NATURAL/SEMI-NATURAL MANGROVE GEO-ECOSYSTEM ESTABLISH BY PLANTATION IN CAN GIO DISTRICT, HO CHI MINH CITY, VIETNAM

T. Miyagi*, Y. Kitaya**, K. Suzuki***, L.V. Sing****, and V.N. Nam*****

* Tohoku Gakuin Univ., 980-511, Sendai, Japan
** Osaka Pref. Univ., 599-8531, Sakai, Japan
*** Yokohama National Univ.,240-0067, Hodogaya, Japan
**** Peoples Committee of Can Gio district, Ho Chi Minh, Vietnam
***** Rural and Agricultural service, Ho Chi Minh, Vietnam

ABSTRACT

Redevelopment of the mangrove geo-ecosystem by reforestation activities is clarified by field investigation at the Forest Park area Can Gio district. The natural forest had destructed by harvecite in 1966 to 1970 during Vietnam War. Although, the reforestation started by the local people that led a series of geo-ecological environmental changes. The plantation lead the ground level rising by sedimentation, the autonomous forest structure change, change the soil condition, increase the species component the below ground biomass and fauna diversity. The process the zonation changes from the ubsuitable one to suitable species complex stared in relation to the respective ground level. Such environmental change is almost same as natural one. Natural ecosystem might be establish not only by the natural process but also it start by the plantation as a trigger.

KEYWORDS

Mangrove Reforestation, Geo-ecology, Can Gio, Vietnam, Harvecite

INTRODUCTION

The mangrove ecosystem is a forest ecosystem developed on above the upper half of the tidal zone in tropical and subtropical coastal zone. The forests have been destroyed rapidly to produce charcoal and to construct shrimp ponds and war during the 1960's to '70's. It has led various environmental problems such as coastal erosion, damage from salt water, and abandoned shrimp ponds.

This ecosystem is formed between the land and sea. The ecosystem is considered to be developed and maintained through both the interaction among the land, sea, and biological forces. These points lead us to recognize that the ecosystem has different characteristics from those of the forest ecosystem of the terrestrial one (Fig.1).

The authors are tracing the changing process by space image remotesencing data and are carrying the field investigation of the rehabilitated mangrove ecosystem in the Can Gio district Ho Chi Minh City. The mangrove forest is developed on the delta, this is an artificial one recovered after the complete extinction of the natural forest because of the defoliation spread during the Vietnam War. This forest has lived for 25 years. In the case of the Can Gio area, the forest floor is bare land of the tidal zone which was created 25 years ago. Therefore, we can study what kind of maturation process the present forest ecosystem has followed by analyzing the condition of the natural forest which existed before the occurrence of the defoliation, the changes of

the land condition caused by denudation, and by replicating the changes of the land and forest after the reforestation.

RESULTS AND DISCUSSION

An area covered with about 40,000ha of natural or semi-natural mangrove forest before the war was completely destroyed by herbicide spray from 1967to 1971(Hong, 1996). After many years of herbicide spraying, the degraded land still remains degraded and bushy or bare. After the end of the war, great efforts have been made towards the rehabilitation of mangroves. An extensive reforestation project was started in 1986 by local government and 54 % of the area was covered by 1998. Actually, since 1968, mangrove reforestation has been undertaken in a small scale by local people. Since 1978, a much larger mangrove reforestation programme has been undertaken by Ho Chi Minh City Forestry Service, NGO groups and local people. During the process many remarkable environmental changes have become apparent.

The mangroves in Can Gio are amongst the richest in the world, with more than 72 species of mangrove flora (Nam & My, 1992; Hong & San, 1993) and 440 species of fauna (Mien et al., 1992; Hon et al., 1996), constituting an environment of high biodiversity (Fig. 2, Fig. 3)

As a result, the forest was registered as the first Biosphere Reserve of UNESCO / MAB in Vietnam in 2000. To understand the transition/degeneration process the mangrove ecosystem follows in this area, I would like to investigate the transition of the forest structure and sediment of this area before and after the spread of defoliation. This kind of investigation can give us a clear understanding of these processes.

From 1978 to 1983, *Rhizophora apiculata* and *Rhizophora mucronata* and *Ceriops tagal* were planted in one part of the forest. *Rhizophora mucronata* did not adapt to the ground level of the plantation at all, and became extinct. *Rhizophora apiculata* were planted in the largest land in the park. Some of the trees reached up to 18m high at the maximum. They have either altered into other tree species or into a natural forest. Also at some places where the ground level is high, the surface ground soil has eroded away, and has accumulated on the river bank. These transitions or changes can be summed up as follows:

1. The changes of the landforms and soil caused by the defoliation
2. The formation of the forest and the recovery of the soil by reforestation
3. The alternation of the species which forms the forest caused as a result of its maladjustment to the ground level and the inflow of other natural species around the area
4. The rapid expansion of the *Avicennia alba* community caused by the inflow of the seeds of the species which adapts to the ground level newly formed
5. The accumulation of the biomass under the ground
6. The extinction of *Sonneratia* which existed widely before the spread of the defoliation

Here I like to introduce some analysis examples to show how the aforementioned transitions or changes have been shifted based on the data collected in our field survey.

Fig. 4 shows the cross sections of the landforms, sediment and vegetation analyzed in

one part of the forest park. We can read the following facts in the cross sections:
The ground of the mangrove forest in the cross section lies on the range 25 - 65 cm above the mean sea level. In the analysis of the sediment carried out at 6 spots between St.1 and St.13, more of mottled iron oxide can be seen on the surface of the sediment on the land than the area at St.6. We can estimate that the land surface denuded by the spread of the defoliation was exposed to the sunlight and caused this phenomenon. We can also assume that the surface of the denuded land suffered from the strong land erosion. On the other hand, 10 - 70cm thick extremely loose clay layer deposit is accumulated on the top of the slightly compact clay layer at St.1, 2, and 3. We assume that this loose clay is a suspended material carried in the surface erosion which occurred in the land area.
At the beginning, *Rhizophora mucronata* was planted at St.1 - 3, and *Rhizophora apiculata* was planted in the rest of the starting areas from St.4 to the outer land area. However, the formation of the tree species and the forest structure have changed greatly as the vegetation data in this figure. *Rhizophora mucronata* went extinct between the stations of 1 and 3. In stead of *Rhizophora mucronata, Avicennia alba* has naturally settled in and has been growing there As a result, the natural succession of the *Avicennia alba* species has been in progress. In the case of the reforestation of *Rhizophora apiculata* at St.3 - 13, *Rhizophora apiculata* has grown favourably around St.13. The natural succession of this species is observed there. However, their growth at St.8 - 13 has been unfavourable. In its place, *Avicennia alba* and *Ceriops decandra* have entered into the plantation, and have caused the natural succession of its own species.
The amount of biomass accumulation in the mangrove sediment is only a little, and this is because it has not been long since the formation of the forest.
These facts suggest to us that the settlement and alternation of various species of trees in the forest naturally occur after the trees in high demand are planted in the forest, and the forest has changed itself adapting to the level of the ground and the features of substance movement on the ground surface. The sudden sedimentation of clay on the places of which ground level is lower than that of St.3 has to do with the increase of the roughness of the ground surface caused by the development of the *Avicennia alba* forest. All of these can enable us to indicate the possibility suggested by Mochida et al (1999) that the autonomous formation of the mangrove ecosystem which adapts to the ground level (tide level) and the vertical distribution of the mangrove forest created through the interaction between the landforms and the vegetation.

CONCLUSION

In the case of Can Gio which has the plantation, a simple and artificial forest was formed. This triggered the accumulation of soil and the entrance of a new species of trees which have led the transition phenomenon into the natural forest which adapts to the changes of the ground level. In Can Gio, changes can be seen not only on the land and in the forest, but also in the fauna which has recovered well. The appearance of a lot of long tailed monkeys (*Macaca fasicularis*), 31 species of reptiles belonging to 14 family and crocodiles proves the recovery.
If there had not been reforestation, the speed of the progress of the land erosion and

drying speed of the ground surface would have been faster, and it would have been much more difficult to restore the forest.

If we assume that the development of the mangrove ecosystem is a series of linking development systems which start with the settlement of the pioneer species of mangroves around the mean water level, we should realize that 'mangrove reforestation' has a significant meaning which is essentially different from that of reforestation of pine trees or eucalyptuses in the land. The purpose of mangrove reforestation is not only to raise forests and produce timber resources from the trees. It also has the significance as an opportunity of creating a new ecosystem. The essential functions of the ecosystem created by this reforestation should not have a great difference from those of the natural ecosystem. Whether or not the seeds of the pioneer species take root in the land artificially or naturally, the ecosystem should develop autonomously as an interaction system after its settlement. Mangrove reforestation has the potential of 'returning to a natural ecosystem' but not the potential of functioning as 'timber resource'.

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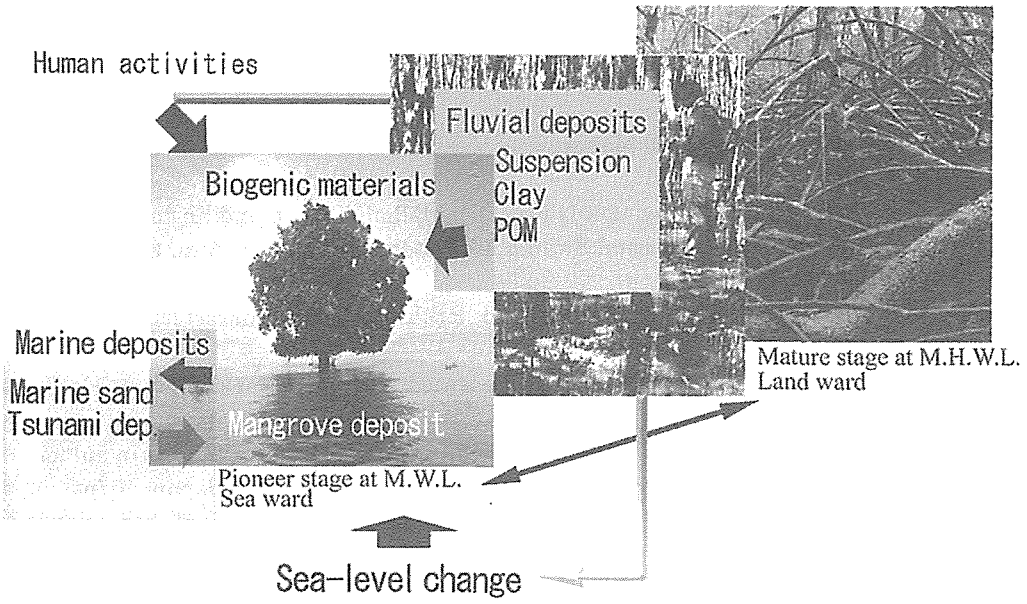

Fig. 1 Schematic illustration of the mangrove ecosystem development and the roles of related components at upper half of the tidal zone

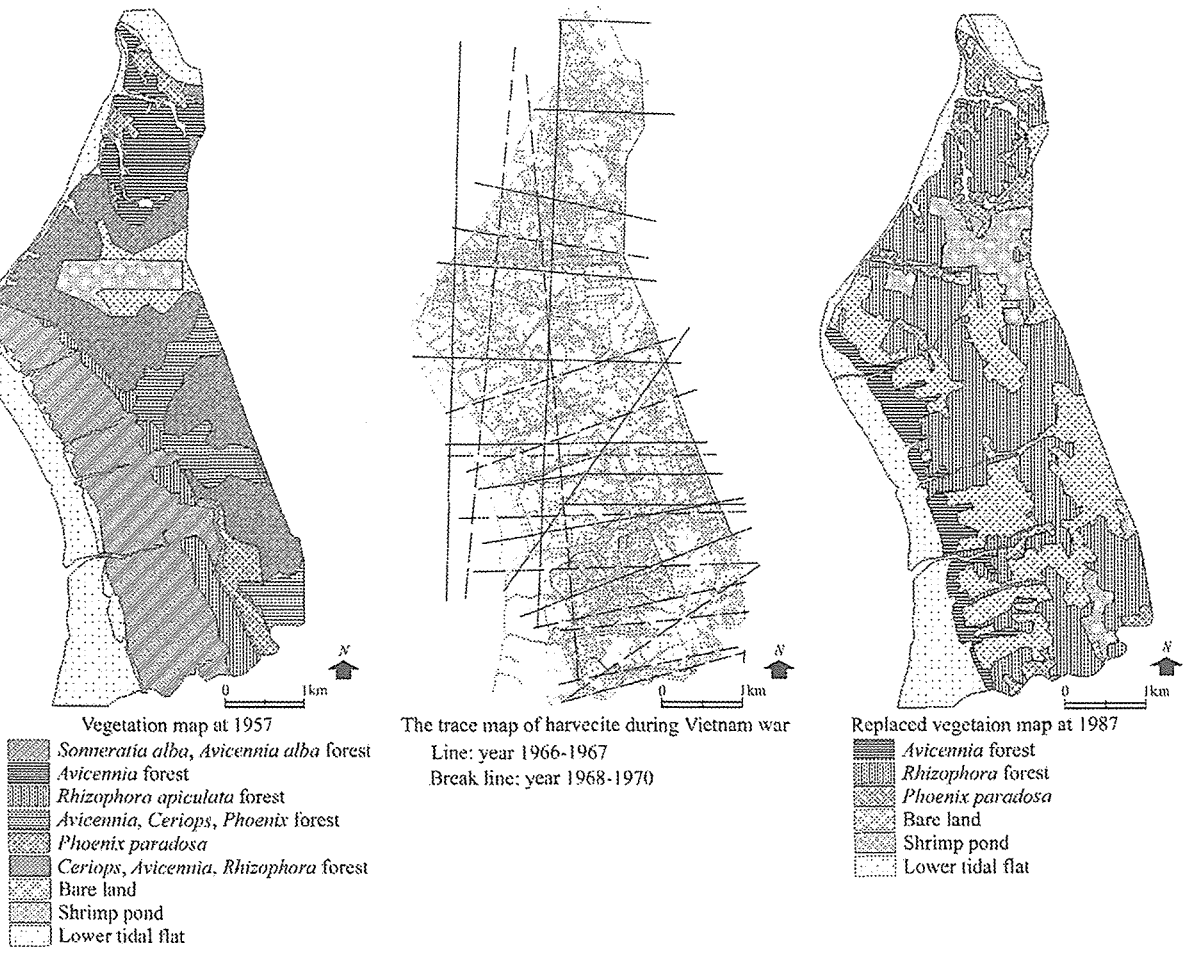

Fig. 2 Change of the mangrove forest distributions between before and after the Vietnam war in Can Gio area Ho Chi Minh city, Vietnam.

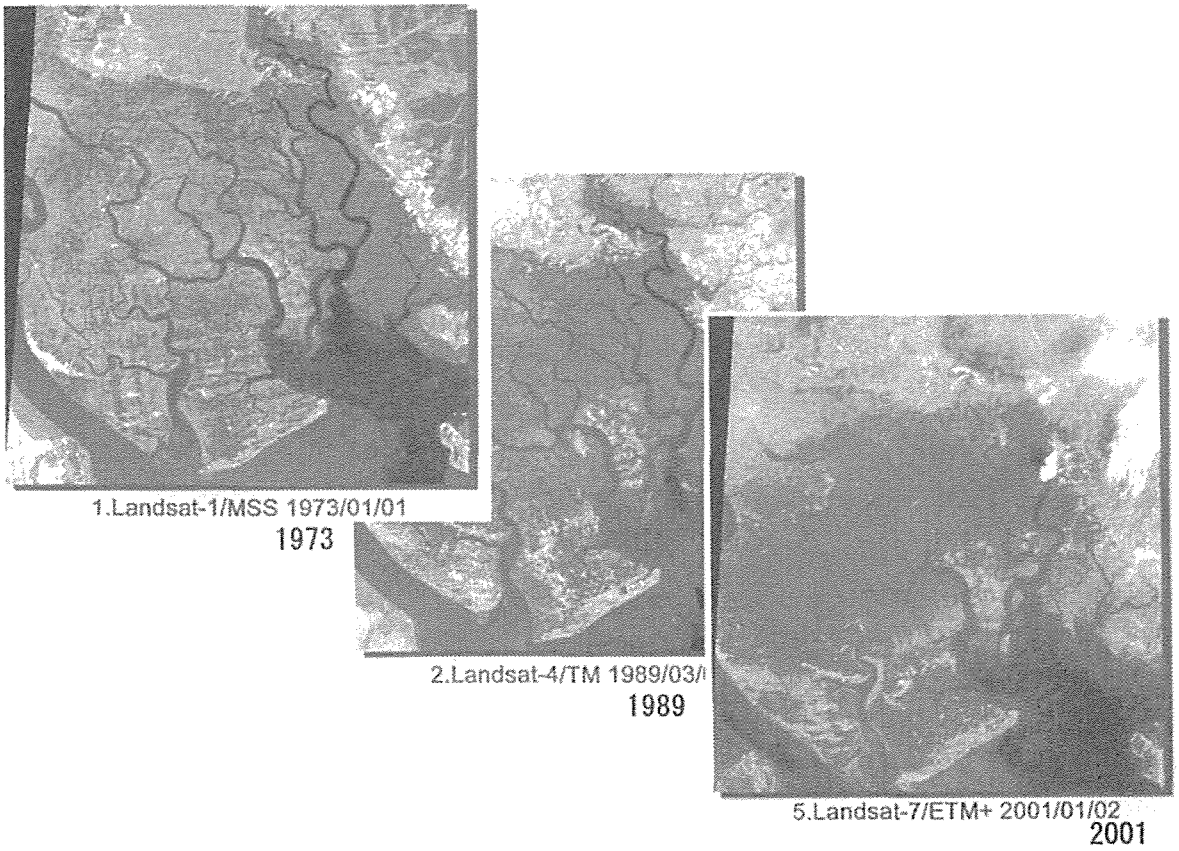

Fig. 3 Changes the mangrove area by Landsat images of Can Gio area Ho Chi Minh city, Vietnam

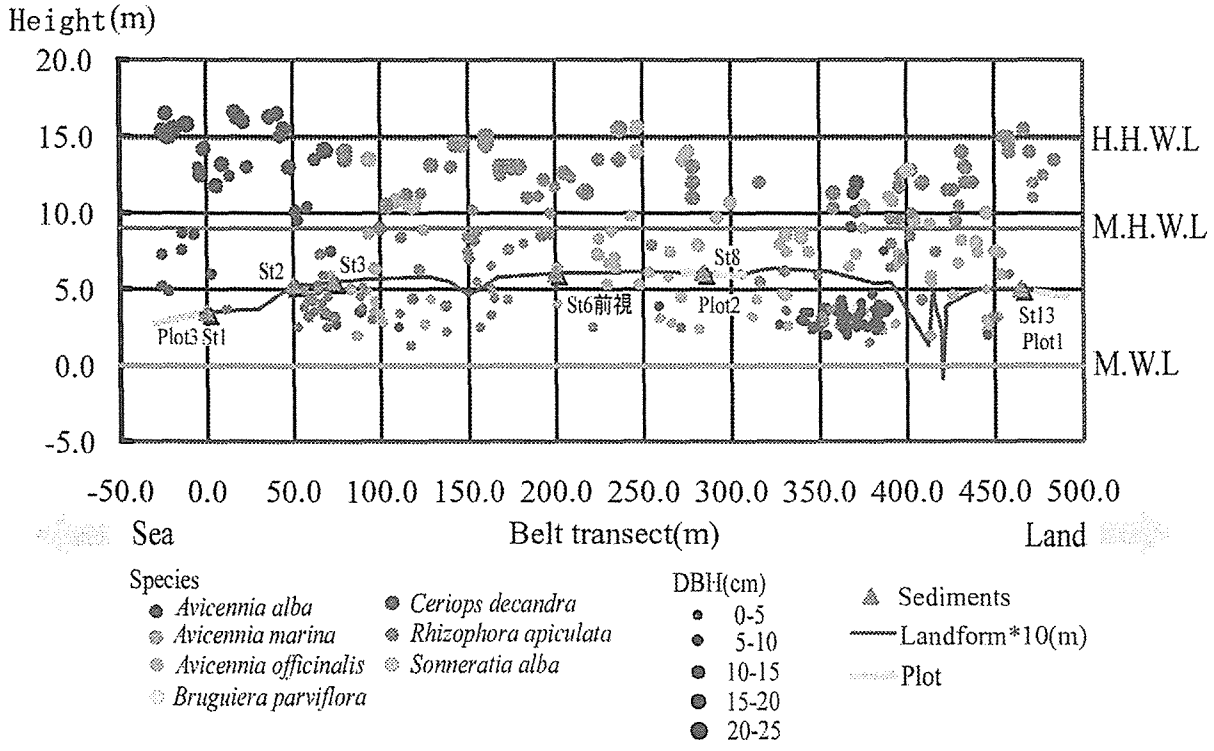

Fig. 4 Line transect of a part of recent mangrove habitat in the Forest Park Can Gio area.