

MANGROVE ECOSYSTEM : STRUCTURE AND FUNCTION

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PREFACE

Probably, no other distinct plant community has attracted as much curiously and scientific attention for as long as have the mangrove forests. Rollets (1981) annotated bibliography lists 5,608 published titles through 1975 with one of the first being the written account from the chronicle of Nearchus, dating back to the Greek mariners of 325 BC.

Mangroves are the rainforests by the sea. The majority of the sub-tropical and tropical coastline is dominated by mangroves, estimated to cover an area of 22 million hectares. However, over the past several decades, the global area in mangroves has increasingly diminished as a result of a variety of human activities, such as over harvesting, freshwater diversion and conversion to other uses.

Mangroves forests are comprised of taxonomically diverse, salt-tolerant trees and other plant species which thrive in inter-tidal zones of sheltered tropical shores, "overwash" islands, and estuaries. Mangrove trees have specially adapted aerial and salt-filtering-roots and salt-excreting-leaves that enable them to occupy the saline wetlands where other plant life cannot survive.

Mangrove forests are vital for healthy coastal ecosystems. The forest detritus, consisting mainly of fallen leaves and branches from the mangroves, provide nutrients for the marine environment and supports immense varieties of sea-life in intricate foodwebs associated directly through detritus or indirectly through the planktonic and epiphytic algal food chains.

These complex ecosystems are found between the latitudes of 32° North and 38° South, along the tropical coast of Africa, Australia, Asia and Americas. These are varying scientific classifications of what constitutes a mangrove plant. According to two reputable scientific studies, mangroves include approximately 16–24 families and 54–75 species. The greatest diversity of mangroves species exist in South-east Asia.

Mangrove forests literally live in two worlds at once, acting as the interface between land and sea. Mangroves help to protect coastlines from erosion, storm damage and wave action. The stability, mangroves provide is of immense importance. They prevent shoreline erosion by

acting as buffers and catch alluvial materials, thus stabilizing land elevation by sediment accretion that balance sediment loss. Vital coral reefs and sea grass beds are also protected from damaging situation.

A primary factor of the natural environment that affects mangrove over the long term is sea level and its fluctuations. Other short-term factors are air, temperature, salinity, ocean currents, storms, shore slope and soil substrate. Most mangroves live on muddy soils, but they also grow on sand, peat and coral rock. If tidal conditions are optimal, mangrove can flourish far inland, along the upper reaches of coastal estuaries.

Mangrove ecosystems have traditionally been sustainably managed by local populations for the production of food, medicines, tannins, fuel wood and construction materials. For millions of indigenous coastal residents, mangrove forest offer dependable, basic livelihoods and sustain their traditional cultures.

Naturally resilient, mangrove forests have withstood severe storms and changing tides for many millennia, but they are now being devastated by modern encroachments. Today, mangrove forests are among the most threatened habitats in the world – disappearing at an accelerating rate, yet with little public notice. Lenticles in the exposed portions of mangrove roots are highly susceptible to clogging by crude oil and other pollutants, attacks by parasites and prolonged flooding from artificial dikes or causeways. Over time, environmental stress can kill large numbers of mangroves trees. In addition, the charcoal and timber industries have also severely impacted mangrove forests, as well as tourism and other coastal developments. The rapidly expanding shrimp aquaculture industry poses the greatest threat to the world's remaining mangroves. Literally, thousands of hectares of lush mangroves forests have been cleared to make room for the artificial shrimp ponds of this boom and bust industry. For the last many years, countless scientists and NGO groups involved in protection of mangrove forests at regional levels and global levels. The damage caused by the excessive intervention of plants and animal life and the irretrievable loss of natural resources are the dramatic results of global significance. In connection with global destruction of the tropical forests, increasing attention has recently been drawn to the ecosystem of the mangroves forests, which are being threatened to an even greater extent.

In the past, mangrove areas were generally regarded as useless, hostile territory. They were not considered to be valuable and were therefore destroyed in varying ways. Only with the help of effective management which takes the various conditions of this highly delicate ecosystem into consideration will it be possible to preserve the genetic multiplicity for future generations. In order to ensure an adequate level of protection, it is essential to recognize the value of these ecosystem on a global scale.

This book is a outcome of the work which we have done separately on various mangrove forests of the world – specifically mangrove forest of

Andaman and Nicobar Islands (nearly 5 years) and mangroves of South Japan (25 years) and worked jointly on mangrove forests of Amami-Oshima Islands, Okinawa Island, Iriomote Island and Ishigaki-Jima Islands of South Japan.

We hope that this book will provide to readers concise, sufficient and recent informations on mangrove ecosystems. The authors wish to thank JSPS-INSIA for granting CEP to study the mangrove forests of South Japan and Ecological Research Laboratory, Chiba for other support, pertaining to visit to these Islands.

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Plate - 1



Kandelia candel forest at Amami-oshima Is.



Inside the forest of *Kandelia candel*



Prof. Odaki at site



Acanthus ebracteatus



Acanthus ilicifolius



Rhizophora apiculata

Plate - 2



Rhizophora stylosa



Rhizophora mucronata



Bruguiera cylindrica



Rhizophora apiculata



Bruguiera parvilora



Lumnitzera littorea

Plate - 3



Aegiceras corniculatum



Schyphiphora hydrophyllacea



Excoecaria agallocha



Avicennia marina



Avicennia officinalis



Xylocarpus granatum



Xylocarpus moluccensis

Plate - 4



Bruguiera gymnorhiza



Ceriops tagal



Bruguiera gymnorhiza & B. sexangula



Sonneratia alba



Heritiera littoralis



Avicennia marina pneumatophores

Plate - 5



Knee roots of *Bruguiera gymnorhiza*



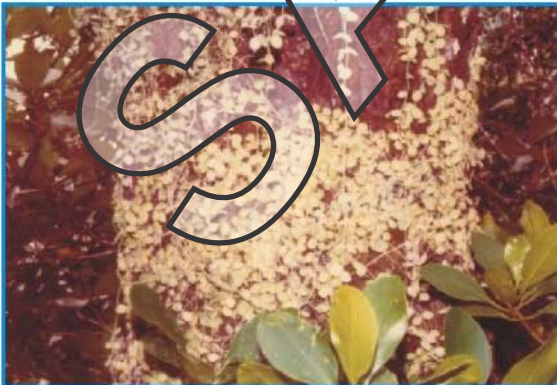
Nypa fruticans



Phoenix paradisa



Pandanus tectorius



Dischidia nummularia



Acrostichum aureum community

Plate - 6



Forest of *Sonneratia alba* at Okinawa Is. Japan



Root system of
Rhizophora mucronata



Avicennia marina
Forest at Goa



Seedling of
Bruguiera gymnorhiza



Kandelia candel forest at Amami-ohshima Is.



Inside the forest of *Candelia candel*

Plate - 7



Mangrove forest is place recreation



General view of mangrove forest at Okinawa Isl.



Rhizophora community



Rhizophora species showing seedling emergence



Zonational pattern in mangrove of
Amami Oshima Is.

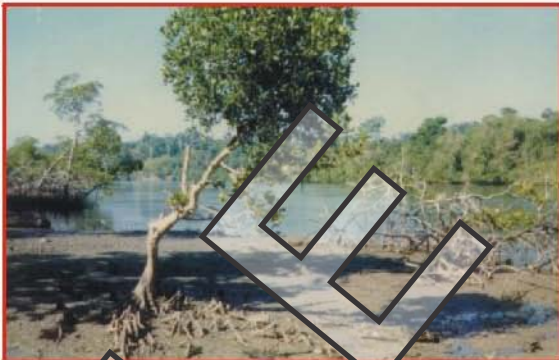


Kandelia candel community at
proximal zone

Plate - 8



Rhizophora showing pattern of root systems



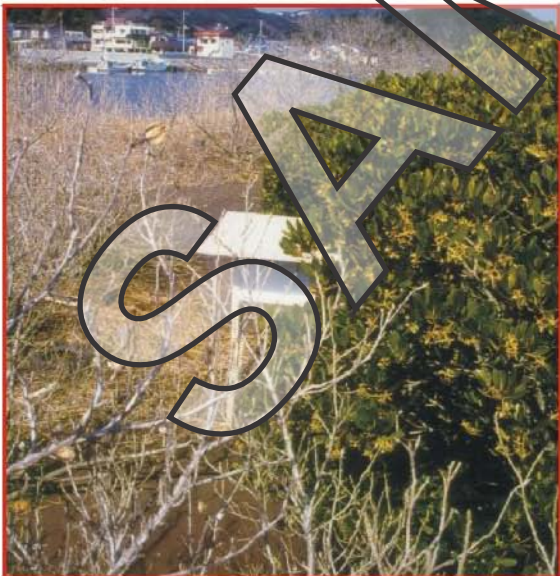
Ceriops tagal showing knee roots



Cutting of mangrove forest at Andaman Isl.



Regeneration of species in disturbed area



Kandelia candel along Minato River Japan

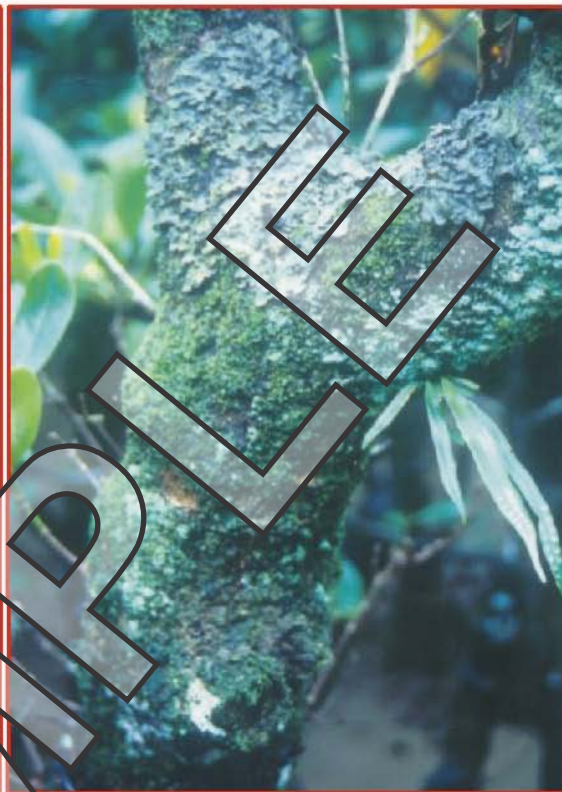


Viviparous seeds of *Kandelia candel*.

Plate - 9



Warty lenticillate bark in
Bruguiera gymnorhiza



Kandelia candel stem harbour
lichens, mosses and ferns



Regeneration of *Kandelia* species *in situ*

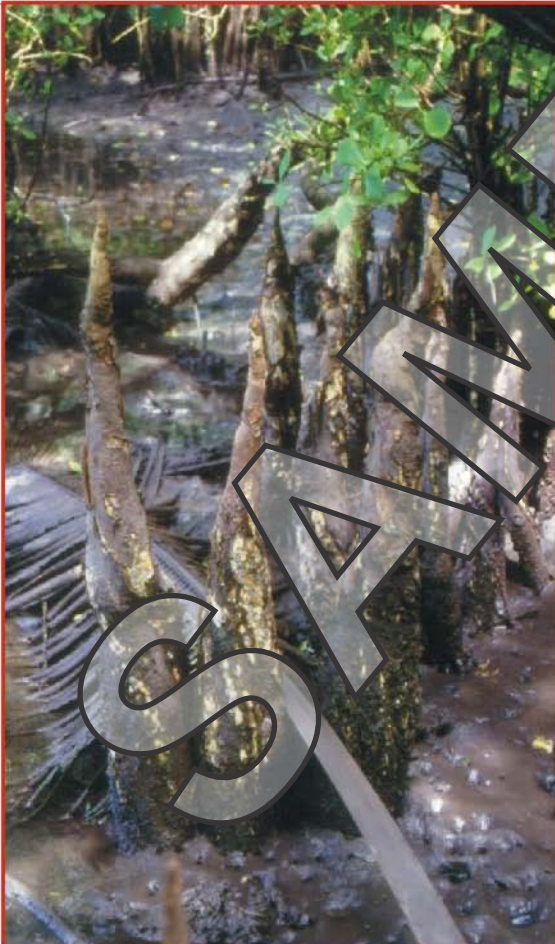
Plate - 10



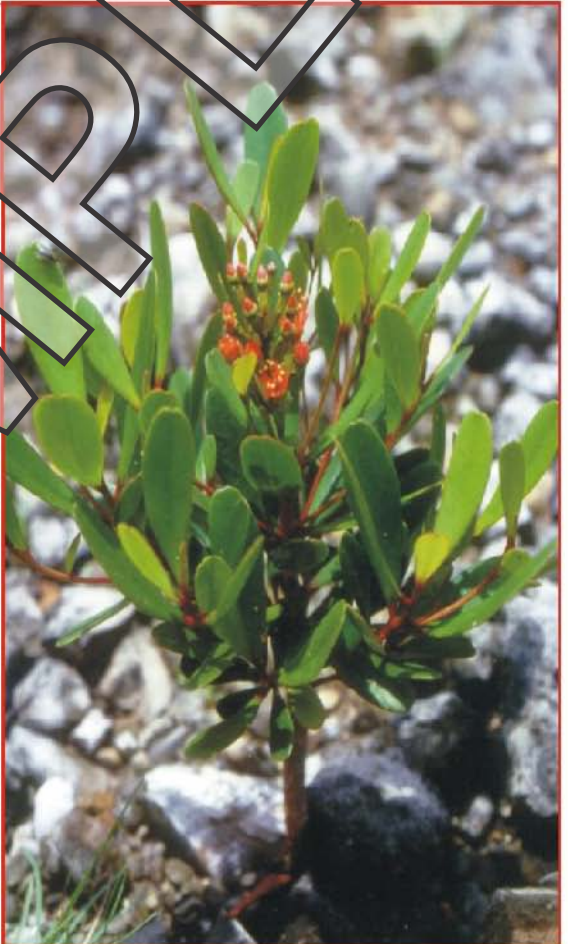
Pneumatophores of *Sonneratia caseolaris*



Old knee roots of *Bruguiera gymnorhiza*



Close-up of the Pneumatophores [2m height]
of *Sonneratia caseolaris*



A small tree of *Lumnitzera littorea*

Plate - 11

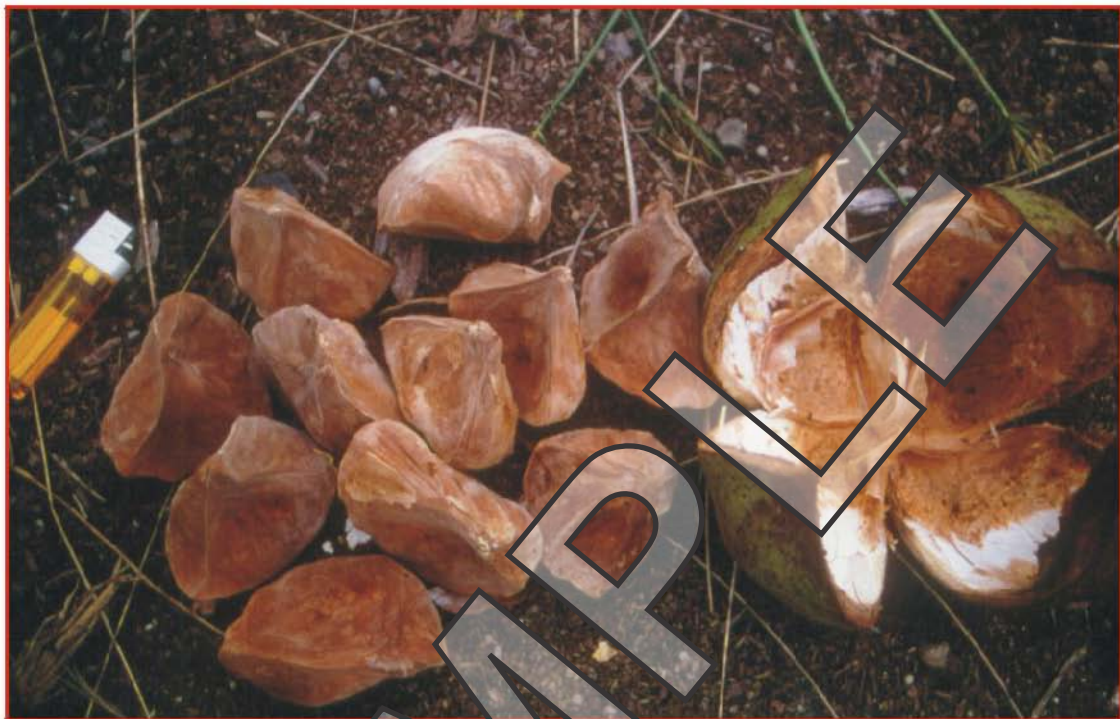


Fruits of *Aegiceras corniculatum*



Germination of seedling of
Aegiceras corniculatum

Plate - 12



Seeds of *Xylocarpus granatum*



Fruits and flower of *Nypa fruticans*