Socio-ecological resilience of restored freshwater ecosystem: Species diversity, landscape connectivity, and stakeholder integration in Sironko River wetland, Uganda

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BACKGROUND

- Uganda is endowed with freshwater ecosystems that sustain biodiversity and drive economic growth.
- Yet these ecosystems are degrading unprecedentedly.
- Uganda has pursued restoration, but this alone is insufficient; these systems must be built to withstand shocks, maintain functionality, and adapt over time.
- No published study has integrated ecological, structural, and governance dimensions of resilience in restored wetlands in Uganda.
- This study aimed to fill this gap and inform the design of future restoration interventions.

RESEARCH OBJECTIVES

i. Assess the spatial differences in macroinvertebrate diversity across river reaches and tree diversity in riparian forests.

ii. Analyse the fragmentation and connectivity of wetland patches in the restored landscape in 2016, 2020, and 2026.

iii. Assess the local community participation, traditional ecological knowledge integration, and institutional inclusivity in the restoration process.

STUDY AREA & METHODS

Conducted in Sironko River wetland landscape (Fig 1).

Ecological assessments and social survey data

- 10 macroinvertebrate sampling sites across restored and unrestored river sections
- 15 tree plots (50 × 10 m) in adjacent riparian forests.
- A 10-year (2016–2026) landscape assessment using GIS and FRAGSTATS.
- Random 292 household interviews across 12 villages.
- A social network analysis of institutional actors.

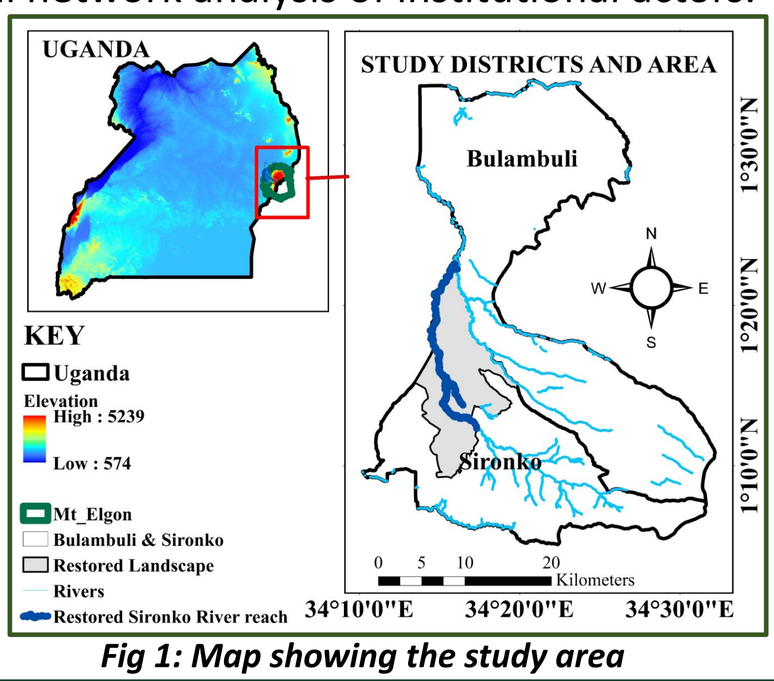


Fig 1: Map showing the study area

CONCLUSION

This study shows that restoration has not produced convergent signs of socio-ecological resilience in the Sironko River wetland. In an era of environmental change, policy and practitioners must move beyond structural rehabilitation to pursue functional species recovery, landscape-scale connectivity, and inclusive governance as interdependent, not separate, pathways to resilience of freshwater ecosystems.

RESULTS

Objective 1: Species diversity

1a, Macroinvertebrate: remained low with no significant difference between restored and unrestored sections (Fig 2).

1b, Riparian tree: generally, low with significant difference between sites but dominated by *Eucalyptus* spp (Fig 3).

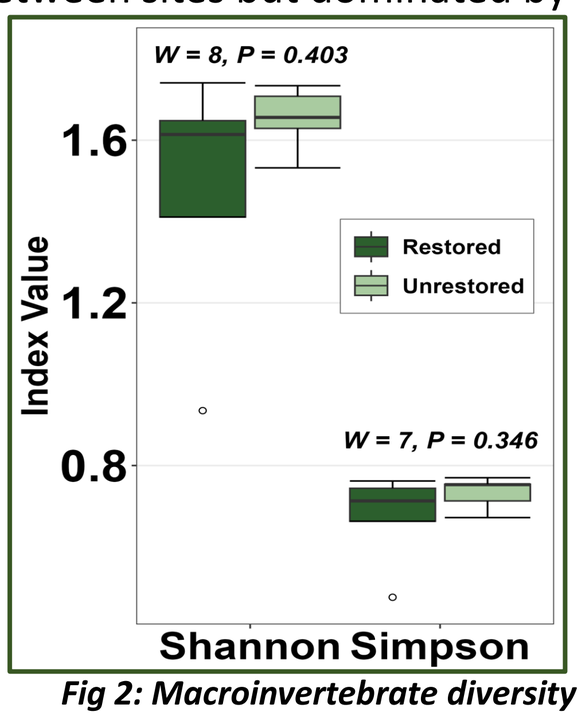


Fig 2: Macroinvertebrate diversity

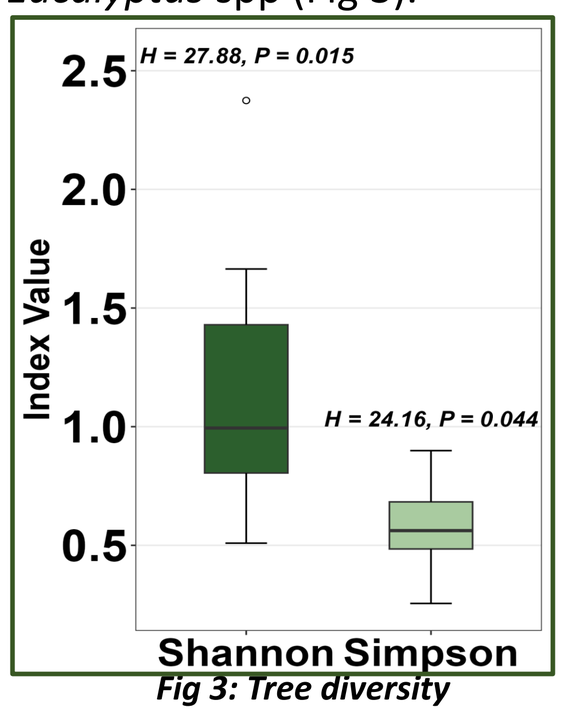


Fig 3: Tree diversity

Objective 2: Landscape connectivity

Sironko Wetland continues to experience progressive loss, fragmentation, and increasing isolation (Fig 4).

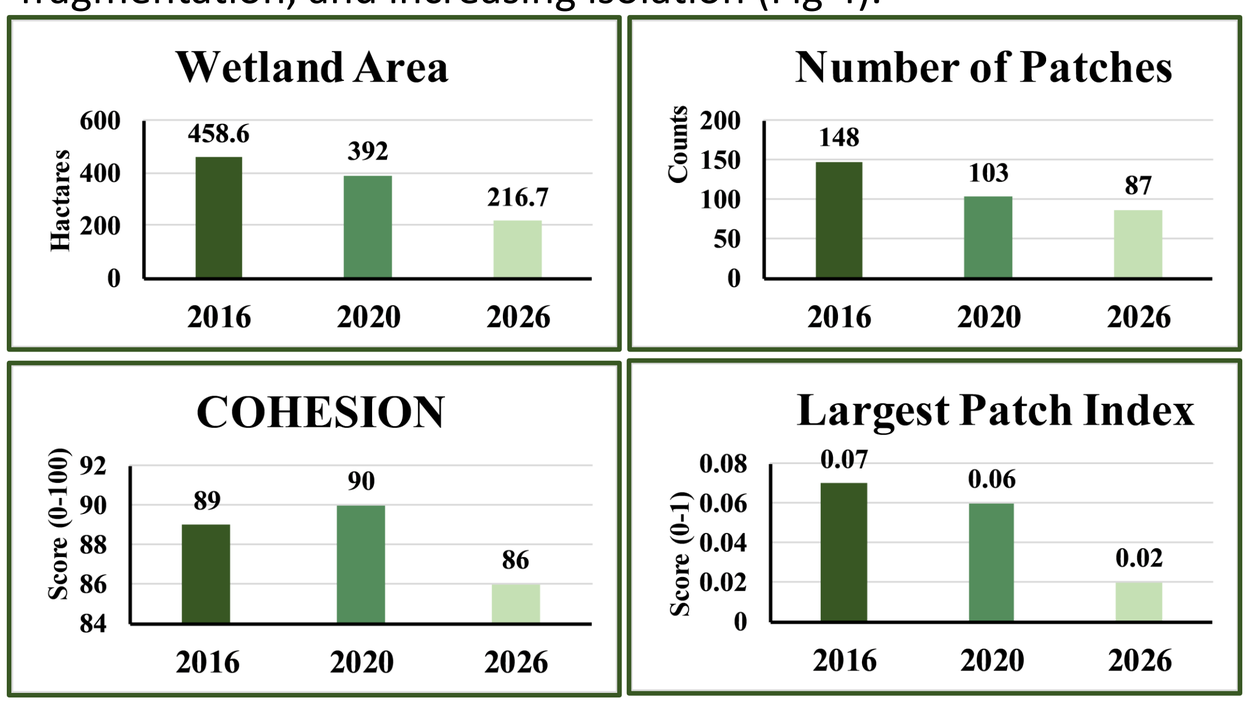


Fig 4: Sironko wetland fragmentation and connectivity trends

Objective 3: Stakeholder participation

3a, Riparian community members are informed and consulted yet exercise minimal influence over decisions, planning, and on-the-ground restoration activities (Fig. 5).

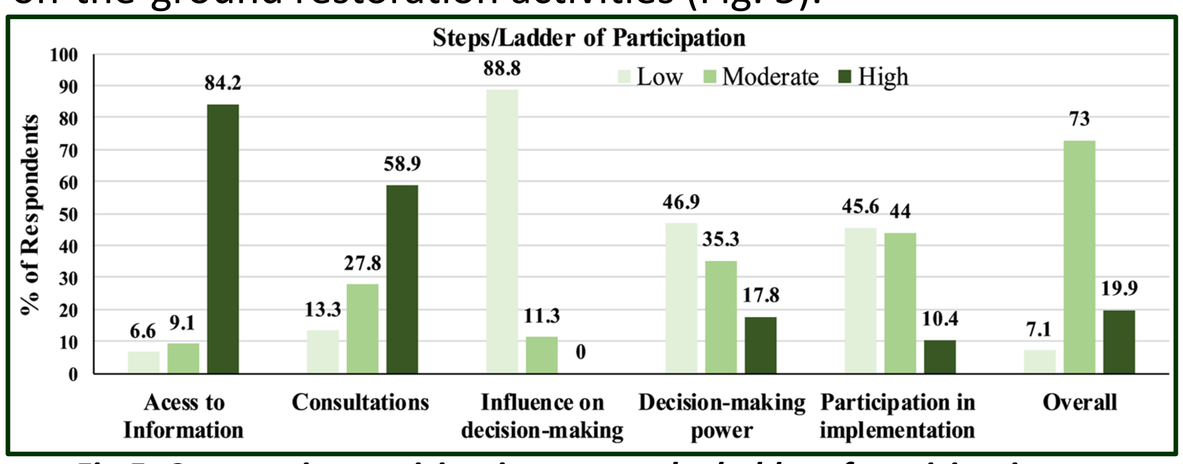


Fig 5: Community participation across the ladder of participation

3b, Respondents held TEK but opined that their knowledge was not integrated into formal restoration programmes.

3c, Institutional governance was low (Density = 0.05), fragmented (Index = 0.91), and highly centralized.

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