

2-4 Ulugan Bay Area

2-4-1 Natural Condition

(1) Climate

The climate type of the Ulugan Bay Area comes closer to the western coast climate type according to the above-mentioned the climatic divisions of the Philippines. Figure 2-2U-1 shows the maximum and minimum monthly average temperatures and rainfall of Puerto Princesa near Ulugan Bay from 1966 to 1996. The rainfall is low

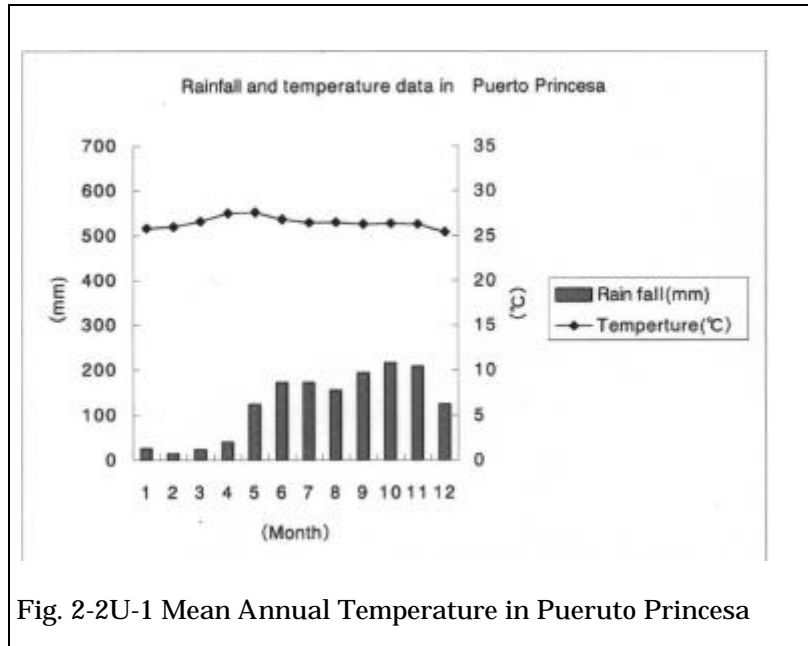


Fig. 2-2U-1 Mean Annual Temperature in Pueruto Princesa

especially during the January to April period in the year. However, this area has lower rainfall in total than that of the two other areas. The hottest month is April with temperatures of 27.5°C, and the coolest is December with temperature of 25.4°C. Also, the annual temperature range here is narrow.

Monsoons have a strong influence over the climate of this district. The variation in the wind direction clearly shows this. Figure 2-2U-2 also shows the wind direction and the sum of the monthly maximum average velocity at Puerto Princess for 1966 to 1996. From January to April, and during the month of November to December, the winds from the east, west and northeast are strong, however, during May to October, strong winds blow from the completely from opposite direction. This shows that January to April and from November to December, this area is influenced by the northeast monsoons, and during the months of May to October, it is influenced by the southwest monsoons. 6_ /

(2) Topography and Geology

Palawan Island, where Ulugan Bay is located, is divided geologically into Northern Palawan and Southern Palawan. Northern Palawan is composed of sedimentary rocks while Southern Palawan is composed of basic rocks and ultra basic rocks. Northern Palawan is considered created by its detachment from the

Eurasian Continent when South China Sea was formed. South Palawan is considered formed by the thrust of the sea bottom under the influence of the building up the Sulu Sea basin. These two geological provinces are separated by the Sabang fault, which lies, to the east of Ulugan Bay.

The eastern part of Ulugan Bay, which is included in the survey area, is composed of sedimentary rocks. These sedimentary rocks are composed of graywackes and shales which were formed during the Cretaceous to Paleogene periods. In contrast, the west area of Ulugan Bay is composed of igneous rocks. These rocks are composed of mafic and ultramafic plutonic rocks, which were formed during the Cretaceous to Paleogene periods. These plutonic rocks are mixed with periodotite accompanying gabbro or diabase dikes.

Alluvium, which formed during the Quaternary period is deposited around the river mouth of the Bahile river which is at the innermost part of Ulugan Bay, and around the river mouth of small-to-medium size rivers, and inside Tagnipa Bay. Mangrove thickets have formed there.

(3) Locational Condition

The Ulugan Bay area like the Lamon Bay area has no influx of a large river but gradual sedimentation of soil and sand. In this respect, this area may fall under

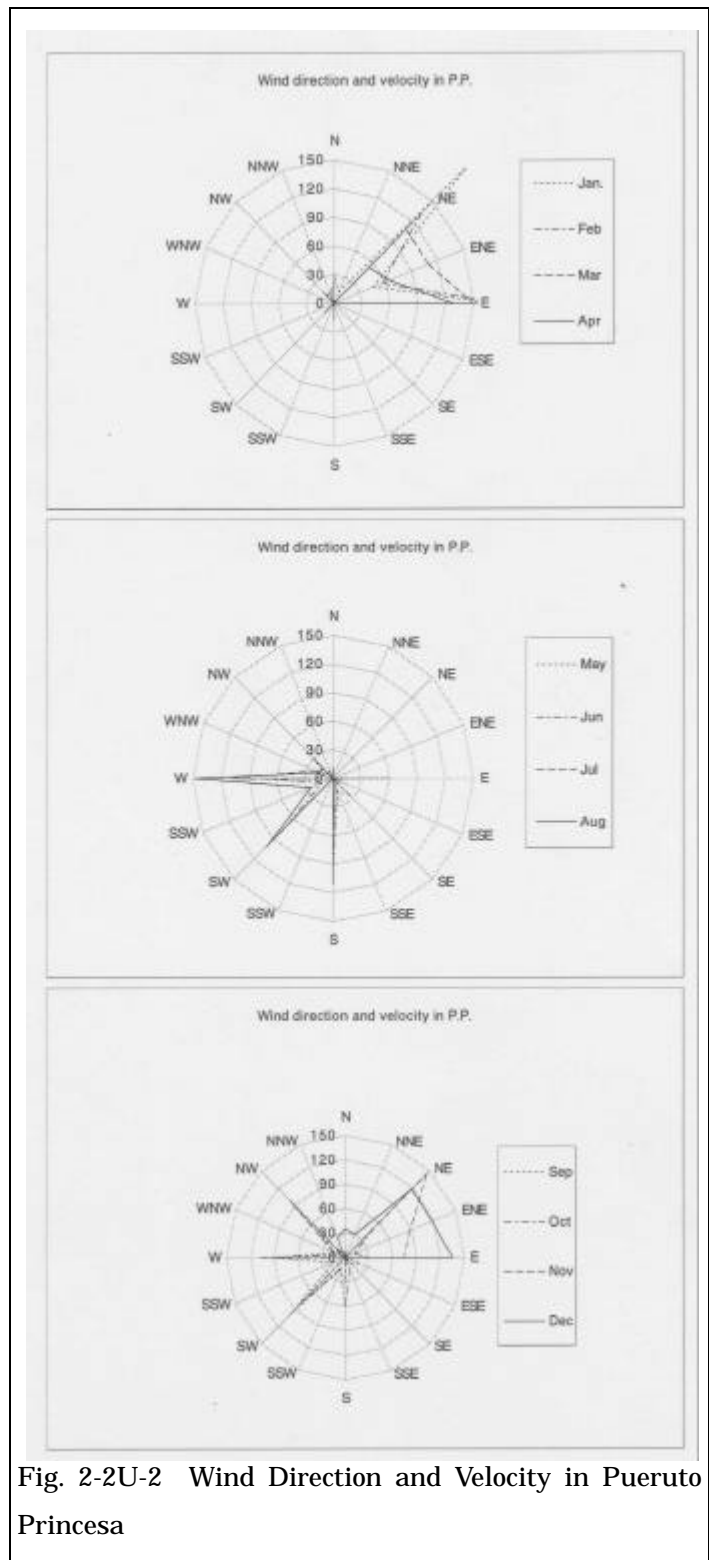


Fig. 2-2U-2 Wind Direction and Velocity in Pueruto Princesa

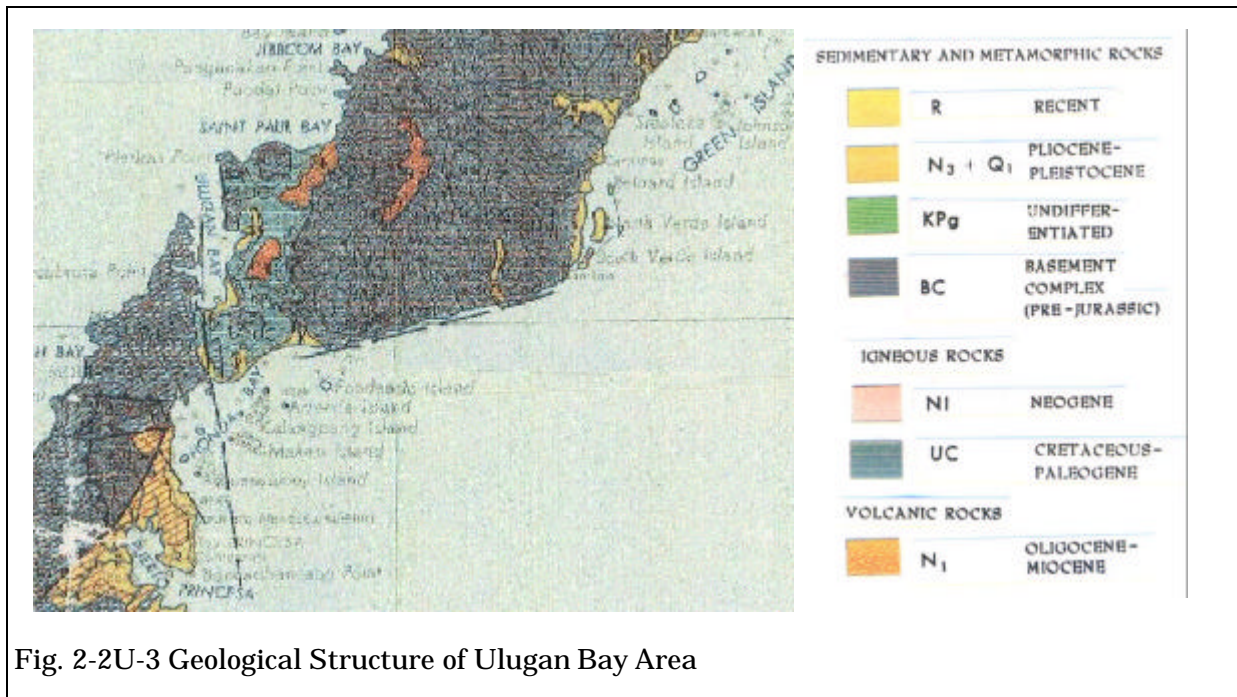


Fig. 2-2U-3 Geological Structure of Ulugan Bay Area

the estuary type. However, the terrain behind this area is steep and no flat area extends landward. That is why the habitat of mangroves is narrow for the estuary type and limited to near the innermost part of the bay. 7_ /

(4) Soil

The soil sediment is narrow compared with the others owing to topographic constraints but in good condition owing to the good development of mangrove above the ground. Particularly, soil in which *Rhizalphora apiculata* and *Bruguiera gymnorhiza* establish the zonation is dark brown and very rich in humus. This suggests that these species are able to supply a large amount of organic matter.

(5) Result of Soil Survey

Figure 2-2U-4 shows the results of the transect survey conducted in the Macarascas zone in the Ulugan Bay area. Along the belt line transect, soil profiles and their conditions are observed at 5 plots, namely that 0 m away from the starting point (Plot.1) , the 30 m away (Plot.2) , that 61 m away (Plot.3) , that 150 m away (Plot.4) , and that 252 m away (Plot.5).

Figure 2-2U-5 shows the soil profile at the point 0 m away from the starting point (Plot.1). *R. apiculata* and *Rhizophora mucronata* are found in the vegetation of the plot. The whole soil layer is about 125 cm in depth, and is divided into 3 layers by soil texture and soil color. Because the layer at depth of 125 cm and

below is filled with coral and shell fragments. The piston soil sampler could not be inserted.

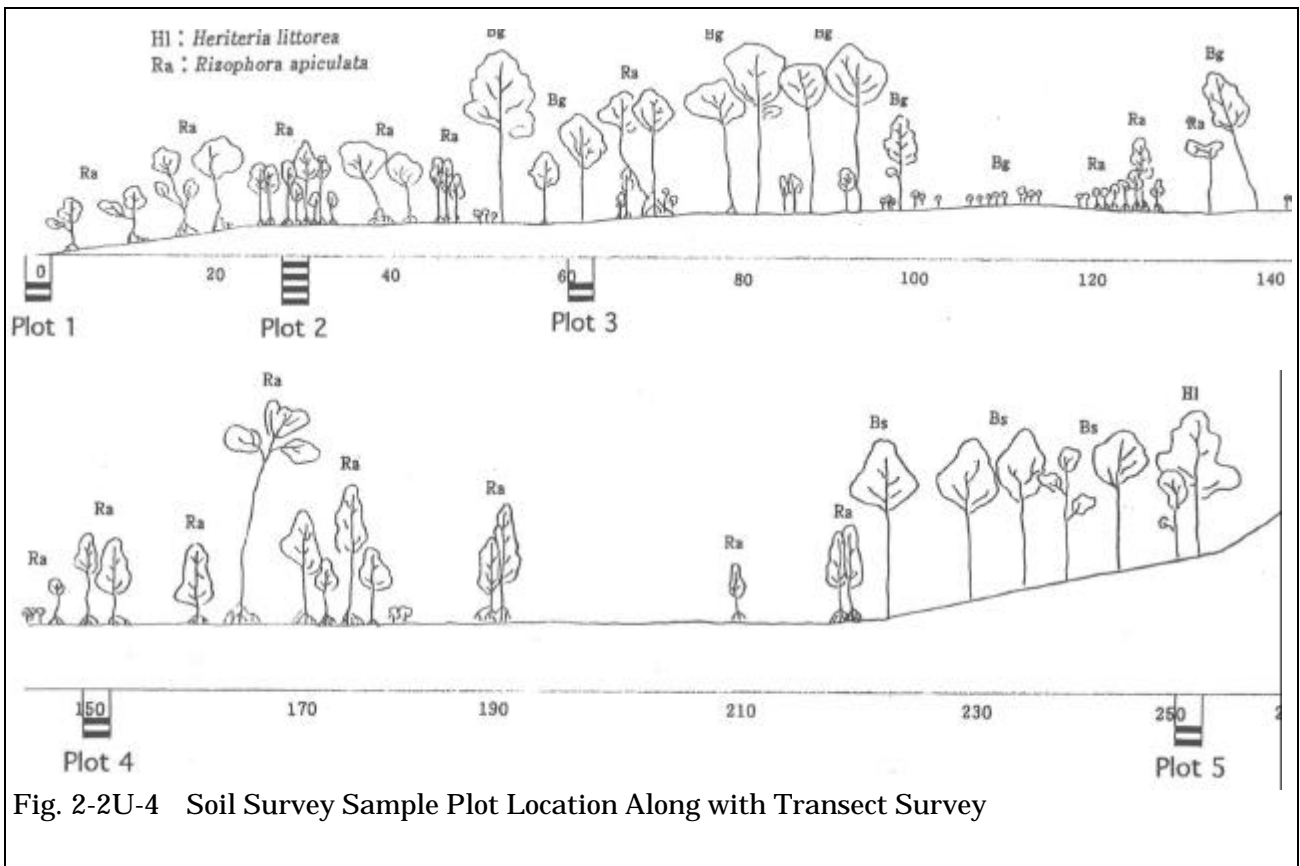


Fig. 2-2U-4 Soil Survey Sample Plot Location Along with Transect Survey

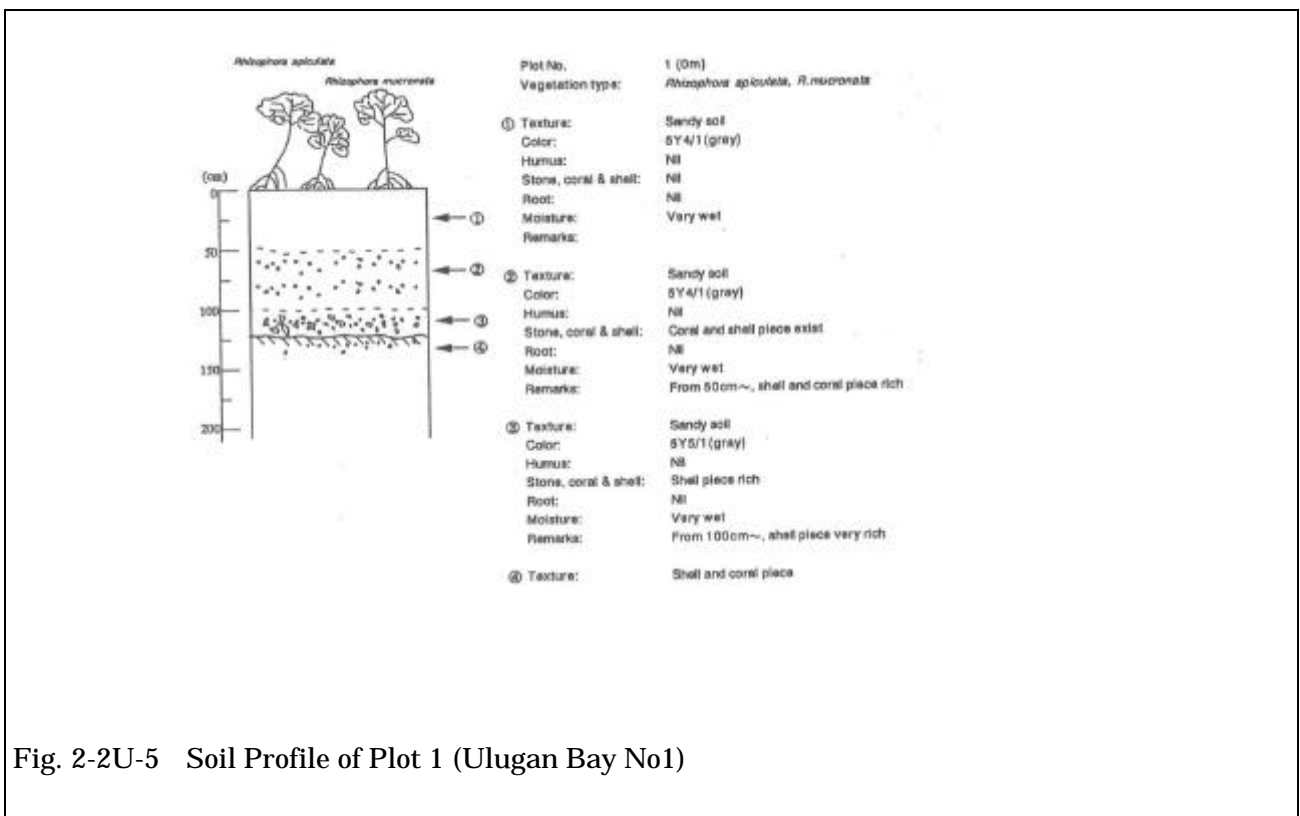


Fig. 2-2U-5 Soil Profile of Plot 1 (Ulugan Bay No1)

The top layer is situated from the surface to a depth of 50 cm . The soil texture is sandy soil, and the soil color is 5Y4/1 (gray), no humus content, and no stone, coral or shell fragments are found. No roots are found, either.

The middle layer is at depth of 50 to 100 cm. The soil texture is sandy soil, the soil color is 5Y4/1 (gray) as well as the top layer, and no humus content contained. A large quantity of coral and shell fragments are found in this soil layer, which is different from the top layer. No roots are found.

The bottom layer is situated at depth of 100 to 125 cm. The soil texture is sandy soil, the soil color is 5Y5/1 (gray), and no humus is contained. Remarkably many shell fragments are found in the soil layer, and as it is getting deeper, the ratio of shell fragments higher. No roots are found.

Figure 2-2U-6 shows the soil profile at the point of 30 m away from the starting point (Plot.2). The vegetation of the plot surface is almost occupied with *Rhizophora apiculata*. The whole soil layer is about 60 cm in depth, and is divided into 2 layers by soil texture and soil color. Because the layer at depth of 60 cm and below is filled with coral and shell fragments, the piston soil sampler could not be inserted deeper.

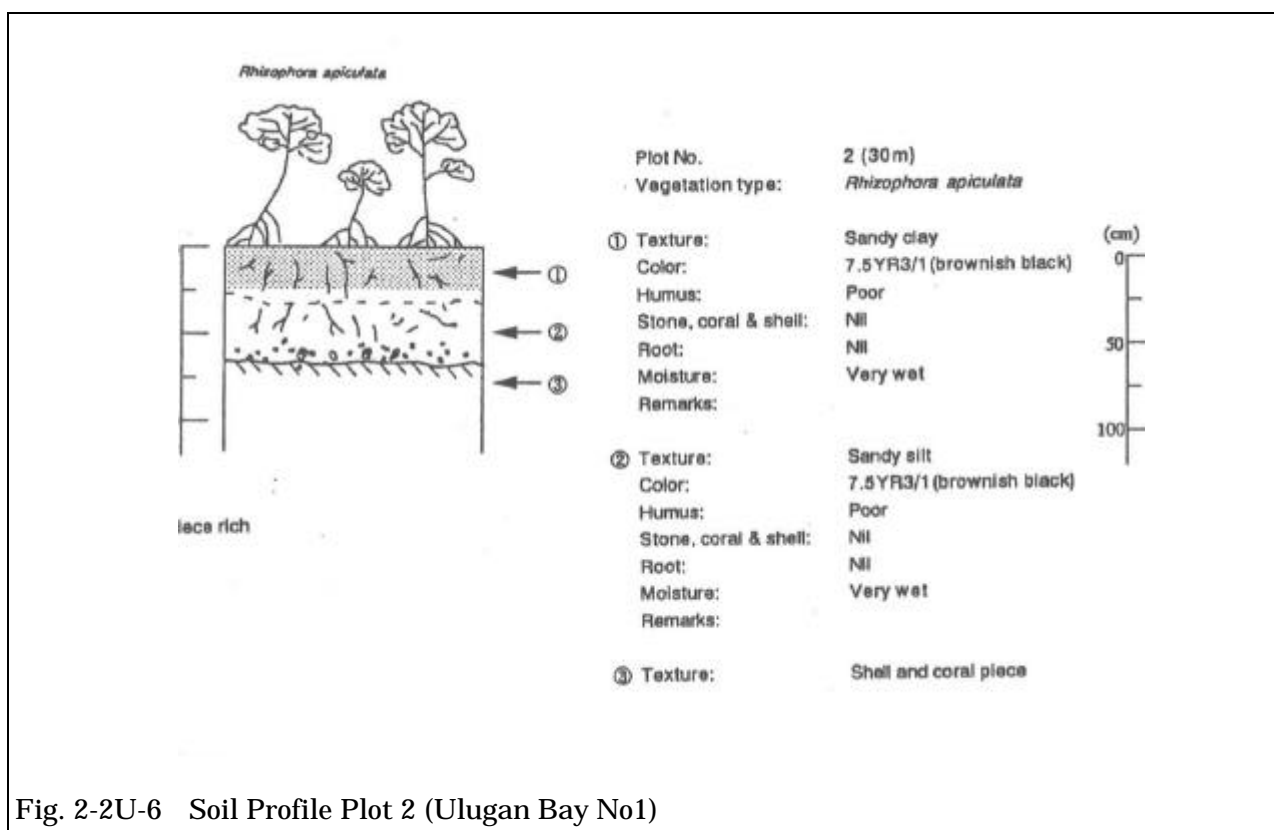


Fig. 2-2U-6 Soil Profile Plot 2 (Ulugan Bay No1)

The upper layer is from the surface at depth of 25 cm. The soil texture is sandy silt, the soil color is 7.5YR3/1 (brownish black), humus is scarce, and no stone, coral or shell fragments are found. No roots are found, either.

The lower layer is at depth of 25 to 60 cm. The soil texture is sand-mixed clay, the soil color is 7.5YR3/1 (brownish black), humus is scarce, and no stone, coral or shell fragments are found. No roots are found, either.

Figure 2-2U-7 shows the soil profile at point 61 m away from the starting point (Plot.3). The vegetation of the ground surface is almost occupied with *B. gymnorrhiza*. The whole soil layer is about 75 cm in depth, and the compositions throughout the whole layer are much the same. The piston soil sampler could not be inserted into the layer in the depth of 75 cm and below which has large-grain-sized sand and thick roots in it.

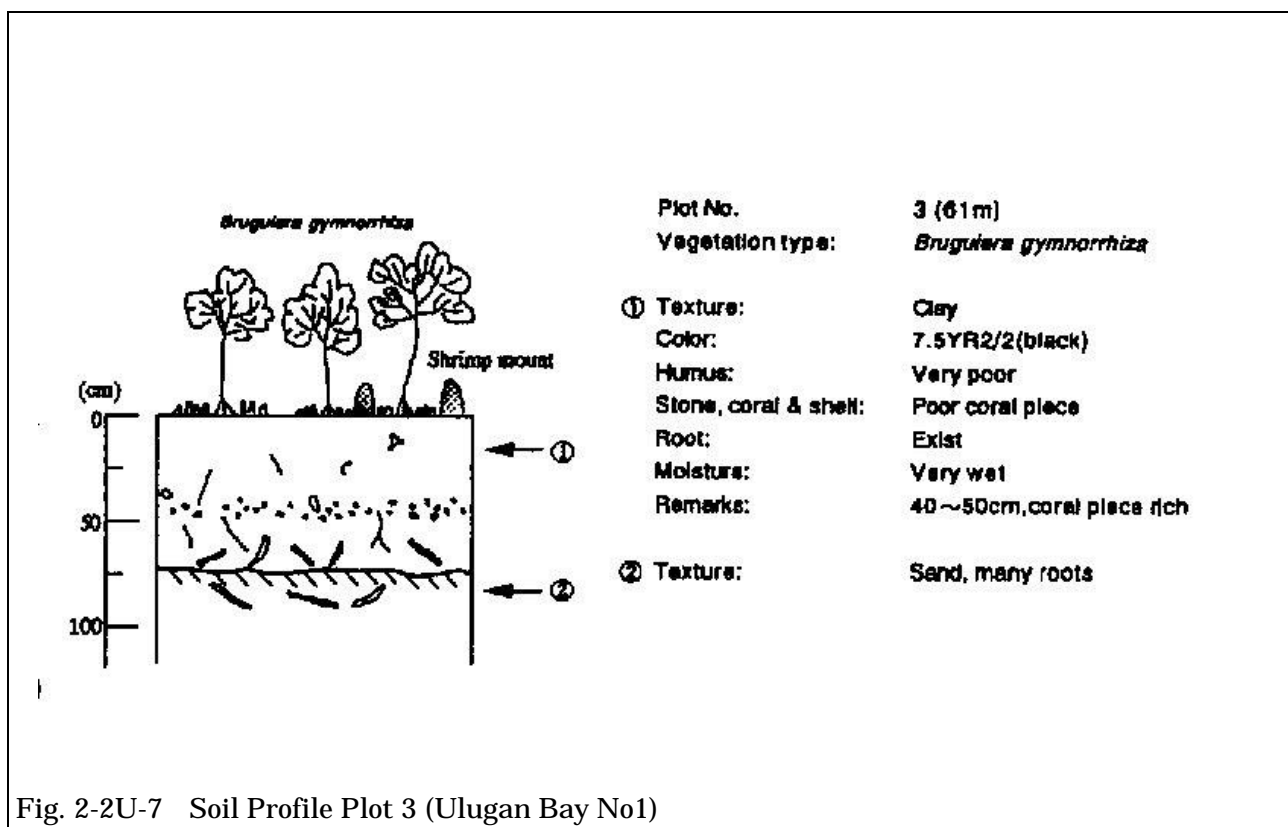


Fig. 2-2U-7 Soil Profile Plot 3 (Ulugan Bay No1)

The soil texture of the layer is clay, and has almost no sand. The soil color is 7.5YR2/2 (black), humus is very scarce, and coral fragments are found at depth of 40 to 50 cm. Roots, which seem to be those of *B. gymnorrhiza*, is found in the deep layer.

Figure 2-2U-8 shows the soil profile at the point 150 m away from the starting

point (Plot.4). *R. apiculata* and *B. gymnorrhiza* are found on the ground surface. The whole soil layer is about 60 cm depth, and is divided into 2 layers by soil texture and soil color. The piston soil sampler could not be inserted into the layer at depth of 60 cm and below which has large-grain-sized sand and thick roots in it.

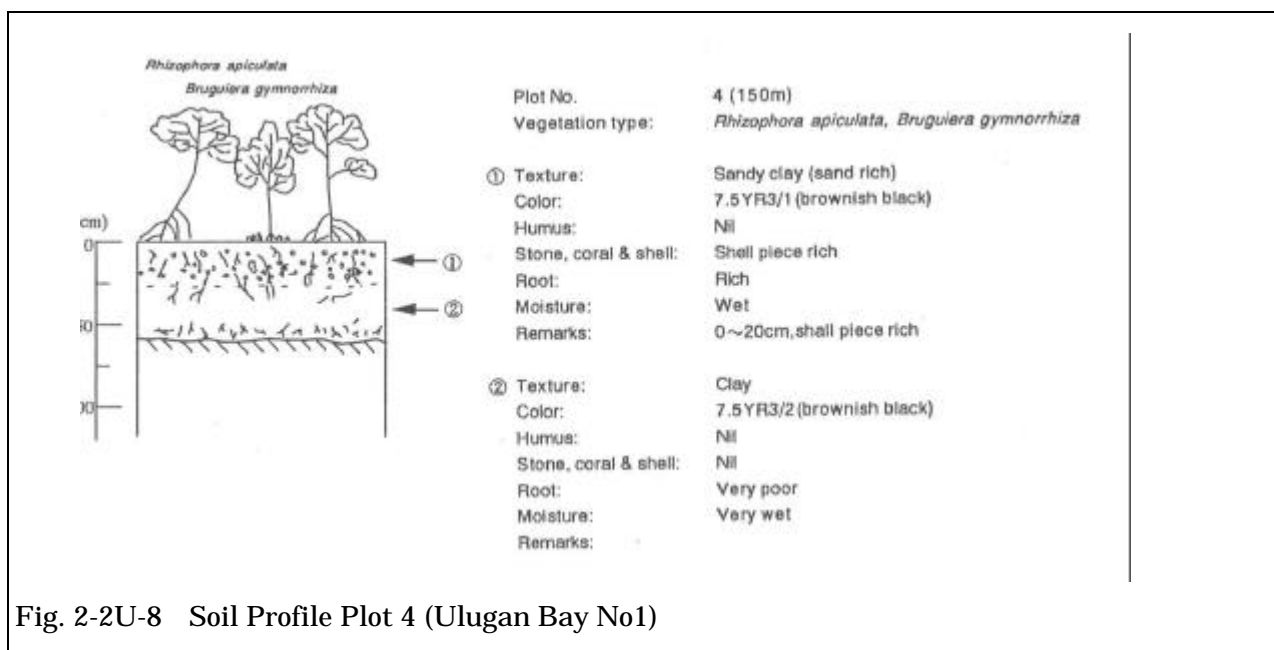


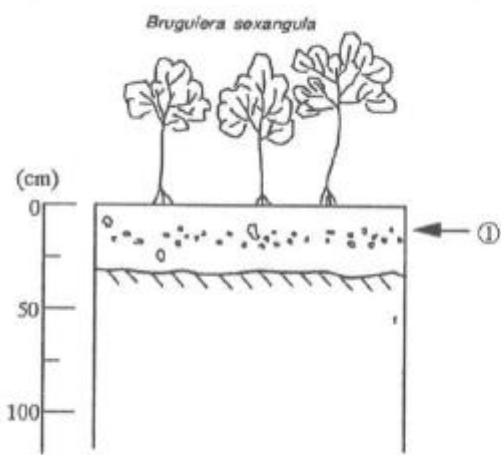
Fig. 2-2U-8 Soil Profile Plot 4 (Ulugan Bay No1)

The upper layer is situated from the surface at depth of 25 cm. The soil texture is much-sand-containing clay, the soil color is 7.5YR3/1 (brownish black), no humus content, and a large quantity of shell fragments are found in the layer, especially in the depth of 0 to 20 cm, near the surface. A lot of fine roots are also found.

The lower layer is situated in the depth of 25 to 60 cm. The soil texture is clay, the soil color is 7.5YR3/2 (brownish black), no humus content, and no stone, coral or shell fragments are found, either. Roots, though in a small quantity, are found.

Figure 2-2U-9 shows the soil profile of the point 252 m away from the starting point (Plot.5). *Bruguiera sexangula* and *Heritiera littoralis* are found in the vegetation of the ground surface. The soil layer is only 30 cm thick, and the composition throughout the whole layer is much the same. The piston soil sampler could not be inserted under the depth of 30 cm due to the existence of large-grain-sized quartz sand.

The soil texture of the layer is sandy silt, and the soil color is 7.5Y4/1 (gray), humus is present, and quartz gravel is found throughout the whole layer. The quartz has the same attributes as the bed rock. No roots are found. The whole, the soil is mostly dark and the organic matter content ratio in the soil is high.



Plot No.	5 (252m)
Vegetation type:	<i>Bruguiera sexangula</i>
① Texture:	Sandy silt
Color:	7.5Y4/1 (gray)
Humus:	Moderate
Stone, coral & shell:	Quartz rich
Root:	Nil
Moisture:	Wet
Remarks:	
②	Soil sample could not be taken

Fig. 2-2U-9 Soil Profile Plot 5 (Ulugan Bay No1)

2-4-2 Mangrove Forest Distribution and Feature

The Ulugan Bay area is a mangrove forest area located along the South China Sea coast of Ulugan Bay in the central part of Palawan Island.

This area maintains the original status of forest similar to the natural condition of the three study areas. Mangrove forests on the west coast of Ulugan Bay are favorably protected under the following conditions: they are designated as a strictly protected area; there are no large villages in the area; and this area is not accessible except from the sea.

On the other hand, there are a considerable number of villages and also roads on the east coast of Ulugan Bay, which is also accessible by land. Mangrove wood seems to have been used by the local people for a long time and the history of logging is also known. Accordingly, most forests look like secondary ones.

Although fishponds were developed near Tagnipa in the northeastern part of Ulugan Bay, there are currently no activities, which catch attention of people. Young secondary forests 15 m to 20 m high grow in good condition. Thus, the policies of the Department of Environment and Natural Resources, the Regional Government and the Municipal Government have been observed on the whole.

The Ulugan Bay area was divided into the four zones of Tagabinit, Macarascas, Bahile, and Taranayan Bay from the northeast.

A mangrove forest extends along the coast of Tagnipa Bay in the Tagabinit Zone. There is limited fishponds in the mouth of a small river in the Ulugan Bay area. The large part of the forest seems to have been felled for commercial purposes, and there are only a few stands of large trees of over 20 cm in diameter. However, small-diameter trees of 10 m to 14 m high grow along the coast and expected the reestablish of a good mangrove environment.

The Macarascas Zone has a mangrove area extending in the southern half of the east coast and basal part of Ulugan Bay. The seaside flat on the east coast of Ulugan Bay is occupied by a mangrove forest extending from 200 m to 400 m landward. This forest is of secondary type of 14 m to 18 m high, where mother trees excluded from cutting in the past are scarce. There is a certain area of primary forest remaining in a flat extending on the side of Ladasen River in the basal part of Ulugan Bay.

The Bahile Zone extends from the west coast of the Bahile River to the southern part of Oyster Bay, forming the core of the mangrove protection area of Ulugan Bay. A mangrove forest of large *R. apiculata* trees of over 20 m can be observed and maintains the original state to the most extent. Particularly around the Ladasen River, there are many areas in which well-developed *R. apiculata* stands remain.

Taranayan Bay developed in a cove near the west side of Ulugan Bay. The coast is occupied by a dense forest of *Rhizophora* with small crowns. The height of trees exceeds 10 m and gives a view of dense forest different from low stands of *R. apiculata* on the coast of Lamong Bay.

Figures 2-2U-10(1) and (2) show some results of the transect survey intended to grasp the relation between the composition of mangrove species in the Ulugan Bay area and changes in tide level. The location of the transect is marked with in Figure 2-2U-43. The transect was set in the seaside flat area 200 m wide located slightly northward from the mouth of the Ladasen River.

On the seaside fringe, *R. mucronata* trees form a pioneer zone by tilting their stems and sending out pneumatophores from the 10 m point inward. About 10 m inward, mangroves become upright and reach 14 m to 16 m in height. This is a configuration typical of mangrove communities on the seaside fringe. Further on, where the ground level rises about 20 cm, there appears

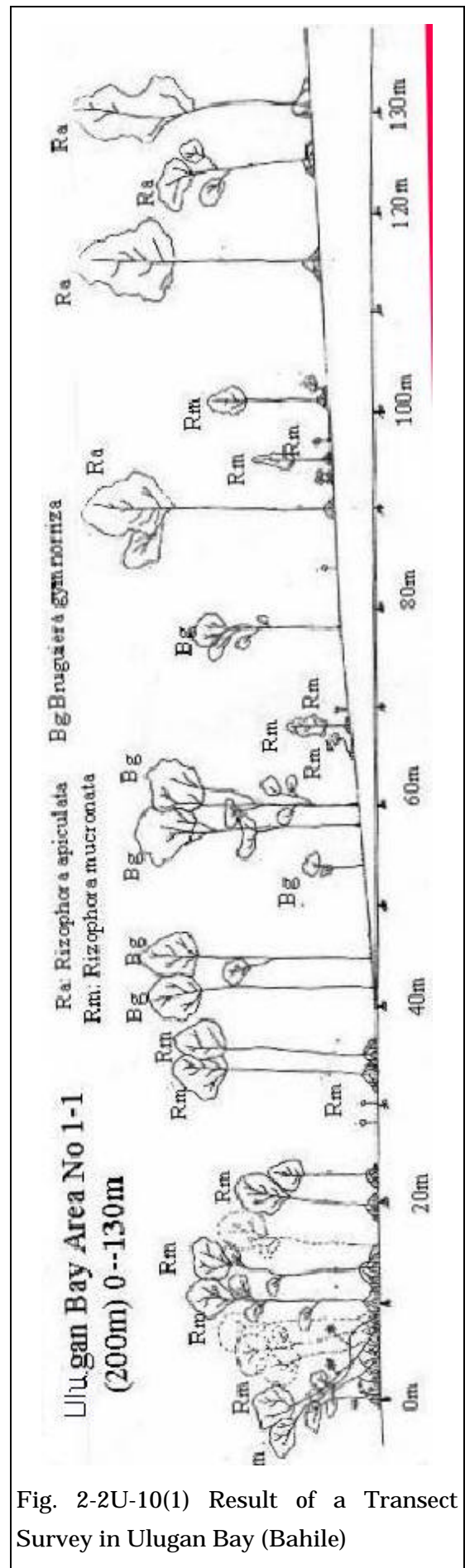


Fig. 2-2U-10(1) Result of a Transect Survey in Ulugan Bay (Bahile)

a zone dominated by *B. gymnorrhiza*. Where the level becomes about 40 cm, dominant stands of *B. gymnorrhiza* are replaced by those of *R. apiculata* from the 100 m point inward in the transect, which extend to the landward fringe. The landward fringe is a very limited zone, where the height of trees rapidly decreases, and trees of *X. granatum* and *Aegiceras floridum* are mixed with low trees of *R. apiculata*.

Seaside flats are not very wide in the Lamon Bay area and the ground level generally shows a continuous change almost evenly from the seaside to the inland. Therefore, the zonation of mangrove forests can be observed.

Figures 2-2U-11(1) and (2) show the results of the transect survey in a mangrove forest about 200 m wide and about 1 km north from the mouth of the Kamang River on the west coast of Ulugan Bay. The location of the transect is marked with in Figure 2-2U43. It is characterized by some differences from others :i.e., high mangroves are a few in an area 150 m from the seaside probably because they were felled; young stands are mixed in the forest at a high rate; and a low height stands of *R. apiculata* instead of *R. mucronata* appears on the seaside fringe. However, it can be judged that the zonation of this transect is fundamentally similar to the foregoing transect. Low height *Rhizophora* stands form a pioneer community on the seaside, and *B. gymnorrhiza* stands appear as the ground level rises. Then, they are replaced by high stands existed zone of *R. apiculata*,

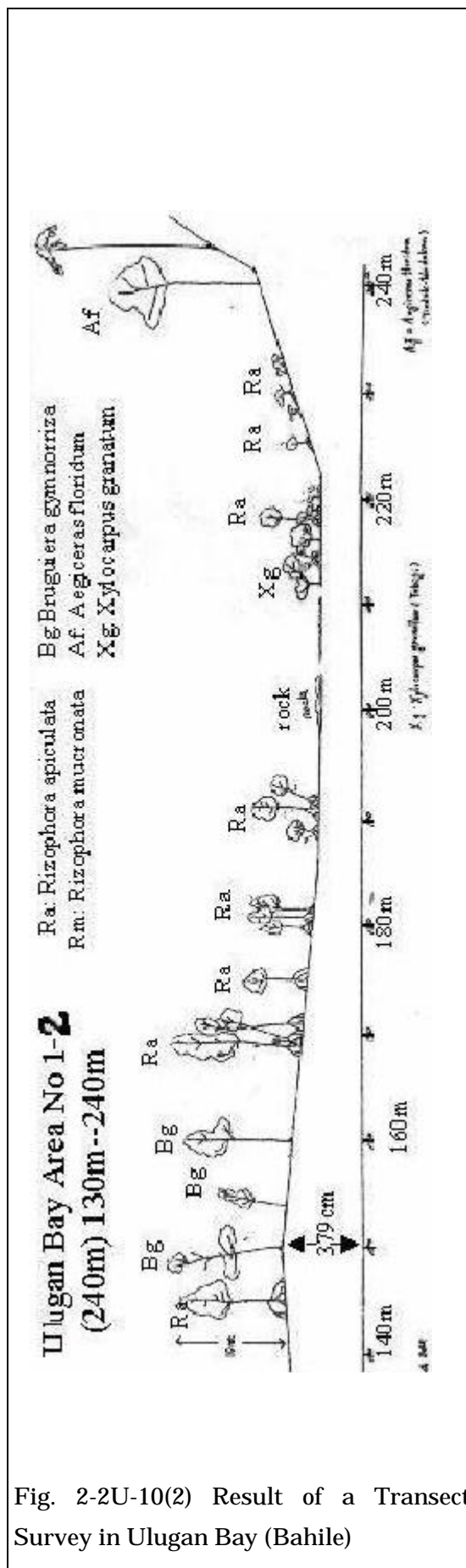


Fig. 2-2U-10(2) Result of a Transect Survey in Ulugan Bay (Bahile)

which extends to the landward fringe. The forest finally reaches inland through a narrow high-intertidal mangrove zone including *X. granatum* about 30 m wide. It seems that felling was once carried out on the east coast of Ulugan Bay, but this transect includes some parts excluded from felling. There appear large stands of *R. apiculata* reaching 27m in height and 50 m wide from the 200 m point on the landward fringe. The floor is densely covered with saplings and young trees of *R. apiculata* and *X. granatum*.

The third transect is located on the east side of the peninsular part of the Macarascus Zone opposite to the second transect. The location is marked with in Figure 2-2U-43. The results of the survey are shown in Figures 2-2U-12(1) and (2). A low height of *R. apiculata* forms a pioneer community on the seaside fringe. Where the ground level rises about 40 cm in a 50 m landward area, they are replaced by a zone of *B. gymnorrhiza*, which is followed by a zone where *B. gymnorrhiza* and *R. apiculata* alternately appear.

Large trees are hardly found in the part of this transect from the 100 m point to the 200 m point. It could not be determined whether they were cut by human beings or damaged by typhoons. At any rate, their disappearance resulted in gaps, in which saplings of *B. gymnorrhiza* and *R. apiculata* densely grow and regenerate well.

In this transect, a zone dominated by

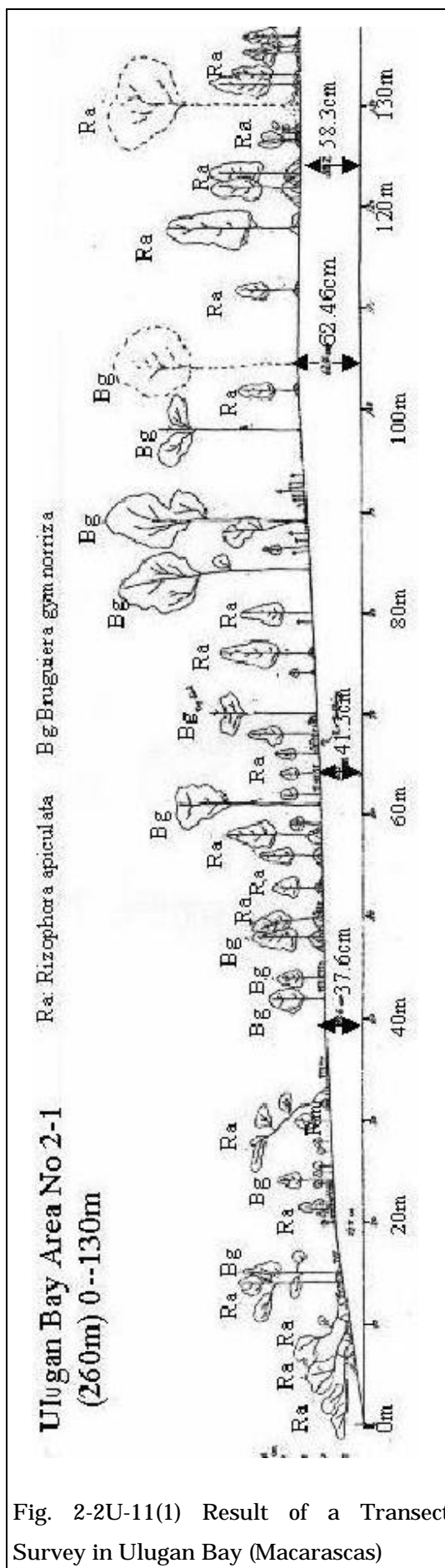


Fig. 2-2U-11(1) Result of a Transect Survey in Ulugan Bay (Macarascas)

B. sexangula instead of *R. apiculata* appears landward, and relatively large trees of *H. littoralis* finally appear on the landward fringe as narrow as 10 m.

The fourth transect shown on Figure 2-2U-13 is a narrow mangrove forest developing behind Oyster Bay located in the northern part of the west coast of Ulugan Bay. Despite of being small as 100 m, characteristic features of mangroves exist: i.e. there is a low height zone of *R. mucronata* or *R. apiculata* as found in other transects, which is followed by *B. gymnorhiza* stands, which are, then, replaced by large stands of *R. apiculata*. Where the forest reaches the landward fringe, a low height zone of much *X. granatum* appears and continues landward.

The results of the transect survey show that although mangrove communities in the Ulugan Bay area vary from place to place in the height and number of standing trees, mangroves in the seaside fringe area have a general pattern like this: (1) *R. mucronata* appears near the river mouth; (2) *R. apiculata* forms as narrow a community as 10 m to 20 m in the pioneer zone far from the river; (3) A zone dominated by high trees of *B. gymnorhiza* appears; (4) The zone is replaced by a high trees of *R. apiculata*, which extends to the landward fringe; and finally (5) A high-intertidal mangrove zone appears as narrow as 10 m to 30 m and extends to the land area.

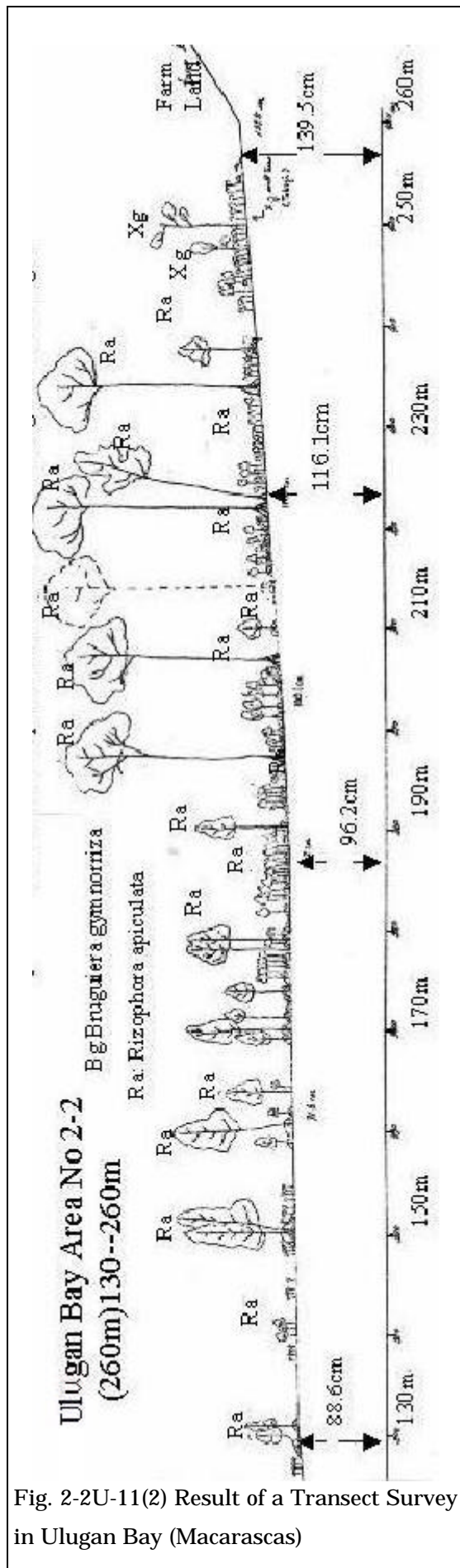


Fig. 2-2U-11(2) Result of a Transect Survey in Ulugan Bay (Macarascas)

Next, the results of the plot survey in these mangrove forests are shown in the following. The first sample is a seaside forest of *R. apiculata* observed in Tarunayan Bay. The survey plot is located 15 m from the seaside. The forest consists of dense stands of only *R. apiculata* as small as 8 m to 10 m and completely closed at a crown density of 100%.

Figure 2-2U-14 shows the location of Plot A, and Figures 2-2U-15 and 2-2U-16 graphically shows the numerical composition of stands by diameter and height. Trees 14 cm in DBH represent the majority of stands totaling 2,050 per ha.

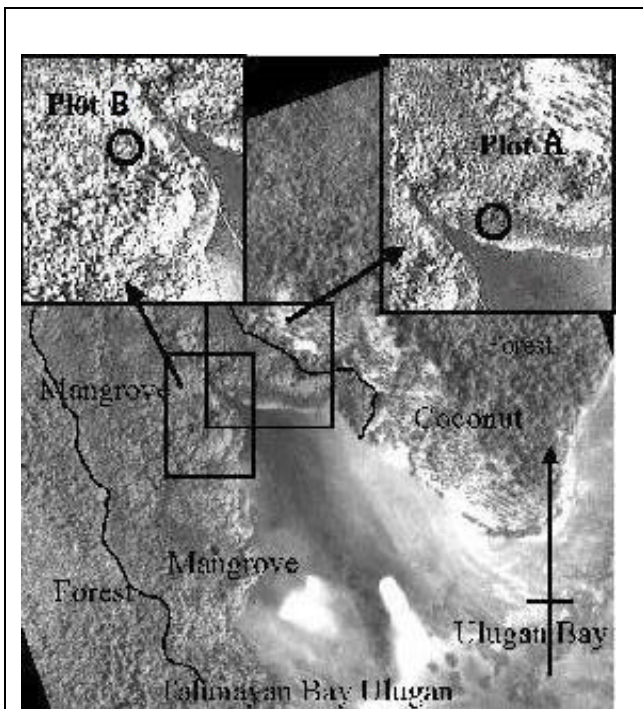


Fig. 2-2U-14 Plot Location in Tarunayan Bay (A:Ra B:Bg) Plot No 32 & 34

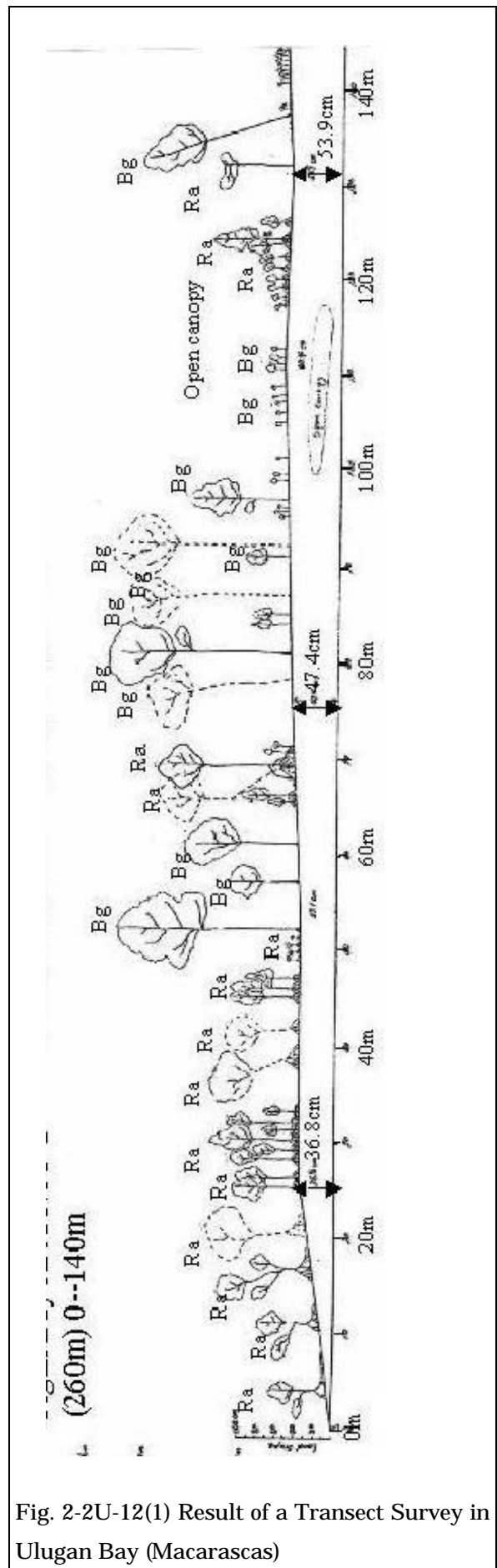
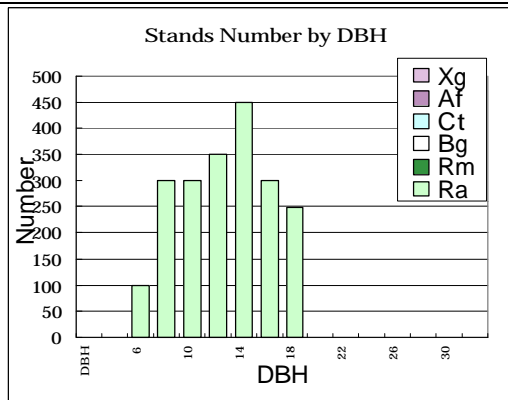


Fig. 2-2U-12(1) Result of a Transect Survey in Ulugan Bay (Macarascas)



Size	Ra	Rm	Bg	Ct	Tot
small	400	0	0	0	400
middle	1100	0	0	0	1100
big	550	0	0	0	550
large	0	0	0	0	0
tot	2050	0	0	0	2050

Fig. 2-2U-15 Stand Number by Species and Height (Plot A)(Plot No 33, Comp. 101M15)

Note: DBH class is follows

Small	4 – 8 cm
Middle	10 – 14cm
Big	16 – 20cm
Large	22cm and more

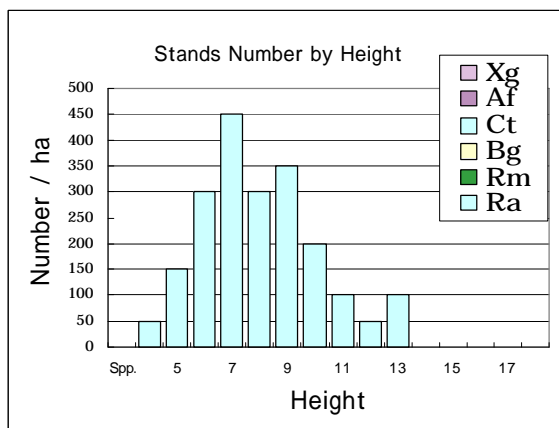


Fig. 2-2U-16 Stand Number by Species and Height (Plot A) (Plot No 33, Comp. 101M15)

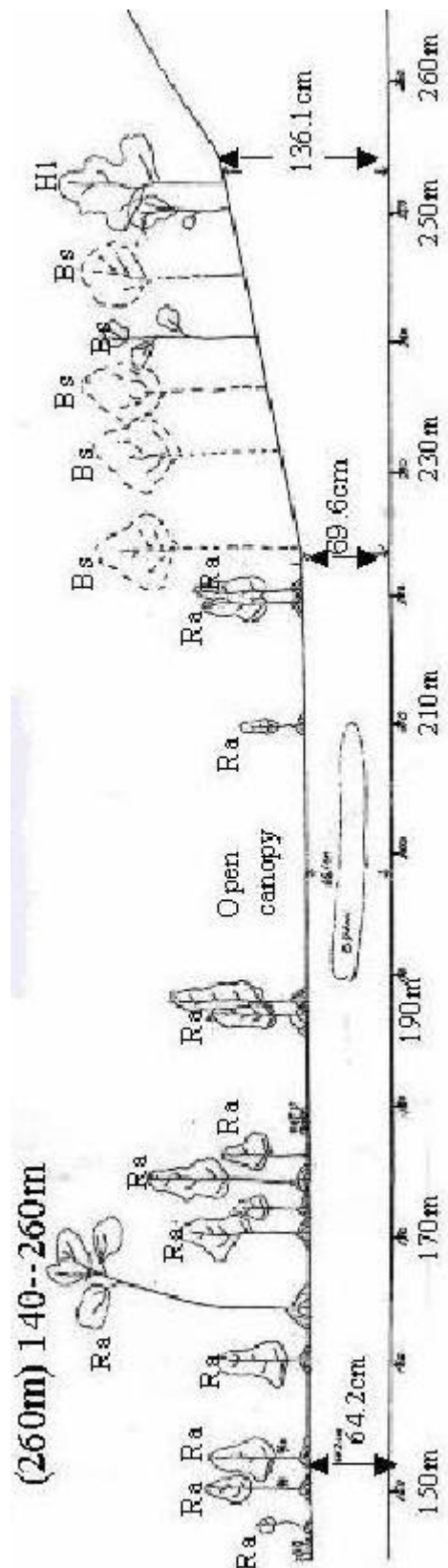


Fig. 2-2U-12(2) Result of a Transect Survey in Ulugan Bay (Macarascas)

Plot B as shown in Figure 2-2U-14 consists of *R. apiculata* stands located about 100 m inward from Plot A. They are superseded by large stands in both diameter and height inside the plot. The numerical composition of stands by diameter and height is shown in Figures 2-2U-18, 2-2U-19, and 2-2U-20. They are superseded by large stands in both diameter and height 2-58. *R.*

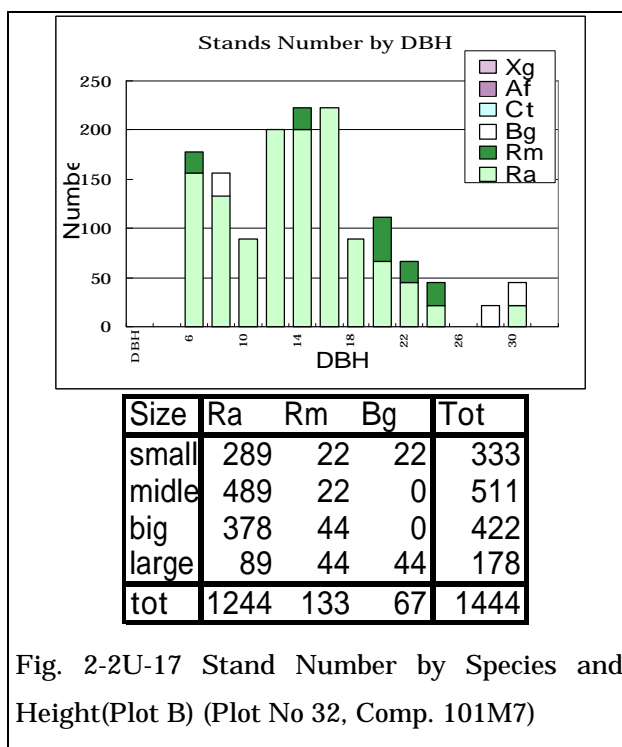


Fig. 2-2U-17 Stand Number by Species and Height (Plot B) (Plot No 32, Comp. 101M7)

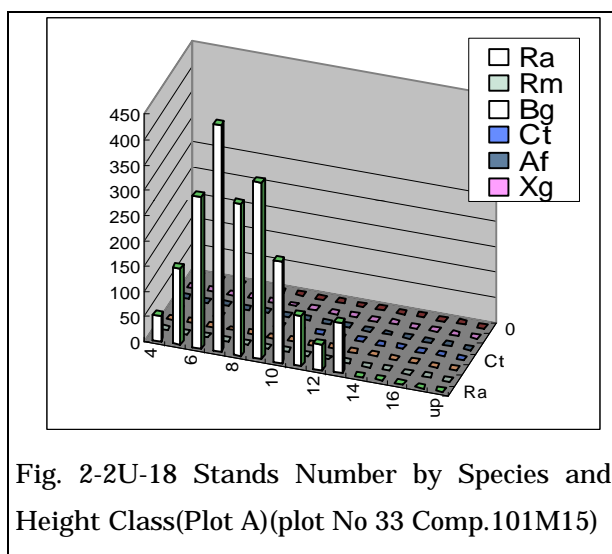


Fig. 2-2U-18 Stands Number by Species and Height Class (Plot A) (plot No 33 Comp. 101M15)

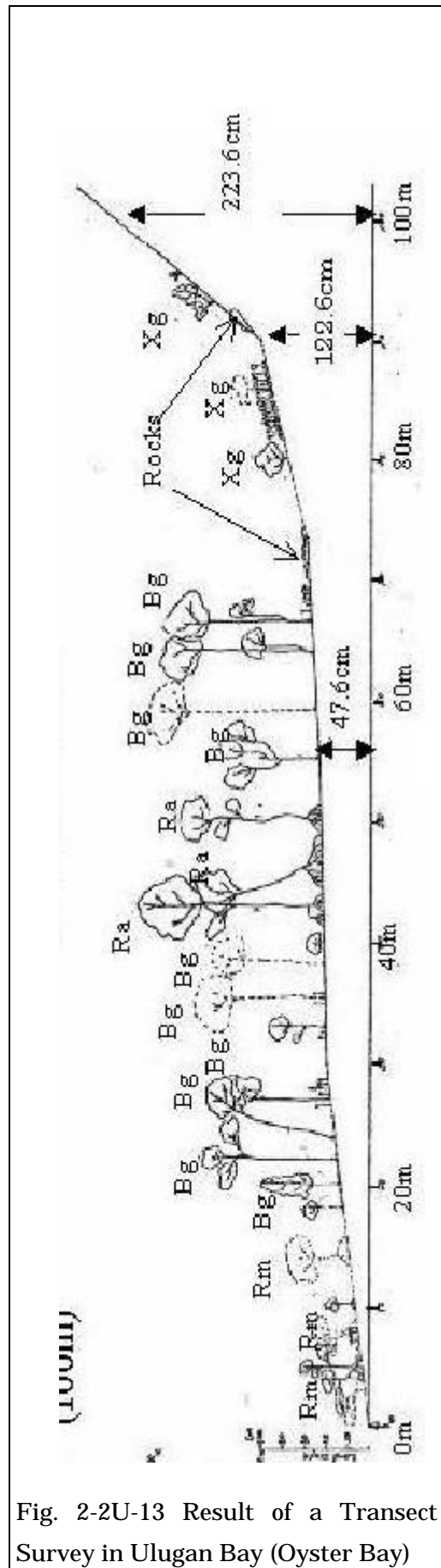


Fig. 2-2U-13 Result of a Transect Survey in Ulugan Bay (Oyster Bay)

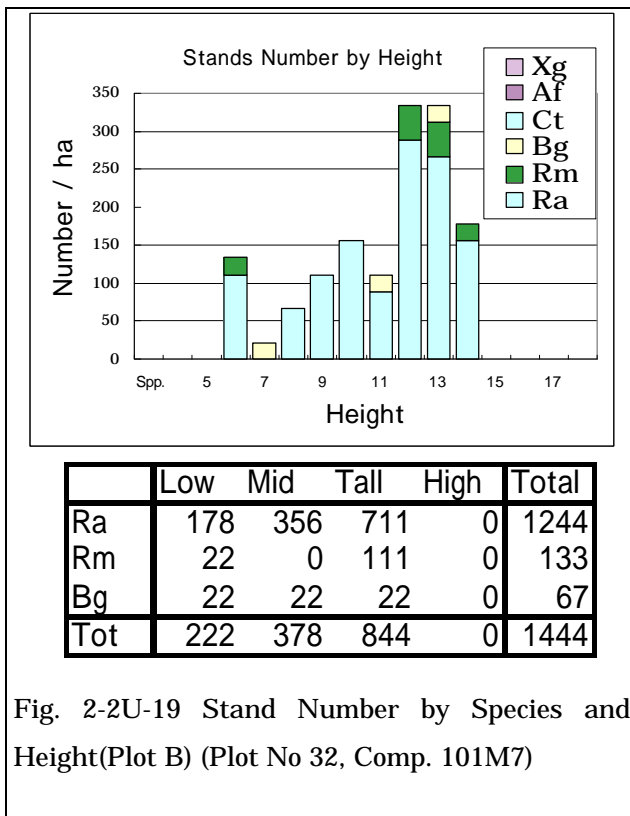


Fig. 2-2U-19 Stand Number by Species and Height(Plot B) (Plot No 32, Comp. 101M7)

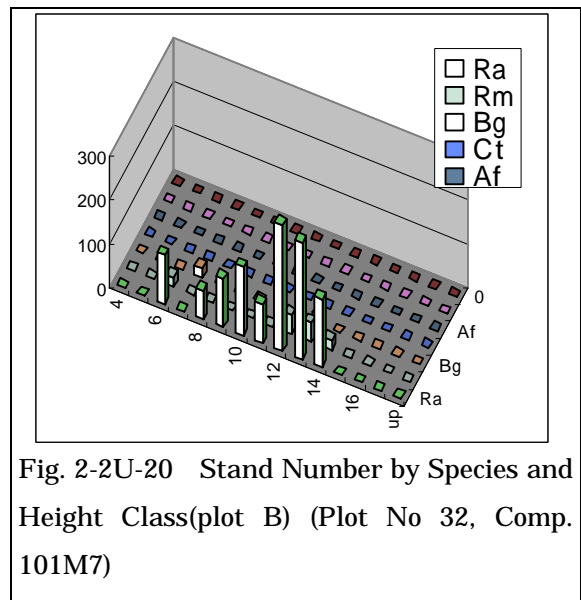


Fig. 2-2U-20 Stand Number by Species and Height Class(plot B) (Plot No 32, Comp. 101M7)

mucronata and *B. gymnorrhiza* are slightly mixing in the composition.

The next plots are typical samples of two forest types, namely old growth stands of *B. gymnorrhiza* 50 m north of the seaside and subsequent stands of *R. apiculata* near the land area. They are 14 m to 22 m in height and their timber volume exceeds 250 m³ respectively. They represent a primary forest in the Ulugan Bay area.

The plots were set in an old growth forest extending on the north side of the mouth of the Ladasen River in the Macarascas Zone. The locations of the plots are shown in Figure 2-2U-21. Plot A consists of *R. apiculata* stands in the middle intertidal area, while Plot B consists of *B. gymnorrhiza* stands near the coastline

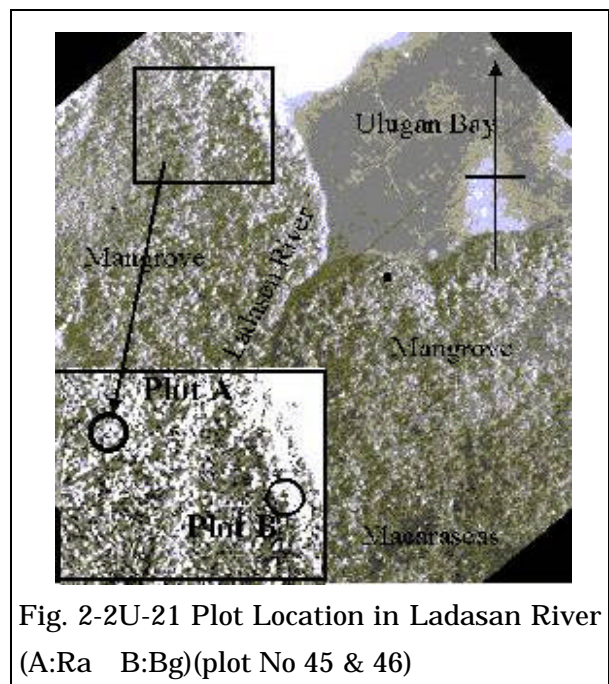
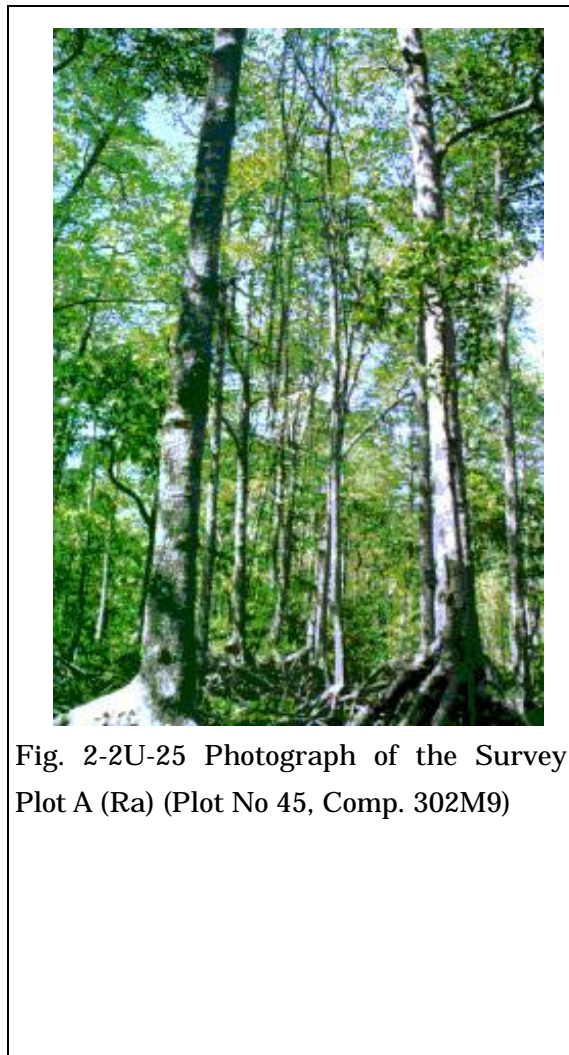
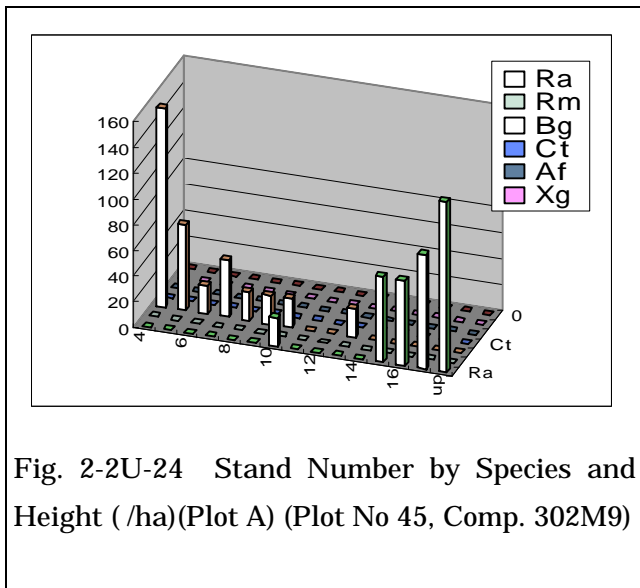
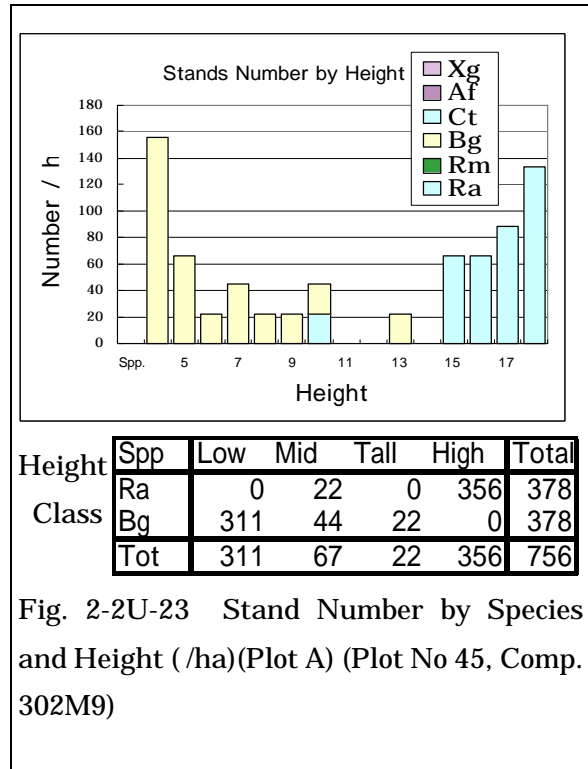
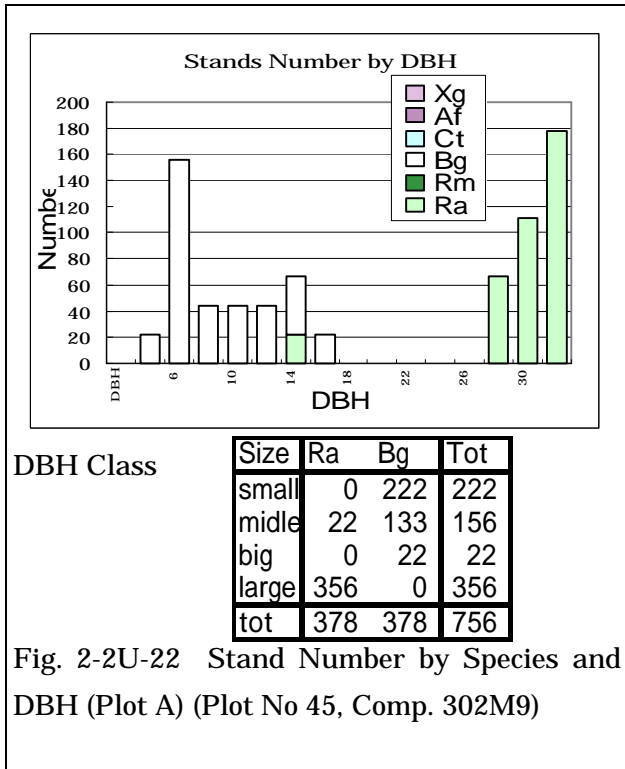


Fig. 2-2U-21 Plot Location in Ladasen River (A:Ra B:Bg)(plot No 45 & 46)



In Plot A, there are 356 stands per ha counted in pure stands of *R. apiculata* whose upper layer consists of trees over 28 cm in diameter. There are 378 trees per ha in the middle and lower layers composed of *B. gymnorrhiza* and slightly *R. apiculata* trees (22 stands) under 16 cm in

diameter. Thus, the number of trees per ha is almost the same in both the upper layer and the middle and lower layer. Their total timber of stands is 756 per ha and total volume is estimated 265 m³ per ha.

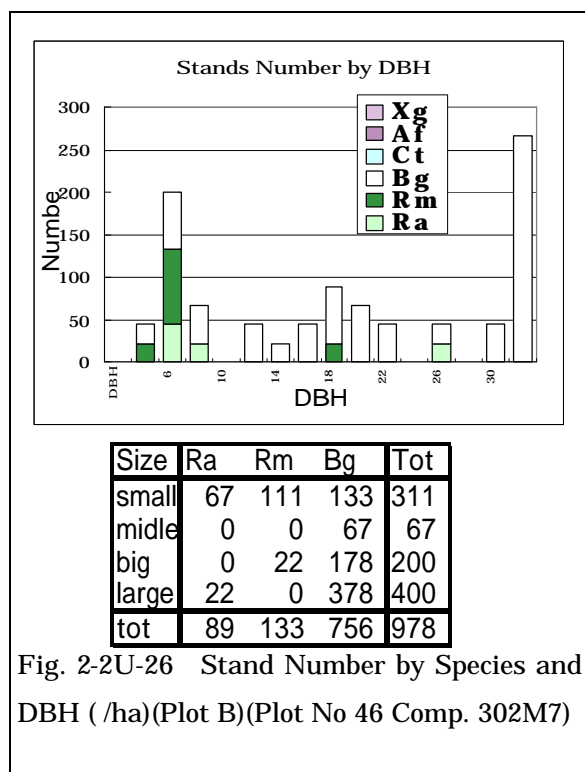


Fig. 2-2U-26 Stand Number by Species and DBH (/ha)(Plot B)(Plot No 46 Comp. 302M7)

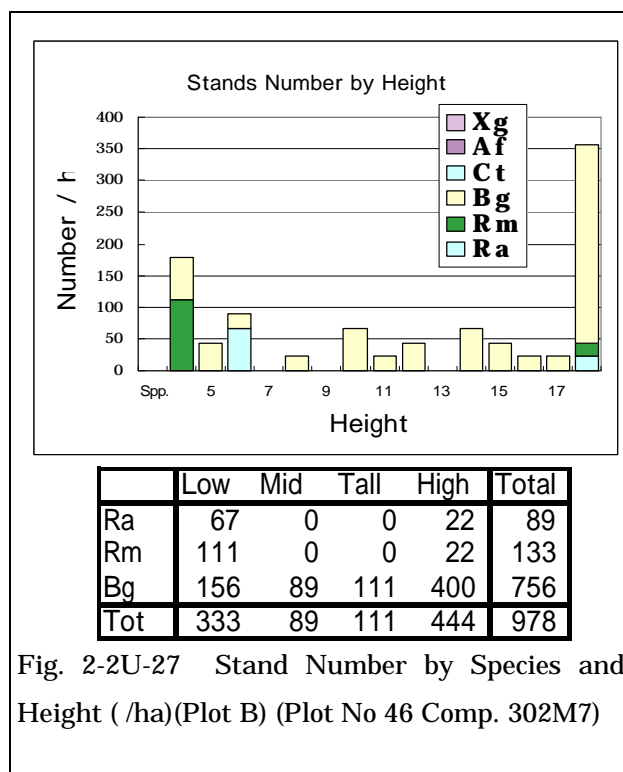


Fig. 2-2U-27 Stand Number by Species and Height (/ha)(Plot B) (Plot No 46 Comp. 302M7)

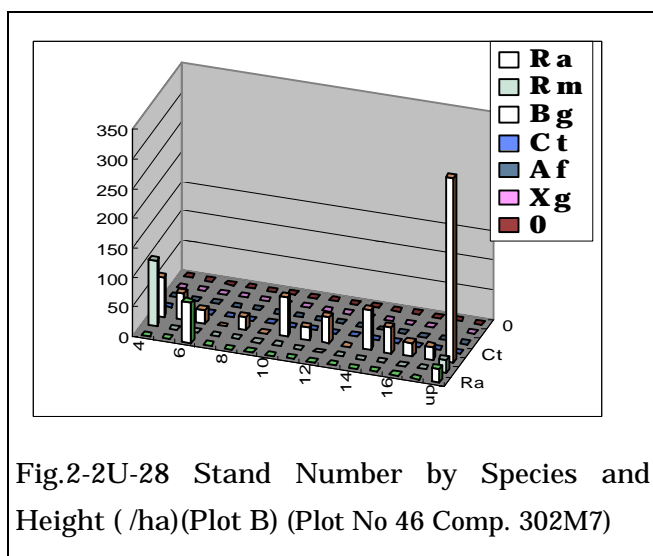


Fig.2-2U-28 Stand Number by Species and Height (/ha)(Plot B) (Plot No 46 Comp. 302M7)

Plot B consists of stands dominated by *B. gymnorrhiza* with *R. mucronata* and *R. apiculata* slightly mixed in the upper and lower layers. The height reaches to 22 m and obviously high stands extend from the

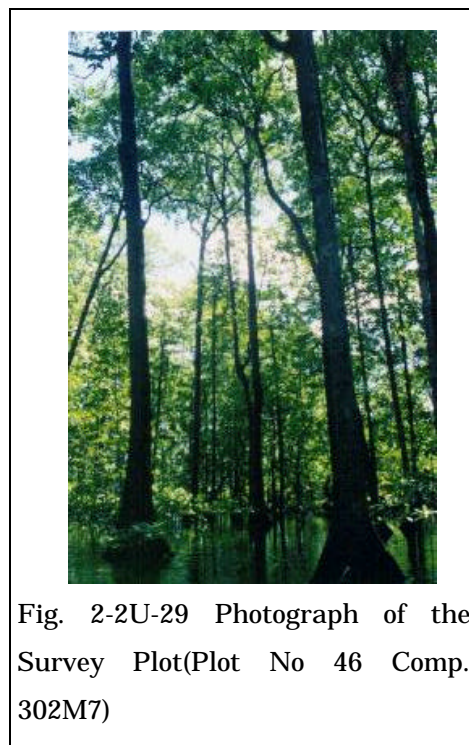


Fig. 2-2U-29 Photograph of the Survey Plot(Plot No 46 Comp. 302M7)

seaside area. The numerical composition of this plot by diameter and height is shown in Figures 2-2U-26 and 2-2U-27 and 2-2U-28.



Fig. 2-2U-33 Photograph of the Survey Plot (Plot No 40, Comp402M2)

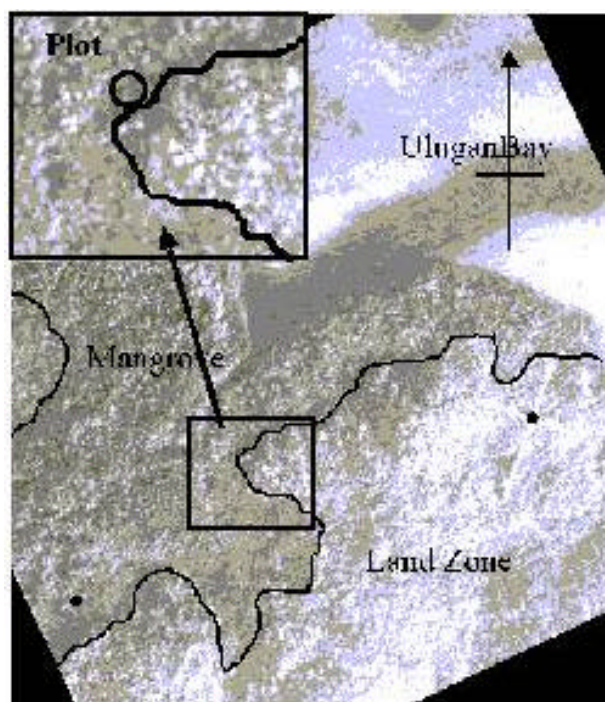


Fig. 2-2U-30 Location of a Plot Survey in Ulugan Bay (high intertidal zone)

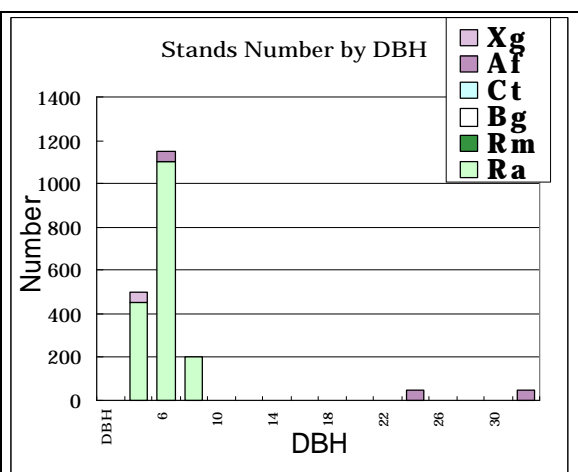


Fig. 2-2U-31 Stand Number by Species and Height (/ha)(Plot No 40, Comp402M2)

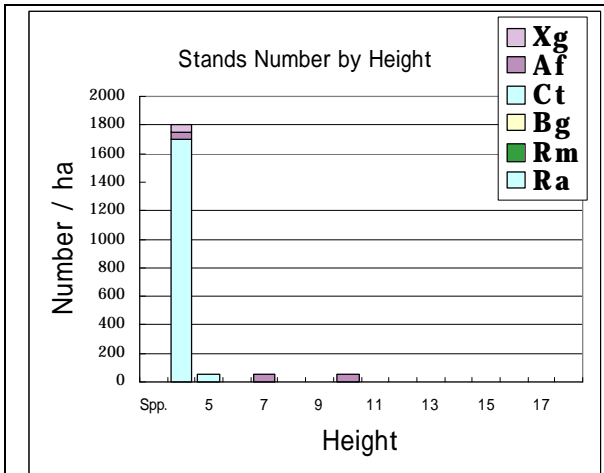


Fig. 2-2U-32 Stand Number by Species and Height (/ha) (Plot No 40, Comp402M2)

DBH	Size	Ra	Af	Xg	Tot
	small	1750	50	50	1850
	midle	0	0	0	0
	big	0	0	0	0
	large	0	100	0	100
	tot	1750	150	50	1950

Height	Low	Mid	Tall	High	Total
Ra	1750	0	0	0	1750
Af	100	50	0	0	150
Xg	50	0	0	0	50
Tot	1900	50	0	0	1950

Table 2-2U-1 Stand Number by Species and DBH, Height (/ha) (Plot No 40, Comp402M2)

Next, data on two plots will be shown in the following. These data record the vegetation of high intertidal areas, which are extremely limited in areas in the Ulugan Bay area. The first plot is a

sample on the landward fringe of the mangrove area along the Umalagan River in the Bahile Zone. The dominant species is *R. apiculata* covering the overall lower layer. The height decreases to 4-6 m, and 6-10 m several trees of *A. floridom* form a conspicuous layer. The location of this plot is shown in Figure 2-2U-30, and the numerical composition of stands (the number of trees per ha by height) is shown in Table 2-2U-1 and Figures 2-2U-31, and 2-2U-32. The largest tree found in the plot is *A. floridum* 47 cm in diameter and 7 m in height.

The second sample of high intertidal areas is located on the landward fringe of Tagnipa on the northeastern coast of Ulugan Bay. The location of the plot is shown in Figure 2-2U-34.

It is a multi-storied forest with the upper layer still composed of *R. apiculata* but very frequently mixed with *B. sexangula* and *X. granatum*. The plot seems to be a transitional area from the *R. apiculata* to the high intertidal area. The height of upper trees is 16 m to 19 m, and the DBH is

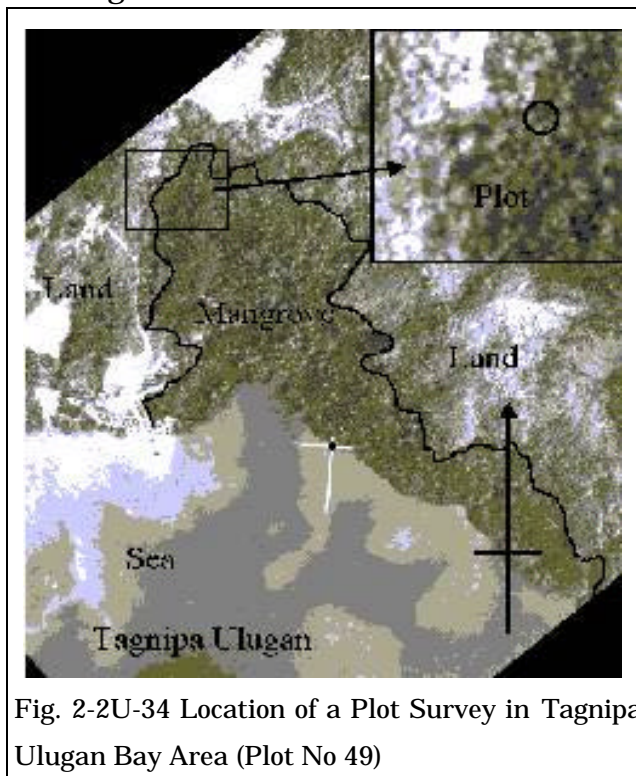


Fig. 2-2U-34 Location of a Plot Survey in Tagnipa Ulugan Bay Area (Plot No 49)

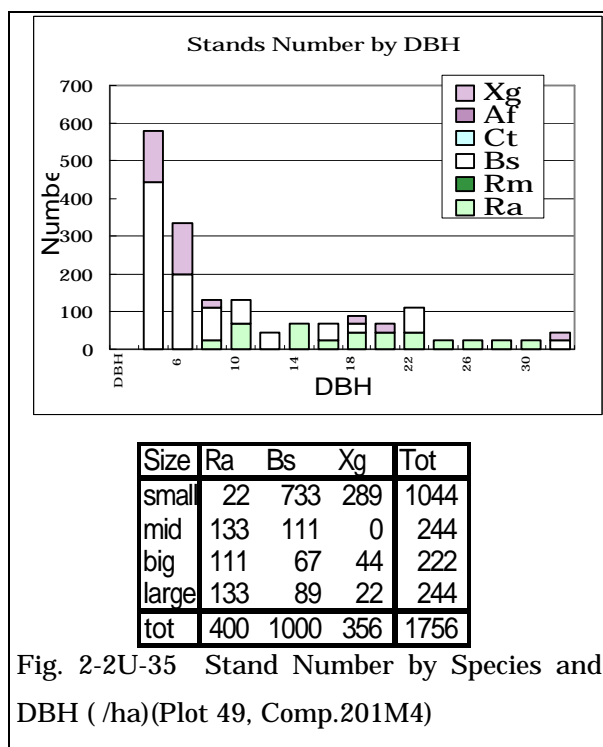


Fig. 2-2U-35 Stand Number by Species and DBH (/ha)(Plot 49, Comp.201M4)

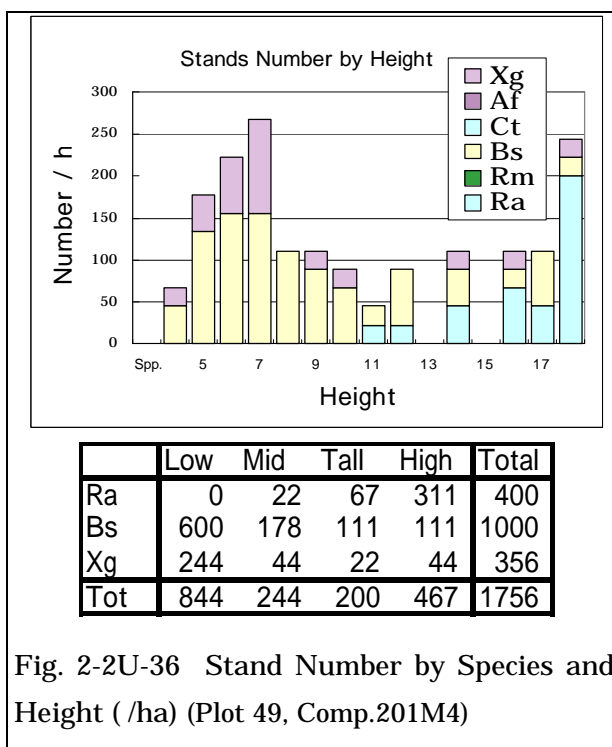


Fig. 2-2U-36 Stand Number by Species and Height (/ha) (Plot 49, Comp.201M4)

30 cm to 36 cm. The plot is a secondary forest once felled as proved by the

existence of small stumps but seems to be rehabilitated well. Data on the structure of stands in this plot are shown in Figures 2-2U-35 and 2-2U-36.

Finally, a secondary forest extending on the east coast of Ulugan Bay will be shown as a sample. Despite being a secondary forest, it is a mangrove forest, which has hardly been felled for recent two decades. The height of trees is 10 m to 16 m and the DBH is 6 cm to 16 cm. The forest is young and closed by over 3,000 trees per ha. There remain a considerable number of old trees, which survived the last felling more than twenty years ago. The species composition of this forest is almost the same as the original forest. *R. apiculata* is a dominant species. As logs were skidded from the seaside at the past felling, such secondary forests are often distributed from the seaside to

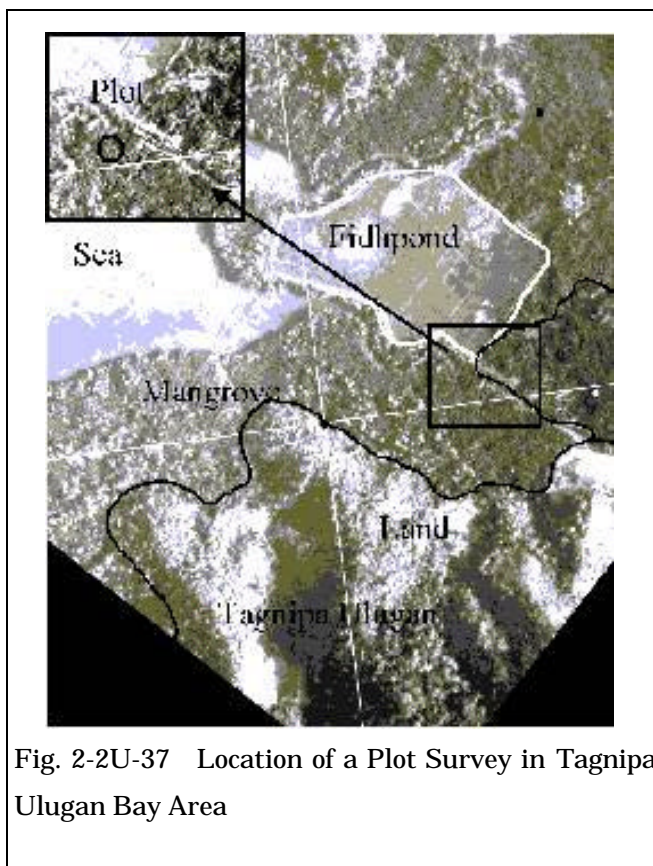
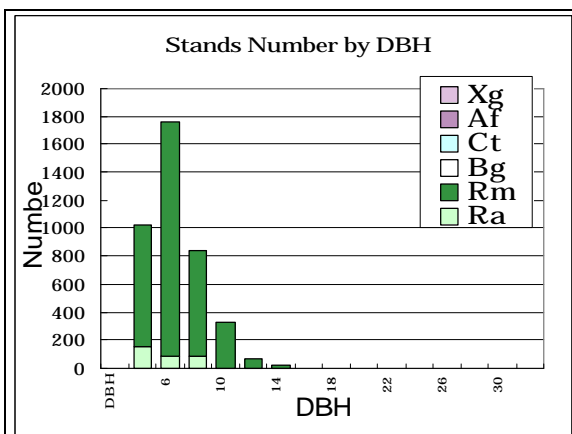
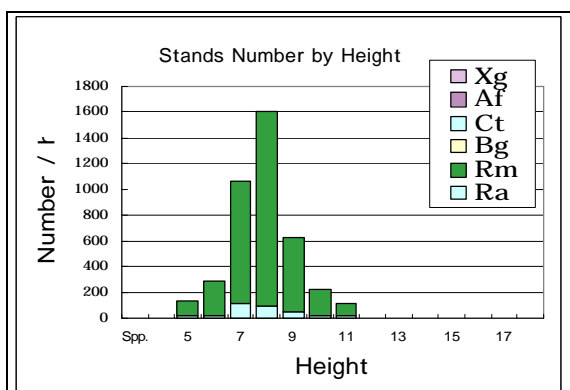


Fig. 2-2U-37 Location of a Plot Survey in Tagnipa Ulugan Bay Area



Size	Ra	Rm	Tot
small	333	3289	3622
middle	0	422	422
big	0	0	0
large	0	0	0
tot	333	3711	4044

Fig. 2-2U-38 Stand Number by Species and Height (/ha)(Plot No 51, Comp 202M5)



	Low	Mid	Tall	High	Total
Ra	244	89	0	0	333
Rm	2844	867	0	0	3711
Tot	3089	956	0	0	4044

Fig. 2-2U-39 Stand Number by Species and Height (/ha) (Plot No 51, Comp 202M5)

the middle tide area. The location of the plot is shown in Figure 2-2U-37. The plot adjoins the fishpond in Tagnipa and commercial felling was carried out in parallel with fishpond development. Data

on the structure of stands are shown in Figures 2-2-38 and 2-2U-39.

R. mucronata is dominant partially because the plot is located on the riverside. Young trees 7-9 m in height and 6 cm in DBH represent the majority and their diameter is under 14 cm.



Fig. 2-2U-40 Photograph of the Survey Plot (Secondary forest of Ra) (Plot No 51, Comp 202M5)

The team surveyed and analyzed mangrove forests in the Ulugan Bay area then comprehensively examined the relationships between the distribution of mangrove forests and its geographical conditions. Comparisons with aerial photo imagery patterns, spatial expanses, and the possibility of distinguishing pattern from adjacent patterns in the photograph. Based on these results, mangrove forests in the Ulugan Bay area was divided into the following four groups that focus on differences in height, and similar forests was classified into sub-compartments. Most part of the Ulugan Bay area unlike the Lamon Bay area where low height young secondly forest. The three species of *R. mucronata*, *R. apiculata* and *B. gymnorrhiza* are distributed in a belt on small area depending on changes in tide level and stream condition and form a group mixture forest on the whole.

- a. **URB**: *R. apiculata* or *R. mucronata* and *B. gymnorrhiza* middle height stands are continuously changing from seashore to middle tidal zone.
- b. **UTR**: Tall *R. apiculata* dominated.
- c. **UXH**: High intertidal mangrove species such as *S. hydrophyllacea*, *H. littoralis*, *E. agallocha* growing.
- d. **UMR**: Middle height *R. apiculata* dominantly spreading.

High intertidal areas in Group c, which generally appear in a very narrow area, are often difficult for zoning on the mangrove forest distribution map. In this case, they are actually not zoned but included in adjacent sub-compartments, and this is noted in the column of remarks in the forest inventory book.

Interpretation of the aerial photographs gives some data of the above mentioned classified groups of areas in total. The area was calculated by computer using GIS, based on Mangrove Forest Classification Map. The result is shown on table 2-2U-2 and Figure 2-2U-41. The total area of mangrove including nipa area (existing

mangrove/nipa areas + existing fishpond area) is 812.85 ha. 15.80 ha, and about 2% of the total area has converted into fishponds.

Big *R. apiculata* dominated area as defined as UTR occupies 115. 73 ha(14% of total Mangrove area excluding mangrove area within fishpond). Largest one is *R. apiculata*, *R. mucronata*, and *B. gymnorhiza* mixed areas as defined URB (421.07 ha/ 55%). Following URB, secondary forest of the URB as defined UMR is occupied 198.83 ha,(26%). Heigh intertidal area pattern of mangrove forest type as defined UXH is covered 55.74 ha (6%).

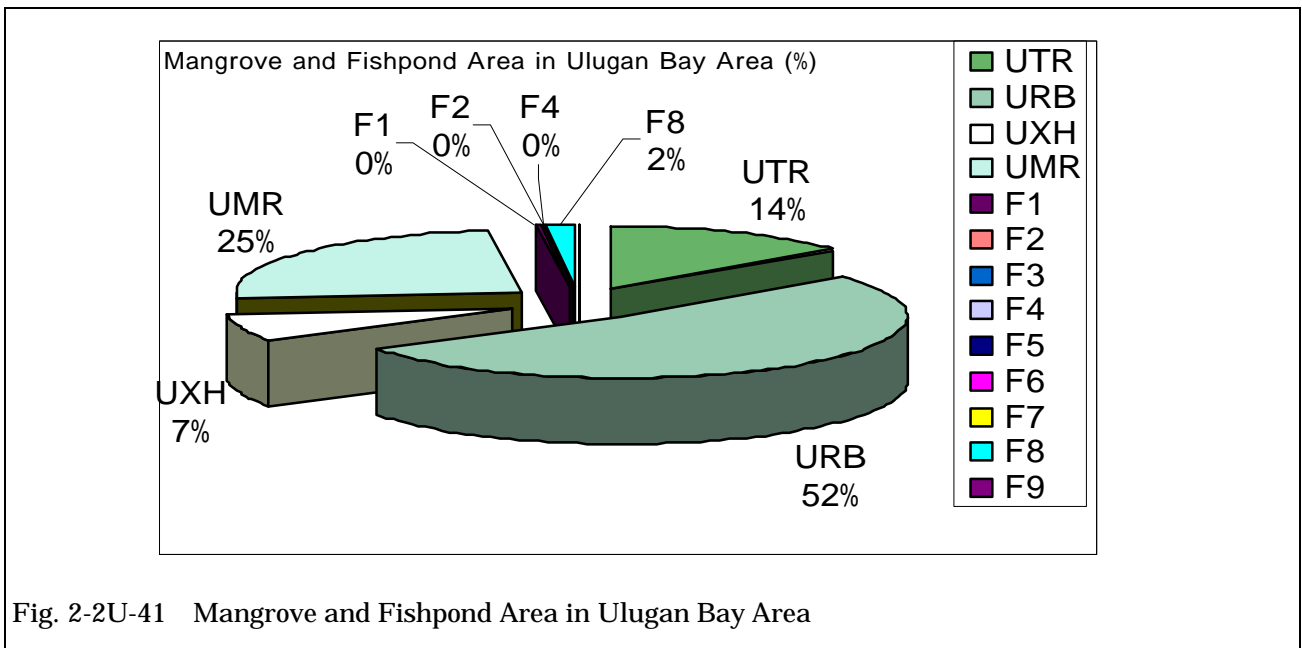


Fig. 2-2U-41 Mangrove and Fishpond Area in Ulugan Bay Area

Table 2-2U-2 Mangrove and Fishpond Areas by Zone (ha)

		Talonayan	Tagabunit	Macarasca	Bahile	Total
Mangrove	UTR	7.18	17.85	65.02	25.32	115.37
	URB	32.7	110.27	168.84	109.26	421.07
	UXH	0	30.39	12.73	12.62	55.74
	UMR		83.55	73.32	41.96	198.83
	sub Total	39.88	242.06	319.91	189.16	791.01
Fishpond	F1		1.41			1.41
	F2					0
	F3					0
	F4					0
	F5					0
	F6					0
	F7					0
	F8		14.39			14.39
	F9					0
	Total		0	15.80	0	0
Others		0	1.38	4.66	0	6.04
G Total		39.88	259.24	324.57	189.16	812.85

Ulgan Area Mangrove area (%)

		Taronayan	Tagabi.	Macara.	Bahili	Total
Mangrove	UTR	18.0	7.4	20.3	13.4	14.6
	URB	82.0	45.6	52.8	57.8	53.2
	UXH	0.0	12.6	4.0	6.7	7.0
	UMR	0.0	34.5	22.9	22.2	25.1
Total		100	100	100	100	100

Ulgan Total (ha)

		Taronayan	Tagabi.	Macara.	Bahili	Total
Mangrove area total		39.88	242.06	319.91	189.16	791.01
Fishpond area total		0	15.8	0	0	15.80
Other area total		0	1.38	4.66	0	6.04
Grand total		39.88	259.24	324.57	189.16	812.85

Ulgan Total (%)

		Taronayan	Tagabi.	Macara.	Bahili	Total
Mangrove area total		100.0	93.4	98.6	100.0	97.3
Fishpond area total		0.0	6.1	0.0	0.0	1.9
Other area total		0.0	0.5	1.4	0.0	0.7
Grand total		100.0	100.0	100.0	100.0	100.0

Consideration on Mangrove Forest Distribution Categorizing

Area	Vegetation Type (Dominant Species)	Landscape Condition						Stands Condition						Occupied Area
		Inter tidal level		Estuarine Location		Location	Soil	Salinity		Crown size		Tree height		
		High	Middle/Low	Up	Middle/Down			No	H	M	L	H	M	
Ulugan Bay	Rm	█	█	█	█	█	Sandy/Thin Clay	█	█	█	█	█	█	Narrow sea side and river side part.
	Bg	█	█	█	█	█	Silt/Cra Thickly	█	█	█	█	█	█	Narrow parts within Ra.
	Ra & Rm	█	█	█	█	█	Silt/Cra Thickly	█	█	█	█	█	█	From seaside to approaching landward, broadly expanding.
	Ra	█	█	█	█	█	Sandy/Thick/Clay Middle	█	█	█	█	█	█	From seaside to approaching landward, broadly expanding.
	Xg, Hl, & Af	█	█	█	█	█	Sand Middle/Thin silt	█	█	█	█	█	█	Narrow band onland-ward fringe.

Vegetation Type (Dominant Species)	Possibility to identify on aerial photo graph and draw on 1:10,000 map	Size of Areas by Vegetative types	Mangrove forest Types on Map	Explanation of Mangrove forest types
Rm	Difficult, too narrow.		Marge to surrounded sub compartment	
Bg	Difficult too small peche.		URB	Ra or Rm and Bg middle height stands are continuously changing from seashore to middle tidal zone.
Ra & Rm	Difficult to divide from Ra, Bg, or Rm.		UMR	Middle height Ra is dominantly spreading area.
Ra	Possible but only in case of original forest.		UTR	Tall Rhizophora apiculata are dominated
Xg, Hl, & Af	Possible but only wider part.		UXH	High intertidal mangrove species such as Xg, Hl, Ea are growing

Fig. 2. 21. 42 Vegetation and Mangrove Area Classification in Ulugan Bay Area

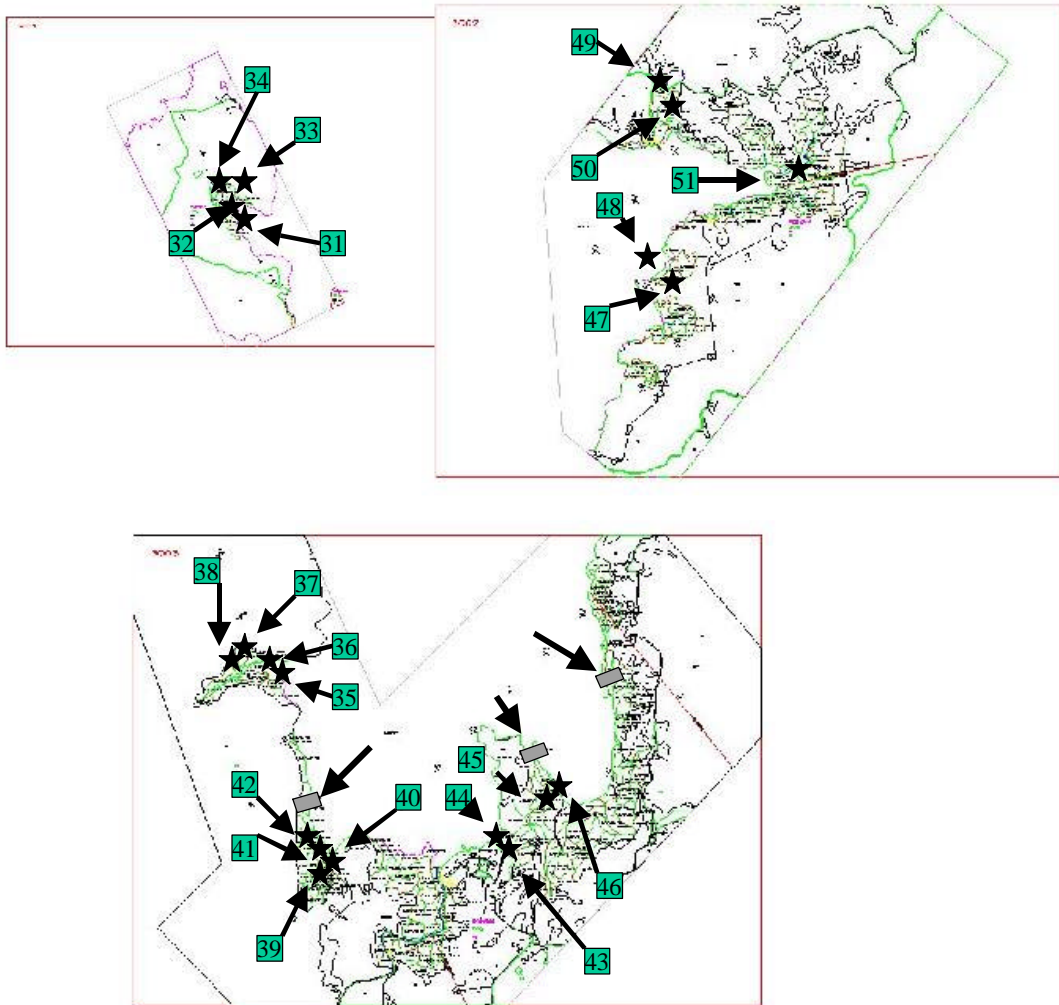


Fig 2-2U-43 Location Map on Transect and Plot Survey in Ulugan Bay Area