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Food security and water availability in data-poor regions: Five scenarios to assess land-use impact in the Tikur Woha catchment, Ethiopia Central Rift Valley

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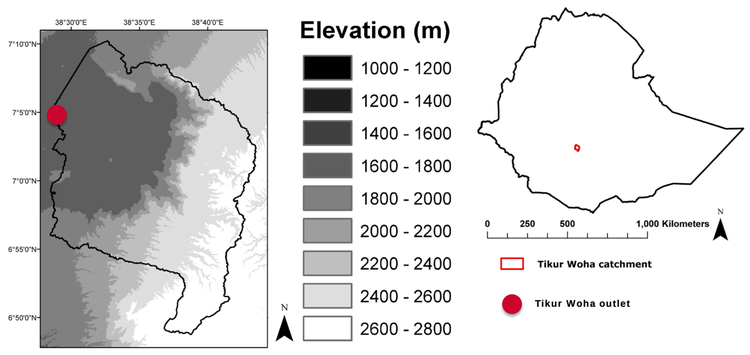
Problem definition

- Growing population and economy affect land-use
- In Ethiopia, forest and grazing land have been converted into cropland
- Enhanced rates of soil erosion and a decrease in soil-water holding capacity are observed as a result of unsustainable agriculture
- Water availability and land degradation are affected thereby threatening food supplies

Study area: The Tikur Woha Catchment

- Located in the Central Rift Valley and drains into Lake Awassa
- Wet season from March to August, dry season from September to February (m.a. rainfall 1200 mm)
- (**Cash**) crops: **Khat**, **Sugarcane**, Ensete, Maize, Green Beans, Teff, Eucalyptus, Coffee
- Highly scattered land-use distribution: average plot size <1 ha per household



Research Aim

Study the effect of land-use on spatial distributions of soil moisture (SM) during the dry season and the temporal surface runoff response of the Tikur Woha catchment

Materials and Methods

- Five land-use distributions: current situation and four scenarios

1) Current land use distribution (Cur. LU distr.); land use remains unchanged

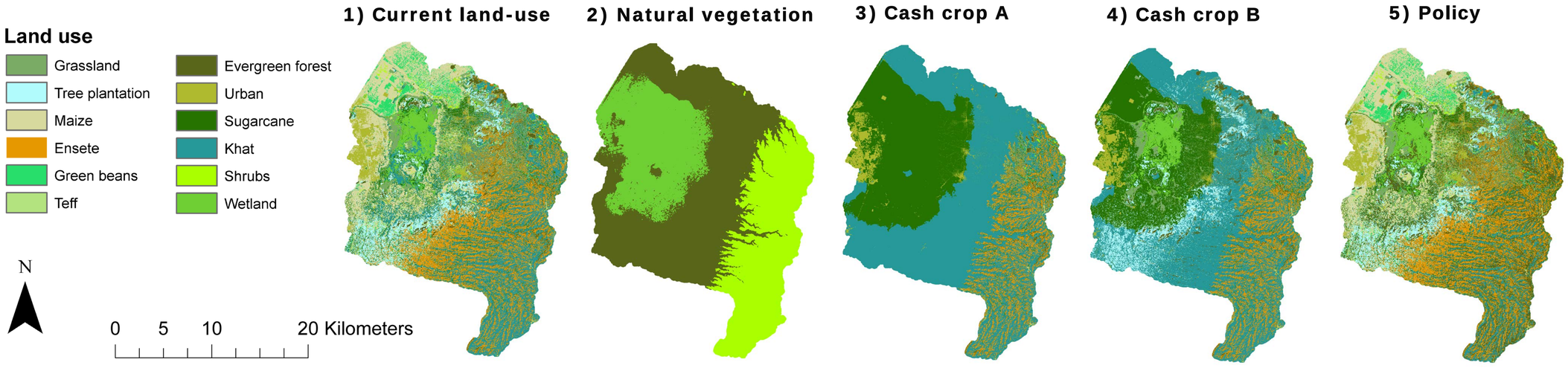
2) Reference scenario mimicking natural vegetation

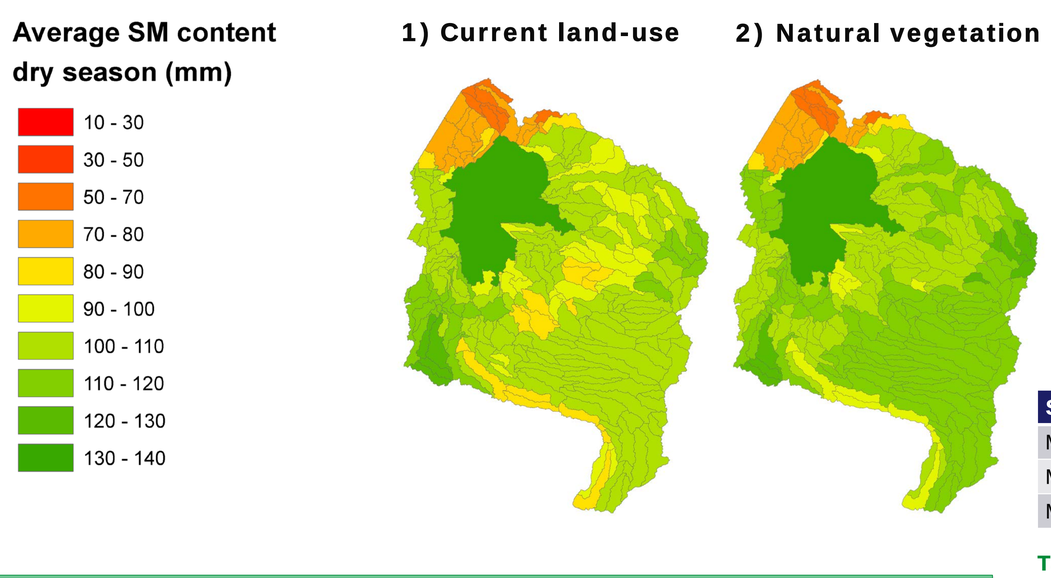
3) Cash crop expansion scenario A: all current land cover except urban is converted to cash crops by a cash crop suitability criterion based on altitude

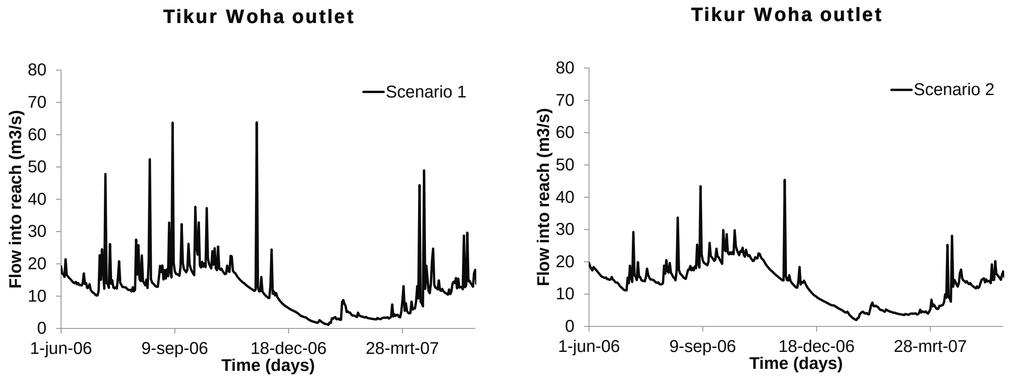
4) Cash crop expansion scenario B: all current agricultural land cover is converted to cash crop by a cash crop suitability criterion based on altitude

5) Policy scenario: illegal khat farms on steep slopes (>15%) are cleared by the government to restore natural vegetation

- Soil Water Assessment Tool is used to assess soil water distributions and surface runoff response of the catchment for the period June 2006 – May 2007







SM (mm)	Cur. LU distr.	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Min	21.7	20.7	12.2	22.9	21.2
Max	126.1	128.1	125.6	125.7	126.1
Mean	97.8	102.1	97.9	97.7	98.3

Table 1: Statistics of average SM content (mm) during the dry season for all land-use distributions.

Conclusions

- Differences between the effects on SM content and runoff response between the current land-use distribution and the cash-crop and policy scenarios are minimal:
  - Shift to cash crop land-use has minimal effect on SM content and runoff response
  - Policy scenario locally increases SM content on the steep slopes, but overall improvement is minimal
- Largest effect occurs when modelling a natural vegetation cover: upslope SM content is improved and runoff peaks are dampened.
- Low SM content during the dry season is persistent in all land-use distributions.

Outlook

The agriculture in drylands is highly dependent on the timing of seasons and thus highly sensitive to temporal rainfall patterns. Improvement of soil water conservation practices could increase drought resilience and improve local water budgets at the start of the dry season.

Acknowledgments
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