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| Citation | Annual Report of FY 2004, The Core University Program between Japan Society for the Promotion of Science (JSPS) and Vietnamese Academy of Science and Technology (VAST). 2005, p. 121-126 |
| Version Type | VoR |
| URL | https://hdl.handle.net/11094/12906 |
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THE SIMILALITY BETWEEN THE AFFORESTED MANGROVE ECOSYSTEM AND THE NATURAL ONE – COMPARATIVE STUDY OF CAN GIO PLANTATION AREA AND IRIOMOTE ISLAND-

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ABSTRACT

The maturing process of the planted mangrove ecosystem at the defoliation tidal swamp was discussed based on field data. The autonomous maturing process has been occurred at the 27 years old mangrove plantation forest. The main facts such as 1) land degradation by erosion and oxidization and new mangrove habitat by sedimentation, 2) Spatial arrangement of forest structure change, 3) Biomass accumulation in above and below ground, 4) Dramatic increases of flora and fauna in and around the plantation area.

INTRODUCTION

Mangrove ecosystem is a unique coastal forest environment. It develops as a buffer or a interactive ecosystems between the sea and land. The total of the area occupies only one to two percent of the tropical forest area in the world. Mangrove forests and the habitats are known as a marine forest ecosystem which plays an important role not only as timber resource but cultivable forest for crustacean and fish and many other fauna. However, these forest and habitat have been destroyed rapidly and strongly to produce charcoal, fuel wood production and shrimp ponds construction since the 1970's. The war also had a significant role of the ecosystem destruction.

This ecosystem is formed between the land and sea. It plays a role as buffer which moderates the effects of both the land an ocean. Also, the ecosystem is considered to be developed and maintained through both the interaction among the land, ocean, biota, and human. These points led us to recognize that the ecosystem has different characteristics from those of the forest ecosystem of the terrestrial one. This means that it is important to consider these factors sufficiently in studying various measures to restore mangrove forests.

Looking at the location of the ecosystem, its formation is developed only on the upper half of the tidal zone. The spatial arrangement of the forest community is explained in relation to the series of the environmental gradient influences such as tide level, salinity, sedimentary, erosion, wave action and tidal current and so on. Mangrove forest itself might be influence to the related environment. The dense aerial roots system and stems decreases the forth of wave and tidal current. The force will have a role of sedimentation. Forest canopy also have some role of the environmental control. It is needless to say the forest has the primary production of the ecosystem. By these special characteristics, we should pay attention to the mangrove forest as the special role of a partner of

interaction forces. The Can Gio district mangrove forest selected to the UNESCO/MAB biosphere reserve in 2000. The fact has an important meaning as the special function of the mangrove reforestation as the rehabilitate the environment.

AUTONOMOUS CHAIN AND INTERACTION PROCESS OF MATURING

The development of mangrove ecosystem takes place in an extremely limited habitat which is positioned in the upper half of the tidal zone. The habitat is in a series of the sequence from the coastal freshwater swamp, mangrove, sea grass and coral ecosystem under the controlled by the sea-level change and coastal plain development. However, mangrove forests can alter their species adapting to changes in the upper half of tidal situation, and the changes the forest dynamics. At the same time, the fauna (living in the environment) can alter adapting the micro environmental changes. This is to say, the interaction between the land and biological forces in the tidal situation, that creates the characteristics of the mangrove ecosystem, is considered to follow the processes as follows (Fig. 1). First of all, land of the mean tide level is formed through some physical process such as sedimentation, natural levee, and tidal flat development. Seeds of the pioneer species (such as *Sonneratia alba*, *S. caseorialis*, *Avicennia alba*, *A. marina*, *Rhizophora stylosa* etc.) of mangrove germinate and take root at the place. In their growth process, the trunks, branches, leaves especially dense aerial roots hold the earth, sand and suspension materials in place which has slide down because of the tide and river flow. At the same time, the mangrove forest accumulates its leaves and roots at its base and on the land. These stems and roots become not only nourishment for the mangrove forest itself, but also becomes sediments which forms the ground as an organic material. The blow ground biomass such as roots has relatively important as a role of sediment. When the ground is filled by the process, its level becomes higher and is less affected by the ebb and flow of the tide and river flow. As a result of this, mangrove alter into another species components (such as *Rhizophora apiculata*, *Bruguiera gymnorhiza* etc.). If the fertility of the forest is high, the forest has larger number of various crustaceans such as crabs, mud lobsters and shellfish around it. When the level of the ground becomes even higher nearly leach to the mean high water and is seldom affected by ebb and flow and sediment transportation, the mangroves again alter into another species (such as *Xylocarpus granatum*, *Ceriops tagal*, *C. decandra*, *Lumnitzera rasemosa*, *L. littorea* etc.) At this stage, mud lobsters form a large number of mounds by makes the burrows in the ground. If we at the area when the high tide, the forest looks as if there are a lots of small islets scattered on the water surface of the forest. Such series of the sequence of the micro environment is a process of interaction chain processes between the biological (the force of mangrove trees and crustaceans) and physical (the force of tide, wave and fluvial process). Additionally, the effects of shadow by crown is also has a role of the restraint of evaporation and oxidization of ground surface.

AFFECTION OF FOREST DESTRUCTION

The clear destruction of the mangrove forest means that is not only cut the trees but also cut the part of chain process and cut the interaction system in tidal zone. It will lead many kinds of environmental degradation. Very unfortunately we have poor information about it. Although, in case of Can Gio mangrove destruction by the defoliation operation by orange gas spray during Vietnam

war and the process of rehabilitation informed us some important information.

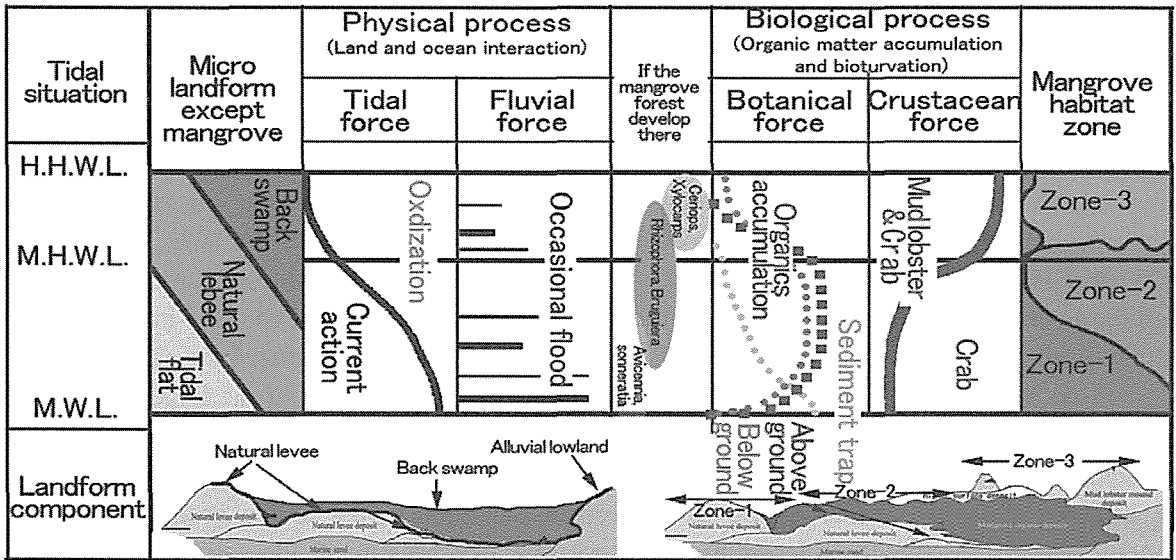


Fig. 1 Interrelationships of various contributors of mangrove ecosystem development in relation to the tidal situation.

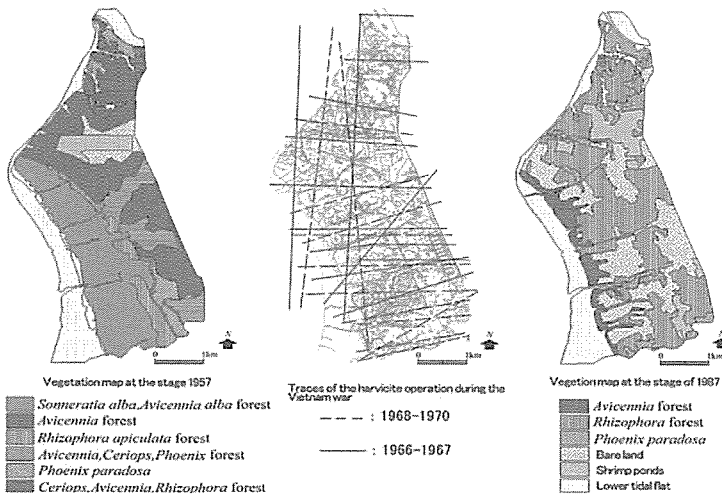


Fig. 2 Change of the spatial arrangement of the mangrove forest between before and after the Vietnam war in Can Gio Forest Park area, Ho Chi Minh city, Vietnam

MATURING PROCESS OF CAN GIO MANGROVE

Before 19th century the Vietnam coast was widely covered by natural mangrove forest. The area was quickly reduced following growth in other land uses. The Can Gio area is located 20km southeast of HoChi Minh city. During the two Indochina wars, the mangroves in Can Gio were destroyed. An area covered with about 40,000ha of natural or semi-natural mangrove forest before the war was completely destroyed by herbicide spray from 1967 to 1971 (Hong, 1996). After the many years of

herbicide spraying, the degraded land still remains degraded and bushy or bare condition. After the end of war, great efforts have been made towards the rehabilitation of mangroves. An extensive reforestation of *Rhizophora apiculata* plantation 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 much larger mangrove reforestation programmed by Ho Chi Minh city forestry service, NGO groups and local people. The planted area nearly amount to 18,000 ha. At the same time the natural mangrove forest such as *Avicennia alba* forest is also developed about 15,000. Now the mangrove ecosystems in Can Gio are amongst the richest in the world, with more than 72 species of mangrove flora (Nam & My, 1992, Hong and San, 1993) and 440 species of fauna (Mien et al., 1992, Hon et al., 1996) constituting an environment of high biodiversity. The project traced the biological and geomorphological changes in the mangrove habitat before and after the herbicide by field measurements and also compared the natural one.

From 1978 to 1983, *Rhizophora apiculata* planted widely because of the large utility for the local people, *Rhizophora mucronata* planted at the lower part of the ground besides of *R. apiculata* and *Ceriops tagal* were planted at the higher portion of the *R. apiculata* area. The arrangement was big different with the former forest. *R. mucronata* did not adapted to the ground level of the plantation at all. *C. Tagal* plantation was also not effective because of the soil condition such as strong acidic and hard crust by large evaporation. Although, the natural transition or semi natural transition of the forest has been occurred in and around reforestation area.

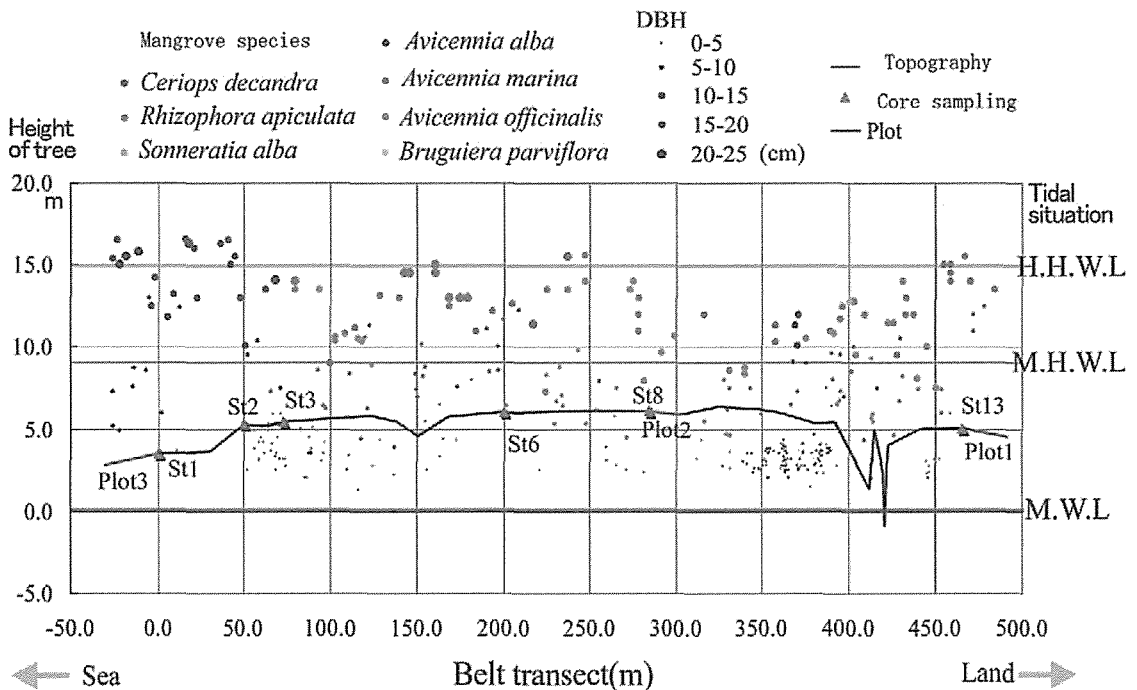


Fig. 3 Line transect of a part of recent mangrove forest and landform in the Forest Park

The facts by field investigation at Can Gio forest park area are summarized as follows:

- 1) The changes of landforms and soil caused by defoliation such as oxidization and acidic sulfur soil, great amount of soil erosion in relatively higher portion of the former mangrove habitat. At

the same time sedimentation is also occurred along the big tidal channel and rivers. Several hundred meters retreat the coastal line at the river mouth of Can Gio town is also happened.

- 2) The formation of the forest and the recovery of the soil by reforestation. It lead not only forest cover but also recover the soil moisture and control the soil erosion in the forest.
- 3) The alternation of the species which forms the forest caused as a result of its maladjustment to the ground level and inflow of other natural species around the area.
- 4) The rapid expansion of the *A. alba* community caused by the inflow of the seeds of the species which adapted to the newly formed ground level by rapid sedimentation.
The amount of sedimentation is 0 to 70cm depth in 150 m in these 10 years.
- 5) The accumulation of the biomass under the ground.
- 6) The extinction of *Sonneratia* which existed widely before the spread of the defoliation.
- 7) *A. officinalis*, *C. tagal* and *C. decandra* community develops under the *R. apiculata* plantation area where relatively low growth.

CONCLUSIVE REMARKS

The UNESCO/MAB Biosphere Reserve of Can Gio Mangrove is still keeping the maturation process. The initiation is caused by plantation. At the same time natural rehabilitation processes are also started. There are very much interesting ecological transition occurred during the 15 years. At the same time planted *R. apiculata* grow up to more than 20 meters high.

The interaction process getting clear and clear by the transition of forest and land surface restructuring. Such process is happened only these 10 to 20 years. There is no case in the terrestrial forestation. The artificial mangrove forest after the strong human interference will establish the natural mangrove ecosystem in the near future.

ACKNOWLEDGEMENT

The authors are grateful to Prof. Fujita Osaka University for his kind coordination the program. And also special thanks to JSPS program for his financial support.

REFERENCE

- Hong P. N. and San H. Y. (1993) Mangroves of Vietnam. The IUCN Wetland Program, Bangkok, 35-41.
- Mien P. V., Lai B., Canh D., Loc D. B., and Viet P. B. (1992) Characteristics of the ecosystem at Sai Gon-Dong Nai estuaries. Paper presentation at the seminar on ecology, Ho Chi Minh City, 18-19, Aug. 1992, 1-7.
- Miyagi T. and Fujimoto K. (1999) Bio-geomorphological study of sedimentary processes in mangrove forest, Iriomote Island, Okinawa Japan." Mangrove research", Subtropical Research Institute, 164-179.
- Nam V. N. and My T. V. (1992) Mangrove protection. A changing resource system: case study in

Can Gio District, South Vietnam. Field Document, 3, FAO Bangkok, 13-18.
Nguyen H. Tri P. N. Hong, and Cuc L. T. (2000) Can Gio Mangrove Biosphere Reserve Ho Chi Minh City, 41ps.