Appendix

Data text file

Plot	PlotID	LU82	LU00	x	y	Area	Location
1	208001	F107	F307	685681.4	784296.8	185961.1	3
2	208002	F107	F106	685342.3	784453.1	129548	3
3	208003	F107	M2	685686.2	783625.9	491523.8	3
4	208005	F105	M102	684944.7	784350.6	274733.9	3
5	208006	F107	M102	685247.3	784180.8	102405.4	3
6	208008	A101	F105	685726.8	782178.9	1150806	3
7	208009	F105	F105	686058.9	781219.6	2961599	3
8	208010	F105	M303	684946	784056.2	139097.9	3
9	208012	F105	A220	685203.2	783892.9	102601.1	3
10	208015	F105	M102	686024	782339.9	687107.7	3
11	208016	U200	A405	686040.9	783571.9	150226.4	3
12	208018	F105	A101	684440.3	783030.1	195834.1	3
13	208021	F105	M102	685143	782206.8	774707.4	3
14	208023	F105	M2	685184.2	781837	504801.3	3
15	208024	A101	M102	685708.7	782409.9	473221.9	3
16	208025	F105	F105	685603.2	783342.8	175151.3	3
17	208026	F107	F105	686054.3	783029.1	140587.4	3
18	208027	F107	F307	686854.5	782653.5	381992.4	3
19	208028	F105	A100	684383.8	782953.5	18755.14	3
20	208030	F106	M2	686919.2	782105.1	610427.3	3
21	208034	F105	F105	686583.7	781813.1	433553.8	3
22	208036	F105	F105	685198.3	781506.6	360291.3	3
23	208037	F106	F105	686902.3	781622.7	122238.6	3
24	208038	F107	W101	688395.2	779853.8	925902.6	2
25	208040	F107	F307	687798.1	781312.3	117776.5	2
26	208041	F105	A101	685358.3	780705.6	654541	3
27	208044	F106	A405	687619.2	781038.9	929181.2	2
28	208045	U200	F105	687663.5	780635.8	277113.3	2
29	208047	U200	U201	687127.3	781017.8	101030.1	3
30	208049	F105	F105	687344.9	780458.8	638582.4	3
31	208051	F105	A302	685019.3	780731.6	48360.38	3
32	208052	F105	F307	690062.4	778267.2	789673.2	4
33	208060	F105	W101	687119.3	780249.1	33874.71	2
34	208061	F105	A405	685212.6	780185	45520.86	3
35	208062	F106	A903	688238.7	779934.8	177707.7	2
36	208065	F105	M102	687703.4	779872.2	126190.8	3
37	208066	U200	F105	687313.9	780045	25782.98	2
38	208068	U200	M102	687506.6	779877.5	36690.76	2
39	208069	U200	W101	687386.3	779870	55372.38	2
40	208071	F105	A405	688726.6	779759.1	52214.05	4
41	208072	U200	F105	686933	779860.6	49548.74	3
42	208075	A405	A405	688459.8	779392.3	398452.6	2
43	208076	A101	U201	687250.3	779818.9	60718.13	2
44	208078	F105	M102	690475.8	777238	2538570	4
45	208079	U200	U201	687008.1	779690.3	71759.03	3
46	208080	A302	F105	684925.4	779495.8	72923.33	3
47	208081	F106	M102	687745.4	779615.4	72397.09	2
48	208084	A302	A302	685432.4	779105.9	491086.1	3
49	208086	A101	A100	687491.1	779401.9	119234.3	2

Plot	PlotID	LU82	LU00	x	y	Area	Location
50	208089	U200	A405	687125.6	779517	48581.95	3
51	208090	U200	A100	687273.5	779511.8	33059.36	3
52	208092	A405	A405	686918.6	779020.6	541460.5	3
53	208093	F105	F105	685161.4	779439.6	44270.94	3
54	208094	A405	F105	686539.6	779259.4	35793.35	3
55	208095	A302	A302	684920.5	779389.3	17382.25	3
56	208097	A101	A405	688461.3	779271.8	59233.88	4
57	208101	A405	A100	687315.5	779247.8	34714.93	3
58	208103	A101	A903	687591.6	779179.7	66343.19	2
59	208109	F105	A405	689034.6	779254	36832.84	4
60	208110	A101	A903	687912.7	778645	378788	2
61	208111	A302	A405	685046.6	779165.1	20009.28	3
62	208113	A101	A101	689010.6	779024	167741.9	4
63	208115	A101	F105	686312.4	778913.3	295638.2	3
64	208116	A405	A903	687696.3	778590.1	325657.8	2
65	208123	F107	A903	687466.7	778913.4	31459.3	2
66	208124	A405	U201	687300	778873.8	43899.2	2
67	208128	U200	A405	688951.7	778542.2	209355.6	4
68	208130	U200	U201	688735	778854.5	51296.76	4
69	208131	U200	A405	688489.9	778899.7	21840.32	4
70	208137	A101	A405	688635.2	778645.4	125300.7	4
71	208139	A101	A101	688304.9	778540.9	224242.9	4
72	208143	A101	M102	689103.1	778758.4	15644.52	4
73	208144	A101	A302	685631.3	778578.9	49581.67	3
74	208147	U200	U201	687354.8	778251.4	176979.1	2
75	208149	A101	A100	686692.2	778337.1	307236.3	3
76	208151	A101	A100	689295.8	778521.5	133473.9	4
77	208153	A101	F105	686087.6	778338.3	106860.9	2
78	208155	F105	A100	686556.2	778237.9	157114	3
79	208156	U200	A405	687281	778284.7	78387.38	3
80	208158	A101	A101	689522.4	778500.3	96484.96	4
81	208159	A101	A405	687043.7	778453.6	51808.67	3
82	208161	A101	M2	685716.8	778402.4	130521.9	3
83	208166	U200	U3	688677.1	778326.9	44038.72	4
84	208167	A101	A101	685712.9	778071.3	196658.4	2
85	208168	A101	A405	688568	778255.6	19621.1	2
86	208169	A101	A100	686062.9	778265.6	27986.96	2
87	208171	F105	A405	689301.2	778101.5	115319	4
88	208172	U200	A100	687177.7	778040	79659.81	3
89	208173	W100	A100	686009.6	777830.9	68712.7	2
90	208174	F105	F105	689524.6	777837.5	247573.6	4
91	208177	U200	U201	688859.4	778085.7	43790.78	2
92	208179	W100	F105	686066.2	777514.3	469787.6	2
93	208184	W100	W101	688082.5	776565.7	NA	2
94	208194	A101	A100	686275.3	777651.7	193780.5	2
95	208199	A101	A405	686463.7	777880.5	71880.72	3
96	208200	A101	F105	689275.4	777722.2	85637.19	4
97	208205	A101	F106	688980.2	777793.4	48849.34	2
98	208209	F105	F105	686707.3	776704.1	946996.3	2
99	208210	F106	A401	688530.7	777695.2	126489.1	2

Plot	PlotID	LU82	LU00	x	y	Area	Location
100	208216	A101	F105	686517.3	777054.5	270244	2
101	208217	F106	A903	688301.3	777685.7	21466.72	2
102	208218	A302	A401	688036.6	777357.7	963990.3	2
103	208220	A101	A903	689080.7	777547.2	72032.62	2
104	208224	A101	U201	689360.9	777513.7	14996.61	2
105	208225	U200	U201	689635.3	777477.7	98807.47	2
106	208227	F105	A405	690400	777013.5	304027.9	2
107	208229	W100	M2	685757.1	777467.5	4508.575	2
108	208243	A302	A903	687838.9	776974	146700.4	2
109	208246	F105	A405	687428.1	776759.8	242713.4	2
110	208248	W100	A903	686292	776768.8	36444.78	2
111	208249	F105	A903	687727.2	776708	47276.88	2
112	208250	A101	A903	686349.5	776600.3	57818.98	2
113	208251	F105	A405	686888.4	776613.3	190808.1	2
114	208254	A101	A101	689613.1	776526.2	508528.3	2
115	208255	A101	A100	689749.6	776776.4	105692.5	2
116	208260	W100	F106	686193.7	776676.6	36301.97	2
117	208263	W100	A903	687285.5	776204.8	240803.8	2
118	208265	F105	A903	687426.8	776396.4	118135.5	2
119	208266	A302	A302	689034.7	775749.9	1653950	2
120	208270	W100	A903	686254.4	775918	281550.8	2
121	208273	A302	F106	688696.1	776311	26415.64	2
122	208275	F105	F106	691471.3	775226.2	1051296	4
123	208278	W100	A405	687087.7	776197.8	41592.8	2
124	208282	A101	F105	686643.9	776185.9	90570.3	3
125	208283	U200	A903	690334.1	776239.2	28668.49	2
126	208285	F106	F106	688508.9	775789.2	152438.1	2
127	208287	F105	A903	686404.9	775877.7	56511.39	2
128	208291	U200	F106	690606.7	776019.4	30927.94	4
129	208292	U200	A405	690184.8	776083.1	92438.98	2
130	208293	U200	A302	689236.3	776011.2	32284.95	2
131	208296	W100	F105	687126.9	775810.5	91526.47	2
132	208298	U200	U201	689435	775972.6	95112.35	2
133	208301	U200	A100	690465.2	775758.3	106410.1	4
134	208302	F105	A302	686625.7	775704.8	162567.5	2
135	208304	A302	F106	688590.4	775769	49553.41	4
136	208305	U200	A101	690526.2	775483.4	231709.5	4
137	208310	A101	A100	690635.8	775026.3	614834.6	4
138	208313	A101	A302	689878.8	775665.6	31807.43	4
139	208314	W100	F106	687109.7	775565.7	63408.19	2
140	208315	A101	A302	689671.7	775259.1	206697.7	4
141	208317	A101	A101	690007.4	774167.9	3002096	4
142	208318	F105	A100	691328.8	774865.5	261879.3	4
143	208322	F106	F105	686204.5	775499.5	2530.719	2
144	208326	F105	A408	692177.9	775042.8	398679.8	4
145	208334	F106	F105	688368.8	774703.8	1122299	2
146	208335	F106	F105	686366.2	775273.7	14359.56	2
147	208338	F106	F105	686605.4	775146.4	5877.424	2
148	208340	A302	F105	687975.6	775029.5	39765.38	4
149	208341	A101	A302	688441.2	774949	71286.27	4

Plot	PlotID	LU82	LU00	x	y	Area	Location
150	208342	A101	A101	688892.2	774916.6	82684.27	4
151	208343	A101	F105	688188	774851.7	68906.66	4
152	208348	F106	A101	689488.7	774455.2	238646.9	4
153	208356	A101	A302	689616.5	774267.2	66135.61	4
154	208350	F105	F105	692916.8	774057	874765.5	4
155	208351	F105	A405	693131.6	774541	15885.19	4
156	208352	F105	U201	693035.3	774442.6	94149.59	4
157	208354	A101	F105	691518.8	774142.7	415718.4	4
158	208357	A101	F105	689131.1	774232.5	41847.76	4
159	208359	F105	M102	693314.9	774022.7	249693.1	4
160	208360	A101	A302	690747.4	774211.4	58576.61	4
161	208362	F106	A101	688524.9	774064.3	12593.63	4
162	208363	A101	A100	692398.5	773661.6	190943.5	4
163	208364	F105-A101	F105	691695.6	773379	1186187	4
164	208367	F106	A302	688912.7	773950.3	56455.08	4
165	208368	F106	A101	689160.2	773877.6	54130.96	4
166	208369	A101	F105	692568.7	773629.4	71955.89	4
167	208372	A101	A302	689764.6	773561.8	113749.8	4
168	208373	A302	A101	689520.9	773543.9	47653.93	4
169	208374	F105-A101	A100	692397.5	773436.5	103007.3	4
170	208375	A302	A302	689607	773521	57892.66	4
171	208377	F105-A101	A101	691046.3	773145.2	102897.6	4
172	208378	F105-A101	A401	691297.5	773005.2	179249	4
173	208379	F105-A101	A101	690517.5	772870.2	145109.8	4
174	208381	F105-A101	A408	691329.2	772627.9	23863.11	4

Colour of land use

colour	CID	LUCode	LU
orangered	1	A100	AbandonedPF
orange	2	A101	PaddyFieldT
burlywood3	3	A302	RubberP
palegreen	4	A304	Eucalyptus
palegreen	5	A305	Teak
palegreen	6	A308	Acacia
burlywood3	7	A389	CoconutRubber
darkorchid	8	A401	MixedOrchard
burlywood2	9	A405	Coconut
magenta	10	A408	Cashew
maroon1	11	A489	CoconutCashew
orangered	12	A900	AbandonedAqFarm
steelblue2	13	A902	FishFarm
steelblue2	14	A903	ShrimpFarm
palegreen	15	F100	EvergreenForestD
darkgreen	16	F101	EvergreenForestM
darkgreen	17	F102	RainForest
mediumseagreen	18	F105	SwampForest
darkgreen	19	F106	Mangrove
yellow3	20	F107	Beach/Forest
mediumseagreen	21	F111	EvergreenForest
yellow3	22	F203	Beach/Coconut
olivedrab3	23	F301	MixedForestP
yellow3	24	F405	MangroveCoconut
gold	25	M101	Grass
gold	26	M102	Scrub/Grass
darkgreen	27	M201	Wetland
tan	28	M301	Mine
tan	29	M401	SaltFlat
yellow	30	M402	Beach
black	31	M404	GarbageDump
yellow	32	M888	Island
white	33	M999	NoData
black	34	U100	Urban
grey40	35	U200	AllocatedProject
grey40	36	U201	LowlandVillage
royalblue	37	U300	Institution
brown3	38	U400	Transp/Communic
wheat1	39	U401	Airport
black	40	U501	IndustrialLand
black	41	U502	Factory
cyan	42	U601	Recreation
azure2	43	W100	Lake
wheat1	44	W101	River/Canal
wheat1	45	W102	Reservoir

colour	CID	LUCode	LU
black	47	U1	Urban
royalblue	48	U3	Institution
darkgreen	49	M200	Wetland
darkgreen	50	M2	Wetland
burlywood2	51	A405-A408	CoconutCashew
yellow3	52	F203-A405	BeachForestCoconut
darkgreen	53	F106-A405	MangroveCoconut
burlywood2	54	A405-F101	CoconutMoistEvergreen
burlywood2	55	A405-A302	CoconutRubberP
orange	56	A102	BroadcastedPF
orange	57	A201	MixedFieldCrop
palegreen	58	A303	OilPalm
magenta	59	A407	Mango
black	60	A704	SwineFarmHouse
orange	61	IA102	BroadcastedPF(irrig)
palegreen	62	F307	Casuarina
darkorchid	63	IA401	MixedOrchard(irrig)
burlywood2	64	IA405	Coconut(Irrigation)
tan	65	M302	LateritePit
red	66	U202	HighLandVillage
wheat1	67	U404	Harbour
orange	68	A220	Watermelon
magenta	69	A420	Langsat
black	70	A702	CattleFarmHouse
orange	71	IA101	PaddyFieldT(Irrigation)
tan	72	M300	AbandonedMine
tan	73	M303	SandPit
tan	74	M304	SoilPit
palegreen	75	A306	Magosa
burlywood3	76	IA302	RubberP(Irrigation)
cyan	77	U603	Cemetery
wheat1	78	W202	FarmPond
grey40	79	F201	MixedDeciduousForest
mediumseagreen	80	F105-A101	SwampForestPaddyFieldT

ที่ ศธ 0521.2.05/129

คณะวิทยาศาสตร์และเทคโนโลยี
มหาวิทยาลัยสงขลานครินทร์
181 ถนนเจริญประดิษฐ์ ตำบลรูสะมิแล
อำเภอเมือง จังหวัดปัตตานี 94000

23 กุมภาพันธ์ 2552

เรื่อง แจ้งตอบรับการเข้าร่วมนำเสนอผลงานวิจัยในการประชุมวิชาการ

เรียน นางสาววรุณวรรณ ศิลามาศ

อ้างถึง หนังสือคณะวิทยาศาสตร์และเทคโนโลยี ที่ ศธ 0521.2.05/018 ลงวันที่ 12 มกราคม 2552

สิ่งที่ส่งมาด้วย กำหนดการประชุม จำนวน 1 ชุด

ตามหนังสือที่อ้างถึงข้างต้น คณะวิทยาศาสตร์และเทคโนโลยี ร่วมกับสมาคมคณิตศาสตร์แห่งประเทศไทย ในพระบรมราชูปถัมภ์ โดยศูนย์ส่งเสริมการวิจัยทางคณิตศาสตร์ และสำนักงานคณะกรรมการวิจัยแห่งชาติ กำหนดจัดประชุมวิชาการคณิตศาสตร์ ประจำปี 2552 (ครั้งที่ 14) 14th Annual Meeting in Mathematics ระหว่างวันที่ 5-6 มีนาคม 2552 ณ โรงแรมไดมอนด์พลาซ่า จังหวัดสุราษฎร์ธานี ซึ่งท่านได้แจ้งความประสงค์เข้าร่วมนำเสนอผลงานวิจัยภาคบรรยาย ความละเอียดแจ้งแล้วนั้น

ในการนี้ คณะวิทยาศาสตร์และเทคโนโลยี มหาวิทยาลัยสงขลานครินทร์ ยินดีให้ท่านเข้าร่วมนำเสนอผลงานวิจัย เรื่อง Land Use System Change around NaThap River in Songkla, Thailand in 1982 and 2000 โดยมีรายละเอียดตามกำหนดการที่ส่งมาด้วยพร้อมนี้

จึงเรียนมาเพื่อโปรดทราบ

ขอแสดงความนับถือ

(ผู้ช่วยศาสตราจารย์พักตรา คูบุรัตน์)
คณบดีคณะวิทยาศาสตร์และเทคโนโลยี
มหาวิทยาลัยสงขลานครินทร์ วิทยาเขตปัตตานี

ภาควิชาคณิตศาสตร์และวิทยาการคอมพิวเตอร์

คณะวิทยาศาสตร์และเทคโนโลยี มหาวิทยาลัยสงขลานครินทร์ วิทยาเขตปัตตานี

ขอมอบเกียรติบัตร เพื่อแสดงว่า

นางสาววรุณวรรณ ศิลามาศ

ได้ร่วมนำเสนอผลงานวิจัย

การประชุมวิชาการทางคณิตศาสตร์ ประจำปี 2552 (ครั้งที่ 14)

ระหว่างวันที่ 5 - 6 มีนาคม พุทธศักราช 2552

ณ โรงแรมไดมอนด์พลาซ่า จังหวัดสุราษฎร์ธานี

(ดร.เมตตา ภูนิ่ง)

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Land Use System Change around NaThap River in Songkhla, Thailand in 1982 and 2000

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Abstract : The purpose of this study was to study the land use patterns around NaThap River (in Tumbon NaThap Sub-district of Songkhla Province, Thailand) in 1982 and 2000, and identify changes of land use. We applied secondary data from Thailands Land Development Department, which are based on surveys of land use in 1982 and 2000. We constructed a map of land use showing locations and general areas for specific land use. The analysis involved using Percentage for identifying pattern of land use change. Our results identified the three largest areas for land use type in 1982 as swamp forests (39.4% of all), paddy fields (23.0%) and lakes (10.1%) and in 2000: swamp forest (26.8%), followed by paddy field (13.8%), and scrub/grass (11.2%). Interestingly lake change to Rivers/canals, 5.3% there also appears to have been an increase in abandoned land in the north and south of the study area and 4.3% increase in shrimp farms around rivers. Swamp forest was the most changed land use in terms of total area (decrease of 12.6%).

Keywords : Land use, Land use change

1 Introduction

Land use in Thailand has changed rapidly as cities have grown and the population increased. It has changed to provide housing and food production for more and more people. Agricultural areas have become industrial factories, natural forests and wetlands are now used for agriculture or residential buildings. Songkhla is a province in the south of Thailand which has been growing and developing recently. It is the centre of commerce and tourism. It is a province that has been affected by the changing land use. Less than 9.6% of the total area is forest (or natural vegetation), while 44.0% is devoted to agriculture and 46.4% to non-agriculture [1].

NaThap is a sub-district in ChaNa district, Songkhla province. It is an old village, 400 years old. This area used to be an army camp, called Thai NaThap until recently. Tumbon NaThap consists of 14 villages and has a major river called NaThap River, which originates from the high mountains in Songkhla and is 26 kilometers long. The land near the river is mostly natural and undeveloped. The main occupation of people in the area is agriculture [2]. In 2002 a power plant was built, using water from NaThap River for cooling.

We are interested in studying the pattern of land use around NaThap River,

comparing use in 1982 and in 2000. Expected results from this study will be useful to land developing in the future and increase the likelihood of using land more efficiently.

Methodology: Secondary data of land use from surveys in 1982 and 2000 from the Land Development Department, region 12, Songkhla Province was used. Sample size of this study is 381 regions of land use in NaThap sub-district. Regions that have an area smaller than five hectare were combined. So, it was reduced from 381 regions to 174 regions. R program was used to arrange the map and to examine the change of land use.

Figure 1: NaThap sub-district

Study area: The total area of NaThap sub-district is 31.32 square kilometers (19,552 rai). The Land Department categorized types of land use into three main groups, and each group was further divided into sub-groups as follows: Natural: swamp forest, lake, mangrove, river/ canal, beach-forest, scrub/ grass, wetland, and casuarinas. Farm: Paddy field, rubber plant, coconut, shrimp farm and mixed orchard. Developed land: allocated project abandoned paddy field, low land village and institutional land.

Variable: Location was categorized into three groups of land use: South, North and River. Types of land use change separate into seven groups: natural, natural to farm, natural to developed, farm to natural, farm, farm to developed and developed to farm.

Statistical analysis: Percentage was used to preliminaries for identifying pattern of land use change.

2 Result

We constructed a map of land use showing locations and general areas for specific land uses in 1982 and 2000. We described sub-groups of land use with colors for example: orange for paddy field, light green for mangrove, gray for allocated project etc. Figure 2 shows a comparison of land use in 1982 and 2000 of the NaThap River. It can be seen that between 1982 and 2000 land use area had decreased for natural and residential and increased for agriculture. In 1982 it is clear that swamp forest is the land use with the most area (39.4% of all). The paddy field has the second most (23.0%) and lake the third most (10.1%). In 2000 was found swamp forest occupies the most area (26.8%), paddy field is second most (13.8%) and scrub/ grass the third most (11.2%) and was found in 1982, 47.7% was nature area, 37.5% was farm, 14.8% was developed, and no abandoned area was identified.

As table 1 shown, in 2000 the number of sub-groups as types of land use had in-

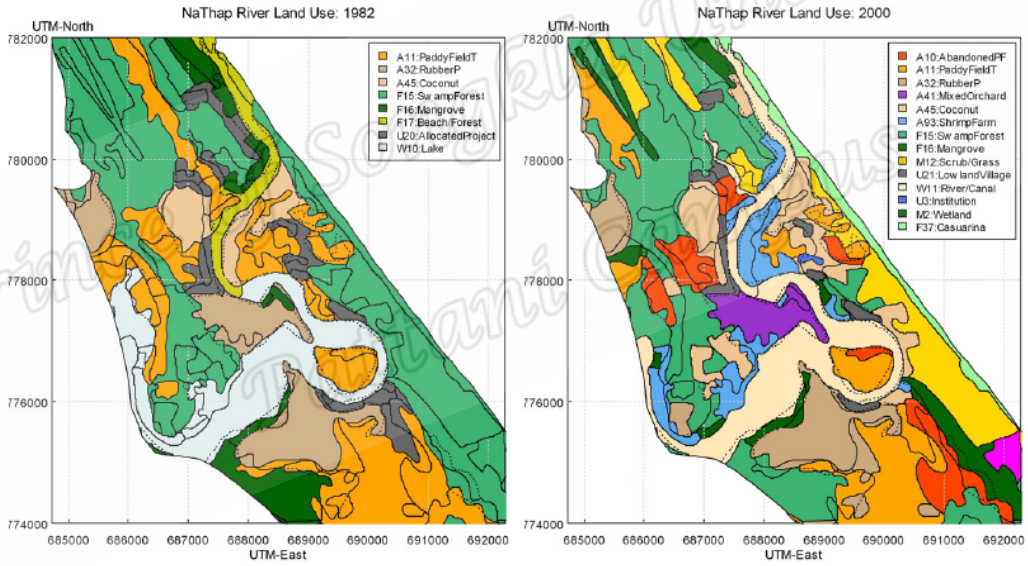

Figure 2: Comparison Land use map in 1982 and 2000

creased since 1982, 38.1% was natural area, 45.5% was farm, 14.8% was developed. The interesting area was changed is lake to river/canal, 5.3% there also appears to have been an increase in abandoned land in north and south and 4.3% increase in shrimp farm around river. The most change was found in the area of swamp forest that showed 12.6% decreasing, Paddy field is second most 9.2% decreasing and coconut the third most 5.2% increasing.

Table 1: Pattern of land use, percentage and location found most

Type of Land use	1982	*Location	2000	Location
Swamp forest	39.4	N and S	26.8	N
Paddy field	23.0	N, AR and S	13.8	N and S
Lake	10.1	R	-	-
Rubber plant	7.5	N and S	6.6	S
Mangrove forest	7.3	AR	3.3	N and S
Beach-forest	5.2	N	-	-
Allocate project	4.7	AR	-	-
Coconut tree	2.8	N	8.1	N and S
Scrub / Grass			11.2	S
River / Canal			9.4	R
Abandoned paddy field			5.3	N and S
Shrimp farm			4.3	AR
Wetland			3.6	N and S
Casuarinas			3.1	N and S
Mixed orchard			2.6	R
Low land village			1.8	N and R
Institutional land			0.1	N
Total			100.0	

*Location: N= North, R= River, S= South, AR= Around river

In table 2, in the South natural areas were the most common land use (unchanged). In the North natural areas changed to farms in 16 areas. In the River farms were the most common type of land use. In this study we have not got type of land use change as developed change to natural and developed change to developed.

3 Conclusion

A land use map was constructed in this study showing locations and general areas around NaThap River for specific land uses in 1982 and 2000. The most decrease was swamp forest area (12.6%) and paddy field (9.2%). In contrast, coconut trees increased by 5.2 %. Interestingly lake to river/canal was a common occurrence. This area may have been constructed for shrimp farm reservoirs. There were an increasing number of abandoned paddy fields in the north and the south, together with increasing number of shrimp farms around the river.

Table 2: Distribution of types of land use change in each location

type of land use change	Location			
	South	North	River	Total
Natural	20	16	7	43
Natural to Farm	3	16	14	33
Natural to Developed	2	1	3	6
Farm to Natural	7	4	8	19
Farm	7	12	16	35
Farm to Developed	2	7	3	12
Developed to Farm	8	11	7	26
Total	51	67	58	174

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