

Does Watershed Protection Benefit Streams? Stream Integrity Evaluation in Selected Protected and Non-Protected Areas on Luzon Island, Philippines

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Abstract

Protected areas (PAs) are widely acknowledged as essential for maintaining biodiversity, but their effectiveness in safeguarding freshwater biodiversity remains uncertain. This uncertainty arises from the insufficient representation of freshwater features within PAs and the need for tailored design and management strategies for freshwater conservation. This knowledge gap is particularly prominent in tropical streams, specifically in the Philippines, where limited research has been conducted on freshwater ecosystems despite their remarkable biodiversity and ongoing degradation. Anthropogenic threats pose significant challenges to these freshwater ecosystems, highlighting the urgent need for conservation efforts. This proposed study aims to address these knowledge gaps by providing empirical data on the effectiveness of terrestrial protected areas in conserving freshwater communities, using benthic macroinvertebrates known to be preferred bioindicators mainly due to their varying degrees of sensitivity to pollution. The study employs the Reference Condition Approach (RCA) as a predictive model to compare stream health within, nearby, or adjacent to both 1) the undisturbed reference sites, Mounts Banahaw-San Cristobal Protected Landscape (MBSCPL) and Mounts Palay-Palay-Mataas-na-Gulod Protected Landscape (MPPMNGPL), and 2) the disturbed test sites, Mount Malepunyo Mountain Range (MMMR) and Palico River Watershed (PRW). The study will assess stream integrity by analyzing stream 1) physicochemical parameters, 2) benthic macroinvertebrate community structure using biological matrices such as Hilsenhoff's Family Biotic Index (HBI), Biological Monitoring Working Party (BMWP), Average Score per Taxa (ASPT), Biological Monitoring Working Party (BMWP), Stream Invertebrate Grade Number—Average Level Version 2 (SIGNAL 2), and SingScore, and 3) functional trait composition through Fuzzy Correspondence Analysis (FCA). The research findings will contribute to a deeper understanding of the relationship between conservation management and freshwater biological communities, which is essential to ensuring biodiversity conservation aside from the mere designation of PAs. Ultimately, this study strives to enhance freshwater conservation practices and contribute to the long-term preservation of these valuable ecosystems.

Keywords: *benthic macroinvertebrates, freshwater biodiversity, biodiversity conservation, physicochemical parameters, functional trait composition, protected areas*