Soil erosion in East Africa: an interdisciplinary approach to realising land management change

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Introduction: Soil erosion and associated land degradation is a widespread 'wicked problem' for rural communities undergoing transitions across the Global South, as climate change, population growth, political upheaval, land tenure change, and migration put unprecedented pressure on natural resources [1,2,3]. Urgent intervention is required to prevent irreversible loss of ecosystem services as unsustainable land management leads to rates of erosion that exceed natural soil production. While on-site loss of soil and nutrients threatens food security [4], pollution of waterways by silt and nutrients impacts water security, and siltation threatens freshwater biodiversity, tourism and efficiency and lifespan of hydropower dams [5]. Hence, soil erosion has far-reaching implications for the food, water, and energy security nexus with impacts that span multiple UN Sustainable Development Goals (e.g. SDG 1, 2, 3, 6, 13, 15).

Methods: The intractability of soil erosion and land degradation problems can only be addressed through inter-disciplinary collaboration. The inter-disciplinary 'Jali Ardhi' approach (Figure 1) supports co-design of land management policy tailored to the needs of specific communities and places in degraded pastoral land in the East African Rift System through three steps: (I) Defining and analysing the problem (II) Identifying pathways to change, and (III) Facilitating action.

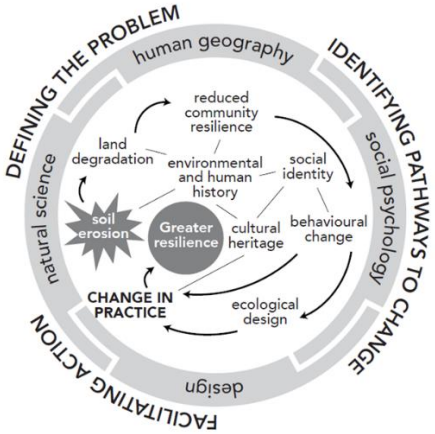

Fig. 1: Disciplines used in this study, their interconnections and position in the soil erosion-land degradation-community resilience challenge

Results: Hydrological and sedimentary evidence shows that, in a northern Tanzanian study region site over the past two decades, severe drought and increased livestock have reduced grass cover leading to surface crusting, loss of soil aggregate stability, and lower infiltration capacity. Infiltration excess overland flow has driven (a) sheet wash erosion, (b) incision along convergence pathways and livestock tracks, and (c) gully development, leading to increased hydrological connectivity. Stakeholder interviews in associated agro-pastoral communities identified significant barriers to adoption of soil conservation measures, despite local awareness of problems. Barriers were rooted in specific pathways of vulnerability, such as a strong cattle-based cultural identity, weak governance structures, and a lack of resources and motivation for community action to protect shared land. At the same time, opportunities for overcoming such barriers exist, through openness to change and appetite for education and participatory decision-making.

Discussion: Guided by specialist knowledge from natural and social sciences, we used a participatory approach that enabled practitioners to enact practice change and become local policy-makers. From this participatory approach emerge pathways towards credible co-designed interventions which can contribute to strengthening community resilience and produce tangible outcomes in the short-term for end-user communities.

References: [1] Bouma et al. (2013) *Geoderma* **200-201**:130-139 ; [2] Koning & Smalling (2005) *Land use policy* **22**:3-11; [3] Ananda & Herath (2003) *J Environ Manage* **68**:343-353 ; [4] Pimentel (2006) *Environ Dev Sustain* **8**:119-137 ; [5] Kondolf et al. (2014) *Earth's future* **2** :256-280