An ecological study of mangrove vegetation in the Ayeyarwady Delta, Myanmar

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THE total land area of Myanmar is 676 553 km², about 51% of which was covered by forest in 1989 (1989 Landsat TM images, Myanmar Forest Department). Mangroves occur in three regions of the country, namely Rakhine, Taninthayi and Ayeyarwady, along the coast of the Bay of Bengal and the Andaman Sea. The Ayeyarwady Delta comprises very extensive mangrove areas that have considerable commercial value.

Several authors worldwide have evaluated the past and present distribution of mangroves (eg Ellison et al. 1999). The study presented in this article focuses on the distribution of mangrove species and communities in the eastern part of the Ayeyarwady Delta and is intended to assist in the more effective conservation, restoration and management of degraded mangrove forest in the region. It formed the basis of a doctoral thesis by the first-named author, which was funded partly by an ITTO Fellowship grant.

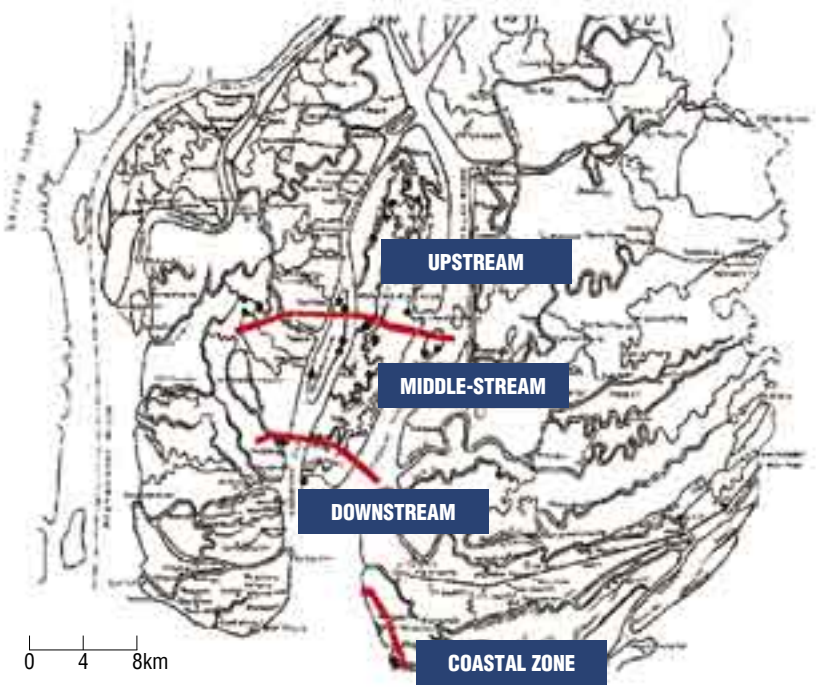
Objectives

The objectives of the study were to: 1) identify the mangrove communities in the Ayeyarwady Delta; 2) clarify the relationship between mangrove vegetation and its environment in the delta; and 3) provide basic information for the future restoration and conservation of mangrove vegetation. A phytosociological survey (Braun-Blanquet 1964, Fujiwara 1987) using line transects and randomly chosen plots was carried out to identify the mangrove community in the study area. Line transects were also used to study the relationship between vegetation distribution and such variables as microtopography, frequency of inundation, water salinity, soil texture and soil nutrient contents.

The Ayeyarwady Division lies at the southern end of the central plains of Myanmar. On the southern and western sides of the division are the Andaman Sea and the Bay of Bengal. The southern part has a tropical monsoon climate, while the northern part, with decreased rainfall, has a tropical savanna climate.

Mangrove zones

Figure 1: Mangrove zonation in the Ayeyarwady Delta



Phytosociological results

The mangrove communities of the study areas can be classified into three categories:

- coastal and river-bank communities, characterised respectively by: 1) *Sonneratia albae-Avicennietum albae*, 2) *Sonneratia apetala*, 3) *Avicennia alba-Avicennia officinalis*, 4) *Avicennia officinalis*, 5) *Sonneratetum caseolaris*, 6) *Kandelia candel*, 7) *Rhizophora apiculata*, 8) *Sarcolobus globosus-Brownlowia tersa*, and 9) *Ipomoea tuba-Hibiscus tiliaceus*;
- the inland communities, characterised by: 1) *Amooro-Heritieretum fomes*, 2) *Aegiceras corniculatum-Ceriops decandra*, and 3) *Phoenix paludosa* (a pioneer species); and
- marsh, which contains a *Leptochloa filiformis* community.

Distribution of mangrove vegetation

Four environmental zones can be delineated in the Ayeyarwady Delta that determine the distribution of the various mangrove vegetation communities *(see Figure 1)*.

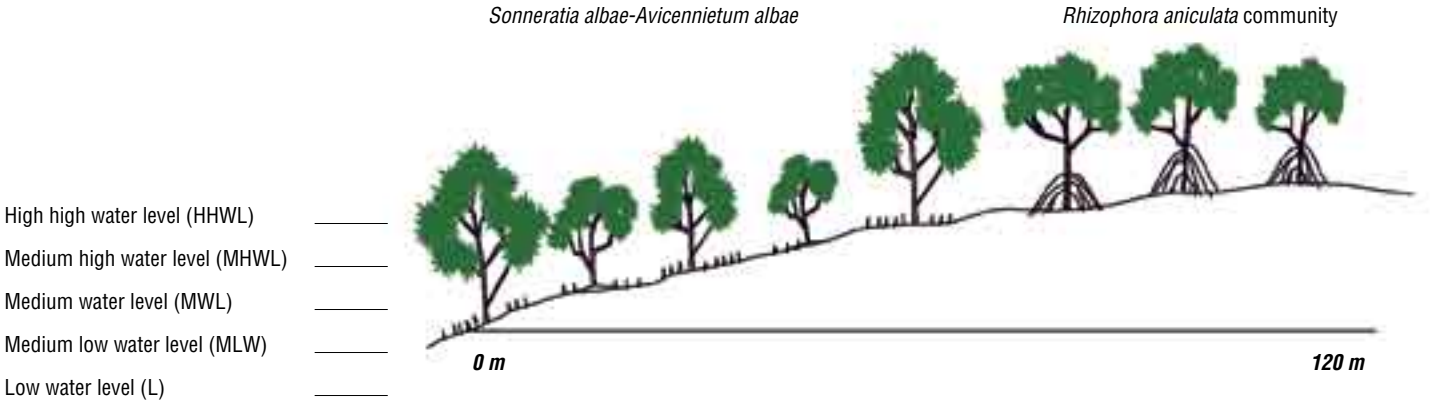
The coastal zone generally comprises low-ground, high-salinity (2.4–2.8% in the dry season) sites subject to strong winds and wave action; as a result the mangrove trees are generally of low height (5–9 m). The soil in this area is generally sandy clay loam or loamy sand. The typical mangrove community in the coastal fringe is made up of *Sonneratia alba-Avicennia alba* and, behind this, of *Rhizophora apiculata*. Human settlements start behind the *Rhizophora apiculata* community. The vegetation profile of this zone is shown in *Figure 2*.

Salinity levels in the 'downstream' zone are slightly lower than in the coastal zone (2.0–2.4% in the dry season). Riverbank soils are silty clay or silty clay loam. *Figure 3* shows a characteristic vegetation profile for this zone; the characteristic communities are *Sonneratia apetala* and *Avicennia alba-Avicennia officinalis*.

Water salinity continues to decline further upstream, measuring 1.5–2.0% in the dry season in the 'middle-stream' zone. Soils in the lower riverbanks are generally silty clay or silty clay loam; they become more clayey further inland. In this zone, the *Leptochloa filiformis* community develops in newly accreted areas and the *Kandelia candel* community appears behind these; the characteristic mangrove community however is dominated by *Avicennia officinalis* and the understorey layer is generally filled with *Acanthus ilicifolius*. *Figure 4* shows the vegetation profile of this zone.

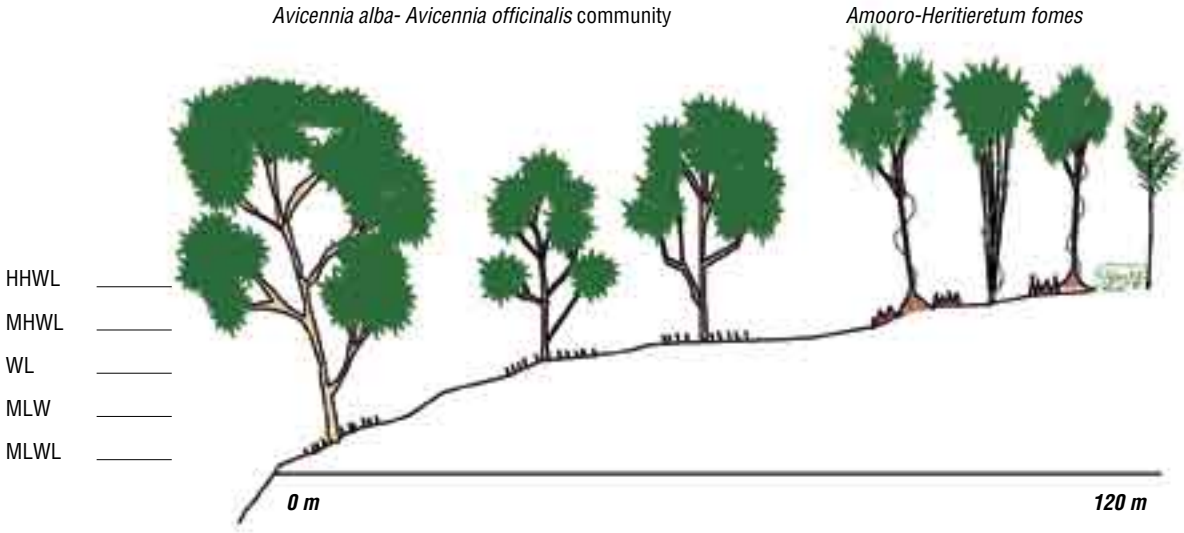
Low profile

Figure 2: Schematic representation of vegetation profiles in the 'coastal' zone



Downstream profile

Figure 3: Schematic representation of vegetation profiles in the 'downstream' zone



Water salinity in the 'upperstream' zone is much lower than in other zones; it peaks in March–April, reaching 0.8–1.2%, but river water is fresh (0.01% salinity) during the rainy season. Soils are silty clay or silty clay loam in the lower riverbank. Large specimens of *Sonneratia caseolaris* grow along the accreted river sites in this zone. Communities characterised by *Amooro-Heritieretum fomes* may be found inland.

Pioneers

The study revealed the wide extent of pioneer species such as *Hibiscus tiliaceus*, *Phoenix paludosa* and *Acrostichum aureum*, which colonise areas disturbed by human activities (eg abandoned paddy fields, fuelwood collection sites, etc) and tend to discourage the regeneration of other mangrove species. The dominance of such species in the delta indicates a relatively high level of human impact; restoring the original mangrove communities, however, may be hindered by the high soil acidity in these areas.

Conclusion

Mangroves perform many important ecosystem services, protecting coastal assets and providing breeding grounds for thousands of species of fish and other species; their conservation and management, therefore, are important parts of sustainable development. The study has clearly

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Economic efficiency and shadow prices of social and biological outputs of village-level organizations of joint forest management in Gujarat, India. ***Contact:*** *Mr Dinesh Misra, Faculty of Forestry, University of Toronto, 33 Willcocks Street, Toronto ON M5S 3B3, Canada; Fax 1–416–978 3834; dinesh.misra@utoronto.ca*

Investigation on shifting cultivation practices conducted by the hill tribes for the development of suitable agroforestry techniques in Myanmar. ***Contact:*** *Dr San Win, Forest Department, Bayint-naung Road, Insein, Yangon, Myanmar; Fax 95–1–66 4459; TEAKNET@mptmail.net.mm*

Sustainability of community forestry in terms of operational plant implementation. ***Contact:*** *Mr Krishnahari Homagain, POB No 13810, Kathmandu Nepal; kbhom@hotmail.com*

Rehabilitation of degraded tropical lowland forest using three indigenous timber species in Peninsular Malaysia. ***Contact:*** *Dr Evelyn Varquez Bigas, College of Forestry, Mindanao State University, c/o PO Box 5448, Iligan City 9200, Philippines; eve1411@yahoo.com*

identified and characterised a number of species-site relationships in the mangrove ecosystems of the Ayeyarwady Delta and has proposed four zones, findings that could be applied in future efforts towards the restoration, conservation and management of Myanmar's mangrove ecosystems. On the basis of the study we have proposed a systematic land-use scheme, details of which are available from the author; the crucial element is the establishment and maintenance of buffer-zone forests in which local people continue to extract resources on the basis of their needs and the capacity of the ecosystem to provide such resources on a sustainable basis.

References

Braun-Blanquet, J. 1964. *Pflanzensoziologie. Grundzuege der Vegetationskunde.* 2nd edition. Springer-Verlag, Vienna, Austria. 865pp.

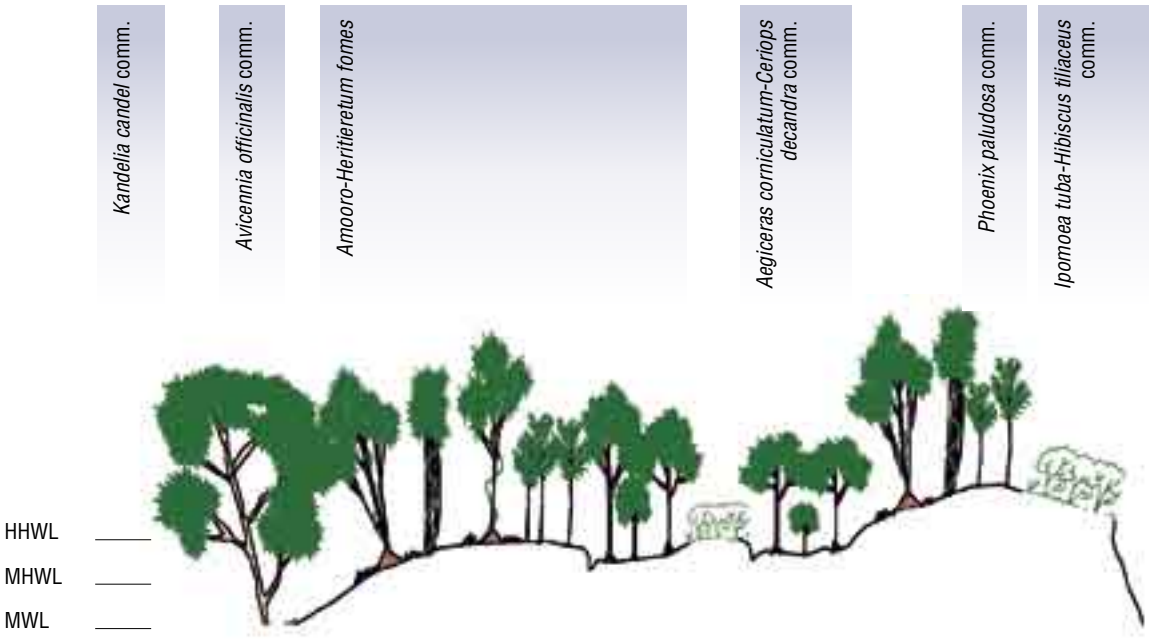
Duke, N., Ball, M. & Ellison, J. 1998. Factors influencing biodiversity and distributional gradients in mangroves. *Global Ecology and Biogeography Letters 7*.

Ellison, A., Farnsworth, E. & Merkt, R. 1999. Origins of mangrove ecosystems and the mangrove biodiversity anomaly. *Global Ecology and Biogeography Letters 8*.

Fujiwara, K. 1987. Aims and methods of phytosociology or "vegetation science". *Plant Ecology and Taxonomy*: The Kobe Geobotanical Society, Kobe, Japan.

Midstream profile

Figure 4: Schematic representation of vegetation profles in the 'middle-stream' zone



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