

# **IMPACTS OF LAND USE EVOLUTION ON STREAMFLOW AND SUSPENDED SEDIMENT IN PASAK BASIN, THAILAND**

## **INTRODUCTION**

### **1. Rationale**

In many developing countries extensive areas have been undergoing land use change since long ago. The largest change in terms of land area and also in terms of hydrological impacts often arises from afforestation and deforestation activities (Calder, 1992; Henderson-sellers et al., 1996). Several studies relate population growth and deforestation in developing countries in the tropics (Palo and Mery, 1990; Rudel, 1989). As the population increased, natural resources have been utilized abruptly in order to serve their increasing demand. The lack of knowledge and understanding in relation to the environment and the functioning of ecological systems as well as selfishness in terms of taking advantage from natural resources lead to the deterioration of natural resources and fewer opportunities for resource utilization (Boonyawat and Susanpoontong, 1996). Shifting cultivation, conversion of marginal land and forest land to agricultural use, over cutting of fuel wood and timber, overgrazing, improper collection, transportation and use of water, construction of roads etc. are combining to put increasing pressure on the natural resource base of hilly areas of many countries.

Consequently, the land-water-plant system of both uplands and the adjoining lowland areas is affected. The people living in upland and lowland areas have been facing uncertainty of rainfall, prolonged drought, sometimes with high intensity storms causing flash floods, declining soil productivity, unfertile and erosive soil having limited depth and moisture holding capacity, sedimentation in stream channels and reservoirs, polluted water which in turn create food shortage, low farm income, health hazards and ultimately affecting people's quality of life. Sometime conflicts arises over water supply among farmers living in upland and downstream areas as the upstream users pay less attention to downstream users. All these are the result of lacking of hydrological knowledge and improper land use practices. So for proper

watershed management it is important to know the relationship between land use changes and the factors that influencing hydrological behavior of a watershed in terms of reduced peak flow, reduced surface run off, reliable base flow and manageable erosion and sedimentation.

The Pasak Basin is situated mostly in the central part of Thailand and the problem referred to above are encountered. An understanding of the impacts of land use evolution on hydrological characteristics in terms of runoff discharge and stream flow regimen and sediment transportation will be useful in proper watershed management planning within Pasak Basin which in turn minimize the problems on the environment and ecological system of it's watershed, maintain the quantity and quality of natural resources in a sustainable manner and on the other hand exploiting it to the best economic advantage with due attention to the equitable involvement of the local dwellers. Based on this background this research is hereby proposed namely "Impacts of land use evolution on streamflow and suspended sediments in Pasak Basin".

## **2. Objectives**

**2.1 Overall objective** - To obtain basic information relating to integrated watershed management planning within Pasak Basin and to be able to apply it to other basins.

### **2.2 Specific objectives**

1) To study land use evolution within Pasak Basin relating to forest area, agricultural area, urban area, water resource area and others during the period 1980-2004.

2) To determine streamflow characteristics in concurrence of land use changes in Pasak Basin over the above period.

3) To investigate the flow timing pattern in the Pasak Basin caused by land use changes over the above period.

4) To assess the impact of land use changes on suspended sediment in Pasak Basin during the period from 1980-2004.

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### **3. Outcomes**

Streamflow characteristics and runoff-rainfall analyses during the period of study give an idea about the hydrological situation caused by land use changes.

From the regression equations as obtained through linear and multiple regression analysis of independent variables including rainfall, land use change factors and dependent variables including discharge and sediment, relationships among those factors are established which is important for forecasting the streamflow and suspended sediment produced by Pasak Basin in future in case of various changes of land use factor that are given.

Streamflow timing parameters such as flow date and flow interval as obtained through graphical presentation of cumulative flow volumes of each month for the given period indicate the flow pattern of the drainage area (including the date on which quarter or half of the annual flow will pass, flow dispersion or longer period of dry season that will account for 5% or 1% of annual flow) caused by land use changes.

As most of the tropical countries have been facing extensive land use changes including forest conversion for agricultural cropping as the serious one and where the soil is highly erodible, the above findings or information can be used or replicated as a management tool for controlling streamflow and reducing reservoir sedimentation in Pasak Basin as well as in some other basin areas in order to formulate an integrated watershed management plan.