

HYDROPOWER IMPACTS OF SOIL EROSION: AN ENVIRONMENTAL COST SIMULATION MODEL

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ABSTRACT

The agriculture sector produces not only goods and services positively valued by society but, also residues like, sediment that will affect the flow of goods and services provided by nature. The present study will focus on the environmental impacts related to off site damages caused by sedimentation. The estimated economic value of the environmental damages will be based on effects at hydroelectric generation plants. Such effects can be classified as lost of reservoir capacity, increasing activities of maintenance and reduction of generation of electricity days.

In order to calculate monetary values of the damages caused by siltation, Replacement Cost Approach and Sacrifice Production methods were used through run of river hydroelectric generation plants located at Sapucaí River in the state of São Paulo. The empirical work is based on the siltation trends of two existing run of river hydropower plants projected over the set of eight units programmed to be installed at Sapucaí River.

Monte Carlo Method (MCM) was used to simulate economic and physical conditions that will affect environmental costs. Under risk conditions ex-ante costs and benefits can be represented by probability functions which can be known as simulation technique, stemming from stochastic variables MCM consists of building and simulate mathematical models by means of using statistical resources. MCM is based on the relative

frequency of certain phenomena that approximates the mathematical probability of occurrence of such phenomena when this experience is repeated several times. Such method consists of the following steps: choosing the representative variables together with the probability accumulated and randomly selected. This process is repeated several times in order to obtain probability distribution of the variables under study. Due to restriction on data availability it was used the triangular distribution of the relevant variables. The important variables associated with the erosion-sedimentation process were the following: extra maintenance costs, lost revenue, drainage cost, and equipment repairs. Minimum, modal and maximum values based on real conditions of functioning of hydropower plants and the erosion-sedimentation process in the riverbasin were associated with the important variables.

The present value of environmental cost was estimated under three discount rates, 3%, 6% and 9% per year. The simulation technique showed that under given sedimentation hypothesis, discounted value ranging from US\$ 176 to US\$ 220 millions, US\$ 84 to 112 millions US\$ 51 to US\$ 68 millions, respectively, with a probability of 75% of occurrence.

Due to risk and uncertainty events involved at chemical, physical and biological identification and quantification of environmental impacts as well as economic factors in the estimation of environmental costs, it is important to weigh the present value of environmental costs according to the probability density function of each relevant variable involved.

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