

MAPPING AND DISTRIBUTION OF THE  
KELANTAN DELTA MANGROVES USING  
REMOTE SENSING AND GROUND DATA

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USING REMOTE SENSING AND GROUND DATA**

**KASAWANI IBRAHIM**

*To my wife, Anasrah Ghazali and  
daughters, Siti Nurah and Siti Azzah*

**Thesis Submitted in Fulfilment of the Requirement for the Degree of Master of  
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## MAPPING AND DISTRIBUTION OF THE KILANTAN DELTA MANGROVES USING REMOTE SENSING AND GROUND DATA

KANAWANI IBRAHIM

October 2003

Chairman : Associate Professor Sutong Nio Ibrahim, M. Sc.  
Member : Professor Mohd Lokman Bin Hassan, Ph. D.  
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Institute : Institute of Geomatics

*To my wife, Khazimah Othman and  
daughters, Siti Sarah and Siti Atikah*

Abstract of thesis presented to the Senate of Kolej Universiti Sains dan Teknologi  
Malaysia in fulfilment of the requirement for the Degree of Master of Science

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**October 2003**

**Chairman : Associate Professor Sulong Bin Ibrahim, M. Sc.**  
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Mangrove forest ecosystem is very sensitive and fragile. The pressures of increasing population, expansion of agricultural industries and urban development, have caused a significant proportion of mangrove to be destroyed. The Kelantan Delta, located between the latitude of 06°11.00'N to 06°13.00'N and the longitude of 102°10.00'E to 102°14.00'E faces similar pressure. The study area concentrates on the Tumpat area within the delta which covers approximately 1 300 ha and comprises 17 islands. The climate is influenced mainly by the northeast and southeast monsoons, with a mean temperature of 26.8°C and 83.7% relative humidity.

The objectives of this study were to determine the distribution and extent of mangrove forests in the Kelantan Delta particularly, the composition and stand structure of mangrove forest types, and to produce the mangrove forest productivity map of the study area.

In this study, inventory data, satellite imagery data, aerial photographs and topographic maps were gathered. Using remote sensing and GIS techniques, all data were compiled to present the latest productivity map of mangrove forest in the Kelantan Delta. A systematic plot design was used during the inventory data collection to find out the composition and stand structure of mangrove forests in the area. Results from the inventory data and digital imagery indicated that 895 ha (64%) of vegetation can be classified as mangrove forest. There are 10 classes of mangrove forest types found in the area namely; *Acanthus-Sonneratia* (323.96 ha, 28.56%), *Avicennia* (97.74 ha, 10.90%), *Acanthus-Nypa* (65.25 ha, 7.28%), *Hibiscus-Acrostichum* (53.55 ha, 5.97%), Mixed *Acanthus* (33.03 ha, 3.68%), *Sonneratia* (18.45 ha, 2.05%), Mixed *Acrostichum* (17.64 ha, 1.96%), Mixed *Sonneratia* (14.58 ha, 1.62%) and Mixed Mangrove (14.31, 1.59%). There are 12 exclusive, 25 non-exclusive and 13 associated species of mangrove in the area with population densities ranging from 49.76 to 703.76 trees per ha. The results of accuracy assessment for sub areas classified using satellite images and aerial photos ranged from 77.78% to 85.96% but increased to 93.1% for aerial photos.

The results of this study using remote sensing techniques accompanied by proper collected ground truth data and inventory analysis provided a database for monitoring the mangrove forests in the Kelantan Delta. The data also proved to be useful in developing and planning the Kelantan Mangrove Forests.



Abstrak tesis yang dikemukakan kepada Senat Kolej Universiti Sains dan Teknologi Malaysia sebagai memenuhi syarat untuk mendapatkan Ijazah Sarjana Sains.

**PEMETAAN DAN TABURAN HUTAN PAYA LAUT DI DELTA KELANTAN  
DENGAN MENGGUNAKAN PENDERIAAN JAUH DAN DATA LAPANGAN**

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Ekosistem hutan paya laut sangat sensitif dan mudah terjejas. Tekanan dari pertambahan populasi, perkembangan industri pertanian dan pembangunan bandar telah menyebabkan sebahagian nyata hutan ini termusnah. Delta Kelantan terletak di antara garisan lintang 06°11.00'U hingga 06°13.00'U dan garisan bujur 102°10.00'T hingga 102°14.00'T menghadapi tekanan yang sama. Kawasan kajian tertumpu di kawasan Tumpat yang berdelta dan dianggarkan seluas 1 300 hektar dan terdiri dari 17 buah pulau. Sebahagian besar cuaca dipengaruhi oleh Monsun Timur Laut dan Monsun Tenggara dengan suhu purata 26.8°C dan 83.7% kelembapan bandingan.

Objektif kajian adalah untuk menentukan taburan dan unjuran hutan paya laut di Delta Kelantan terutamanya, menentukan komposisi dan struktur dirian dalam jenis-jenis hutan paya laut dan, untuk menghasilkan peta produktiviti hutan paya laut di kawasan kajian.

Dalam kajian ini, data dari bancian hutan, imej satelit, foto udara dan peta topo diperolehi. Dengan penggunaan teknik penderiaan jauh dan sistem maklumat geografi (GIS), kesemua data digabungkan untuk menghasilkan peta produktiviti terkini hutan paya laut di Delta Kelantan. Rekabentuk plot sistematik digunakan semasa bancian hutan untuk menentukan komposisi dan struktur dirian hutan paya laut di kawasan kajian. Dari analisa dan pemprosesan data bancian dan imej digital, menunjukkan 895 ha (64%) dari tumbuhan boleh dikelaskan sebagai kawasan hutan paya laut. Terdapat 10 kelas jenis hutan di kawasan kajian iaitu; *Acanthus-Sonneratia* (323.96 ha, 28.56%), *Avicennia* (97.74 ha, 10.90%), *Acanthus-Nypa* (65.25 ha, 7.28%), *Hibiscus-Acrostichum* (53.55 ha, 5.97%), *Acanthus* Campuran (33.03 ha, 3.68%), *Sonneratia* (18.45 ha, 2.05%), *Acrostichum* Campuran (17.64 ha, 1.96%), *Sonneratia* Campuran (14.58 ha, 1.62%) and Mangrove Campuran (14.31 ha, 1.59%). Terdapat 12 jenis spesis eksklusif, 25 jenis bukan eksklusif dan 13 spesis bersekutu hutan paya laut dengan kepadatan populasi berjulat dari 49.76 hingga 703.76 pokok se hektar. Keputusan penilaian ketepatan berjulat dari 77.78% hingga 85.96% untuk setiap subkawasan pengkelasan imej satelit tetapi meningkat kepada 93.1% untuk foto udara.

Hasil kajian menunjukkan dengan menggunakan teknik penderiaan jauh yang diselaraskan dengan pengutipan data lapangan yang tersusun dan analisa data bancian menyediakan data asas untuk penyeliaan Hutan Paya Laut di Delta Kelantan. Data juga terbukti berguna dalam pembangunan dan perancangan Hutan Paya Laut di Kelantan.