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Bridging gender gaps in rangeland resource and conflict mapping: the role of participatory GIS, a case study in Kenya

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Key words: Participatory GIS (PGIS); Gender Inclusion; Rangeland; Resource Mapping

Abstract

This study examines the role of Participatory Geographic Information Systems (PGIS) in resource mapping, policy formulation, and conflict resolution in Isiolo County, Kenya. PGIS integrates Traditional Ecological Knowledge (TEK) with modern mapping to engage local communities and enhance mapping accuracy beyond conventional methods. The approach emphasizes gender inclusion, as men and women contribute distinct yet complementary knowledge. Men typically identify broader geographic features and economic stability resources, while women provide insights into water sources and household-level needs, addressing issues such as water access and food security. Gender-specific maps underscore the value of including women in resource management, fostering strategies that reflect the needs of all community members and enhancing decision-making equity. PGIS also helps address regional conflicts over rangeland resources by mapping contested areas and facilitating dialogue among groups like the Samburu and Turkana communities. Through Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs), the study captures a wide range of local perspectives on environmental challenges, climate impacts, and security risks. This inclusive approach supports culturally relevant and scientifically grounded resource governance, which is essential for building resilience in pastoralist communities. Overall, the findings highlight PGIS as a valuable tool for sustainable rangeland management, aligning with broader frameworks for climate resilience and conflict management. By promoting community-led mapping and incorporating diverse perspectives, PGIS enables comprehensive solutions to complex environmental and socio-economic challenges, advancing effective policy outcomes in Kenya's rangelands.

Introduction

Rangelands, often arid or semi-arid landscapes, are essential for millions of pastoralists and agro-pastoralists who rely on grazing lands, water sources, and vegetation for their livelihoods. However, these resources are highly variable and vulnerable to environmental pressures. Participatory Geographic Information Systems (PGIS) is a valuable tool in Africa for managing these rangelands (Cho and Mutanga 2021). PGIS combines traditional ecological knowledge with modern mapping technologies, allowing local communities to contribute their understanding of the landscape to create accurate, context-specific maps that often surpass what remote sensing alone can achieve (McCall and Dunn 2012). Incorporating gender balance in Participatory GIS (PGIS) is essential because men and women bring distinct knowledge and experiences regarding natural resources. Including both perspectives ensures comprehensive, accurate resource mapping and supports equitable

decision-making (Bullock et al. 2022). Actively involving women in PGIS recognizes their specific needs, like water accessibility, fostering solutions that benefit all community members (Boongaling et al. 2023). This inclusivity also boosts community buy-in, as both genders see their input reflected in management plans, creating shared ownership crucial for sustainable resource initiatives.

Our study examines community perceptions on land use, natural and market resources, land management challenges, and climate-related risks, recognizing the often-gendered nature of these views. We used PGIS, focus group discussions, and key informant interviews to capture gender-specific local knowledge for more accurate rangeland mapping. Key objectives include integrating traditional ecological knowledge into PGIS, engaging diverse community members—especially women and marginalized groups—to ensure comprehensive resource management, and using PGIS to map conflict zones, promoting dialogue and cooperation to resolve disputes.

Methods

We conducted a Participatory GIS (PGIS) workshop in Isiolo County, Kenya, to gather local insights on rangeland resource management in May 2024. Participants were divided into three groups—men, women, and a mixed group (both men and women). Each group was supported by an enumerator trained in map reading and effective questioning. The male and female groups were facilitated by male and female enumerators, respectively, to ensure comfortable and open discussions. Each group received a paper map created from Google Earth images (scale 1:22,000) of western Isiolo, consisting of seven joined A1-sized sheets (Corbett 2009). Participants mapped natural and market resources, livestock migration routes, water sources, overgrazed and underutilized areas, and conflict zones (Figure 1).

Figure 1. Different groups at doing a mapping exercise. The right panel shows the map after exercise was conducted

In addition to mapping, we held focus group discussions (FGDs) with all three groups. These discussions aimed to deepen our understanding of the participants' perspectives on local geography, resource utilization, environmental and land management challenges, service access, climate impacts, conflict zones, and security risks. To further validate and expand on the FGDs and mapping results, we conducted key informant interviews (KIIs) with local experts.

Our data analysis involved multiple steps: initially, participants identified and marked familiar features on the map. FGD transcripts were organized and coded based on recurring themes, including land use, resource ownership, climate stressors, and conflict dynamics. Using Nvivo software, we performed thematic analysis to explore patterns across the groups, paying particular attention to gender-based differences in perceptions. This comparative approach helped reveal how men, women, and mixed groups experienced and prioritized rangeland issues differently, enriching our overall understanding of resource management challenges in Isiolo County.

Results

Gendered Perspectives on Resource Mapping

Incorporating gendered perspectives in Participatory GIS (PGIS) exercises has highlighted the distinct yet complementary contributions of men and women to resource mapping in pastoralist communities. The differences in how men and women valued and utilized rangelands were evident in their contributions. Men, often engaged in broader community-level resource management, were quick to map livestock routes, conflict-prone areas, and critical grazing lands, emphasizing practices that sustain herds and support economic stability. Women, initially hesitant, contributed detailed insights into household-level resource needs once engaged. They mapped essential water sources and seasonal rivers, underscoring the critical impact of water scarcity on daily routines and food security. In the mixed group, these perspectives merged, creating a holistic view of rangeland resources (Figure 2). This integration showcased the value of both men's ecological knowledge and women's focus on resource availability for household and livestock needs, emphasizing that inclusive mapping fosters a comprehensive understanding of resource use and challenges.

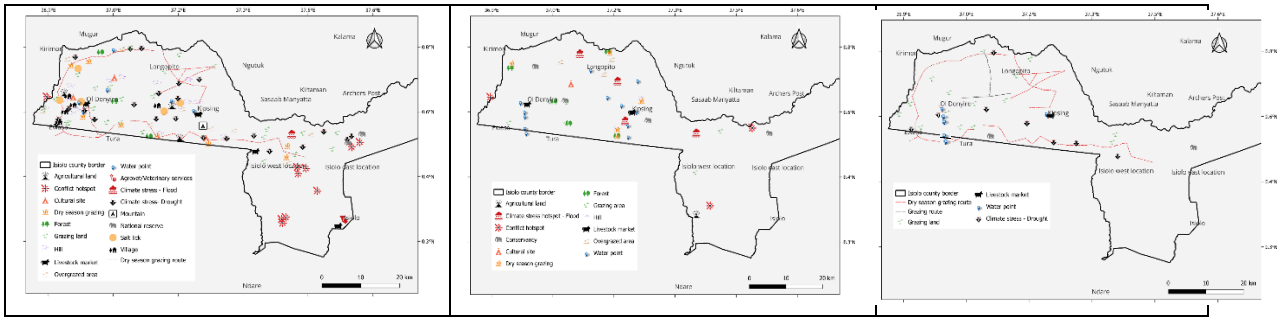

Figure 2. Features marked by men, mixed (both men and women) and women group

Gendered Roles in Environmental Resilience and Conflict Management

The FGDs provided deeper insights on how gendered perspectives shape responses to land challenges, climate stressors, resource conflicts, and climate-related security risks (Figure 3). Men focus on grazing boundaries, livestock disease management, and constructing gabions to prevent soil erosion, while women manage household water resources, build soil conservation structures, and plant grass to protect soil. Climate change exacerbates these challenges, with men noting issues like livestock diseases and resource loss, and women facing heightened burdens in household care and food security due to water scarcity. Conflicts over grazing lands and water points also reveal gendered impacts, with men often involved in cattle rustling disputes and women facing increased vulnerability when managing household survival after conflict. Community-driven solutions, like peace committees and local agreements, demonstrate the need for inclusive, culturally grounded strategies that integrate both men's and women's knowledge for effective resource management and conflict resolution.

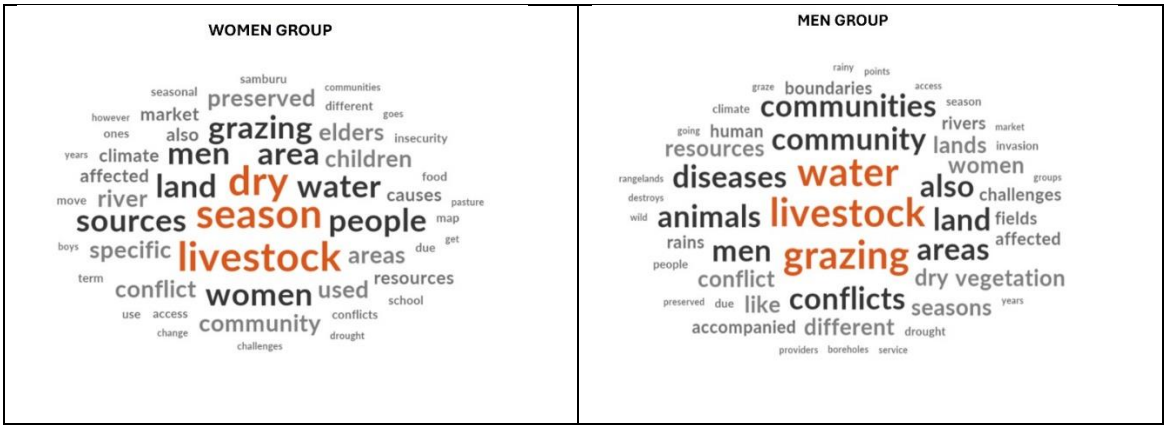

Figure 3. Comparative word clouds highlighting key concerns of women and men groups in Isiolo county, Kenya on resource management and environmental challenges.

Discussion and Conclusions

Our study demonstrates the effectiveness of Participatory GIS (PGIS) for resource management and policy formulation by promoting inclusive decision-making. In our study, we prioritized the inclusion of diverse community members, particularly women and marginalized groups, to capture a wide range of knowledge and experiences related to resource management. The findings revealed that while women provided valuable insights on water points and grazing lands, they lacked confidence in addressing topics like agrovet locations and climatic stress points, often highlighted by men. This reflects women's historical exclusion from resource management discussions, which has limited their exposure and capacity to communicate on these platforms. Gender-specific maps created in our study underscore the unique insights that women bring, especially in areas like water access and household resource use, making them essential for comprehensive management plans. Comparing responses from men, women, and mixed groups provided a deeper understanding of local geography, resource use, and environmental challenges. In conclusion, our research underscores the importance of PGIS, community engagement, and gender inclusion in managing Isiolo's resources. Furthermore, PGIS fosters greater community engagement in policy development, ensuring that policies are grounded in local realities and supported by the people they impact. This engagement helps build trust (McCall 2021).

Acknowledgements

We would like to thank all funders who support this research through their contributions to the CGIAR Trust Funds. We would also like to CGIAR Initiatives - Livestock and Climate, Climate Resilience, and Fragility Conflict and Migration for supporting this work.

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