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ASSESSMENT OF LAND USE AND LAND COVER PATTERN OF GUJARAT STATE

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Abstract

Land use and land cover transformation have turned out to be a dynamic factor in recent strategies for dealing with natural resources and monitoring environmental changes. The research aimed to assessment of Land use and Land cover pattern of Gujarat State. The study area was classified and mapped into four broad land cover classes i.e., agriculture, fallow, barren/unculturable/wastelands, built-up, forest, wet lands and water bodies. The land use and land cover data were collected from NRSC of the year 2015-16. The state has been categorized into four divisions i.e., Central Gujarat, north Gujarat, Saurashtra-Kutch & south Gujarat. The Land use and land cover of Gujarat state to the geographical area of the state has 52.1% of its area under agriculture, 6.3% of fallow land, 21.0% of Barren/Unculturable/wastelands, 2.7% of Builtup, 11.1% of forest, 3.4% of wetlands and 3.4% of water bodies.

Keywords: Land Use; Land Cover

Introduction

Land Use and land Cover (LULC) is the classification or division of an area according to how the people are utilizing the land and the natural land type. The LULC map serves the better purpose of understanding the current landscape of any area or region. Land Use and Land Cover assessment is an integral part of scientific analysis related to understanding climate variables, carbon budgeting, and meeting the socio-economic requirement of mankind (NRSC).

As a matter of fact, the assessment of the land use and land cover is necessary so that we know and study the current sta-

tus of how the lands are occupied, temporal and spatial changes in the land use and land cover, climatic and socio-economic determinants acting upon land use and land cover. In addition to identifying the changes and issues, the LULC assessment also serves the purpose of planning and managing the resources concerned. And also, there are no known studies that deal with the land use and land cover assessment of Gujarat as a whole. Hence, it is specifically in this context that this research aims at assessing the land use and land cover pattern of all the districts in Gujarat, sub-divided into concerned divisions.

Objectives

- The present study is to assess the land use and land cover pattern of Gujarat state.

Study Area

Gujarat, the Land of the Legends stands bordered by Pakistan and Rajasthan in the northeast, Madhya Pradesh in the east, and Maharashtra and the Union territories of Diu, Daman, Dadra and Nagar Haveli in the south. The Arabian Sea borders the state both to the west and the southwest. It is located between 20°01' to 24°07' north latitudes and 68°04' to 74°04' East longitude. It experiences diverse climatic conditions, wet in the southern districts and desertic in the north-west region. Summer temperature varies between 25 degrees to 45 degrees. Winter temperature varies between 15 degrees to 35 degrees and monsoon temperatures from 27 degrees to 35 degrees. Its ecosystem ranges from deserts, scrublands, grasslands, deciduous forests, and wetlands to mangroves, coral reefs, estuaries, and gulfs.

The topography of Gujarat shows wide variations. It is located near the Thar desert, therefore most of the land is dry and arid in nature. Moreover, the topography of Gujarat is characterized by the small hilly tracts especially around the Rann of Kutch region.

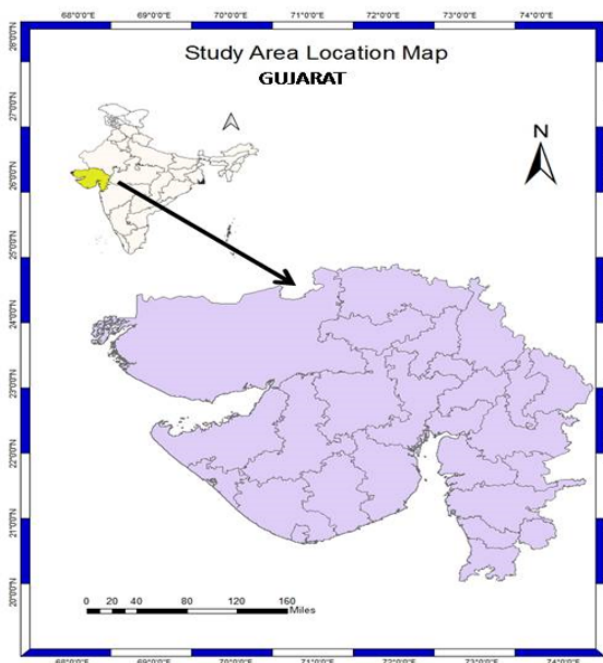


Fig. 1. Study area location map

Methodology

The present study based on secondary data was collected from various sources such as Gujarat Forest Department, Official Gujarat State Portal, Forest Survey of India, NRSC, and review of the literature. Quantitative techniques were mostly used for the study. Simple statistical techniques were used to facilitate visual interpretation.

1. The land use and land cover data were collected from NRSC of the year 2015-16. Here we have studied the area under various classes of land use and land cover and why it differs in all the divisions of Gujarat.
2. The state has been categorized into four divisions i.e., Central Gujarat, north Gujarat, Saurashtra-Kutch & south Gujarat.

Results and Discussions

Land use is commonly defined as a series of operations on land, carried out by humans, with the intention to obtain products and/or benefits through using land resources. Land cover is commonly defined as the vegetation (natural or planted) or man-made constructions (buildings, etc.) which occur on the earth's surface. Water, ice, bare rock, sand, and similar surfaces also count as land cover. Gujarat with its geographical area of 196244.5 Sq.Km has been categorized into 7 Landuse and Landcover classes (2015-16) i.e. Agriculture, Fallow, Barren/Unculturable/Wasteland, Builtup, Forest, Wetlands, and Water Bodies.

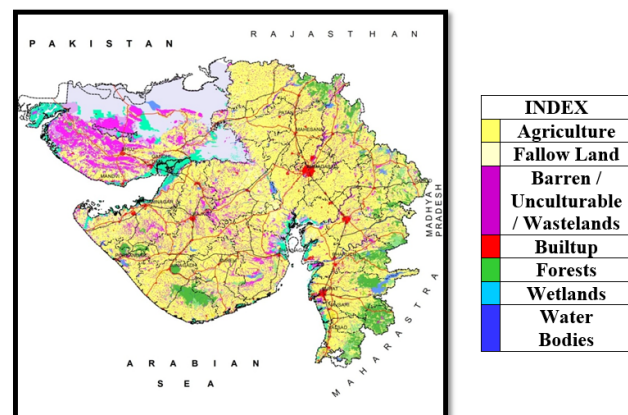


Fig. 2. Map 2 Source: National Remote Sensing Centre, ISRO

Table 2 shows the area and percentage of Landuse and Landcover of Gujarat state (2015-16) to the geographical area of the state. The state has 102191.9 Sq. Km of its area under agriculture, 12385.9 Sq.Km of fallow land, 41266.5 Sq.Km of Barren/Unculturable/wastelands, 5175.7 Sq.Km of Builtup, 21859.2 Sq.Km of forest, 6611.5 Sq.Km of wetlands and 6753.7 Sq.Km of water bodies.

Table 1. Data

Divisions	No. of District	Name of District	Area (in Sq.Km)
Central Gujarat	8	Ahmedabad	7090
		Vadodara	6354
		Anand	3204
		Chota Udaipur	1192
		Dahod	3642
		Kheda	3442
		Mahisagar	2261
		Panchmahal	3481
North Gujarat	6	Gandhinagar	2140
		Aravalli	3308
		Banaskantha	10743
		Mehasana	4401
		Patan	5792
		Sabarkantha	4086
		Rajkot	7750
		Amreli	7397
Saurashtra-Kutch	12	Bhavnagar	8487
		Botad	2564
		Dev Bhumi Dwarka	4051
		Gir Somnath	3289
		Jamnagar	5980
		Junagadh	5542
		Morbi	8786
		Porbandar	2316
South Gujarat	7	Surendranagar	9238
		Kachchh	45674
		Surat	4549
		Bharuch	6509
		Dang	1766
		Narmada	2817
		Navsari	2246
		Tapi	3139
		Valsad	3008

Table 2. Land Use and Land Cover Pattern 2015-16 in Gujarat State

S.N	Categories	Area (Sq. Km)	Area (%)
1	Agriculture	102191.9	52.1
2	Fallow	12385.9	6.3
3	Barren/Unculturable/Wastelands	41266.5	21.0
4	Built-up	5175.7	2.7
5	Forest	21859.2	11.1
6	Wetlands	6611.5	3.4
7	Water bodies	6753.7	3.4
8	Geographical Area	196244.5	100.0

Source: Gujarat Forest Department

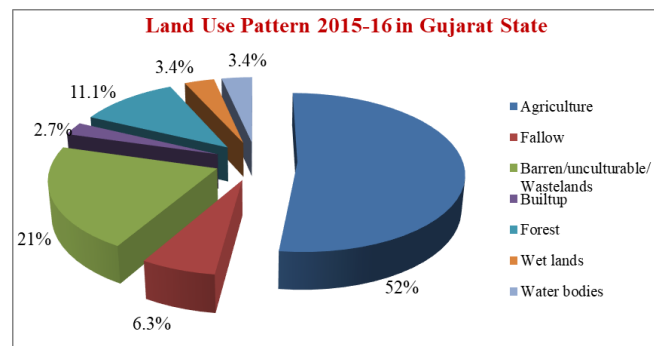


Fig. 3. Land use and Land cover pattern of Gujarat

Agriculture

Gujarat has an agricultural economy. The total crop area amounts to more than one-half of the total land area. Gujarat is the main producer of tobacco (15.62%), cotton, and groundnuts in India. Animal husbandry and dairying have played a vital role in the rural economy of Gujarat.

Table 3. Divisions wise Area under Agriculture 2015-16 in Gujarat State

S.N	Divisions	Area (Sq. Km)	Area (%)
1	Central Gujarat	20635.8	10.5
2	North Gujarat	21808.5	11.1
3	Saurashtra-Kutch Gujarat	41369.6	21.1
4	South Gujarat	14092.0	7.2
	Gujarat	102191.9	52.1

Source: Gujarat Forest Department

Table 3 shows the division-wise Area under Agriculture 2015-16 in Gujarat state. It depicts that Saurashtra-Kutch Gujarat has the highest area under agriculture of 41369.6 Sq.Km. This division has most of the reservoirs and dams of Gujarat on which it is dependent such as Malan reser-

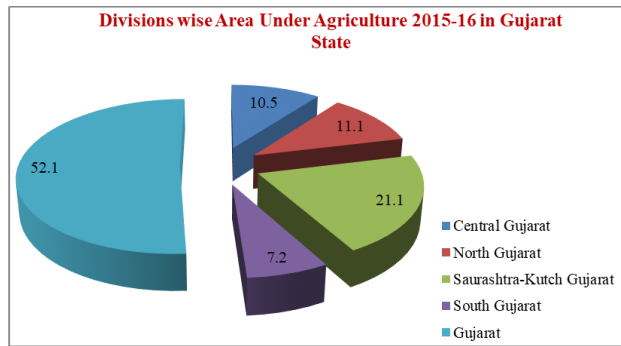


Fig. 4. Division Wise Area under Agriculture

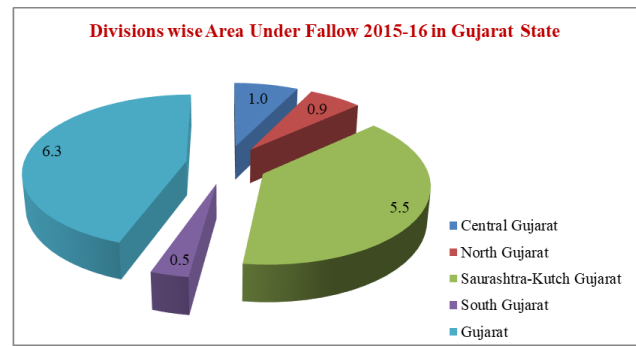


Fig. 5. Division Wise Areas under Fallow Land

voir, Bhadar reservoir, Melakdi Talav, Khambhada reservoir, Fodara Dam, Kalindri Dam, Kharo Reservoir, etc. Another reason for its highest area under agriculture must be because of the highest rainfall it has received in the year 2015 i.e., 1100 mm which led to the increase in sown area. South Gujarat has the lowest area under agriculture of 14092 Sq.Km. Central Gujarat and North Gujarat have 20635.8 Sq. Km and 21808.5 Sq.Km of the area under agriculture respectively

Fallow

Land that is periodically left idle to recuperate is current fallow land. This represents the cropped area that is kept fallow over the current year. Current fallow lands are left without cultivation for one or less than one agricultural year. According to 2015-16, Gujarat has fallow land of 12385.9 Sq.Km of the total geographical area.

Table 4. Divisions wise Area Under Fallow 2015-16 in Gujarat State

S.N	Divisions	Area (Sq. Km)	Area (%)
1	Central Gujarat	2037.1	1.0
2	North Gujarat	1690.5	0.9
3	Saurashtra-Kutch Gujarat	10758.8	5.5
4	South Gujarat	900.5	0.5
	Gujarat	12385.9	6.3

Source: Gujarat Forest Department

Table 4 shows the division-wise area under fallow land in Gujarat state from 2015-16. It depicts that South Gujarat has the lowest area under fallow land of 900.5 Sq. Km and Saurashtra-Kutch have the highest area under fallow land of about 10758.8 Sq.Km. Central Gujarat and North Gujarat have fallow land of 2037.1 Sq. Km and 1690.5 Sq.Km of the total geographical area of the state.

Barren/Unculturable/Wastelands

The land which cannot be used for cultivation is called barren land such as hilly terrains, deserts, and ravines, etc. The land which is left fallow (uncultivated) for more than five years is called wasteland and is included in this category. It can be brought under cultivation after improving its fertility.

Table 5. Divisions wise Area Under Barren/Unculturable/Wastelands 2015-16 in Gujarat State

S.N	Divisions	Area (Sq. Km)	Area (%)
1	Central Gujarat	1988.2	1.0
2	North Gujarat	2234.7	1.1
3	Saurashtra-Kutch Gujarat	37001.4	18.9
4	South Gujarat	1022.2	0.5
	Gujarat	41266.5	21.0

Source: Gujarat Forest Department

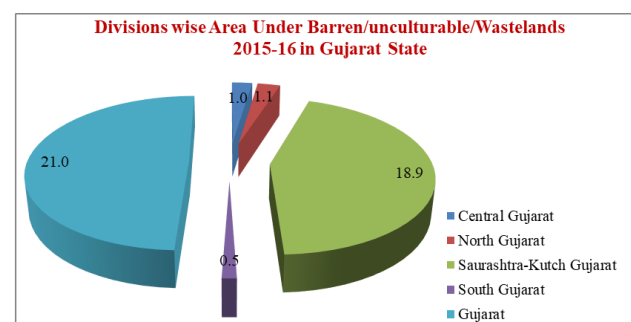


Fig. 6. Division Wise Areas under Barren/Unculturable/Wasteland

Table 5 shows the Division wise area under barren/Unculturable/wastelands 2015-16. It has been observed that Saurashtra-Kutch has the highest area under barren/Unculturable /wastelands of 37001.4 Sq.Km. This division is known for the large area of salt marshes or Rann of Kutch which alone covers 27,454 Sq.Km, Unculturable

coastlands near Gulf of Kutch, black hills, Dhinodhar hills, Khatrod hill ranges, etc which contributes towards the barren/Unculturable/wastelands. South Gujarat has the lowest area of 1022.2 Sq. Km as most of the lands are under built-up area, forest or agriculture. Central and North Gujarat have area under barren land of 1988.2 Sq. Km and 2234.7 Sq.Km respectively.

Builtup

Built-Up area consists of rural and urban areas. Built-up and related land, in land use and agriculture statistics, comprises residential land, industrial land, quarries, pits and mines, commercial land, land used by public services, land of mixed-use, land used for transport and communications, for technical infrastructure, recreational and other open lands.

Table 6. Divisions wise Area Under Builtup 2015-16 in Gujarat State

S.N	Divisions	Area (Sq. Km)	Area (%)
1	Central Gujarat	1372.1	0.7
2	North Gujarat	812.8	0.4
3	Saurashtra-Kutch Gujarat	2407.5	1.2
4	South Gujarat	983.3	0.5
	Gujarat	5175.7	2.6

Source: Gujarat Forest Department

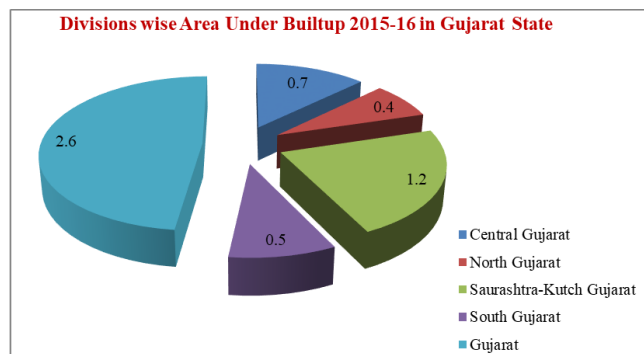


Fig. 7. Division Wise Areas under Builtup

Table 6 shows the division-wise area under built-up in Gujarat state. It has been observed that the Saurashtra-Kutch division has the highest area under built-up of 2407.5 Sq. Km as it consists of the highest number of towns and villages under it i.e. 12 districts and north Gujarat has the lowest area of 812.8 Sq.Km and this division consist of 6 districts which are the lowest amongst the four divisions, hence the built-up is less. Central Gujarat and South Gujarat have a built-up area of 1372.1 Sq. Km and 983.3 Sq.Km respectively.

Forest

A forest is an area of land dominated by trees. According to the State of Forest Report (2018), Gujarat has only 11.1% of its geographical area declared as forest, which is much below the national average. Forest and tree cover is in the extent of 11.46 % (7.46 % forest cover and 4.00% tree cover outside forest-TOF) of its geographical area. The state has wide variations in Geophysical and Eco-climatic conditions ranging from hot saline deserts to humid hilly tracts and from coast to high hills, which have resulted in the formation of various types of forest.

Table 7. Divisions wise Area Under Forest 2015-16 in Gujarat State

S.N	Divisions	Area (Sq. Km)	Area (%)
1	Central Gujarat	3055.8	1.6
2	North Gujarat	2951.9	1.5
3	Saurashtra-Kutch Gujarat	10821.8	5.5
4	South Gujarat	5029.7	2.6
	Gujarat	21859.2	11.1

Source: Gujarat Forest Department

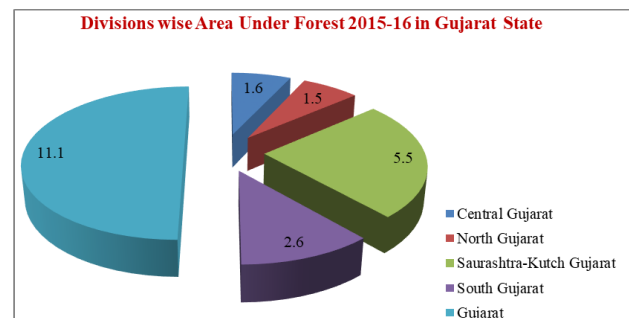


Fig. 8. Division Wise Areas under Forest

Table 7 shows the division-wise area under forest in Gujarat state 2015-16. It has been observed that Saurashtra-Kutch has the highest area under forests of 10821 Sq.Km. this division has a total of 21 wildlife sanctuaries, national parks, and other protected areas. Some of them are Gir Wildlife Sanctuary & National Parks, Marine Sanctuary, Wild Ass Sanctuary, Kutch Desert Wildlife Sanctuary, Kachchh Biosphere Reserve, Blackbuck National Park, etc. North Gujarat has the lowest area under forest of 2951.9 Sq. Km and the major forest covers are under Jessore Sloth Bear Sanctuary, Balaram Ambaji Wildlife Sanctuary, and Hill forest. Central Gujarat and South Gujarat have 3055.8 Sq. Km and 5029.7 Sq.Km respectively. The state's forest cover in Gujarat has evinced an overall increase since 1991 when the forest cover was only 11,907 sq. km and increased to a maximum of 21859.2 sq. km in 2015-16.

Wetlands

Wetlands are areas in which water is the key factor regarding controlling the environment and allied flora and fauna. They occur where the water table is at or near the surface of the land. They are among the world's most productive environments in terms of aquatic biodiversity. Wetlands have been described as “the kidneys of the landscape”, because of the functions they perform during hydrological and chemical cycles and as “biological supermarkets” because of the extensive food webs and rich biodiversity they support (Mitsch & Gosselink 1993).

Table 8 shows the division-wise area under wetlands in Gujarat state 2015-16. It has been observed that Saurashtra-Kutch has most of the wetlands in Gujarat amongst all the divisions and it covers an area of 5459.6 Sq.Km. It has 7029 wetlands accommodating 2386 small wetlands. The dominating categories of wetlands here are the inter-tidal mudflats, rivers/streams, salt pans, reservoirs, mangroves, etc. North Gujarat has the lowest area of land under wetlands i.e. 54.3 Sq.Km. The major wetland categories are rivers/streams, reservoirs, and tanks/ponds. Central Gujarat and South Gujarat have 281.9 Sq. Km and 819.8 Sq.Km of the area under wetlands respectively and their major wetland subclasses are rivers/streams, tanks/ponds, reservoirs, salt marsh, mudflats, etc.

Table 8. Divisions wise Area Under Wetlands 2015-16 in Gujarat State

S.N	Divisions	Area (Sq. Km)	Area (%)
1	Central Gujarat	281.9	0.1
2	North Gujarat	54.3	0.0
3	Saurashtra-Kutch Gujarat	5459.6	2.8
4	South Gujarat	819.8	0.4
	Gujarat	6611.5	3.4

Source: Gujarat Forest Department

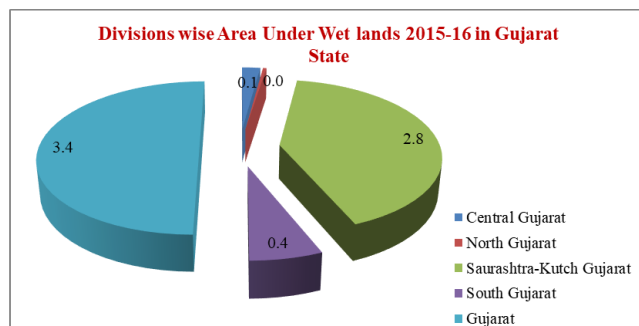


Fig. 9. Division Wise Areas under Wetlands

Water Bodies

A body of water or water body is any significant accumulation of water, generally on a planet's surface. The term most often refers to oceans, seas, and lakes, but it includes smaller pools of water such as ponds, wetlands, or more rarely, puddles.

Water bodies occupy 6753.7 Sq.Km of the total geographical area of the Gujarat state. Table 8 shows the division-wise area under water bodies in Gujarat state from 2015-16. It has been observed that Saurashtra-Kutch has the highest area under water bodies amongst the four divisions of 3255.7 Sq.Km. Some of the major water bodies are Harmirsar Lake, Shakoar Lake, Narayan Sarovar, Saroj Lake, Gundi Talav, Shinai Lake, etc. North Gujarat has the lowest area under water bodies of 917.2 Sq. Km and the major water bodies are Sahasralinga Talav, Bindu Sarovar, Thol Lake, etc. Central Gujarat and South Gujarat has 1294.7 Sq. Km and 1186.2 Sq.Km of the area under water bodies respectively. Major water bodies are Kankaria Lake, Nal Sarovar, Sursagar Lake, Chandola Lake and Vastapur Lake of central Gujarat, and Gopi Talav, Narmada River of south Gujarat.

Table 9. Divisions wise Area under Water bodies 2015-16 in Gujarat State

S.N	Divisions	Area (Sq. Km)	Area (%)
1	Central Gujarat	1294.7	0.7
2	North Gujarat	917.2	0.5
3	Saurashtra-Kutch Gujarat	3255.7	1.7
4	South Gujarat	1186.2	0.6
	Gujarat	6753.7	3.4

Source: Gujarat Forest Department

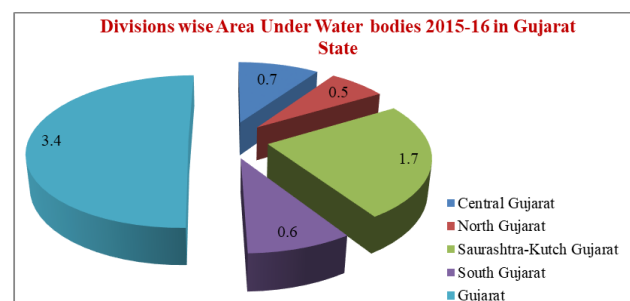


Fig. 10. Division Wise Areas under Water Bodies

Conclusion

The present study shows the assessment of land use and land cover pattern of Gujarat state. The study divides the state into four divisions, each consisting of concerned districts and a general division of the land use and land cover categories. The

study shows different tables and pie diagrams of areas under different land use and land cover classes. Saurashtra-Kutch division with 12 districts has the highest percentage of area under agriculture, fallow, built-up, forest, wasteland/barren land, wetland, and water bodies. In terms of agriculture, fallow, wasteland/barren land, and forest, there are huge differences in the area covered between the Saurashtra-Kutch division and the other divisions. The Kutch region alone makes a huge difference because of its large geographical area of 45,674 sq.km. The study thus helps to access and understand the current status and Spatio-temporal changes of land use and land cover of Gujarat.

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