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Health impact and nine fold classification of land use change in Nilakottai Taluk, Dindigul District, Tamil Nadu

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Abstract
Land use change (LU) is the study of land surface change. Land use (LU) changes in Nilakottai taluk Dindigul District, Tamil Nadu, India, were determined during the period 1999 to 2019 using geospatial technology. The present study area Nilakottai taluk is in Dindigul district located between $10^{0}0$' N to 10^{0} 17' North latitude and $77^{0}40$' E to 77^{0} 68' East longitudes. Nilakottai taluk is found in the southernmost part of Dindigul district. Nilakottai taluk shares borders with Kodaikanal, Aathur and Dindigul taluk in North and East Madurai district in the South of Nilakottai, Theni district is in the west. The main purpose of this study is to provide an understanding and to predict land use change using Remote Sensing and GIS techniques in Nilakottai Taluk. The study consists of Land use change over specific time intervals. Secondary sources were collected the statistical department Nilakottai in population census data, Land use data, Soil data, crop data, irrigation and climate data are collected from this office. Then Dindigul collector offices, statistical office collected by statistical hand book, that book cover all data. Land use changes caused by urbanization; agricultural expansion and other types of human activity could put humans at greater risk of infectious disease outbreaks in Nillakottai taluk.

Keywords: Land use (LC) - nine fold classification - health impact- Geo spatial -GIS

1. Introduction
Land and water are the essential natural resources for sustaining human being and their management is the basic for food security and rural economy of the nation. Land use and Land cover change (LUCC) is the study of land surface change. Land use (such as agriculture, pasture, or plantation) describes human use of land, while land cover (such as forest or desert) describes the biophysical characteristics of the land surface. A land Use classification study using Landsat-8 and involving six land-cover classes found that SVM (Support Vector machines) was able to achieve a relatively high overall accuracy of 88% **[1]**. Recently, Mansaray *et al*. pen *et al*. [2, 3, 4] analyzed the impact of training sample size on the overall accuracies of SVM and RF for mapping paddy rice in China in 2015 and 2016 [5].
Land-use change is a globally significant driver of pandemics and caused the emergence of more than 30% of new diseases reported [6, 7]. Land-use change includes deforestation, human settlement in primarily wildlife habitat, the growth of crop and livestock production, health infrastructure and urbanization [8, 9, 10]. Human activity is dramatically changing the global landscape.**[11,12]** These changes in land use and cover are, in turn, altering the dynamics of infectious disease transmission in numerous ways [13, 14, 15]. They are creating new habitat and breeding sites for disease vectors that, in many cases, favor disease transmission [16, 17]. Land use and land cover changes have significant health environmental consequences at local, regional, and global scales.**[18]** These changes have intense implications at the regional and global scales for global loss of biodiversity, distresses in hydrological cycles, increase in soil erosion, and sediment loads [19].
Humans impact the physical environment in many ways: overpopulation, pollution, burning fossil fuels, and deforestation. Changes like these have triggered climate change, soil erosion, poor air quality, and undrinkable water [20]. These changes in land use and cover are, in turn, altering the dynamics of infectious disease transmission in numerous ways. They are creating new habitat and breeding sites for disease vectors that, in many cases, favour disease transmission. Thus, economic development and public health interventions and not climate change appear to have been the primary drivers of the incidence of these vector-

borne diseases globally over the past decade [21,22,23]. Vector-borne diseases constitute an important cause of death, disease burden and health inequity, a brake on socioeconomic development, and a strain on health services [24, 25, 26]. Continued progress in controlling these diseases is therefore an important contribution to global health, development and security.

Vector-borne diseases are spread by insects (such as mosquitoes) [27, 28]. Insects that live and breed in water can cause diseases with rashes and flu-like symptoms, diarrhea, and even death [29, 30]. West Nile Virus and malaria are examples of a vector- borne disease. [31]The burden of these diseases is highest in tropical and subtropical areas, and they disproportionately affect the poorest populations. Since 2014, major outbreaks of dengue, malaria, chikungunya, yellow fever have afflicted populations, claimed lives, and overwhelmed health systems in many countries [32, 33]. Extreme gradient boosting (Xg boost) is a relatively new algorithm first described by Chen and Guestrin [34]. One of the earliest remote sensing applications of Xgboost was conducted by Georganos *et al.* [35] using Bayesian parameter optimization on very-high resolution WorldView-3 data. They found that Xgboost was able to outperform RF and SVM by 2–5% in larger sample sizes albeit with increased computational time compared five non-parametric classifiers using Landsat-8 data [36, 37].

2. Study Area

The present study area Nilakottai taluk is in Dindigul district located between $10^{0}0$' N to 10^{0} 17' North latitude and $77^{0}40$' E to 77^{0} 68' East longitudes. Nilakottai taluk is found in the southern most part of Dindigul district. Nilakottai taluk shares borders with Kodaikanal, Aathur and Dindigul taluk in North and East Madurai district in the South of Nilakottai, Theni district is in the west. (Fig 1)

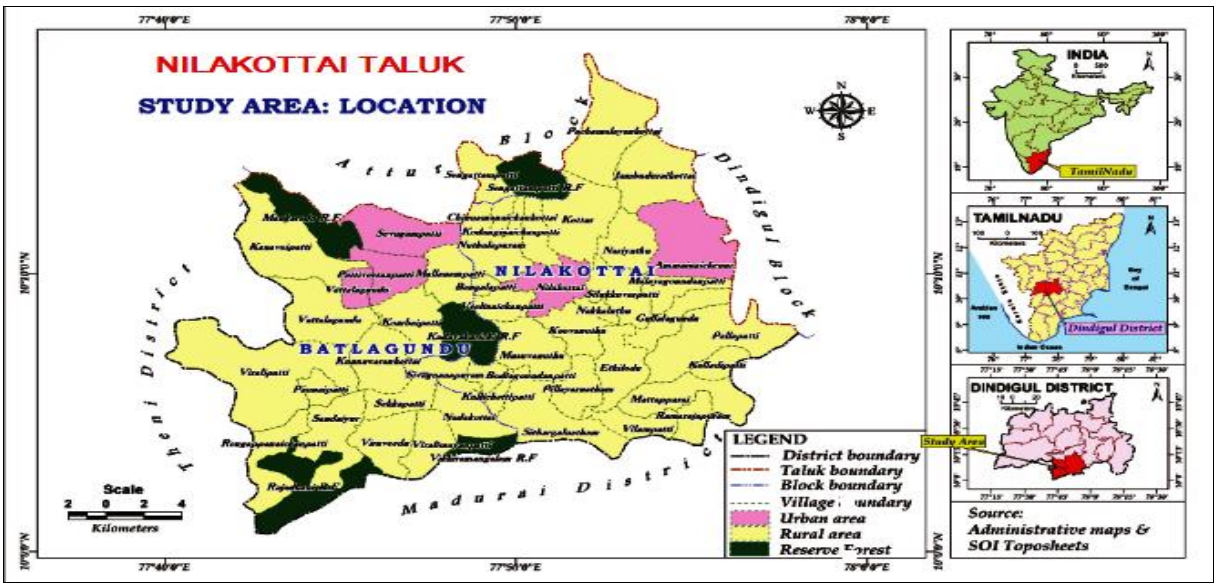

Fig 1: Location of Study Area

3. Aims and objectives of this study are as follows

1. To detect and determine land use change.
2. To understand the inter-annual dynamics of land use change.
3. Analysis the impact of Health due to land use changes.
4. To predict future land use change.

4. Methodology

The main purpose of this study is to provide an understanding and to predict land use change. The study consists of Land use change over specific time intervals. Identification of what, change occurred and where, Analysis of the causes and implications of change. Prediction of land use change in future.

Secondary data only used. Secondary sources were collected the statistical department Nilakottai in population census data, Land use data, Soil data, crop data, irrigation and climate data are collected from this office. Then Dindigul collector offices, statistical office collected by statistical hand book, that book cover all data.

5. Result and Discussion

5.1 Net sown area

The pattern of distribution of net cultivated area depicts variations among villages and blocks. The average net sown in taluk is 30.9%.Net sown area very high in Vilampatti and Nuthulapuram, in Nilakkotai block and Pannaipatti and Sekkampatti in Batlagundu. Maximum number of net sown area covers in kullagundu, Ethilodu, Kottur, Malayagound anpatti, Mattapparai, Nariyuthu, Pillaiyarnatham, and Sivagananapuram, Ammainaickanur (TP), Kanavaipatti, Kunnuvarankottai and they are clustered in the western part of taluk other villages are less percent of net sown area are found at the centre (Table 1). In the year 1999 the average net sown area in Nilakottai Block 50.20% and Batlagundu Block 42.0%, and total Nilakottai Taluk average net sown area is 30.9%.In the year 2019 the average net sown area in Nilakottai Block 31%.The net sown area was decreasing in -19.2% and the Batlagundu Block 28.73% (Table 1).The net sown area was decreasing -13. 27%.Totally the net sown area was decreasing in comparing 1999-2019 land utilization. (Fig 1).

5.2 Current Fallow Land

A considerable share of fallow land is observed in the study area. This is quite natural in agricultural regions. Such lands include the land under orchard, groves, permanent fallows & the currently, prepared for cultivation. Among the

villages of Nilakottai block, the share is high in kodanginaikanpatti, kalladipatti, Musuvanuthu, pallapatti, veelinaayakanpatti, and in nilakottai (TP). In Batlagundu Block very high share of fallow is observed in Viralipati and viruveedu. (Table 1). In the year 1999 the Nilakottai Block shares with, fallow land in 8.91% and 2019 was 4.05%. So the fallow land was decreasing in -4.86% of the current period. During Batlagundu block in 1999,the (Table1) fallow shares with5.04% and 2019 was 0.08%, comparing the twenty years decreasing -4.96% in the current period.(fig 3).

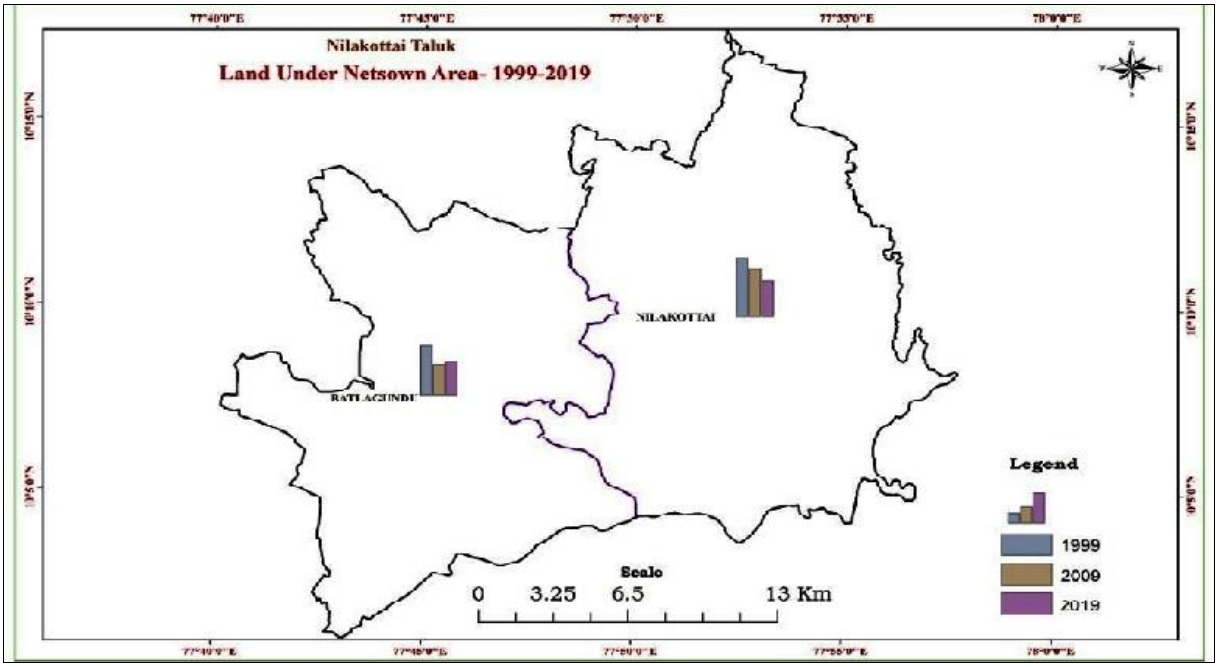

Fig 2: Land under Netsown Area 1999 2019

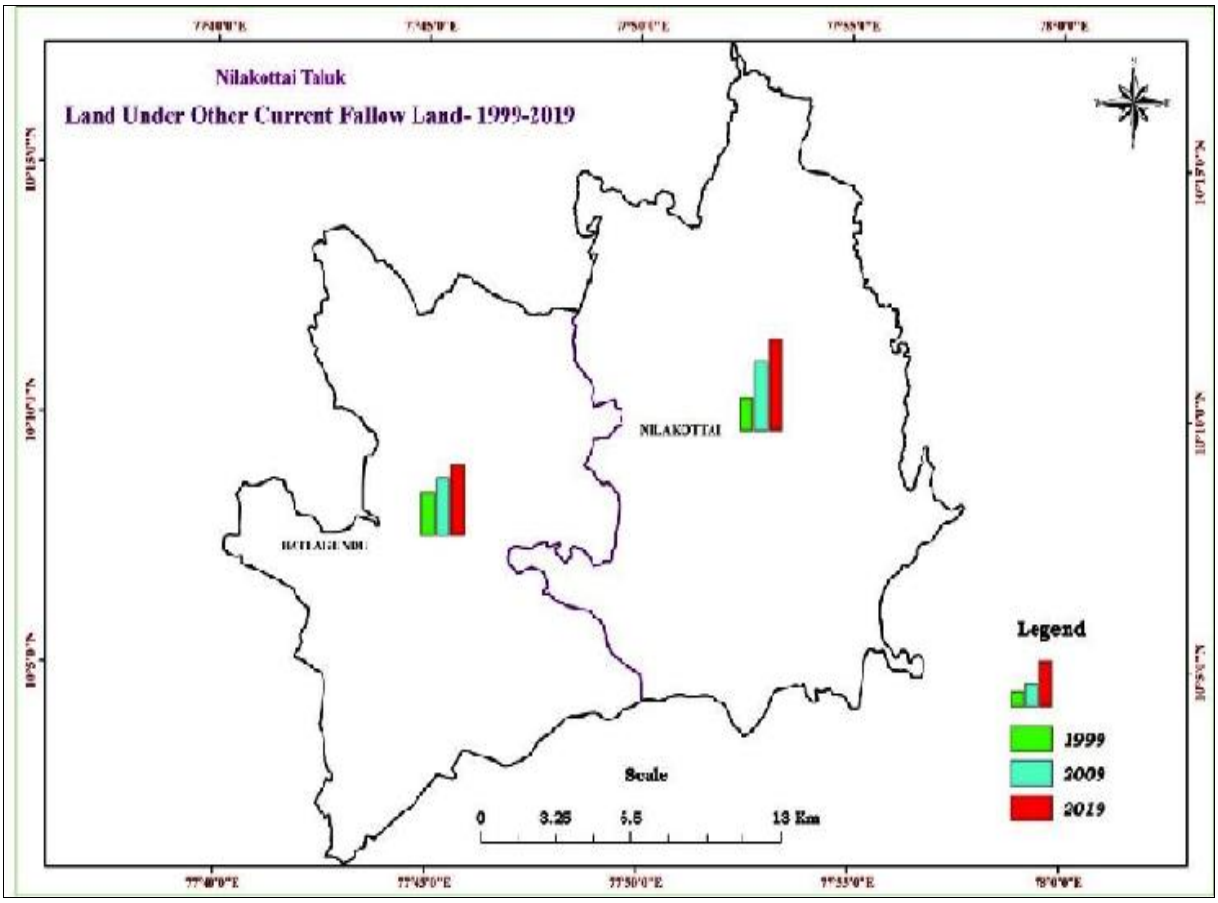

Fig 3: Land under other current Fallow land 1990-2019

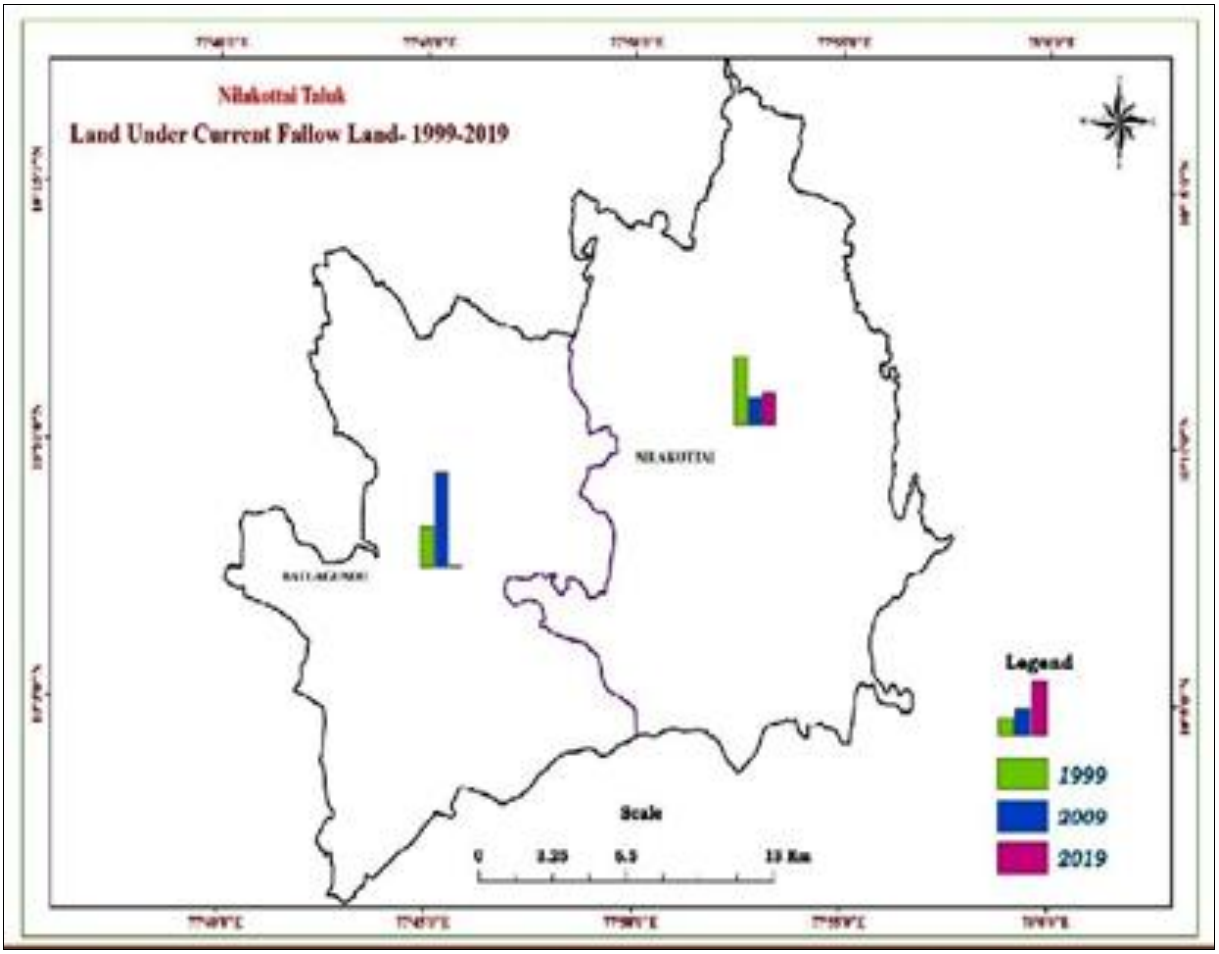

Fig 4: Land under current Fallow land 1990-2019

5.3 Other Fallow Land

It's includes all land which was taken up for cultivation but is temporarily Out of cultivation for a period of not less than one year and not more than five Year. In the year 1999, the Nilakottai block shares other fallow land. In 12.64% and in the year 2019 was 36%, comparing the current twenty years increasing. Other fallow lands shares in 16.90% and 2019 was 28% comparing current Twenty years increasing other fallow land (Table 1). In Nilakottai taluk has during 1999 was 14.5% and 2019 was 32.4% they are Comparing current twenty years Other Fallow was increasing 17.9% in the total Nilakottai taluk.(Fig 4)

5.4 Land put to Non – Agricultural Land

In the study area, the land under non - agricultural use in predominant where settlements along with other infrastructural facilities as well as area under water bodies are more. Thus the north central part of taluk, shows more area under non-agriculture use, where the Batlagundu block, Nilakottai urban settlement and other Activities are concentrated. The shares of non-agricultural land use is notified high in Etilodu, Bodiagoundanpatti, Kullagundu, Kodanginaickanpatti, Kovanuthu, Mattaparai, Nakkaluthu, Pilaiyarnatham, Ramarajapuram, Silukuvarpatti, Sithargalnatham, sivananapu-ram, and in Nilakottai block, non-agriculture including buildings roads, railway lines, rivers, canals, check dams, swamp areas, social, forest. In Batlagundu block there are area under non-agricultural Land uses found in as Viralimayan patti, Kunnuvarankottai, Pannaipatti and Batlagundu (TP) these villages are located on the border area of Madurai district, so the non - agricultural land use is high. In general the urban areas particularly the town panchayats scores more shares in non-agricultural land use in this taluk.

In the year 1999 Nilakottai block shares land put non-agricultural land use 14.28% and In 2019 was 14.8%.It's comparing twenty years decreasing 0.52% and in Batlagundu block was 1999 non-agricultural Land uses was 12.25% and in 2019 was 11.38%. Hence they decreasing comparing twenty years. (Table1). In Nilakottai taluk 1999, non – agricultural land use in 13.34% and in 2019was 13.06%, so they decreasing -0.28% in total Nilakottai taluk.

5.5 Barren and Uncultivable Waste Land

Barren rocky / stony waste are rocky exposure of different rock types, which occur as massive rock, boundaries, taluk materials, stony waste etc. the cultivable waste land is obviously more long the margins of the hilly tracks. In the study area the share of barren and cultivable Waste land found high in Nariyuthu. All other villages have less share.

In Musuvanuthu, Veelinaickanpatti, Bodiagoundanpatti, and in Batlagundu block, the share is very measure, it is in Kanavaipatti, Sandaiyur, Viralimayanpatti and Sekkapatti, Thus the discussion about the Land use pattern indirectly reflected the work participate and economic Status of the study area. (Table 1). In the year 1999 in Nilakottai block barren and uncultivable waste land shares with 5.16% and in 2019 was 5.10%.It's different between twenty years decreasing -0.06% in the current year and in Batlagundu block, in 1999, barren uncultivable land shares with 4.66% and in 2019 was 4.68%,it's increasing 0.02% of total Nilakottai taluk.

5.6 Cultivable Waste

These include land available for cultivation, where up or not taken up for cultivation once but cultivated during the last five years or more in succession including the current years for some reasons or others. Such land may be either fallow covered, with shrups and jungle, which are not put to any use they may be accessible and may lie in isolated blocks or within cultivated holding. (Table 1). In the year 1999, Nilakottai block have a cultivable waste in 0.90% and in 2019 was 0.89% it comparing decreasing 0.04% in current period. In Batlagundu block was 1999 cultivable waste 1.77% and in 2019 was 1.49% it comparing twenty years decreasing 0.28% the total Nilakottai taluk cultivable waste in 1999 was 1.29% and in 2019 was in 1.18%. It is comparing twenty years decreasing total cultivable waste in o.11% total Nilakottai taluk.

5.7 Permanent Pastures and Grazing Land

Pasture is land used for grazing, pasture lands in the narrow sense are enclosed tracts of armland, grazed by domesticated, livestock, such as horse, cattle sheep or swine soil type mimum annual temperature and rainfall are important factors in pasture is typically grazed throughout the summer.(Table1).In the year 1999 the Nilakottai block shares permanent pastures and grazing land in 0.34% and 2019 0.34% that's not change and not available in Batlagund block. Because, They have soil type, minimum temperature and rainfall so they not suitability in Batlagundu Block. In Nilakottai taluk total permanent pasture and grazing land in 1999 was 0.19% and In 2019 was 0.19% that's not change in comparing 20 years in Nilakottai taluk.

5.8 Land under Miscellaneous tree crops and groves not including Net Area Sown

This including all cultivable land which is not including in net area sown is put to some agricultural use. Land under casuring trees, thatching grasses, bamboo bushes and other groves for fuel etc. which are not include under "orchards" are classified under this category, (Table 1). In the year 1999 Nilakottai block shares land under miscellaneous tree crops in 0.04% and in 2019 was 0.75% its comparing twenty years increasing 0.28% in Nilakottai block. In Batlagundu block in 1999 was 0.86% and in 2019 was 0.97% and its comparing 20 years increasing 0.11% in totally its Nilakottai taluk was 1999 in 0.64% and in 2019 was 0.88% and its increasing 0.21%.

5.9 Land Use Classification (1999)

The outcomes of the present study are presented in (table 1).The net sown area was high in Nilakottai taluk in 1999 was 50.20% and Batlagundu block was 42% and totally Nilakottai taluk was 46.5%.(Fig 4)Half part of land was shared by net sown area and otherwise, other current fallow land was secondly shared in Nilakottai block was 12.64% and Batlagundu block was16.90% totally Nilakottai taluk shared with 14.5%. Next third rank was land put to non - agricultural (Buildings, Road, Railway lines, Rivers Canals Check dams, Swamps areas, Social forest),in Nilakottai block was 14.28% and Batlagundu block was 12,25% totally in this taluk covers 13.34% of total area.

Then fourth rank was forest at Nilakottai block in 7.10% and otherwise Batlagundu Block in 17.12% and totally Nilakottai taluk covers forest in 11.68% next fifth rank was Other fallow in Nilakottai block,8.9% & Batlagundu block 5.04% totally Nilakottai taluk in7.20%.The sixth rank of barren uncultivable land in Nilakottai block was 5.16% otherwise, totally Nilakottai taluk in 4.66% of total area. The seventh rank was cultivable waste in Nilakottai block in 0.90% and Batlagundu block in 1.77%, otherwise total Nilakottai block in 1.29% of total area. Next eight rank of land under miscellaneous trees, in Nilakottai block in 0.34% and Batlagundu block in 0.86% total Nilakottai taluk in 0.64%. Next last rank was permanent pasture and grazing land in Nilakottai block in 0.00%, because this climate was not suitable for growing grazing land. Totally Nilakottai taluk in 0.19% of the total area.

Table 1: Land Use Change in Nilakottai Taluk -1999-2019

Land Utilization	Name Of the Blocks	Nilakottai Block			Batalagundu Block			Nilakottai Taluk		
	Year /Change	1999	2019	Change	1999	2019	Change	1999	2019	Change
Fores		7.1	7.1	NIL	17.12	17.3	0.16	11.68	11.7	NIL
Barren Uncultivable Land		5.16	5.1	-0.06	4.06	4.07	0.01	4.66	4.68	0.02
Land Put To Non-Agricultural Uses		14.3	14.1	-0.52	12.25	11.4	-0.87	13.34	13.1	-0.28
Cultivable Waste		0.9	0.86	-0.04	1.77	1.49	-0.28	1.29	1.18	-0.11
Permanent Pasture And Other Grazing Land		0.34	0.34	NIL	0	NIL	NIL—0	0.19	0.19	NIL
Land Under Miscellneous Tree Crops And Groves Not Include Net Are Sown		0.47	0.75	0.28	0.86	0.97	0.11	0.64	0.85	0.21
Current Fallow Land		8.91	4.05	-4.86	5.04	0.08	-4.96	7.2	5.87	-1.33
Other Current Fallow Land		12.6	36	23.36	16.9	28	11.1	14.5	32.4	17.9
Net Sown Area		50.2	31	-19.2	42	28.7	-13.27	46.5	30.1	-16.41

Source: Statistical Hand Book Nilakottai Taluk

6. Comparison of Land Use from 1999-2019

The maximum changes occurred in other fallow land increasing 17.9% in total Nilakottai taluk. Permanent pasture and grazing land current twenty years not change, then cultivable Waste are decreasing in 0.11% of total Nilakottai taluk, in twenty years. Barren and Uncultivable waste land is increasing 0.02% of total Nilakottai taluk. Land put to non - agricultural land was decreasing -0.28% in total Nilakottai taluk. Because Nilakottai taluk was mostly covered in villages and most of the workers are farmers so non - agricultural land was decreasing. Current fallow land was decreasing -4.96% in 1999-2019, of Nilakottai taluk. Because Nilakottai taluk was poor in ground water, and minimum rainfall was occurred so current fallow land was decreasing. Net sown area was decreasing in -13.27%, because that's areas occurred low rainfall and underground

water was very low. so net sown area was decreasing. Forest area was increasing0.16% in Nilakottai taluk, that's minimum change of this taluk.(Table 1).

7. Conclusion

The present study can be analyzed foe nine fold classification changes. The total area of all kind of land use in year of 1999-2019 there was other fallow land was increasing and net sown area was decreasing. Because this taluk have a minimum rainfall and underground water level was low. This Taluk mostly used for cultivated by well irrigation. Underground water was decreasing and rainfall very low in this taluk. So save rain water in Canals, Wells, Lakes and Dams. Then they used for January to July very poor and moderate rainfall period.

Cultivate semi arid climate crops, for example paddy,millet and are short term Zaid crops like ground nut, Pulses, Vegetables, and Flowers etc. Only river flowing area was NE-SW mostly cultivated in paddy other are short term crops. Other Places are cultivated by well, canal, irrigation. Net sown area was decreasing so maximum sale our cultivated land for other farmers not soled real-estate and building and industry constructions. Farmers used only organic fertilizer to save soil and save human life.

Land use change is a process by which human activities transform the natural landscape, referring to how land has been used, usually emphasizing the functional role of land for economic activities. Land use changes are often nonlinear and might trigger feedbacks to the system, stress living conditions, and threaten people with vulnerability.Land use changes caused by urbanization; agricultural expansion and other types of human activity could put humans at greater risk of infectious disease outbreaks**.**

8. Ethical approval

Ethical approval not required. This article does not contain any studies with human participants or animals performed by any of the authors.

9. Conflict of Interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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