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A review of Local Climate measures to increase resilience of East African Agroecological Systems

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Introduction

Climate change threatens agroecosystems, with widespread attention to the radiative impacts of greenhouse gasses. Parallel to these macro-scale phenomena, small-scale biogeophysical processes shape local climates by altering surface energy dynamics [1]. These processes form local climates below the atmospheric boundary layer (Figure 1) and are shaped by land surface characteristics. Management of local climates involves deliberate adjustments to local surface properties to influence key factors such as net solar radiation, soil moisture, soil and air temperature, air humidity, and wind (Figure 2). **This review documents local climate management practices and their impact from Ethiopia, Kenya, and Tanzania and identifies scalable strategies that leverage local knowledge for proactive adaptation.**

Example measures from East Africa

Trenches (Credit: Giulio Castelli)

Soil bunds (Credit: Mathias Gurtner)

Alley cropping system (Credit: Francesco Sambalino)

Results

This review highlights the impact and effectiveness of local climate management interventions in East Africa. 54 intervention techniques were found, categorised into five strategies:

1. **Soil moisture management and recharge** (e.g., soil bunds, '*Ngoro*' pit systems). – increases moisture retention and reduces temperatures [2].
2. **Evaporation losses management** (e.g., windbreaks, shading). – conserves soil moisture and buffers temperatures [3].
3. **Surface water and open water storage management** (e.g., check dams, water ponds). – buffers temperatures [4].
4. **Vegetation management and conservation** (e.g., Taungya systems, farmer-managed natural regeneration ('*Kisiki Hai*')). – regulates temperatures and enhances soil and water conservation [5].
5. **Soil and land surface practices** (e.g., soil amendments, intercropping). – enhances soil structure and moisture retention and reduces temperature fluctuations [6].

Definition of Local Climate

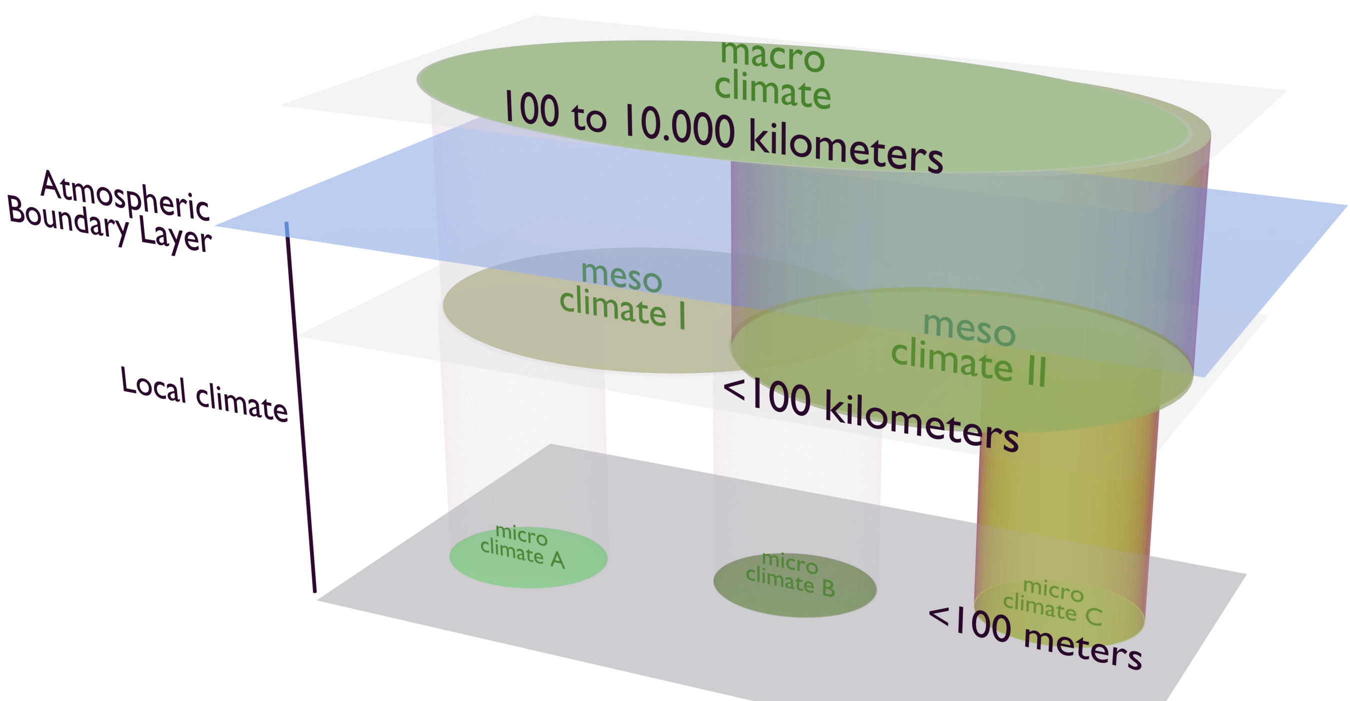

Figure 1 – Local Climate definition and scale

Methods

- Through a comprehensive literature survey and expert consultations, interventions and their impact were identified and characterized
- This process yielded a list of measures aimed at mitigating climate impacts, which were then categorized into five themes based on their objectives and effects

Biogeophysical processes that shape local climates

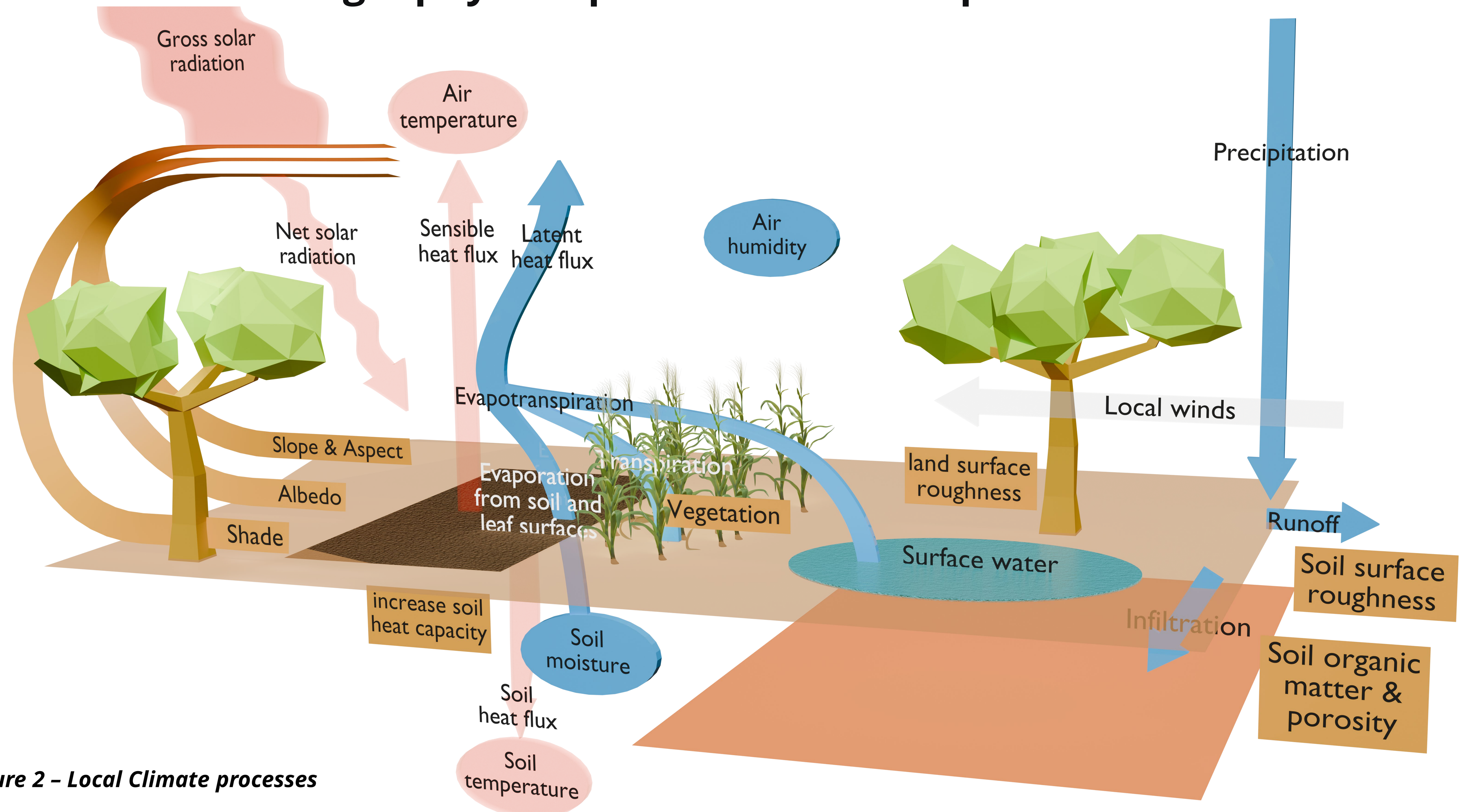

Figure 2 – Local Climate processes

Discussion and conclusions

- Landscapes play a critical role in climate regulation, with local interventions offering sustainable alternatives to large-scale geoengineering.
- Indigenous and local knowledge systems are invaluable for designing effective climate management strategies, emphasizing integrating natural processes with intentional interventions.
- The effectiveness of interventions is context-dependent, requiring tailored approaches that consider local conditions and knowledge.

This review emphasizes the importance of adopting a bottom-up approach to climate regulation, concentrating on localized interventions. It advocates for a 'third way' approach [7] that enhances reactive measures with proactive, locally-led initiatives.

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Book: Managing the Local Climate – A Third Way to Respond to Climate Change