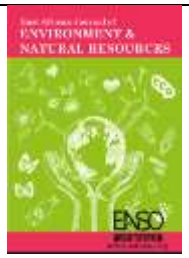

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Original Article

Wetland Restoration and Conservation. Case of Uganda

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Wetland Restoration, Conservation, Degradation, Wetland Management.

ABSTRACT

Wetlands are the natural filters with a variety of important ecosystem benefits and are more relevant in improving people's livelihoods. However, as a result of increasing global economic pressures, they have drastically decreased resulting in more global environmental challenges such as climate change. This has attracted international and regional attention for wetland management through restoration which has several success and failure stories. This review aimed at establishing the dynamics for wetland restoration success and failure in Uganda through narrative literature review. The findings showed that institutional and policy environment, land tenure systems, traditional and indigenous knowledge, and project scope significantly affect the restoration outcomes. Therefore, there is a need for comprehensive interdisciplinary collaboration for effective and efficient governance and alternative live- hoods analysis, the integration of traditional knowledge for land tenure system support, fostering gender sensitive and a multisectoral, approach and prioritizing community-centered practices to address land tenure system complexities and ensure the sustainability of wetland ecosystems for future generations in restoration initiatives.

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INTRODUCTION

Wetland, the natural filter is a transitional landscape between terrestrial and aquatic systems where the water table is usually at or near the surface. Wetlands are characterized by continuous, seasonal, periodic standing water or saturated soil (Reed, 2005). Wetland ecosystems play invaluable ecosystem roles and contribute significantly to global food security, these services include provisional, cultural and regulatory services (Amler *et al.,* 2015). Currently, the global coverage of wetlands of international importance stands at 2303 wetlands, with Europe, and Africa with the largest share. However, more than half of this coverage is threatened by human-induced activities such as biological resource use, natural system modification, and expansion of agricultural land with river and lakeside catchment areas most affected (Xu *et a*., 2019). The global estimates indicate that the wetland loss has been substantial since 1700 and more degradation mainly occurred in the 20th and early 21st centuries (Davidson, 2014).

Uganda in particular still faces significant wetland loss and degradation (Warsame *et al.,* 2022). To avert this wetland coverage loss trend for the benefit of human well-being, the Government of Uganda (GOU) and other partners have implemented strategies and initiatives. This is further supported by the country's third National Development Plan (NDP III) 2020/21- 2024/25 with a target of increasing wetland coverage to 9.57% in FY 2024/25 from 8.9% in FY2020/21 through restoration (NDP III, 2020/21- 2024/25). Wetland restoration and improving land use practices reduce greenhouse gas emissions, increase carbon sequestration, and ecosystem service productivity (Delgado et al, 2015).

Restoration calls for a multispectral, disciplinary, and coordinated, integrated approach to natural resource and landscape management through resource conservation, boosting productivity, social-economic development, and poverty alleviation (Delgado *et al*., 2015; Rodrigo, 2021). Furthermore, strengthening the links between research and policy implementation is important for sustainable wetland restoration in Uganda. With increasing international and regional interest and investment in wetland restoration through funding, conventions, and national policies among others, the comprehensive evaluation of the failure and success of these interventions is rarely assessed for informed future directions. Determining the success of restoration programs is challenging as the term definition is imprecise as it varies depending on the context and individuals involved Zedler(2007), this underscores the need for evaluation of the restoration activities implemented.

Restoration has biological and social outcomes, this forms the debate on the success and failure of restoration programs (Walters *et al*, 2021). Restoration success can be complete recovery, relatively quick, partially successful with some degree recovery or it can yield little or no recovery thus failure. The success of restoration projects and programs spans from species resilience to regaining and performing natural processes and failure is attributed to a mixture of local and landscape constraints that involve management and natural processes. This can be addressed through perspective strategies like enhancing ecosystem services, resilience to future change, supportive environmental policies, evidence-based evaluation, and interdisciplinary collaboration (Suding, 2011).

Despite ecological outcomes, social outcomes in most restoration projects are limited, this hinders future support for restoration activities as they create negative externalities for commercial land uses in the communities neighbouring the wetland (Buckley & Crone, 2008). This review article deepens the understanding of the factors for the success and failure of restoration projects and programs in Uganda.

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Methodology

This review was done through a narrative literature review and the information obtained from original peer-reviewed articles published in scientific journals with a focus on wetland degradation and restoration in Uganda. We critically searched electronic literature databases from trusted courses including but not limited to Google Scholar, PubMed, and Research Gate for all available peer-reviewed data. The following key search terms were used "wetland degradation", "wetland conservation" OR "wetland restoration" The accuracy of the information was peer verified by a third party who reviewed the draft write-up, and any differences were settled by debate among the authors. After the writers' discussions, the final data were gathered, looked over, and contrasted, and conclusions were reached as consequently for articles published in English between 2010 and 2024.

Trend and Status of Wetlands in Uganda

Globally, it is estimated that 70% of the wetlands has been lost since 1970 with the largest loss in the 20th century, and loss trend is projected to increase unless comprehensive and holistic wetland management approaches are adopted (Gupta & Gupta, 2023). Despite Africa having the largest share of the global wetland coverage estimated at 131 million hectares, it experiences the greatest wetland loss (Xu *et al,* 2019). With increasing anthropogenic activities such as expansion of the agricultural land, urbanization, and industrialization due to economic demand amidst the growing human population, natural resources such as wetlands are over-strained (Kuchara *et al,* 2023). Uganda has continuously had a significant change in wetland coverage over the recent decades, for instance**,** the extent of wetlands reduced by 15.6% from 37,575 km^2 in 1994 to 13% by 2017, 2021 at 13.9%, (Figure 1), and of the remaining wetlands, only 9.3% remains intact while 4.1% has succumbed to degradation (National State of the Environment Report 2021-2022). The eastern region has over time recorded the greatest wetland loss to agricultural land expansion due to rice growing (NSOER, 2022. (Table 1, Figure 3)

The key factors for wetland degradation and loss in Uganda include; urbanization, industrial development and population increase at a rate of 3% annually, mining, and agriculture (Turyasingura, 2022). Implemented strategies such as the Environment Protection Force (EPF), cancellation of illegal titles issued in wetlands, designation of wetlands as Ramsar sites, sensitization/awareness, and wetland demarcation have significantly contributed to the restoration progress in Uganda (Yikii, 2018)(Figure2).The institutions involved in the wetland management and restoration in Uganda include the ministry of Water and the Environment, the National Environment Management Authority (NEMA), Non-Governmental Organizations, Community-Based Organizations among others. Notable wetland- water catchment areas threatened in Uganda include; Edward Nile basin 7,130 km^2, Achwa River Basin (27,601 km^2) Albert Nile Wetland Basin (20,047 km^2) Lake Edward Wetland Basin (7,130 km^2) Lake Albert Wetland Basin (18,037 km^2) Lake Kyoga Basin (57,233 km^2), Victoria Nile Wetland Basin (27,389 km^2) (Uganda wetland atlas 2016)

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Figure 1; Graphical trend of wetlands in Uganda Source. National State of the Environment Report 2022

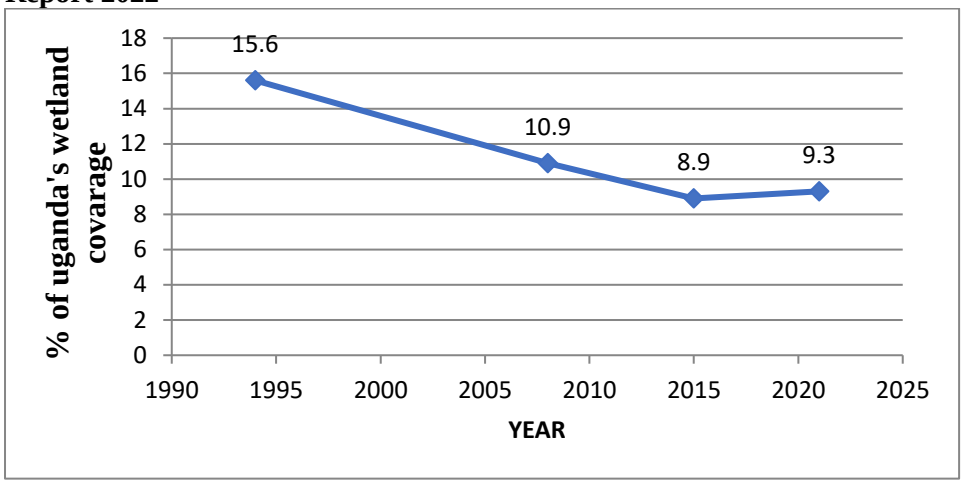

Figure 2: Wetland restoration progress in Uganda. Source: National State of the Environment Report 2022

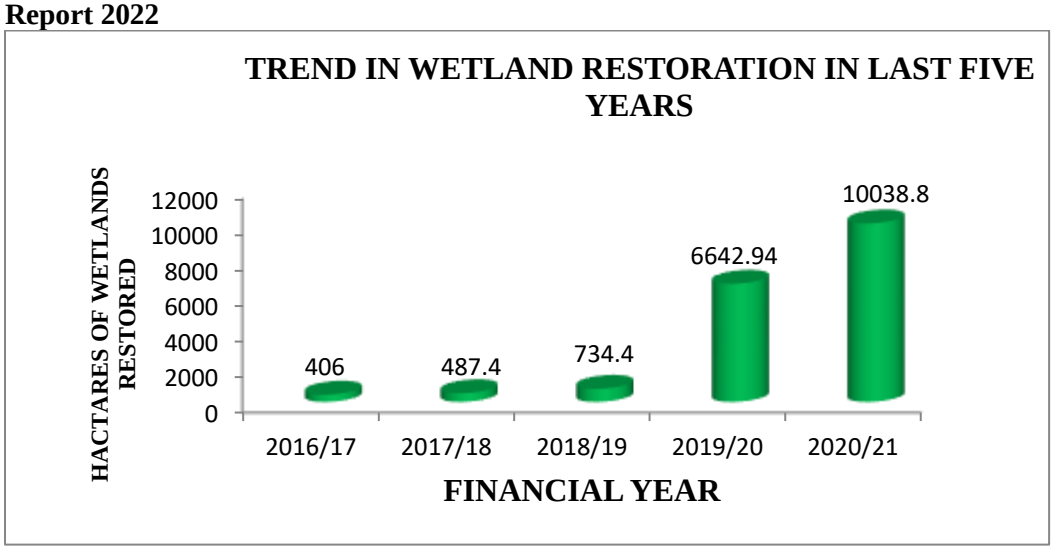

Figure 3: Rice growing severely degraded Namatala wetland in Mbale district eastern Uganda.

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Table 1: Regional wetlands status in Uganda (1994-2021)

Region	1994(sq.km)	2021(sq.km)	Degraded(sq.km)
Central	977.6(28.9%)	7363.9(32.8%)	2409.7(21.3%)
Eastern	9171.7(27.2%)	4533.4(20.2%)	4638(41.0%)
Northern	9579.6(28.4%)	68000.0(30.3)	2779.7(26.4%)
Western	5237.6(15.5%)	3760.2(16.7%)	1477.5(13.1%)

Source: Ministry of Water and Environment, Wetland Department.

The factors influencing Wetland Restoration.

Effective wetland restoration is influenced by several factors from early planning to post-implementation, monitoring and learning from past experiences is important for future restoration programs amidst change and the need for development **(**Spieles and Douglas, 2022). These factors include governance, project scope, land ownership, better possible alternative livelihoods, and indigenous knowledge among others.

Governance-Institutional and policy environment

Over time, decentralization has been argued as one of the effective ways of restoration in natural resource management indicating power dissolution as an effective collective tool for community action (Larson,2008). There is a significant link between restoration and decision-making, community-government relations, and benefit sharing. Weak interlinkages and partnerships between sectors, departments alongside the absence of ordinances and by-laws on watershed restoration, can lead to failure of s some restoration projects (Akello *et al.,* 2017). However, decentralization in wetland restoration is limited by elite capture, local elites take advantage of the poor, weak accountability, conflicts over resources, and limited capacity (Brown & Lassoie 2010). Other governance challenges include inadequate institutional capacity, knowledge gaps of existing legal frameworks, political interference, inadequate funding, corruption, and accountability by local leaders that have a significant influence on restoration outcomes (Nakiyemba,2013). This calls for a multifaceted approach and having good governance principles for reliability and realization of the expected restoration outcomes (Agaton, 2024).

Land tenure systems on land restoration

The constitution of Uganda recognizes mainly four land tenure systems that is freehold, leasehold, mailo land, and customary tenure (Uganda Constitution 1995). The differences in the in the customary, religious, and statutory settings significantly influence the land ownership and use rights as well as the gender roles (Musinguzi et al, 2021). In Uganda, most women traditionally do not own land and yet dominate the agricultural sector, one of the threats to wetland management and thus they play a significant role in the degradation of the ecosystems (Rugadya,2008). Women are important stakeholders in wetland restoration but they are often neglected. This has hindered the restoration efforts as there is a gender gap due to social beliefs, customs, limited knowledge and skills, and obstacles to land ownership (Abillah, et al, 2021). This calls for inclusive stakeholder engagement approaches to address the inefficiencies in land management. Women play a critical role and evidence has shown their significant contribution in restoration for example Mikoko Pamoja in Kenya where women were involved in the project leadership (Wylie et al., 2016).

Cultural, Traditional, and Indigenous Knowledge.

Often ignored, traditional and indigenous knowledge is very influential in restoration programs. Integration of traditional knowledge provides a wealth of wisdom, practices about past and current ecological, and community needs status for contextual and appropriate interventions/approaches. It identifies keystone species and sites, empowers communities, sustainable land management practices (Santini and Miquelajauregui, 2022). However, it is

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subject to several limitations as it requires comprehensive inclusivity of a diversity of cultural values and practices varying across, geographical regions in a shared, fair and equitable manner. It is also limited by conflicting and contradicting cultural values in the same region. Addressing these limitations, restoration programs would benefit from the knowledge within traditional and indigenous communities for social and ecological benefits (Chirwa, Larwanou, & Syampungani, 2015).

Alternative livelihoods

Natural resources such as wetlands and forests are at the center of social, political and economic development of most countries in Africa as they are key in their economies and peoples' livelihoods because of their ecosystem services (Herrick *et al.,* 2019). Over time people have depended on these resources however, in the last two decades, the use is unsustainable leading to destruction and degradation (Zhang *et al.,* 2022). Communities depend on these resources for agriculture, and other activities like mining. At the 5th International Union for Conservation of Nature (IUCN) World Conservation Congress in 2012, alternative livelihood programs were adopted as a tool for wetland restoration and biodiversity management. Alternative livelihood options are strategies for achieving biodiversity conservation by replacing existing livelihood strategies of significant effect to the environment (Roe *et al,* 2015). Restoration programs at the community level often result displacement and shift in livelihood sources leading to food shortages underscoring the need for sustainable and effective alternative livelihoods. Short of this, the restoration success is limited for example Limoto wetland restoration in eastern Uganda failed because the alternatives were ineffective and unsustainable, restoration necessitates alternatives that are sustainable, community-tailored, tenable, and benefit local communities while safeguarding natural resources (Kameri, 2023).

Past Restoration Profiling and Baseline Studies

With growing interest in restoration as agreed under the Convention on Biological Diversity (CBD) for all member states to restore degraded areas and promote biodiversity conservation, several projects have been implemented, however, they are poorly documented. This limits the general and specific understanding of the dynamics involved in restoration and lessons for future directions (CBD.2010; Thomas et al, 2014). In Uganda, the restoration activities are poorly documented and not readily available for access. Additionally, restoration activities do not have sufficient history and baseline understanding of the degraded areas. These form the basis of evaluating the success and failure of many restoration projects.

Project/Program-Level Scope

Project/program-level factors are key in determining the success or failure of restoration interventions. These range from the design to implementation stages of projects and programs and include strategies, approaches, and activities implemented within specific projects or programs (Ika& Pinto, 2022). Among the factors, the selection of appropriate restoration practices, restoration techniques, and methods is instrumental as some may be more suitable for specific landscapes or ecosystems, soil conditions, and climate change (Schuster and Doerr,2015). Therefore, careful consideration and evaluation of restoration practices is essential for achieving successful restoration outcomes.

Monitoring and evaluation allows for the assessment of restoration progress, identification of challenges or issues, and adjustment of strategies as needed. Robust monitoring and evaluation systems enable project managers to track the success of restoration interventions, identify areas for improvement, and make informed decisions for future actions (Djenontin *et al.,* 2018). According to Bernhardt *et al,* (2007) less than half of the restoration projects set SMART objectives. Project/program-level factors are crucial in determining the success or failure of restoration interventions. The selection of appropriate restoration practices, availability of

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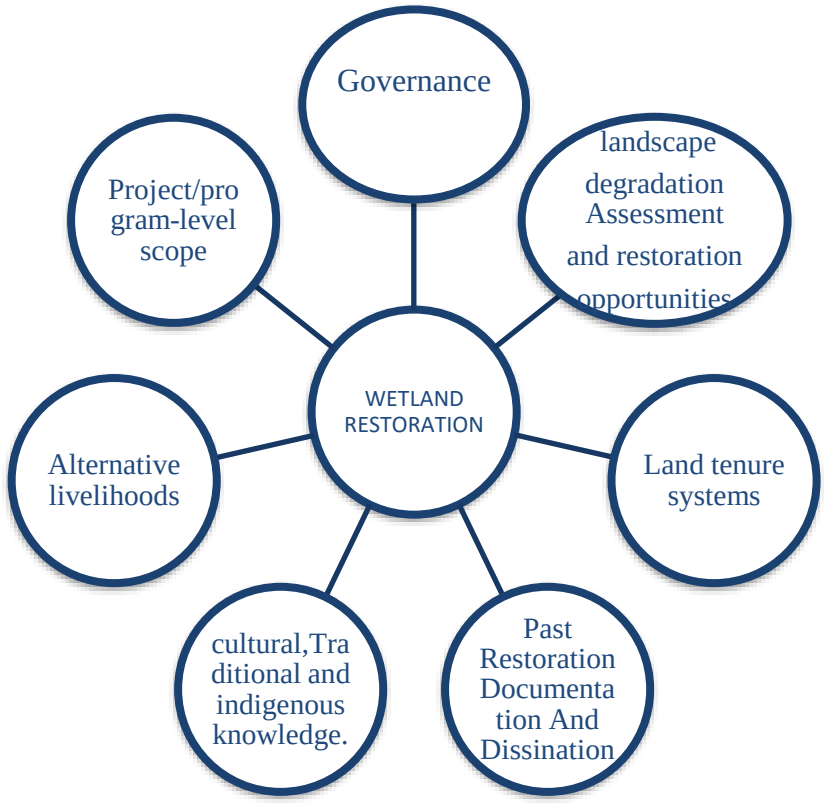
technical support and resources, and effectiveness of monitoring and evaluation systems are key factors that influence restoration outcomes (Cao *et al*, 2024).It is important to consider these project/program-level factors in conjunction with other factors at different scales to achieve successful restoration programs.



Factors influencing wetland restoration

Conclusion.

The journey of wetland restoration has been marked by both successes and failures, offering valuable lessons for future endeavors. Despite significant challenges, restoration efforts have demonstrated the potential for ecological recovery through community engagement, better alternative livelihoods, well thought after project/program level scope, Key hindrances to restoration include lack of better alternative livelihoods, poor governance and traditional beliefs, however, the persistence of wetland degradation underscores the need for a nuanced understanding of the factors influencing restoration outcomes.

Through the examination of case studies and review of literature, it becomes evident that the success of wetland restoration hinges on a multitude of factors, including effective governance through robust management practices and enabling policies, stakeholder engagement, and the integration of traditional knowledge. Conversely, failures often stem from inadequate planning, weak institutional frameworks, and unsustainable livelihood alternatives. These lessons highlight the importance of adaptive management and evidence-based decision-making in navigating the complex dynamics of wetland restoration.

In conclusion, it is vital to take into account the hard-earned lessons from successful and failed wetland restorations for future restoration programs. This requires interdisciplinary cooperation, community-centered practices, and resilience-based restoration strategies. It is possible to create a more sustainable path to preserving and restoring these critical landscapes

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for both current and future generations by embracing this complexity.

4.1Additional point

This review process involved use of some of the non-reviewed reports, hence it might be subject to publication bias, but provides ground information form projects implemented in Uganda. This article might have missed some other information from the articles not reviewed and those not within the searched publication sites. However, it contains important information that can be adopted beyond Uganda in wetland restoration.

4.2 Declaration of competing interest

The authors declare no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. Apart from the national statement of the environment report 2021/22 prepared by national environment management authority the organization he works for.

4.3Author's contribution

D. Twinomujuni is the author of the review. A. Tumwebaze.

E. Baluku. F. Ogwal reviewed and edited the work. R. Komakech as a corresponding author.

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REFERENCES

Abillah, I.O., Mwangi, B., Otieno, R. J., & Machogu, C. (2021). Gender Roles in Wetlands Conservation and Restoration in Murang'a County, Kenya.

Agaton, C. B., & Guila, P. M. C. (2024). Success Factors and Challenges: Implications of Real Options Valuation of Constructed Wetlands as Nature-Based Solutions for Wastewater Treatment. Resources, 13(1), 11.

Akello, Sarah & Nelson, Turyahabwe & Sseguya, Haroon & Okullo, Paul & Agea, Jacob. (2017). Local Community Participation in Restoration of Watersheds in Uganda. American Journal of Environmental Protection. 5. 25-32. 10.12691/env-5-2-1.

Amler, Esther & Schmidt, Michael & Menz, Gunter. (2015). Definitions and Mapping of East African Wetlands: A Review. Remote Sensing. 7. 5256-5282. 10.3390/rs70505256.

Bernhardt ES, Sudduth EB, Palmer MA, Allan JD, Meyer JL, 2007. Restoring rivers one reach at a time: results from a survey of US river restoration practitioners. Restor. Ecol. 15:482–93

Brown, H. & Lassoie, James. (2010). Institutional choice and local legitimacy in community-based forest management: Lessons from Cameroon. Environmental Conservation. 37. 261 - 269. 10.1017/S0376892910000603.

Cao, R.; Wang, J.; Tian, X.; Zou, Y.; Jiang, M.; Yu, H.; Zhao, C.; Zhou, X. Post-Restoration Monitoring of Wetland Restored from Farmland Indicated That Its Effectiveness Barely Measured Up. Water 2024, 16, 410. https://doi.org/10.3390/w16030410

CBD. 2010. Decision adopted by the Conference of the Parties to the Convention on Biological Diversity at its tenth meeting. UNEP/CBD/COP/DEC/X/2. 29 October 2010 (available at https://www.cbd.int/doc/decisions/cop-10/cop-10-dec-02-en.pdf). Accessed 06/17/2015

Davidson, N. C. How much wetland has the world lost? Long-term and recent trends in global wetland area. Marine Freshwater Res. 65, 936–941 (2014).

Delgado, C., Wolosin, M., & Purvis, N. (2015). Restoring and protecting agricultural and forest landscapes and increasing agricultural productivity. Working Paper for Seizing the Global Opportunity: Partnerships for Better Growth and a Better Climate, 1–44. Retrieved fromhttp://2015.newclimateeconomy.report/

Article DOI: https://doi.org/10.37284/eajenr.7.1.2153

wp-content/uploads/2015/12/NCE-restoring-protecting-ag-forest-landscapes-increase-ag.pdf.

Delgado, Christopher & Wolosin, Michael & Purvis, Nigel. (2015). Restoring and protecting agricultural and forest landscapes and increasing agricultural productivity.

Djenontin, Ida Nadia & Foli, Samson & Zulu, Leo. (2018). revisiting the Factors Shaping Outcomes for Forest and Landscape Restoration in Sub-Saharan Africa: A way Forward for Policy, Practice and Research. Sustainability. 10. 906. 10.3390/su10040906.

Gupta, A., & Gupta, S. (2023). Environmental Issues and Challenges. Taylor & Francis.

Herrick JE, Abrahamse T, Abhilash PC, Ali SH, Alvarez-Torres P, Barau AS, ... & Von Maltitz GP (2019) Land restoration for achieving the sustainable development goals: An international resource panel think piece. United Nations Environment Programme. https://wedocs.unep.org/bitstream/handle/20.500.11822/29749/LandSDG.pdf?sequence=1&is Allowed=y

Ika, Lavagnon & Pinto, Jeffrey. (2022). The "re-meaning" of project success: Updating and recalibrating for modern project management. International Journal of Project Management. 40. 10.1016/j.ijproman.2022.08.001.

Kameri Ochoko, J., Luyiga, S., & Barasa, B. (2023). Wetland Restoration Dilemma in Uganda: Investigation of Alternative Livelihood Options for Restoring Limoto Wetland in Eastern Uganda. American Journal of Environment Studies, 6(1), 74 - 92. https://doi.org/10.47672/ajes.1462

Kuchara, Vishwa & Charan, Ronak & Mankad, Archana & Solanki, Hitesh. (2023). Wetland Degradation and Loss Due To The Expansion Of Anthropogenic Activities. International Association of Biological and Computational Digest. 2. 41-47. 10.56588/iabcd.v2i2.191.

Larson, A. & Soto, Fernanda. (2008). Decentralization of Natural Resource Governance Regimes. Annual Review of Environment and Resources. 33. 10.1146/annurev.energy.33.020607.095522.

Musinguzi M, Enemark S, Mwesigye SP (2021) Fit for purpose land administration: Country implementation strategy for addressing uganda's land tenure security problems. Land 10

Nakiyemba, Alice & Isabirye, Moses & Poesen, J. & Maertens, Miet & Deckers, Jozef & Mathijs, Erik. (2013). Decentralised Governance of Wetland Resources in the Lake Victoria Basin of Uganda. Natural Resources.04. 55-64. 10.4236/nr.2013.41006.

NSOER 2022, National State of Environment Report 2022

Reed, D.J. (2005). Wetlands. In: Schwartz, M.L. (eds) Encyclopedia of Coastal Science. Encyclopedia of Earth Science Series. Springer, Dordrecht. https://doi.org/10.1007/1-4020-3880-1_352

Rodrigo, M. A. (2021). Wetland restoration with hydrophytes: A review. *Plants*, *10*(6), 1035.

Roe, D., Booker, F., Day, M., Zhou, W., Allebone-Webb, S., Hill, N. A. O., Kumpel, N., Petrokofsky, G., Redford, K., Russell, D., Shepherd, G., Wright, J., & Sunderland, T. C. H. (2015).

Rugadya MA (2008) Unveiling gender, land and property rights in post-conflict Northern Uganda. Associates research occasional paper 4:1–17

Santini NS and Miquelajauregui Y (2022) The Restoration of Degraded Lands by Local Communities and Indigenous Peoples. Front. Conserv. Sci. 3:873659. doi: 10.3389/fcosc.2022.873659

Schuster, E. and Doerr, P. (2015). A Guide for Incorporating Ecosystem Service Valuation into Coastal Restoration Projects. The Nature

Article DOI: https://doi.org/10.37284/eajenr.7.1.2153

Conservancy, New Jersey Chapter. Delmont, NJ.

Spieles, Douglas. (2022). Wetland Construction, Restoration, and Integration: A Comparative Review. Land. 11. 554. 10.3390/land11040554

Suding, K. N. (2011). Toward an era of restoration in ecology: Successes, failures, and opportunities ahead. Annual Review of Ecology, Evolution, and Systematics, 42, 465-487.http://dx.doi.org/10.1146/annurev-ecolsys-102710-145115

Thomas, E., Jalonen, R., Loo, J., Boshier, D., Gallo, L., Cavers, S., Bordács, S., Smith, P. & Bozzano, M. 2014. Genetic considerations in ecosystem restoration using native tree species. Forest Ecology and Management, 333, 66–75

Turyasingura, Benson & Saturday, Alex & Hubert, Hirwa & Mohammed, Fatima. (2022). Wetland conservation and management practices in Rubanda District, South-Western Uganda. 10.21203/rs.3.rs-1876968/v1.

Uganda wetland Atlas 2016

Walters, M. Baruah, M. Karambiri, P. Osei-Wusu Adjei, C. Samb, E. Barrow,the power of choice:: How institutional selection influences restoration success in Africa, land use policy, Volume 104,2021,104090,ISSN 0264-8377

Warsame, Ali & Luyiga, Suzan & Akiyode, Oluwole. (2022). Assessing Wetland Degradation in a Growing Urban Area: Case of Nsooba in Kampala, Uganda. 1. 1.

Wylie, L., Sutton-Grier, A. E., & Moore, A. (2016). Keys to successful blue carbon projects: Lessons learned from global case studies. Marine Policy, 65, 76-84.

Xu T, Weng B, Yan D, Wang K, Li X, Bi W, Li M, Cheng X, Liu Y. Wetlands of International Importance: Status, Threats, and Future Protection. Int J Environ Res Public Health. 2019 May 22;16(10):1818. doi: 10.3390/ijerph16101818. PMID: 31121932; PMCID: PMC6571829.

Yikii, Fred. (2018). Awareness, perceptions and implementation of policy and legal provisions on wetlands in Uganda.

Zedler, J. (2007). Success: An Unclear, Subjective Descriptor of Restoration Outcomes. Ecological Restoration. 25. 162-168. 10.3368/er.25.3.162.

Zhang, Y., Khan, I., & Zafar, M. W. (2022). Assessing environmental quality through natural resources, energy resources, and tax revenues. Environmental Science and Pollution Research, 29(59), 89029-89044.

