



**FACULTY OF SCIENCE AND EDUCATION
DEPARTMENT OF BIOLOGY**

RESEARCH BY THESIS

IMPACT OF ANTHROPOGENIC STRESSORS ON ECOSYSTEM HEALTH AND POTENTIAL IN-STREAM RESTORATION MEASURES OF RIVER MANAFWA CATCHMENT IN EASTERN UGANDA

By

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ABSTRACT

River ecosystems in tropical highland catchments are increasingly affected by interacting land-use pressures that alter water quality, habitat condition and aquatic biodiversity. This study assessed anthropogenic pressures and short-term in-stream restoration responses in the River Manafwa catchment, eastern Uganda. Specifically, it examined physicochemical water quality, macroinvertebrate assemblages, community perceptions, and the performance of pool–riffle and woody in-stream structures. Guided by pragmatism and three complementary theoretical lenses, the study combined repeated wet- and dry-season biophysical monitoring at nine land-use sites, a cross-sectional community survey and key-informant interviews ($n = 247$), and a short-term restoration trial at Nakokolo and Khuboda between March and September 2025. Water-quality variables were analysed using inferential statistics and multivariate ordination; macroinvertebrate assemblages were assessed using SASS5/ASPT and diversity metrics; community data were analysed descriptively and by factor analysis; and restoration responses were compared across structure type and season. Land use and season significantly structured several physicochemical variables ($p < 0.05$), and the water-quality PCA separated forested reference reaches from more disturbed agricultural, urban and car-washing sites. Macroinvertebrate assemblages also differed among sites, with the natural-forest reference reach showing high biological integrity (ASPT about 9.8) and the cassava site lower integrity (ASPT about 5.9); multivariate ordination reinforced this ecological separation. Community respondents showed high awareness of environmental degradation (mean awareness score 4.44 ± 0.65), while ten retained perception factors explained approximately 65% of total variance and revealed an awareness–action gap also reflected in key-informant accounts. The restoration trial produced measurable short-term responses: pool–riffle sequences supported 2,256 individuals and 33 families, while woody structures supported 1,887 individuals and 22 families, with multivariate patterns indicating complementary physicochemical and biological responses across seasons. The study concludes that River Manafwa ecosystem condition is shaped by interacting land-use, seasonal, biological and social processes. It recommends pollution source control, riparian protection, participatory catchment governance, and longer-term replicated evaluation of nature-based restoration before catchment-wide scaling.

Keywords: Anthropogenic stressors, River ecosystem health, Macroinvertebrates, Water quality, River restoration, River Manafwa catchment.