

GIS APPLICATION FOR ADMINISTRATION AND MANAGEMENT ON HUAISAI ROYAL DEVELOPMENT STUDY CENTER

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“ABSTRACT” : Huaisai Royal Development Study Center under His Majesty the King’s remark is located on Cha-um district, Phetchaburi province. The Huaisai’s area covered 2541.05 ha or 25.41 km.² The main problem of Huaisai Royal Development Study Center was drought, low rainfall (about 700 mm/yr) and low soil fertility. The worst in soil structure showed sandy structure the topsoil and hard pan in the sub-soil. Therefore, this area was not suitable for agricultural production. Geographic Information System (GIS) was a tool for making decision on the location of the check dams in Huaisai Royal Development Study Center. The 8 spatial data of the land use, soil suitability, contour lines, sloping areas, transportation, forestry plantation, water bodies and streams were interpreted and analyzed by using GIS software. In addition, Global Positioning System (GPS) was used for field survey. The results of this study were used to indicate the suitable locations of the check dams. In conclusion, the total of 150 check dams should be construction. The other result could be employed for forecasting the areas risky to forestry fires and planning on future land use in order to protect soil erosion. And the most benefit of this study was developing the package problem for access and query information. This program will be use for sustainability and efficiency of administration and management on Huaisai’s natural resources and environments in the future. Saving the cost on buying the geographic program.

1. INTRODUCTION under His Majesty the King’s remarks

In the past, Huaisai Royal Development Study Center was plenty of wild animal especially deer, which called “Nern-sai”. Unfortunately, the forest and many wild animals had been disturbed by human and agricultural practices. From these phenomena, Huaisai environment changed from plenty of rainfall to lack of rainfall. At the present, the average rainfall was 700 mm/year. The others effect to the balance of nature and destroying soil structure are highly application on pesticides and chemical fertilizers for pineapples in a long period. For that reason, His Majesty the King Bhumibol Adulyadej remarks on reforestation and establishment agriculture research center in Huaisai area. And water resources were the importance factor for agriculture and life. The correct location and number of check dams are very necessary for water supply. GIS had been use as a tool for decision making on location and number of check dam. Otherwise, GIS had been used to forecasting on forest fire and land use planning

2. OBJECTIVES

- 1) To serve GIS database system for Huaisai Royal Development Study Center
- 2) To find the suitable position for check dams
- 3) To indicate to risky area on forest fire in cultivated forest
- 4) To be planning for land use and protection of soil erosion
- 5) To develop the package program for access, query maps and information

3. TARGET AREA

Huaisai Royal Development Study Center is situated in Sam-pa-ya sub-district, Cha-um district, Phetchaburi province in western region of Thailand. The whole area of Huaisai Royal Development Study Center was 5,722.66 ha or 57.23 km². The center’s area had been divided into 3 zones (Fig. 1).

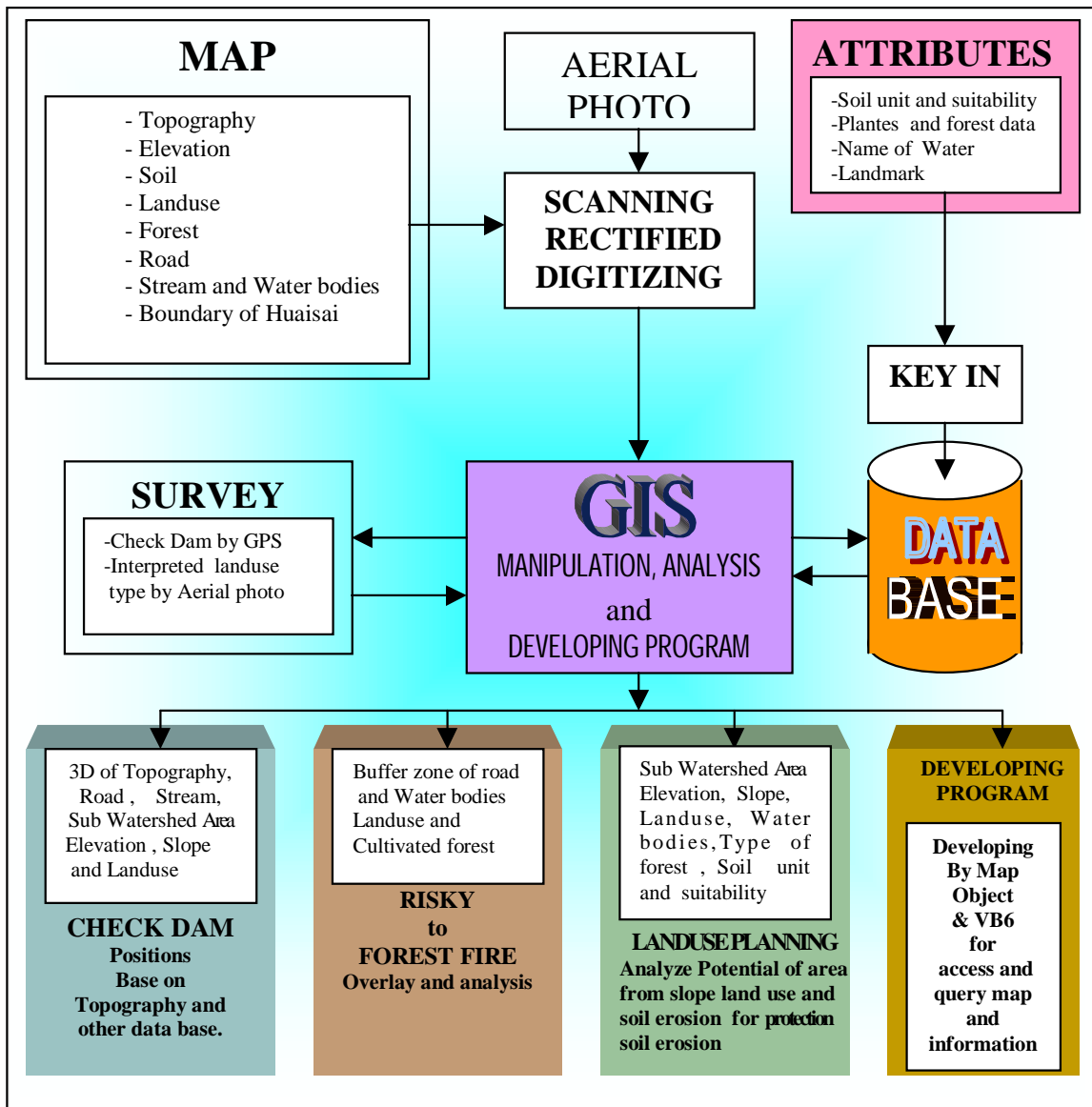
Zone 1 : Research center area 2541.05 ha or 25.41 km²

Zone 2 : Residential and agriculture areas 2426.88 ha or 24.93 km²

Zone 3 : Government offices area 754.73 ha or 7.75 km²

4. METHODOLOGY

Workflow is as follows.



This study considered on both attribute and spatial data, in order to find out the suitable position the check dams. The attribute data was collected from Huaisai Royal Development Study Center estate records and meteorological records. The spatial data is extracted from satellite images and existing maps. These spatial and attribute data were linked within a GIS database. Existing maps were used to prepare digital coverage of field boundaries, land use, soil boundaries, road and stream network, slope, elevation and aspects. Huaisai Royal Development Study Center parameters had concerned about cultivated forest and agriculture crops especially pineapples. The designed database structure and input data were processed by using scanner and sending to GIS. To be rectification aerial photo and map to geo-coordinate system and data manipulation (Fig. 2). To be survey for classified land use from aerial photo and check dam by using Global Positioning System (GPS). The attribute and spatial data had been proceeded the package program for access, query maps and information.

5. RESULTS AND DISCUSSION

The check dams' position had been decided by carefully considered which the decision based on elevation, topography, road and stream network, slope, watershed, soil suitability, water bodies. The 150 check dams with 6 different horizontal line should be constructed on Huaisai Royal Development Study Center, which

covered the area 2541.05 ha (Table 1 and Fig. 3). From the field survey checked and confirmed the positions of check dams by using GPS and aerial photos, including inspection the potential of soil structure for water reservation found that there are only 101 check dams should be constructed. If all check dams had been dug 3 meters in the depth, the water capacity would be 480,535 m³ (Table 2 and Fig. 4). The area risky to forest fire were defined into 2 degree as less and medium risk (Table 3 and Fig. 5). There were 21 species of plants cultivated for reforestation in years 1984 to 1989. The study area could define as the indifference on land use for protected on soil erosion , paddy field 551.36 ha, orchards and trees 1,965.58 ha, field crops 1,538.37 ha, forest 960.73 ha, water body 192.68 ha, and area of other uses 513.94 ha (Table 4 and Fig. 6).

Table 1 Lines of check dams in sub-watershed of Huaisai Royal Development Study Center

Sub-watershed	Lines of Check Dams	Length (km)	Watershed (m ²)	No. of Check Dam	Height (m.)	Slope (%)	Remarks
Official Area, Watershed 5.073 km ²	1	3.472	2,106,850	26	47 – 48	11.42	To rely on the irrigation pipes
	2	2.591	338,422	15	42 – 45	6.34	To rely on some part of roads
	3	3.456	535,753	10	39 – 41	2.96	To rely on the old roads
	4	2.513	506,258	15	25 – 37	2.30	To rely on forestry roads
	5	0.465	-	4	31	2.44	To connect with the level 4 th of check dam
	6	0.387	-	-	26	1.71	To connect with the level 4 th of check dam
East side of Khoa Thong Area , Watershed 3.042 km ²	1	1.413	597,808	11	44 – 47	17.50	To rely on the irrigation pipes
	2	1.761	799,643	22	39	10.89	
	3	1.674	203,718	10	34	2.08	
	4	1.688	276,436	7	30	1.58	
	5	2.740	375,302	10	26	1.43	
	6	2.205	568,880	13	25	1.40	
	7	0.541	-	Connected line for water distribution			
Total		24.906	6,309,070	143	The positions of more 7 of the check dams are out of the study area.		

Table 2 The suitable locations of check dams after field survey and adjustment

Sub - watershed	Lines of Check Dams	Watershed (m ²)	No. of Check Dams	Cross Section Area of Check Dams (m ²)	Check Dams Capacities (m ³)	Budget (Baht)
Official Area, Watershed 5.073 km ²	1	2,106,850	21	11,476.41	34,429	516,438
	2	338,422	13	15,341.92	46,026	690,386
	3	535,753	3	1,915.63	5,747	86,203
	4	-	11	14,005.47	42,016	630,246
	Out of line			10,928.09	32,784	491,764
East side of Khoa Thong Area , Watershed 3.042 km ²	1	597,808	2	834.53	2,504	37,554
	2	799,643	17	26,503.63	79,511	1,192,663
	3	203,718	12	26,910.52	80,732	1,210,973
	4	276,436	7	29,374.03	88,122	1,321,831
	5	375,302	5	10,471.60	31,415	471,222
Out of Study Area		-	10	12,416.26	37,249	558,732
Total		5,740,190	101	160,178.09	480,535	7,208,012

Table 3 The area risky of forest fire in cultivated forest in Cultivated Forest ,years 1984 - 1989

Year	No. of Plantation	Area of Cultivated Forest (ha)	The Risky Areas to Forestry Fires		Types of Cultivated Forest*
			Less (ha)	Medium (ha)	
1984	1	9.15	0.65	8.50	1, 2, 6, 8, 10, 12, 13, 14
	2	4.53	2.69	1.84	
	3	20.56	12.93	7.63	
	4	2.20	0.00	2.20	
1985	1	83.97	13.24	70.72	1, 9, 10, 12
1986	1	5.54	0.88	4.66	1, 3, 6, 10, 12, 18, 20, 21
	2	71.59	37.85	33.74	
	3	3.09	1.80	1.28	
	4	0.65	0.00	0.65	
1987	1	19.26	2.84	16.41	4, 5, 6, 7, 8, 10, 12, 13, 16, 18, 18, 19, 21
	2	53.99	8.32	45.68	
	3	63.48	14.05	49.42	
1988	1	5.54	0.00	5.54	2, 4, 5, 6, 7, 9, 10, 11, 14, 15, 18, 19, 21
	2	46.63	32.02	14.61	
	3	0.83	0.00	0.83	
	4	8.10	7.29	1.13	
1989	1	25.74	3.61	22.13	1, 3, 12, 18
	2	7.41	4.36	3.05	
	Total	515.62	194.46	321.15	

*1 = *Acacia auriculaeformis* 2 = *Acacia mangium* 3 = *Acacia tomentosa*
4 = *Azalia xylocarpa* 5 = *Anacardium occidentale* 6 = *Azadirachta indica*
7 = *Cassia fistula* 8 = *Cassia siamea* 9 = *Casurina equisetifolia*
10 = *Casurina junghuhiana* 11 = *Dipterocarpus alatus* 12 = *Eucalyptus eitriodora*
13 = *Lagerstroemia euspidata* 14 = *Lagerstroemia loudonii* 15 = *Lagerstroemia speciosa*
16 = *Leucaena leucocephala* 17 = *Peltophorum pterocarpum* 18 = *Pterocarpus macrocarpus*
19 = *Sindora siamensis* 20 = *Tectona grandis*
21 = *Xylia xylocarpa*

Table 4 The suitable land use for protection on soil erosion in sub-zone of the project

Zones	The suitable land use for protection on soil erosion (unit:ha)						
	Paddy Fields	Orchards and Trees	Field Crops	Forest	Reservoirs	Area for Other Uses	Total
1	7.87	973.48	508.79	960.73	90.09	0.09	2,541.05
2	383.60	992.10	1,029.59	-	20.98	0.61	2,426.88
3	159.88	-	-	-	81.61	513.24	754.73
Total	551.36	1,965.58	1,538.37	960.73	192.68	513.94	5,722.66

6. CONCLUSION

The positions of check dams in Huaisai Royal Development Study Center after adjustment all database with the field survey found that 101 check dams in difference 6 horizontal lines. In the year 1984 – 1989, the total area of cultivated forest was 515.62 ha. There were less and medium risk on forest fire about 194.46 and 321.15 ha, respectively. By using GIS analyze, the administration and management on forest fire protection are located the sites for fire awareness which easy to fire control. In order to protection on soil erosion in zone 1, they should extend to cultivated forest to 445.11 ha. Finally, we had already developed the package program for Huaisai Royal Development Study Center using to planning on administration and management in the near future.

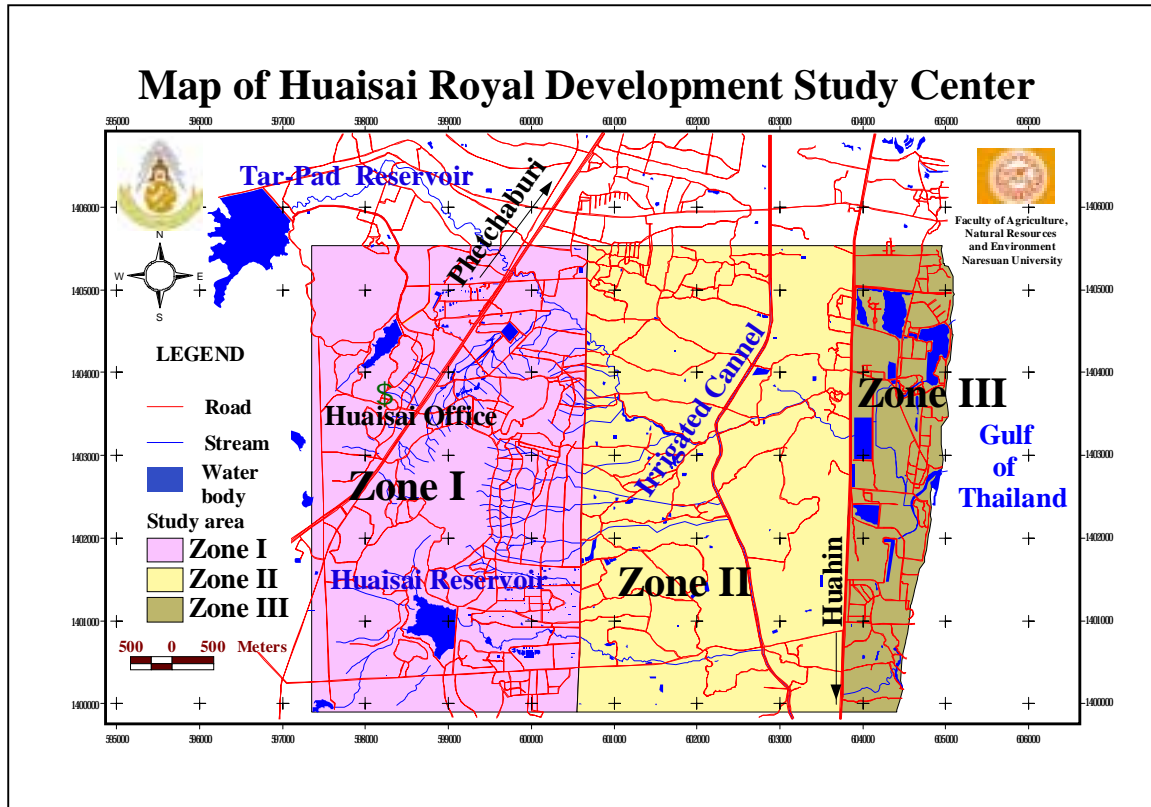


Fig. 1 Huaisai Royal Development Study Center is situated in Sam-pa-ya sub-district and Cha-um district, Phetchaburi province which located on the western region of Thailand.

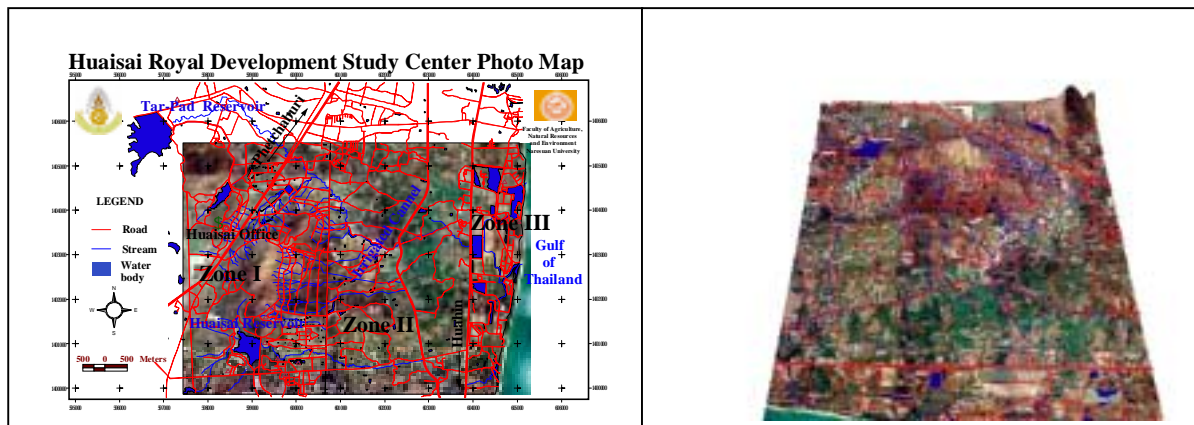


Fig. 2 The photo map and 3 dimensions from coastal to the west site of Huaisai Royal Development Study Center

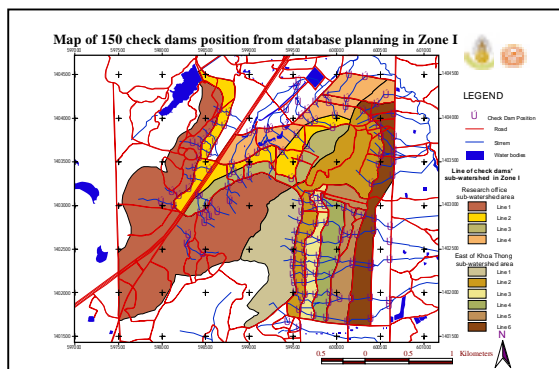


Fig. 3 Map of 150 check dams positions from database planning in zone I

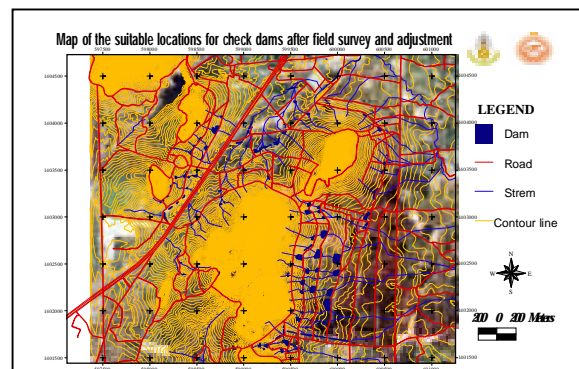


Fig. 4 Map of the suitable locations for check dam after field survey and adjustment.

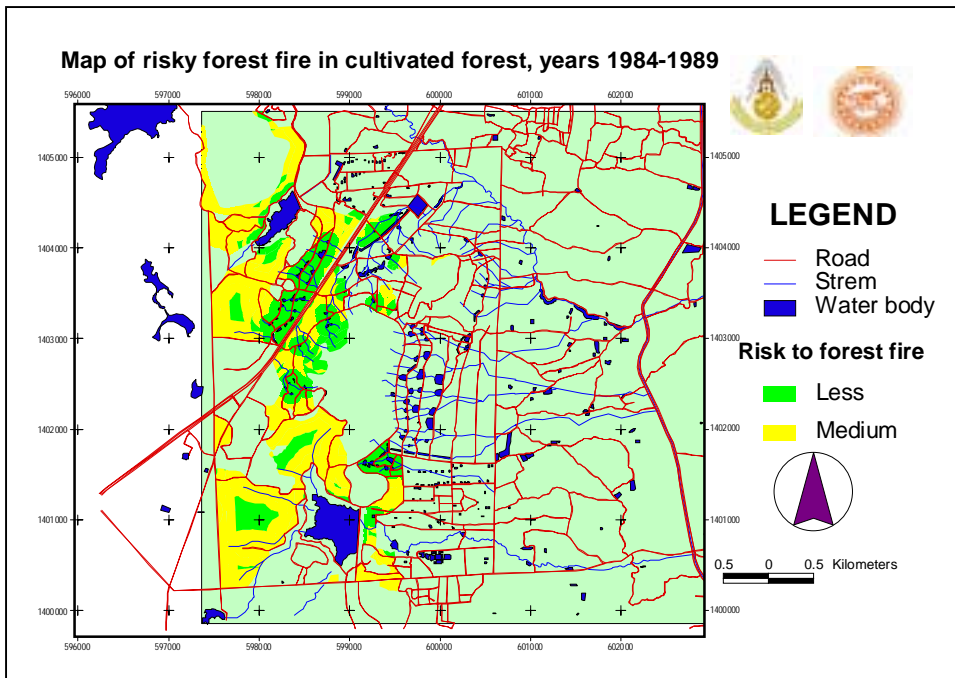


Fig. 5 The risky forest fire in cultivated forest , year 1984-1989

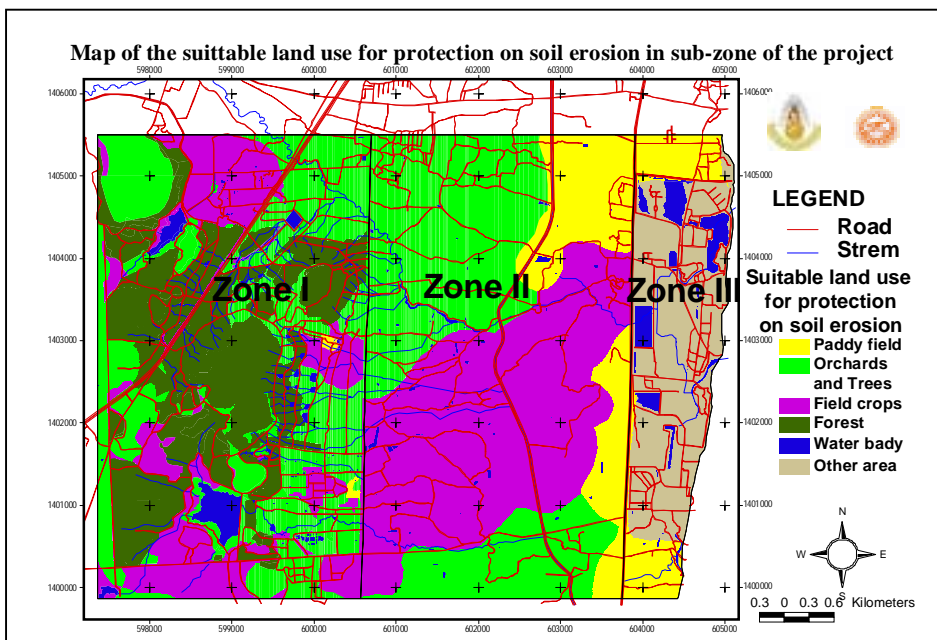


Fig. 6 The suitable land use for protection on soil erosion of the project

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