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Restoring rangelands: Evaluating the Effectiveness of Assisted Natural Regeneration (ANR) for invasive *Opuntia stricta* Control and Community Perception in Maiyanat Community Conservancy, Kenya

Overview

Rangelands in Laikipia County are important for both people and nature. These grassland ecosystems play a key role in maintaining biodiversity and supporting local economies. They support a wide range of wildlife and provide rich cultural diversity. The Laikipia county is home to Kenya's famous indigenous Maa Community, whose livelihood depend largely on pastoralism. However, the spread of *Opuntia stricta* (Haw.) Haw, an invasive cactus species, is threatening these valuable rangelands. The plant reduces grazing land, displaces native vegetation, and degrades habitats for wildlife and livestock, cause injury to livestock, leading to biodiversity loss and challenges for pastoral livelihoods.

O. stricta was introduced to the area around the 1950s and has since spread widely across the landscape (Strum et al., 2015). Its high adaptability, aided by tissues containing about 90% water, enables it to survive harsh conditions and thrive in diverse habitats, including rocky and disturbed areas, where it outcompetes native vegetation (Shackleton et al., 2017). With few parasites and a high reproductive capacity, the species spreads rapidly and is difficult to control (Mugane et al., 2024).

Background

Several approaches have been used to control *O. stricta* in Maiyanat, including physical removal, biological control, mechanical clearing by tractors, utilization, and Assisted Natural Regeneration (ANR), that is, the removal of *O. stricta* to accelerate natural forest recovery. Despite ongoing control efforts, current management is guided by broad policies that do not specifically address *O. stricta*.

This policy brief draws on field evidence from 100 nested ecological plots (20×20m for trees species; 3×3m for grasses), including 50 restored and 50 non-restored sites, as well as 40 household interviews and three focus group discussions with locals and decision-makers across the Maiyanat rangeland on their perspectives of use and management options, with a view to assess the effectiveness of ANR in controlling *O. stricta*.

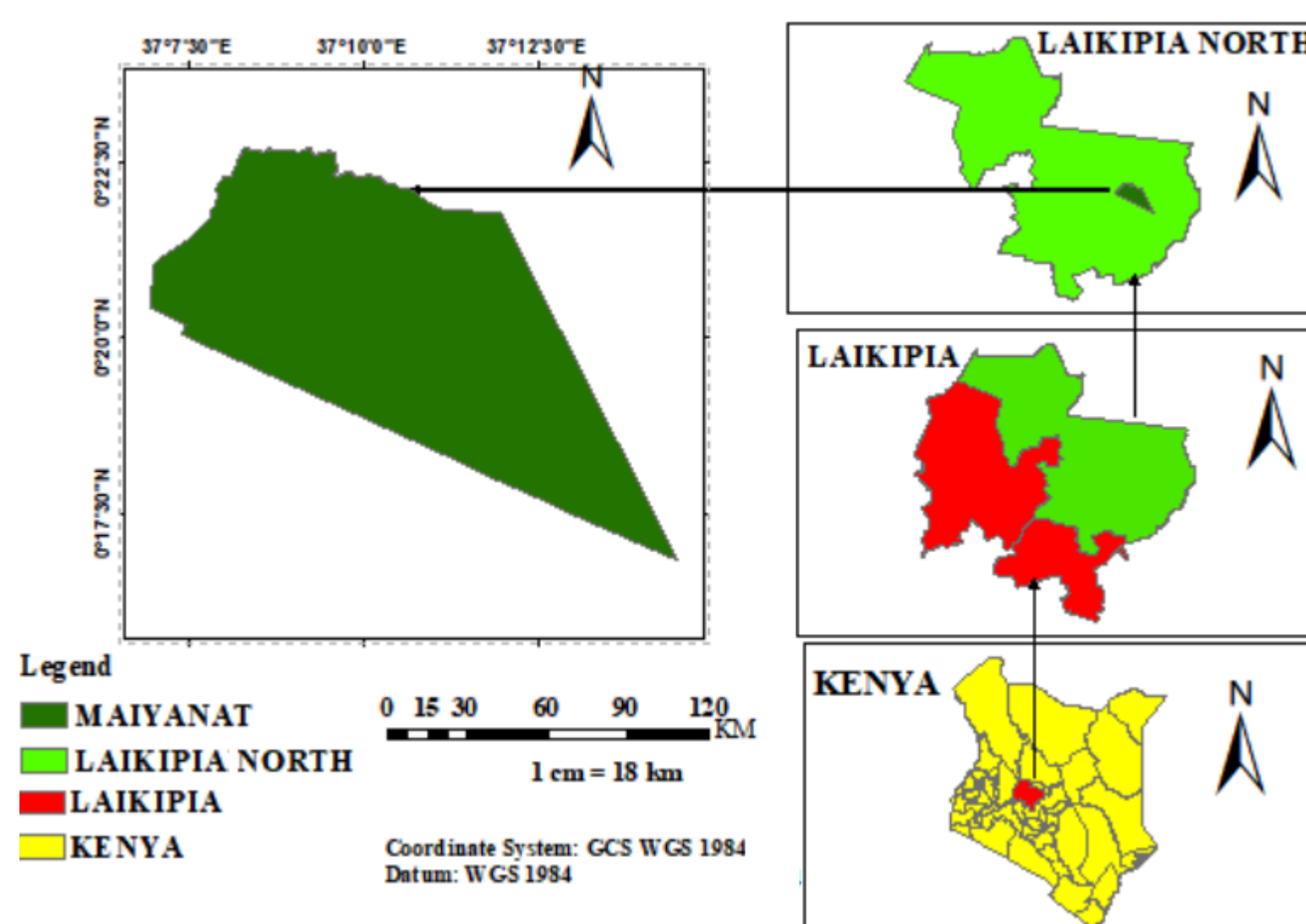


Fig. 1. Map of Maiyanat community conservancy (study area)

Key recommendations

- Develop and implement a national invasive *Opuntia stricta* management strategy that formalizes stakeholder coordination and provides a clear framework for control, utilization, and long-term management.
- Promote the productive use of *O. stricta* by scaling up and supporting value chains such as biofuel, cactus juice, oil, and other products, transforming the invasive species into an economic resource that supports its control.
- Strengthen local coordination and evidence-based management through county-led monitoring, hotspot mapping, community participation, and localized research to guide effective interventions.
- Enforce biosecurity measures to prevent further spread, including strict regulations on the movement of manure and materials from infested areas.
- Invest in sustainable control methods by allocating dedicated funding and assessing the environmental and carbon impacts of large-scale control approaches before implementation.



Key findings

Ecological assessments showed that Assisted Natural Regeneration (ANR) significantly improved rangeland restoration, with restored sites recording a 36.8% higher plant species richness than non-restored sites (Fig. 2).

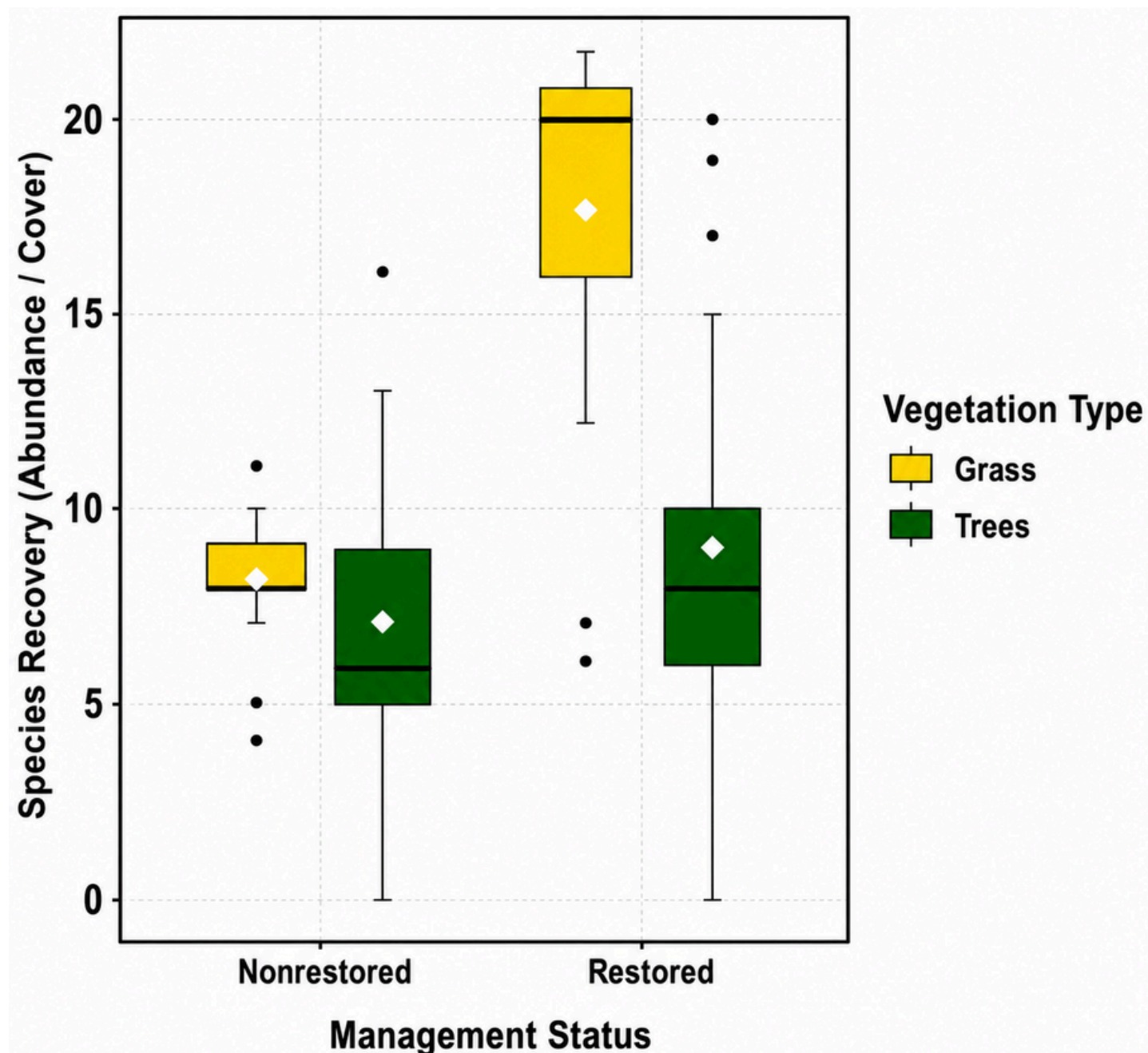


Fig. 2. Box plot showing native species distribution in non-restored (n = 50) and restored (n = 50) sites. Horizontal lines are median values, white diamonds are mean, and red dots are outliers

Household interviews and focus group discussions highlighted the perceived threats on local livelihoods of *O. stricta* (Fig. 3), as well as its resilience. A single fruit contains approximately 113 seeds and can remain viable for up to two years, enabling the species to survive drought periods and rapidly regenerate when moisture becomes available. Respondents also highlighted the strong potential for utilizing *O. stricta* as livestock feed. Among the tested treatments, slurry-based feed was the most preferred by livestock, with animals adapting more quickly compared to feed prepared through burning and chopping. In addition, participants reported that processing *O. stricta* biomass into biogas can provide a sustainable source of household energy. Empirical evidence indicated that one bucket of slurry in a bio-digester can produce enough cooking gas for a household for up to one week.

Finally, stakeholders identified a policy gap in the management of *O. stricta*. Existing invasive species management is guided by broad policies that do not specifically address *O. stricta*, limiting the effectiveness of control and restoration efforts.

KEY REFERENCES

- Mugane, J., Muok, B., & Bulli, P. (2024). Influence of prickly pear cactus (*Opuntia stricta*) on the socio-economic status of pastoral livelihoods of rangelands in the Northern Rift Valley of Kenya. *Editon Consortium Journal of Geography and Environmental Sciences*, 2(1), 1–18.
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- Strum, S. C., Stirling, G., & Mutunga, S. K. (2015). The perfect storm: Land use change promotes *Opuntia stricta*'s invasion of pastoral rangelands in Kenya. *Journal of Arid Environments*, 118, 37–47.

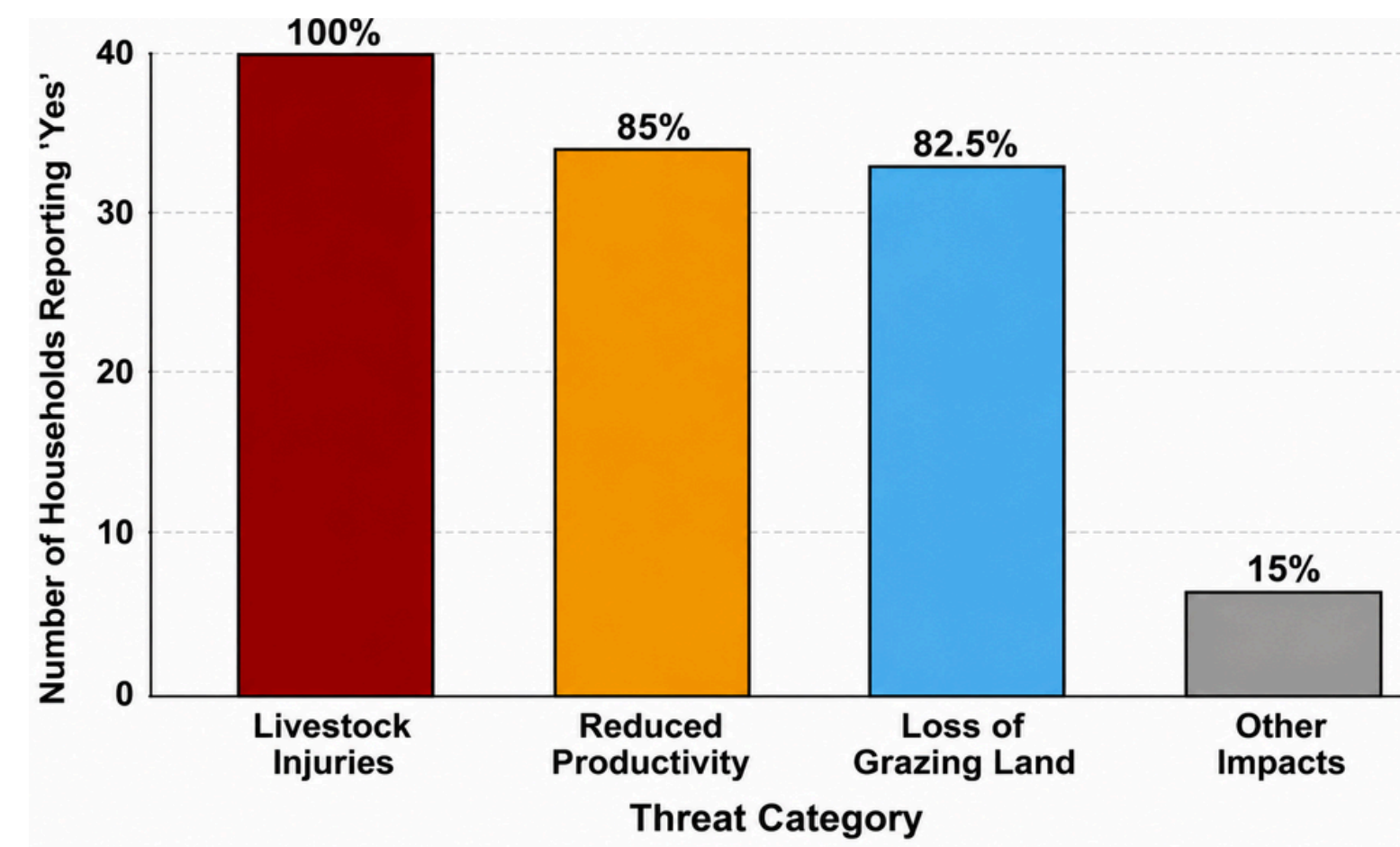


Fig. 3. Bar graph showing perceived threats of *O. stricta* on livelihoods by respondents (n = 40) in Maiyanat

Precautionary observation

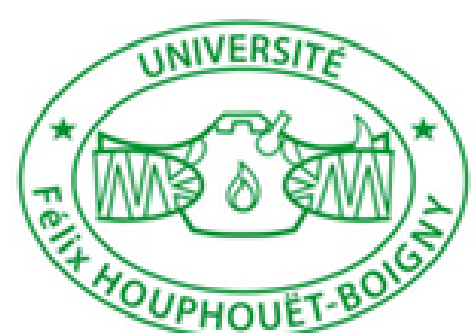
Although this study focused on *O. stricta* management, stakeholders raised concerns about the growing promotion of Juncao grass in parts of Kenya, including Laikipia (Naivasha) and Mandera. Its strong performance in dry environments has increased interest in its use as livestock fodder. However, lessons from *O. stricta* highlight the need for caution when introducing new species. Also, given that Juncao has lower crude protein content than Australian Red Napier Grass, there is need for localized ecological compatibility assessments before large-scale expansion to minimize potential environmental risks and prevent future invasive threats.

Conclusion

The findings from Maiyanat demonstrate that Assisted Natural Regeneration (ANR) is an effective approach for restoring rangelands invaded by *Opuntia stricta*, resulting in a 36.8% increase in species richness in restored areas. The study also shows that control through utilization offers additional benefits, including livestock feed and biogas production, creating opportunities to turn the invasive species into a useful resource.

However, the persistence and rapid spread of *O. stricta*, combined with the absence of species-specific policy guidance, continue to hinder long-term management efforts. Effective restoration therefore requires a dedicated policy framework that supports coordinated action, community participation, and evidence-based management. Integrating scientific research, indigenous local knowledge, and practical utilization pathways will strengthen efforts to control *O. stricta*, restore biodiversity, and improve the resilience of Laikipia's rangelands.

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