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Land use land cover change simulation for future scenario for Malaprabha sub-basin

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Abstract-The foremost focus of this paper is to check the land use/cover in Malaprabha sub-basin in light of the need and reason to foresee forthcoming situation of Malaprabha sub-basin. Land use characterization and examination is act utilizing a GIS and Remote detecting procedure, and GIS helped 'Markov chain' system is utilized to show the land use/cover change. In light of the past pattern (from 2000 to 2017) of land use/cover change, the forthcoming land use/cover guide of Malaprabha sub-basin for the time of 2025 & 2035 has been created. What's more, gathered maps and pictures were arranged and grouped for examination and understanding. IDRISI Selva, Land Change Modeler (LCM) was utilized to work over the land use/cover changes between different classes amid for the period 2000 & 2017. ArcGIS programming were additionally used to plan land use/cover arrangement utilizing picture preparing directed grouping strategy in a multi-fleeting methodology. Forecast of land use/cover change was done by the neural system worked in module in the Selva version of IDRISI. In this research its shows that land use/cover change in Malaprabha sub-basin of the year 2025&2035 the built-up area has been increased and the agricultural crop land, agricultural plantation, agriculture fallow land forest area has been decreased.

Index Terms- Land use Land cover, Landsat (TM), IDRISI SELVA, Image classification land change modeller, Malaprabha sub-basin.

1. INTRODUCTION

Land utilize is the human utilization of land. Land utilize includes the administration and change of common habitat (Rai. el al 2014). Physical material of the globe is called as a land cover. It joins grass, dark best, tress, revealed ground, water. Land user/cover is mainly termed as a land change which is the human's transformations in Earth's earthbound surface. The change in environment is due to greater change in land use/cover which envelops the best ecological worries of human populaces today, including environmental change, biodiversity misfortune, soils and air and contamination of water (Sundara Kumar) The collection of LULC timely information and LULC change detection for the foresee of forthcoming land use land cover image what's more, it is a most recent research which will be especially helpful to the urban arranging and natural resources management (Giri et al 2005).In this specific situation, it is truly necessary to appraise the land use changes over the time and foresee the forthcoming situation of Malaprabha Sub basin. For this investigation, an examination is performed by a remote detecting based Land Change Modeler (LCM) strategy. In light of past pattern (from 2000-2017) of land use changes, the future land utilizes forecast guide of Malaprabha sub basin and in its encompassing for the year 2025 and 2035 have been produced.(Rai. el al 2014) The outcome demonstrates that a section of the classes will change fundamentally. This sort of expository examination can be momentous in practical advancement.

1.1 Problem identification

Malaprabha watershed has been going through a rapid procedure of urbanization and population development since the most recent couple of decades. Quick development of population, rapid urbanization and industrialization in the external outskirts of Malaprabha sub basin has made weight on the adjustments in arrive utilize design.(Shahidul 2011) The area has been encountering rushed changes in arrive use for foundation improvement as of late. It is critical to think about the loss of Agricultural cropland, Agricultural plantation, Agricultural fallow land, Waterbody, forest, Built-up, Wetland/others and furthermore to perceive how and what changes happened through. The vast part of the financial advancement exercises is engaged in and around Malaprabha sub basin (Hadi 2014). The developing urbanization in the external outskirts of Malaprabha sub-basin has made additional

strain to change in land utilize design. The target of this examination in this way is to analyze and predict the future land use/cover change of Malaprabha sub-basin.

2. STUDY AREA

Malaprabha sub-basin arises at the Western Ghats of Belagavi District, Karnataka at an attitude of 792.4m at Kanakumbi town which of 16 km far from the Jamboti town, khanpur taluk, Belagavi area of Karnataka and the totally lies in Karnataka. It is a tributary of the Krishna basin and accounts 5% of Krishna basin. The sub-basin lies between 15° 45' N and 16°25' N and 74°00' E and 75°55' E and receives average of 766mm rainfall annually. Malaprabha sub-basin has total of 11,538 sq.km catchment area and located in semi-arid region in India, rainfall of this area is seasonal (Monsoon) the subsequent requirement for a supply to meet the farming and drinking requests of the region.

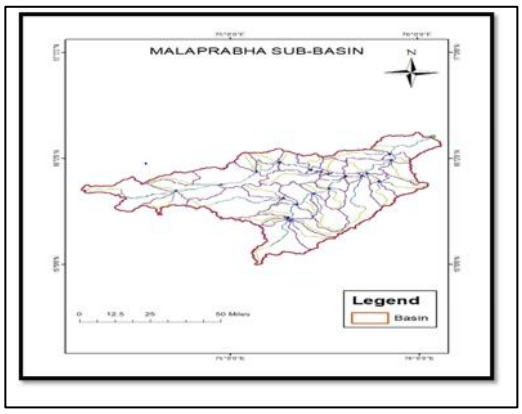

Fig. 1. Study area map

3. METHODOLOGY

Satellite image data were downloaded from USGS earth explorer site, Satellite images comprise eight bands they are having determination of 30 m from 1 to 7 bands. The determination for Band 8 (panchromatic) is 15 meters. Landsat TM and Landsat ETM of year 2000 and 2017 image were collected. The pictures are anticipated to WGS-1984 and UTM zone - 42N arrange framework.

ArcGIS 10.1 was utilized to create land use/cover arrangement in a multi-transient approach. To anticipate the forthcoming land utilize/front of the investigation territory, remote detecting based systems have been utilized. Add up to seven lands use/cover classes have been recognized for this investigation, for example, water body, woods rural decrepit land, agrarian cropland, rural ranch, developed territory and wetland/others. Each picture was independently characterized utilizing the administered arrangement most extreme probability calculation. Flow chart of methodology is shown in the (fig 2)

Land Change Modeller for natural maintainability is coordinated programming created by IDRISI Selva for analysing land cover changes. The land use/cover changes show the instruments bolster of land examination. Usage of the model in like manner gives an unrivalled approach of the components of the land utilize frameworks and the assistance required for organizing and technique makes. Setup can likewise anticipate the conceivable future change and utilization of the land use/cover towards the various situation. By utilizing this two land cover maps were investigated that have indistinguishable legends. The change examination board gives a quick appraisal of perceptible change is increases & misfortunes arrive cover classes. The second alternative, net change, demonstrates the after effect of taking the prior land cover zones, including the increases what's more, subtracting the misfortunes. The third alternative is to analyze the commitment to changes accomplished by a single land cover. Its research has been done between the sets of Landsat (TM) pictures of the year 2000 and 2017.

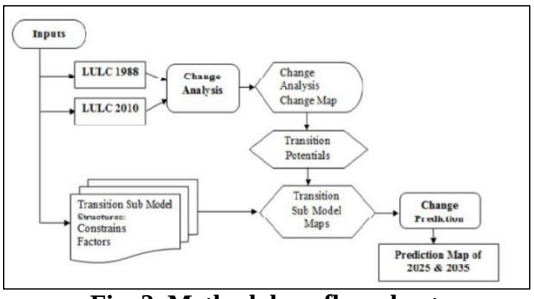

Fig. 2. Methodology flow chart

4. RESULTS AND DISCUSSION

From both the grouped pictures of 2000 & 2017, the territory of each land use/cover classifications was registered (Table 1; Fig 3 & 4) and looked at measurably if there are contrasts between the picture

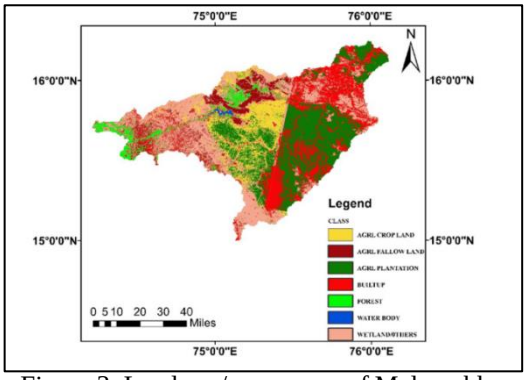

Figure 3. Land use/cover map of Malaprabha sub-basin of the year 2000

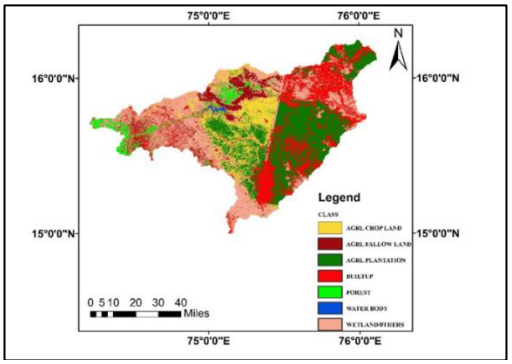

Fig. 4. Land use/cover map of Malaprabha sub-basin of the year 2017

From the table,1 it is clearly shows that the land use/cover classes for Water body, Forest Agricultural fallow land, Agricultural cropland and Built-up area has been increased and Agricultural plantation and wetland/others have been decreased in Malaprabha watershed as there no change in total land cover of Malaprabha Sub-basin area is 11538 sq.km.

Table 1. Land use/cover changes between the year of 2000&2017

Lulc classes	Lulc area 2000 year (sq.km)	Lulc area 2017 year (sq.km)	Lulc area in % (2000)	Lulc area in % (2017)	% change from (2000-2017)
Water body	29	28.10	0.25	0.24	0.01
Forest	116.09	487.32	9.67	4.22	5.45
Agricultural fallow land	978.29	745.51	8.47	6.46	2.01
Agricultural crop land	2514.87	1246.56	21.79	10.86	10.99
Agricultural plantation	2983.95	3024.61	25.86	26.21	-0.35
Built-up area	2857.81	2605.09	24.76	22.57	2.19
Wetland/others	1057.85	3400.01	9.16	29.37	-20.77
Total	11538	11538			

4.1. Change detection analysis using land change modeler method

Land Change Moeller was utilized to separate the land utilize/cover changes for different land use/cover types (classes) amid the period 2000-2017. A fundamental standard back of the module is to assess the pattern of the change from one land utilize class to other, the affecting components, for example, slope, road, aspect and soil type, lastly predict the land utilize design light of the ago change drift. The land change module works on neural system and requirements to carry out higher exactness, however, precision build up on impact factors. The gains & losses by various classes are assessed by land use/cover changes. Amid the time of 2000-2017, the greater part of the land utilizes/cover classes have the two gains and losses, for example, water body has been lost 12.14% and increased 11.43% with the net loss of 0.71%. Forest has been lost 76.50% and increased 46.18% with the net loss of 30.32%. The agricultural fallow land has been lost 75.54% and increased 50.65% with net pick up of 24.89%. Agricultural plantation has been lost 41.50% and increased 42.29%with net picks up of 0.79 %. Agricultural cropland has been lost 60.19% and increased 47.76% with net pick up of 12.43%. The built-up region has been lost 57.99% and increased 53.91%with net gain 4.08%.Wetland/others have been lost 33.89% and increased 79.43% with the net loss of 45.54 %. (Fig 5)

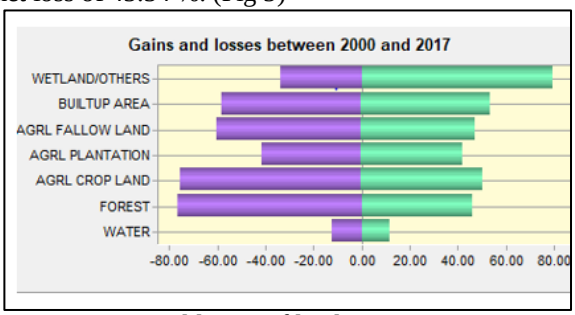

Fig. 5. Gains and losses of land use/cover categories between 2000&2017

From the figure, it shows the huge changes and transitions different land utilize/cover classes during the year of 2000 and 2017. The figure appears the principle changes and transition are fundamentally among agricultural land, built-up and wetland/others

4.2 Constraints and Factors

Requirements is criteria that breaking point the extension of developed land utilize. Physical imperatives can be existing developed territory, water bodies (streams), street organize etc. It is superfluous to do this for a basic land change modeler expectation. All components may keep up their unique qualities height, separation to streets, etc.do not need to be institutionalized the work effectively in a model. Factors are a criterion that enhances or diminish from the suitability of a

specific alternative under consideration. Regardless, in the event of variables, it is unique and they give a level of appropriateness for a region to change. The accompanying element has built for the displaying: distance from road network, digital elevation model of Malaprabha watershed, aspect map of Malaprabha watershed, slope map of Malaprabha (Fig 6&7). A tab is last change displaying step. This gives the two land change modellers; the multi-layer perceptron neural system and calculated relapse. For numerous factors is to show meanwhile multi-layer perceptron is picked. In addition, multi-layer perceptron neural system is very equipped for displaying non-direct connections and the most powerful land cover change models.

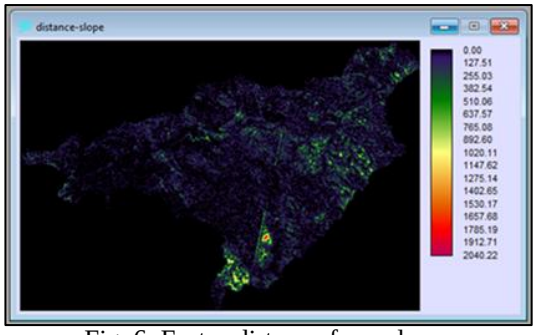

Fig. 6. Factor distance from slope map

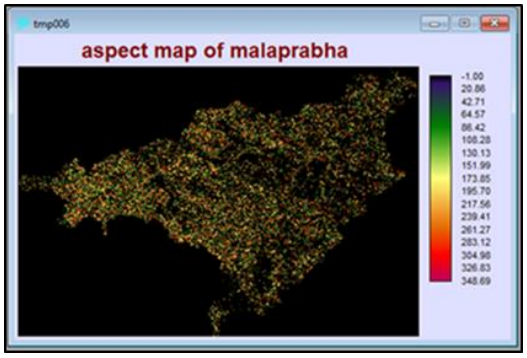

Fig. 7. Factor distance from aspect map

4.3. Multi-layer perceptron (MLP) neural network

This multilayer neural network system relies upon the Back propagation (BP) calculation that is a directed preparing calculation. Typical technique for preparing Artificial Neural Networks. From a coveted yield, the system gains from numerous data sources. A Multi-Layer Perceptron (MLP) is fed in advance counterfeit neural system demonstrate that maps sets of toward information onto an arrangement of fitting yield. A multi-layer perceptron contains different layers of centers in an organized diagram, with each layer totally associated with the accompanying one.

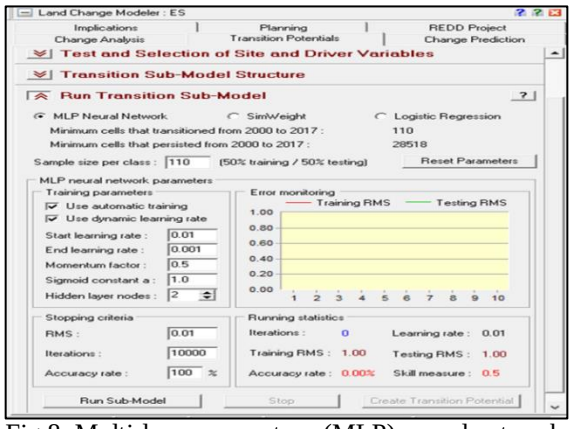

Fig.8. Multi-layer perceptron (MLP) neural network classifier proses

From the (fig 9, 10&11) are the transition potential maps which are obtained by multi-layer perceptron has completed 10000 emphases of preparing and testing with half of the exactness.

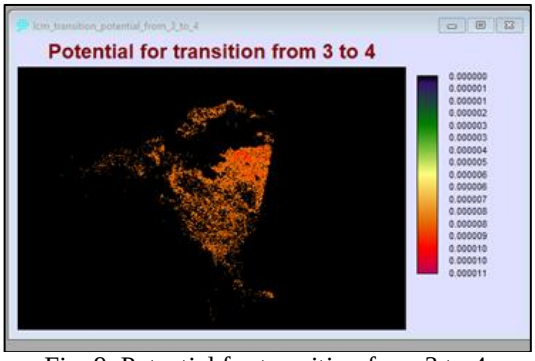

Fig. 9. Potential for transition from 3 to 4

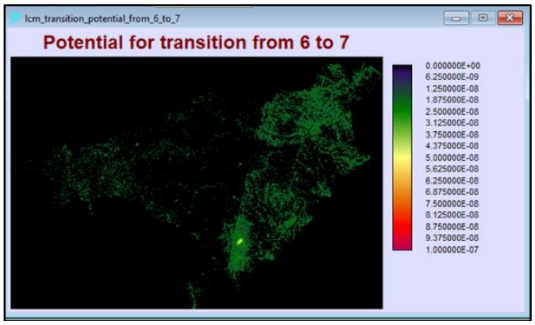

Fig. 10. Potential for transition from 6 to 7

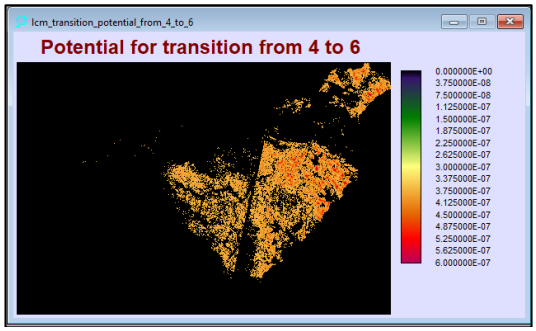

Fig. 11. Potential for transition from 4 to 6

4.4 Markov chain modelling

Markov Chain decides is a measure utilizing the earlier and later land cover images alongside the date indicated. This technique decides precisely how much land would be relied upon to progress from later to predicted date in light of a projection of change possibilities of the future and makes a change possibility document. Progress possibility document organize is that records probability in which each land cover characterization will be changed to each different class. The Markov Chain is an arbitrary procedure where the going with transition relies upon the present state. Markov produces change frameworks (Table 02 & 03), the progress territory network furthermore, an arrangement of contingent likelihood picture by examining two grounds utilize and land cover pictures (Fig 10,11&12) from two dates (2000 & 2017). From the table, the lines remain for more seasoned land utilize/cover classes and sections remain for more current land utilize and arrive cover classifications (Table 02 & 03).

Table 2. Markov prediction to 2025 based on land use/cover map of year 2000&2017

Transition Probabilities Grid

Given : Probability of changing to :

	WATER BODY	FOREST	AGRL CROP	AGRL PLANTATION	AGRL FALLOW LAND	BUILTUP AREA	WETLAND/OTHERS
WATER BODY	0.9403	0.0000	0.0000	0.0000	0.0000	0.0136	0.0461
FOREST	0.0000	0.3581	0.0330	0.0333	0.0047	0.1184	0.4524
AGRL CROP LAND	0.0000	0.0252	0.3569	0.2908	0.0000	0.1414	0.1858
AGRL PLANTATION	0.0000	0.0000	0.1068	0.7132	0.0000	0.1329	0.0471
AGRL FALLOW LAND	0.0000	0.0000	0.0000	0.0000	0.5458	0.1104	0.3438
BUILTUP AREA	0.0006	0.0079	0.0865	0.1202	0.0406	0.5476	0.1966
WETLAND/OTHERS	0.0001	0.0607	0.0000	0.0059	0.0878	0.1031	0.7425

Table 3. Markov prediction to 2035 based on land use/cover map of 2000&2017

Transition Probabilities Grid

Given : Probability of changing to :

	WATER BODY	FOREST	AGRL CROP LAND	AGRL PLANTATION	AGRL FALLOW LAND	BUILTUP AREA	WETLAND/OTHERS
WATER BODY	0.8706	0.0038	0.0008	0.0007	0.0000	0.0296	0.0945
FOREST	0.0001	0.1401	0.0364	0.0679	0.0575	0.1696	0.5285
AGRL CROP LAND	0.0001	0.0308	0.1579	0.3285	0.0179	0.1963	0.2685
AGRL PLANTATION	0.0000	0.0072	0.1292	0.5317	0.0000	0.1997	0.1322
AGRL FALLOW LAND	0.0000	0.0242	0.0041	0.0000	0.3073	0.1670	0.4975
BUILTUP AREA	0.0010	0.0236	0.0895	0.1832	0.0628	0.3328	0.3081
WETLAND/OTHERS	0.0003	0.0667	0.0104	0.0262	0.1212	0.1589	0.6163

From the table 04 the projected land use/cover map for the year 2025 and 2035. It is clearly shown that land use/cover classes for Built-up area has been increased by 4.41% and Forest area, Agricultural cropland, Agricultural plantation, Agricultural fallow land and Wetland/others area has been decreased in Malaprabha watershed as there is no change in total land cover of Malaprabha watershed area is 11538 sq.km. From (Fig 13) shows area statistic of different land use/cover classes between 2000, 2017, 2025 and 2035.

Table 4. Land use/cover changes between the year of 2025&2035

LULC CLASSES	LULC AREA 2025 YEAR (Sq.km)	LULC AREA 2035 YEAR (Sq.km)	LULC AREA IN % (2025)	LULC AREA IN % (2035)	% CHANGE FROM 2000-2017
Water body	28.49	28	0.25	0.24	0.01
Forest area	479.43	482.91	4.15	4.2	-0.05
Agricultural fallow land	733.50	738.89	6.35	6.5	-0.15
Agricultural crop land	828.39	1082.23	7.19	9.37	-2.18
Agricultural plantation	2976.01	2997.28	25.29	26	-0.71
Built-up area	2422.14	2136.89	21.41	17	4.41
Wetland/others	4069.62	4071.80	35.01	37	-1.99
TOTAL	11538	11538			

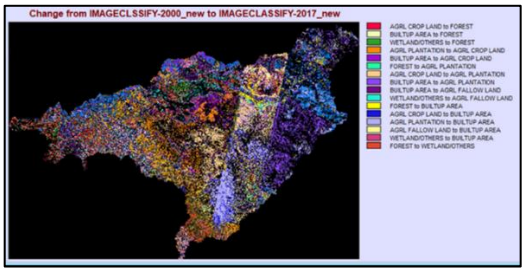

Fig.10. land use/cover classes' changes from the year 2000 to 2017

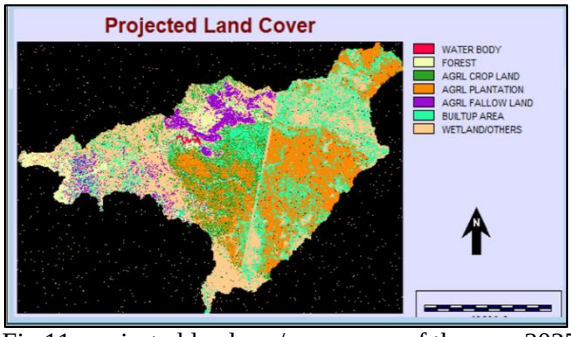

Fig.11. projected land use/cover map of the year 2025

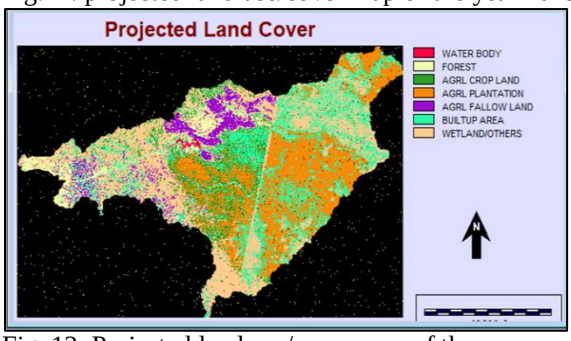

Fig. 12. Projected land use/cover map of the year 2035

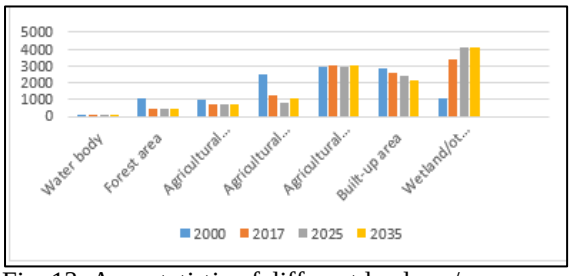

Fig. 13. Area statistic of different land use/cover classes among 2000, 2017, 2025&2035

5. CONCLUSION

In this study satellite recorded data with ArcGIS software application is used to create the land use/cover map of the year 2000 and 2017 and incorporated with IDRISI Selva software to anticipate the future land utilize/front of the yare 2025 and 2035 of Malaprabha sub-basin. The Malaprabha sub-basin has encountered change in land use/cover between the year of 2000-2017 the results shows the increases in built-up area, agricultural fallow land, agricultural crop land and forest and significantly deceases in agricultural plantation and wetland/others. Using IDRISI Selva the future map for the year 2025 and 2035 of Malaprabha sub-basin land use/cover map has been projected in light of the year of 2000-2017. The results clearly shows that built up area is increasing (4.41%), while there are fluctuating decreasing trends for other land cover classifications, for example, Agricultural Fallow land (0.15%), wetland/others (1.99%), Agricultural cropland (2.18%), and Agricultural plantation (0.71%) and also the forest area (0.05%) whereas water body is being consistent with negligible change. Also the present demonstrated the efficiency of remote detecting in the investigation of land utilize/cover change. Land use /cover management prescriptions for Malaprabha sub-basin

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