STUDY OF LAND USE CHANGE FROM 1997 TO 2014 USING LANDSAT DATA IN BANGLI REGENCY

N**uranita naningsi**
[1]Program Studi Teknik Industri, Fakultas Teknik, Universitas Mahendradatta
Jl. Ken Arok No.12, Peguyangan, Denpasar, Bali 80115
Email: nuranitananingsi@yahoo.co.id

Abstrak *– Kabupaten bangli adalah merupakan kabupaten satu-satunya diwilayah kabupaten di Provinsi Bali yang tidak memiliki pantai dengan luas 52.081 Ha atau 9,24% dari luas wilayah Provinsi Bali (563.666 Ha). Pertumbuhan dan perkembangan wilayah di kabupaten Bangli berdampak positif terhadap perekonomian masyarakat namun juga berdampak negatif terhadap lingkungan. Alih fungsi lahan menjadi salah satu isu negatif dari perkembangan wilayah Kabupaten Bangli. Penelitian ini bermaksud untuk menghitung besarnya perubahan fungsi lahan yang terjadi dalam kurun waktu 17 tahun (1997 – 2014) di kabupaten Bangli.*

Citra Landsat 5 TM, Landsat 7 ETM+ dan Landsat 8 OLI/TIRS digunakan dalam penelitian ini untuk mengetahui peta penggunaan lahan. Peta penggunaan lahan diperoleh melalui proses klasifikasi citra dengan menggunakan metode supervised kemudian diverifikasi menggunakan data lapangan. Teknik klasifikasi supervised terbagi menjadi 9 klas yaitu danau, lahan kosong, hutan, pemukiman, semak belukar, sawah irigasi, sawah tadah hujan, tegalan, dan perkebunan. Hasil analisis memperlihatkan perubahan penggunaan lahan pada tahun 1997 - 2003 yakni danau bertambah 3,60(0,00%), pemukiman (2.777,00 ha (5,32%)), dan tegalan bertambah (1.866,80 ha (35,84%)) sedangkan lahan kosong (-99,00 ha (-0,19%)), hutan (-223,90 ha (-4,29%)), semak belukar (-629,10 ha (-1,21%)), sawah irigasi (-679,50 ha (-1,30%)), sawah tadah hujan (-515,70 ha (-0,99%)) dan tegalan (-17.287,20 ha (-33,19%)) cenderung berkurang. Ditahun 2003 - 2014 yakni yang mengalami perubahan besar adalah perkebunan (918,90 ha (1,76%)), kemudian pemukiman (569,70 ha (1,09%)), lahan kosong (36,00 ha (0,07%)), semak belukar (91,80 ha (0,18%)), dan sawah tadah hujan (502,20 ha (0,96%)), sedangkan yang berkurang danau (-6,30 ha (-0,01%)), hutan (-0,60 ha (0,00%)), sawah irigasi (-540,00 ha (-1,04%)), dan tegalan (-1.571,70 ha (-3,02%)). Hasil prediksi ini diperoleh dengan tingkat akurasi sebesar 89,45%. Hasil analisis penggunaan menunjukkan luas perkebunan khususnya pada wilayah kabupaten bangli sangat tinggi, akan tetapi meningkatnya pengembangan sarana penunjang pariwisata yang sangat pesat mempengaruhi luas penggunaan lahan, kemudian areal pemukiman mengalami peningkatan luas yang cukup tinggi, khususnya diwilayah kecamatan kintamani.

Kata Kunci : *Perubahan penggunaan lahan; data satelit LANDSAT; Kabupaten Bangli.*

Abstract – *Bangli Regency is a district the only region in the province of Bali district that does not have a beach with an area 52,081 hectares or 9.24% of the total area of Bali Province (563,666 ha). Growth and development in the region Bangli Regency give the positive impact on the economy of the community, but also give the negative impact on the environment. Land use change conversion into one of the negative issues of development Bangli Regency. This study intends to calculate the amount of land conversion that occurred area within 17 years (1997-2014) in Bangli Regency.*

Landsat 5 TM, Landsat 7 ETM + and Landsat 8 OLI / TIRS imageries were used to determine the land use map. Land use maps obtained through the process image classification using supervised methods then verified using field data. Supervised classification techniques are divided into nine classes, namely the fresh water, bare land, forest, settlements, shrubs, irrigate paddy field, un irrigate paddy field, dry land and plantations. The results show changes in land use from 1997 until 2003 that fresh water increased 3.60 (0.00%), residential increased (2,777.00 ha (5.32%)), and dry land increase (1,866.80 ha (35.84%)) while the bare land (-99.00 ha (-0.19%)), forest (-223.90 ha (-4.29%)), shrubs (ha -629.10 (-1.21%)), irrigated paddy field (-679.50 ha (-1.30%)), Un irrigate paddy field (-515.70 ha (-0.99%)) and dry land (-17,287.20 ha (-33.19%)) tends to decrease. During the period 2003 - 2014 there is a change of land use in Bangli Regency, the biggest change occurred in Plantation reached (918.90 ha (1.76%)), Subsequent changes occurred in the function of residential/urban growth increased (569.70 ha (1.09%)), bare land (36.00 ha (0.07%)), Bushes (91.80 ha (0.18 %)), and un irrigate paddy field (502.20 ha (0.96%)), Besides the addition, there is also a vast reduction in fresh water (-6.30 ha (-0.01%)), forest (-0.60 ha (0.00%)), irrigated fields (-540.00 ha (-1.04%)), and dry land (-1,571.70 ha (-3.02%)). The results obtained with this prediction accuracy rate of 89.45%. Anslyze of land use showed that significant decrease of plantantion area in

bangli regency hill, due to rapid development of infrastrusture of tourism is very rapid and then extensive residential area have increased particularly in sub district of the kintamani district.

Keyword: *Land Use Change; Landsat data; Bangli Regency.*

INTRODUCTION

Along with the development of ever increasing population, the need for land to be used as residential and agricultural land so plantations perceived increasing as well. This causes the land conversions, both from agricultural land into residential areas or of forests into plantations and agriculture.

Land use is the soil-forming factor is the determinant of the outcome of any intervention activities of the land surface of the earth man who is dynamic and serves to meet the needs of both material and spiritual life (Arsyad, 1989).

Bangli Regency is a regency on Bali that does not have a beach area and most of the area is a plateau, it affects the activity of the population and population density. This activity led to the forest population metamorphose into agricultural land, both legally and illegally.

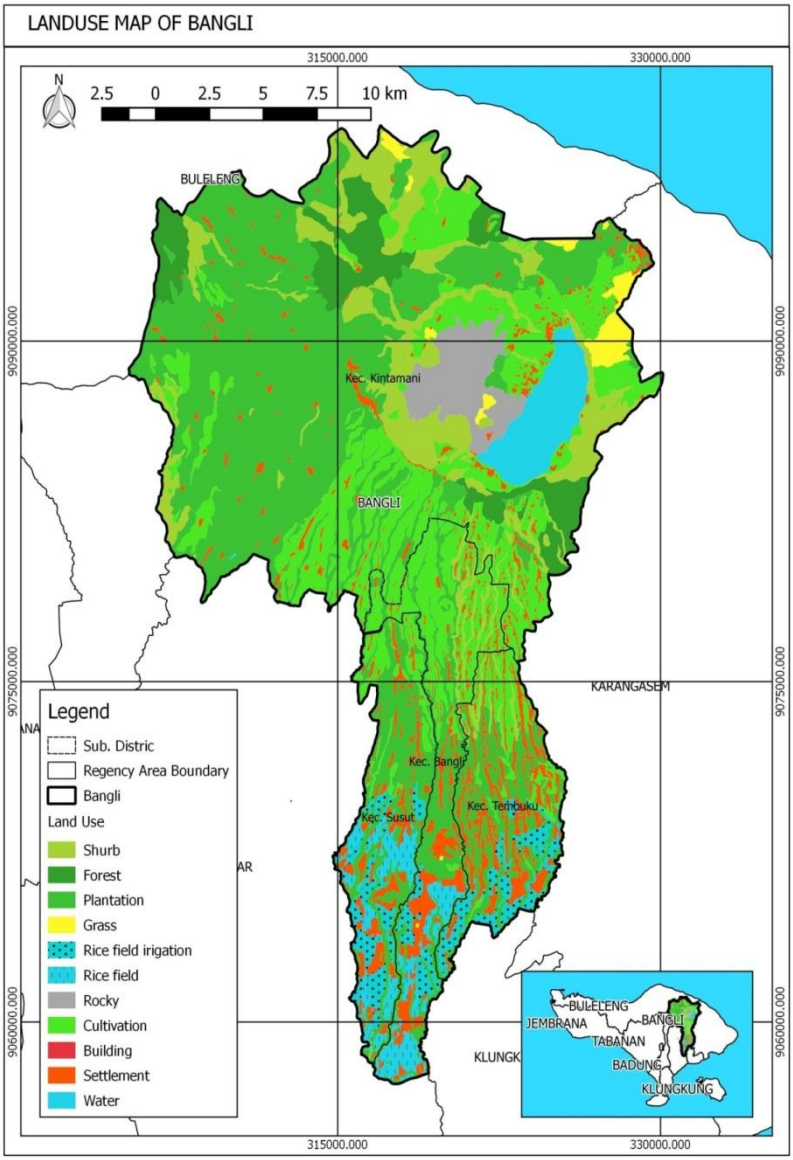

Figure 1. Research Location (RTRW, 2009)

The impact of land use change from forest to non-forest and to non- agricultural already benefit both socially and economically (Tang, 2005).

Looking at the above conditions, the need for a strategic and solution for the management classification of land use synergies in accordance with the characteristics of the region. For this study was conducted to find the public perception in the preservation of land use in Bangli Regency using Landsat data.

RESEARCH METHOD

Research Location

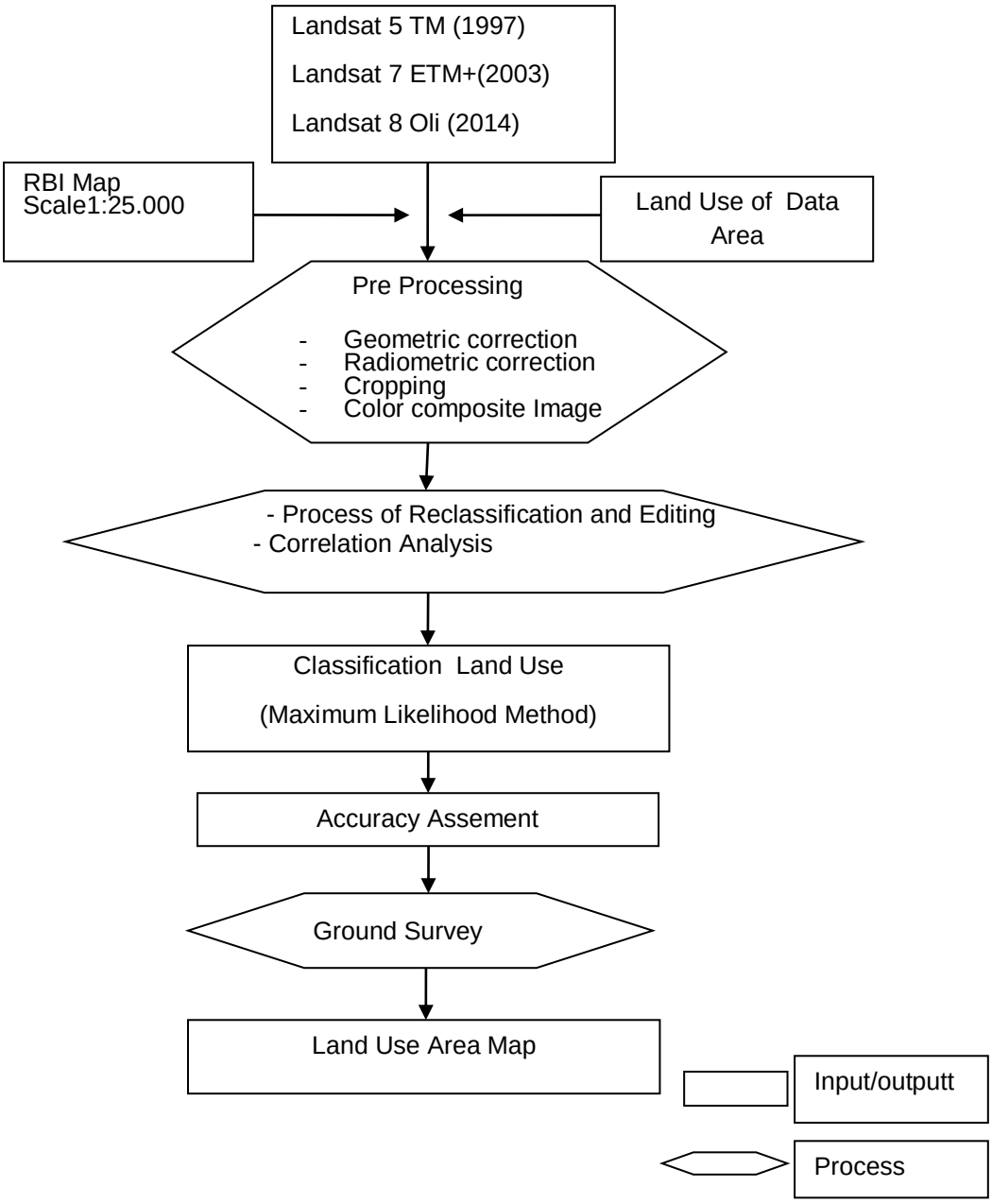

Figure 2. Concept Research

This research was conducted in Bangli Regency. It is located in between $8^0$8'30 '' until $8^0$31'87 '' South latitude and between $115^0$27'48 '' until $115^0$27'24'' east longitude, with an area of 52.081 Ha or 9.25% of the total area of Bali Province (563.666 ha). Bangli Regency has 4 Regional District and 72 villages/wards. Administratively, the study area is at the boundaries of the following: (1) northern part of Buleleng Regency, (2) the eastern part of Karangasem Regency, (3) southern part of Klungkung Regency and, (4) western part of Gianyar Regency and Badung Regency. The study was conducted in Bangli Regency. Location of the study is showed in Figure 1.

17th 2014, path 116 row 66 from USGS; 2). Geometric is ageographic position associated with the spatial distribution (spatial distribution); 3). Convert DN value of Landsat Imageries into reflectance value of the surface (radiometric correction); 4). Cropped Landsat Imageries; 5). Created composite RGB of Landsat imageries; and 6). Landsat imageries classification used supervised with maximum llikelihood method.

Research Scope

This study is about the process of land use changes, includes fresh water, bare land, residential, bushes, irrigate paddy field, un irrigate paddy field, dry land and plantation during 1997- 2014.

Land Cover Change detection

Landsat data in 1997, 2003 and 2014 were classified the land use by supervise classification with maximum likelihood method to particular nine catelogies, namely : fresh water, bare land, residential, bushes, irrigate paddy field, un irrigate paddy field, dry land and plantation.

RESULT AND DISSCUSION

Land Use Change detection

The interpretation of satellite imageries conducted to get land use map. Its took a few step to get land use map, namely: 1). Downloaded Landsat 5 TM imageries acquisition August 19th 1997, Landsat 7 ETM+ imageries acquisition March 21st 2003 and Landsat 8 OLI/TIRS imageries acquisition of July

The classification results in rresearch location Bangli regency in 1997, 2003 and 2014 with nine categories including fresh water, bare land, residential, bushes, irrigate paddy field, un irrigate paddy field, dry land and plantation land are shown Figure 3.

The total area of Bangli Regency is 52.080.00 ha. Inside, the land use classification for 1997 (figure 3 - a) showed that majority of the study area was fresh water accounting for 1,878.27 ha (3.61%), bare land 2,154.57 ha (4.14%), forest 5,151.57 ha (9.89%), residential 1,650.57 ha (3.17%), bushes 5,225.37 ha (10.03%), irrigate paddy field 3,211.17 ha (6.17%), un irrigate paddy field 1,546.17 ha (2.97%), dry land 30,770.07 ha (59.08%), and plantation 492.27 ha (0.95%) respectively (Table 1).

Land use area and percent coverage for 2003 (figure 3 - b) show that fresh water 1,881.87 ha (3.61%), bare land 2,055.57 ha (3.95%), forest 2,918.67 ha (5.60%), residential 4,422.57 ha (8.49%), bushes 4,596.27 ha (8.83%), irrigate paddy field 2,531.67 ha (4.86%), un irrigate paddy field 1,030.47 ha (1.98%), dry land 13,482.87 ha (25.89%), and plantation 19,160.07 ha (36.79%) respectively (Table 1).

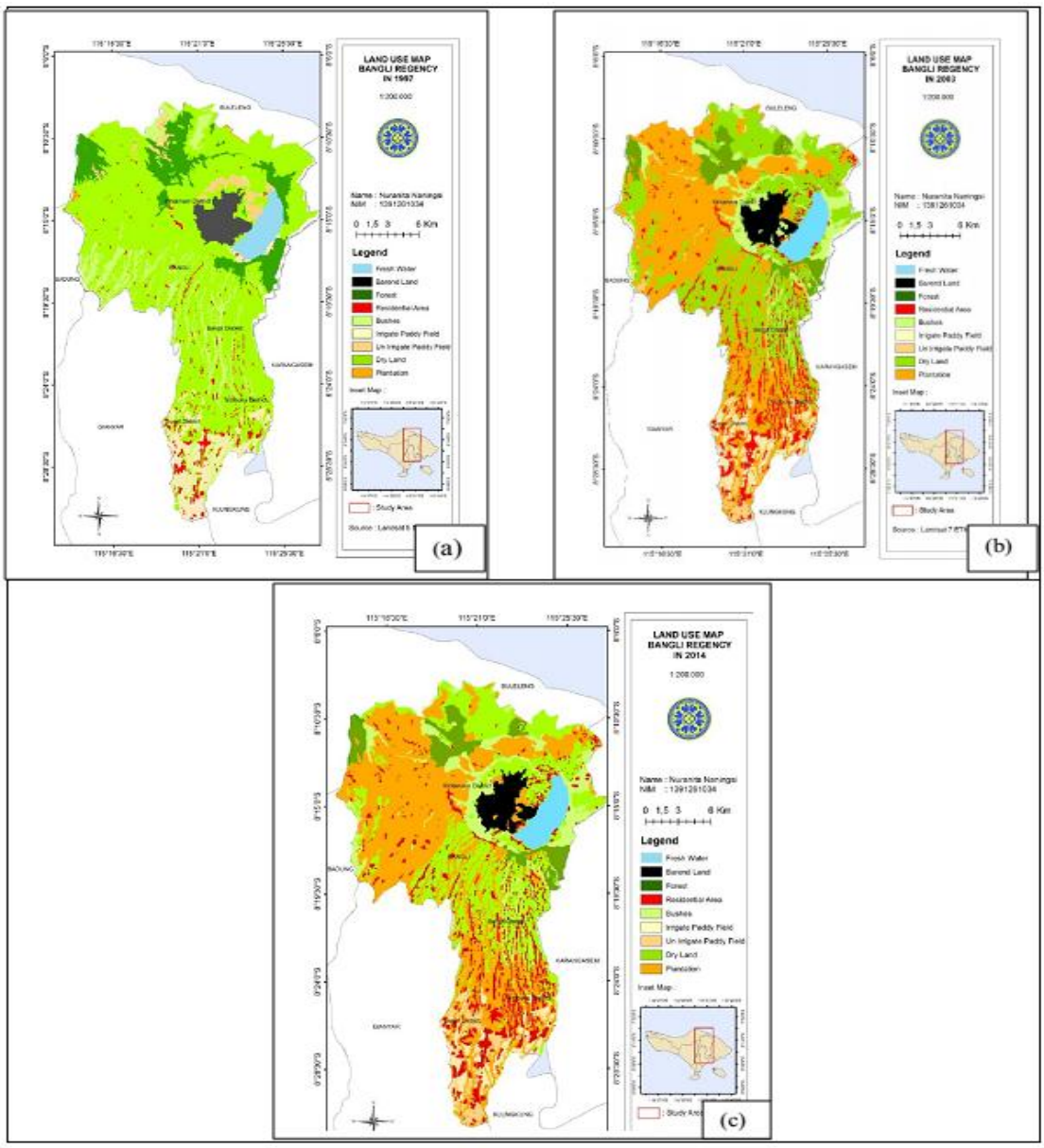

Figure 3. Land Use Map Bangli Regency in 1997 (a), 2003 (b) and 2014 (c)

Land use area and percent coverage for 2014 (figure 3 - c) also shows that fresh water 1,875.57 ha (3.60%), bare land 2,091.57 ha (4.20%), forest 2,918.07 ha (5.60%), residential 4,992.27 ha (9.59%), bushes 4,688.07 ha (9.00%), irrigate paddy field 1,991.67 ha (3.82%), un irrigate paddy field 1,532.67 ha (2.94%),dry land 11,911.17 ha (22.87%), and plantation 20,078.97 ha (38.55%) respectively Table 1. Most portion of the land use class was during this period.

Table 1.

Land Use classes, area and percent coverage change in Bangli Regency from 1997 - 2014

No	Class name	1997		2003		2014	
		Ha	%	Ha	%	Ha	%
1	Fresh Water	1,878.27	3.61	1,881.87	3.61	1,875.57	3.60

2	Bare Land	2,154.57	4.14	2,055.57	3.95	2,091.57	4.02
3	Forest	5,151.57	9.89	2,918.67	5.60	2,918.07	5.60
4	Residential	1,650.57	3.17	4,422.57	8.49	4,992.27	9.59
5	Bushes	5,225.37	10.03	4,596.27	8.83	4,688.07	9.00
6	Irrigate Paddy Field	3,211.17	6.17	2,531.67	4.86	1,991.67	3.82
7	Un Irrigate Paddy Field	1,546.17	2.97	1,030.47	1.98	1,532.67	2.94
8	Dry Land	30,770.07	59.08	13,482.87	25.89	11,911.17	22.87
9	Plantation	492.27	0.95	19,160.07	36.79	20,078.97	38.55
	Total Area	**52,080.00**	**100.00**	**52,080.00**	**100.00**	**52,080.00**	**100.00**

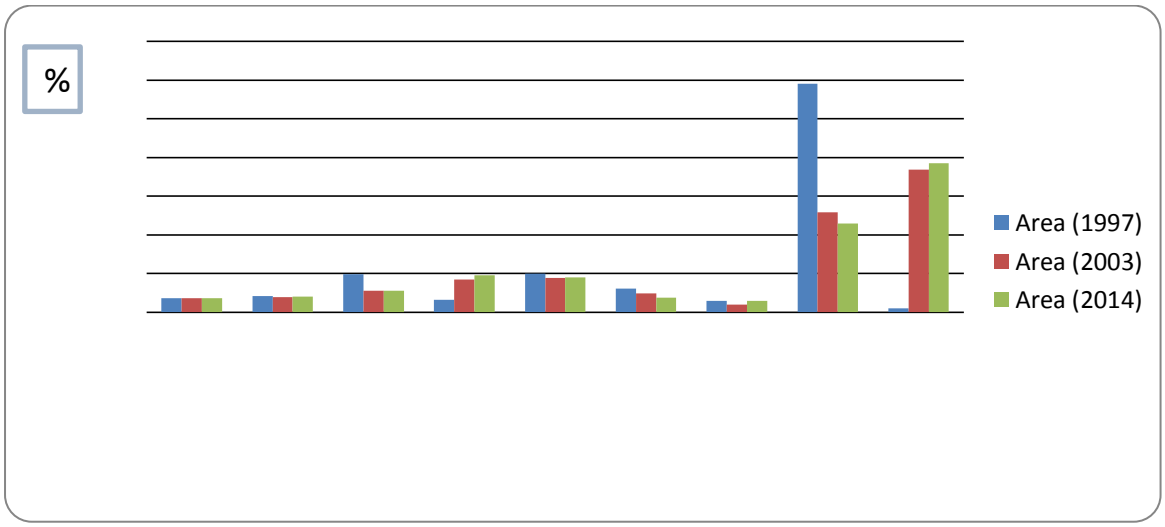

Figure 4. indicated land use change detection in Bangli Regency from 1997 – 2014 is represented Table 1 data

Table 2.

Land Use change , area and percent coverage change in Bangli Regency from 1997 - 2014

No	Class name	Land Use Change 1997-2003		Land Use Change 2003-2014	
		Ha	%	Ha	%
1	Fresh Water	3.60	0.00	-6.30	-0.01
2	Bare Land	-99.00	-0.19	36.00	0.07
3	Forest	-223.90	-4.29	-0.60	0.00
4	Residential	2,777.00	5.32	569.70	1.09

5	Bushes	-629.10	-1.21	91.80	0.18
6	Irrigate Paddy Field	-679.50	-1.30	-540.00	-1.04
7	Un Irrigate Paddy Field	-515.70	-0.99	502.20	0.96
8	Dry Land	-17,287.20	-33.19	-1,571.70	-3.02
9	Plantation	18,667.80	35.84	918.90	1.76

During 1997 – 2014 in Bangli regency land use change detection (Table 2) shows the total area of Bangli regency is 52.080.00 ha. The percentages of land use change for 1997 - 2003 are fresh water (3.60 ha (0.00%)), bare land (-99.00 ha (-0.19%)), forest (-223.90 ha (-4.29%)), residential (2777.00 ha (5.32%)), bushes (-629.10 ha (-1.21%)), irrigate paddy field (-679.50 ha (-1.30%)), un irrigate paddy field (-515.70 ha (-0.99%)),dry land (-17,287.20 ha (-33.19%)) , and plantation (18,667.80 ha (35.84%)).

The are percentages of land use change for 2003-2014 are fresh water (-6.30 ha-(-0.01%)), bare land (36.00 ha (0.07%)), forest (-0.60 ha (0.00%)), residential (569.70 ha (1.09%)), bushes (91.80 ha (0.18%)), irrigate paddy field (-540.00 ha (-1.04%)), un irrigate paddy field (502.20 ha (0.96%)), dry land (-1,571.70 ha (-3.02%)), and plantation (918.90 ha (1.76%)). Most portion of the land use change class was during this period.

CONCLUSION AND SUGGESTION

Conclusion

The study of land use change classification map in Bangli Regency was created in 1997, 2003 and 2014 with nine categories. Accuracy of assessment in 2014, overall accuracy was 89.45%. Its result is a good.

From this study it can be concluded that the method of remote sensing can be used as a tool in the analysis of land use changes. The results of the analysis determines the change of land in 1997 - 2014 region Bangli district namely the addition of land and reduction of land. Knowledge of the land change can be used to determine the quality of the environment.

Suggestion

1. For researchers, the use of Landsat image as a source of data in order to map the Land use areas with image interpretation technique can give sufficient information about the extent of the area, because the accuracy that obtained is good enough.

2- It is needed to carry out further research using a new image to compare the accuracy obtained and the changes land use areas and to compare the land use change and correlation analysis.

3. The time of intake of training area be carefully because it determine correctness of digital classification.

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