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

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1. UNIVERSITY OF PLYMOUTH
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3. Transformative Learning for Sustainable Living Schumacher College
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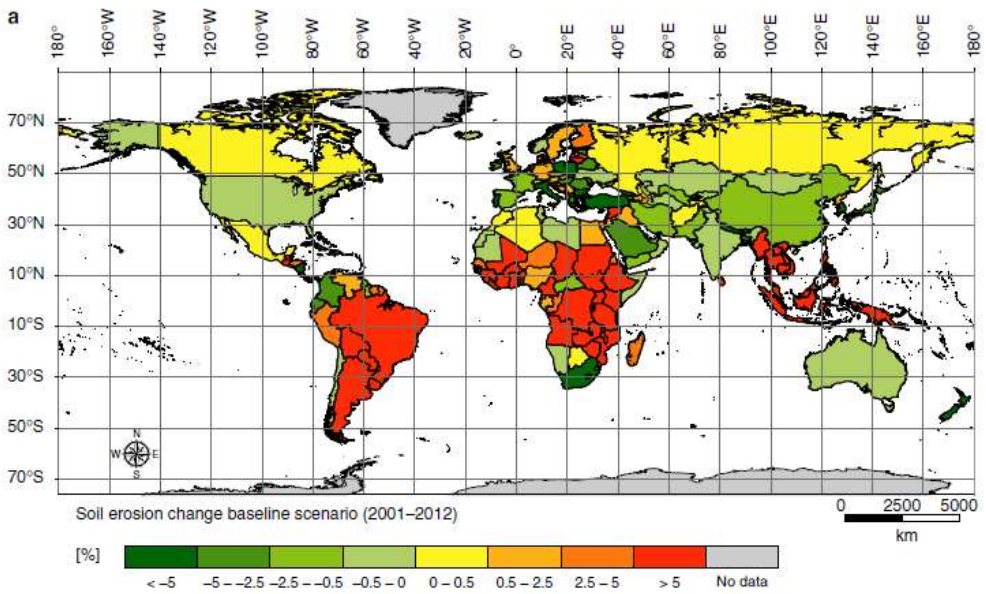
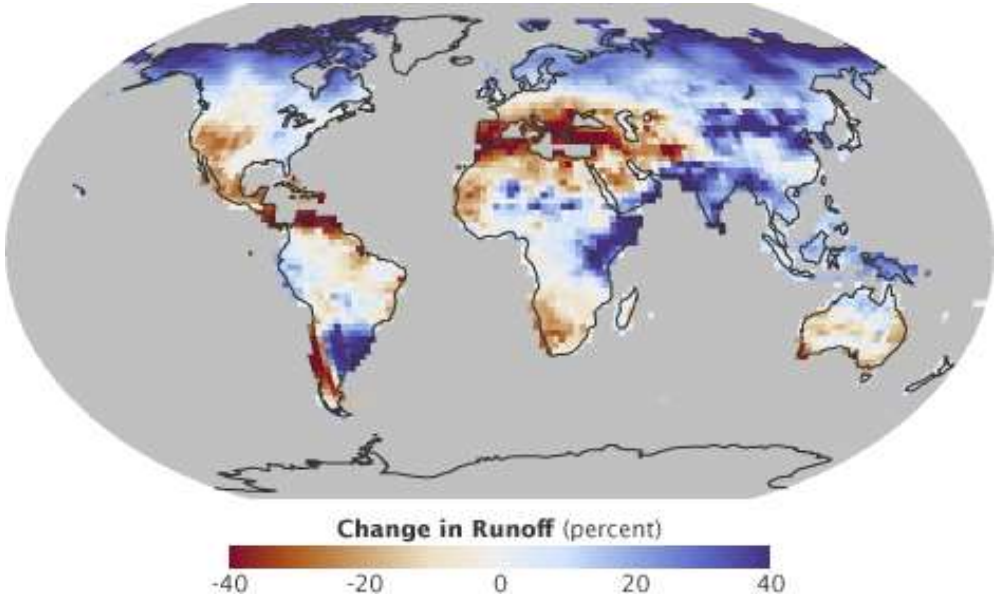
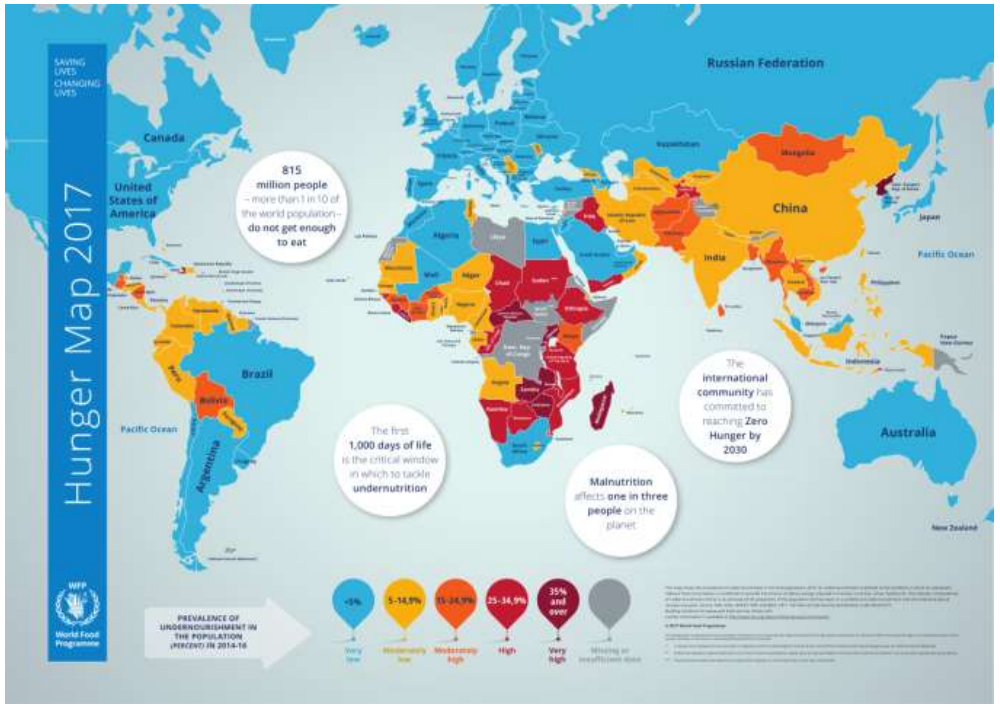
Soil erosion, land degradation, the FWE nexus and SDG in East Africa







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Soil erosion in East Africa: an inte
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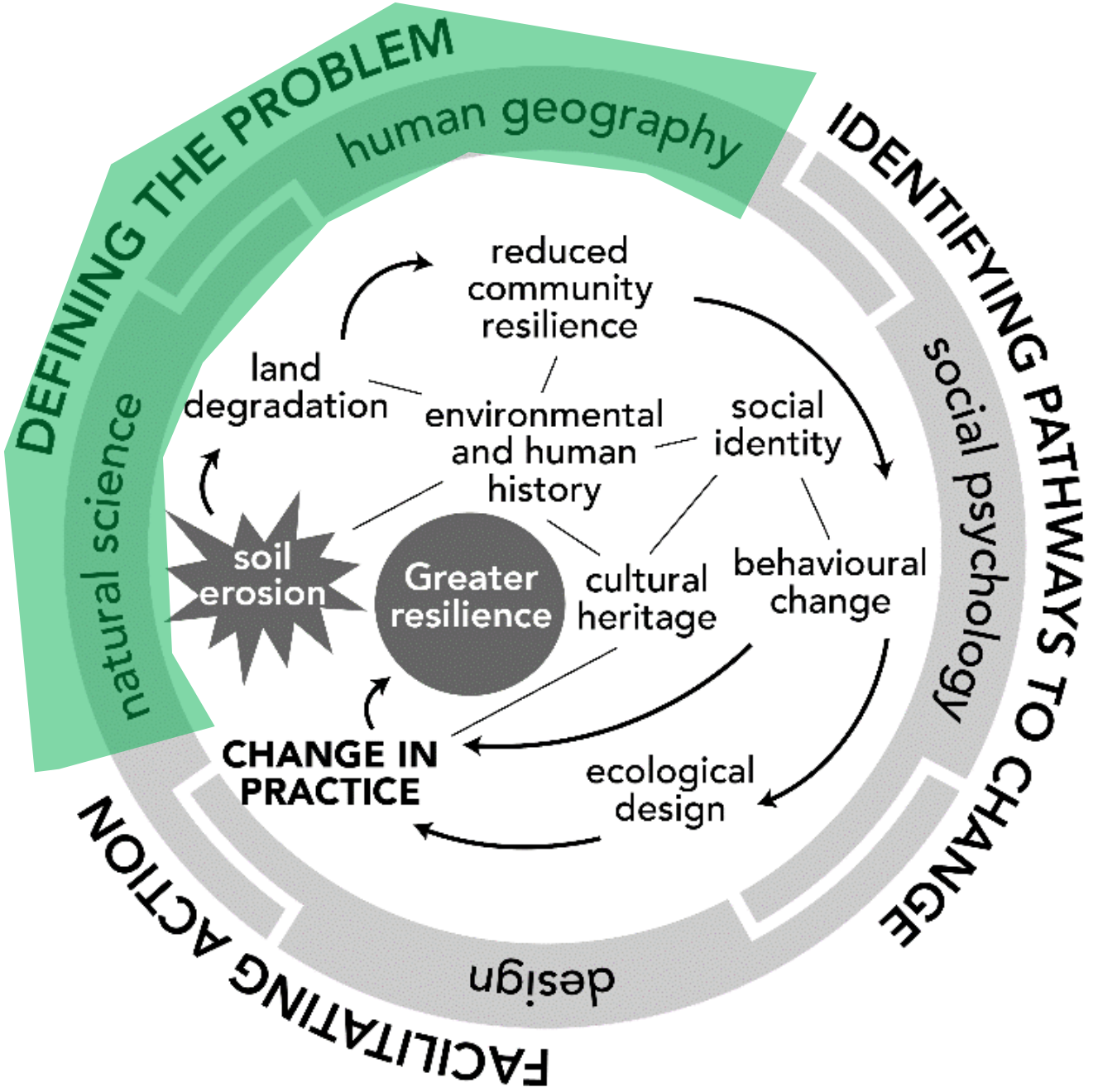

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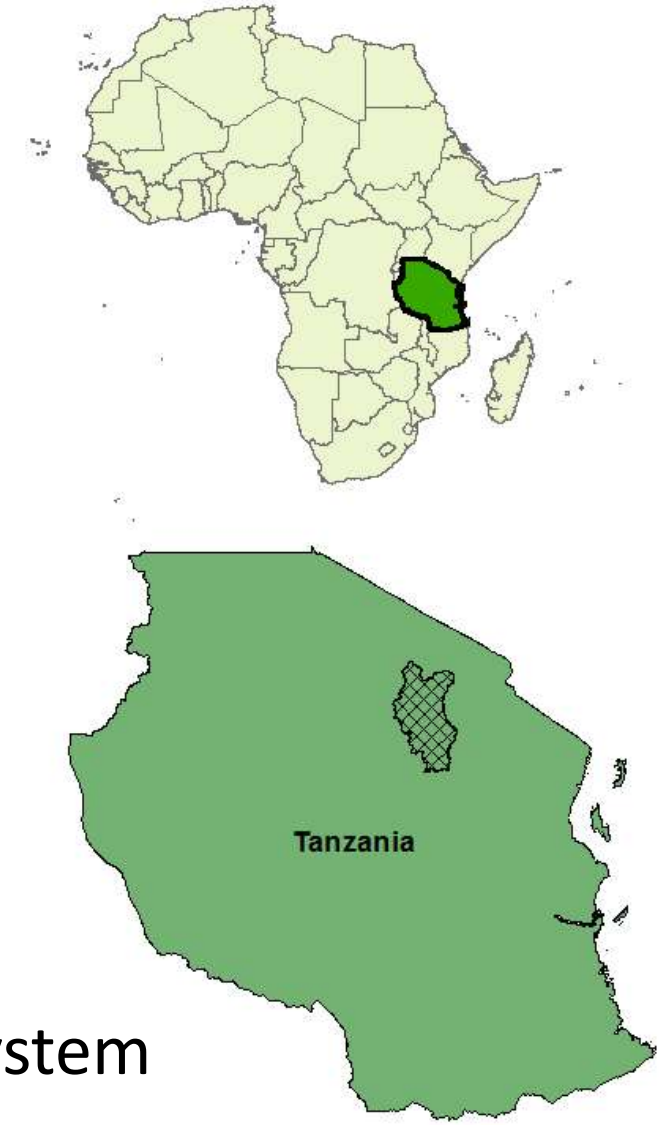
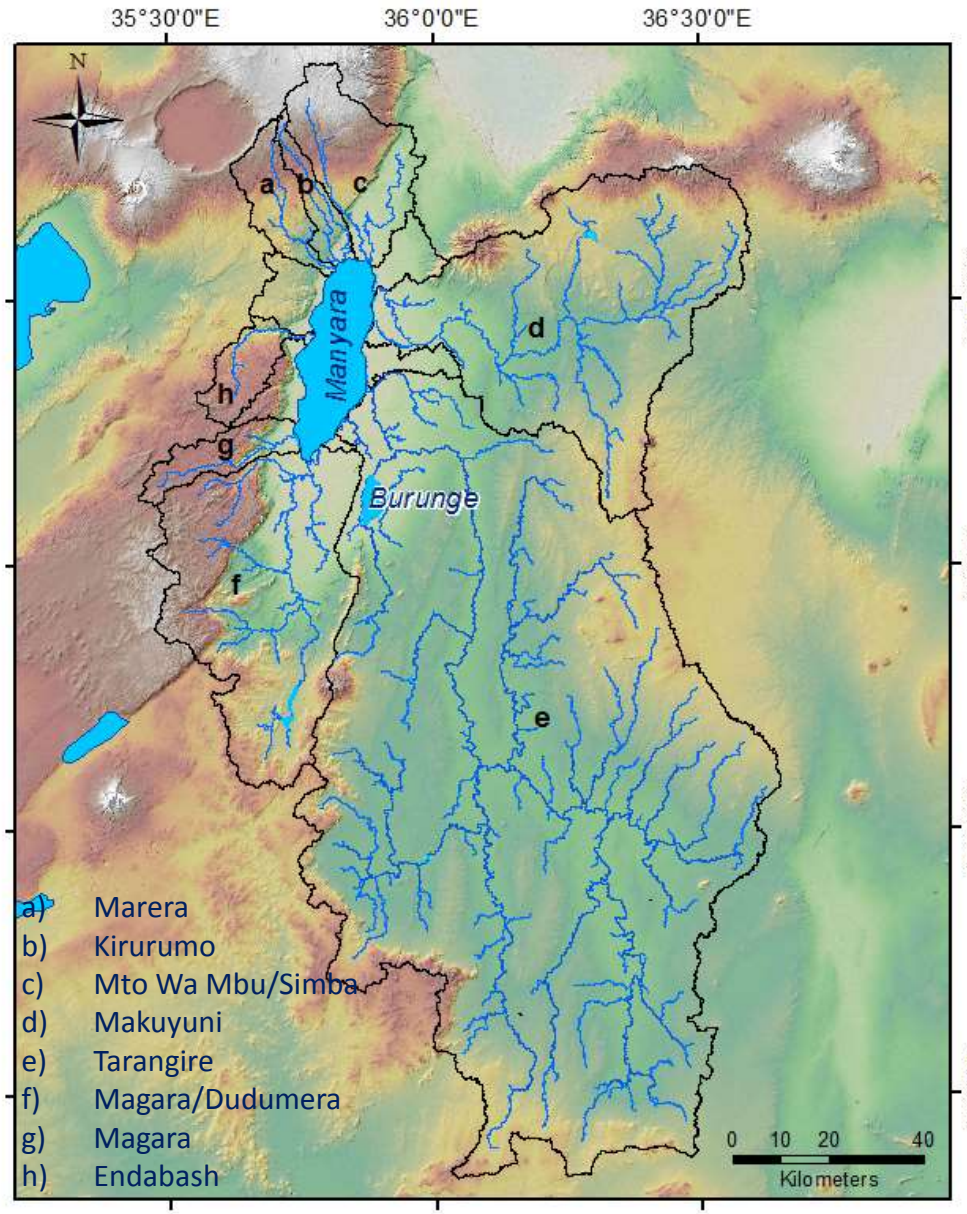
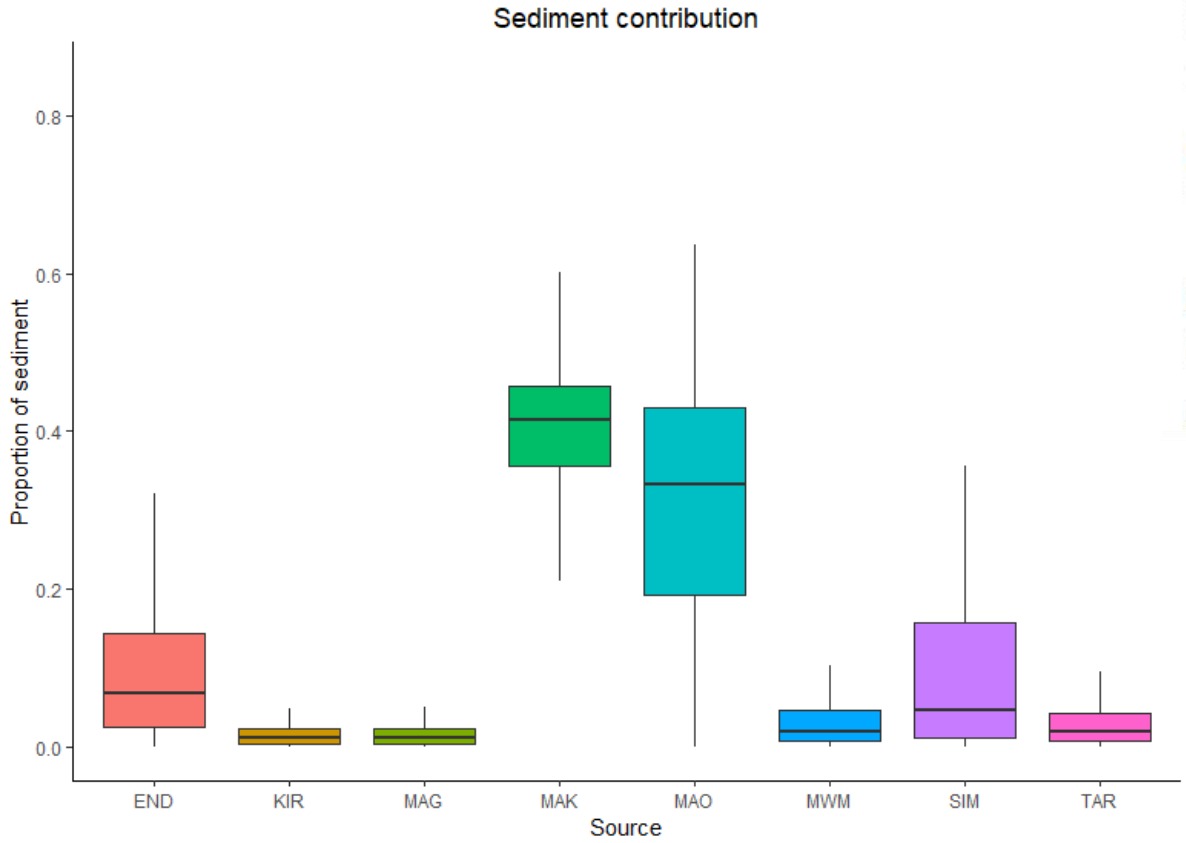
Environmental forensics in the Lake Manyara catchment

- Endorheic system
- System of high social-ecological diversity and importance
- Increasing pressures
- Threatened ecosystem service provision





Social-ecological type system for East-African rift



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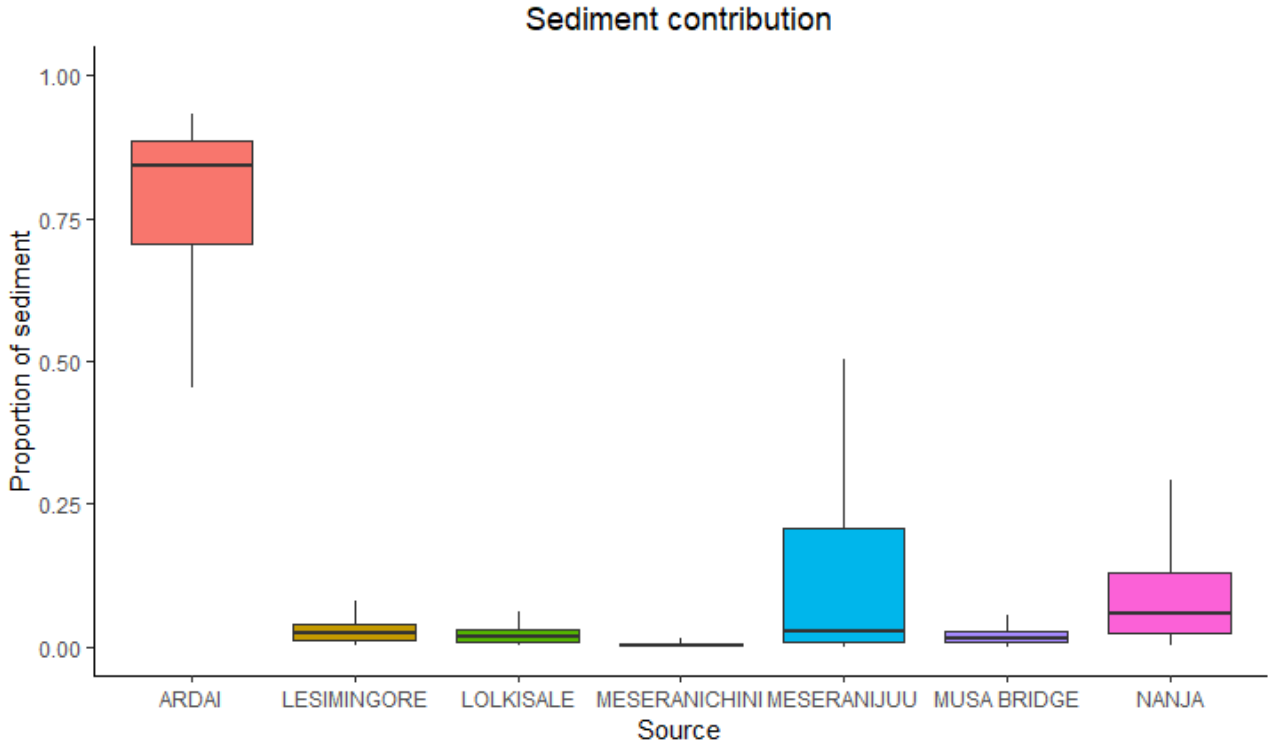
Pinpointing areas of increased soil erosion risk following land cover change in the Lake Manyara catchment, Tanzania

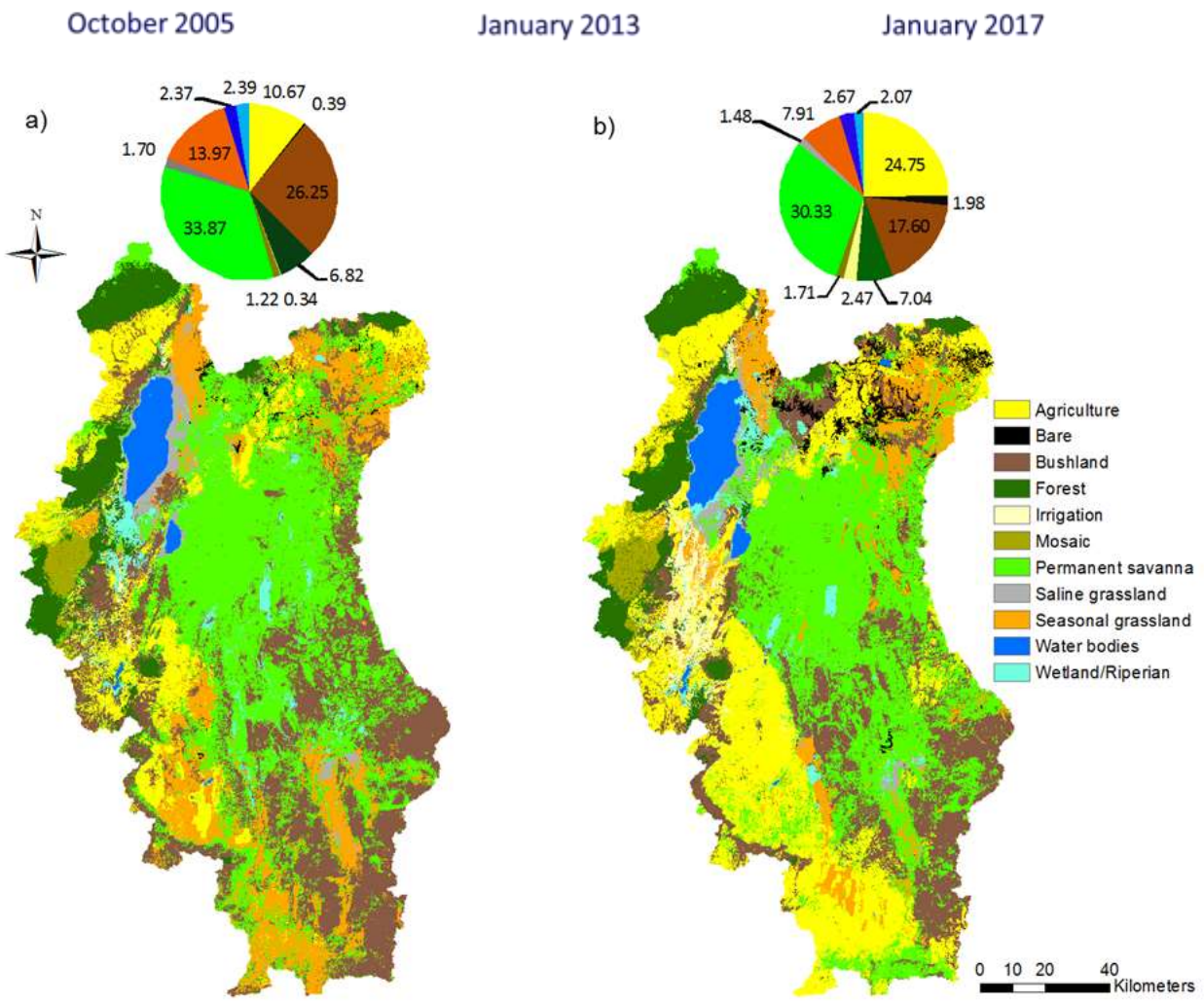
Maarten Wynants[a,*], Henok Solomon[b], Patrick Ndakidemi[c], William H. Blake[a]



Sediment fingerprinting and mixing model

- Most of sediment in LM comes from two tributaries.

Land cover reconstruction and erosion modelling



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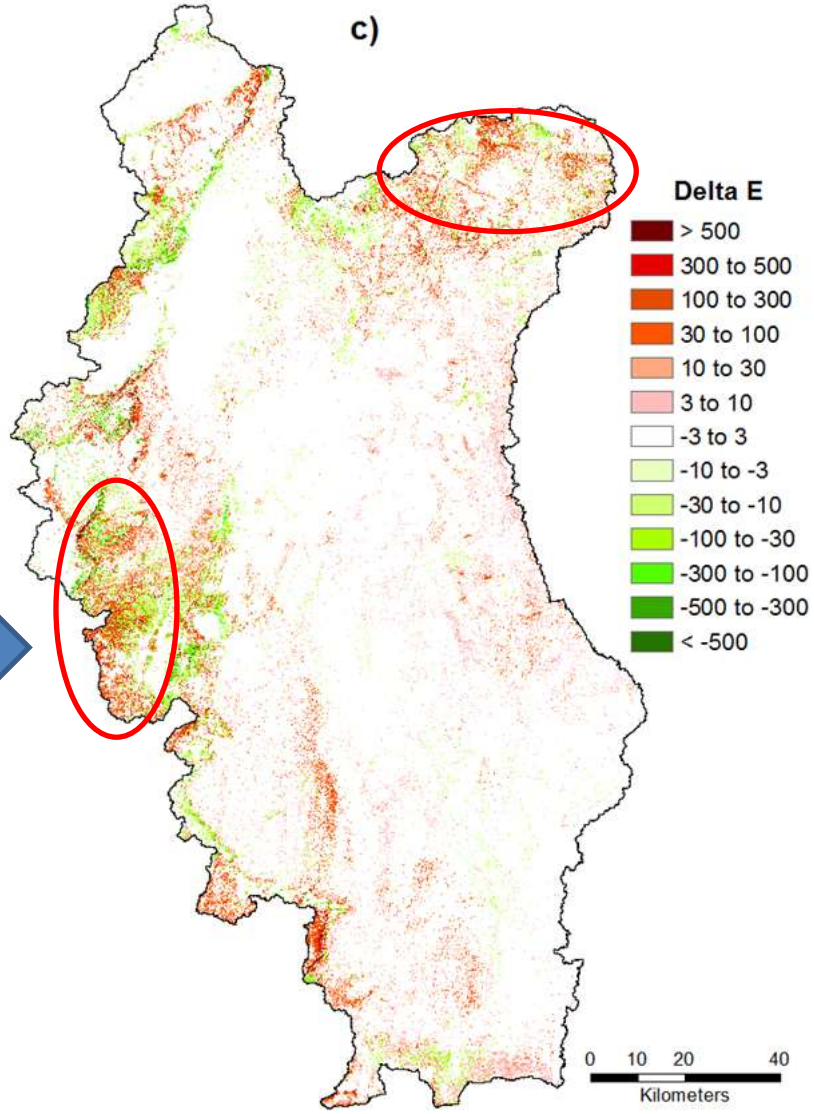
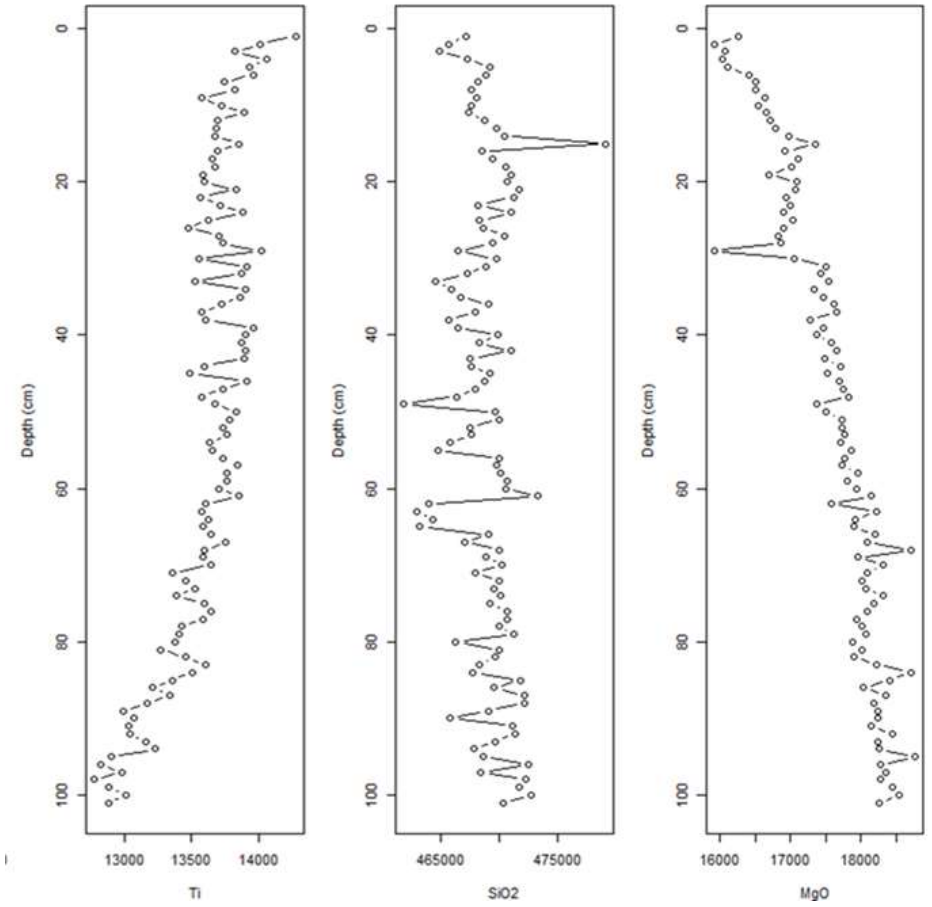
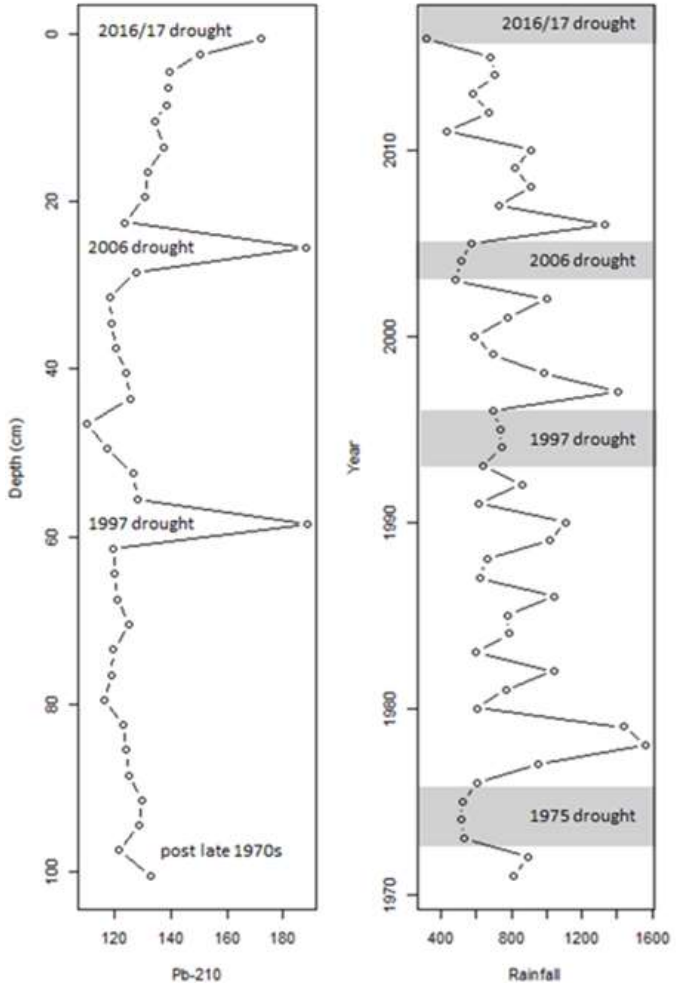


Sedimentary evidence of landscape change and increased erosion



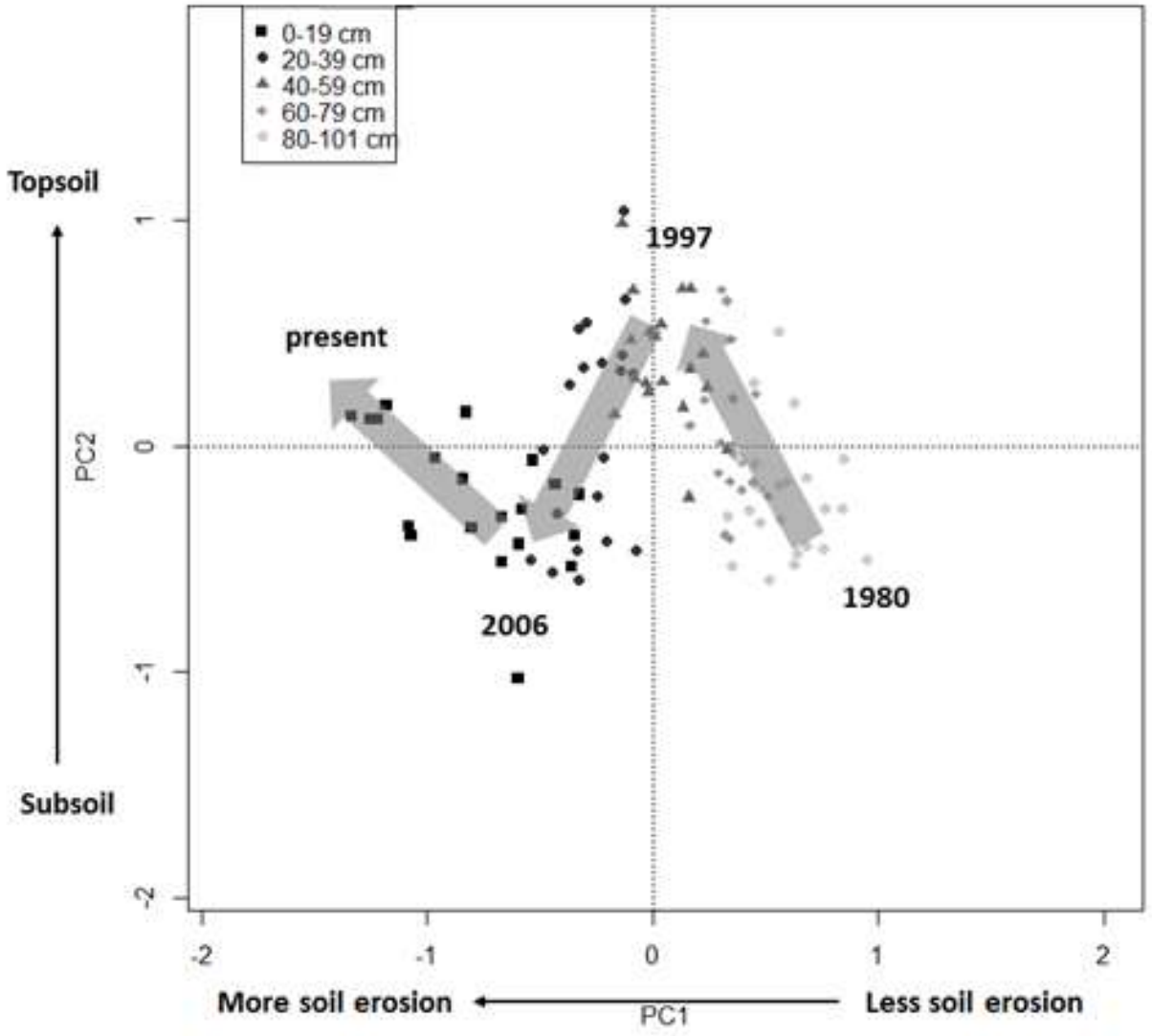
- Different geochemical properties linked to topsoil and subsoil (weathering profile)
- Some geochemical properties enhanced by lake drying (e.g. Mg)
- Multivariate analysis combines all geochemical signals to identify overall recent trends



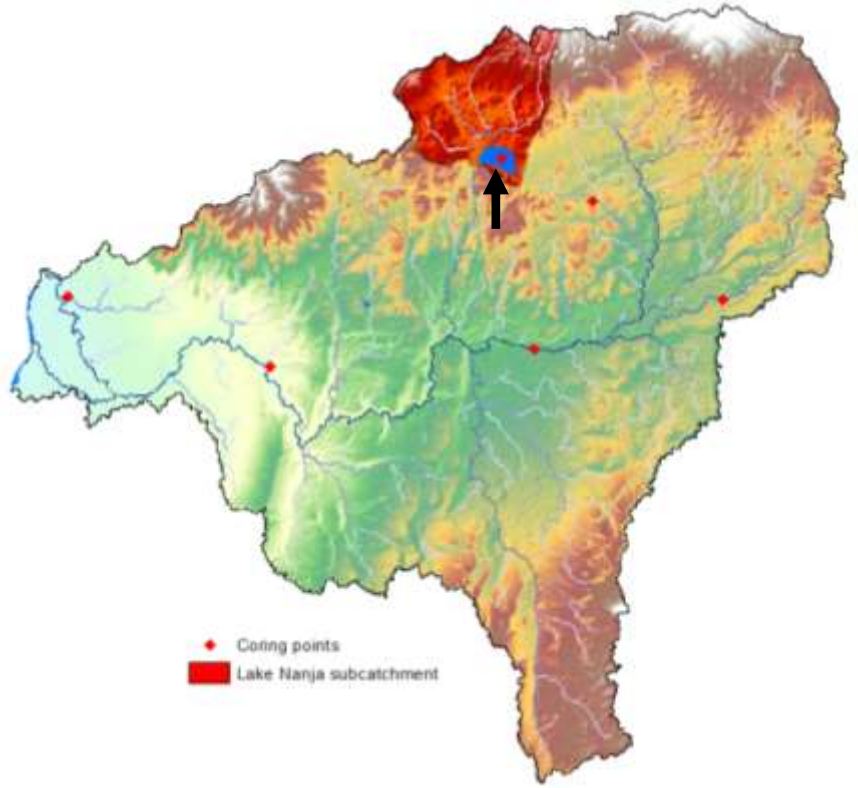
Key question: what time period does this 1 m core represent?

- Linking Excess 210-Pb profile with drought record

General increase in sediment input with alternating periods of top- and subsoil [gully] input

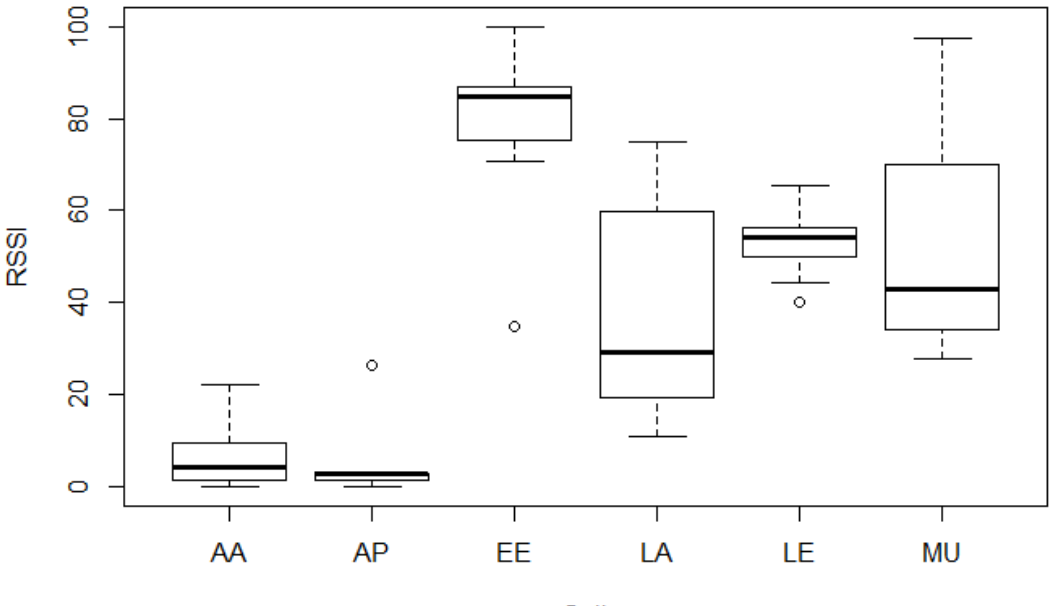


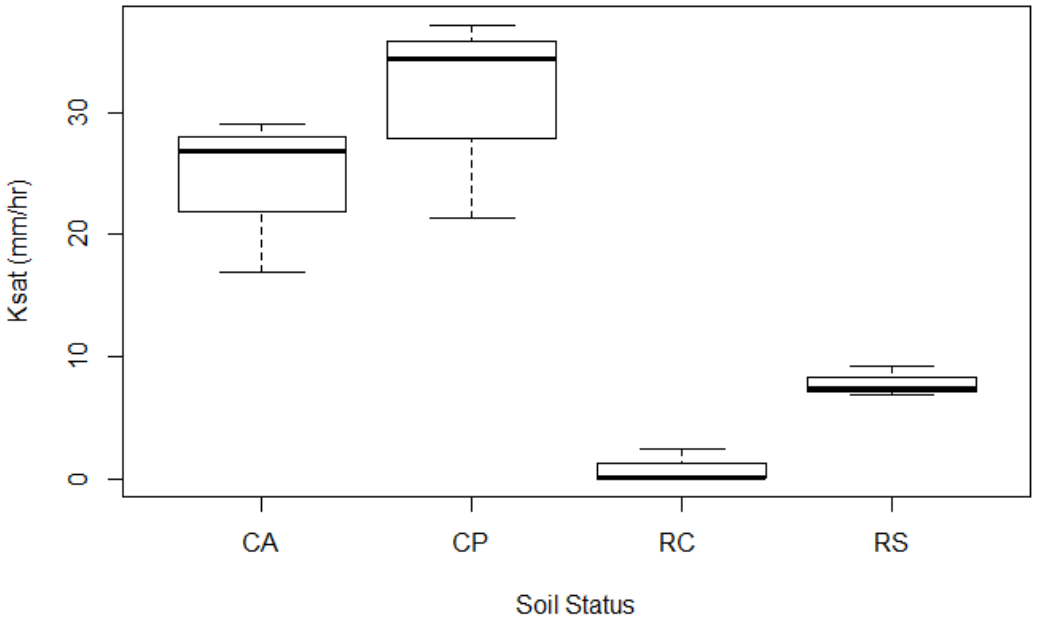
Upslope catchment: Nanja



- Soil resources are disappearing
- Natural history corresponds with oral narratives of environmental change
  - ➢ *Unsustainable change*

Loss of vegetation cover [drought, grazing, deforestation] exposes and weakens soil





Reduced infiltration leads to OLF and sheet erosion

Photo: Carey Marks/University of Plymouth

OLF converges with natural topography and along trackways…

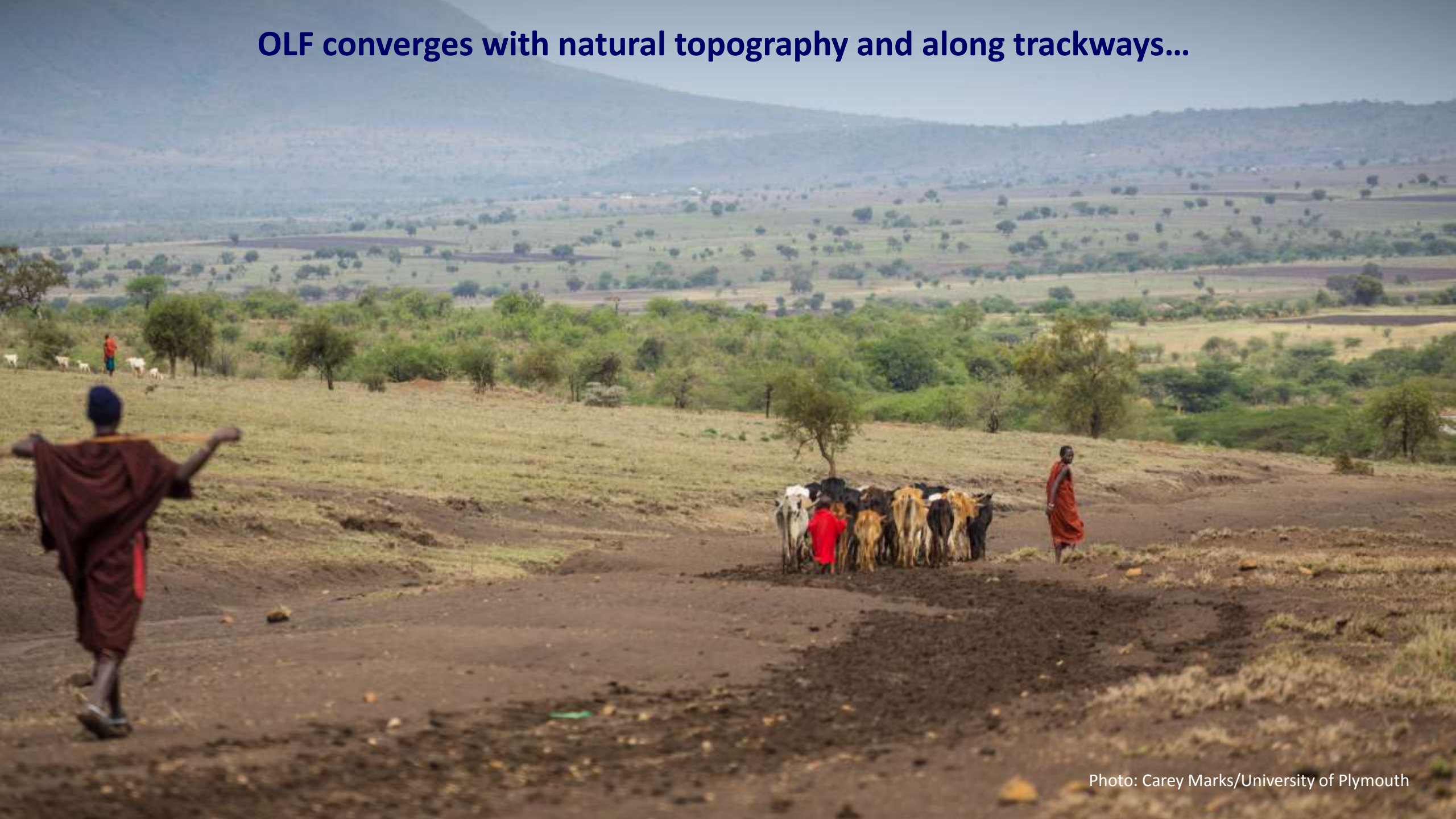
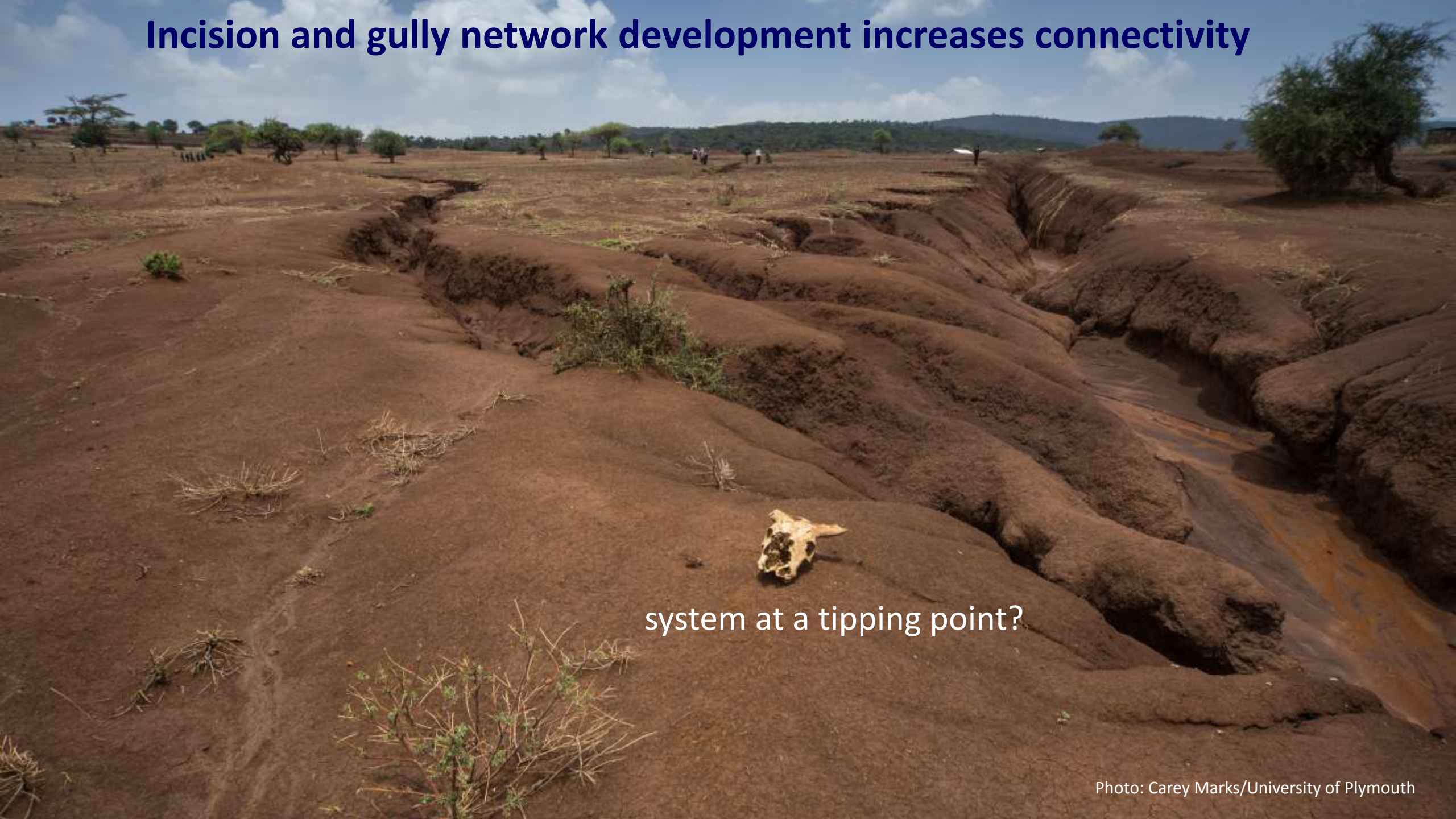


Photo: Carey Marks/University of Plymouth

Incision and gully network development increases connectivity



system at a tipping point?

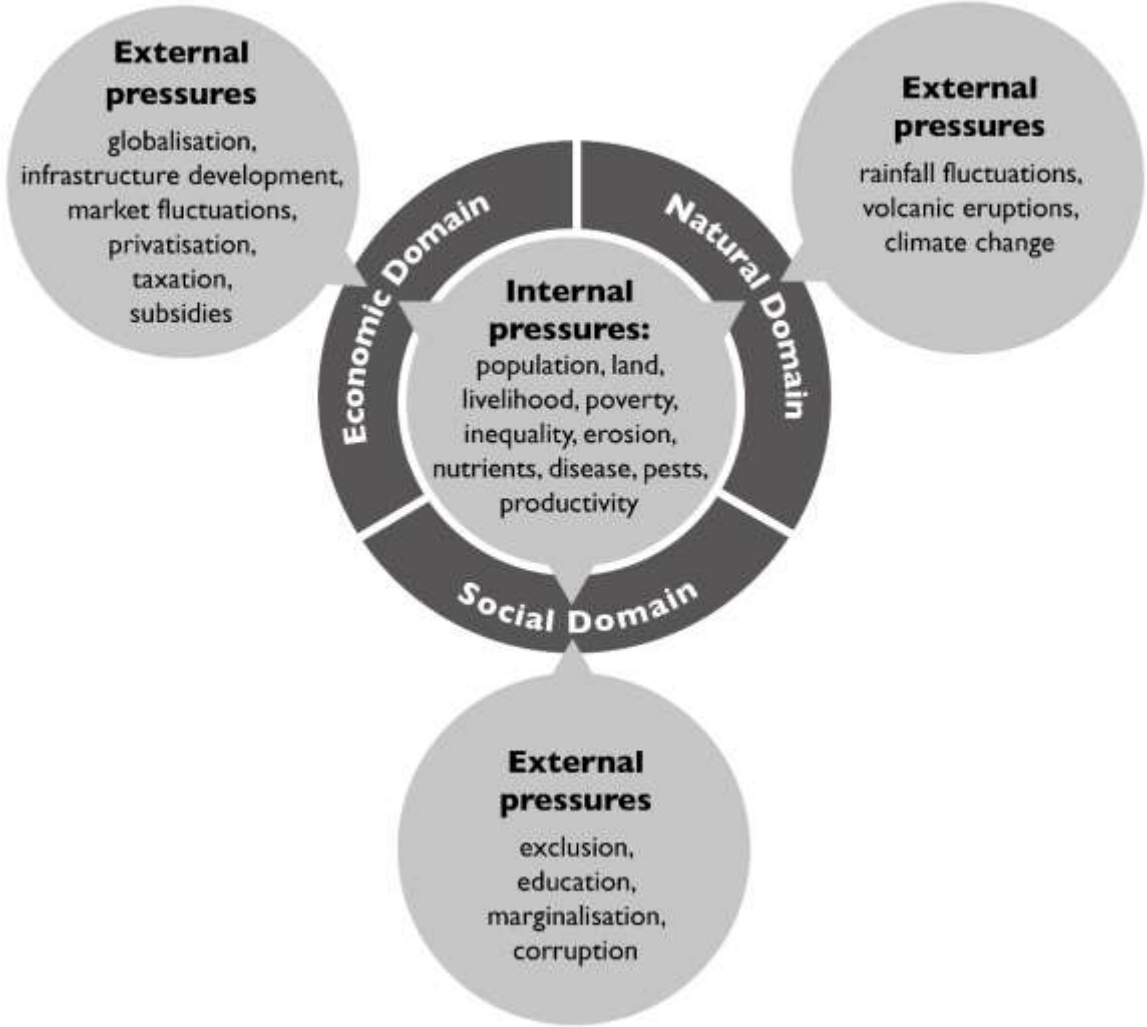
Photo: Carey Marks/University of Plymouth

Enhanced runoff and erosion is a catchment-wide problem

Increased flood peaks and siltation of downstream ecosystems threaten infrastructure, biodiversity and water quality

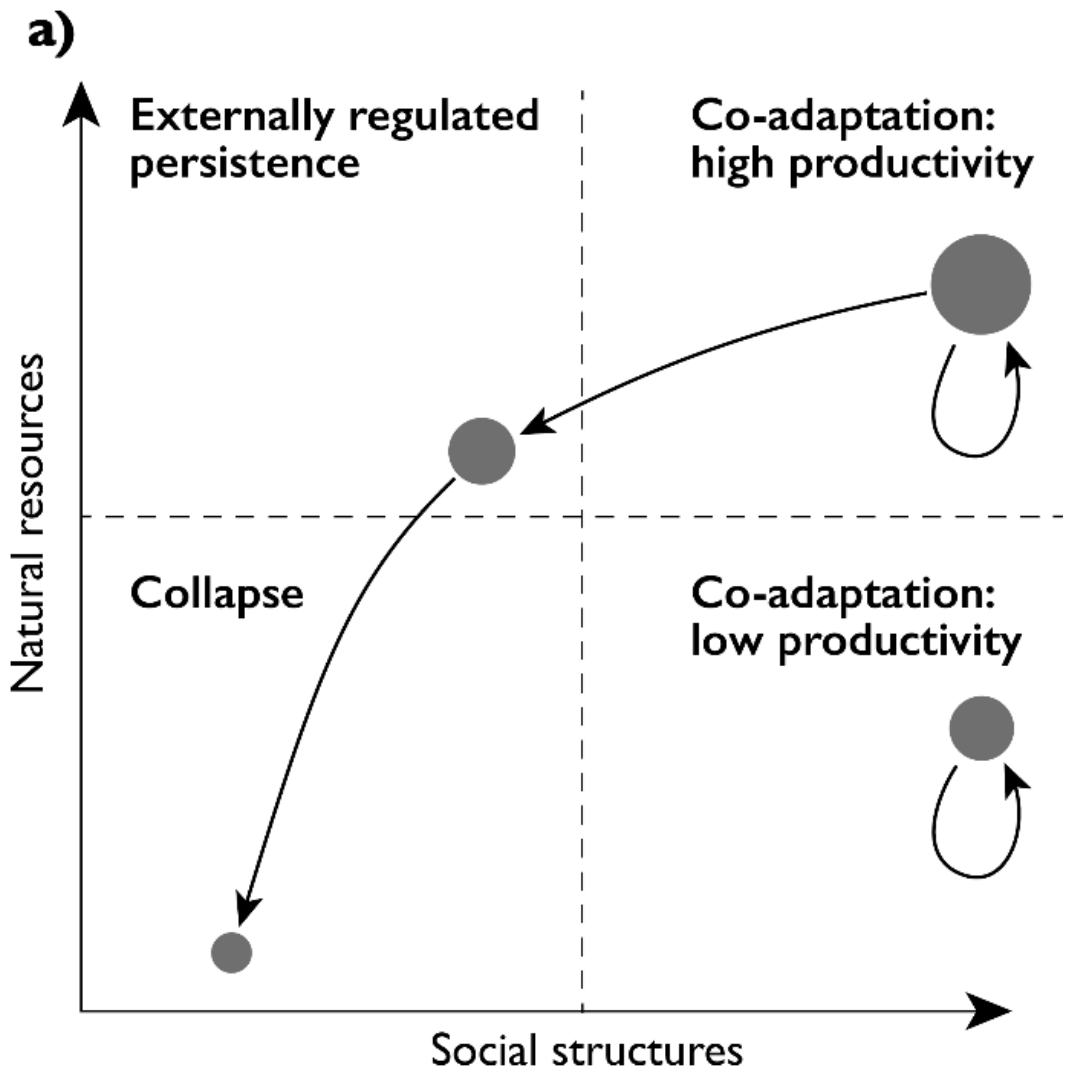
But… ‘overgrazing’ and ‘land cover change’ are symptoms of wider environmental and social dynamics and transitions

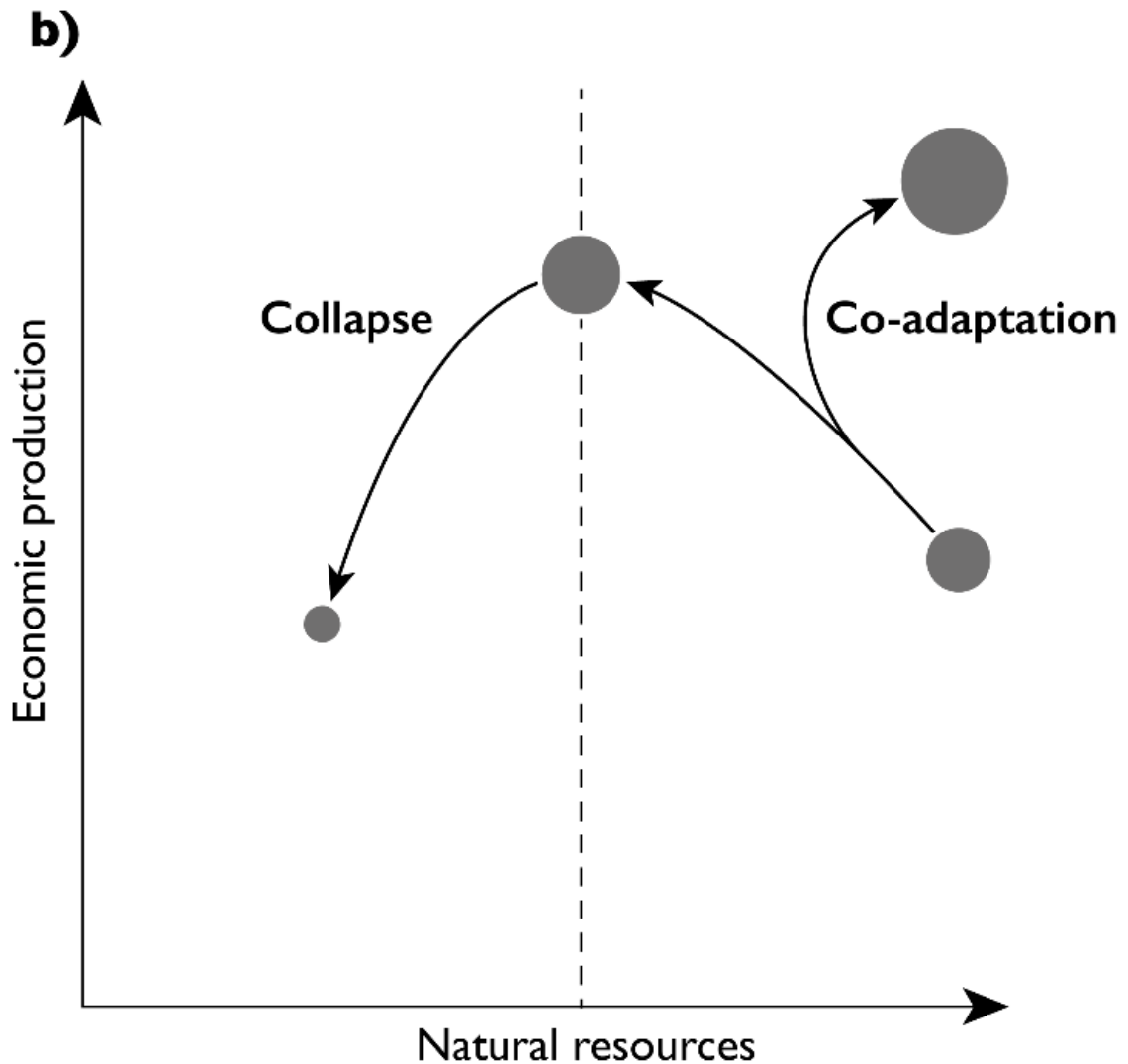
- Natural high vulnerability to soil erosion.
  - Changing environmental conditions
- Complex history of disruptions
  - Indigenous social-ecological systems
  - Colonial period
  - Post-independence
- Current drivers of increased erosion
  - Poverty
  - Population increase
  - Governance and political rep.
  - Land rights and –access



Wynants et al. 2019. Reg. Environ. Chang.

Changing interactions between the social, economic and natural domains





Communities locked in unsustainable trajectories.

Population growth

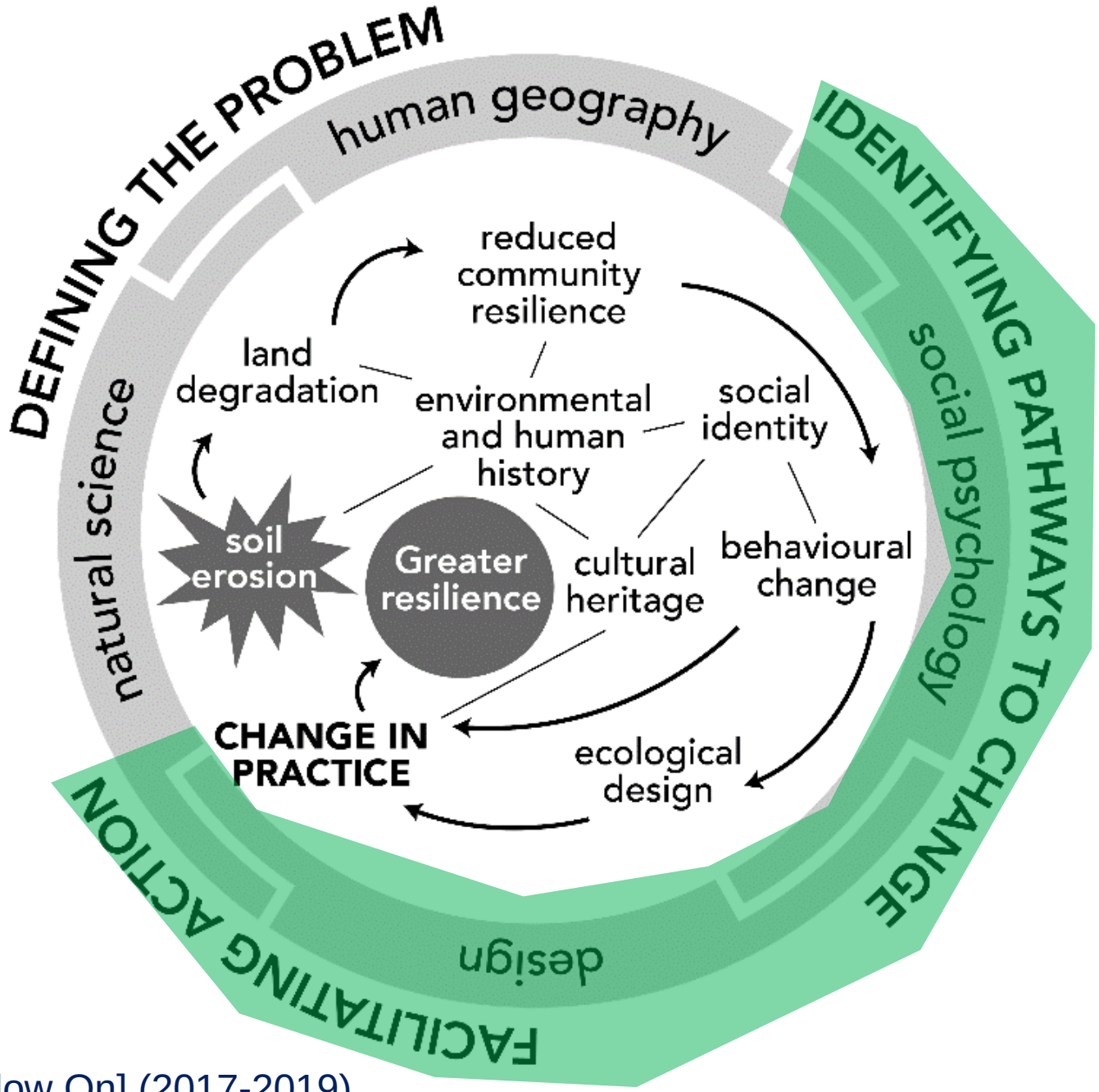
Changing rainfall patterns

Sedentarisation / migration

Governance change

Shifts in land ownership

How can they escape?



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Realising change: barriers and opportunities

Cultural importance of cattle & cattle as 'savings account'

Who takes responsibility for protecting common land?

Harmony in community versus environmental protection

Lack of skills and opportunities to diversify livelihood

Education and external input is more accessible and valued

Cohesive communities

Degradation is fast and leads to recognition that environment may force change

Possibility for win-win situations

- Co-designing management plans through a shared community vision for the future
- Innovative tools for learning and to support behaviour change

Meeting the community's challenge: impact ambitions 2018-2019

- Demonstrating land management techniques
- Building links with local sustainable examples
- Nesting co-designed community solutions in governance structures (byelaws)

Demonstration restoration plots to catalyse behaviour change

Knowledge exchange to elucidate community-led solutions

Co-design of village-specific byelaws

The interdisciplinary Jali Ardhi [Care for the Land] Project

https://www.theguardian.com/environment/gallery/2017/may/04/soil-erosion-in-tanzania-in-pictures
https://www.plymouth.ac.uk/news/interdisciplinary-approach-the-only-way-to-address-devastating-effects-of-soil-erosion
https://vimeo.com/282603338

Pictures by: Carey Marks (scarlet design)

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