Chapter 3 EXISTING LAND RESOURCES

3.1. Existing Conditions of Land Resources

3.1.1. Maps collected and digitized

To examine the land resources, existing maps and statistical data, reports, satellite imageries of LANDSAT have been used. The following map data have been transformed into digital files in order to use a geographic information system (GIS) for the Study:

- Topographic Map	(1:50,000, NAMRIA)
- Land Use	(1: 250,000, DA)
- Slope	(1: 250,000, DA)
- Erosion	(1: 250,000, DA)
- Soil Taxonomy	(1: 250,000, DA)
- Land Management Unit	(1: 250,000, DA)
- Geology	(1:1,000,000 Geological map, Bureau of mining)
- Road Network	(various scales, LGUs and DPWH)
- Population center	(various scales, LGUs)
- Municipality boundary	(1:50,000, DENR)
- Davao City District boundary	(1:20,000, Davao City)
- Watershed	(1:250,000, JICA Study team based on watershed map by NIA and topographic map)
- Flood Prone Area	(various scales, LGUs)
- CADC Area maps	(various scales, DENR)

3.1.2. Existing land use

Physical conditions of land have been analyzed using GIS with some of the digitized maps listed above.

(1) Elevation

According to GIS computation, 43.3% of the total DIDP Area is lower than 200 m, which mostly lies along coastal and river basin areas around Digos, Davao City, Tagum City, Lupon, and Mati. Mountains stand mainly along the DIDP's western border with Bukidnon, North Cotabato, and South Cotabato including the Mt. Apo area, and borders of Compostela Valley and Davao Oriental.

In Davao del Norte, because of the Tagum-Libuganon river basin, more than half the total provincial land is lower than 200 m. This area and land lower than 500 ms combined covers almost 80% of the provincial land. In Compostela Valley, land lower than 200 m is dominant, accounting for 42% of the provincial land. At the same time the province has a large area of mountainous area with land higher than 1000 m occupying 17% of the total provincial area. Compostela Valley occupies 51.4% of the land of 1500 m or higher in the DIDP Area. Davao City has land lower than 200 m along the coastal line and in the Davao river basin. The City is dominant in 500-1000 m areas and higher, which are located mostly in Paquibato, Marilog, and Baquio districts. Davao del Sur is relatively dominant in land lower than 200 m, accounting for 36.2% of the provincial land, which spreads along the

Padada river in the Digos area. The land higher than 1000 m is almost 10% of the total provincial area that is mostly located in southern part bordering with South Cotabato. Davao Oriental is also dominant in land lower than 2000 m which mostly lies on Lupon, Cateel, and Mati Area. The mountain area is stretching along the boundary with Compostela Valley.

Table 18 and Figure 2 illustrates the elevation of the DIDP Area.

Table 18 Elevation Distribution in the DIDP Area

(km²)

Province	0-200m	200-500m	500-1000m	1000-1500m	1500m -	Total
DAVAO DEL NORTE	2,030.1	814.6	692.7	114.3	0.3	3,652.0
COMPOSTELA VALLY	1,882.5	933.5	900.0	515.6	248.6	4,480.2
DAVAO CITY	616.3	762.4	841.3	90.0	93.7	2,403.7
DAVAO DEL SUR	1,494.6	1,012.0	1,131.9	398.3	86.5	4,123.4
DAVAO ORIENTAL	1,700.6	1,482.6	1,292.0	474.9	54.6	5,004.7
DIDP	7,724.2	5,005.0	4,857.8	1,593.2	483.7	19,663.8

Source: JICA Study Team based on the GIS derived computation on the digital map.

(2) Slope

Slope conditions, based on GIS derived maps and figures, are shown in Table 19 and Figure 3. In the DIDP Area, relatively flat or gently sloped area with the slope smaller than 8% occupies the largest area, 5,446 km², or 28.2% of the total DIDP Area. Davao del Norte has most extensive land in this category with 1,469 km² or 27% of the DIDP total of this category. Following Davao del Norte, Compostela Valley occupies 1,302 km² or 24% of the DIDP total of this category. These extensive flat or gently sloped areas are because of fluvial plains of the Tagum-Libuganon river, Hijo and Isin river, and Agusan river.

Davao City has the largest share of land slope over 50%, accounting for 732 km², or 30.2% of the total City Area. Davao del Norte has the largest share of gently sloped land (0-8%) with 44.2% of the total provincial land, mostly found along the Tagum-Libuganon river. Next to Davao del Norte is Davao del Sur, accounting for 1,257km2 or 30.5% of the total provincial land, found mostly in the Digos-centered coastal areas. Davao Oriental is dominantly covered with steep land of 30-50% slope covering 1,922 km² or 38.4% of the total provincial area. Including moderately sloped and very steep lands (18% or steeper), almost 68% of land in Davao Oriental has slope larger than 18%, leaving limited areas of gentle slopes concentrating in Baganga, Cateel, Lupon-Banaybanay and Mati areas.

Table 19 Slope Distribution in the DIDP Area

(km²)

	0-3 %	3-8%	8-18%	18-30%	30-50%	50%-	Total Area
DAVAO DEL NORTE	1,200	269	228	460	524	644	3,325
COMPOSTELA VALLEY	737	566	644	1,122	753	658	4,479
DAVAO CITY	166	279	296	322	609	732	2,404
DAVAO DEL SUR	887	370	542	622	870	832	4,123
DAVAO ORIENTAL	759	213	666	1,144	1,922	297	5,002
DIDP	3,749	1,697	2,376	3,671	4,678	3,162	19,333

Source: JICA Study Team based on GIS digital file of the Slope Map (1:250,000) from DA.

(3) Erosion susceptibility

Based on the digitized erosion map, a large area of the DIDP Area is categorized as Severe Erosion Susceptibility area, covering 8,055 km^2 or 42.4% of the total DIDP Area. Lands of severe and moderate erosion susceptibility altogether cover 58.2% of the DIDP Area. The area of severe erosion susceptibility is comparatively large in Compostela Valley with 2,693 km^2, Davao del Sur with 2,273 km^2, and Davao del Norte with 1,602 km^2, corresponding to 61.1%, 56.5% and 48.3% of the respective provincial areas. In Davao City and Davao Oriental, lands of Slight Erosion Susceptibility dominate accounting for 50.6% of the total City area and 43.2% of provincial area, respectively.

Table 20 Erosion Susceptibility in the DIDP Area

(km^2)

	No Apparent Erosion	Slight Erosion	Moderate Erosion	Severe Erosion	Un-classified	Total Area
DAVAO DEL NORTE	1,098	237	373	1,602	3	3,313
COMPLA VALLEY	655	146	904	2,693	12	4,411
DAVAO CITY	329	1,146	466	322	1	2,263
DAVAO DEL SUR	816	656	276	2,273	0	4,021
DAVOA ORIENTAL	655	2,146	983	1,165	23	4,972
DIDP	3,553	4,331	3,002	8,055	39	18,980

Source: JICA Study Team based on GIS digital file of the Erosion Map (1:250,000) from DA.

(4) Geology

There is not a detailed map of geology covering the whole of the DIDP Area. Although there are geological maps of the respective provinces and city, they are not consistent with each other along the provincial boundaries. To cover the DIDP Area, the Study Team used the map at scale of 1:100,000 published by the Bureau of Mining. According to the map, the following geological characteristics are found.

Mindanao Island is located on a considerably complex topographical and geological structure, which is created by movement of the Philippine Plate and the Pacific Plate, and the Eurasian Plate as well as Pan-Pacific Volcanic Zone activity. The major fault system runs in the north-south direction, and diagonally to this system minor fault systems are formed.

The geologic strata are mainly sedimentary rocks that were formed relatively recently, mainly after the Mesozoic Era. In the DIDP Area, the oldest geological strata are sandstone and shale, part of which were metamorphosed. This forms the mountain range in Compostela Valley and Davao Oriental. Tertiary Rocks include sandstone, shale, and limestone and stretch over a large area. They are forming rugged mountains in Mindanao Island. Strata of coral limestone and sandstone that were formed in the late Tertiary period and Pleistocene form lower hills.

Volcanoes like Mt. Apo that were formed mainly in the Quaternary period and form high mountain areas. On fluvial lowland along rivers, alluvium is accumulated and forms delta and coastal lowland.

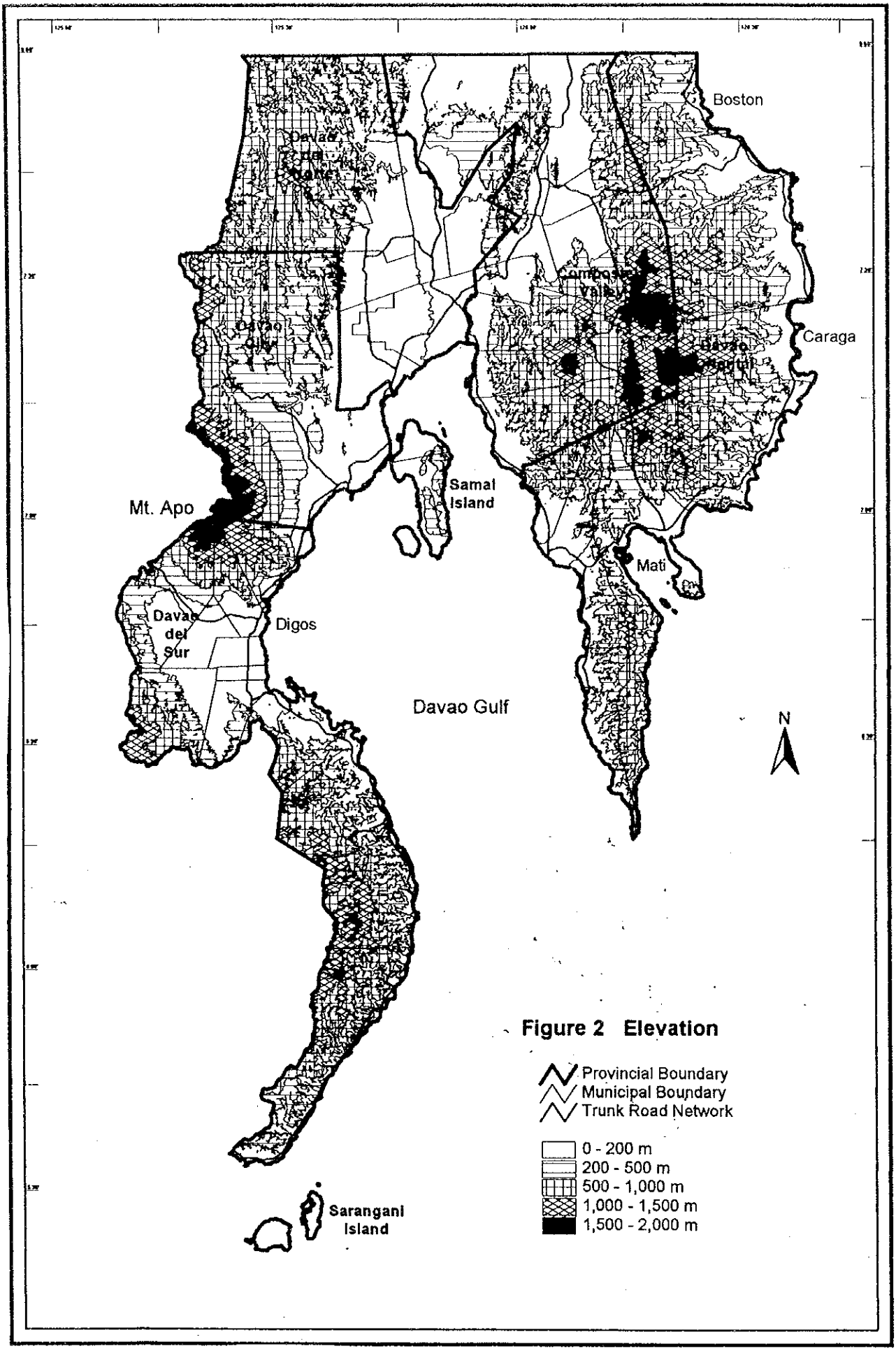

Figure 2 Elevation

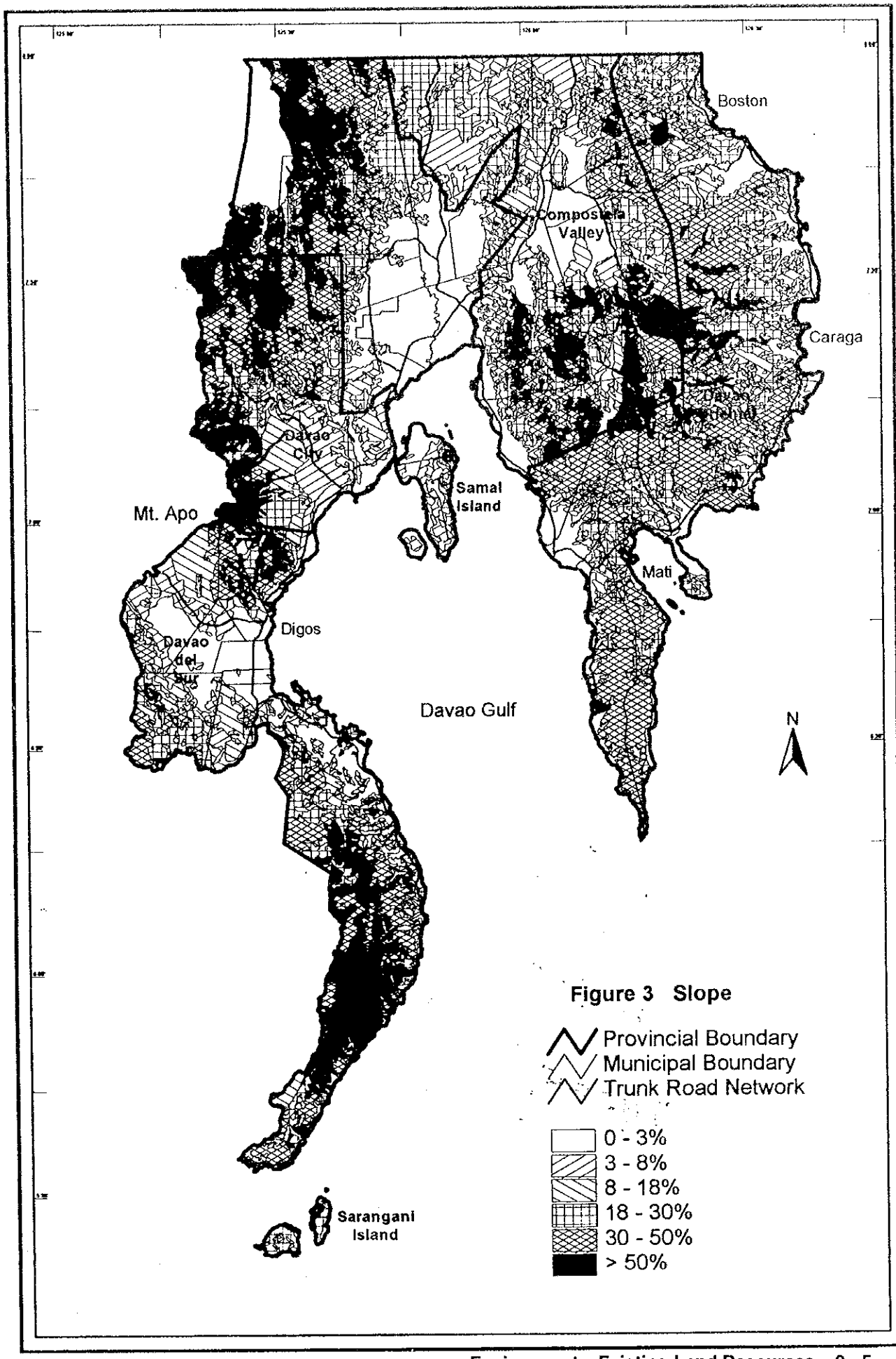

Figure 3 Slope

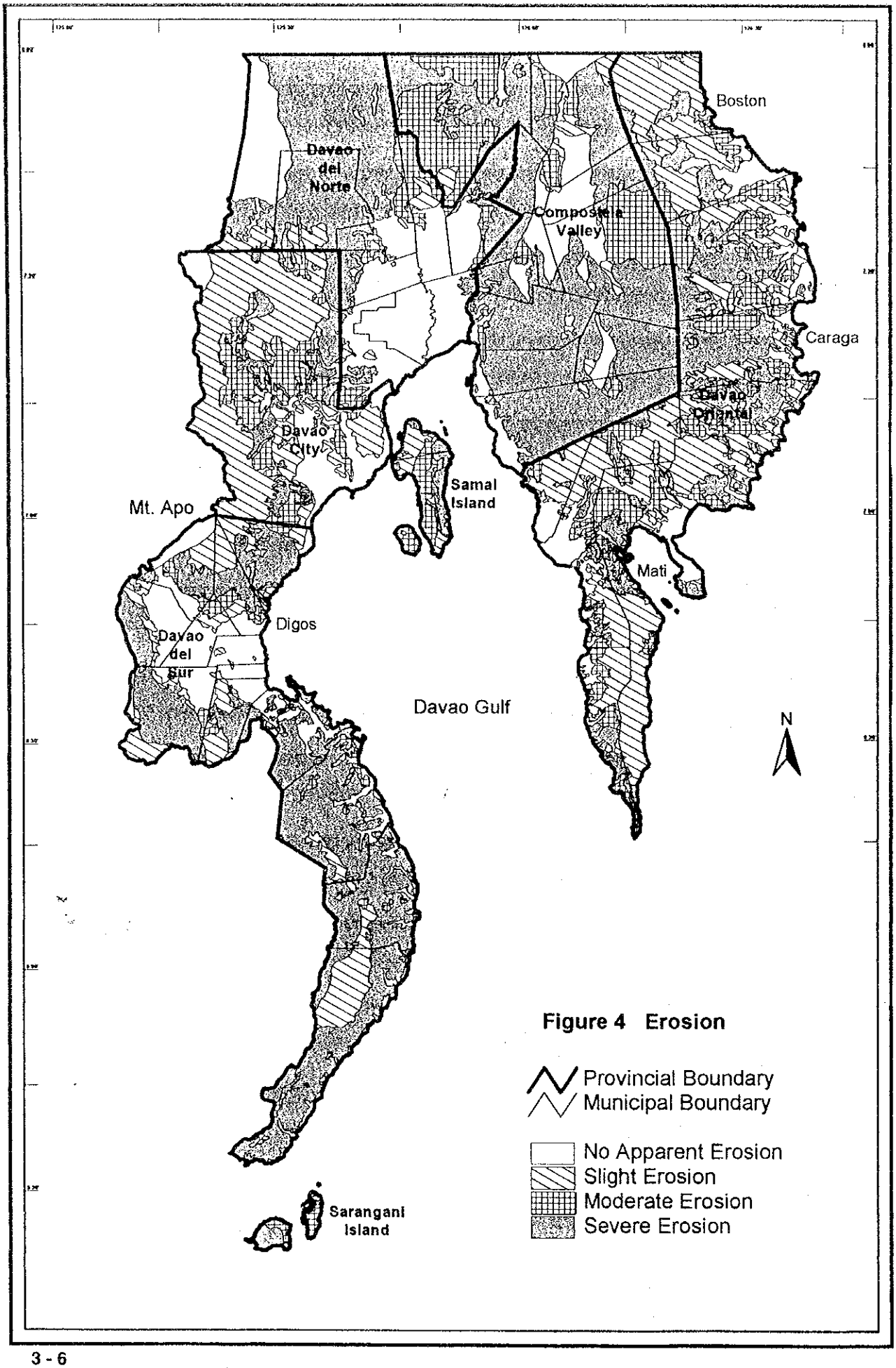

Figure 4 Erosion

Figure 5 illustrates the geological conditions of the DIDP, and Table 21 shows the area by geological type and province/city.

Table 21 Geology in the DIDP Area

(km²)

Class	Era	Rock Type	DAVAO DEL NORTE	COMPOS-TELA VALLEY	DAVAO CITY	DAVAO DEL SUR	DAVAO ORIENTAL	DIDP
R	Recent	Alluvium	978.6	629.8	185.7	615.2	413.9	1,844.6
N3+Q1	Plio-Pleistoncene	Sand and Gravel	1,083.6	1,105.5	201.4	382.7	488.4	2,177.9
N3+Q1LS	Plio-Pleistoncene	Coral Limestone	0.0	0.0	34.1	33.9	0.0	68.0
N2	Tertiary	Sandstone	744.0	540.8	845.6	1,151.1	366.8	2,904.4
N1LS	Tertiary	Limestone	0.0	0.0	0.0	21.4	0.0	21.4
N1	Tertiary	Andesitic conglomerate, sand and shale	103.5	746.5	269.0	1,240.4	2,014.3	4,270.2
Pgl	Tertiary	Marine conglomerate	0.0	1,091.1	0.0	0.0	234.5	1,325.6
Kpg	Mesozoic-Tertiary	Graywake and Metamorphosed shale	42.3	0.0	0.0	0.0	153.8	153.8
K	Mesozonic	Metamorphosed Graywake, quartzite, shale, etc.	0.0	368.6	0.0	0.0	804.8	1,173.5
UC	Mesozoic-Tertiary	Mafic rocks	91.8	0.0	0.0	0.0	445.4	445.4
QV	Quaternary	Andesite, Dacite, etc.	0.0	0.0	236.1	416.6	0.0	652.7
QVP	Quaternary	Pyroclastics, tuffs	0.0	0.0	644.1	256.7	0.0	900.7
UV	Quaternary	Basalt, Andesite Lava flow	636.8	6.5	0.0	0.0	78.2	84.6
Total			3,680.7	4,488.9	2,416.0	4,117.9	5,000.1	16,022.8

Source: JICA Study Team. Based on GIS computation.

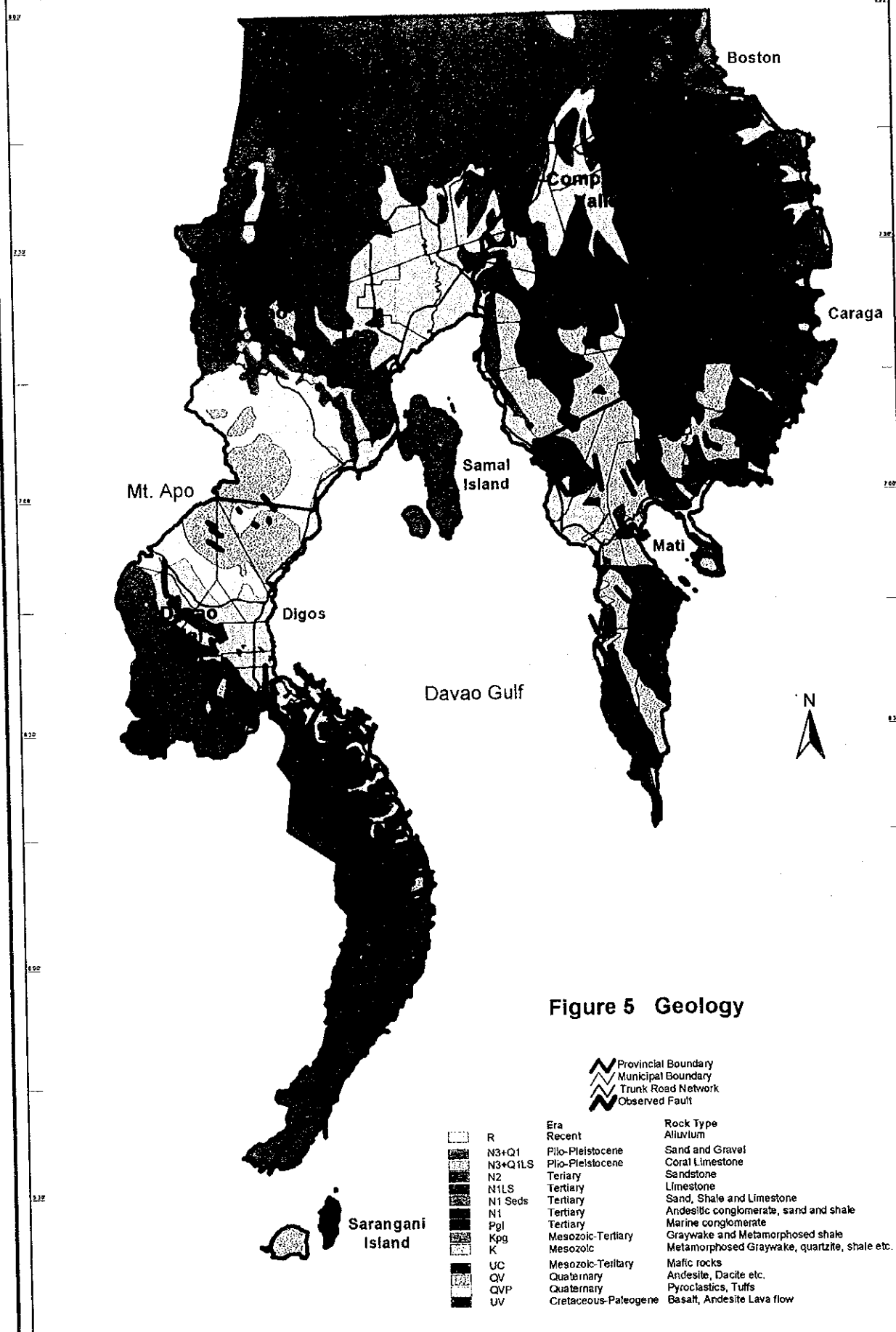

Figure 5 Geology

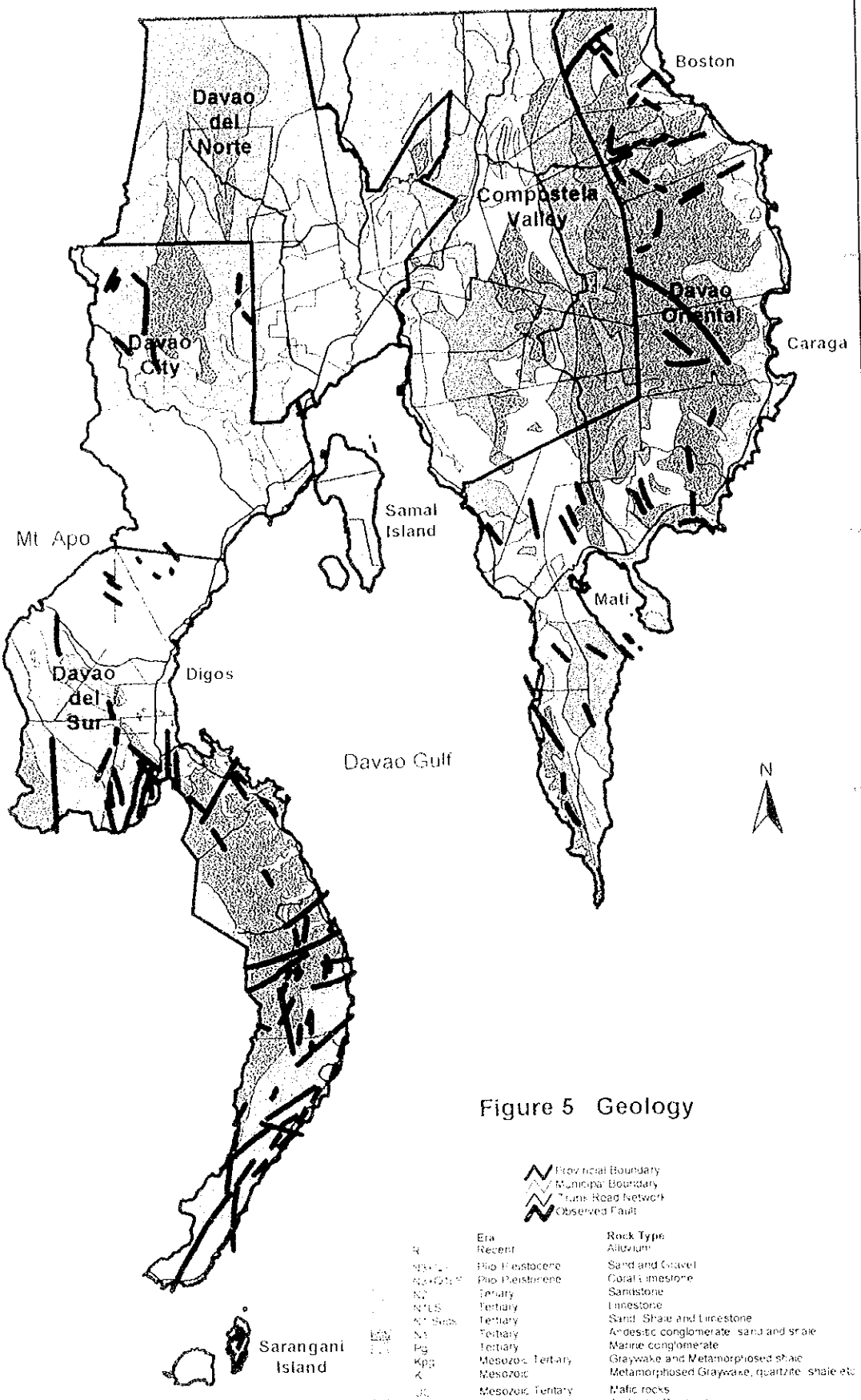

Figure 5 Geology

(5) Soil

DA surveyed soil conditions by province in the 1980's with aerial photographs and through field surveys. DA compiled the provincial soil information into regional soil taxonomy map at a scale of 1:250,000. The map was made based on topographic and geological features as well as soil parent material, and further soil profile development and chemical characteristics.

The whole picture of soil distribution in the DIDP Area by soil type and by province and city based on the GIS computation is shown on Table 22 and Figure 6.

Table 22 Soil Taxonomy in the DIDP Area

(km²)

	DAVAO DEL NORTE	COMPOSTELA VALLEY	DAVAO CITY	DAVAO DEL SUR	DAVAO ORIENTAL	DIDP
Typic Tropofibrists	21.9	0.0	0.0	7.7	13.8	21.6
Hapludult-Rhodudults-Dlystropets Association	0.0	33.7	465.5	158.9	370.9	1,029.0
Typic Paleudults	0.0	42.9	0.0	166.7	0.0	209.7
Hapludults-Dystropepts-Eutropepts Association	5.1	281.1	805.8	154.0	650.6	1,891.6
Rendolls-Eutropepts Association	299.6	245.8	32.1	65.7	147.5	491.2
Vertic epiaqualfs	4.2	0.0	0.0	24.7	0.0	24.7
Aquiq Hapludalfs	0.0	20.3	0.0	0.0	9.8	30.1
Typic Hapludalfs	12.0	6.5	4.3	391.4	8.6	410.8
Aeriq Tropaquepts	337.7	175.1	0.0	5.3	0.0	180.5
Aquiq Eutropepts	88.4	0.0	4.2	10.2	12.8	27.2
Fluventic Eutropepts	638.7	566.3	197.4	555.4	672.4	1,991.6
Typic Eutropepts	359.5	553.7	252.8	172.7	715.6	1,694.9
Eutropepts-Hapludalfs Association	549.6	347.0	282.6	425.3	282.9	1,337.9
Eutropepts-Troporthents Association	0.0	15.1	0.0	163.5	332.2	510.7
Typic Hdraquents	0.0	0.0	0.0	0.0	18.3	18.3
Typic Psammaquents	0.0	77.4	0.0	0.0	0.0	77.4
Typic Tropopsamments	5.1	0.0	2.9	198.8	90.9	292.6
Lithic Troporthents	0.0	0.0	5.8	7.4	0.0	13.3
Troporthents-eutropepts-Hapludalfs Association	1,004.2	2,115.1	323.9	1,615.5	1,675.5	5,730.0
Riverwash	0.0	0.0	0.0	0.0	2.4	2.4
Escarpments	0.0	0.0	26.3	0.0	0.0	26.3
Unclassified	326.0	0.0	0.0	0.0	0.0	0.0
Total	3,652.1	4,480.2	2,403.7	4,123.4	5,004.4	16,011.6

Source: JICA Study Team based on GIS computation.

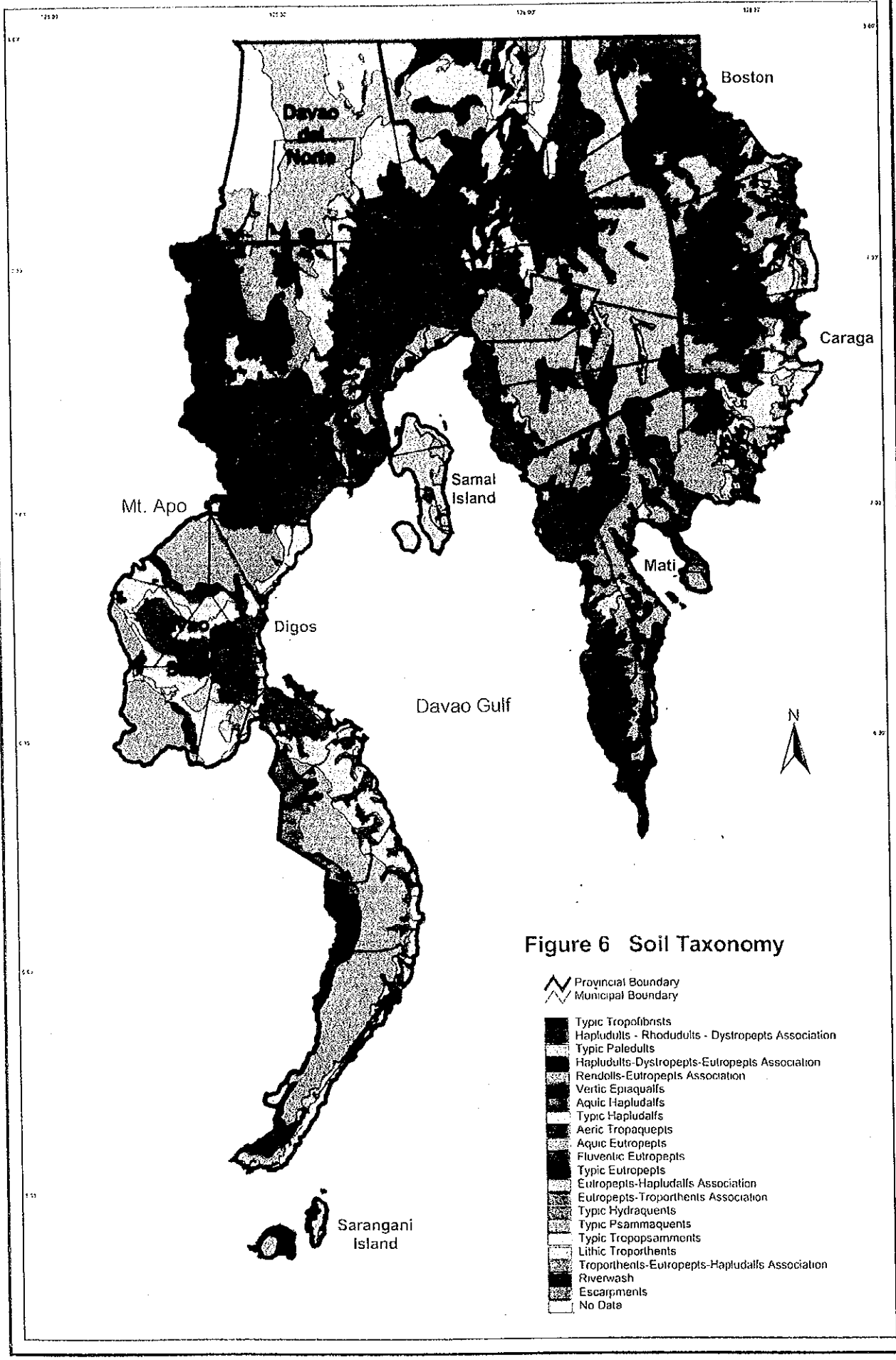

Figure 6 Soil Taxonomy

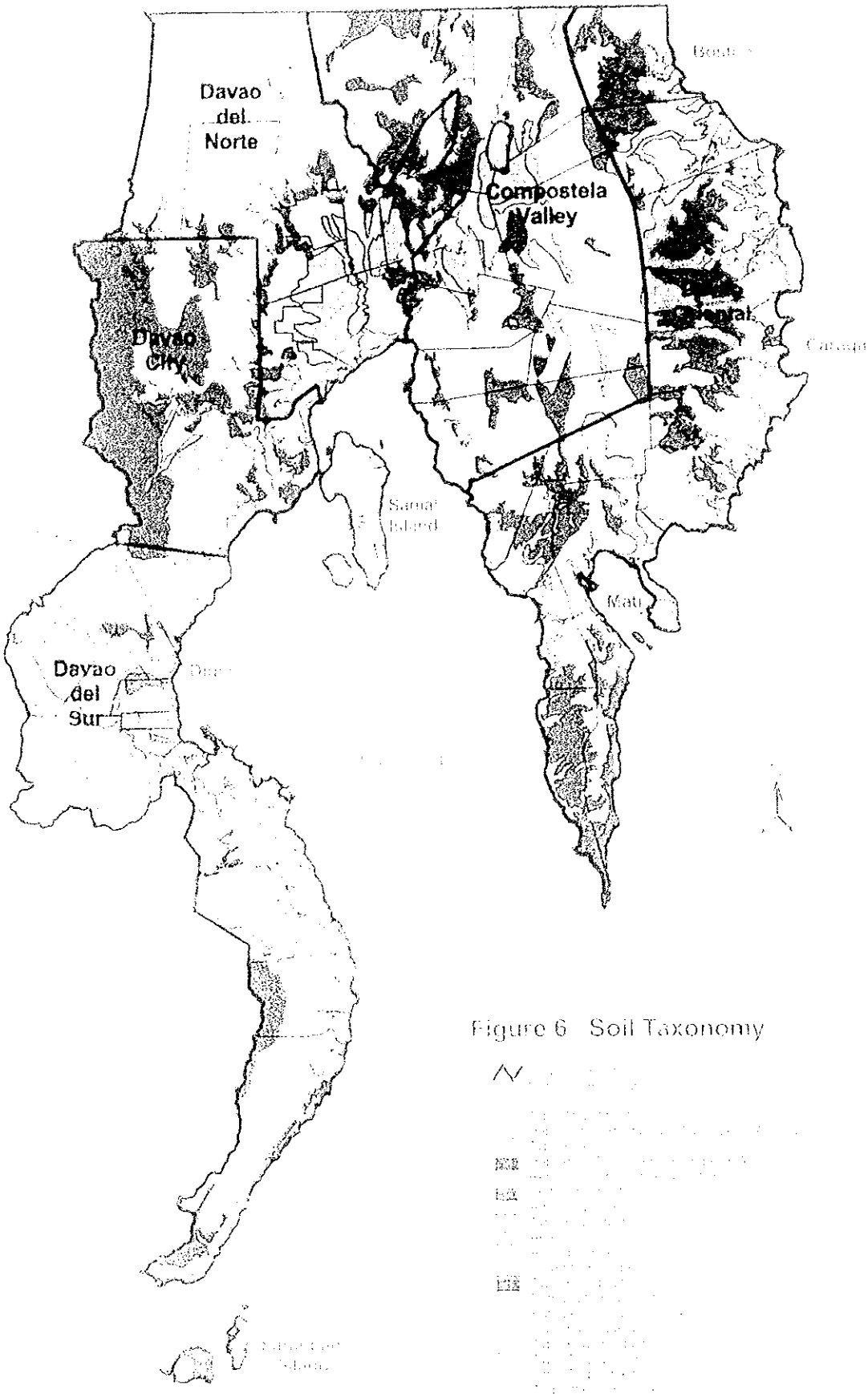

Figure 6 Soil Taxonomy

(6) Existing land use

The Study Team has reviewed the land use information using GIS based on Land Use Map (1:250,000) digitized, that had been printed in 1989-90 by DA (the real source year is not known), that is the latest map available at hand covering the whole of the DIDP Area.

Table 23 shows land use figures computed by GIS and Figure 7 illustrates the land use in the DIDP Area based on the said DA's map. Dominant land use is forest/wood land occupying 8,623 km^2, accounting for 44.4% of the total DIDP Area. However, the distribution of forest areas differs considerably among the LGUs. Compostela Valley is covered with forest by 55.2% of the total land area and Davao Province 53.1%; on the other hand, Davao del Sur shows the least forest coverage among the five LGUs with only 19.8% of the total provincial land.

The second dominant land use is agricultural area, covering 6,893 km^2 in the DIDP Area, or 35.5% of the total DIDP Area. Of the agricultural land, the industrial crops occupy 63.2% of the total agricultural land, out of which dominant is coconut with an 89.1% share. Coconuts are widely distributed along the coastal lowland and in the Agusan river basin area. Paddy rice occupies the second largest area in agricultural land, accounting for 1,140 km^2 for paddy rice irrigated and non-irrigated combined or 16.5% of the total agricultural land in the DIDP Area. The paddy fields are mostly located in Davao Province, in particular, in the Libuganon river basin, Upper Agusan river basin, and Banaybanay - Lupon area. Corn is the next covering 1,068 km^2, or 15.3% of the total agricultural area in the DIDP Area. Corn is found mostly in Davao Oriental.

Grassland occupies 3,693 km^2, or 19.0% of the DIDP Area. Grassland is extensively distributed in Davao del Sur, which occupies 46.1% of the total grassland area of the DIDP Area. In Davao Province, the municipalities of San Vicente, Asuncion and New Corella area covered with a tract of grassland. Also, grassland is found in the northern part of Davao City.

Built-up area is very limited, covering only 80 km^2 accounting for 0.4% of the total DIDP Area. The area is concentrated in Davao City accounting for 64.3 km^2, or 65.8% of the total built-up area. Other than Davao City, major built-up areas are found in Tagum City, Digos in Davao del Sur, and Cateel, Lupon and Mati in Davao Oriental.

(7) Agricultural area on slope land

To examine agricultural activities on a slope land (18% or steeper land), the digital maps of existing land use and slop maps have been overlayed.

In the DIDP Area, 199,037 ha, or 28.9% of the total agricultural land, 689,336 ha, are on 18% slope or steeper land. A 51% of the agricultural land is on 18 - 30% slope, and 40.1 % on 30-50%, and the other 9% on 50% or steeper land. Davao Oriental is dominated in slope farming share to the DIDP total accounting for 59.8%. Davao Oriental shows the highest share in every slope category, with 53.7% in 18-30%, 70.2% in 30-50%, and 47.5% in 50% or more.

Comparing the slope agricultural land to the total provincial agricultural land, Davao Oriental again shows the highest, accounting for 118,935 ha or 51.4% of the total provincial agricultural land. Following are Compostela Valley with 24.2%,

Davao City 23.1%, and Davao del Sur 18.3%. The lowest is Davao del Norte with only 8.6%.

Coconut is predominant as crops on such steep land in Davao del Norte, Davao City, Davao del Sur, and Davao Oriental. In Compostela Valley, coffee is rather dominant. In Davao Oriental, corn is also conspicuous.

Table 23 Existing Land Use in DIDP Area

(km²)

	DAVAO DEL NORTE	COMPOS-TELA VALLEY	DAVAO CITY	DAVAO DEL SUR	DAVAO ORIENTAL	DIDP
AGRICULTURE	1,346.5	985.6	765.8	1,481.2	2,314.4	6,893.4
Cereal	484.5	369.6	26.1	210.8	1,116.7	2,207.7
Paddy (Irrigation)	313.4	238.8	13.1	127.9	103.2	796.5
Paddy (Non-irrigation)	171.2	58.0	2.5	0.0	111.5	343.3
Corn	0.0	72.8	10.4	82.8	901.9	1,068.0
Fruits	201.6	18.3	38.0	35.2	37.4	330.6
Citrus	0.0	1.5	0.0	0.0	0.0	1.5
Pineapple	0.0	0.0	12.8	0.0	0.0	12.8
Pomelo	0.0	0.0	0.0	0.0	37.4	37.4
Banana	201.6	16.8	20.6	35.2	0.0	274.2
Fruit tree	0.0	0.0	4.7	0.0	0.0	4.7
Industrial Crops	660.3	597.6	701.7	1,235.3	1,160.3	4,355.1
Coffee	0.9	166.8	59.6	0.0	0.0	227.3
Cacao	0.0	0.0	9.0	0.0	0.0	9.0
Abaca	0.0	0.3	0.5	0.0	0.0	0.9
Ramie	2.6	0.0	3.7	0.0	0.0	6.2
Sugarcane	0.0	0.0	0.0	229.3	0.0	229.3
Coconut	656.8	430.5	628.8	1,006.0	1,160.3	3,882.5
GRASSLAND	336.7	936.8	477.9	1,703.4	237.6	3,692.5
Grassland	336.5	928.2	477.9	1,703.4	232.5	3,678.5
Ipil-Ipil	0.0	0.0	0.0	0.0	5.2	5.2
Bamboo	0.2	8.6	0.0	0.0	0.0	8.8
FOREST/WOODLAND	1,927.4	2,468.1	1,040.6	795.7	2,391.0	8,622.9
Forest	1,911.0	2,389.2	1,040.6	795.7	2,391.0	8,527.5
Rubber tree	8.7	17.8	0.0	0.0	0.0	26.5
Falcata	7.7	61.1	0.0	0.0	0.0	68.8
WETLAND	8.9	81.3	1.0	24.3	11.4	127.0
Mangrove, tree	0.0	0.0	0.0	5.4	0.6	6.0
Inland march, tree	1.1	74.8	0.0	0.0	0.0	75.9
Inland marsh, grass	0.0	0.0	0.0	3.7	5.7	9.4
Fishpond	7.8	6.5	1.0	15.3	5.1	35.6
MISCELLANEOUS	10.0	3.4	64.3	12.8	7.3	97.8
Built-up	2.4	0.0	60.3	10.8	6.6	80.0
Kaingin	0.0	0.0	0.4	0.0	0.0	0.4
Airport	0.0	0.0	0.6	0.0	0.4	0.9
River-water	0.0	0.0	0.0	1.1	0.4	1.5
rivers water, lakes	7.6	0.0	0.0	0.0	0.0	7.6
Livestock	0.0	0.0	3.1	1.0	0.0	4.0
Mine	0.0	3.4	0.0	0.0	0.0	3.4
TOTAL	3,629.5	4,475.2	2,349.5	4,017.5	4,961.8	19,433.5

Source: JICA Study Team. GIS computation based on the digitized Land Use Map (1:250,000) by DA, 1989-1990.

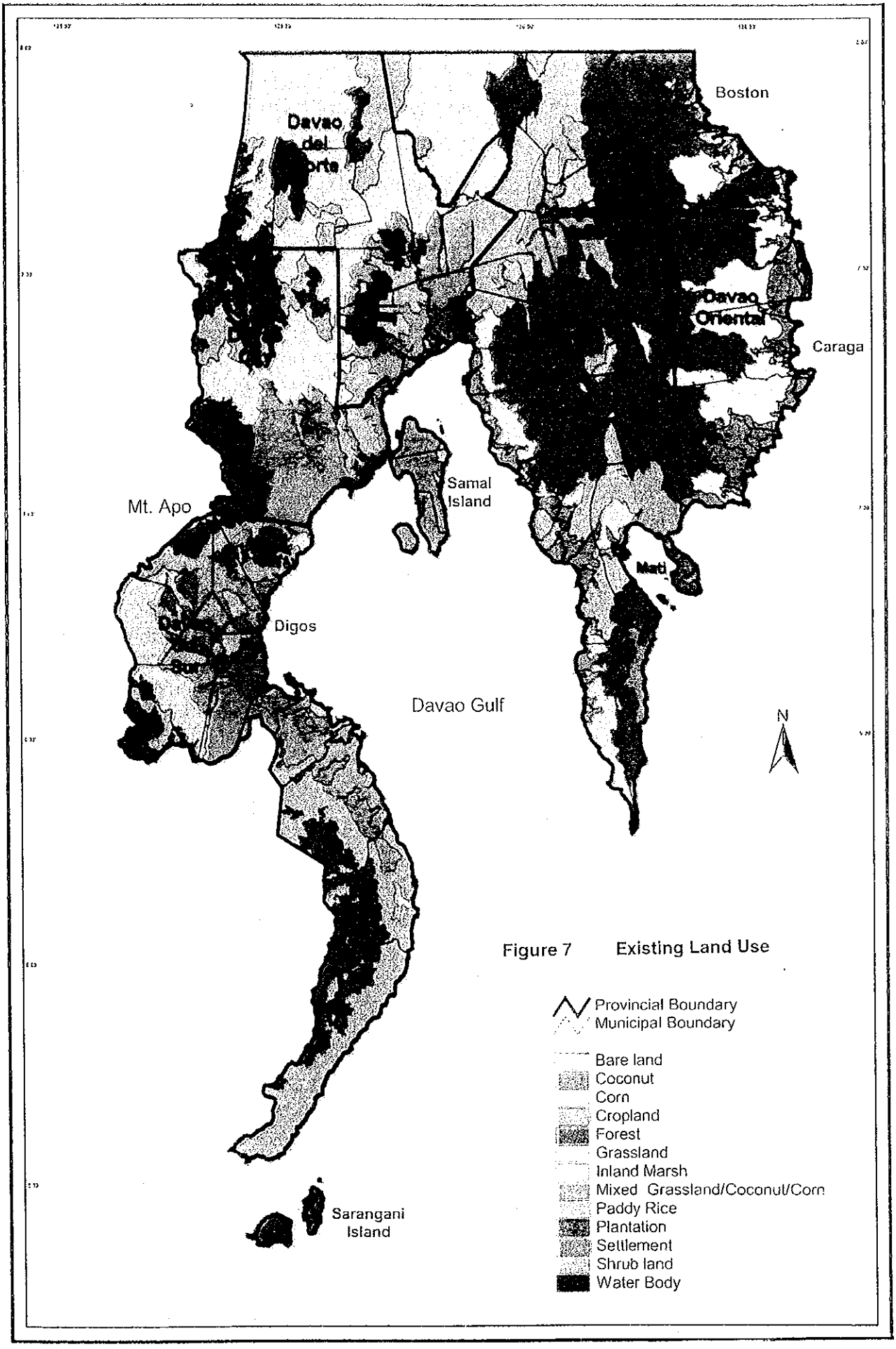

Figure 7 Existing Land Use

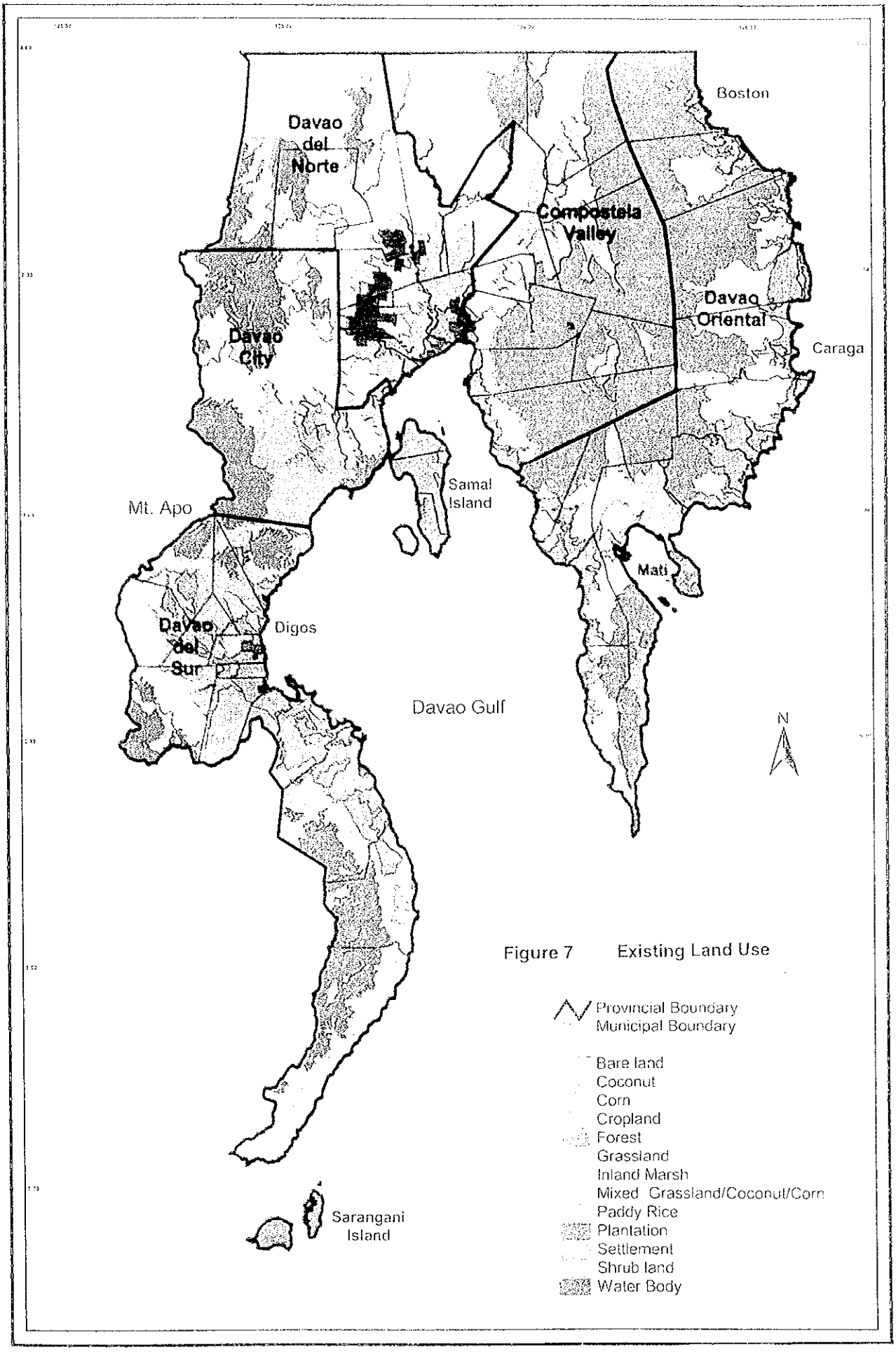

Figure 7 Existing Land Use

Table 24 Agricultural Land on Slope Land in the DIDP Area

(ha)

	DAVAO DEL NORTE	COMPOSTELA VALLEY	DAVAO CITY	DAVAO DEL SUR	DAVAO ORIENTAL	DIDP
18-30%	5,809	16,909	9,826	14,410	54,481	101,434
30-50%	3,426	5,459	5,845	9,058	56,002	79,790
50 %-	2,278	1,454	1,981	3,648	8,453	17,813
Total (18% or more)	11,513	23,822	17,653	27,116	118,935	199,037
Total Agricultural Land	134,648	98,559	76,576	148,117	231,436	689,336

Source: JICA Study Team. GIS computation.

(8) Watershed

In the DIDP Area, there are 36 major watershed categorized by NIA. However, as of now, almost half the names of the watersheds are still unidentified and yet to be confirmed with NIA.

Table 25 and Figure 9 illustrate the watershed in the DIDP Area with information about erosion susceptibility and flood area. The Tagum river has the largest watershed area, with 3,015 km^2. Following the Tagum river are the Padada-Mainit river with 1,666 km^2, Davao river with 1,300 km^2, and Talomo river with 1,281 km^2.

The Tagum river watershed has the largest area of severe erosion susceptibility with 1,587 km^2 or 52.6% of the watershed area. Watershed numbers 23, 30, 35, and 36, the Hijo river, and the Caraga river have more than 75% of the respective watershed area are categorized severe erosion susceptibility area, indicating a serious environmental problems of the watersheds and that the deforestation of the watersheds is very serious.

The Tagum river basin has a large area prone to flood, covering 339.1 km^2 or 11.2% of the total watershed area. Following the Tagum river is the Agusan river with 177.3 km^2 or 9.2% of the total watershed area.

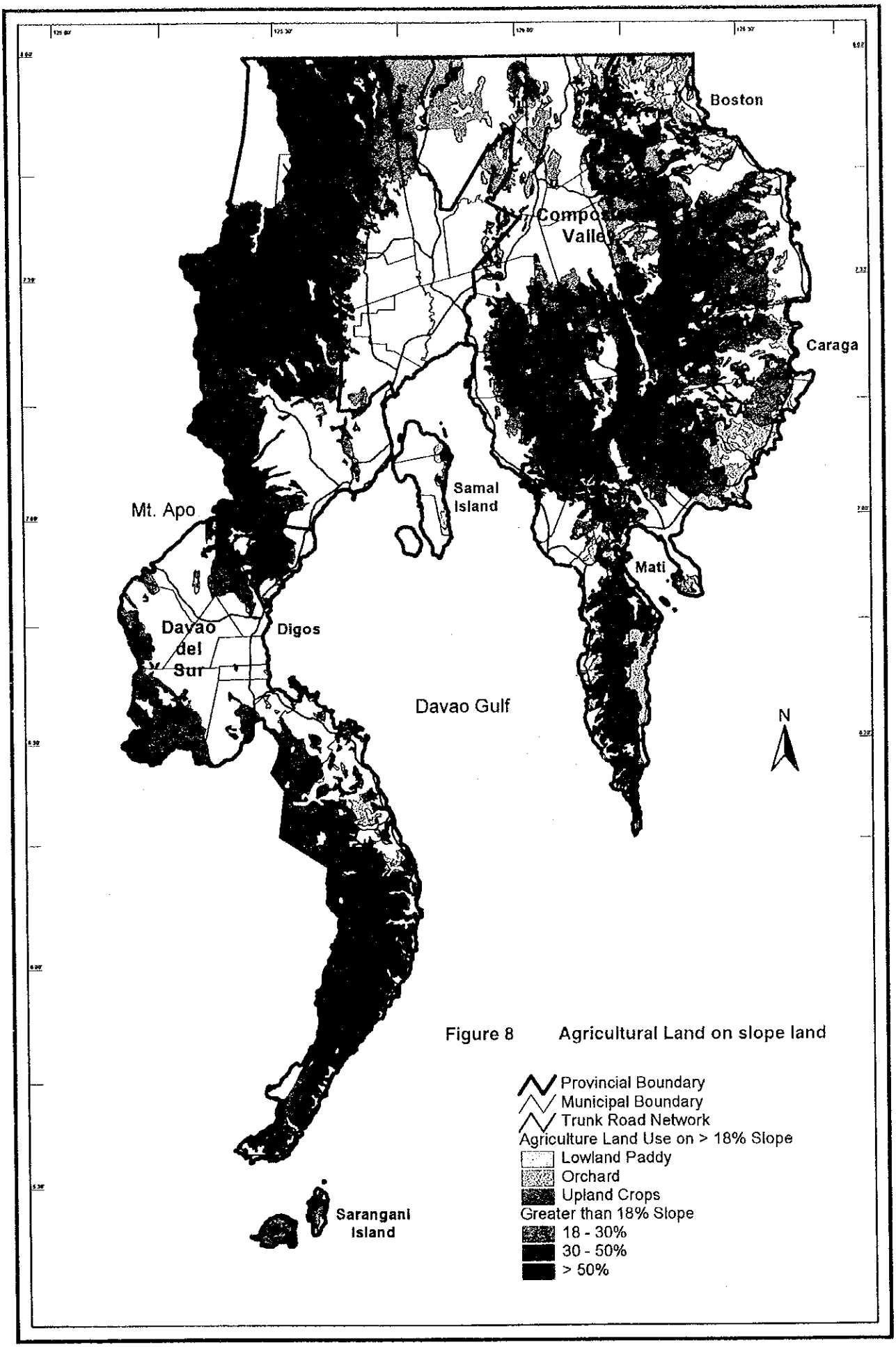

Figure 8 Agricultural Land on slope land

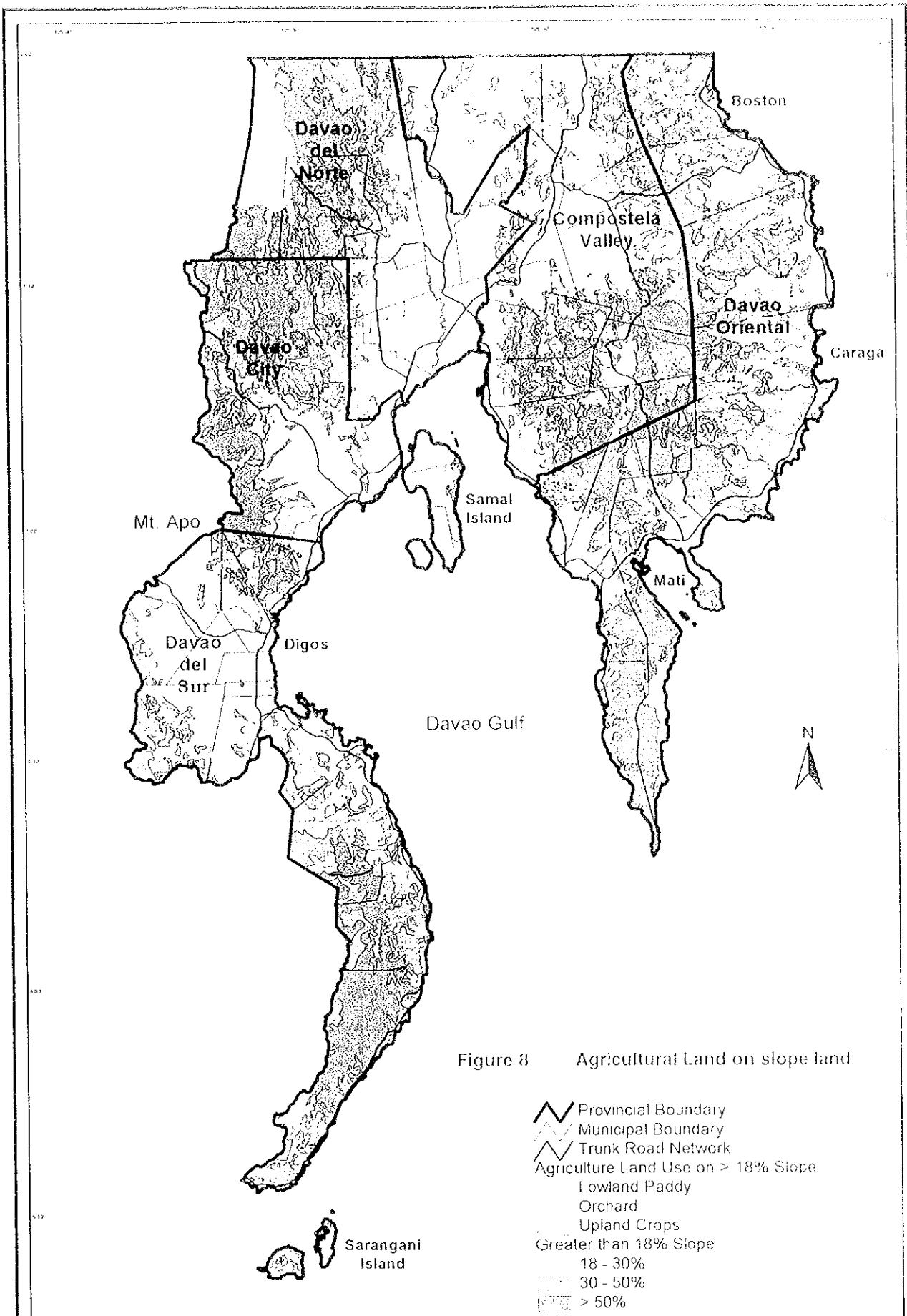

Figure 8 Agricultural Land on slope land

Table 25 Watersheds, Severe Erosion and Flood Prone Area

		Watershed	Severe Erosion		Flood Prone Area	
	Watershed	Area (km^2)	Area (km^2)	(%)	Area (km^2)	(%)
6	Padada-Mainit River	1,666	639.9	38.4%	79.5	4.8%
7	Linu-Dao River	168	32.0	19.0%	4.1	2.4%
8	Talomo River	1,281	293.8	22.9%	39.6	3.1%
9	Davao River	1,300	217.2	16.7%	49.6	3.8%
10	Lasang River	462	99.0	21.4%	19.4	4.2%
11	Tagum River	3,015	1,586.9	52.6%	339.1	11.2%
12	Hijo River	723	545.1	75.4%	20.8	2.9%
13	Cateel River	872	182.2	20.9%	38.1	4.4%
14	Baganga-Mahandor River	343	171.3	49.9%	7.2	2.1%
15	Manungao River	394	218.3	55.4%	8.1	2.1%
16	Casauman River	400	152.5	38.1%	12.2	3.0%
17	Bagoan River	152	42.1	27.7%	4.9	3.2%
18	Quiraman River	201	0.0	0.0%	7.3	3.6%
19	Manay River	148	56.3	38.1%	4.6	3.1%
21	Caraga River	538	428.5	79.6%	4.7	0.9%
22	Agusan River	1,936	868.8	44.9%	177.3	9.2%
23		245	202.9	82.9%	0.0	0.0%
24		239	150.6	62.9%	0.0	0.0%
25		119	52.4	44.0%	0.0	0.0%
26		150	90.6	60.4%	3.4	2.3%
27		1,046	769.9	73.6%	37.8	3.6%
28		276	79.4	28.8%	6.8	2.5%
29		187	8.3	4.4%	0.0	0.0%
30		413	374.4	90.7%	29.2	7.1%
31		673	93.8	13.9%	37.8	5.6%
32		300	10.0	3.3%	12.1	4.0%
33		243	36.4	15.0%	0.0	0.0%
35		94	75.8	80.9%	0.0	0.0%
36		195	173.2	88.9%	0.0	0.0%
0	no numbered watersheds	1,009	441.4	43.8%	0.0	0.0%
	DIDP	18,788	8,093	43.1%	943	5.0%

Note: The names of the unnamed w3ateersheds will be identified later after NIA data is acquired.
Source: JICA Study Team based on GIS computation

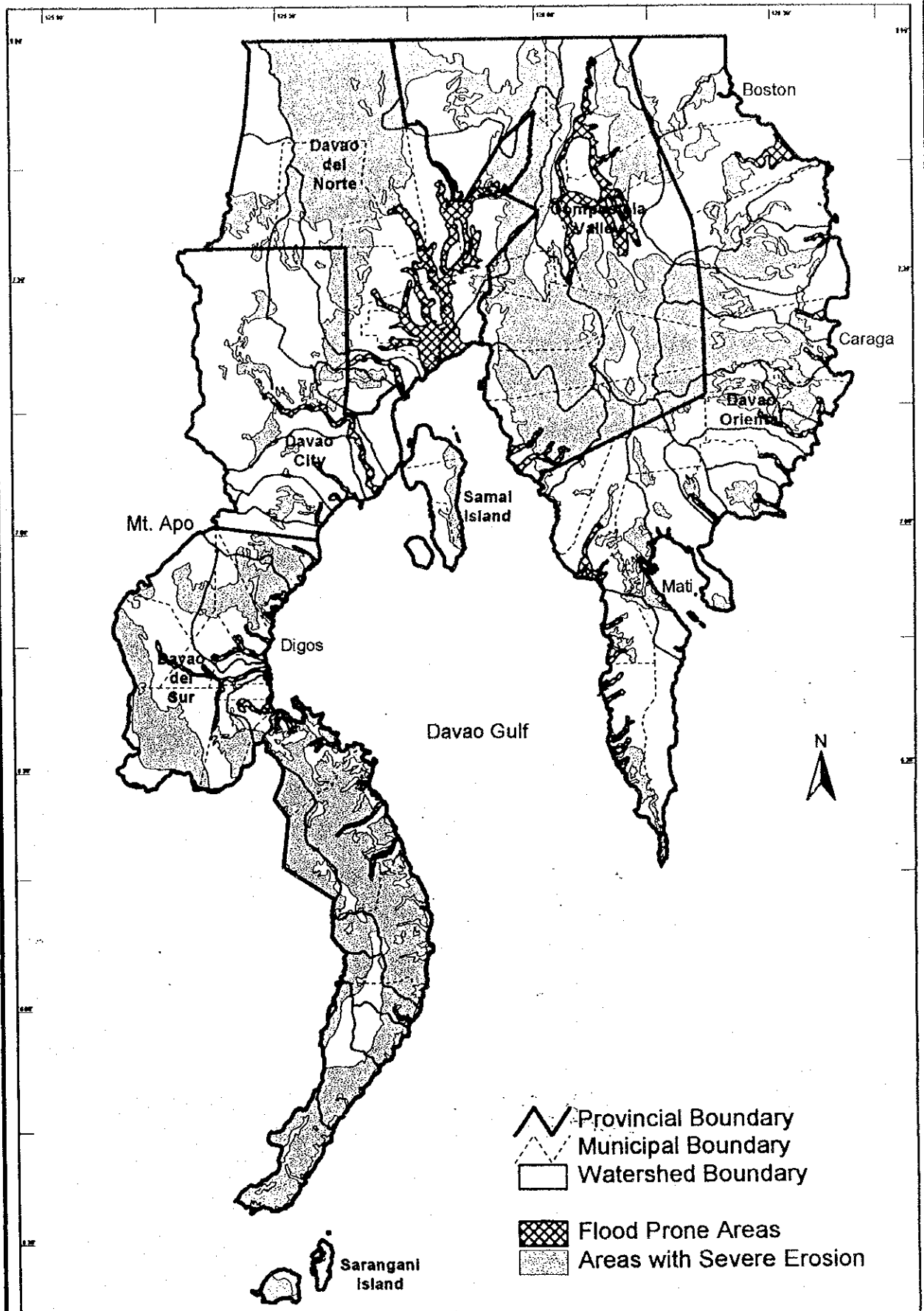

Figure 9 **Watershed, Severe Erosion Susceptibility Area and Flood Prone Area**

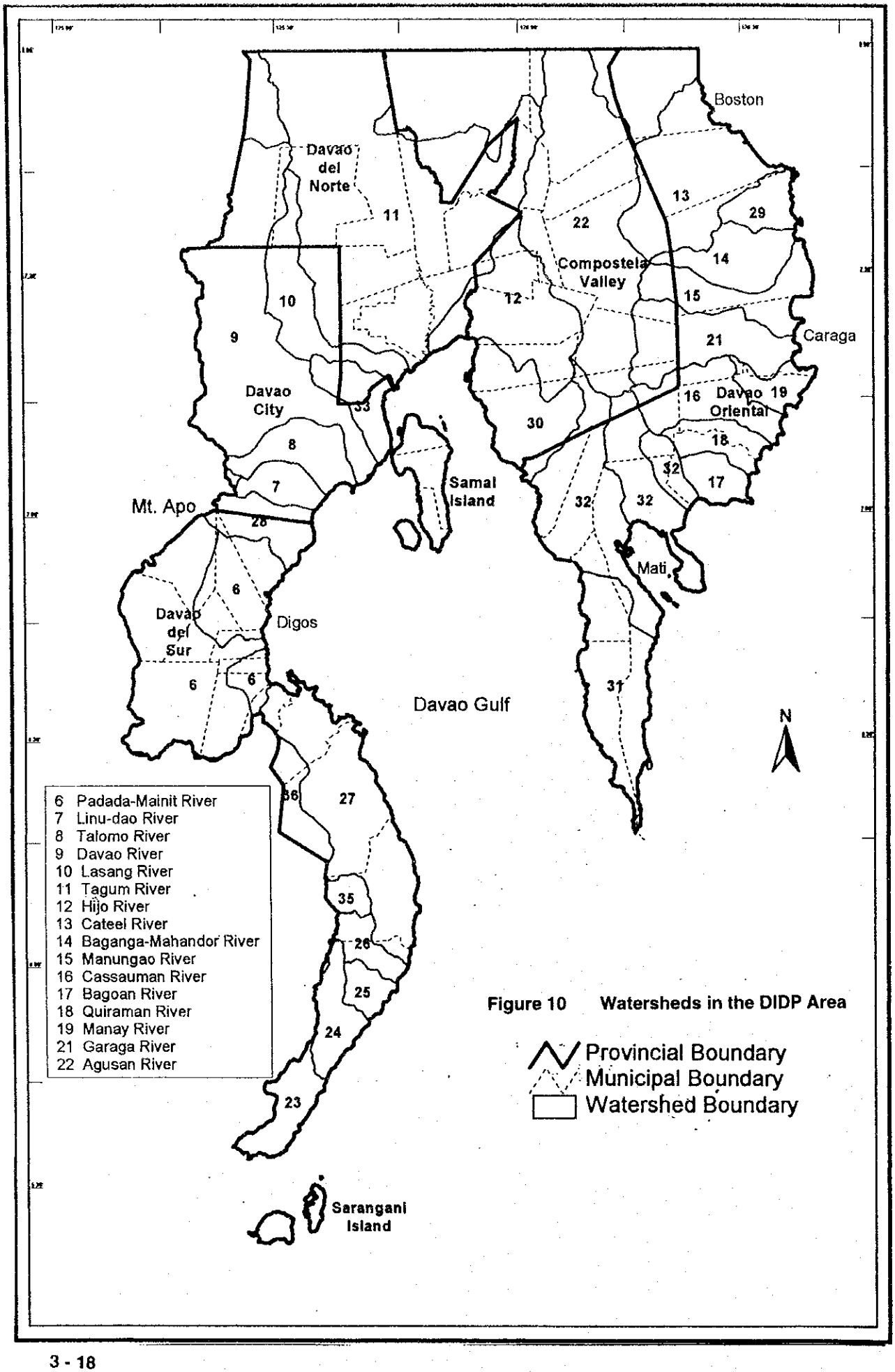

Figure 10 Watersheds in the DIDP Area

3.2. Land Tenure Situation

3.2.1. Ancestral domains

In the DENR's Department Administrative Order No.2.S, 1993, the following policies and objectives as to Ancestral Domains are stated.

Basic policy: 1) Preserve and maintain the integrity of ancestral domains, 2) Recognize Indigenous Cultural Communities (ICC) customs and traditions, and 3) /Promote indigenous ways for sustainable development natural resources i.e. ICC traditional practices.

Objectives: 1) Protect ICC tenure over ancestral lands and domains, and 2) ensure sustainable development of natural resources especially the forest.

Enactment of the Indigenous People's Rights Act (IPRA) on 27 October 1997 has established the IPs' rights and mandates to award Certificates of Ancestral Domain Claims. The CADC areas can be claimed in the forest land (or non-A &D area). The total CADC area is huge in the DIDP Area covering 256,828 ha, or 13.1% of the total DIDP Area at present (Tables 26; Figure 11). There is no limit to claiming CADC areas, and it is likely that the area be increased. As a matter of fact, there are a lot of CADC areas waiting for approval. Table 27 shows the CADC areas applied for approval. They cover 277,974 ha of land. The CADC area approved and on the pending list altogether covers 534,802 ha accounting for 27.2% of the total DIDP Area.

The CADC areas are exclusive for the ICCs with the following rules.

Safeguards against encroachment

No person who is not a resident of the domain or who does not belong to the claimant community may be given license or permit to exploit the natural resources in the area without consent of the community expressed in public hearings and consultations.

Implementation of government programs within ancestral domain

No governmental programs under the control of DENR shall be implemented within any ancestral domain without the consent of a majority of the recognized leaders of the community.

Contracts, leases and permits within ancestral domains

Contracts entered into and permits and leases issued by DENR for the exploitation of natural resources inside ancestral domain shall remain in force and effect until they expire. All such contracts, leases or permits shall not be renewed except those issued to members of the ICC through its recognized indigenous leaders.

Table 26 CADC Approved in the DIDP Area

Municipality/ District	Barangays	Indigenous Peoples	Total Area (ha)	Number of Beneficiaries	Date
Talaingod	Binongbong, Simong, Kaabakahan, Tibucag, kabuling, Malid, Dalingding, Palton, Lumabag, Angelo, igang, Dalingdigan, Dagohoy, Tibi-Tibi, Misolong	Kaylawan, langilan fo the Ata-Manobo	60,000.00	1,656	21-Oct-1997
Sto. Tomas	Talos, San Jose	Ata-Manobo	12,600.00	n.a	1996/3/11
Davao del Norte			72,600.00	1,656	
Monkayo		Mandaya, Dibabawon, Manguangan, Nanobo	30,000.00	n.a.	1996/6/27
Compostela Valley			30,000.00	n.a.	
Paquibato	Tapac	Ata-Manobo	9,363.00	5,292	26-Aug-1995
Paquibato	Malabog, Colosas, Pandaltan, Paradise embac	Ata	22,634.00	3,074	26-Feb-1998
Baguio	Tambobong	Obo-Manobo	8,236.00	780	27-Feb-1998
Marilog	A part of CADC area of South Cotabato			n.a.	
Davao City			40,233.00	9,146	
Magsaysay	Maibo	B'laan	7,027.47	4,123	26-Aug-1995
Matabo	Colonsabak Dongan Pekong			n.a.	
Malita	Tagacaolo	Tagacaolo	33,730.74	27,700	26-Aug-1995
Davao del Sur			40,758.21	31,823	
Manay	Taokanga	Mandaya	6,916.00	1,092	28-Oct-1997
Caraga	Sangab	Mandaya	5,200.00	668	28-Oct-1997
Boston	Nabunga, Simulao, San Jose, Cawayanan	Mandaya-Manubo	17,112.00	17,112	25-Sep-1997
Mati	Tagbinonga, don Salvador	Mandaya	5,000.00	165	21-Oct-1997
Lupon	Don Malano Marcos				
Lupon	Marayag & Calapagan	Mandaya	18,820.00	n.a.	Apr-96
Baganga	Mahan-ub	Mandaya	20,189.00	1,174	25-Sep-1997
Davao Oriental			73,237.00	20,211	
DIDP Total			256,828.21	62,836	

Source: Land management Services, DENR region XI

Table 27 CADC Area Pending Application in the DIDP Area

Province/City	Municipality/ District	Barangay	Tribal	Area (has)	Date filed
Davao Oriental	1 Tarragona		Mandaya	10,000	1997/3/13
	2 Cateel		Mandaya	10,000	1996/11/2
	3 Banaybanay	Pintatagan, Mahayag	Mandaya	10,000	1997/7/24
	4 Banaybanay	Macamboi, Cabaya	Mandaya	10,000	1997/7/18
	5 Baganga	Campawan	Mandaya	10,000	1997/2/20
	6 Baganga	Mahan-ub	Mandaya	20,189	1997/8/26
	Total			70,189	
Davao del Sur	1 Sta. Maria	Kidadan, Buca, San Antonio, San Pedro, Baslawan, Pongpong	Tagakaoko	4,442	1997/7/21
	2 Kiblawan	Kimlawis	B'laan	6,637	1996/8/21
	3 Kiblawan	Abnate, Kimlawis	B'laan	8,736	1997/7/21
	4 Don marcelino		Manobo-B'laan	20,000	1996/1/3
	Total			39,815	
Davao City	1 Marilog		Obo-Bgobo-Matigsalog	27,950	1997/7/2
	Total			27,950	
Davao Province	1 New Bataan & Compostela		Mansaka-Mandaya	10,000	1995/10/16
	2 Compostela	Bongkilaton, Ngan	Manadaya	10,000	1996/3/18
	3 Kapalong	Gupitan	Mandaya, Manobo	10,000	1996/2/22
	4 Kapalong	Dugayan, Gupitan	Dibabawon	10,000	1996/7/8
	5 Pantukan		Mansaka	10,000	1996/9/9
	6 Asuncion	Camansa	Manguangan	10,000	1996/5/17
	7 Maco		Mansaka	10,000	1996/9/3
	8 Pantukan	Napnapan	Mansaka	10,000	1996/12/3
	9 Pantukan		Mansaka	10,000	1997/3/24
	10 Maco, Mabini, Pantukan		Mansaka, Mandaya	10,000	1996/6/18
	11 Compostela	Ngan	Mandaya	10,000	1996/6/28
	12 Mabini	Cuambog	Mansaka	10	1996/12/9
	13 Mabini		Mansaka, Mandaya	10,000	1997/2/20
	14 Mabini	Cuambog	Mansaka	10,000	1997/4/1
	15 Pantukan	Kingking	Mansaka	10	1996/12/3
	16 Samal & Talikod Island		Isamal	10,000	1997/6/20
	Total			140,020	
DIDP Total				277,974	

Source: Land Management Service (LMS), DENR Region XI

3.2.2. Comprehensive Agrarian Reform Program (CARP)

The Comprehensive Agrarian Reform Program is an integrated program which covers a set of measures to effect land tenure improvement and provide production and support services not only to eliminate obstacles to development but also to accelerate the process of development. It is primarily tasked to transfer ownership of agricultural lands to tenant farmers, help farmer beneficiaries of land reform to increase their productivity and income, and shift landowner resources to industry or to some other productive endeavors.

Proclamation No. 131 dated July 22, 1987 instituted the CARP which covers, regardless of tenure arrangement and commodity produced, all public and private

agricultural lands and other lands of the public domain suitable to agriculture.

Among the main features of the program are the following:

- a retention limit of 5 ha plus 3 ha for every direct heir and tiller who is 15 years of age and above;
- coverage of all private and public agricultural lands as provided by Executive Order 229, including public lands, regardless of tenurial arrangement and crops produced; and
- lands to be acquired and distributed over a period of 10 years.

The Program has three phases of implementation.

1) Phase I covers all idle and abandoned, voluntarily offered, or foreclosed public lands devoted to agriculture, to be acquired and distributed upon the effectivity of the Law and to be completed within four years.
2) Phase II covers all alienable and disposable public and arable agricultural lands as well as privately owned lands in excess of five (5) hectares, to be completed within four years.
3) Phase III begins on the fourth year and covers all other private agricultural lands from 25 to 50 hectares with a retention limit of 24 hectares, the implementation of which will take place on the sixth year of the program.

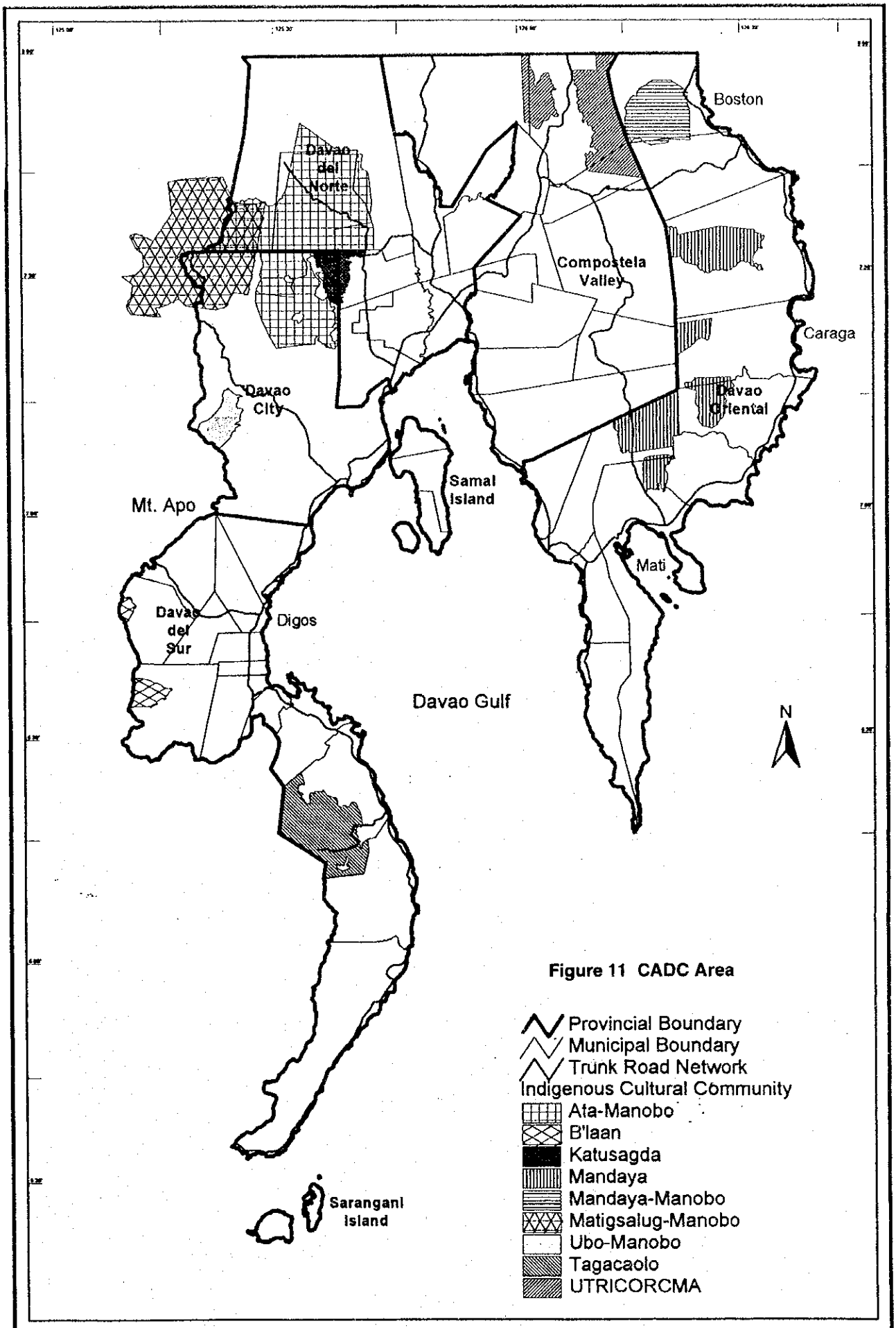

Figure 11 CADC Area

CARP in the DIDP Area

The DIDP Area has 186,843 ha of working scope of CARP as of December 1997. Out of it, 138,529 ha of land has been distributed to farmers, or 74.1% of the total working scope accomplished. In Provinces and City, Davao City's performance is the lowest with 59% accomplishment. Other provinces show similar accomplishment percentage rate in the 1970's.

Regarding the accomplishment in the Phases, Phase III, targeting private lands, shows the lowest rate, with 47.3% vis-à-vis the working scope. In this Phase, accomplishment of Davao City and Davao del Norte is decisive, with 7.5% and 9.2%, respectively.

The CARP was terminated in June 1998 as mandated in Comprehensive Agrarian Reform Law (RA 6557) with 48,314 ha left undistributed and to be distributed in the future. After the CARP termination, continuous program in this line is implemented. The commercial farms in the working scope are distributed in 7,205 ha in Davao Province, 2,556 ha in Davao City, 1,933 ha in Davao del Sur, and 933 ha in Davao Oriental.

Table 28 Agrarian Reform Accomplishments in the DIDP Area

Province/City	Phase		Working Scope (ha)	Accomplish-ment	Accomplish-ment rate (%)
Davao Province	Phase I	(June 1988-June 1992)	51,662	45,936	88.9%
	Phase II	(June 1988-June 1992)	31,300	28,896	92.3%
	Phase III	(June 1992-June 1998)	5,523	506	9.2%
	Phase IV	Deferred Commercial Farm	7,205	0	0.0%
	Total		95,690	75,338	78.7%
Davao City	Phase I	(June 1988-June 1992)	10,041	9,289	92.5%
	Phase II	(June 1988-June 1992)	2,372	1,233	52.0%
	Phase III	(June 1992-June 1998)	3,285	246	7.5%
	Phase IV	Deferred Commercial Farm	2,556	0	0.0%
	Total		18,254	10,768	59.0%
Davao del Sur	Phase I	(June 1988-June 1992)	12,512	11,718	93.7%
	Phase II	(June 1988-June 1992)	5,415	2,175	40.2%
	Phase III	(June 1992-June 1998)	7,199	5,752	79.9%
	Phase IV	Deferred Commercial Farm	1,933	0	0.0%
	Total		27,059	19,645	72.6%
Davao Oriental	Phase I	(June 1988-June 1992)	9,324	8,029	86.1%
	Phase II	(June 1988-June 1992)	20,264	16,425	81.1%
	Phase III	(June 1992-June 1998)	15,319	8,324	54.3%
	Phase IV	Deferred Commercial Farm	933	0	0.0%
	Total		45,840	32,778	71.5%
DIDP	Phase I	(June 1988-June 1992)	83,539	74,972	89.7%
	Phase II	(June 1988-June 1992)	59,351	48,729	82.1%
	Phase III	(June 1992-June 1998)	31,326	14,828	47.3%
	Phase IV	Deferred Commercial Farm	12,627	0	0.0%
	Total		186,843	138,529	74.1%

Source: DAR region XI

3.3. Agricultural Land Capability

The entire DIDP Area will be classified into four classes according to the soil productivity capability classification criteria which was developed by the Soil Research and Development Center of DA in cooperation with a JICA technical cooperation program.

3.3.1. Capability classification procedure

(1) Definition of classes

Soil rating is made for four different crop production groups:

1) Lowland rice including both irrigated and rainfed production,
2) Upland crops such as grains, vegetable and legumes, rootcrops,
3) Tree crops including fruit orchard, forest species, palm species, and
4) Pasture crops.

Land suitability for each crop production group is categorized into the following four classes:

Class 1: The soil is highly productive for agricultural use. None to slight limitations or hazards for sustainable crop production. Regarded as naturally fertile and of greatest potential for agricultural use, without need for any particular improvement practices

Class 2: The soil is moderately productive for agricultural use. With moderate limitation of hazards for sustainable crop production. Some improvement practices are required, hence, with reduced benefits as compared to Class 1.

Class 3: The soil is marginally productive for agricultural use. With severe limitations or hazards for sustainable crop production. Can be cultivated for selected crops under very careful management. Fairly intensive improvement practices are required such that added expenditure to maintain production will only bring marginal benefit.

Class 4: The soil is unproductive or incapable of supporting agricultural production. With the greatest natural limitations or hazards.

(2) Evaluation criteria

The evaluation criteria consist of five components which are further divided into 12 soil qualities and 28 soil characteristics as follows. Each item on soil characteristics are classified into four classes according to the criteria rating also developed by SRDC, DA.

Ratings of each of soil characteristics items are summarized by soil qualities, rating of which is determined by the lower class of the associated soil characteristics items. Rating of each soil quality is then summarized by soil components, following the same procedure as above.

Soil components	Soil qualities	Soil characteristics
A. Soil rooting condition	A.1 Soil depth A.2 Bulk density	- Depth of topsoil - Bulk density
B. Soil moisture	B.1 Risk of over wetness B.2 Risk of water stress	- Topography, available water, water regime, soil moisture content - Topography, soil texture
C. Soil fertility	C.1 Capacity for nutrient renewal C.2 Availability of nutrients C.3 Inherent fertility C.4 Absence of soil fertility constraints	- Depth of topsoil, organic matter content - Total-N, Avail-P, Ex-K, Ca, Mg, BSP - CEC, %P retention, pH of subsoil - Topsoil pH, EC, organic horizon >25cm
D. Soil workability	D.1 Ease of plowing/puddling D.2 Absence of impediments to cultivation	- Consistency, stickiness, texture - Fragments
E. Soil hazard	E.1 Absence of erosion hazard E.2 Absence of flooding hazard	- Slope, erodability - Flooding

Note: The evaluation criteria consists of five (5) components which are further divided into 12 soil qualities and 28 soil characteristics

Source: JICA Study team based on the SRDC technical information series No3, Soil Productivity Capability Classification; Part 1 - Soil Productivity Rating, revised, October 1997, edited by Dr.Tochiaki Ohkura and Mr. Rodelio Carating, Soil Research and Development Center, Department of Agriculture

Finally overall productivity classification will be determined by the lowest class among the rating of soil components. Sample expression of soil productivity capability classification is as follows.

Crop groups	Class	Soil rooting condition			Soil moisture			Soil fertility					Soil workability			Soil hazard		
		A -	A.1,	A.2	B -	B.1,	B.2	C -	C.1,	C.2,	C.3,	C.4	D -	D.1,	D.2	E -	E.1,	E.2
Lowland rice	3	1 -	1,	1	2 -	1,	2	3 -	1,	2,	3,	3	2 -	1,	2	3 -	3,	1
Upland crops	3	1 -	1,	1	2 -	1,	2	3 -	1,	2,	3,	3	2 -	1,	2	3 -	3,	1
Orchard	3	1 -	1,	1	1 -	1,	1	3 -	1,	2,	3,	3	1 -	1,	1	3 -	3,	1
Pasture	3	1 -	1,	1	1 -	1,	1	3 -	1,	2,	3,	3	2 -	1,	2	3 -	3,	1

Detailed criteria for evaluation in LMU is shown in Appendix 1 to this chapter.

3.3.2. Assessment of land capability

(1) Availability of data for the land capability classification

The following data as related to land capability classification were obtained:

1) Land management units (LMUs) map,

2) Soil/Land Resources Evaluation Project Report for Davao City, Davao Province and Davao del Sur,

3) Soil taxonomy map showing soil mapping units (SMUs),

4) Slope map, and

5) Erosion map.

All of these data are published by the Bureau of Soils and Water Management (BSWM) of DA. While the LMU map provides information on landform pattern,

dissection, parent material, etc., the SMU map provides information mainly on soil fertility. Slope map and erosion map provide information on the extent of potential erosion hazard.

Information on each LMU is provided by the report on Soil/Land Resources Evaluation Project. As criteria for LMU classification have been modified after the publication of the reports for Davao Province and Davao del Sur, however, re-interpretation of old LMUs into new LMUs was necessary for those provinces. Another difficulty was no such report exists for Davao Oriental.

As for the soil taxonomy map, although SMU is shown according to the US soil taxonomy, associated data on soil profile description and physico-chemical analysis are not available for all SMUs. Slope map and erosion map cover the entire DIDP Area, and have sufficient information for classification. Overall information will cover 11 soil qualities except soil bulk density for capability classification.

(2) Land capability classification

Assessment is made on land capability for the DIDP Area according to the following procedure.

1) Each LMU according to the old system in the reports on Soil/Land Resources Evaluation Project for Davao Province and Davao del Sur, was re-interpreted into new LMU(s) which appears in the LMU map, based on the descriptive information on landform pattern, dissection, soils, parent material, slope, erosion features and drainage condition.

2) New LMUs are evaluated based on the new classification criteria developed by the Soil Research and Development Center (SRDC) of DA for the criteria on soil depth, risk of over wetness, and risk of water stress and flood.

3) As for the other LMUs which were not covered by the re-interpretation, rating was made mainly based on the LMU description.

4) The classification for Davao Oriental is made referring to the same LMUs appearing in the neighboring provinces.

5) SMUs are evaluated through the interpretation of primary data on soil profile description and physico-chemical analysis to classify them into four capability classes.

6) As for the SMUs which are not supported by the basic data, classification was made referring to the LMUs with associated soil profile description and physico-chemical analysis.

(3) Capability class distribution

Land capability classification is then made by overlaying four maps of LMUs, SMUs, slope and erosion. The results are shown in Figures 12 through 15. The areas of each class are shown on Table 29.

The lowland area generally shows the higher capability for all the crops. Almost 70% of the total DIDP Area is unsuitable for lowland paddy because of its terrain and dominant mountainous area. Davao del Norte has a large share in land suitable for lowland paddy accounting 33.5% for Class 2 and 16.4% for Class 3, or 49.9% both combined. Within its own territory, Davao del Norte shows a higher rate of

land of Classes 2 and 3, covering almost 40% of the total area. For upland crops, almost same tendency as lowland crops is found.

For orchard, almost 60% of the total DIDP Area is suitable or highly suitable. Davao City's suitability for upland crop is the highest with 79.6%, followed by Davao del Norte with 69.8%. Davao del Sur is in general unsuitable for orchard, where 57.1% of the provincial land is found unsuitable.

In suitability for pasture, the DIDP Area is rather suitable as a whole with 67.7% of the total area suitable or highly suitable.

Table 29 Land Capability Distribution by Crop Type in the DIDP Area

(km²)

Type	Class	Davao del Norte	Compostela Valley	Davao City	Davao del Sur	Davao Oriental	DIDP
Lowland Paddy	Class 2	69,421	35,821	20,225	44,018	37,530	207,015
	Class 3	61,563	73,812	66,152	45,808	127,524	374,859
	Class 4	199,177	313,848	147,432	310,603	325,705	1,296,764
Upland crops	Class 2	41,814	29,724	7,578	36,861	33,657	149,632
	Class 3	90,930	88,975	76,092	48,119	132,104	436,220
	Class 4	197,392	304,799	150,121	315,355	324,939	1,292,606
Orchard	Class 2	45,659	31,863	8,679	38,694	37,924	162,820
	Class 3	184,847	189,353	177,493	133,156	278,513	963,362
	Class 4	99,634	202,276	47,619	228,479	174,260	752,269
Pasture	Class 2	46,088	33,653	9,793	42,379	40,771	172,684
	Class 3	185,078	196,076	202,844	171,367	353,592	1,108,956
	Class 4	98,975	193,763	21,154	186,585	96,332	596,810
Total Agriculutural Land		330,141	420,113	233,792	400,330	490,695	1,875,071

Source: JICA Study Team based on GIS computation

3.4. Sustainability of Agricultural Land

Agricultural land is examined in terms of sustainability based on the land capability for agriculture. The capability is classified into four categories although there is no Class 1 land in the DIDP Area. The following are definition of sustainability.

Sustainable land use: land use that is in accordance with sustainability of the land for use and can be continued on into the future with no loss of productivity, and no deterioration of the land resource e.g. suitable for upland crops and being used for upland crops.

Overused land: land being overused, the intensity of the use is too high e.g. unsuitable for upland crops but being used for upland crops. As a result, this category of the land needs management inputs to bring back into line with its land suitability.

Underused land: land being underused. The comparison of the land use and land suitability sometimes reveals that there are areas of land that are not being used to their potential. The intensity of its use is below its suitability. Even the land is used for a crop cultivation for which the land is suitable, the intensity or extensity of cultivation cannot be evaluated from the data available from GIS. Therefore, in this study, land suitable for agricultural use being used for grassland (grassland, ipil-ipil, and bamboo) are picked out as this category. This area will be candidate agricultural land in the future.

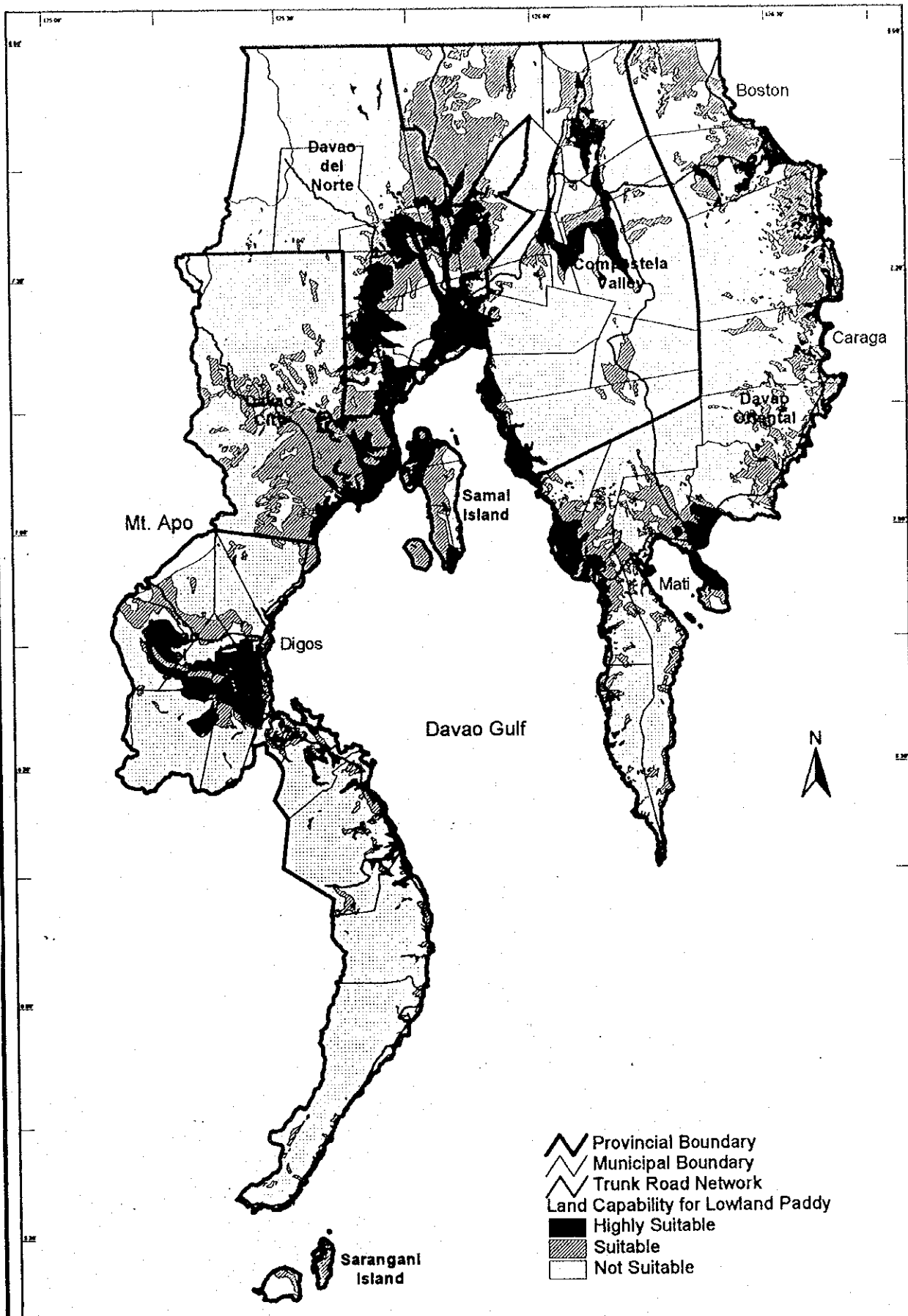

Figure 12 Land Capability for Agricultural Use (Lowland paddy)

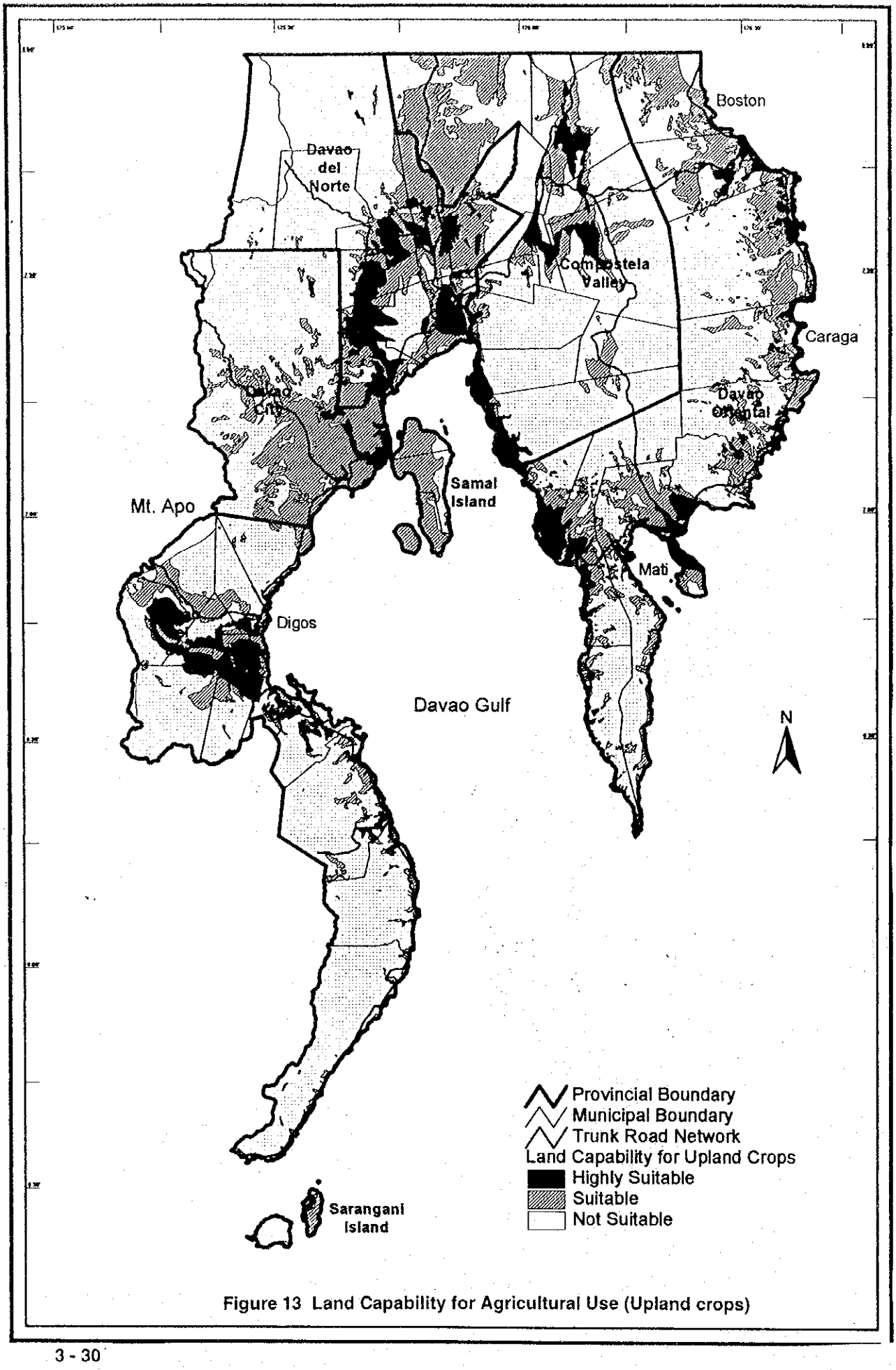

Figure 13 Land Capability for Agricultural Use (Upland crops)

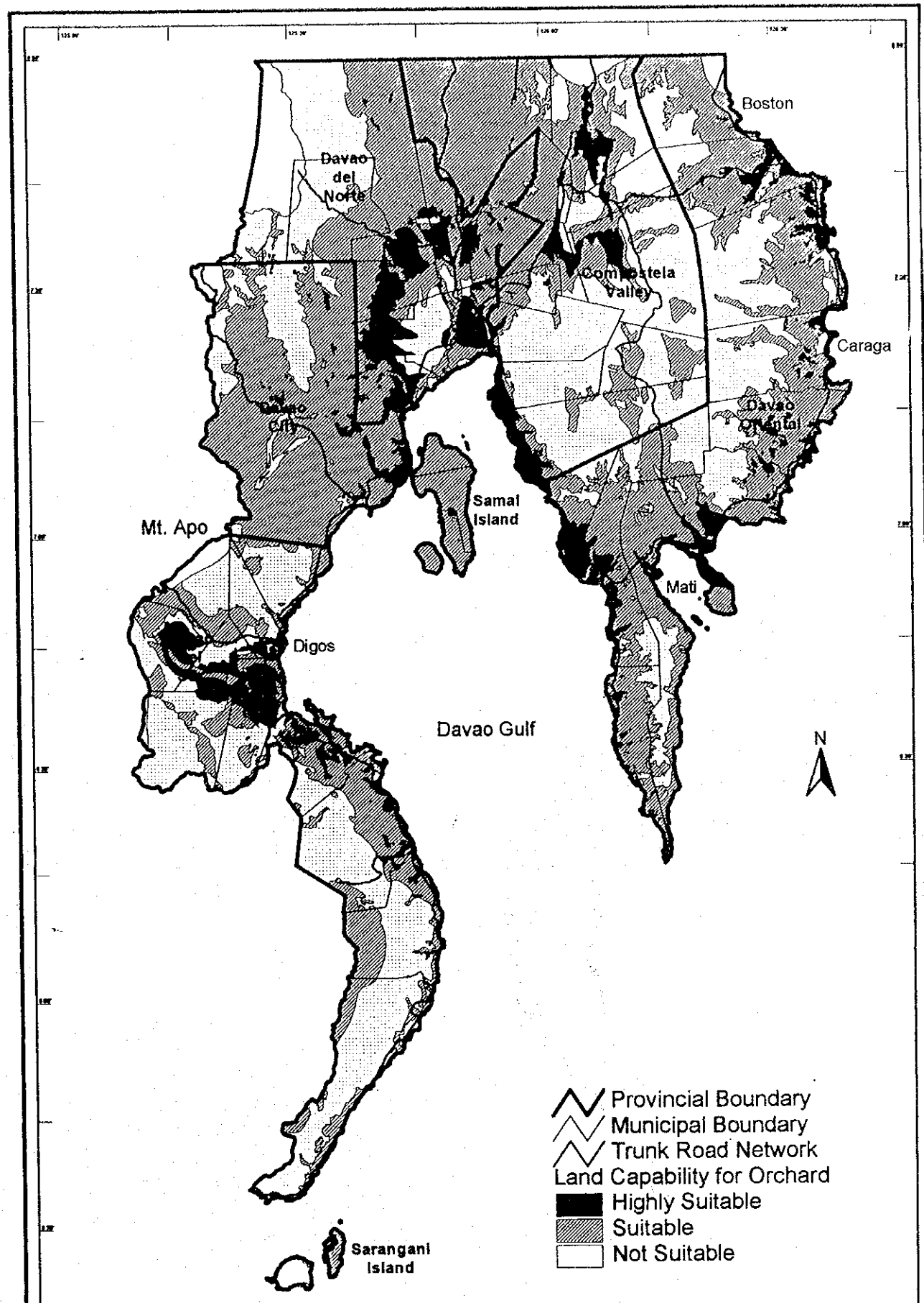

Figure 14 Land Capability for Agricultural Use (Orchard)

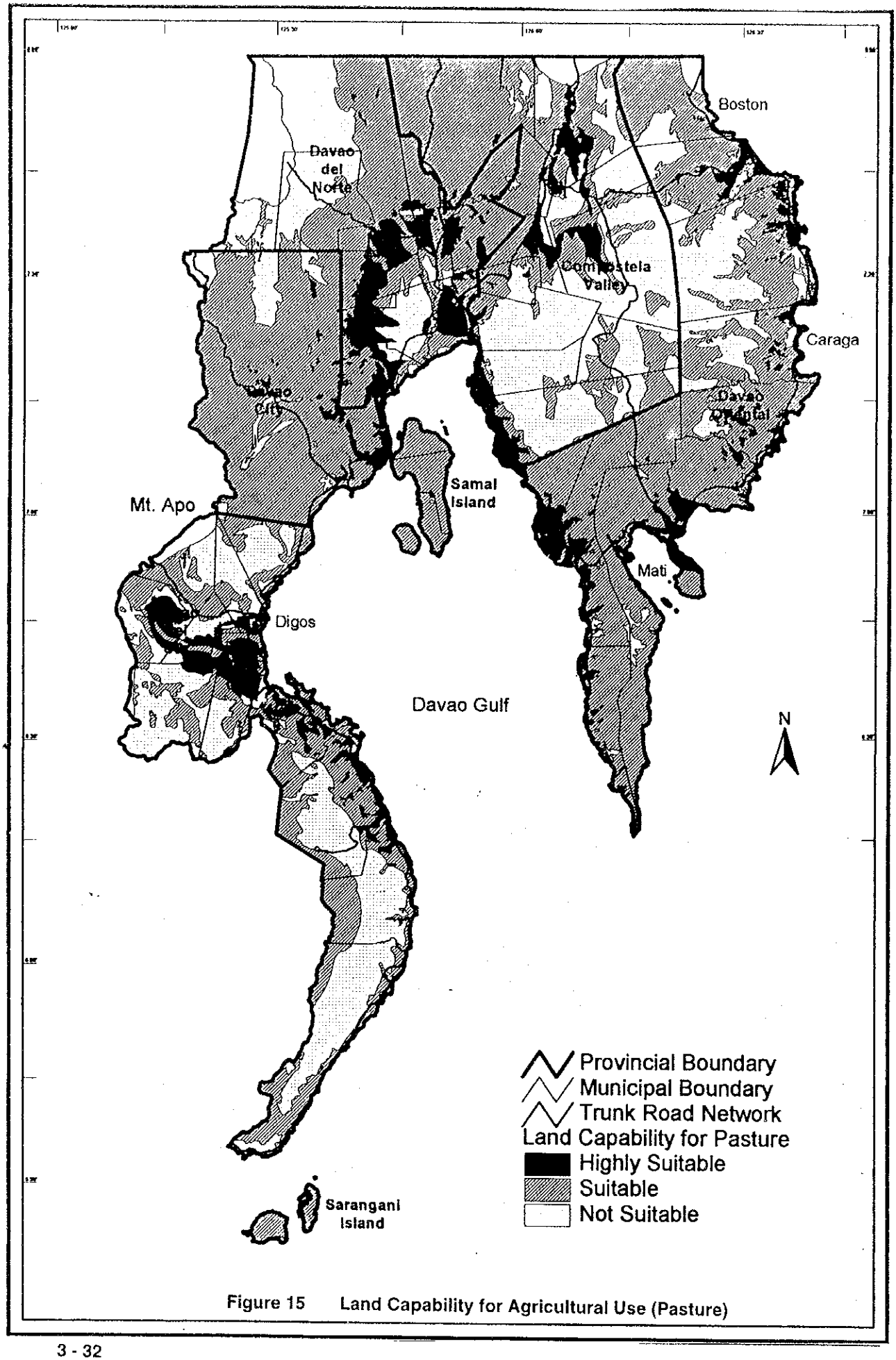

Figure 15 Land Capability for Agricultural Use (Pasture)

The results are shown in Table 30 and Figure 16 below.

Table 30 Sustainability of Agricultural Land

Category	Description (existing land use and land capability)
Sustainable	- Lowland paddy (irrigated) - Lowland paddy (non-irrigated) on land of class 2 or 3 in lowland paddy - Upland crops on land of classes 2 or 3 in upland crops - Orchard crops on land of classes 2 or 3 in orchard
Overused	- The above crops on land of class 4 in respective crop capability
Underused	- Grassland on land of classes 2 or 3 in capability for lowland paddy, upland crops or orchard.

Note: Upland crops indicate corn, ramie, and sugarcane
Orchard includes coffee, cacao, citrus, pineapple, pomelo, banana, rambutan, fruit tree, and abaca
Grassland includes grassland, ipil-ipil, and bamboo
Source: JICA Study Team

In the DIDP Area, more than 74.2% of the total agricultural land area categorized as being sustainable. However, it varies considerably from province to another, and from a crop to another. In the total agricultural land, Davao City shows the highest sustainability ratio with 94.3%, followed by Davao del Norte with 87.7%. Davao Oriental has the least ratio of sustainable agricultural land use. Because of its total agricultural land area, Davao Oriental occupies both the sustainable and overused agricultural land, with 29% for sustainable and 47% for overused.

Crop-wise ratios of sustainability show that upland crop land, especially corn which is cultivated on a large tract of land in Davao Oriental, is characterized by high incidence of overused land, accounting for 62.1% of the total upland crop area. This, again, differs among provinces and City. Davao del Norte has only sustainable upland crop area, while Davao Oriental has 69.1% of overused area of this kind.

Regarding underused land that is grassland on land suitable for agricultural use, totals 207,583 km^2 in the DIDP Area. Of the underused grassland, 32.2% is located in Laak, Davao City, and Mati in a large continuous tract of lands. The rest of the land of this type is scattered in Davao del Sur and Compostela Valley. This is a candidate area for agricultural use in the future development.

Table 31 Sustainability of Agricultural Land in the DIDP Area

(km^2)

	Lowland paddy		Upland crop		Orchard		Agricultural land			
	S	O	S	O	S	O	S	O	Total	U
Davao del Norte	40,249	8,204	257	0	73,362	7,772	113,867	15,976	129,844	32,762
Compostela Valley	24,860	4,822	5,128	2,151	38,909	21,538	68,898	28,511	97,409	66,888
Davao City	1,358	209	644	743	70,156	3,393	72,158	4,345	76,503	38,455
Davao del Sur	12,792	0	15,493	15,619	73,835	28,232	102,120	43,851	145,971	47,006
Davao Oriental	15,343	6,035	27,772	62,236	102,687	13,953	145,802	82,224	228,026	22,473
DIDP	94,602	19,269	49,294	80,750	358,949	74,888	502,845	174,907	677,752	207,583

Note: S-sustainable, O-overused, U-underused
Source: JICA Study Team

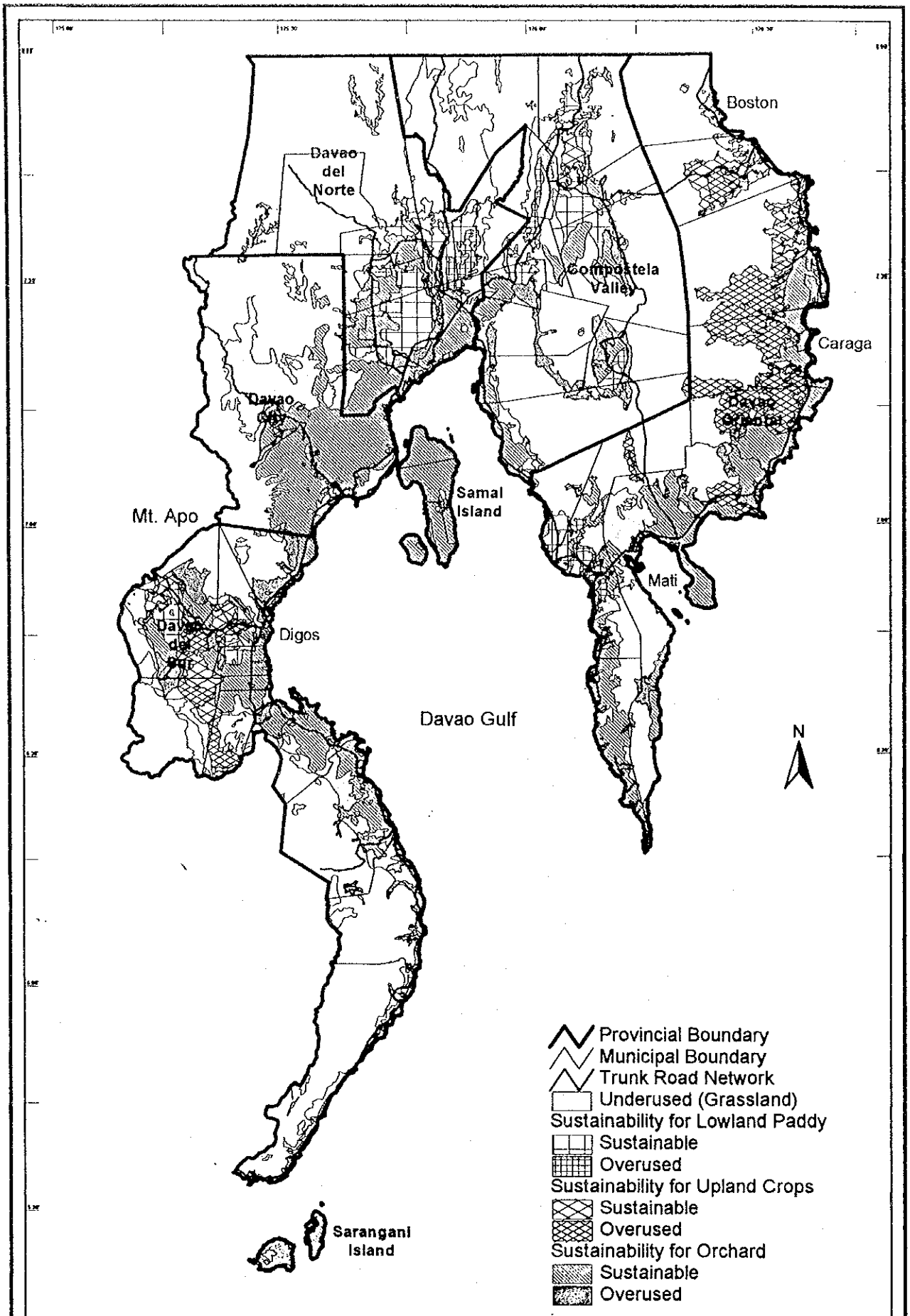

Figure 16 Sustainable Use of Agricultural Land