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The impact of forest use on the intertidal crab community in managed mangroves of Cilacap, Central Java, Indonesia

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1. INTRODUCTION

Mangrove forests that grow in intertidal areas and possess a high diversity of benthos habitats in the tropics, generally provide good conditions as breeding, spawning, hatching and nursery grounds, for example, for prawns and crabs (Alongi, 1990). Dai and Yang (1991) explained that the word "crab" denotes a group of animals from the section of Brachyura (sub order Reptantia, order Decapoda, class Crustacea). Crabs are very important in maintaining ecosystem processes in mangrove forests because some of them process detritus (Ewel *et al.*, 1998). Twilley *et al.* (1995) explained that crabs are keystone species in mangrove ecosystems or a central ecosystem element in a mangrove forest because of their enormous impact on ecosystem dynamics. They can, for instance, process as much as 70% of the leaf litter. Also, their burrowing activity causes sediment texture distribution and tree productivity.

Unfortunately, there are anthropogenic disturbances such as destruction and deforestation of mangroves leading to decrease its coverage, finally causing the disappearance of natural nursery grounds for crabs (Binett *et al.*, 1995). Recent forms of direct impact include the destruction of biodiversity by land uses such as installing farm land and prawn ponds (agricultural activities), urban development and forest clear-felling (Twilley *et al.*, 1995). Sucgang (1994) illustrated that the conversion of mangrove forest into prawn ponds causes coastal erosion, wet inundated lands, intrusion, depletion of supply of river sediments, flooding, damages to infrastructure and loss of property. Moreover, owing to the continued increase in installing prawn ponds, organic and inorganic material accumulation into sediment and water will take place. After harvesting, sediments remain on the ground of the pond. In addition, polluted water is discharged directly to surrounding waters (Sansanayuth *et al.*, 1996). Loss of biodiversity is regularly identified as one of the greatest environmental risks facing mankind as a result of anthropogenic disturbances. Legislation has been proposed to preserve biodiversity and governments have been argued to approach this issue. An international treaty for the conservation of biodiversity has been negotiated (Jutro, 1993).

The intensity of disturbance is measured in terms of size (from small to large) and frequency (from rare to common). The disturbance causes patch diversity in flora and fauna. In an intertidal community, it was found that patch dynamics after disturbance provides a good example of how disturbance size may play a role in determining species diversity (Petraitis *et al.*, 1989). There is an intermediate disturbance hypothesis predicting that richness will be highest in communities with moderate levels of disturbance and at intermediate time spans following disturbance (Collins *et al.*, 1995). Butterfly richness, for example, is high at transition between ruderal and forest areas, whereas its abundance is high at ruderal areas (Spitzer *et al.*, 1993).

To predict disturbance, percent cover of habitat can be used as good indicator. Undisturbed areas usually have a high habitat percent cover. Hence, their diversity is relatively more constant. On the other hand, anthropogenically disturbed areas have a fluctuating diversity. During succession, diversity increases initially as species colonize a bare surface, and declines later as one species monopolizes the space (Sousa, 1979).

There are three approaches to study diversity: theoretical population biology, quantitative phytosociology and classic biogeography. The first approach concerning the role of species interactions such as competition and predation is termed alpha diversity type. The second approach concerning species distributions along environmental factors that apply also to animal communities is termed beta diversity type. The last approach concerning the relative richness of regional floras and faunas that stress historical factors such as migration, isolation and speciation in the interpretation of diversity is called gamma diversity type (Shmida and Wilson, 1985).

Diversity encompasses the two different concepts of variety, i.e., richness and evenness. Richness refers to the number of species per unit area, whereas evenness refers to their abundance, dominance or spatial distribution. Species diversity can refer to all organisms in a community, but usually discussions are restricted on practical grounds to certain groups of species related to the interest of ecologist (Barnes *et al.*, 1998). Diversity may mean merely species richness or the number of species together with abundance (Hayek and Buzas, 1997).

Diversity and some “measures of effort” such as abundance may be correlated for biological reasons (Gaston, 1997).

The tropical forests of the world may have lost between 33% and 50% of their species by 2010. A substantial portion of the biodiversity may even have been lost, before it has been completely documented. There is a task for conservationists to map biodiversity. They need to map the biological elements, the spatial or habitat elements, and the contours of conservation (Ganeshaiah and Shaanker, 1998).