Pacific International Journal, Vol. 3(3), 81-97; 2020
ISSN (Print) 2663-8991, ISSN (Online) 2616-4825
DOI: 10.55014/pij.v3i3.101
https://rclss.com/index.php/pij

Comprehensive Spatial planning of Sonamarg resort in Kashmir Valley, India for sustainable tourism

Ishfaq Gujree[1], Arfan Arshad[2], Aijaz Reshi[3], Zubair Bangroo[4]

[1]Institute of Tibetan Plateau Research, University of Chinese Academy of Sciences, Beijing. China
[2]Institute of Remote Sensing and Digital Earth, University of Chinese Academy Sciences, Beijing. China
[3]College of Computer Science and Engineering, Department of Computer Science, Taibah University, Al Madinah, Al Munawarah Saudi Arabia
[4] Institute of Remote Sensing and Digital Earth, University of Chinese Academy Sciences, Beijing. China
*Correspondence: Ishfaqgujree@outlook.com

Tourism Industry is directly linked with the environment, as tourists mainly travel to natural and green environment destinations. This study has made an attempt to demonstrate the application of Geospatial Approach in evaluation of Master Planning for Sonamarg Resort most visited tourist place of Kashmir valley. Master Plan (MP) for Tourist Resort of Sonamarg was evaluated using topographical settings (Slope, Aspects and Elevation) natural drainage and land use land cover map. Evaluation of Master plan for Sonamarg tourist resort was carried out in two ways i.e., zone vise (A, B, C and D) and slope vise. High resolution Google Earth satellite images of IKONOS were used to analyze current land use land cover in Sonamarg, which are classified into 7 classes. ASTER DEM was used to prepare the slope, elevation and drainage maps. RETScreen Expert was used to get the climate data from NASA to correlate it with the Tourist inflow months. Results indicated that "Zone A" may exhibit conversion from pastures and built up into mixed zone and village settlement; "Zone B" from agriculture to river fronts; "Zone C" from pasture land to golf course and camping areas; "Zone D" from built up, pastures and recreations sites to golf lodges and facilities areas. Slope vise evaluation indicated that forest should be on higher slope, recreational tourist including Golf Course, River Front and Organized Parks on the moderate slope while built up on the lower slope. The Rapid settlement expansion is seen as one of the potential threats to sustainable development and settlement planning coupled with effective resource utilization and allocation of infrastructure initiatives are other key concerns.

Keywords: Tourism, Master Plan, GIS, IKONOS, LULC, RETScreen

Introduction

Tourism is generally defined as traveling of peoples form one location to another within the same country. The World Tourism Organization (WTO) has defined tourism as the traveling of peoples outside their usual environment and stay there not more than three years with the motto of leisure, business and other devotions [1], whereas "Sustainable Tourism" defined as the tourism concept which while increasing the tourists' arrivals, it also ensures to create positive impacts on the social, environment and economy in the country [2]. The economic benefits of tourism are obvious, and have long received priority attention from governments and the industry. Tourism can never be truly sustainable, because of its travel component alone but significantly, more sustainable forms of tourism can certainly be developed and should be strongly supported [3].Consequently, performance evaluations in destination management have often been substituted with simple economic indicators in marketing-oriented development models. These indicators, such as revenue, foreign exchange earnings, inbound international arrivals, domestic tourism income, and numbers of domestic stays, are frequently used in destination performance evaluations [4]. Kashmir valley has such massive resorts and historical places, and competition among these is rising rapidly. Evaluation of destination performance has become a crucial subject matter in destination management [5]. There is an important need to make management strategies and comprehensive plan in urbanized zones to preserve nature resources [6, 7].Kashmir Valley has little importance for industrialization but it offers ideal environment for tourism due to temperate climate and unique geographical location and has become important source of economic development [8]. Kashmir valley is a longitudinal depression in the great northwestern complex of the Himalayan ranges. Territorially, Kashmir valley forms the interior part of the Jammu and Kashmir [9]. It constitutes an important relief feature of tremendous geographic significance. Carved out tectonically, the valley has a strong genetic relationship with the

[Received 05 March 2020; Accepted 26 June 2019; Published (online) 30 Sep 2020]

Himalayan complex, which exercises an all-pervading influence on its geographic entity. Numerous competitiveness studies has been undertaken by research scholars to improve better understanding of destination's competitive advantages [10]. Most competitiveness studies has considered only simple economic parameters [11-14] but few of them taken into account the ecological and social parameters as well because these are in sustainable development of resorts. In urbanized and industrialized zones an extensive amount of carbon is being returned into the atmosphere which has negative impacts on ecosystem [15]. Planners used to delineate the areas for future land use development in the comprehensive plan mainly based on their subjective interpretations, with limited ecological supporting evidence and analysis [16]. Sensors and GPS widespread use, virtual and augmented reality and the full adoption of social media and mobile technologies have pushed the emergence of smartness in tourism [17]. Satellites provide high-value data globally, which enables us to serve customers at any place on earth. The advancements in Geographic Information System (GIS) and remote surveillance technologies have enabled the acquisition of Spatio-temporal satellite data for better understanding of land use planning. In order to accommodate future urbanization and conserve most ecological values theoretically based on: (1) mapping ecological values on the local level; (2) quantifying different land use categories' impacts on ecological values locally; and (3) zoning the future land use category impacting ecological values more on the land of less ecological values to protect the land of high ecological values from urbanization's interference [18]. GIS (Geographic Information System) has widely used in numerous studies related to tourism to display them graphically, identify suitable zones [19, 20]; Olya and Alipour (2015) [21] monitor land use changes in destination and to perform spatial analysis using satellite database [22, 23]. It has also been widely applied to model the inter-destination and intra-destination spatial changes of tourists for tourism planning and management [20, 24-27] have used integrated GIS and networking approach to categorize 43 villages situated in South Korea, based on their spatial significance for tourism development. It's not only applied in general tourism fields but also has been adopted in the planning and management of niche tourism and different themed tourism routes i.e., to evaluate landscape characteristics for alternative tourism development in Hungary and Croatia [28]. In Czech Republic guide trail network and unified GIS database for cycling trials has also been prepared [29]. GIS technique has also been used in various wine tourism case-studies [30-33].[32] used GIS technique to estimate total trail's length and inter-winery distances among six wine trails in New York. Recently study conducted by [34] using GIS spatial analysis have explored the combined effects of neighboring wineries on wine prices in Washington (USA).

Tourism industry presently accounts for 292 million of employed people worldwide, representing one out of ten jobs in the world [35]. This industry has been growing at an increasing rate during the past decades and is considered as the backbone in the economy of Jammu And Kashmir State. The present study is carried out for Sonamarg tourist resort which is one of the most visited and strategic tourist destinations in the Kashmir valley and a base for high altitude trekking, it has gained both national and international recognition as a tourist destination. What has come up so far in the Sonamarg tourist resort has been the outcome of a spontaneous growth process and piece-meal approach adopted for development [8, 36]. As a result, Tourist Township is confronted with problems of inadequacy of infrastructure, inorganic and amorphous growth, deforestation of rich forest slopes, soil erosion, receding snow line, development along river front and encroachment of the Resort, which need to be addressed on priority basis. Considering its importance, way-back in early eighties, efforts were made to formulate a systematic and comprehensive broad policy frame work. Unfortunately, the plan devised could not be translated on ground; as a result development in planned manner has remained a gray area [37]. With the constitution of (SDA) Sonamarg development authority and delineation of the planning area limits of the Sonamarg tourist resort, the authority has shown keen interest to develop it in a planned manner, besides harmonizing its potential which has remained untapped till now. However, scientific approaches are yet to take root in the development of tourism destinations [38]. In this paper hereafter MP is used as for Master Plan

Objectives of the Master Plan

Planning abstraction is the main point for realizing the benefits of the tourism sector for localities, public and environment. The critical objective of the Master Planning (MP) is to move the industry on to a path of sustainability, shift from the current unsustainable development to sustainable development. *Growth based on a sustainable market position*. The industry needs to return to a path of sustained growth and to do so must develop a sustainable market position. *Enhancing the visitor experience* current run-down resorts must be made more attractive; gaps in the product offer covered through mobilizing investment; and the visitor experience made more rewarding and diverse through increasing the types and quality of attractions. *Community based development* for sustainable development; local communities must play a major role in defining, developing and managing the tourism experience so that they take ownership of the industry. *An inclusive industry* from its current perception as an exclusive industry that benefits the few, the Kashmiri people should come to view the industry as inclusive, benefiting them and the state as a whole. This will call for measures that ensure that the benefits of tourism are spread widely and to promote gender equality. For *Environmental sustainability* the environment is the product. Its continued degradation threatens the future of the industry and the lives of successive generations. The industry must

contribute to the preservation of the natural habitat. Spatial master planning is an crucial aspect of planning with a focus on physical planning in various sectors as well as tourism. Its importance has increased with respect to sustainability.

The contributions of the current study is to emphasis the need of the MP for Sonamarg with the limited devaluation of the natural settings and evaluate the MP with the current LULC (Land Use Land Cover) on ground using high-resolution images. It also analyses whether the construction in different zones under the proposed MP will be suitable at the place mentioned at a particular slope.

Materials and Methods

Study Area

Sonamarg is located in the northern Ganderbal district of Union Territory of J&K, which was gateway of ancient Silk route from the valley side connecting it with the Gilgit, Tibet through Zojila pass. The popular tourist spot known as "Golden Meadow" is situated at a distance of 87 Km in the north east of the Srinagar city between 34º.18′ North latitude and 75º.21′ East longitude at an elevation of 2749 m from mean sea level. It is the last destination point in Kashmir valley enroute to Kargil and Leh and holy amaranth cave through baltal [39] This tourist resort is triangular in the shape, with its apex towards east. It stretches for about 5 km along the left of Srinagar -Leh road. Baltal plain enroute Kargil road along Sind River provides vast potentials, to develop it as a tourist region like Pahalgam as shown in Fig.1. The Sonamarg resort is surrounded on almost all sides by mountain ranges characterized by snow covered lofty peaks, dense forests and sparkling glaciers, presenting a fascinating landscape for which it is known in worldwide. On way to Leh, Sonamarg is the last stoppage point of Kashmir valley before the Zojila pass into ladakh [40]. Sonamarg situated at an altitude of 2740 m above mean sea level, is a place where "Meadows" reflect in golden color which holds our eyes and heart for a while. Sonamarg has no permanent settlement and is inaccessible during winter due to heavy snowfall and avalanches. It was reported that Sonamarg had a population of 392 (51 % of males and 49 % of females) excluding tourists and those working in the tourism industry (Indian Census Report, 2011). In late April when Sonamarg is open for road transport, the visitors have access to snow which is furnished all over like a white carpet. The popular Thajwas glacier at the westside of Sonamarg bowl, trucks its terminal in the South and bridge over Sind nalla in the north. Ponies can be hired for the trip up to Thajwas glacier, a major attraction during the summer months. However, there is need for some strict regulations to save the environment of the area from overload of tourisms.

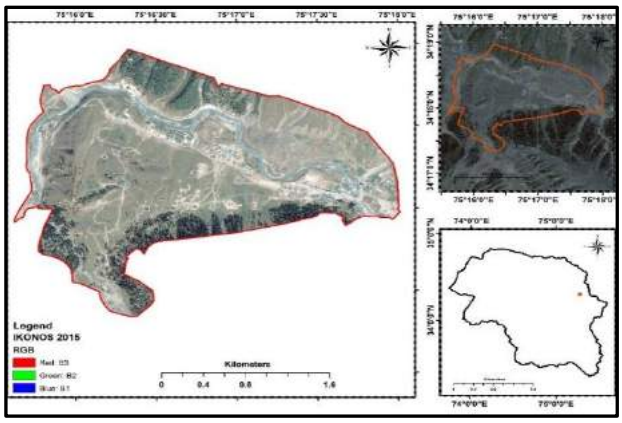


Fig. 1 Location of Sonamarg resort in Kashmir Valley.

Data Used in Study

Different types of data sets i.e. IKONOS satellite images, ASTER imagery, scanned map of SDA (Sonamarg development authority) master plan, tourist capacity and load, and GPS data were used to evaluate the current Master Plan (MP) of Sonamarg tourist resort. Tourist inflow data (Capacity and load) and scanned map of MP of Sonamarg study area was collected from Sonamarg Development Authority (SDA) for year of 2015. RET Screen Expert Clean Energy Management Software was used to get climate data variables from NASA (National Aeronautics and Space Administration). To prepare current land use land cover of Sonamarg, satellite imagery of IKONOS were collected from Google Earth for year 2015. GPS data of different locations was collected to validate the land use land cover status.

Data Preprocessing

High resolution Google Earth satellite image of IKONOS was used to analyze current land use land cover in Sonamarg. For preparation of current land use land cover map, a total of 20 images were extracted from Google Earth covering the entire study area. All the images were individually georeferenced in ArcGIS software. The images downloaded, cover large areas while the actual area being studied only covers a small portion of the image that's why required study area was extracted by mask in ArcGIS. DEM (Digital Elevations Model) of ASTER was used to prepare the slope, elevation and drainage maps. Drainage map was prepared using hydrology toolset available in ArcGIS. Different tools of hydrology i.e., basin, fill, flow accumulation, flow direction, flow length, sink, snap poor point, stream link, stream order, streams to feature and watershed were applied in sequence to delineate the drainage lines. RETScreen Expert Clean Energy Management Software were used to get climate data from NASA in order to correlate it with the Tourist Monthly inflow data as indicated in the table 5 and Fig 8(a & b).

Image Classification

Image classification is a technique of extracting useful information from a raster image. The resulting images after classification can be used to make land use maps. All the images after preprocessing were classified using unsupervised classification technique. In un-supervised classification technique ISODATA clustering algorithm was applied which classifies the image according to require number of classes and the digital number (DN) of each pixel [41]. All images after classification were corrected manually using ground truth data. Reclassify option in Arc GIS tool box was used to recode the misclassified areas based on ground truth data. The study area was classified into forest, agriculture, scrub land, pasture, barren land, streams, built-up, bus stand, recreational parks (amusement park, medicinal plant nursery and other parks). Land use land cover map (LULC) of Sonamarg was prepared to assess the environmental feasibility of Sonamarg MP (2005-2025) with respect to the current land use land cover of Sonamarg resort [42].

Sonamarg Development Authority (SDA) Design Concepts for Master plan

As discussed in preceding studies, Sonamarg has emerged as a transit-cum-tourist site. Situated in the sindh valley at a distance of 58 miles from Srinagar city, the existing development scenario of the meadow of gold can be viewed in the context of its tourism potential. For the exploitation of potential resources of Sonamarg resort, optimal development scenario based on sustainable development approach is desired to be reflected in the design concept of its plan. Sustainable tourism concept and its associated research and rhetoric continue to be a constant source of debate, discourse and criticism [43]. It is to be noted that the ecological and environmental sensitivity of the area has to be considered in the development of tourist infrastructure. It is therefore, asserted that the concept of carrying capacity has to be followed in the design concept so that its ecology can be conserved because of its importance, the design concept for the formulation of a land use plan of Sonamarg tourist resort, can be viewed in the context of its three main facets viz. transit area, tourist area and the base camp for Amarnath yatries. These three aspects of development have a direct bearing on the nature, magnitude and scale of infrastructure required for its development. As a result, there has to be a functional coordination and a harmonious blend among the facets of development. Thus, it implies that a balanced approach is imperative for the environment friendly and sustainable development of the area. In spite of the fact that Sonamarg as it appears, is at the disposal of tourists, but in real sense it is not so, various development constraints like shabby elongated commercial development along Srinagar road, in front of tourist reception centre building, haphazard car parking, unattended/neglected green area, landslides, avalanches etc. They have adversely affected the image and aesthetics of the resort keeping in view its geography and remoteness; it has to be developed as an ecologically self-sustaining entity. In other words, it implies that the development plan shall provide for all those activities and amenities which are essential for all-round growth and development. For example, the area should be provided with adequate services, facilities and utilities. Besides this, the bi-functional character of the tourist flow (i.e., operational area and service area) has to be clearly identified in the proposed land use plan. Thus, it is quite desirable that the design concept should reflect the tripartite nature of area in general arid bi-functional character in particular vis-a-vis in its intimate harmony with the ecology in environment of the area.

Evaluation of Master Plan for Tourist Resort

MP for Sonamarg tourist resort was evaluated using topographical setting (slope, aspects and elevation), natural drainage and land use land cover. Current land use land cover was compared with proposed MP of Sonamarg Development Authority (SDA). Evaluation of MP for Sonamarg tourist resort was carried out in two steps i.e., zone vise (A, B, C and D) and slope vise. Fig. 2 illustrated the zone was MP of Sonamarg proposed by SDA.

Fig. 2 Zone vise MP of Sonamarg Development Authority proposed for Sonamarg Resort

Results and Discussion

Current LULC Map 2015

From the analysis of the high-resolution satellite data supported by extensive ground sampling and validation studies, ten broad land use/land cover classes were delineated from IKONOS image viz. forest, agriculture, scrub land, pasture, barren land, streams, built-up, bus stand, recreational parks (amusement park, medicinal plant nursery and other parks). Table 1 shows pasture dominates the study area covering 42.12% of the total study area. Forest with rank second covers 31.27% area, followed by agriculture and water

body (streams) with 1.17% and 1.40% respectively. Also the current tree line has decreased around the Sonamagr bowl with respect to past temporal frame, which has also led to increase in barren area at various points. The rest of the classes' viz built-up, bus stand, national highway, paved road and unpaved road bound the area of 0.21% 0.04%, 0.28%, 0.18% and 0.06% respectively. Pasture dominates along both the sides of the Sonamarg in the upper reaches. Agriculture, built-up are presently dominant in the lower reaches of the Sonamarg resort. Major land use and land cover classes observed in the Sonamarg town and its vicinity that fall under the study area are depicted in Fig 4.

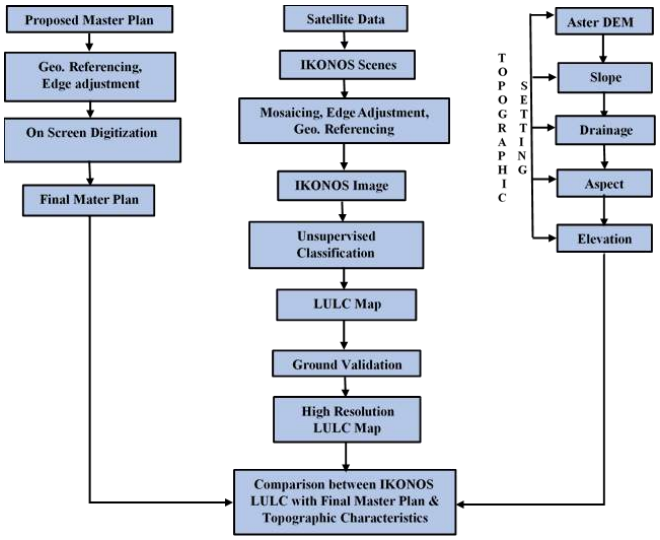


Fig. 3 Shows step vise procedure of evaluation of MP for Sonamarg resort.

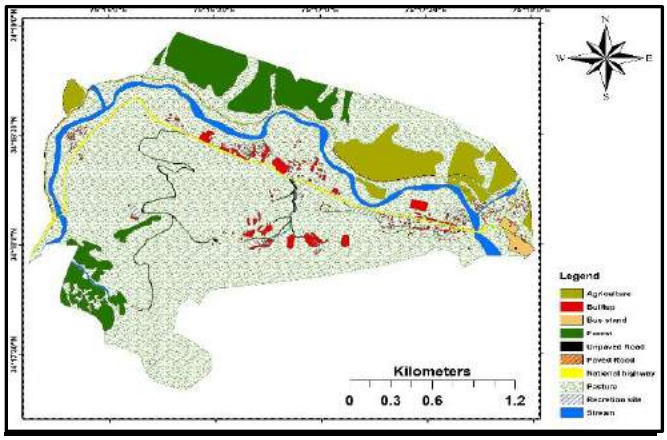


Table 1 Area-vise distribution of different land use/land cover classes.

LULC Classes	No. of Classes	Area (Sq. meter)
Agriculture	9	386344
Built-up	567	108171
Bus stand	3	33782
Forest	12	3722
Unpaved Road	10	44485
Paved Road	6	45330
National highway	1	55661
Pasture	33	**3886448**
Recreation site	56	54539
Stream	6	227037

Field Validation of LULC Map

Field study was carried out to validate the features in Land Use Land Cover (LULC) map generated from IKONOS. The detailed land use/land cover was validated using ground truthing, supported by Global Positioning Survey (GPS) at 23 ground control points as shown in Fig. 5. The dominant land use at these spots was also recorded. The necessary changes resulting from ground truthing were incorporated into the data layer.

4.3 Topographical settings of Sonamarg

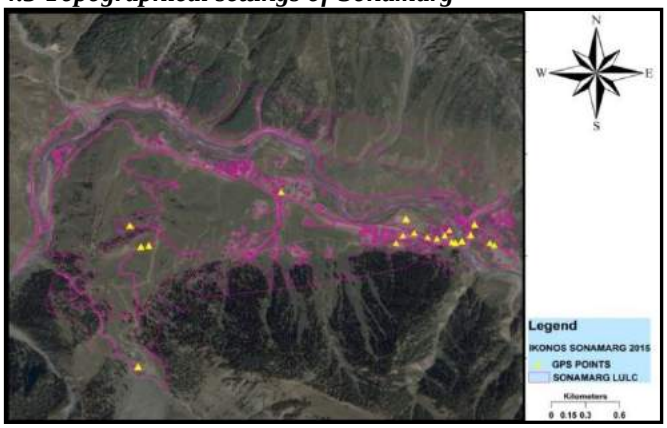
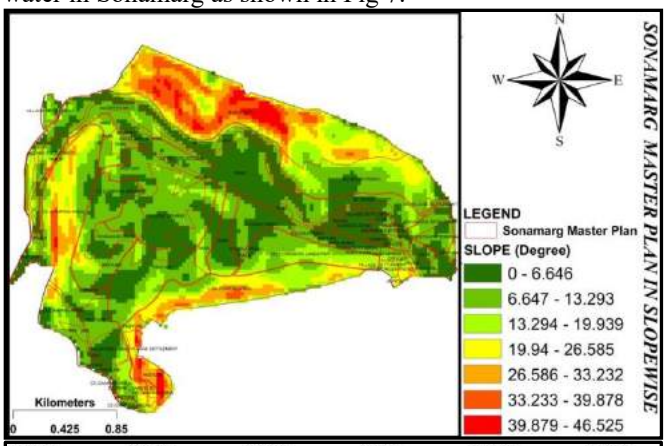


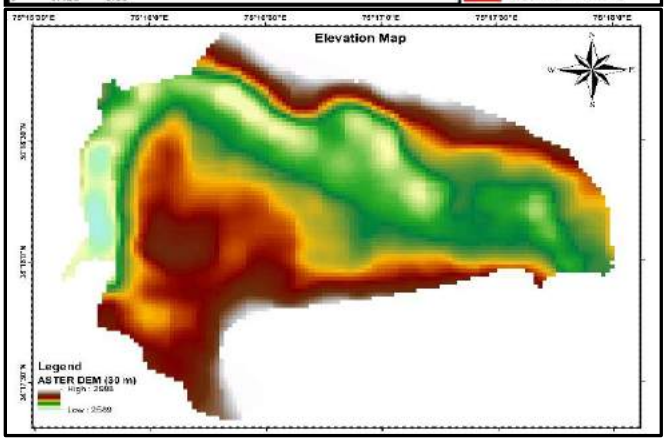
Fig. 6 (a and b) provides information about the slope and elevation of the Sonamarg tourist resort. High resolution Digital Elevation Model (DEM) was used for slope, analysis in a GIS environment. It was evident from the slope analysis that the higher reaches of the valley have moderate slope gradient and approximately 80% of the area falls in the slope range of 9º-10º, while 7% of the area falls in the slope range of 7° – 8° mostly in the lower part of the Sonamarg resort. Only small area falls in the slope range of 8° – 9°, which comprises bare rocky area. The agricultural activity is highest in the slope range of 5° – 6°, while the slope range of 1°– 4° comprises lush evergreen forest and alpine pasture. The elevation map of Sonamarg resort ranges from 2300 m to 5400 m. The information about the topographic profiling of the entire Sonamarg is given in Fig. 6.

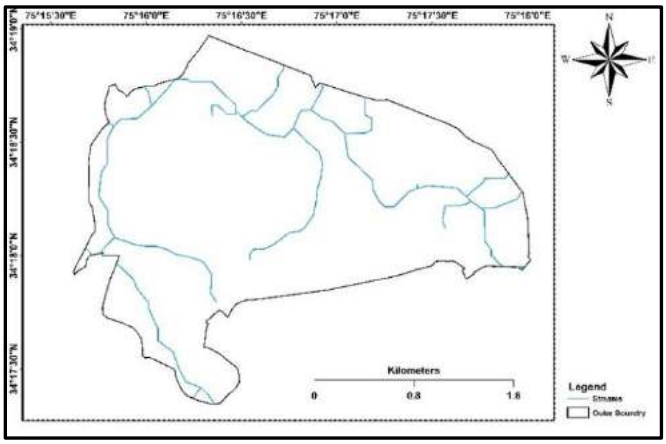
Natural Drainage

The drainage system of the Sonamarg tourist resort is dominated by river sindh with a number of small nallahs flowing down from uphill meandering the Sonamarg resort before they join Sindh River. Most of the discharge of these nallahs is retained in the

Sonamarg resort makes them slushy and marshy in nature. These nallahs need to be tamed to ensure smooth flow of water in Sonamarg as shown in Fig 7.







Tourist Inflow for the Year 2015

Table 2 illustrated the categories of registered hostels along with room and bed capacities in Sonamarg till 2015. As of 2015 the number of hotels in Sonamarg was 15 with total room and bed capacities of 303 and 602 respectively. Out of the 15 hotels 9 hotels were categorized as A-Class category with room and bed capacities 223 and 442 respectively. Only 1 hotel was categorized as B-Class category with room and bed capacities 20 and 40 respectively, while 4 hotels were categorized as C-Class with room and bed capacities 60 and 120 respectively. Table 3 indicated the current tourist load and carrying capacity in 2015.

Table 2 Registered hotels in Sonamarg valley (2015)

Registered hotels name and guest houses	**Category**	**Rooms**	**Beds**
Namroose resorts	A	30	60
Barzman	A	21	42
Divine inn	A	17	34
Snow land	A	27	52
Sonamarg glacier	A	14	28
Snow land resort hotel & restaurant	A	12	24
Sindh resort hotels & restaurant	A	48	96
Rah-villas	A	26	50
Tranquil retreat	A	28	56
Glacier heights	B	20	40
International Himalayan camping complex	C	25	50
Sunshine resorts	C	13	26
Vishansar camping	C	10	20

Table 3 Showing overall class vise tourist capacity/load (2015)

Classes	**Carrying capacity**	**Tourist load**
Residential	68599	12500
Commercial	37901	**64280**
Truck terminal	16803	**21775**
Camping site	17372	**20650**
Hotels and lodging	17260	**82300**
Parking area	16328	14800
Road network	357012	135600

It was observed that Sonamarg is overloaded as regards to the hotels and lodging capacity of 17260 against the tourist load of 82230 and commercial of 37901 against the tourist load of 64280. Table 4 illustrated the monthly inflow of tourists (local, foreign and domestic) in Sonamarg in year 2015. The tourist inflow data of 2015 indicated that the number of tourists visiting Sonamarg remains highest in the months of May and June followed by august, April and July. However, in those months favorable climatic conditions are also recorded using RETScreen climate data as shown in table 5 and Fig 8 (a &b). In January and February, the areas normally remain out of bounds for tourism as a result of heavy snowfall in the region.

Table 4 Tourist inflow in 2015

Months	Domestic	Foreign	Local	Total
January	1141	130	33	1304
February	869	290	27	1186
March	**4720**	**273**	**689**	**5682**
April	**14057**	**756**	**1100**	**15913**
May	**57272**	**357**	**7009**	**64638**
June	**39442**	**271**	**6488**	**46201**
July	**6569**	**210**	**798**	**7577**
August	**7351**	**670**	**8021**	**16042**
September	**6515**	**406**	**5893**	**12814**
October	5547	227	2984	8758
November	4558	154	551	5263
December	2923	239	340	3502
Total	150964	3983	33933	188880

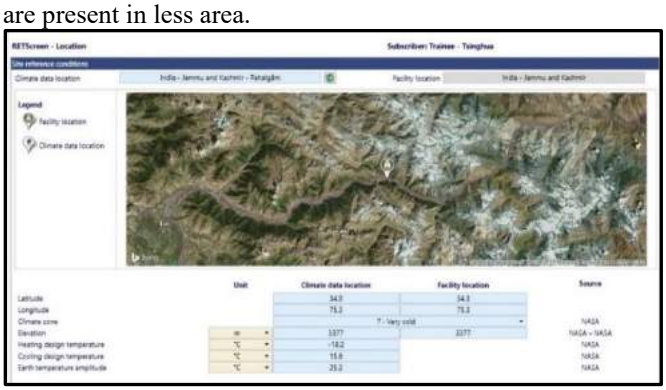
Table 5 Showing climatic variables for 2015

Months	Minimum temperature (°C)	Maximum temperature (°C)	Relative humidity (%)	Precipitation (mm)	Wind speed (m/s)
January	-9.49	-0.79	0.55	9.02	2.14
February	-8.89	0.03	0.70	130.02	2.32
March	-8.53	0.61	0.77	254.14	1.92
April	-2.30	6.49	0.76	170.52	2.00
May	**2.56**	**12.16**	**0.65**	**51.31**	**2.21**
June	**5.02**	**14.27**	**0.67**	**123.79**	**1.92**
July	**9.50**	**18.95**	**0.77**	**132.66**	**2.10**
August	**8.20**	**18.21**	**0.74**	**52.23**	**2.27**
September	3.47	14.77	0.63	53.36	2.11
October	-1.31	10.33	0.59	75.88	1.98
November	-4.85	3.91	0.65	34.84	1.92
December	-11.72	-0.87	0.67	39.67	2.06

Slope Vise Evaluation of Master Plan (2005-2025)

Table 6 illustrated the slope vise feasibility study of current land use land cover classes based on SDA master plan. On the basis of slope, we are able to come up with the tangible results that the planning zones that are proposed in the MP are correctly placed there or not. Plantation and forest 230.36 hectares needed to be at the higher slopes, while built up area proposed in the land use plan, about 8.87 hectares for hutment and integrated tourist resorts, 1.86 hectares for residential cum guest houses as well as other built up uses amenities and facilities cover 6.81 hectares, institutional 2.63 hectares, commercial 1.52 hectares needs to be placed at the lowest slopes. The recreational/tourist area consists of golf course 78.56 hectares, river front 32.53 hectares, organized parks 11.25 hectares are placed on the moderate slope. Sonamarg is a tourist resort with the natural land covers like pastures and

the forests where as built-up and other man-made land cover are present in less area.



Zone Vise Evaluation of Master Plan (2005-2025)

MP for tourist resort of Sonamarg was evaluated using topographical setting (slope, aspects and elevation) natural drainage and land use land cover map based on scanned map of SDA master plan. Scanned map of MP of SDA was compared with current land use land cover map of Sonamarg. Evaluation of MP for Sonamarg tourist resort was carried in four different zones which were already proposed by SDA i.e., Zone A, B, C & D with their respective sub zones.

and the existing road from the bridge at the entrance of the Sonamarg resort up to the nilgrad bridge. It is predominantly proposed to be developed as tourist accommodation and amenities and facilities area. Along the river a buffer of 150 to 200 feet as indicated in the land use plan is proposed to be developed to conserve the river front from being built up and also to save the river sindh from pollution. For regulating growth and development in the planning zone, it is further subdivided into 5 planning sub-zones A1 is a mixed-use zone, A2, A3 tourist accommodation and A4 inhibits village settlement along srinagar-sonamarg road. Planning sub-zone A1 which is mixed sub-zone locates bus terminal, shopping, hospital and janta type hotels around bus stand are proposed to take care of tourist accommodation of lower economic status.

The MP proposes construction of the mixed zone (A1) on the land that is currently pasture and built up as shown in Fig. 9. On the concrete base good number of built up is present on current location having lowest slope shown in table 6. Planning sub zone (A1) which is mixed sub zone locates bus terminal, shopping, hospital and janta type hotels around bus stand are proposed to take care of tourist accommodation of lower economic status. Tourist accommodation facilities already available on the ground, that are not required anymore

Table 6 Feasibility for land cover classes (Master plan)

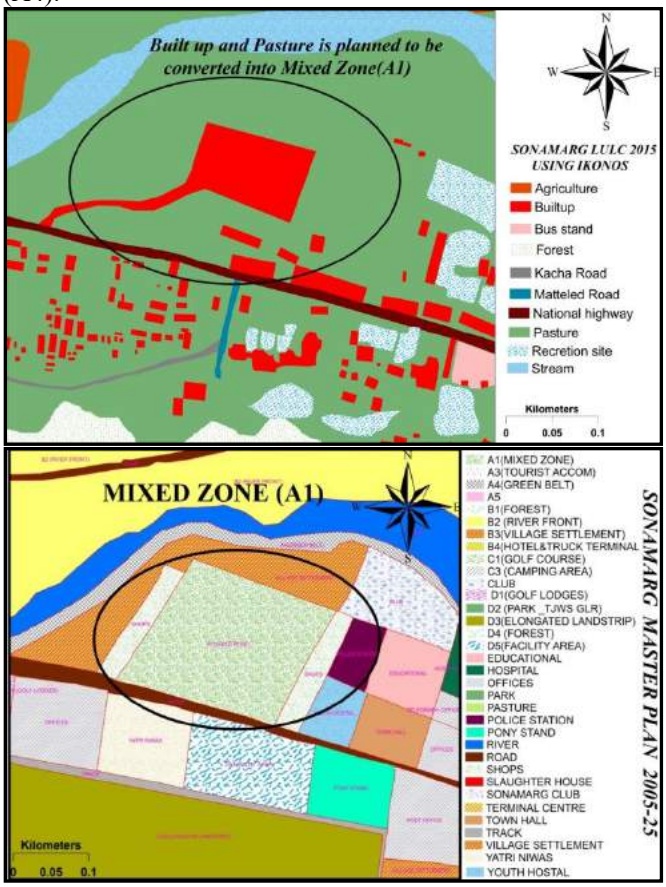
S.no	Master plan (LULC) 2005-2025	Current (LULC) 2015	Slope ranges	Feasibility
1	Mixed zone (A1)	Pasture and Built up	(0 - 6.4)	Feasible
2	River front (B2)	Agriculture	(0 – 19.93)	Feasible
3	Camping Area (C3) Left side of track	Pastures	(19.94 – 26.5)	Not Feasible
	Camping Area (C3) Right side of track	Pastures	(6.64 – 13.29)	Feasible
4	Golf Course (C1)	Pasture	(0-13.29)	Feasible
5	Golf lodges (D1)	Pasture and Built up	(0-13.29)	Feasible
6	Elongated strip of Land (D3)	Pasture and Built up	(6.64 – 19.93)	Less Feasible
7	Facility Area (D5)	Pasture, Built up and Recreation site	(0 – 13.29)	Feasible
8	Recreational Park	Pasture and Built up	(0 - 6.4)	Feasible
9	Park	Pasture and Built up	(0-13.29)	Feasible
10	Slaughter house	Pasture and Forest	(0 – 6.64)	Feasible
11	Hospital	Pasture, Built up and Recreation site	(6.64 – 13.29)	Feasible
12	Village Settlement	Pasture	(0 – 6.64)	Feasible
13	Govt. Facility centers	Pasture, Built up and recreation site	(0 – 13.29)	Feasible

Evaluation of Zone A

Fig. 9 illustrated the conversion of (a) current land use land cover classes into (b) other classes proposed by SDA MP in Zone A. Zone A includes the area located between the river

on the basis of low-price rates for tourists. This kind of conversion is totally unjustifiable in the resort may have negative impacts. Fig. 10 illustrated the conversion of (a) current land use land cover (pastures) into (b) village settlement proposed by SDA MP in sub-zone A4. The MP proposes construction of bigger hospital on the land that is

currently pasture, built up (Mosque and Small Health centre) and recreation sites, which is at a lowest slope and near to green belt zone (A4). Further construction of the big health centre at this site may facilitate the locals and the tourists as well, but on the other side lot of hospital waste will come out and directly drain into the river and contaminate it. Therefore, it is suggested to revive the MP as the change is in the zone (A4).



Evaluation of Zone B

It includes the areas on the right side of the river sindh and further divided into five sub-zones i.e., B1 is predominantly proposed as forest area, B2 as river front, B3 village settlement, B4 includes small hotels and truck terminal ahead nilgrad bridge and B5 includes the areas from check post to the stream across the river sindh and some hutments are proposed for accommodation purposes. This zone is predominantly green with very less development proposed there to maintain its invigorating landscape. However, feasibility study needs to be carried out for the alignment of the by-pass as proposed in the land use plan in consultation with the BECON authorities.

Fig. 11 conversion of (a) current land use land cover (agriculture) into (b) river front proposed by SDA MP in sub-zone B2. The MP proposes the development of islands as picnic spots on the pattern of island retreat. In addition to the development of river front on both sides of the river, provision of sit-outs and mobile kiosks at a medium slope as shown in the above table 6. It is suggested that establishing the river front (B2) near the banks may contaminate river as the waste will directly lead in the river, therefore it may be checked properly so that waste disposal should be treated scientifically.

Evaluation of Zone C

Locates the golf course forests in the north-west and camping area. It forms the main operational recreational area of the tourist resort. The golf course which has been earmarked as planning zone C1 needs to be developed to attract golf lovers to sonamarg planning zone C3 is retained as campaign area however, car parking for the campers is proposed adjacent to it. Planning zone C3 is a major endowment area in the form of forests and pasture slopes, no further tree cutting shall be allowed in the area because it will have devouring effect on the landscape and tourist image.

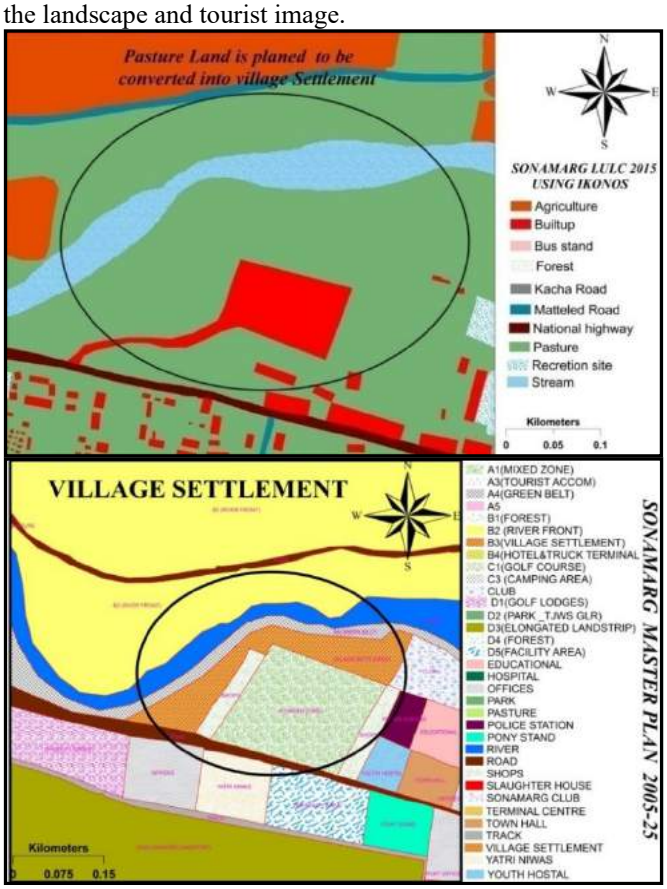


Fig. 10 Shows conversion of (a) current land use land cover (pastures) into (b) village settlement proposed by SDA MP in sub-zone A4.

Fig. 12 conversion of (a) current land use land cover (pasture) into (b) Golf courses proposed by SDA MP in sub-zone C1. The MP proposes pasture land to be converted into the golf course, where as a huge pasture patches have been vandalized

to form golf course. The proposed golf course is present on the lowest slope and is good to construct the golf course at present location. Further it will attract the tourists and will generate good economy as well. However, it is suggested that golf course construction may not affect the ecological setup of sonamarg.

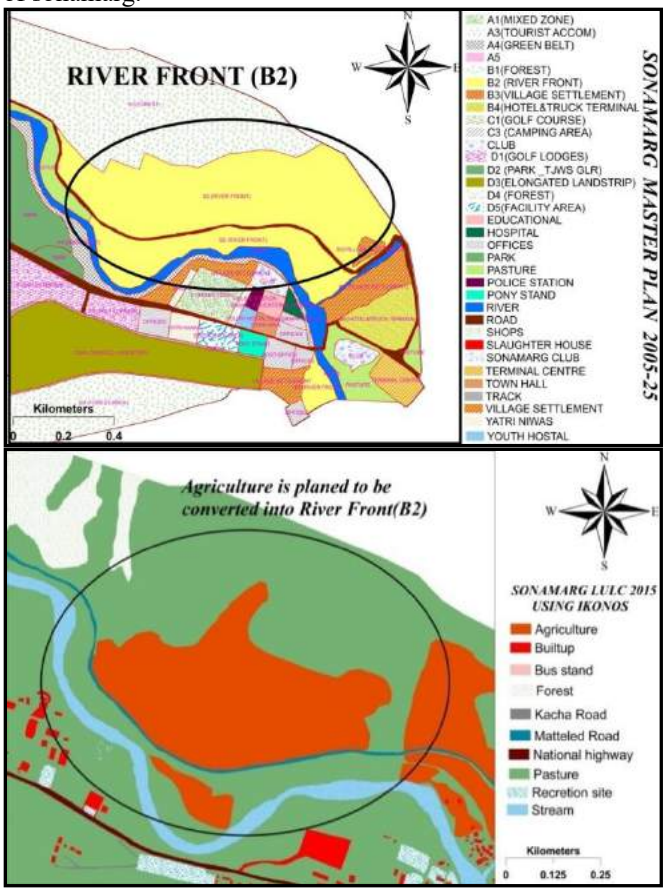
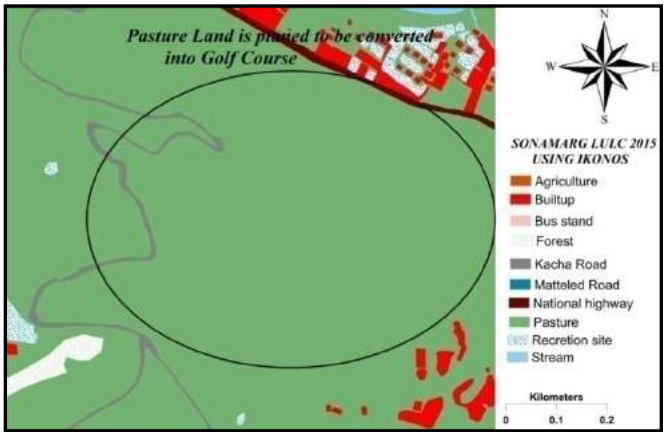


Fig. 11 Conversion of (a) current land use land cover (agriculture) into (b) river front proposed by SDA MP in sub-zone B2.



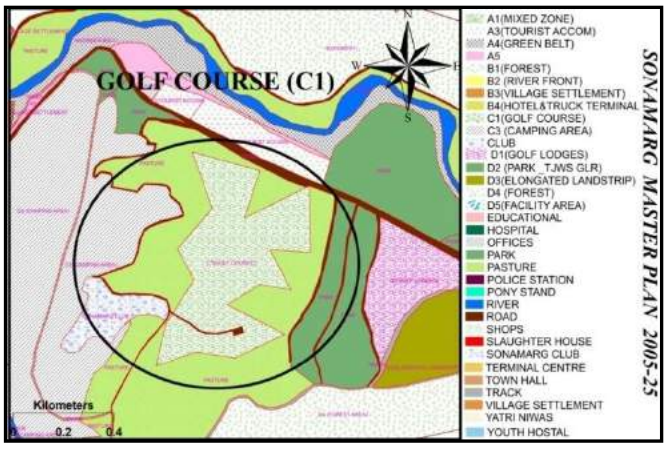


Fig. 12 Conversion of (a) current land use land cover (pasture) into (b) Golf courses proposed by SDA MP in sub-zone C1.

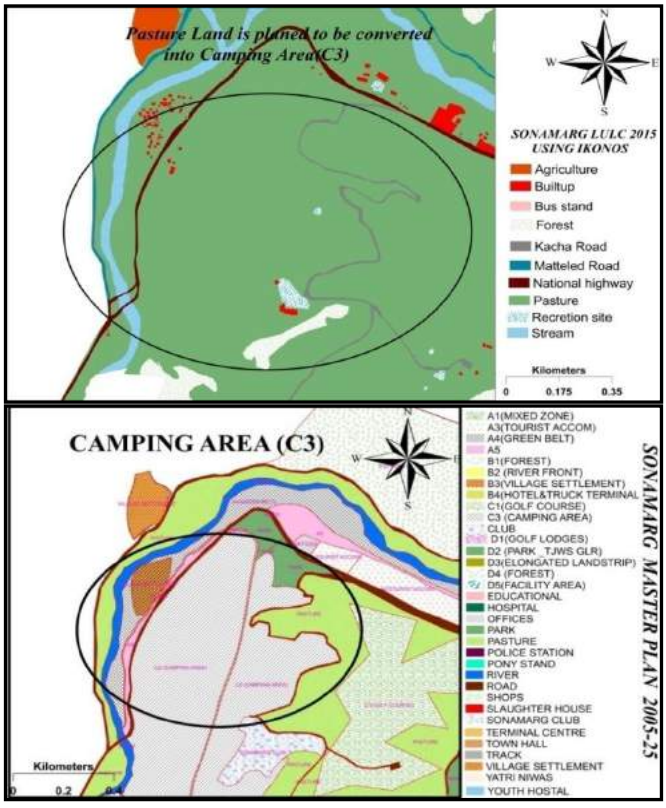


Fig. 13 Conversion of (a) current land use land cover (pasture) into (b) Camping area proposed by SDA MP in sub-zone C3.

Fig. 13 conversion of (a) current land use land cover (pasture) into (b) comping area proposed by SDA MP in sub-zone C3. Under the master plan, an extensive camping area (C3) is planned that cuts across the huge patches of pastures. Planning zone C3 is retained as camping area however, car parking for the campers is proposed adjacent. On one side of

the camping area C3 that is present on the highest slope and other side is at medium slope as shown in table 6.

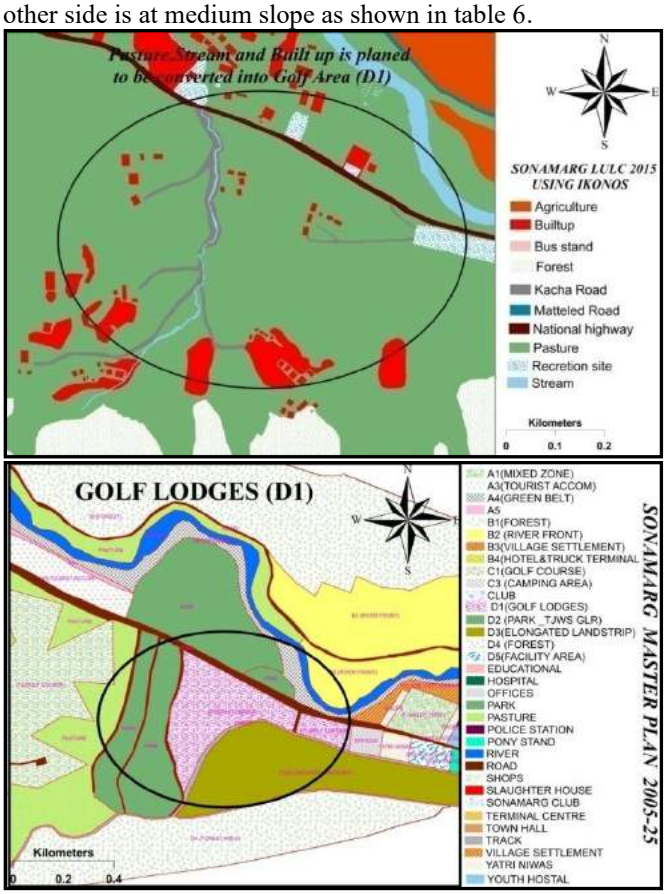


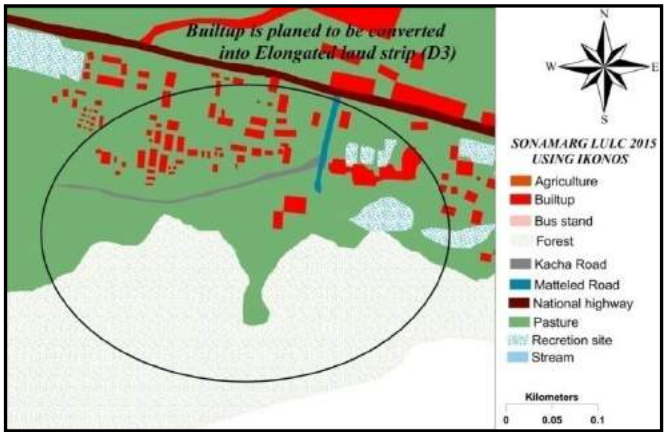
Fig. 14 Conversion of (a) current land use land cover (pastures and built up) into (b) Golf Lodges proposed by SDA MP in sub-zone D1.

Therefore, it is suggested campers car parking may be revived on the MP. However, parking area is already present on the ground which should be constructed in such a way so as to accommodate maximum number of cars that sonamarg receives during the peak tourist visit in a day. The conversion may have negative impacts on the ecology of the area.

Evaluation of Zone D

Planning zone D covers the area from thajiwas glacier up to nilgrad bridge all-along the mountains. It is further sub-divided into 4 planning sub-zones. Planning sub-zone D1 includes the area which is bounded by the golf course in the north, pony track in the west, sonamarg-leh road in east and tourist reception centre in the south including linear contour and lower plateau along with massive boulders. It is proposed to be developed as a low-density tourist accommodation in the form of integrated tourist resort with single storey hutment area in the form of hutment and integrated tourist resorts. Planning sub-zone D2 includes the Thajwas area consisting of park developed by Sonamarg development authority, forest area and the areas adjoining glacier. This area is the busiest tourist activity area. Some tourist activity in the form of kiosks, pony sheds, rain shelters and car parking are proposed to be provided in this area in the interest of boosting the tourism. Planning sub-zone D3 is an elongated strip between water supply lines and the pony track along the foot-hills on the south-east of the main resort. It extends from golf course to the police station near nilgrad bridge. This area is earmarked predominantly for tourist accommodation. Planning sub-zone D4 consists predominately of forests along the southern mountain range and planning sub-zone D5 consists the predominantly the facility area including tourist receipt centre, police station, car parking and existing Sonamarg.

Fig. 14 indicated the conversion of (a) current land use land cover (pastures and built up) into (b) golf lodges proposed by SDA MP in sub-zone D1. The MP proposes construction of golf lodges (D1) on the land that is currently pasture and has some built up. Planning zone (D1) includes the area which is bounded by the golf course in the north, pony track in the west, Sonamarg-leh road in the east and tourist reception centre in the south. Including linear contour and plateau along the massive boulders. Whereas it is proposed to be developed as a low-density tourist accommodation in the form of integrated tourist resort with single story hutment area in the form of hutments and integrated tourist resorts. The construction of golf lodges at this site will be devastating the sonamarg's ecology as the patches of pasture and the stream which is flowing through this area is supposed to be filled and thus destroyed. Therefore, it is suggested that, activities may have negative impacts on the ecology of the area. Hence, should be reviewed.



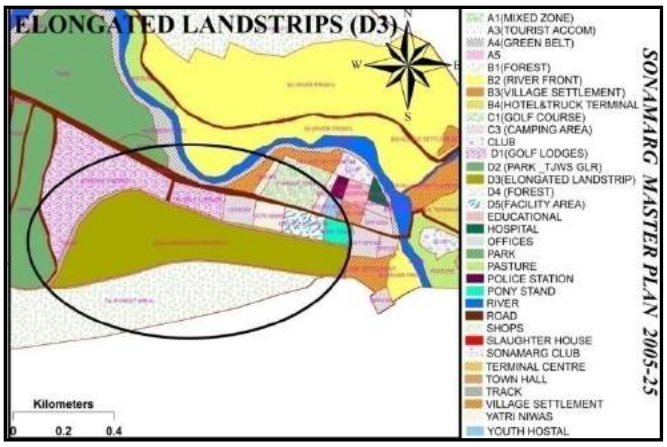


Fig. 15 Conversion of (a) current land use land cover (pastures and built up) into (b) Elongated strips proposed by SDA MP in sub-zone D3.

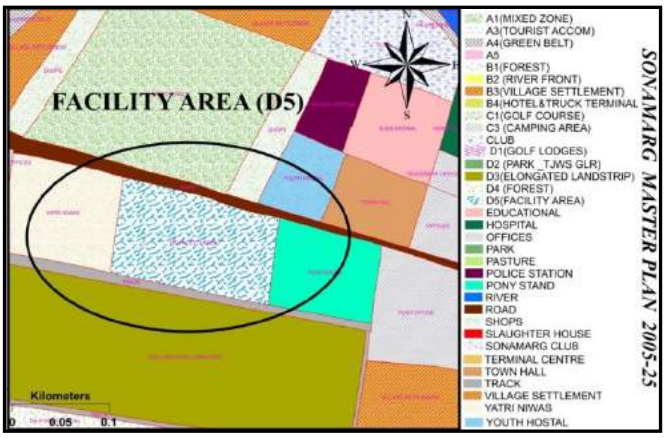
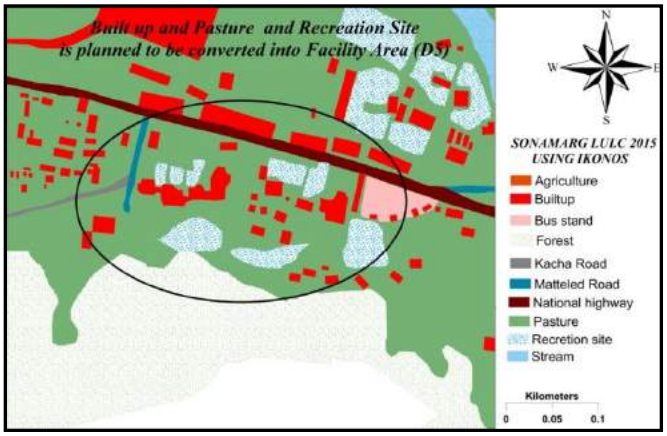
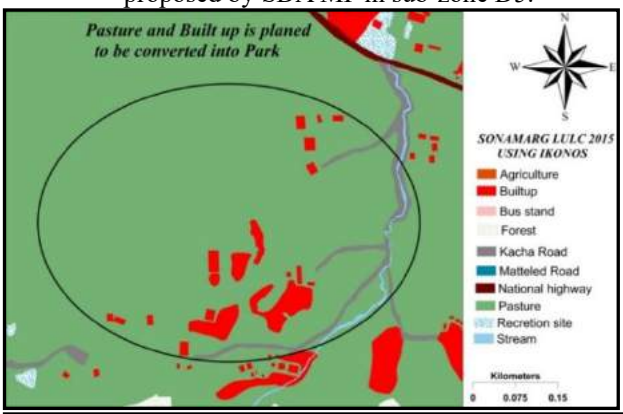
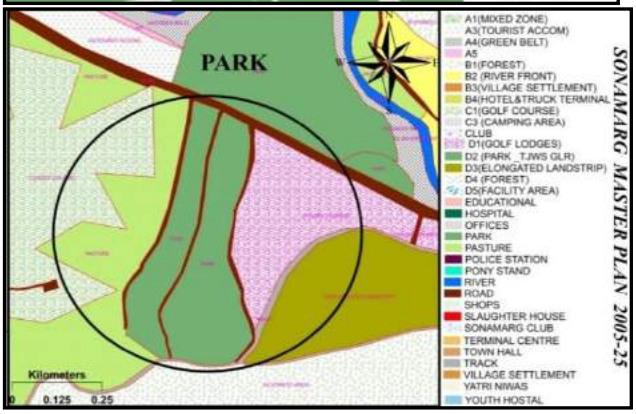


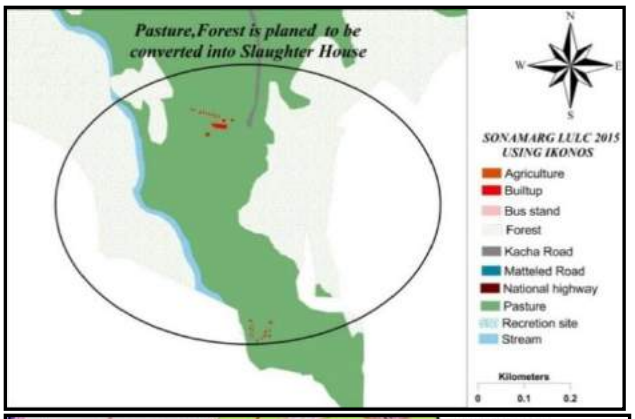
Fig. 16 Conversion of (a) current land use land cover (pastures, built up and recreation sites) into (b) Facility areas proposed by SDA MP in sub-zone D5.

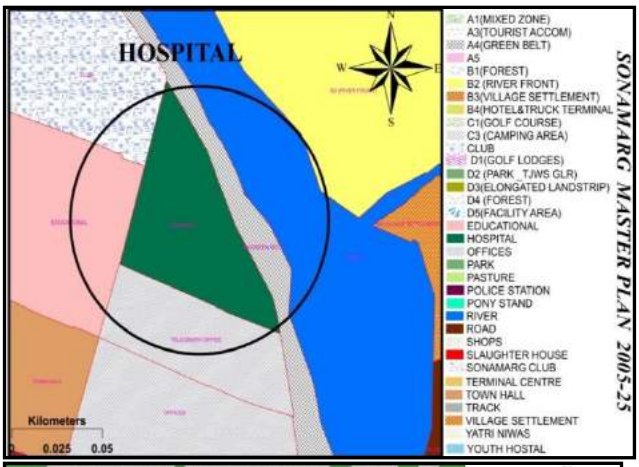
Fig. 15 conversion of (a) current land use land cover (pastures and built up) into (b) elongated strips proposed by SDA MP in sub-zone D3. The MP proposes built up and pasture land to be converted in the elongated strip of land (D3) that already has some built up. Elongated strip of land between water supply lines and the pony track along the foot-hills on the south-east of the main resort extends from golf course to the police station near nilgrad bridge. The area is earmarked predominantly for tourist accommodation and will prove beneficial in boosting economy of the Sonamarg, which is at a medium slope shown in table 6. It is suggested that the construction of the low-density hutment in the form of integrated tourist resort with the single story may be done in the sustainable manner so that sonamarg's ecological set-up doesn't affected.

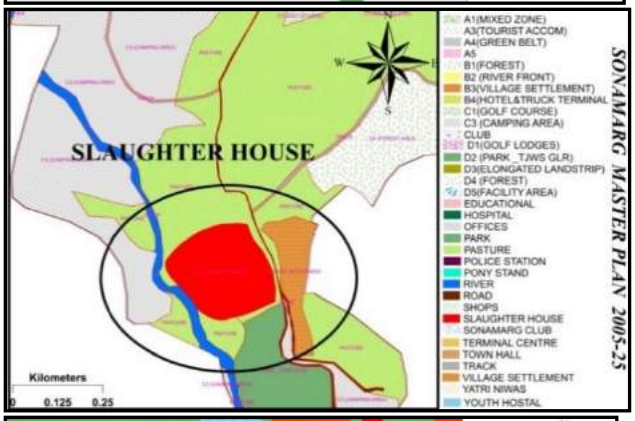


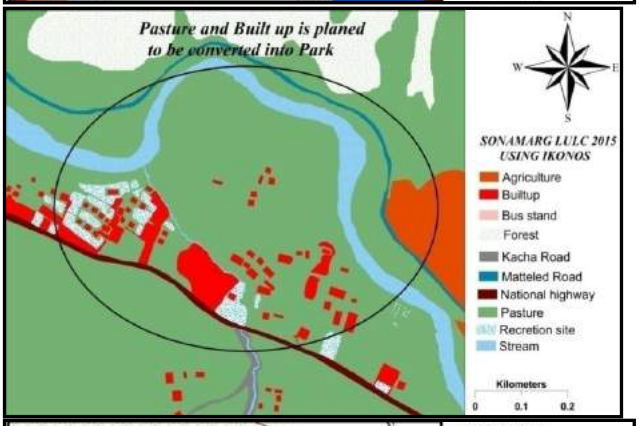


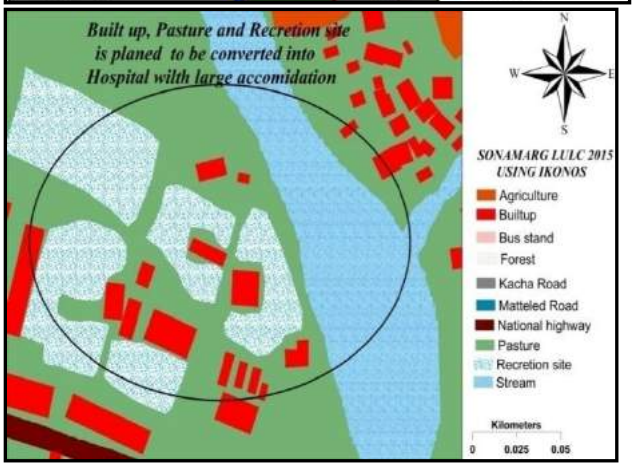


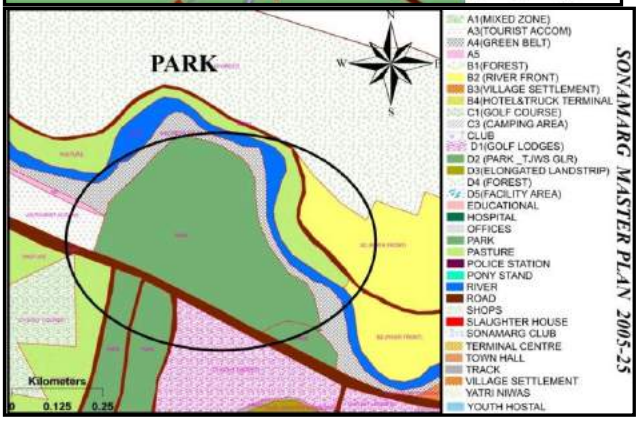

Pasture,Forest is planed to be converted into Slaughter House
SONAMARG LULC 2015 USING IKONOS
Agriculture
Builtup
Bus stand
Forest
Kacha Road
Matteled Road
National highway
Pasture
Recretion site
Stream
Kilometers
0 0.1 0.2


HOSPITAL
A1(MIXED ZONE)
A3(TOURIST ACCOM)
A4(GREEN BELT)
A5
B1(FOREST)
B2 (RIVER FRONT)
B3(VILLAGE SETTLEMENT)
B4(HOTEL&TRUCK TERMINAL)
C1(GOLF COURSE)
C3 (CAMPING AREA)
CLUB
D1(GOLF LODGES)
D2 (PARK _TJWS GLR)
D3(ELONGATED LANDSTRIP)
D4 (FOREST)
D5(FACILITY AREA)
EDUCATIONAL
HOSPITAL
OFFICES
PARK
PASTURE
POLICE STATION
PONY STAND
RIVER
ROAD
SHOPS
SLAUGHTER HOUSE
SONAMARG CLUB
TERMINAL CENTRE
TOWN HALL
TRACK
VILLAGE SETTLEMENT
YATRI NIWAS
YOUTH HOSTAL
Kilometers
0 0.025 0.05
SONAMARG MASTER PLAN 2005-25


SLAUGHTER HOUSE
A1(MIXED ZONE)
A3(TOURIST ACCOM)
A4(GREEN BELT)
A5
B1(FOREST)
B2 (RIVER FRONT)
B3(VILLAGE SETTLEMENT)
B4(HOTEL&TRUCK TERMINAL)
C1(GOLF COURSE)
C3 (CAMPING AREA)
CLUB
D1(GOLF LODGES)
D2 (PARK _TJWS GLR)
D3(ELONGATED LANDSTRIP)
D4 (FOREST)
D5(FACILITY AREA)
EDUCATIONAL
HOSPITAL
OFFICES
PARK
PASTURE
POLICE STATION
PONY STAND
RIVER
ROAD
SHOPS
SLAUGHTER HOUSE
SONAMARG CLUB
TERMINAL CENTRE
TOWN HALL
TRACK
VILLAGE SETTLEMENT
YATRI NIWAS
YOUTH HOSTAL
Kilometers
0 0.125 0.25
SONAMARG MASTER PLAN 2005-25


Pasture and Built up is planed to be converted into Park
SONAMARG LULC 2015 USING IKONOS
Agriculture
Builtup
Bus stand
Forest
Kacha Road
Matteled Road
National highway
Pasture
Recretion site
Stream
Kilometers
0 0.1 0.2


Built up, Pasture and Recretion site is planed to be converted into Hospital with large accomidation
SONAMARG LULC 2015 USING IKONOS
Agriculture
Builtup
Bus stand
Forest
Kacha Road
Matteled Road
National highway
Pasture
Recretion site
Stream
Kilometers
0 0.025 0.05


PARK
A1(MIXED ZONE)
A3(TOURIST ACCOM)
A4(GREEN BELT)
A5
B1(FOREST)
B2 (RIVER FRONT)
B3(VILLAGE SETTLEMENT)
B4(HOTEL&TRUCK TERMINAL)
C1(GOLF COURSE)
C3 (CAMPING AREA)
CLUB
D1(GOLF LODGES)
D2 (PARK _TJWS GLR)
D3(ELONGATED LANDSTRIP)
D4 (FOREST)
D5(FACILITY AREA)
EDUCATIONAL
HOSPITAL
OFFICES
PARK
PASTURE
POLICE STATION
PONY STAND
RIVER
ROAD
SHOPS
SLAUGHTER HOUSE
SONAMARG CLUB
TERMINAL CENTRE
TOWN HALL
TRACK
VILLAGE SETTLEMENT
YATRI NIWAS
YOUTH HOSTAL
Kilometers
0 0.125 0.25
SONAMARG MASTER PLAN 2005-25

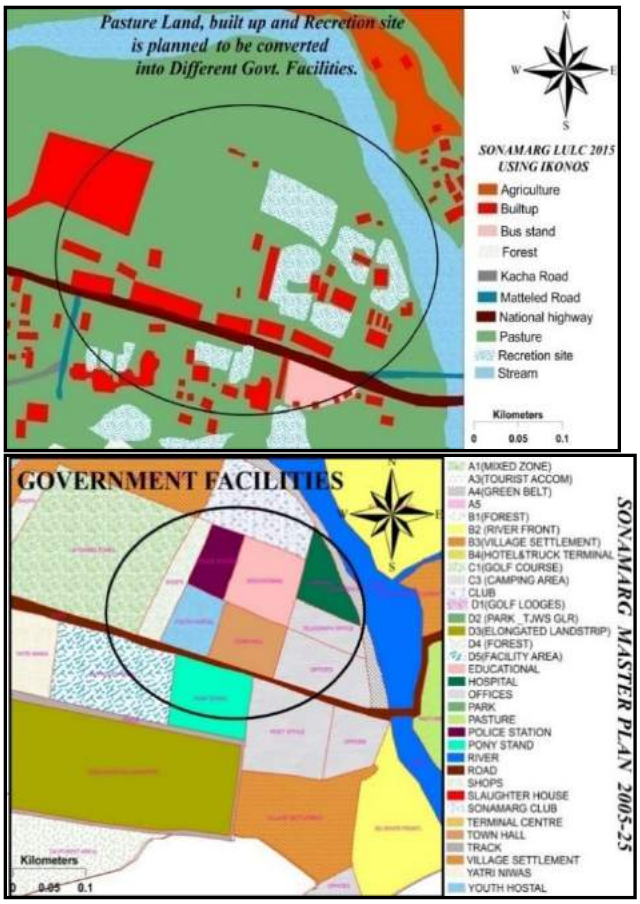


Fig. 16 shows conversion of (a) current land use land covers classes (recreation sites, pastures, built up and forest areas) into (b) other areas (parks, slaughter house, hospital and government facilities) base on master plan.

Fig. 16 conversion of (a) current land use land cover (pastures, built up and recreation sites) into (b) Facility areas proposed by SDA MP in sub-zone D5. The MP (M.P) proposes construction of the facility area (D5) on the land that is currently pasture, built up and recreation sites. Planning zone D5 consists predominantly the facility area including tourist receipt centre, police station, car parking and existing sonamarg development authority office with the hutments. It is present on the lowest slope shown in table 6. The construction may result in the destruction of the ecology of the area if done unscientifically. Therefore, it is suggested that these facilities must go out of the resort as natural land cover may be recovered.

Other Areas

Fig. 15 illustrated the conversion of (a) current land use land cover classes (recreation sites, pastures, built up and forest areas) into (b) other areas (parks, slaughter house, hospital and government facilities) base on master plan.

The MP proposes construction of the park on the land that is very near to the river. Currently a good proportion of built up which are in the form of hotels are present at this location which is on the lowest slope as shown in table 6, further construction of recreational park very close to river may contaminate the river water. Therefore, it is suggested that proper waste management is needed in order to construct recreational park very close to river else may affect the ecological set-up.

Under the master plan, the land occupied by military settlement (pasture and built up) is planned to be converted into the recreational park which is at a medium slope. Recreational park construction may not affect the natural settings but should be maintained in sustainable manner to accommodate more tourist in peak seasons as well.

The construction under the MP proposes vandalization of the existing pastures and the forest that are present on the ground, which is at lowest slope. While as the construction of slaughter house is shown over a wide area where there is nearby a stream Therefore, it is suggested that activities directly involve the conversion of pasture into impervious land cover (slaughter house) over the huge area which should be reviewed. This kind of activities to the be shifted to outer area (Gaganger). Hence, it may cause the disturbances in ecology.

The MP proposes pasture land and built up to be converted into the village settlement, which is at a lowest slope and good for village settlement. Therefore, it is suggested that this kind of plan should be further thoroughly reviewed so that negative impacts on the ecology of the area are minimized. The MP proposes that the land that is currently pasture, recreation site and built are planned to be converted into different government facility centers. They earmarked the same area for it, which is present on the lowest slope as shown above table 6, no doubt it may facilitate the locals as well as the tourists, it is rather suggested that sustained way should opted for its construction.

Conclusions and Recommendations

Nature has been destroyed and our fragile ecology has stood in jeopardy of losing its biodiversity through changing habitat. Despite the fact that planning and management for Tourism Development among others has been made mandatory by the decree, thus this study made an attempt to demonstrate the spatial application to generating land use land cover maps for Sonamarg resort using high resolution (IKONOS) imageries. Geo-spatial data of very fine resolution and mapping software like ArcGIS available, it is with relative ease one can prepare maps with the detailed information of the ground. However, it would in turn help in designing a good master plan which help to decide the possible pathways within sustainable tourism development. The studyanalyis many levels from large scale decisions to landuse land cover mapping within a broad manner.

RETScreen expert software is being used to get the climate data to correlate it with tourist month wise inflow. In the present case the results indicate that carrying capacity of Sonamarg resort is facing serve dearth during the peak season months thus needs MP. However, Sonamarg is expanding towards its peripheral region with the conversion of its natural landforms into parks, golf course, slaughter houses, hospitals, village settlement and government related facility centers at different locations in Sonamarg resort. The study revealed that in spite of the increase in the number of tourists and the urban population, quality of urban life is sub-standard. For a good quality of life on Sonamarg resort, smart planning is required for the resort to make it the one of the best tourist resorts of Kashmir valley with minimized disturbances to nature. This could be further utilized to deal with all aspects of planning, such as policies, strategies, spatial decisions, building design and architecture, density, site planning etc. The urban sprawl is seen as one of the potential threats to sustainable development where urban planning with effective resource utilization and allocation of infrastructure initiatives are key concerns. Continuous intervention of human settlement to natural land covers in Sonamarg resort has led planners to come up with the MP for resort. All the conversions for land use land cover classes proposed in the MP comprises the degradation of pasture lands. Natural land cover change on the immense scale may harm the environment setting of the area so; it is advised to make the changes with the less environmental degradedness. However, the tourists visit these kinds of resorts for natural land covers present over there. The degraded natural setting change may affect the tourist flow which in turn affects the economy as well. So, it is better to shift these facilities mentioned in the proposed MP on the upper regions of the area which will not only be socio-economically fruitful but also environment friendly. Whereas only limited number of constructions may be allowed in the resort to ensure the natural land cover which leads less impact on the ecological setup of the Sonamarg.

Acknowledgements

Authors like to thank SDA (Sonamarg Development Authority) for the data and valuable suggestions and also USGS (Earth Explorer) for accessing the high-resolution data for the study. We would like to express our gratitude to the Dr. Raja Muhammad Afzal for giving RETScreen Software Training. We would like to thank RETScreen Software Developers and Partners National Aeronautics and Space Administration (NASA) for providing climate data. We would like thank to department of Earth sciences & Geography & Regional Development, University of Kashmir for their support during the work.

Conflicts of Interest

Authors declare no conflict of interest.

References

[1]. S. Mufeed and R. Gulzar, "Tourism in Saudi Arabia. Global review of research in tourism, hospitality and leisure Management (GRRTHLM)," *An Online International Research Journal,* vol. 1, pp. 167-178, 2014.

[2]. Y. Chong Kar, "Tourism sustainability: economic benefits and strategies for preservation and conservation of heritage sitesin Southeast Asia," *Tourism Review,* vol. 74, pp. 268-279, 2019.

[3]. W. Butler Richard, "Contributions of tourism to destination sustainability: golf tourism in St Andrews, Scotland," *Tourism Review,* vol. 74, pp. 235-245, 2019.

[4]. L. Wenbin, "Evaluating Tourist Destination Performance: Expanding the Sustainability Concept " *Sustainability,* vol. 10, p. 516, 2018.

[5]. [5] S. L. Smith, *Tourism analysis: A handbook*: Routledge, 2014.

[6]. A. C. Nelson and T. Moore, "Assessing urban growth management: The case of Portland, Oregon, the USA's largest urban growth boundary," *Land Use Policy,* vol. 10, pp. 293-302, 1993.

[7]. M. Artmann, O. Bastian, and K. Grunewald, "Using the concepts of green infrastructure and ecosystem services to specify Leitbilder for compact and green cities—the example of the landscape plan of Dresden (Germany)," *Sustainability,* vol. 9, p. 198, 2017.

[8]. H. A. Mir, "Impact of tourism industry on economic development of Jammu and Kashmir," *International Journal of Scientific & Engineering Research,* vol. 5, pp. 592-598, 2014.

[9]. I. Gujree, I. Wani, M. Muslim, M. Farooq, and G. Meraj, "Evaluating the variability and trends in extreme climate events in the Kashmir Valley using PRECIS RCM simulations," *Modeling Earth Systems and Environment,* vol. 3, pp. 1647-1662, 2017.

[10]. D. M. Hogan and M. R. Walbridge, "Urbanization and nutrient retention in freshwater riparian wetlands," *Ecological Applications,* vol. 17, pp. 1142-1155, 2007.

[11]. E. M. Orsega-Smith, L. L. Payne, A. J. Mowen, C.-H. Ho, and G. C. Godbey, "The role of social support and self-efficacy in shaping the leisure time physical activity of older adults," *Journal of Leisure research,* vol. 39, pp. 705-727, 2007.

[12]. C. J. Martin-Mikle, K. M. de Beurs, J. P. Julian, and P. M. Mayer, "Identifying priority sites for low impact development (LID) in a mixed-use watershed," *Landscape and urban planning,* vol. 140, pp. 29-41, 2015.

[13]. C. Liyanage and K. Yamada, "Impact of population growth on the water quality of natural water bodies," *Sustainability*, vol. 9, p. 1405, 2017.
[14]. W. Luo, *Evaluating Tourist Destination Performance: Expanding the Sustainability Concept* vol. 10, 2018.
[15]. M. Conte, E. Nelson, K. Carney, C. Fissore, N. Olwero, A. J. Plantinga, *et al.*, "Terrestrial carbon sequestration and storage," *Natural capital: theory and practice of mapping ecosystem services*, pp. 111-128, 2011.
[16]. C. Andersen, I. D. Foster, and C. J. Pratt, "The role of urban surfaces (permeable pavements) in regulating drainage and evaporation: development of a laboratory simulation experiment," *Hydrological processes*, vol. 13, pp. 597-609, 1999.
[17]. F. Femenia-Serra, "Smart destinations and tech-savvy millennial tourists: hype versus reality," *Tourism Review*, vol. 74, pp. 63-81, 2019.
[18]. L. Zhou, Y. Wu, T. Woodfin, R. Zhu, and T. Chen, "An Approach to Evaluate Comprehensive Plan and Identify Priority Lands for Future Land Use Development to Conserve More Ecological Values," *Sustainability*, vol. 10, p. 126, 2018.
[19]. B. Boers and S. Cottrell, "Sustainable tourism infrastructure planning: A GIS-supported approach," *Tourism Geographies*, vol. 9, pp. 1-21, 2007.
[20]. G. Brown, "Mapping landscape values and development preferences: a method for tourism and residential development planning," *International journal of tourism research*, vol. 8, pp. 101-113, 2006.
[21]. H. G. Olya and H. Alipour, "Risk assessment of precipitation and the tourism climate index," *Tourism Management*, vol. 50, pp. 73-80, 2015.
[22]. S. J. Page and C. M. Hall, *The geography of tourism and recreation: Environment, place and space*: Routledge, 2014.
[23]. M. Li, L. Fang, X. Huang, and C. Goh, *A spatial–temporal analysis of hotels in urban tourism destination* vol. 45, 2015.
[24]. A. Papatheodorou, "Exploring the evolution of tourism resorts," *Annals of tourism research*, vol. 31, pp. 219-237, 2004.
[25]. G. Lau and B. McKercher, "Understanding tourist movement patterns in a destination: A GIS approach," *Tourism and hospitality research*, vol. 7, pp. 39-49, 2006.
[26]. J. Connell and S. J. Page, "Exploring the spatial patterns of car-based tourist travel in Loch Lomond and Trossachs National Park, Scotland," *Tourism Management*, vol. 29, pp. 561-580, 2008.
[27]. S.-H. Lee, J.-Y. Choi, S.-H. Yoo, and Y.-G. Oh, "Evaluating spatial centrality for integrated tourism management in rural areas using GIS and network analysis," *Tourism Management*, vol. 34, pp. 14-24, 2013.
[28]. V. Varjú, A. Suvák, and P. Dombi, *Geographic Information Systems in the Service of Alternative Tourism – Methods with Landscape Evaluation and Target Group Preference Weighting* vol. 16, 2014.
[29]. M. Bil, M. Bilova, and J. Kubecek, "Unified GIS database on cycle tourism infrastructure," *Tourism Management*, vol. 33, pp. 1554-1561, 2012.
[30]. P. H. Dougherty, "Introduction to the geographical study of viticulture and wine production," in *The Geography of Wine*, ed: Springer, 2012, pp. 3-36.
[31]. A. Mathews, *Applying Geospatial Tools and Techniques to Viticulture* vol. 7, 2013.
[32]. B. Henehan and G. White, "Evaluation of wine trails in New York," ed, 1990.
[33]. J. J. Yuan, L. A. Cai, A. M. Morrison, and S. Linton, "An analysis of wine festival attendees' motivations: A synergy of wine, travel and special events?," *Journal of Vacation Marketing*, vol. 11, pp. 41-58, 2005.
[34]. N. Yang, J. J. McCluskey, and M. P. Brady, "The value of good neighbors: A spatial analysis of the California and Washington State wine industries," *Land Economics*, vol. 88, pp. 674-684, 2012.
[35]. V. Teeroovengadum, "Environmental identity and ecotourism behaviours: examination of the direct and indirect effects," *Tourism Review*, vol. 74, pp. 280-292, 2019.
[36]. K. A. U. I. Singh, "Tourism in Jammu And Kashmir Economy: Role and Performance," *Journal of Economic & Social Development*, vol. XII, pp. 112 - 123, 2016.
[37]. S. Aijaz and M. Malik, "Paying guest tourist accommodation—A new trend to boon sustainable tourism development in Kashmir," *International Journal of Recent Scienti*, pp. 1468-1473, 2014.
[38]. Y. Higuchi, "The potential value of research-based evidence in destination management: the case of Kamikawa, Japan," *Tourism Review*, vol. 74, pp. 166-178, 2019.
[39]. A. Jehangir, N. A. Dar, A. Yousuf, and A. H. Sofi, "Air quality at Sonamarg-a tourist hill station in Kashmir valley, India," *Journal of Experimental Sciences*, 2011.
[40]. M. P. Gunawan, "Domestic tourism in Indonesia," *Tourism recreation research*, vol. 21, pp. 65-69, 1996.
[41]. A. W. Abbas, N. Minallh, N. Ahmad, S. A. R. Abid, and M. A. A. Khan, "K-Means and ISODATA clustering algorithms for landcover classification using remote sensing," *Sindh University Research Journal-SURJ (Science Series)*, vol. 48, 2016.
[42]. M. Malik, M. Bhat, and N. Kuchay, "Watershed based land use land cover change detection analysis

for sustainable development of Lidder catchment in Kashmir Himalayas," *Jamia geographical studies*, vol. 2, pp. 295-312, 2013.

[43]. L. Ruhanen, "New directions in sustainable tourism research," *Tourism Review*, vol. 74, pp. 138-149, 2019.