Introduction to Goods and Services of Coastal Wetland Habitats

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Coastal area

The coast is where land and ocean meet. If this line of meeting did not move, defining the coast would be easy – it would simple be a line on the map – but the natural processes that shape the coast are highly dynamic, varying in both space and time. Thus the line that joins land and ocean is constantly moving, with the rise and fall of tides and the passing of storms, creating a region of interaction between land and sea. Therefore, the coast may be thought of as the area that shows a connection between land and ocean, and a coastal area defined (Ketchum, 1972*)* as: the band of dry land and adjacent ocean space (water and submerged land) in which terrestrial processes and land uses directly affect oceanic processes and uses, and vice versa.

- contain both land and ocean components;
- have land and ocean boundaries that are determined by the degree of influence of the land on the ocean and the ocean on the land; and are not of uniform width. depth, or height.

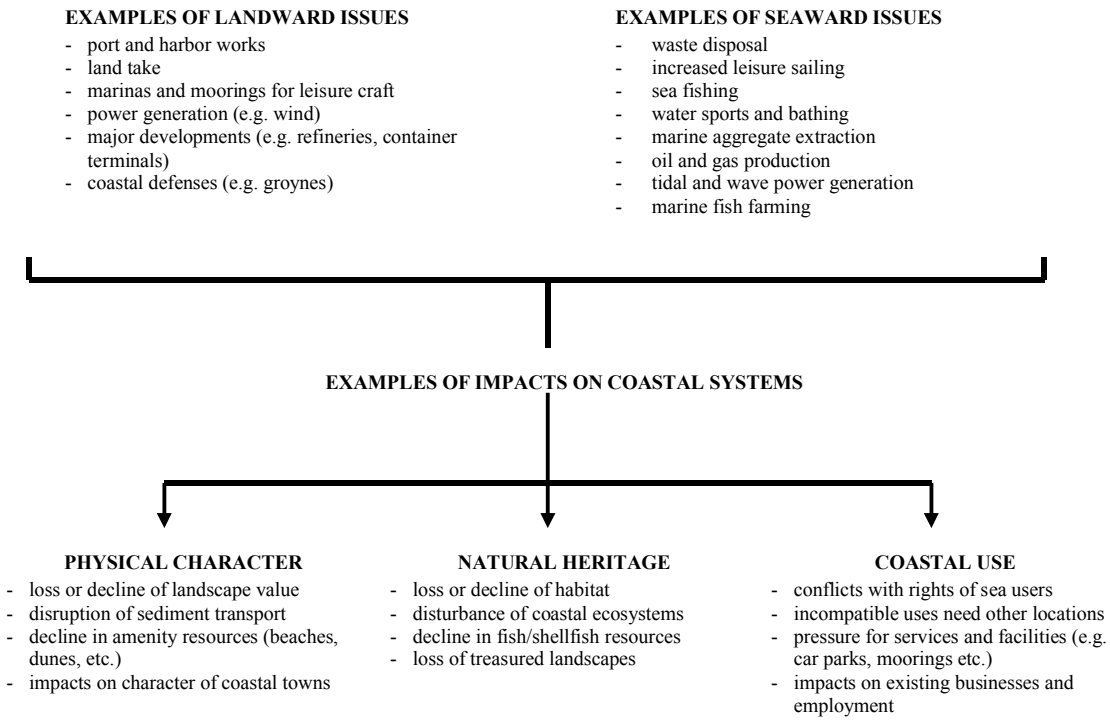

Figure Examples of impacts on coastal systems in the United Kingdom (Local Government Management Board, 1995)

Introduction to Wetlands

Definitions

Many definitions have been given to wetlands and their main difference is how broad the definition is. According to the Ramsar Convention, wetlands are defined as '*areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed sic meters.*' Wetlands may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six meters at low tide lying within the wetlands' This definition is used throughout this handbook.

Classification of wetlands:

Wetlands differ in salinity, water depth, water movement, and bottom substrate etc. These physical and chemical factors in turn determine the flora and fauna in wetlands.

Usually wetlands are classified by their basic hydrological features. The following classification is commonly used:

i. Marine: Permanent salt-water systems. Tidal or inter-tidal. Including sandy beaches, rocky shores, shallow seas and coral reefs.
ii. Estuarine: Means 'of the estuary'. Differs from 'Marine' in the water is brackish due to inflow from a river system. Salinity may fluctuate seasonally. As river system carries fine sediments to the estuary, mudflats are commonly found in estuarine wetlands.
iii. Riverine: Means 'of the river' – flowing fresh water. Usually with low vegetation cover. Floodplains also belong to the riverine system.
iv. Lacustrine: Means 'of the lake' = non-flowing, usually non-tidal waters. Bigger ones 'ponds'. Usually with low vegetation cover.
v. Palustrine: Mean 'of the marsh or swamp' – slow or non-flowing shallow waters dominated by trees and shrubs (usually referred as 'swamps'), or persistent emergent (usually referred as 'marshes').

Wetland benefits

If we look at maps of human settlements, in any part of the world and at any time in human history, we will find most cities, towns and villages are located by wetlands (rivers, lakes etc). This is hardly surprising, as we cannot live without water, but wetlands provide us with many more benefits.

Wetland benefits can be classified into direct harvest from wetlands (good, or products), functions or services wetlands perform, and ecosystem scale attributes (Adamus and Stockwell 1983, Claridge 1991)

To maintain the benefits of wetlands, good management of the wetland system and following the principles of wise use and sustainable use is important. Destruction or degradation of wetlands will affect the function and attributes of wetlands. Unsustainable harvest of wetland products will deplete the resources.

Definition of wise use: "The wise use of wetlands is their sustainable utilization for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem".

Sustainable utilization is defined as "human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations".

Products (Goods):

Products of goods are natural resources that can be harvested from wetlands. These include:

i. Forest resources. These include direct harvest of timber, firewood, medicinal plants, reeds and forest products such as honey and bee wax.
ii. Wildlife resources and fisheries. These usually include species collected for food such as fishes, amphibians, crustaceans, mollusks and other wetland dependent species, sometimes in may include species for other uses such as crocodiles for leather, otters for their pelts etc. However, large-scale commercial exploitation is very likely to be unsustainable.
iii. Forage resources for livestock. In southern Europe (and many other places), horses and cattle graze in some wetlands. In South East Asia, emergent water plants provide food for water buffalo.
iv. Peat. In many areas peat has been used as a form of fuel for thousands of years. However, large scale peat extraction is not sustainable. When extracted in large scale the whole wetland system will be destroyed.

Functions (Services)

Functions or services of wetlands are normally not measurable in monetary terms but benefit all inhabitants living near, and those using a wetland site. These functions include:

i. Recharge and discharge of groundwater. Excess ground-water moves into the underground aquifer, or underground water moves upward and becomes surface water. These functions stabilize ground and underground water supplies. Water is usually purified during these processes.
ii. Flood control. Inland wetlands (e.g. lakes) act as buffers to store excessive rainfall and release runoff gradually. The middle and lower reaches of the Yangtze River in China is a good example to show the importance of flood control function of wetlands.
iii. Shoreline stabilization and storm protection. Wetland vegetation absorbs the energy of waves and currents. The mangroves in the tropics are believed to have had a role in reducing storm damage onshore. For example.
iv. Retention of sediments. Vegetation of wetlands also acts like sieves that retain sediments in water
v. Nutrient retention and retention of pollutants. Wetlands act as sinks of nutrients and toxicants as they are absorbed by wetland vegetation. The nutrients retained in wetlands support the growth of other wetland organisms.
vi. Biomass export. Like other plants, wetland plants fix inorganic carbons into organic matter. This in turn feeds into the wetland ecosystem. Phytoplanton is the base of the food web, and fallen leaves etc., also provide food for aquatic animals.
vii. Micro-climate stabilization. The hydrological, nutrient and material cycles of wetlands may help to stabilize climatic conditions such as temperature and humidity of the area.
viii. Transportation. Open water and water channels have long been used as a means of cheap and convenient transportation.
ix. Recreation and tourism. Recreation includes swimming, yachting, bird watching, sport fishing etc. Because of their scenery and products (e.g. fish), wetlands have long been popular for recreation. In recent years as the human societies become more urbanized, wildlife watching and ecotourism are developing and becoming an important source of revenue for many countries.

Attributes:

i. Biological diversity. Many wetland systems support a high diversity of wildlife, many of which are endemic or threatened. Wetlands are also the natural genetic reservoir of some domesticated plant species, for example, wild rice.
ii. Uniqueness to culture and heritage. Wetlands played a part in development of human history. The major cradles of civilizations were all located along river valleys. Many historical and cultural relicts, such as Angkor Wat in Cambodia and Bagan in Myanmar, are located not far from wetlands (major rivers and lakes). This was probably because of the ease of transportation, and the availability of water and the wetland products.

Wetlands area

About 9% or 5.7 million square kilometers of the Earth's surface is wetlands. The greatest proportion is made up of bogs (30%), fens (26%), swamps (20%) and floodplains (15%), with lakes accounting for just 2% of the total. Mangroves cover about 240,000 km^2 of coastal area and a estimated 600,000 km^2 of coral reefs remain worldwide (WCMC, *Global Biodiversity,* 1992). About 56% of wetlands are found in tropical and subtropical regions and almost 1/3 are located in Asia (Mitsch and Gosselink, 2000).

Wetland ecosystems are cradles of biological diversity. Countless species of plants and animals depend on them for survival. Fishes in Wetlands number around 20,000 species worldwide. Diversity amongst aquatic species groups is highest in the tropics: South America has the most species with 2,220 species, of which more than 1,000 are in the Amazon River basin; Africa has 2,000 species, with more than 700 occurring in the Zaire River basin: Europe has about 200 species; and, Asia has an estimated 1,600 species but this number is increasing as additional research is undertaken [WCMC, *Global Biodiversity,* 1992].

The Southeast Asian Region is rich in marine biodiversity. Field records of hermatypic coral genera indicate that Indonesia, Malaysia and Philippines form the centre of coral diversity. Countries bordering the South China Sea largely depend on wetlands for their livelihood. In Cambodia, Over 30% of its territory is wetlands. Following internationally accepted criteria for wetland identification (defined by the Ramsar Convention), over 20% (36,500 Km^2) of the Kingdom may be classified as wetlands of international importance (Cambodia Wetland Report, 2003).

Case study in UNEP/GEF South China Sea project-Wetlands subcomponent

The UNEP/GEF South China Sea Project focuses its activities on five wetland types, namely: estuaries (including deltas), lagoons, intertidal mudflats, peat swamps, and non-peat swamps. Their functions, products and attributes are shown in Table 1.

Estuary. A wetland type where the river mouth widens into a marine ecosystem, the salinity of which is intermediate between salt and fresh water where tidal action is an important biophysical regulator.

Lagoon. A semi-enclosed coastal basin with limited freshwater input, high salinity and restricted circulation which often lies behind sand dunes, barrier islands or other protective features like coral reef of an atoll.

Intertidal mudflat. A wetland type that is usually an unvegetated area, dominated by muddy substrate.

Peat swamp. Under normal oxygen-rich conditions, dead plant matter decomposes eventually into carbon dioxide and water. When under low temperature, high acidity, low nutrient supply, water-logging, and oxygen deficient conditions, the process of decomposition is retarded and dead plant matter accumulates as peat.

Non-peat swamp. A wetland type having still water areas around lake margins, and in parts of floodplains such as oxbows, where the water rests for longer periods. Their precise characteristics vary according to geographical location and environment.

Table 1 Functions, Products and Attributes of Wetlands. (X = Present; √ = common and important value)

	Estuaries	Lagoons	Intertidal Mudflats	Peatswamps	Non-peatswamps
Functions (Services)					
Groundwater recharge				X	X
Groundwater discharge	X	X		X	X
Flood control	X	X		X	
Shoreline stabilization/erosion control	X	X			
Sediment/toxicant retention	X	X	X	√	√
Nutrient retention	X	X	X	√	√
Biomass export	X	X	X		√
Storm protection	X		X		X
Water transport	X	X			
Recreation/tourism	X	X	X	X	X
Products					
Forest resources	√				X
Wildlife resources	√	X	X	X	X
Fisheries	√	X	X		X
Agricultural resources	X			X	
Water supply	X			X	X
Energy Resources				√	
Attributes					
Biological diversity	√	√	√	X	X
Uniqueness to culture/heritage	X	X	X	X	X

Source: Dugan, P.J. (eds) 1990

Wetland Loss

It has been estimated that about 50% of wetlands have been lost worldwide since 1900. This has mostly occurred in the northern temperate zone, however, since the 1950s, tropical and subtropical wetlands especially swamp forests and mangroves have been rapidly disappearing (Stuip, *et al.,* 2002).

Agriculture is considered the principal cause for wetland loss worldwide. By 1985, it was estimated the 56%-65%, 27%, 6% and 2% of available wetlands in Europe and North America, Asia, South America and Africa, respectively, had been drained for agriculture (Stuip *et al.,* 2002). Scott (1993) quoted an overall wetland loss of 31%, 78%, and 22% in Indonesia, Philippines and Thailand, respectively. In their review, Immirzi *et al*. (1992) quoted peatland losses of 82%, for Thailand; 71% for West Malaysia; 18% for Indonesia; 13% for China; and, 11% in Sarawak in East Malaysia.

The Ramsar Site Database provides insight to the main threats to wetlands. In 1999, 84% of Ramsar-listed wetlands had undergone or were threatened by ecological change. The most widespread threats being drainage for agriculture, settlement and urbanization, pollution and hunting.

Coastal wetlands play a critical role in protecting coastal land from the influence of violent coastal weather by providing a buffer against storm surges and protecting coastlines from erosion. In Malaysia, it has been estimated that the economic gain is US$300,000 per kilometer from intact mangrove swamps for storm protection and flood control alone, which is the cost of replacing them with rock walls. This role of coastal wetlands may become even more important under conditions of changed climate over the next 50-100 years.

Sources of Information:

Robert Kay and Jackie Alder. (1999). Coastal Planning and Management.

Chan, S., Benstead, P.,Davies, J. and Grubh, R (2001). The Wetland Management Handbook for South East Asia. Ministry of the Environment, Japan.

UNEP. 2004. Wetlands Bordering the South China Sea. UNEP/GEF/SCS Technical Publication No. 4