

**Mangrove Forest Decline and its Effect on Coral Reefs:
A Case Study on the Economic and Natural Ramifications of Wetland Decline**
RE: Dr. Pamela Hallock-Muller

Abstract

Tannic acid is a naturally occurring substance derived from plants which stains water a brown color, the structure of the tannic acid in water aids in preserving coral reefs. The destruction of mangrove forests in the coastal wetlands is drastically decreasing the amount of natural tannins in the water and thus subjecting the nearby coral reefs to undue UV radiation. In effect, the reefs are being sunburned and eventually coral bleaching occurs. This case study will illustrate the possible reasons for mangrove forest devastation, the linkage between coral bleaching and the former, and finally demonstrate the affects that are beginning to occur.

The Broad Picture

The wetlands are broadly defined as mangrove forests, mudflats, coral reefs, shallow coastal waters, and estuaries...within this general description lies millions of plant and animal species and several economic and social necessities. 300 million people in only six countries, (75% of those nations' populations) live within that defined area and 60% of all "animal protein" consumed in that region is seafood alone.¹ The United States is not without its own dependence upon these coastal regions, the Mississippi Delta wetlands alone account for 25-30% of the nation's seafood harvest, 19% of the nation's oil supply, and 25% of America's gas supply². The importance of the coral reefs extends even those statistics, the coral reef accounts for less than 1% of ocean floor but 1/4th of all sea life lives within it—incorporating 25,000 different species from 32 of the available 33 animal phyla that exist. These reefs act as nursery grounds and habitats for 10-20% of all the world's fisheries and from these remarkable marine habitats,

¹ <http://www.wetlands.org/capacity/WW/past/wwvol-2/feature/iss10/feature.htm>

² <http://www.waterobserver.org/backscatter/issues/2003-winter.html>

medicines such as anticoagulants and anticancer agents can be drawn.³ Also, more than fifty products can be derived from the mangrove forests including food stuffs, paper, dyes, and alcohol.⁴ These provide economic attachments which cannot be ignored. On average the global reefs provide \$375 billion dollars worth of goods and services *per year*--that is \$60 for every member of the human race. In developing countries they contribute 1/4th of the total fish-catch, which in turn provides food to one billion people in Asia alone. Globally, half a billion people live within 100 kilometers of a coral reef and reap the benefits of the close proximity.⁵

Tourism is also contributing factor to the economic impacts of coral reef bleaching. Throughout world, tourists visiting the coastal regions comprise 10% of the population, and 1% of the gross national product; Florida's reefs alone attract \$1.6 billion dollars annually.

The actual structure of coral is comprised of calcium carbonate skeletons left by previous coral polyps; the coral actually derives its vivid coloring from the different types of algae that live within the skeletal structure. This symbiotic relationship is very delicate and is subjected to slight changes in water temperature, amount of UV radiation, and clarity of water. Coral bleaching occurs when one of these triggers provide stress to the coral structure, under this negative stimuli, the algae may die off, leaving the white coral skeletal structure exposed—thus appearing to be “bleached”. If the bleaching is sustained, the coral polyps will eventually starve to death.⁶ While regeneration is possible, maintained coral bleaching drastically lowers the chances of any rejuvenation to occur.

Mangrove tannins are one of nature's protectors of the coral reefs. These tannic acid macromolecules come from the mangrove trees which reside in the swampy wetlands above some coral reef sites. The tannic acid mixes with the marshy waters surrounding the forest and

³ <http://www.esa.org/education/edupdfs/coralreefs.pdf>

⁴ <http://www.wetlands.org/capacity/WW/past/wwvol-2/feature/iss10/feature.htm>

⁵ <http://www.aaas.org/international/africa/coralreefs/ch1.shtml>

⁶ <http://atlas.aaas.org/index.php?part=2&sec=eco&sub=reefs>

dye the water the color of tea, when swept out into the ocean, this brownish water acts as a form of natural sunscreen for the coral reefs, protecting the delicate balance from too much UV radiation; with the tannins absent, solar radiation is quickly sun burning massive amounts of coral and depriving it of the delicate algae which inhabit the skeletons and provide nourishment to the carbonate structures. In essence, the destruction of the mangrove swamps is burning away coral nutrients and effectively starving the corals into extinction. Also, what with human beings cutting down the mangrove forests and draining the low-lying swamplands for beach-side resorts, we are inadvertently killing off the one buffer zone between hotel strips and Mother Nature. Additionally, a rapid decline of available fish and subsequent tourism is bound to occur once the coral reefs begin to die off.⁷

This “buffer zone” consists of the natural sea-walls that are formed by coral reefs and mangrove swamps. As Director of the Global Marine Programme, Mr. Simon Cripps stated, “coral reefs act as a natural breakwater and mangroves are a natural shock absorber, and this applies to floods and cyclones as well as tsunamis”. To really understand this point, one must look at the recent tsunami tragedy which wrecked havoc upon the nations of the South Pacific. In the low-lying Maldives Archipelago coral reefs were basically intact and unspoiled while mangrove forests were still prevalent throughout the islands, and subsequently there were 100 fatalities within a population of 270,000. Contrarily, the tourist town of Phuket in Thailand had disposed of the majority of the available mangroves and corals—opting instead for hotel strips and aquaculture facilities...and while the population was roughly the same at the time of the tsunami tragedy, the amount of fatalities was ten fold that of the Maldives. Senior researcher at Southampton University Oceanography Centre Doug Masson stated, “...there is a dampening effect if you have a coral reef...coral is what probably saved the majority of the people in the Maldives. The

⁷ Hallock-Muller, Pamela. Professor of Biogeological Oceanography. University of South Florida. Personal interview, August 9, 2005.

reef broke up the tsunami and it traveled as a broken wave and so was far less deadly.’⁸ The results of continued mangrove and coral reef protection serve as more than a preserved natural beauty or even a preserved economic investment...more so it is a natural barrier between the brutal natural forces and delicate human life.

Indications of a Growing Problem

As the Global Reef Monitoring Strategic Plan states, “Globally, best estimates suggest that about 10% of coral reefs are already degraded, many beyond recover, and another 20% are likely to decline within the next 20 years. At least 2/3rds of the world’s coral reefs may collapse ecologically within the lifetime of our grandchildren, unless we implement effective management of these ecosystems as an urgent priority.’⁹

The rate of available and pristine mangroves and corals is rapidly declining, already Thailand has lost nearly half of its mangroves between the years 1975 to 1993.¹⁰ The Louisiana wetlands are losing 25-35 square miles each year, which equates to roughly a football-field sized piece being destroyed every forty five minutes; and between 1980 and 1990, the Malaysian mangroves, (2.5% of the entire global supply) have disappeared by 12%.¹¹ This has resulted in the stunning conclusion that almost 35% of the globe’s mangrove forests have disappeared entirely due to human population and the never-ending search for exploitable natural resources.

Questions and Scenarios:

Provide short but concise answers to the following questions.

⁸ <http://www.terraily.com/2005/>

⁹ <http://www.esa.org/education/edupdfs/coralreefs/pdf>

¹⁰ <http://www.terraily.com/2005/>

¹¹ <http://www.wetlands.org/capacity/WW/past/wwwol-2/feature/iss10/feature.htm>

- 1) Come up with an innovative campaign slogan and mission statement for an environmental organization dedicated to preserving the wetlands.
- 2) What could be some potential benefits of continuing to develop the coastal marshes into commercial and residential properties?
- 3) What other economic benefits could be derived from protecting the mangrove swamplands and the coral reefs?
- 4) Assume that you are proposing a congressional act to protect the coastal wetlands and coral reefs. Not developing this prime real estate could deprive both local communities and the federal government alike of valuable tourist towns and spreading economic wealth. What methods would you use to convince these people that conservation is necessary in the long run?