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Identification of Potential Tourism Places in Sikkim using Remote Sensing & GIS

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Abstract: Nestled in the Eastern Himalayas, the state of Sikkim is home to immense biological diversity and rich natural and cultural heritage. It is one of the highest regions with an area of 7096 sq. km. It is a biological hot spot with many rare, endemic varieties of flora and fauna. This bio-diversity wealth contributes significantly to the country's natural heritage and to the nation's ecological balance. Besides, Sikkim is a cauldron, in which the great cultures of Tibet and India have been synthesized together to evolve as a land of variegated cultures and traditions. Yet the region has tended to be left far behind in developmental needs and poverty levels are comparatively high. Current economic wisdom states that the tourism sector would constitute a keep sector in the economy of hill regions. Sikkim has great potential for the same as it has a major portion of its land comprising of the Great Himalayas, and has several trekking routes offering for attracting a growing trekking community. The tourism trends are studied to map the state of progress and prospects of tourism in the state, and for the general understanding of patterns of tourist influx. Tourism in Sikkim is predominantly domestic; foreign tourists comprise only 5.5% of the total tourist influx[1]. The trends reveal that Sikkim tourism is in the developmental stage of increasing growth of tourist influx. Simulations based on three scenarios suggest that approximately 7.6–10.4 lakhs tourists would visit Sikkim during the year 2017, which would also have Implications on the infrastructure, environment, natural resources, culture and eco-tourism of the state. The impacts are also analyzed in light of papered increase in the population and trends of livestock resources and agricultural production. A proactive planning involving optimal use of management options, therefore, is required for a viable symbiosis of tourism and environment, and sustainability of tourism in the state.

Keywords: RSGIS; Sikkim; Remote; Sensing

I. INTRODUCTION

Tourism and environment are intricately related. The environment of a tourist destination, its socio-cultural attributes, resources and heritage value constitute the basic background elements for the evolution, growth and development of tourism in that area. The increasing tourism activities in a tourist destination often result in overuse and degradation of the environment and resources of tourism which in turn lead to a decline in the growth of tourism, and loss of tourism value of the destination. Tourist destinations usually follow a lifecycle; the boom and bust course is most common [1]. Tourism in a destination depends on the carrying capacity, resilience of the host/destination environment.

The purpose of this paper is:

a) To study the major potential tourism places in Sikkim.

b) To identify the potential tourism places in Sikkim as the study area and then extending the work by including other three districts, by using RS & GIS Techniques.

c) To create a Map showing probable areas where tourism places can appear using information retrieved after processing the data with RS & GIS software being used.

d) To provide awareness to the people of Sikkim about the potential tourism places in Sikkim.

The paper will be concerned with identifying every possible areas in Sikkim where potential tourism places could take place with the availability of various input data like topographic maps, satellite images and various other maps like soil map, rainfall data etc. 3-D digital elevation modeling capabilities and guided visual program module of the software (ERDAS IMAGINE 9.2) will be utilized to successfully enumerate the contributing factors for identification of potential tourism places in Sikkim.

II. REMOTE SENSING AND GIS

Indian remote sensing programme had a modest beginning in the early sixties when aerial platforms were used to acquire information about the earth resources. The first Indian experimental satellite, sent by India for earth observation was Bhaskar-1. This was placed in to the orbit by a Comos rocket from Russia commodore on 7th June 1979 [2]. Bhaskara had a pay load consisting of two band TV cameras for land applications and a Satellite Microwave Radiometer for oceanographic/atmospheric applications. However, experimental studies were conducted primarily using LANDSAT data, towards the development of operational methodologies for resource management applications.

IRS-1A, IRS-1B, IRS-1C, IRS-1D satellites

The first indigenous operational remote sensing satellite IRS-1A was launched in March 1988 which was continued to provide excellent data even beyond its mission life of three years. The second satellite, IRS-1B was launched in August 1991 with the linear Imaging Self Scanner (LISS)-I and LISS-II on board. The satellites have provided the images in four spectral bands in the visible and near regions (0.45 to 0.86 microns) with spatial resolution of 72 meters and 36 meters respectively [3]. The second generation of IRS satellites includes IRS-1C and IRS-!D was successfully launched on September 29, 1997. When compared to IRS-1A/!B, sensors of these satellites have a better spectral and spatial resolution, more frequent revisits, provision for stereo-viewing and on board recording facilities [4]. These satellites have three sensors namely LISSIII, Panchromatic (PAN) and Wide Field Sensors (WiFS). The LISS-III sensor has four spectral bands in the 0.5-0.7 micron region, with a swath 142 km had spatial resolution of around 5.8 meters and has steering capabilities up to ± 260° which will enable frequent revisits and are suitable for stereo viewing [5]. The WIFS sensors operate in 2 spectral bands such as red and near infrared, with a spatial resolution of 188 meters and swath of 774 km enables monitoring of vegetation dynamics. Satellite data products are as:

a. False colour composites.
b. TM. Thematic maps.
c. Positive and negative films.
d. Digital data in CD's tape and floppy disks.Maintaining the Integrity of the Specifications

III. ABOUT SIKKIM (STUDY AREA)

Sikkim is 22nd state of India and is mountainous state that shares its boundary with three sovereign nations, Nepal in west, Bhutan in east and Tibet, China in north. The sate shares its southern boundary with Darjeeling district of West Bengal, India. The state is situated between 27°04'46" and 28°07'48" north latitudes and 88°00'58" and 88°55'25" east longitudes [6]. The state has total geographical area of 7096 sq km.

Sikkim has a very rugged topography and formidable physical feature. Northern region of Sikkim is mostly covered by the snow and has no populated area except Lachen and Lachung. Southern Sikkim is densely populated and is fairly cultivated in patches. It is subjected to erosion by River Teesta and its tributaries. The general slope of the state is from north to south. However, the degree of slope varies from place to place. It is roughly 600m per km in north and east, 300-600m per km in the south, 150-300m per km in west and southern portion of south Sikkim [7].

Figure: 1 Study area

Tourism is travel for recreational, leisure or business purposes. The World Tourism Organization defines tourists as people who "travel to and stay in places outside their usual environment for more than twenty-four (24) hours and not more than one consecutive year for leisure, business and other purposes not related to the exercise of an activity remunerated from within the place visited". Tourism has become a popular global leisure activity. In 2008, there were over 922 million international tourist arrivals, with a growth of 1.9% as compared to 2007 [8]. International tourism receipts grew to US$944 billion (euro 642 billion) in 2008, corresponding to an increase in real terms of 1.8%.

As a result of the late-2000s recession, international travel demand suffered a strong slowdown beginning in June 2008, with growth in international tourism arrivals worldwide falling to 2% during the boreal summer months. This negative trend intensified during 2009, exacerbated in some countries due to the outbreak of the H1N1 influenza virus, resulting in a worldwide decline of 4% in 2009 to 880 million international tourists arrivals, and an estimated 6% decline in international tourism receipts.

IV. TOPOLOGICAL STUDY OF STATE SIKKIM

A topo-sheet is a shortened name for 'Topographic sheet'. They essentially contain information about an area like roads, railways, settlements, canals, rivers, electric poles, post offices etc. According to their usage, they may be available at different scales (e.g. 1:25000, 1: 50000 etc, where the former is a larger scale as compared to the latter) [9]. Thus any point on it can be identified with its corresponding lat-long, depending upon the scale (i.e. if the scale is large, more accurate lat-long).

There were essentially four toposheet covering entire Sikkim taken into consideration for extraction of topological information of state Sikkim, the toposheet taken in a scale of 1:250000 (revised in the year 1962).

V. METHODS

A. Registration Process:

Registration of toposheet as per the latitude and longitude value of earth taking into consideration Everest 1969 standard.

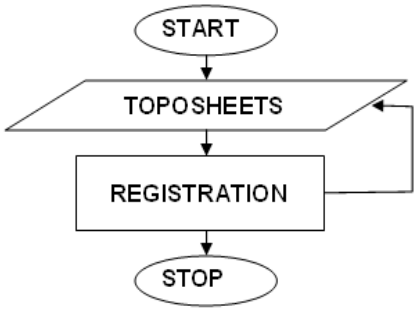

Figure: 2 - Flow chart for registration

B. Mosaic Process:

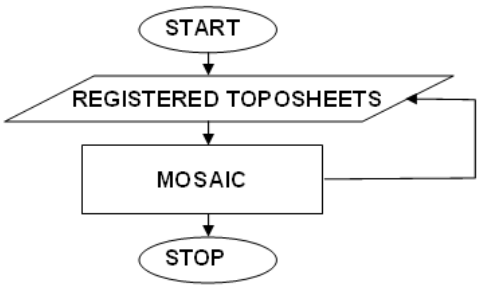

Figure: 3 - Flow chart for Mosaic

C. Demography:

Demography is the statistical study of human populations.

D. Climate of Sikkim:

The climate ranges from sub-tropical in the south to tundra in the northern parts. The tundra-type region in the north is clad by snow for four months a year though the temperature drops below 0 °C (32 °F) almost every night [10]. The peaks of north-western Sikkim are perpetually frozen [11]. Most of the inhabited regions of Sikkim, however, witness a temperate climate, with the temperatures seldom exceeding 28 °C (82 °F) in summer or dropping below 0 °C (32 °F) in winter.

E. Economy of Sikkim:

Sikkim's gross state domestic product for 2004 is estimated at $478 million in current prices.

Sikkim's economy is largely agrarian. The British introduced terraced farming of rice, n addition to crops such as maize, millet, wheat, barley, oranges, tea and cardamom.

F. Transport:

Sikkim does not have any airports or railheads because of its rough terrain; however, the first airport of the state is expected to be ready by 2011 in Pakyong, 30 km (19 mi) away from Gangtok. The closest airport, Bagdogra Airport, is near the town of Siliguri, West Bengal.

G. Culture:

The Sikkimese celebrate all major Hindu festivals such as Diwali and Dussera. Nepali festivals like Tihar and Bhimsen Puja are common. Losar, Loosong, Saga Dawa, Lhabab Duechen, Drupka Teshi and Bhumchu are Buddhist festivals [11].

H. Rainfall in Sikkim:

An examination of available rainfall data shows that the mean annual rainfall is minimum at Thangu (82 mm.) and maximum at Gangtok(3494 mm.). An isohyetal analysis of these data reveals that there are two maximum rainfall areas (i) South-East quadrant, including Mangan, Singhik, Dikchu, Gangtok, Rongli etc. (ii) South - West corner including Hilley [12]. In between these two regions, there is a low rainfall region e.g. Namchi.

Table 3.8

Month	Rainfall (mm/month)
January	37.0
February	53.0
March	104.1
April	151.7
May	287.6
June	442.7
July	480.1
August	440.1
September	331.8
October	156.0
November	30.7
December	19.1
Total	**2533.9**

Figure 4:- Rainfall statistics for different month for state Sikkim

VI. RESULTS

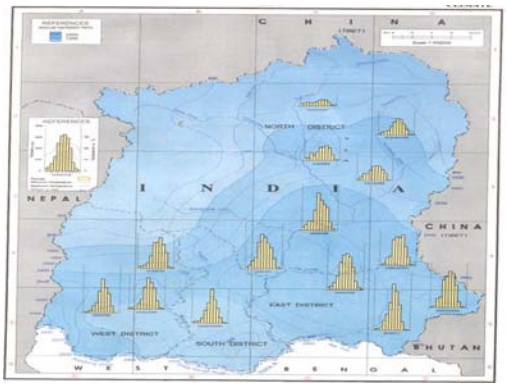

Figure 5:- Rain fall map of Sikkim

At the end of the paper, some of the areas of sikkim has successfully been highlighted as potential tourism places in Sikkim after having processed all the input data through the system processed all the input data through the system and taking into account all the relevant parameters and references for the paper [13]. The result has been shown in the form of maps. All relevant maps were created, classified and used for superimposing has also been enclosed.

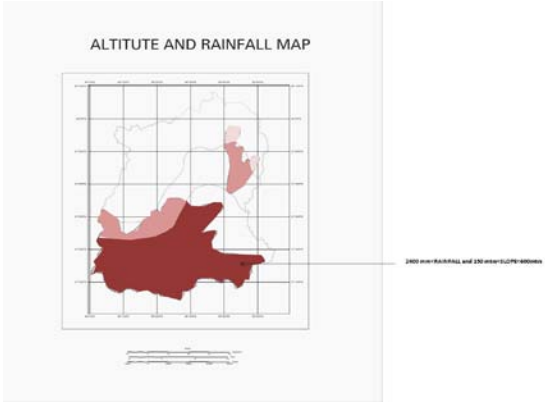

Figure: 6

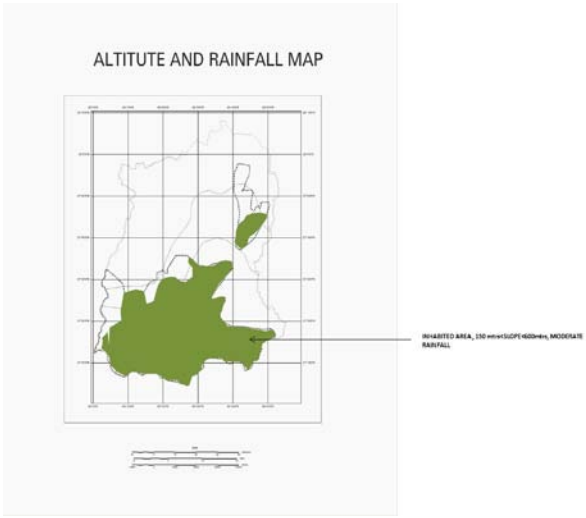

Figure: 7

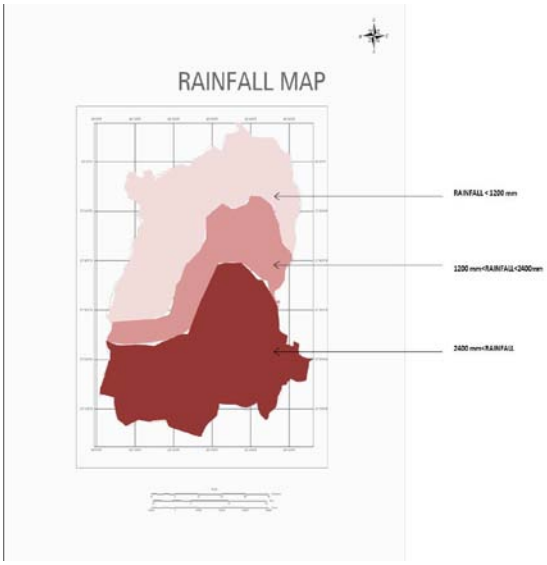

Figure: 8

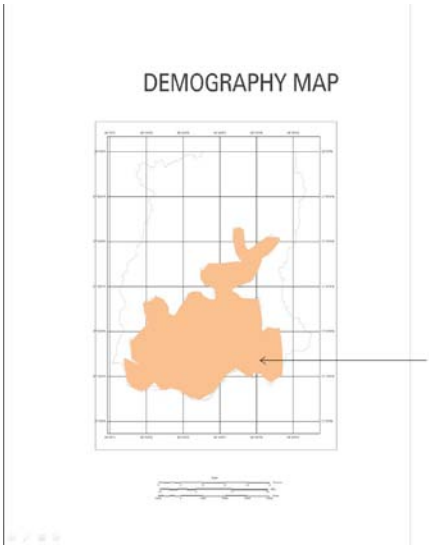

Figure: 9

Figure: 10

VII. CONCLUSION AND DISCUSSION

Good quality, multi-spectral imagery can allow tourism to be identified using a combination of direct inspection and computer based analyses. The availability of imagery with a sub-metre resolution means that tourism is potentially observed able. However, research into the use of such techniques for tourism detection has so far been limited.

The paper entitled "Identification of potential tourism places in Sikkim using RS and GIS technique" will help to gain a very deep knowledge about tourism. With the use of RS & GIS techniques and the applicability of ERDAS Imagine 9.2 the processing became very much easier, resulting in a production of output maps which will shows some of the potential tourism places in Sikkim.

VIII.ACKNOWLEDGMENT

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