CHAPTER II

BACKGROUND INFORMATION

2.1 Coral Reef Application

This session will explain the basic information of coral reef ecosystem. The seagrass ecosystem is also explained because it is located on the reef.

2.1.1 Coral Ecosystem

A coral reef is defined as calcium carbonate, produced by corals. It forms a rocky eminence on the sea floor and customarily grows upward to the tide limit. This community is the high productivity community which can grow in the shallow clear water area (Veron, 1986). Light determines the depth which photosynthesis can occur in the zooxanthellae on coral tissues and regulates calcification rates (Loya, 1976). Because of turbidity of water most reefs in The Gulf of Thailand are formed at water depth less than 10 meters on pre-existing hard substrate (Sudara et al., 1989). The reefs have been built by scleractinian corals, which provide the reef framework, and the coralline algae. which cement the framework together.

Important though the physical environment is in determining the composition of coral communities (Figure 1), it is the biological environment that creates the wealth of corals that is so characteristic of coral reefs. As far as the corals themselves are concerned, each species has its own array of growth strategies, food requirements and reproductive capacities. The net of all interaction and balances is to make coral communities among the most diverse of any communities on earth (Veron, 1986).

In response to environment gradients, reefs are conspicuously zoned as bands roughly parallel to the shore (Figure 2). The internal spaces between reef and shore are packed with fragments of broken reef organisms which have largely been wave-broken and washed

off the reef. This detritus is known as bioclastic and compliment the major component in this area which is known as Reef Flat. Other principal components are sand and foraminifera. All of these ingredients, after repeated concentrations of the interstitial seawater under the hot sun over many low tide periods, become cemented into bedrock and beach stone package under the reef flat zone (Hopley, 1982). Many organisms use the reef flat as their habitat, the seagrass and algae can be found in dense zone and exhibit their own community which is the reef subcommunity.

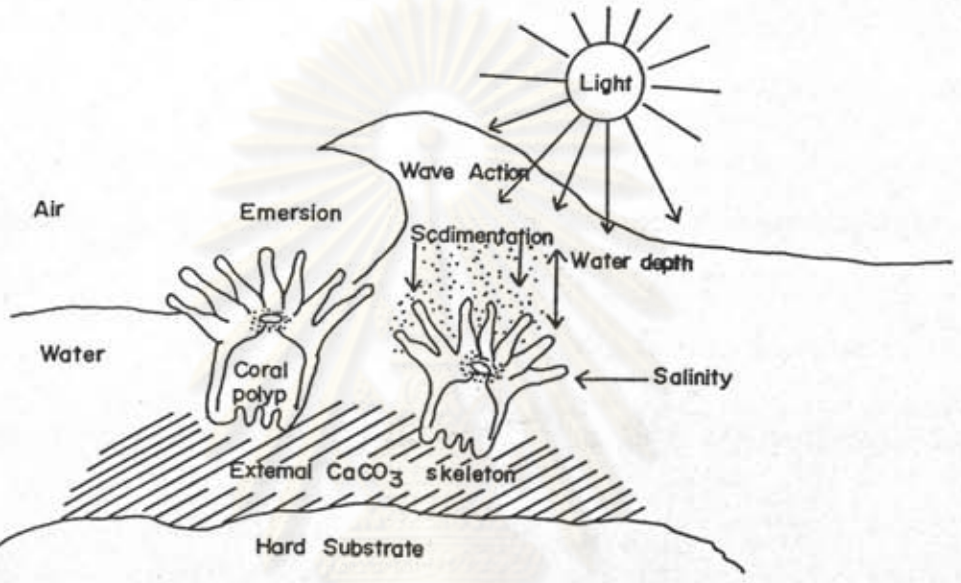


Figure 1. Coral Responded The Environment Gradient (Modified from Sudara et al., 1990).

At the outer edge of reef flat is the reef crest (Hopley, 1982) which may expose from sea level during the low tide and acts as the wave front protecting the reef flat from erosion. According to critical environment factors the reef crest has only small living corals. Below the reef crest is the more steeply zone known as reef slope, corals may dominate with various forms.

Due to the reefs in different environments form the unique reef pattern, the wind driven currents and waves which build and erode the reef structure largely determine reef evolution, morphology and component zones (Flood and Orme, 1977). The biological factors also regulate the coral feature difference in each area, thus, none of the reefs are similar to each other, reefs only can be categorized in the general group.

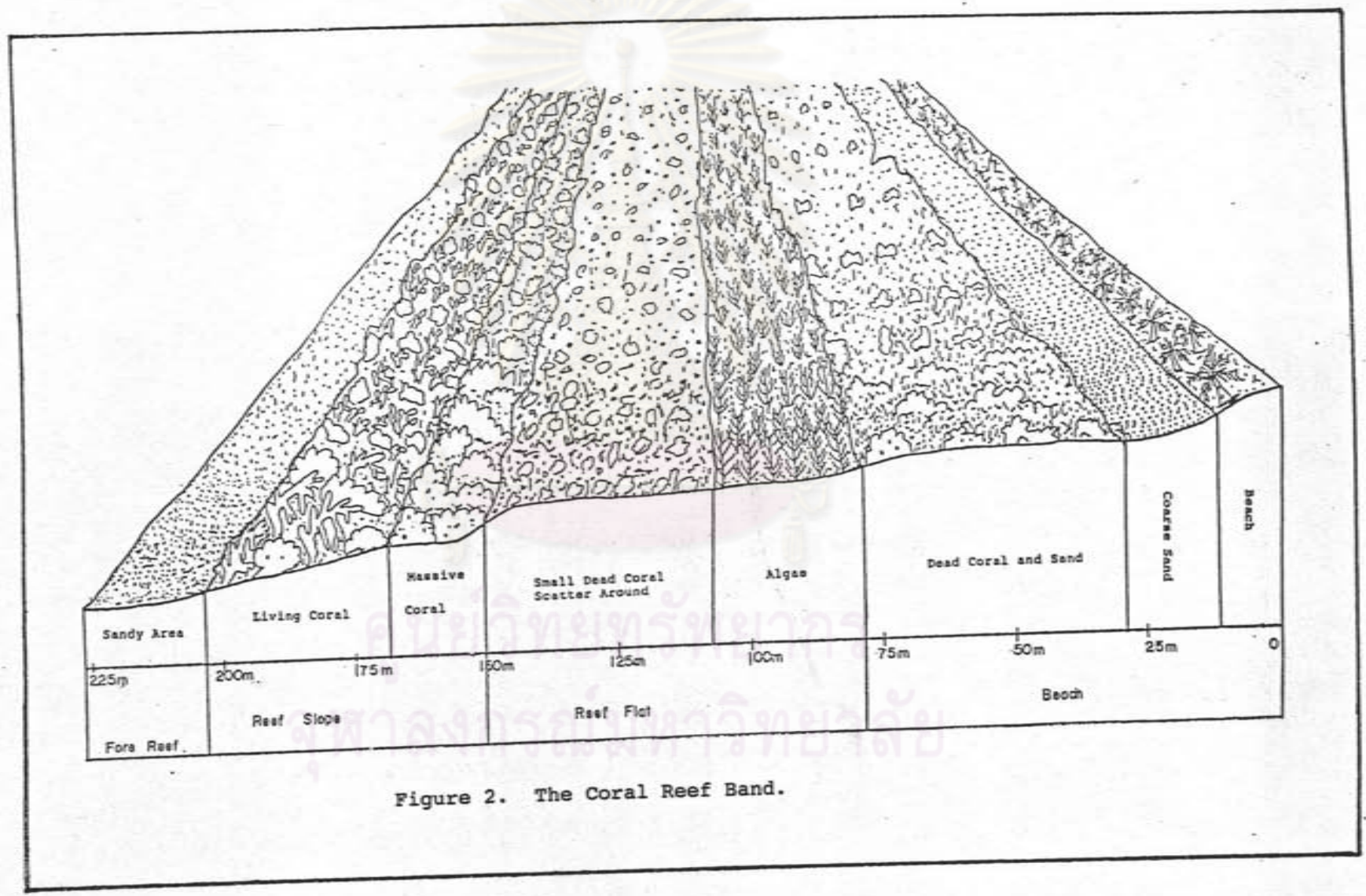


Figure 2. The Coral Reef Band.

2.1.2 Seagrass in the Reef

Although this thesis emphasizes on the reef study, the seagrass community is included because in some reefs the seagrass may be distributed in reef flat and sea floor near the reef (Nateekarnjanalarp, 1990). However, this thesis will feature only on the seagrass in the reef flat because the seagrass in the sea floor is separated from the reef ecosystem.

Seagrass are flowing plants which were adapted for living in sea water. There are two seagrass species distributed on the reef flat in The Gulf of Thailand, Enhalus acoroides as a major species, and Thalassia hemprichii as a minor species (Nateekarnjanalarp, 1990, Figure 3). Many algae may occur in between seagrass, for example Halimeda spp. Seagrass anchor themself into the sand by dense roots which form a rhizome below the plants. Seagrass community is complex and highly productive so that it forms important nursery ground for many organisms (Zeiman, 1987).

The seagrass communities in Samui Islands have been studied in 1989 (Nateekarnjanalarp, 1990), the results suggest that there are a lot of marine organisms using the seagrass as their habitat. Recently the seagrass in these areas is still be studied by a few projects (Sudara et al., 1991).

Classification of reefs has been a feature of traditional geomorphology, leading to genetic explanation and recognition of regional variation. It is surprising to find, therefore, that the extremely broad and simple classification of Darwin (1842; cited by Hopley, 1982) is still in common use for describing reef forms, particularly in the area that has the different environment from Darwin study sites. Within each class of reef, reef in Thailand only classed in Fringing Reef although there is much morphological diversity. One significant attempt has been made to produce a genetic classification of reef in The Gulf of Thailand (Sudara and Thamrongnavasawat and Sookchanuluk, 1989), however that simple classification used only the shore transect data to separate the reef forms. The general idea to divide the reef form is the reef morphology and component distribution, and it needs remotely sensed result as a tool to demonstrate this classification.

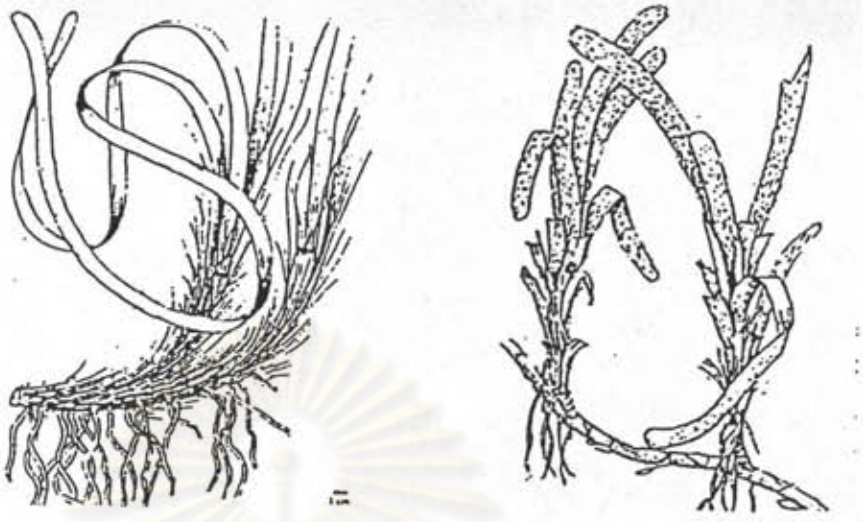


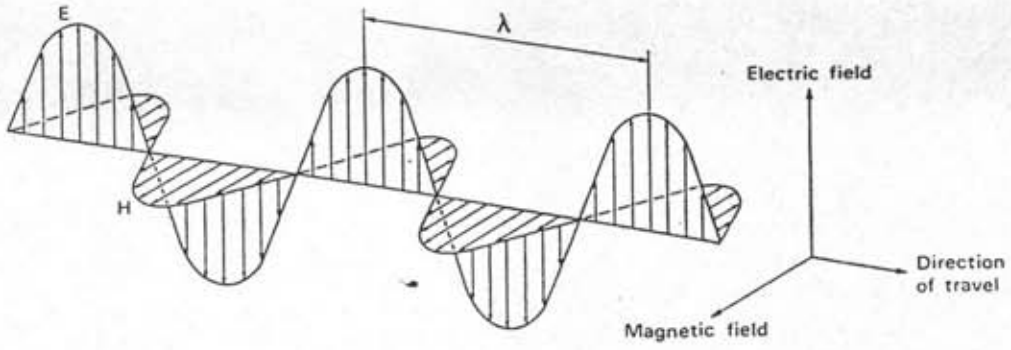
Figure 3. Enhalus acoriodes and Thalassia hemprichii (Nateekarnjanalarp, 1990).

2.2 Remote Sensing Application

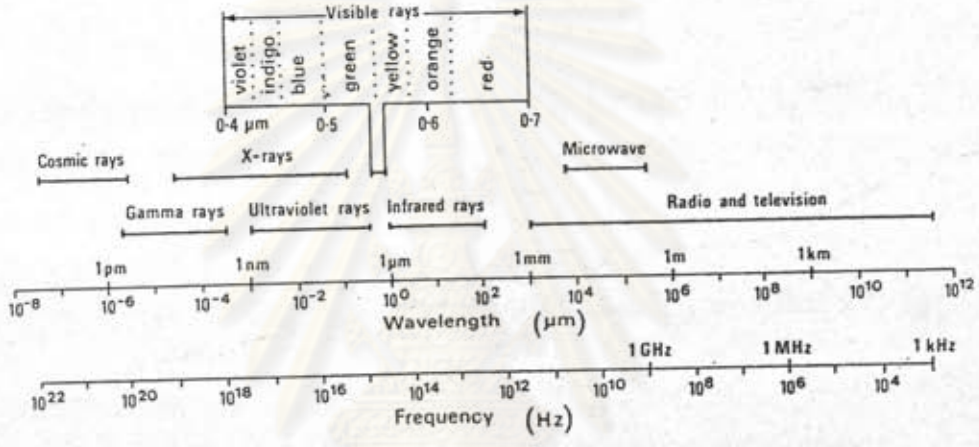
Remote Sensing is a general term which describes the action of obtaining information about an object with a sensor. Such sensor relies on detection variation in reflected or emitter radiation from Earth's surface in different regions of the electromagnetic spectrum (Harrison and Jupp, 1989, Figure 4). Remote sensing is primarily concerned with deriving information using an elevated platform. The data provides an idea view of Earth for various resource inventory and monitoring studies.

Reflectance is defined as the ratio of reflected to incident radiation. That is the proportion of energy reflected by an object. The effects to radiation levels detected by a remote sensing device are surface orientation (relative to both energy source and sensor), surface roughness (relative to the wavelengths of energy) and particle scattering in the atmosphere and water column (Harrison and Jupp, 1989).

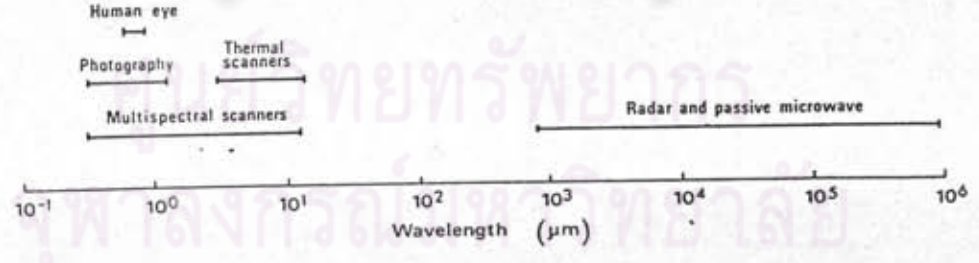
The source of the radiation being sensed can be separated in two systems (Harrison and Jupp, 1989). Active remote sensing devices direct radiation of a particular form towards as object and then detect the amount of that energy which is radiated by the object. Passive sensors which radiation from some other sources,



Electromagnetic Spectrum



Band Regions in Wavelength and Frequency



Wavelength Region of Different Sensors

Figure 4. The Electromagnetic Spectrum, Band Region and Wavelength of Different Sensors (Modified from Harrison and Jupp, 1989)

principally the sun. Aerial photograph and Landsat Satellite imagery are examples of data. However, the aerial photograph is obstructed by the sensor facility and the cost so this project objects on the satellite data.

2.2.1 Satellite

This thesis uses two satellite data, Landsat TM and SPOT. The instrument of satellite illustrated in Table 1. Both satellites are polar-orbit provide imagery with a range of resolutions. These satellites operate in sun-synchronous orbits, that is they always pass a given latitude at the same solar time (Harrison and Jupp, 1989). Data usually acquired on request and transmitted to the nearest in regions which are outside the range of ground stations.

Landsat is initiated by the National Aeronautic and Space Administration (NASA). The satellites transmit images to earth receiving stations. These satellites were designed primarily for collection of earth resources data. The current Landsat satellites contain in two sensor systems: a four channel multi-spectral scanner (MSS) and a seven channel thematic mapper (TM) multi-spectral system. Landsat 4 and 5 satellite data are the most readily available satellite data in Thailand, Landsat 4 launched on July 1982 and Landsat 5 on April 1984 (Figure 5; NASA, 1984).

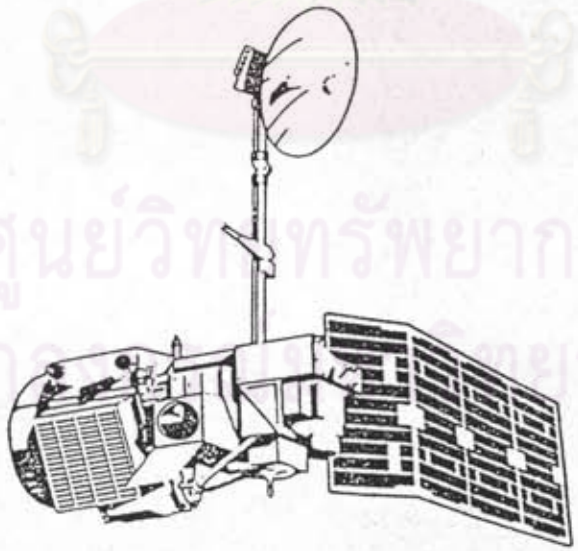


Figure 5. Landsat-5 Satellite (NASA, 1984).

Thematic mapper is an imaging device suitable for this study because it records scenes in seven band, six in the visible and one in the thermal infrared. The record of radiation intensity also increase from 64 levels in MSS to 255 levels in TM. This can make the data interpretation become easier.

While the Landsat series of satellites have been the best-known polar-orbiters and have provided the most commonly used data, imagery in this study is available from SPOT (Figure 6) which is French satellite launched on 1986 (Harrison and Jupp, 1989). Each SPOT scene, whether acquired in Panchromatic or Multispectral mode. This satellite data has more resolution than Landsat but less scanner. The use of both satellites depend on the suitable data for the objectives.

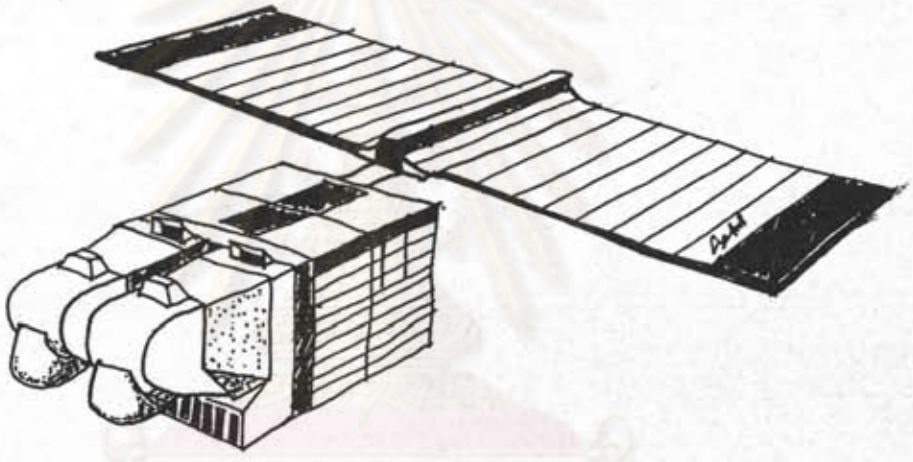


Figure 6. SPOT-1 Satellite (Ratanasermpong, 1987).

Remote sensing technology exploits the fact that variations in the physical properties of sunlight being reflected from water bodies, shallow seas and submerged features. The data provide a component information on coral reef ecosystem. The remotely sensed data also extend interpretations from well known areas to those which have little information.

If the idea from remote sensing can be used for the coral reef, it can be helpful for the reef research and survey. The request from reef scientist highlights the fact that remote sensing for coral reefs will be adopted as a common mapping and monitoring method if it is researched, developed and finally customized.