



# Land use/ land cover change detection analysis at the end of Thamirabarani River, Tamil Nadu, India using Remote Sensing and GIS Techniques

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## Abstract.

The main objective of the present study is analysis of Land use/land cover change detection at the end of Thamirabarani River, Tamil Nadu, India using Remote Sensing and GIS techniques. From the land use / land cover maps of 1998, 2008 and 2018, it is distinct that settlements and saltpans have considerably increased, whereas fallow land and water bodies have decreased over the period of 20 years. Crop lands and fallow lands are converted into saltpans at many places in the delta. This better understanding of this study going to help the environment is to mitigate the river water salinization and seawater incursion in the aquifers, engineering solution such as weir construction across the Thamirabarani River has been proposed based on the land use pattern.

**Keywords:** Land use, Land cover, change detection, Thamirabarani, Tamil Nadu, India, Remote Sensing, GIS.

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## 1. Introduction

Arrive utilize alludes to man's exercises and the different employments which are carried on and inferred from arrive. Arrive cover alludes to water bodies, vegetation, shake/ soil, fake cover and others coming about due to arrive change [2]. Since both the terms

arrive utilize and arrive cover are closely related and are not commonly select, they are conversely. Seeing the soil from space, it is presently exceptionally pivotal in understanding the impact of man's exercises on common assets. In circumstances of quick changes in arrive utilize, perceptions of the soil from space



grant the data of human exercises and utilization of the scene [3]. Mining of both surface, subsurface minerals and rocks cause colossal harm to the vegetation and fauna, hydrological relations and soil organic properties. Too mining operation leads to a broad harm and misfortune to the timberland's framework [4]. The overburden of mines when dumped in unmined regions makes mine ruins which eventually influence the encompassing vegetation.

Remote sensing and GIS procedures are presently giving modern instruments for progressed arrive utilize mapping and arranging. The collection of remotely detected information encourages the concise examinations of soil framework, capacities, designing, alter within the neighbourhood, territorial as well as at worldwide scales over time [5]. Satellite imagery especially may be a important instrument for producing arrive utilize alter location [6], [7]. Additionally, human initiated arrive cover changes in Ghana were studied by applying foremost components investigation and vector examination methods to supply data on the alter sort and power.

The display ponder points to decide the rate of arrive cover changes within the consider region amid 1998, 2008 and 2018, as well as to account for the inborn spatial changes, degree of changes, and distinguishing the variables mindful for the changes [8], [9]. This data will be valuable in giving a more educated and well-structured arrive utilize arrange for the locale organization and give a premise for more successful common resource's administration [10], [11].

This think about makes a difference to spare the environment for the long run within the perspective of landuse pattern we are able

get it the taking after comes about. the Thamirabarani Stream is one of the perpetual waterways of southern India [16]. Coastal aquifers are exceedingly affected by the saline water interruption, likely due to the over-extraction of subsurface water for the quickly developing salt panning exercises in this locale. The salt panning contributes more income than rural cultivating in this coastal locale. In this way, the agricultural lands are persistently changed

to saltpans, and it has escalated over the past two decades. The resultant saltwater invasion has exceedingly weakened the subsurface water quality within the southern side of the delta. The seawater interruption could be a prime danger in this deltaic locale up to the town of Attur, found at 7 km from the coast of Inlet of Bengal.

## 2. Study Area

The trunk framework of Thamirabarani Stream begins 1,500 m over Cruel Ocean Level (MSL) on a portion of the Annamalai run on the eastern slants of the Western Ghats within the Tirunelveli locale of Tamil Nadu and streams through Tirunelveli and Tuticorin areas. From the source to ocean, the entire length of the stream is almost 125 Km (Figure 1). Chithar, Pachayar, Manimuthar, Gadanathi and Ramanathi are the major tributaries of Thamirabarani Waterway. As most of its extensive catchment areas lay within the Western Ghats, the waterway appreciates the complete good thing about both the southwest (June to September) and northeast (October to December) storms which make the waterway perpetual. Summer showers are too recorded amid the transitional period [12], [13]. The territorial incline of the bowl is towards east [1].

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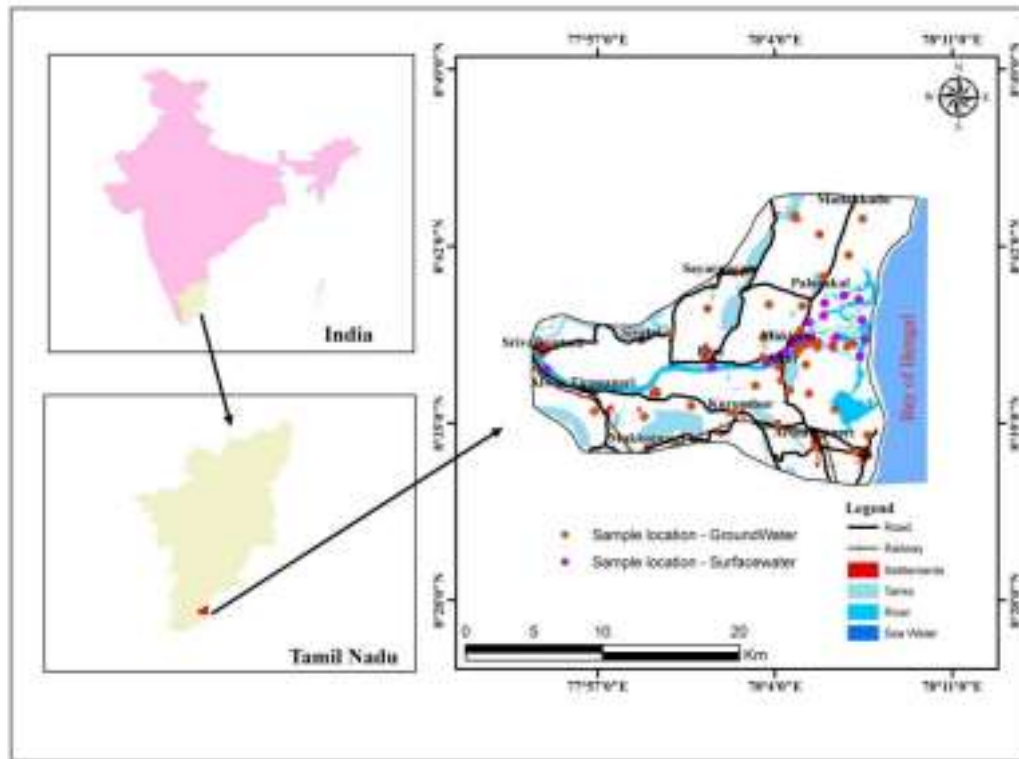


Figure 1. Study area map

### 3. Methodology

Three types of data were used in this study to prepare land use/land cover maps and to analyse the change detection in the land use categories [14]. Land use maps of the study area were prepared using LANDSAT-6 TM image of Path: 096 and Row: 055 for the year 1998 and 2008, and LANDSAT OLI image of Path: 102 and Row: 125 for the year 2018 with the reference of Survey of India (SOI) toposheets (Numbers: 58 H/10, 58 H/14, 58 L/2).

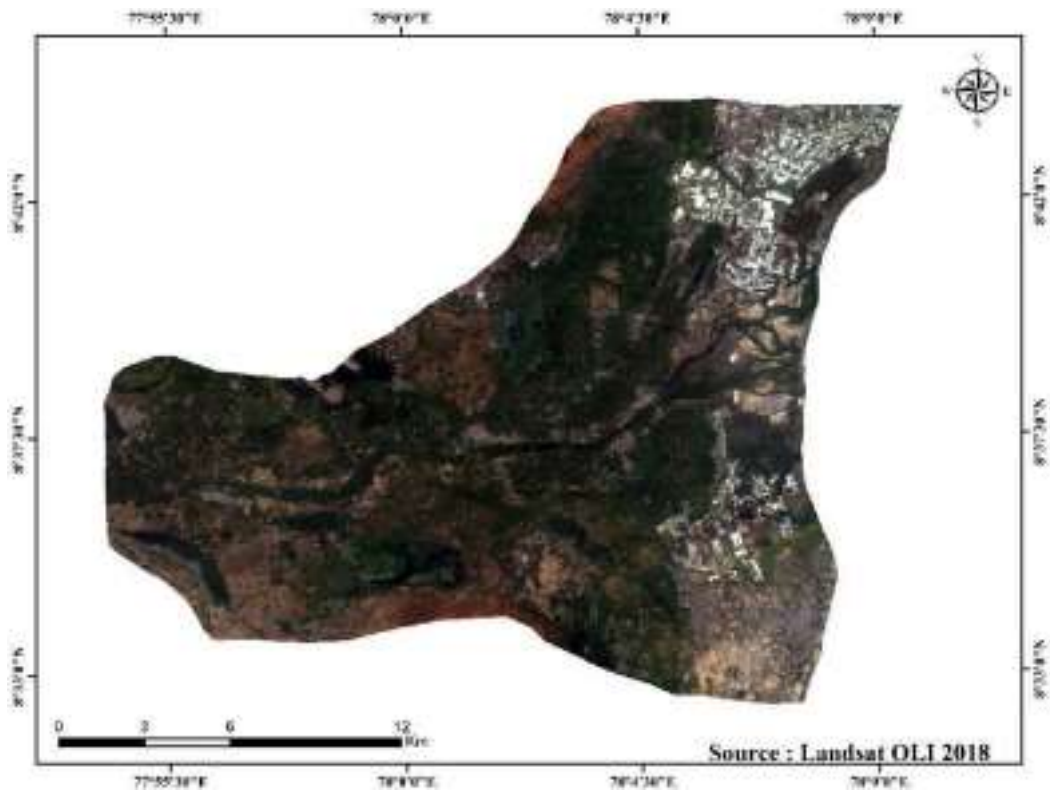


**Figure 2 Landsat satellite image of 1998**



**Figure 3 Landsat satellite image of 2008**





**Figure 4 Landsat satellite image of 2018**

Figure 5 illustrates the detailed methodology adopted to detect the land use/land cover changes in the study area over the period of 20 years (1998, 2008 and 2018).

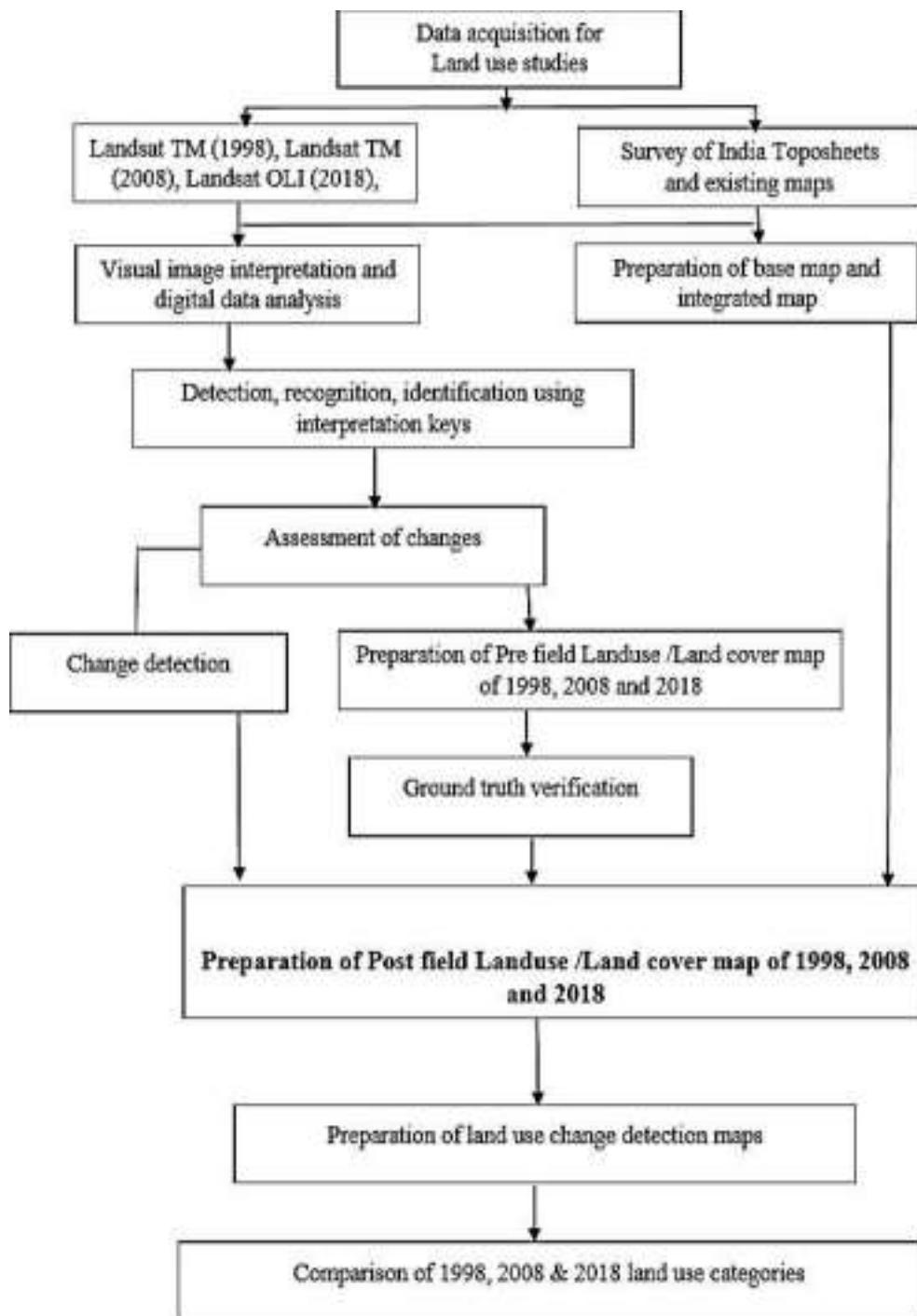


Figure 5 Flowchart shows the methodology for land use/ land cover change detection

#### 4. Results and Discussions

##### Land use / land cover Changes

Land use/ land cover maps can be arranged by visual translation of lackey pictures overlaid on Study of India toposheets (1: 50000 scale) and affirmed by the ground truth information and field visits [15].

As visual elucidation of fawning imageries are troublesome, advanced elucidation was connected in this think about to distinguish the arrive utilize / arrive cover young ladies. The arrive utilize / arrive cover maps of the ponder region are outlined within the Figures 6, 7 and 8. The land utilize changes totally



different classes amid 1998, 2008 and 2018 are displayed in Tables 1 and 2.

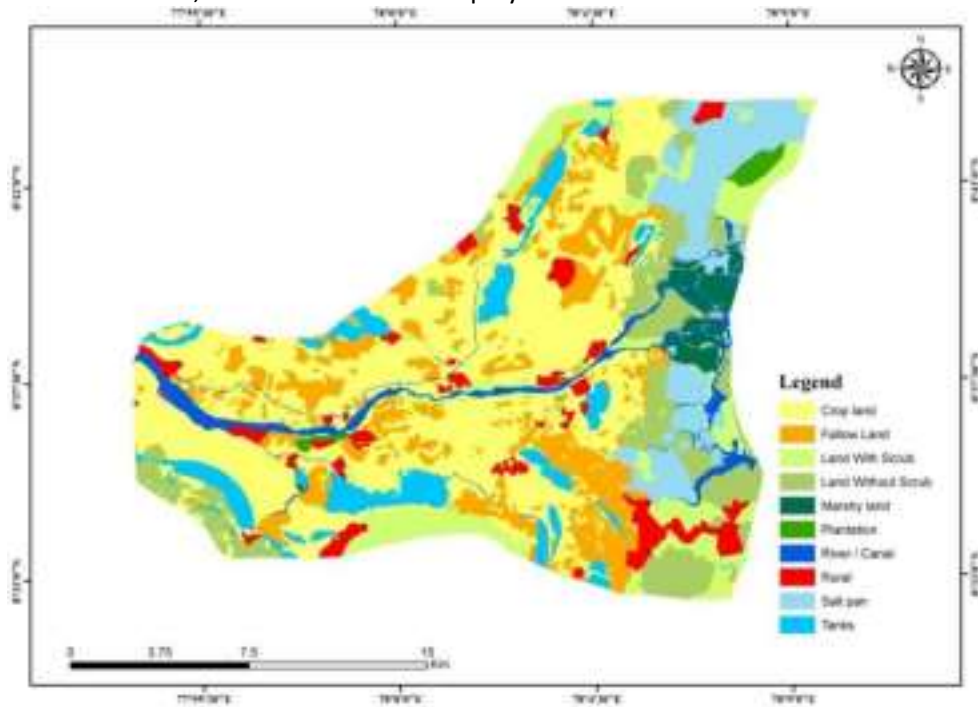


Figure 6 Land use / land cover map of 1998

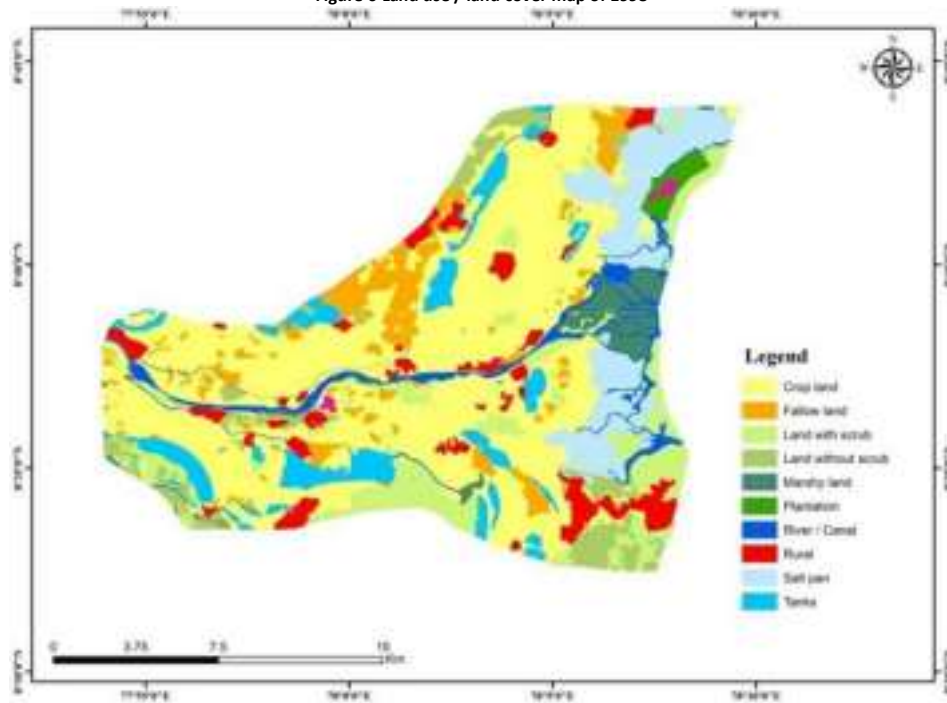
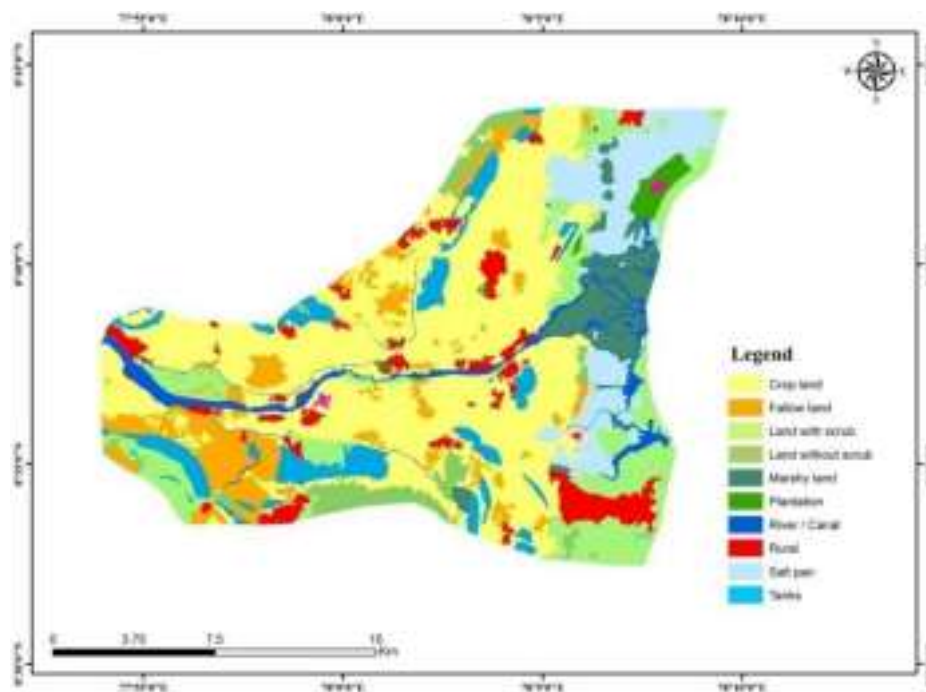


Figure 7 Land use / land cover map of 2008





**Figure 8 Land use / land cover map of 2018**

**Table 1 Land use / land cover changes over the period of 10 years (1998-2008)**

Land use / land cover parameters	For the Year 1998 (Area in km <sup>2</sup> )	For the Year 2008 (Area in km <sup>2</sup> )	Variations (Area in km <sup>2</sup> )	Variations (Area in Percentage)
Crop Land	138.65	169.57	30.92	22.30
Fallow Land	53.06	26.63	-26.43	-49.81
Land With Scrub	40.55	39.66	-0.88	-2.17
Land Without Scrub	37.33	20.82	-16.51	-44.23
Marshy land	7.56	11.78	4.22	55.82
Plantation	2.69	3.49	0.79	29.37
River / Canal	16.51	16.02	-0.49	-2.97
Rural	17.62	20.66	3.04	17.25
Saltpan	30.19	34.53	4.34	14.38





Tanks	25.76	25.88	0.11	0.43
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**Table 2 Land use / land cover changes over the period of 10 years (2008-2018)**

Land use / land cover parameters	For the Year 2008 (Area in km <sup>2</sup> )	For the Year 2018 (Area in km <sup>2</sup> )	Variations (Area in km <sup>2</sup> )	Variations (Area in Percentage)
Crop Land	169.57	157.67	-11.90	-7.02
Fallow Land	26.63	32.73	6.11	22.94
Land With Scrub	39.66	45.31	5.64	14.22
Land Without Scrub	20.82	14.09	-6.73	-32.32
Marshy land	11.78	17.21	5.43	46.10
Plantation	3.49	4.17	0.68	19.48
River / Canal	16.02	14.92	-1.10	-6.87
Rural	20.66	21.23	0.57	2.76
Saltpan	34.53	35.98	1.45	4.20
Tanks	25.88	25.88	0.00	0.00

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**Table 3 Land use / land cover changes over the period of 20 years (1998-2018)**

Land use / land cover parameters	For the Year 1998 (Area in km <sup>2</sup> )	For the Year 2018 (Area in km <sup>2</sup> )	Variations (Area in km <sup>2</sup> )	Variations (Area in Percentage)
Crop Land	138.65	157.67	19.02	13.72
Fallow Land	53.06	32.73	-20.33	-38.32
Land With Scrub	40.55	45.31	4.76	11.74



Land Without Scrub	37.33	14.09	-23.24	-62.26
Marshy land	7.56	17.21	9.65	127.65
Plantation	2.69	4.17	1.48	55.02
River / Canal	16.51	14.92	-1.59	-9.63
Rural	17.62	21.23	3.61	20.49
Saltpan	30.19	35.98	5.79	19.18
Tanks	25.76	25.88	0.12	0.47

From the Table 1, Table 2 and Table 3, it is observed that the land use/land cover changes in the study area. The land use/land cover categories have expanded, while neglected areas and areas without scrub have diminished over the period of 20 years. This appears that neglected areas are changed over into settlements in numerous places. At the same time, undesirable bushes (areas with scour) have developed in numerous ranges. These bushes have moreover involved the water bodies driving the change in this category amid 2018. In expansion to this, groundwater energy from surface water bodies is getting influenced. Hence, the study prescribes clearing of bushes especially within the water bodies to encourage surface water capacity. Especially close to the coast, in expansion to degraded lands and areas without scour, scrub lands were changed over into salt pans. Salt panning exercises have expanded over the final two decades as 19.18%. Due to extension in salt panning exercises, groundwater quality gets weakened in this deltaic locale.

### 5. Conclusion

The study utilizes remote sensing and GIS techniques to investigate the changes in vegetation, settlements, and neglected areas. The study categories have expanded, though scrub areas and water bodies have diminished over the period of 20 years (1998-2018). This

examination shows that desolate areas are changed over into settlements at numerous places. At the same time, undesirable bushes (areas with scour) have developed in numerous zones, which have expanded the zone of vegetation amid 2018. These undesirable bushes have moreover involved the water bodies, which are categorized as vegetation within the oblique information. It has impressively diminished the range of water body amid 2018. This study suggests periodical removal of bushes within the water bodies to extend the surface water capacity.

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