



## The Integrated Soil Erosion Risk Management Model of Central Java, Indonesia

M.A. setiawan (1,2), J. Stoetter (1), J. Sartohadi (2), N. Christanto (2,3)

(1) Institute of Geography, University of Innsbruck, Austria (muhammad.setiawan@student.uibk.ac.at), (2) Department of Geography and Environmental Science, Faculty of Geography, Gadjah Mada University, Indonesia, (3) ITC, Earth System Analysis, the Netherlands

Many types of soil erosion modeling have been developed worldwide; each of models has its own advantage and assumption based on the originated area. Ironically, in the tropical countries where the rainfall intensity is higher than other area, the soil erosion problem gain less attention. As in Indonesia, due the inadequate supporting data and method to dealing with, the soil erosion management appears to be least prior in the policy decision. Hence, there is increasing necessity towards the initiation and integration of risk management model in the soil erosion, to prevent further land degradation problem in Indonesia. The main research objective is to generate a model which can analyze the dynamic system of soil erosion problem. This model will comprehensively consider four main aspects within the dynamic system analysis, i.e.: soil erosion rate modeling, the tolerable soil erosion rate, total soil erosion cost, and soil erosion management measures. The generating model will involve some sub-software i.e. the PC Raster to maintain the soil erosion modeling, Powersim Constructor Ver. 2.5 as the tool to analyze the dynamic system and Python Ver. 2.6.1 to build the main Graphical User Interface model.

The first step addressed in this research is figuring the most appropriate soil erosion model to be applied in Indonesia based on landscape, climate, and data availability condition. This appropriate model must have the simplicity aspect in input data but still deal with the process based analysis. By using the soil erosion model result, the total soil erosion cost will be calculated both on-site and off-site effect. The total soil erosion cost will be stated in Rupiah (Indonesian currency) and Dollar. That total result is then used as one of input parameters for the tolerable soil erosion rate. Subsequently, the tolerable soil erosion rate decides whether the soil erosion rate has exceeded the allowed value or not. If the soil erosion rate has bigger value than the tolerable soil erosion rate, the soil erosion management will be applied base on cost and benefit analysis. The soil erosion management measures will conduct as decision maker of defining the best alternative soil conservation method in a certain area. Besides the engineering and theoretical methods, the local wisdom also will be taken into account in defining the alternative manners of soil erosion management.

As a prototype, this integrated model will be generated and simulated in Serayu Watershed, Central Java, since this area has a serious issue in soil erosion problem mainly in the upper stream area (Dieng area). The extraordinary monoculture plantation (potatoes) and very intensive soil tillage without proper soil conservation method has accelerated the soil erosion and depleted the soil fertility. Based on the potatoes productivity data (kg/ha) from 1997-2007 showed that there was a declining trend line, approximately minus 8,2% every year. On the other hand the fertilizer and pesticide consumption in agricultural land are significantly increasing every year. In the same time, the high erosion rate causes serious sedimentation problem in lower stream. Those conditions can be used as study case in determining the element at risk of soil erosion and calculation method for the total soil erosion cost (on-site and off-site effect). Moreover, The Serayu Watershed consists of complex landforms which might have variation of soil erosion tolerable rate.

In the future, this integrated model can obtain valuable basis data of the soil erosion hazard in spatial and temporal information including its total cost, the sustainability time of certain land or agriculture area, also the consequences price of applying certain agriculture or soil management. Since this model give result explicitly in spatial and temporal, this model can be used by the local authority to run the land use scenario in term of

soil erosion impact before applied them in the real condition. In practice, such integrated model could give more understanding knowledge to the local people about the soil erosion, its processes, impacts, and how to manage that.

Keywords: Risk assessment, soil erosion, dynamic system, environmental valuation