

**THE DEVELOPMENT OF WETLAND CONSERVATION AND  
MANAGEMENT PLAN FOR SUNGAI PULAI**

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**THE DEVELOPMENT OF WETLAND CONSERVATION AND  
MANAGEMENT PLAN FOR SUNGAI PULAI**

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***My special dedication to my family :***

***My beloved wife and son,***

*Masni Salleh and Muhammad Naufal Mohd Husaini*

*Thank you for all your patient and support*

***To my lovely mother and father,***

*Siti Saedah Rahmat and Mohd Hosnan Bin Ali*

***To my lovely friend,***

*Staff of ALMA*

*Thank you for everything*

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## ABSTRACT

Wetland is one of the most important ecosystems on earth as it improve water quality, control floods, regulate global carbon levels, have significant cultural and recreational values, and also provide habitat for plants and animals uniquely adapted to living in the wet conditions. The basic concern of this study is to identify conservation and compatible wetland areas in Sungai Pulai Johor Ramsar Sites. In other words the study intends to address the conservation principle of sustainable mangrove management. This study evaluates the environmental and land use changes of mangrove forest wetland. The data collection procedure was based on secondary and primary sources. Beside that, there are many acts, enactments and guidelines relevant to the planning and management of mangrove forests and wetlands used. The study area covers Sungai Pulai Mangrove Forest (SPMV) that is the largest riverine mangrove forest in Malaysia. Few developments are taking place rapidly in this sensitive wetland environment with modes concern to the environment. The study identifies areas is SMFR that need to be conserved in the wetlands area; these area areas of high biodiversity that are highly sensitive to human interference. Sungai Pulai determined into Biosphere Zone through regulation and guideline justification. The Biosphere Zone included the core zone, buffer zone and transition zone. The core zone can be categorized into three main area that is protection zone, public zone and conservation zone. For this study, there are three main stages in the production of zoning plans and guidelines for the management of wetlands. Approach adopted in the analysis is an approach to PFCA (Properly functioning Assessment Criteria). This technique involves a set of criteria selected wetlands of potential impacts on habitat and biological. Profiling and analysis for these study covers five (5) major environment variables ; Environmentally Sensitive Area (ESA), Buffer Zones, Land use, Biological Environment (Fauna ; mammal, bird, fish, mollusc, crustacean and macrobenthos assessment) (Flora : Mangrove, seagrass) and Physical Environment (Water quality and air quality). Matrix analysis was carried out in helping to facilitate the determination of the criteria for each zone. This analysis measures the importance of an area based on the seven main factors, namely the importance of biogeography, natural, ecological importance, economic importance, social importance, planning and scientific interest. The study found that 5,613.921 hectare (26 percent) of the area should belongs to conservation zone, while 6,650.025 hectares (30 percent) can be develop (public zone).

## ABSTRAK

Tanah lembap merupakan salah satu ekosistem yang paling penting di dunia kerana ia meningkatkan kualiti air, mengawal banjir, mengawal tahap karbon global, mempunyai nilai-nilai budaya dan rekreasi yang penting serta menjadi habitat tumbuhan dan haiwan unik yang hidup dalam kawasan berair. Asas kajian ini adalah untuk mengenal pasti kawasan pemuliharaan tanah bencah di Tapak Ramsar Sungai Pulai Johor. Dalam erti kata lain, kajian ini akan menggunakan prinsip pengurusan dan pemuliharaan bakau secara lestari. Kajian juga menilai perubahan alam sekitar dan penggunaan tanah tanah lembap hutan bakau. Kaedah pengumpulan data adalah berdasarkan kepada data-data primer dan sekunder. Selain itu, kajian juga melihat beberapa akta, enakmen dan garis panduan yang berkaitan dengan perancangan dan pengurusan hutan paya bakau dan tanah bencah. Kawasan kajian meliputi Hutan Bakau Sungai Pulai (SPMV) yang merupakan hutan bakau terbesar di Malaysia. Pembangunan beberapa tepubina berlaku dengan pesat di sekitar kawasan sensitif alam sekitar ini dengan kebimbangan penurunan kualiti alam sekitar. Kajian ini mendapati kawasan hutan simpan Sungai Pulai perlu dipelihara sebagai kawasan tanah lembap, kawasan berbiodiversiti tinggi yang sensitif kepada sebarang aktiviti manusia. Sungai Pulai ditentukan kepada Zon Biosfera melalui justifikasi perundangan dan garis panduan. Zon Biosfera termasuk zon teras, zon penampan dan zon peralihan. Zon teras boleh dikategorikan kepada tiga kawasan utama iaitu zon perlindungan, zon awam dan zon pemuliharaan. Untuk kajian ini, terdapat tiga peringkat utama dalam pembentukan plan pengezonan dan garis panduan bagi pengurusan tanah lembap. Pendekatan yang diguna pakai dalam analisis adalah satu pendekatan Properly Functioning Criteria Assessment (PFCA). Teknik ini melibatkan satu set kriteria tanah lembap dipilih berpotensi menerima impak terhadap habitat dan biologi. Profil dan analisis untuk kajian ini merangkumi lima (5) pembolehubah alam sekitar utama; Kawasan Sensitif Alam Sekitar (KSAS), Zon Penampan, Guna tanah, Persekitaran Biologi (Fauna; mamalia, burung, ikan, moluska, krustasia dan makrobentos) (Flora: Bakau, rumput laut) dan Alam Sekitar Fizikal (kualiti air dan kualiti udara). Analisis matriks juga telah dijalankan dalam membantu memudahkan penentuan kriteria bagi setiap zon. Analisis untuk mengukur kepentingan dan fungsi sesuatu kawasan berdasarkan tujuh faktor utama, iaitu kepentingan biogeografi, semula jadi, kepentingan ekologi, kepentingan ekonomi, kepentingan sosial, perancangan dan saintifik kepentingan. Kajian mendapati 5,613.921 hektar (26 peratus) daripada keseluruhan kawasan merupakan kawasan pemeliharaan sementara 6,650.025 hektar (30 peratus) adalah boleh dibangunkan (zon umum)

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## LIST OF ABBREVIATION

BPK	Blok Perancangan Kecil
CBD	Convention on Biodiversity
CCD	Convention to Combat Desertification
CITES	Convention on the international Trade in Endangered Species (UN)
CMS	Convention on Migratory Species
DID	Jabatan Pengairan dan Saliran (Irrigation and Drainage)
DOE	Department of Environment
ESA	Environmentally Sensitive Area
ESCP	Erosion and Sediment Control Plan
GIS	Geographical Information System
IM	Iskandar Malaysia
IUCN	International Union for Conservation of Nature
JPBD	Jabatan Perancangan Bandar dan Desa Semenanjung Malaysia (Federal Department of Town and Country Planning)
JUPEM	Jabatan Ukur dan Pemetaan Malaysia (Mapping and Survey Department)
MNS	Malayan Nature Society
MWQCS	Malaysia Marine Water Quality Criteria and Standard
NO <sub>2</sub>	Nitrogen oxide
NEQ	Northeast Quadrant
NGO	Non Government Organisation
NLP	National Land Code
NPP	National Physical Plan
NWI	National Wetlands Inventory
NWQ	Northwest Quadrant
PFC	Properly Functioning Criteria
PTNJ	Johor National Parks Corporation
PTP	Port Tanjung Pelepas
RMAQG	Recommended Malaysian Air Quality Guidelines
RMK9	Rancangan Malaysia Ke 9
SEQ	Southeast Quadrant
SJER CDP	South Johor Economic Region Comprehensive Development Plan
SO <sub>2</sub>	Sulphur Dioxide
SPMFR	Sungai Pulai Mangrove Forest Reserve
SWQ	Southwest Quadrant
TP	Totally Protected
TSP	Total Suspended Particulate

UN	United Nation
UNCLOS	United Nations Convention on the Law of the Seas
UNFCCC	United Nations Framework Convention on Climate Change
VAST	Vegetation Assets, States and Transitions
WHC	World Heritage Convention
ZOI	Zone Of Impact

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Background**

Sustainable environmental management systems become more complex when the development related of natural ecology, economics, human, and subsystems. The whole world started to care about sustainable development, especially after the world conference “United Nations Conference on Environment and Development” in 1992 in Rio de Janeiro (Moffat, 1996). Management of natural resources in tropical forests is needed due to population demand in developing the forest as the main area for economic activity leading to increasing pressure on the forest, water and soil (Bocco et al., 2004).

Resource planning and management has a complex attribute. This is because of the limited of the resource character and needs to be managed from time to time. It accompanies with the rapid growth of urbanization and urban development that occurs following the demand for resources on the of particular natural resources. The scenarios generate the pollution and affected the areas with high biodiversity, particularly wetlands areas (Yokohari et al., 2000).

Pressure from the development and growth of human population has caused continuous damage to natural resources. It becomes worse when the exploration of

natural resources is done without awareness of the importance of the environment. Management of natural resources is even more difficult for developing countries because of the competition between the development and natural conservation.

People make the demand for high quality of life including good public health, the unpolluted environment, good and safe food and drink, as well as the area of open space for recreation in (Botkin and Beveridge, 1997). This situation requires the successful management of resources effectively and systematically in ensuring the success of well-managed.

Management of natural resources is the interaction between ecological, economic, political and social culture that involves understanding the decision to strengthen natural resource management goals and the initial action to achieve it (Decker, 1997). According to the 2006-2010 Ninth Malaysia Plan (RMK-9), emphasis is given to preventive measures to reduce the negative impact on the environment, intensify efforts to conserve and sustainably manage natural resources.

Exploration for natural resource areas for development needs has caused many problems. Physical development of residential, commercial, utility and agricultural systems is a major influence in changing the original land use, while areas with unique natural wetlands are facing strong pressure, as a result of the development of industrial activities. This has resulted in exploration carried out to make profit. Provisions of the law and regulation set have been limiting the exploration for natural resources. However there is still a shortage of enforcement which caused many problems.

Implementation of the law related to natural management, conservation and preservation of natural environment are also important to serve as the main tool to regulate and drive the success of the management of wetlands. The existence of legislation and guidelines issued by the relevant departments of planning and resource management success is based on the needs and scope of their work. Therefore, the successful of the good management of natural resources depend on the implementation of the law and the guidelines on the management of administrative areas.

## 1.2 Problem Statement

Wetlands ecosystems are often mistakenly undervalued. Few people realize the range of products derived from freshwater habitats such as wetlands food such as fish, rice and cranberries, medicinal plants, peat for fuel and gardens, poles for building materials, and grasses and reeds for making mats and baskets and thatching houses. These complex habitats act as giant sponges, absorbing rainfall and slowly releasing it over time. Wetlands are like highly efficient sewage treatment works, absorbing chemicals, filtering pollutants and sediments, breaking down suspended solids and neutralizing harmful bacteria (World Wildlife Fund, 2005).

Half of the world's wetlands have already been destroyed in the past 100 years alone (World Wildlife Fund, 2005). Conversion of swamps, marshes, lakes and floodplains for large-scale irrigated agriculture, ill-planned housing and industrial schemes, toxic pollutants from industrial waste and agricultural run-off high in nitrogen and phosphorous pose some of the main threats to wetlands. Among threatened species are several river dolphins, manatees, fish, amphibians, birds and plants. In addition, alien 'invasive' species brought from ecosystems in foreign lands disrupt functions in native ecosystems. Africa alone spends about US\$60 million annually to control aquatic invasive species (World Wildlife Fund, 2005).

Traditionally, local communities in mangrove ecosystems collected fuelwood, harvested fish and other natural resources. However, in recent decades many coastal areas have come under intense pressure from rapid urban and industrial development, compounded by a lack of governance or power among environmental institutions. Mangroves have been overexploited or converted to various other forms of land use, including agriculture, aquaculture, salt ponds, terrestrial forestry, urban and industrial development and for the construction of roads and embankments. Mangroves can be affected by several different activities simultaneously, or over time as land use patterns change.

### 1.3 Case Study

The study area comprises of Johor wetlands that have been declared as wetlands of international importance at the Ramsar convention, namely Sungai Pulai in Southern Johor State not far from Singapore, particularly rich in mangroves and inter-tidal mudflats. These coastal and estuarine sites support a large number of species, notably vulnerable and threatened species, and provide both livelihoods and important functions for the local population.

In Johor, Sungai Pulai Mangrove Forest Reserve (SPMFR) is the largest riverine mangrove system. The SPMFR is managed primarily for commercial wood production using the silvicultural system that requires clear felling of trees under a 20-year rotation. About 80% of the SPMFR consists of mangrove stands less than 20 years of age. The Port of Tanjung Pelepas authority, located at the estuary, works hand-in-hand with environmental groups for the conservation of the estuary (Johor National Park Corporation, 2009).

The site is managed in line with the Integrated Management Plan for the sustainable use of mangroves in Johore. SPMFR is one of the lists in Ramsar Site in Malaysia includes Tasik Bera, Tanjung Piai and Pulau Kukup (Ramsar Convention, 2002). Ramsar is the first of the modern global intergovernmental treaties on the conservation and sustainable use of natural resources for the habitat of humankind in a way compatible with the maintenance of the natural properties of the ecosystem, but, compared with more recent ones, its provisions are relatively straightforward and general.

The degradation and loss of wetlands and their biodiversity has imposed major economic and social losses; and costs to the human populations of these river basins. Thus, appropriate protection and management of the wetlands is essential to enable these ecosystems to survive and continue to provide important goods and services to the local communities. The main threat to Sungai Pulai comes from the industrial, agricultural activities in the straits, coupled with unplanned tourism, hunting, and water activities.

#### **1.4 Aim of The Study**

The study aims to propose the wetlands conservation and management plan areas for Johor Ramsar site Sungai Pulai.

#### **1.5 Objectives Of The Study**

There are several objectives of this study which include;

- i. To assess and evaluate the wetlands components including physical environment, biological environment, and landuse through the primary and secondary data.
- ii. To identify areas for conservation in Sungai Pulai through Properly Functioning Criteria (PFC) Assessment and Matrix Analysis.
- iii. To strengthen the wetlands function as the Environmental Sensitive Area (ESA) and develop zoning plans for its conservation
- iv. To recommend mitigation measures to minimize potential impact of the project in the study area.
- v. To identify zones according to size by using layering analysis techniques.

#### **1.6 Significance of The Study**

This study was carried out because most previous research works have only focused on identifying potentials of the area, without looking at its environmental effects. On the other hand a significant number of preceding researches have tended to use the conventional methods of planning and evaluation.

Recently, society has begun to appreciate the benefits of mangroves and there is a growing awareness of their values such as coastal protection, coastal subsistence of coastal dwellers and commercial fisheries. There are also increasing efforts by governments, NGOs and local communities around the world to conserve, rehabilitate and manage mangroves sustainably, but the literature and success stories are still limited.

Recognition of the environmental, social and economic impacts associated with the decline and degradation of mangroves are now being addressed through legislative, management, conservation and rehabilitation efforts aimed at mitigating the negative impacts of development on mangrove ecosystems. These include the introduction of new legislation and new governing bodies with clearer administrative or advisory roles on environmental issues; stronger conservation status for some mangrove areas of outstanding value (e.g. as Biosphere Reserves); and more emphasis on public awareness raising and education.

However, many of the current management policies adopted are still sectoral in nature, which frequently leads to conflict of interests, and to continuing unsustainable exploitation of mangrove resources. An integrated approach to coastal area and river basin/watershed management through coherent policy development and concerted action is increasingly being regarded as the best way to achieve conservation and sustainable use of mangrove and other coastal resources.

As part of valuable natural resource, mangrove forests are highly productive ecosystems that typically dominate the intertidal zone of low energy tropical and subtropical coastlines (Kathiresan & Bingham 2001). In all continents mangroves are distributed world-wide and FAO (2007) estimates that the total area for mangroves are 15.6 to 19.8 million ha. In 2006, mangrove forests area in Peninsular Malaysia is estimated to be about 107,802 hectares (ha), of which 82,091 hectares have been gazetted as Permanent Reserved Forests (PRFs).

In addition, Malaysia has 2.12 million hectares of national and state parks, wildlife sanctuaries, turtle sanctuaries and wildlife reserves. Some 3.43 million hectares are also protected as water catchments area (Sorensen, 2002). Recently there



is a regional conference on biological diversity that took place from 9-20 February 2004, at the Putra World Trade Centre in Kuala Lumpur, Malaysia. Over 2,300 participants attended, representing 161 governments, as well as UN agencies, non-governmental organizations (NGOs), intergovernmental organizations (IGOs), indigenous and local communities, academia and industry.

The main causes for loss of biodiversity in Malaysia are habitat destruction, over harvesting and pollution. As of early 1995, the National Policy on Biological Diversity was in the final phase of formulation before being endorsed by the Cabinet. The aim of this national strategy is to maintain plants and animals in their original habitats as well as outside of their original habitats in facilities such as botanical gardens. The purpose is to ensure long-term food security and preservation of the unique biological heritage of Malaysia (Natural Resources Aspect of Sustainable Development in Malaysia, 2000).

## **1.7 Scope on The Study**

The study will focus on the physical assessment of the wetlands, i.e. biodiversity value of the study. It will focus on identifying potential areas and areas that needs to be conserved in the wetlands area. This study will identify potential areas for development; at the same time locating environmentally sensitive areas that needs to be conserved. Considering the project objectives, the methodology will be looked at from two perspectives, i.e. conservation and development. The data collection procedure will mainly be based on secondary sources with partial primary investigation of the study sites.

One of the main objective is to assess whether a riparian-wetlands area is functioning properly. In order to assess the wetlands area, there is an important process for Assessing Proper Functioning Condition (PFC). PFC is not intended as a design tool, but can be used as a guide to develop management strategies. The

process will be supported by The Ecosystem Management Framework. It will be identified through matrix of Interim Marine and Coastal Regionalisation (IMCR) (i.e. is an ecosystem-based classification for marine and coastal environments and Vegetation Assets, States and Transitions (VAST) framework).

## **1.8 Limitation on The Study**

This project will be restricted to evaluate the existing environment and identifying conservation areas through zoning. The study will also be dependent on secondary data, with partial primary data based on investigations of the study sites. Another limitation is in the technique used in data analysis. This technique (pair wise comparison method) has the capacity of comparing only two criteria at a time. Moreover the highly subjective nature of preference weights and rapid elicitation of the method can lead to issues of validity.

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