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Symposium on Biomathematics (SYMOMATH 2014)

East Java, Indonesia
31 August–2 September 2014

Editors
Thomas Götz and Agus Suryanto

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The Effect of Recruitment Rate and Other Demographic Parameters on the Transmission of Dengue Disease

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Abstract. One of important factors which always appears in most of dengue transmission mathematical model is the number of new susceptible recruited into the susceptible compartment. In this paper we discuss the effect of different rates of recruitment on the transmission of dengue disease. We choose a dengue transmission model with the most realistic form of recruitment rate and analyze the effect of environmental change to the transmission of dengue based on the selected model. We model the effect of environmental change by considering that it can alter the value of mosquito's carrying capacity and mosquito's death rate. We found that the most prevalent effect of the environmental change to the transmission of dengue is when it can alter the death rate of the mosquitoes.

Keywords: Mathematical model, dengue transmission, carrying capacity, intrinsic growth rate
PACS: 02.30.Hq

INTRODUCTION

Indonesia is known as one of an endemic region of vector-borne diseases. The diseases include dengue which is transmitted by *Aedesaegypti*and *Aedesalbopictus*. The first recorded appearances in Indonesia were in Jakarta and Surabaya in 1968. Since then dengue fever (DF) and its more severe form, dengue haemorrhagic fever (DHF), have been growing rapidly [1,2]. It is also recorded that dengue outbreak was common and almost appears every year in many parts of Indonesia. Although many efforts have been done to tackle and to eliminate the disease, it still prevalence with a significant high incidence rate in many parts of Indonesia. This indicates that we still need further understanding in the behavior of the disease including its transmission pattern. Among other methods to understand the spread of the disease, mathematical modeling approach is commonly used.

In this paper we derive several mathematical models of dengue transmission with different types of recruitment rate and discuss the implication in controlling the spread of the disease. We choose a dengue transmission model with the most realistic form of recruitment rate and analyze the effect of environmental change to the transmission of dengue based on the selected model. We model the effect of environmental change by considering that it can alter the value of mosquito's carrying capacity and mosquito's death rate.

MODEL FORMULATION

Basic Model

To derive the model, first we define the symbols which we use in the formulation as shown in Table I. We follow the method in [3] and [4] in which the basic model is written in (1) to (5) of the following system of differential equations:

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