominantly a conglomeratic sequences, consists of alternate beds of pebble conglomerates, coarse-grained sandstone and clays. This Formation is poorly cemented and younger formation of Siwalik formation (Palaeobio Palaeoenv 2011). The due to the formation the study is not stable so the hilly area where the slope is high are slide when the heavy rainfall is occurs.

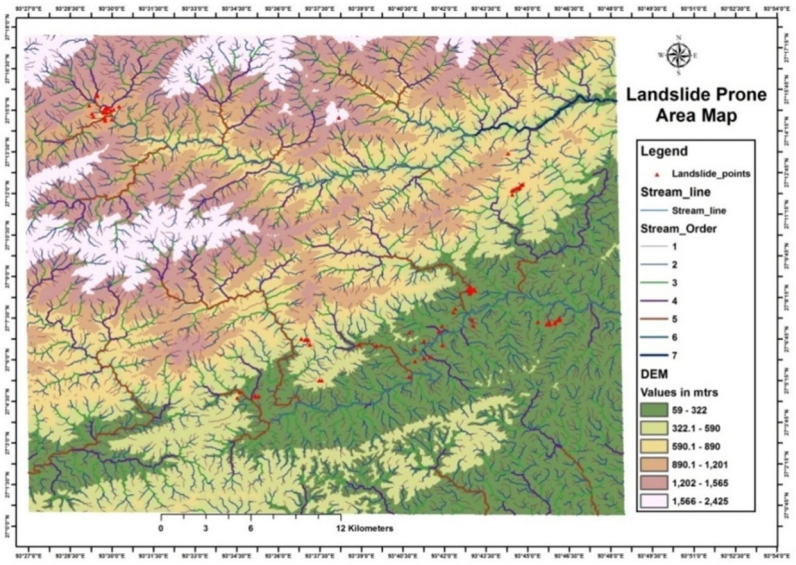

Figure 4: Map showing stream networks in the study area (Source: CARTOSAT -I)

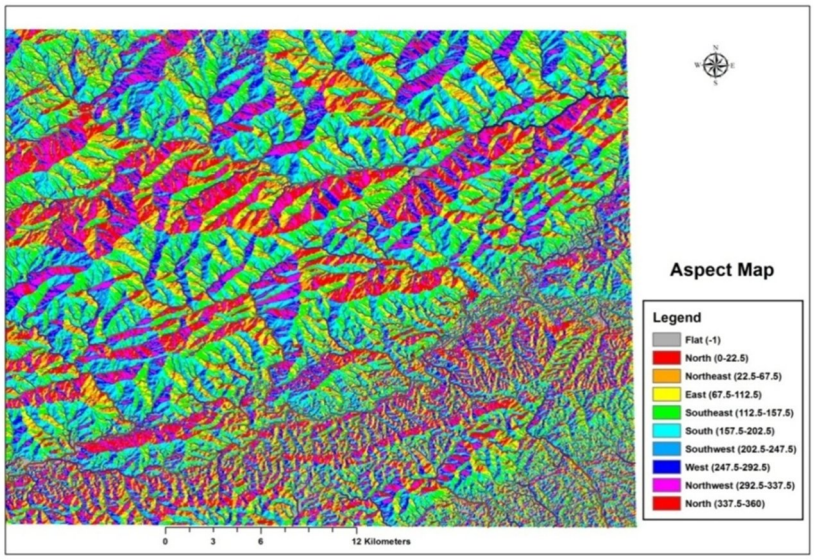

Figure 5: Map showing aspect of the study area (Source: CARTOSAT - I)

6. Conclusion

After the study we have got that due to the slope and heavy rainfall and the most important the geological formation of the area is very big reason for the sliding of landmass and we can say that most of the landslide is occurs near to the river or river stream which is between 60 to 500 meters from sea level. And most of the landslide spot are found in the aspect of northwest and southwest part of the study area, at the in the study we have reviews the Vetiver system to reduces the landslide is very suitable and eco friendly we can also planted many plants in the slope of the areas and now these day this techniques are very powerful techniques.

7. Acknowledgement

I offer my sincerest gratitude to Prof. B. Singh, Principle Investigator of the Project “Mapping Management and Analysis of Medicinal and Aromatic Plants of Arunachal Pradesh using GIS and Phytochemical Molecular Techniques” funded by the North- Eastern council, Shillong, Govt. of India

I offer my sincerest gratitude to Dr. P.R.Gajurel, the Associate Professor. Her patience and kindness throughout my thesis, as well as her academic experience, have been invaluable to me. Without her encouragement and effort, the thesis would not have been completed.

My sincere appreciation and thanks to North- Eastern Council, Shillong, Govt. of India for providing me with the required funding and support for my work.

7. References

Church, RL., 2002 Geographical information systems and location science. Computer Oper Res 29:541–556.

Mendoza,GA.,1997 A GIS-based multicriteria approach to land use suitability assessment and allocation. 7th Symposium on Systems Analysis in Forest Resources.

Yaakup,A, Ludin,AMN, Susilawati,S, Haibenarisal,B 2005., GIS inurban planning and management: Malaysian experience. Interna-tional Symposium & Exhibition on Geoinformation, Geospatial Solutions for Managing the Borderless World, Pulau Pinang.

Klosterman,RE.,1995 The appropriateness of geographic information systems for regional planning in the developing world. Comput. Environ. Urban Syst 19:l–13.

Peuquet, DJ, Marble ,DF., 1990 Introductory readings in geographic information systems. Taylor & Francis, London.