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A Framework for Using Economic Cost-Benefit Analysis in Watershed Conservation, an Experience in Taiwan

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Cost-benefit analysis (CBA) is often applied at different levels of decision supports. CBA is a systematic approach to estimate the strengths and weaknesses of alternatives for decision makings. In many countries, CBA is required by law and regulation in different fields, including policy-making and public investment. The benefits of practicing the management of watershed conservation also need to be quantified so that decision-makers can understand engineering projects better. Applying CBA in watershed conservation can provide a comparison of total economic gains and losses resulting from practices and reveal impacts on different aspects with economic principles. Nevertheless, to quantify the benefits derived from watershed conservation, an array of technical relationships in various aspects which is still unclear requires to be developed. For this concern, this study examined several perspectives of watershed conservation to propose the framework of CBA in watershed conservation for Taiwan. In this study, we focused on four main kinds of sediment control facilities including check dam, embankment, slope protection, and ground sill work, and described the effect of sediment conservation based on theoretical sediment processes in spatial as well as temporal. We further analyzed their utilities from the perspective of the water supply. In addition to sediment control estimations, this study also determined some economic factors which were not determined in the past. We yielded a demand curve of raw water from the water supplying data and calculated a social discount rate from government bond rates. Also, we suggested adopting a general extreme value method to investigate the benefit under an extreme turbidity event and adopting an alternative costing method to estimate the water quality improvement benefits. This framework is successfully applied in Taiwan for the evaluation of watershed conservation projects. With this framework, engineers could perform economic CBA for reservoir watershed conservations more efficiently, practically, and precisely.

Keywords: Watershed conservation, Economic cost-benefit analysis, Sediment control, Reservoir management