

Finding Eroding Areas and Patterns with GIS and Community Knowledge in the Ethiopian Highlands

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- Conserve soil resources for low-income or subsistence farmers
- Decrease sediment loads in rivers that rural communities depend on as drinking water
- Minimize particulate matter that can fill up reservoirs and hydro-electric dams



Soil erosion in Ethiopia



soil bunds



drainage ditches



stone bunds



gully plugs

What needs to happen?

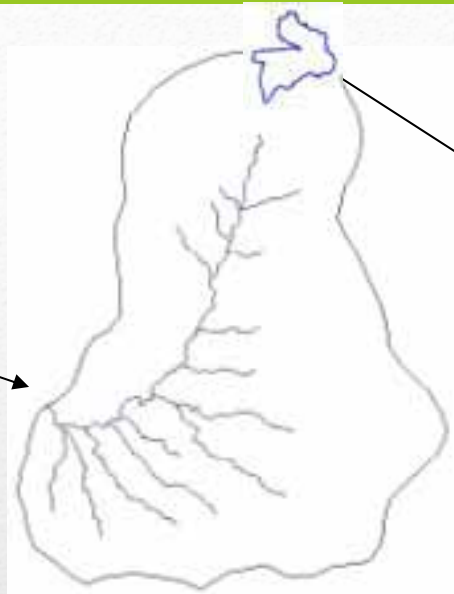


**social
aspects**

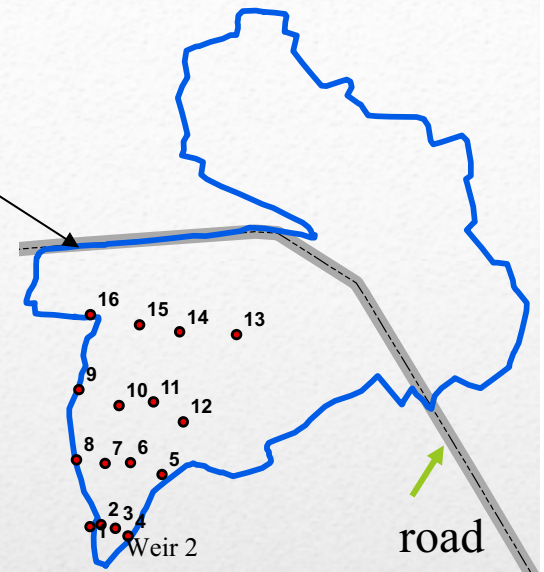
What needs to happen?

- (i) identify sediment sources using the Universal Soil Loss Equation-GIS
- (ii) identifying sediment sources and runoff generating areas using erosion pins and water table monitoring
- (iii) identify sediment sources using community mapping to better understand which areas community members feel they should address
- (iv) determine the context-specific relationship between the spatial variability in soil nutrient losses and the spatial variability in soil loss
- (v) compare between these techniques soil erosion sources and nutrient loss.

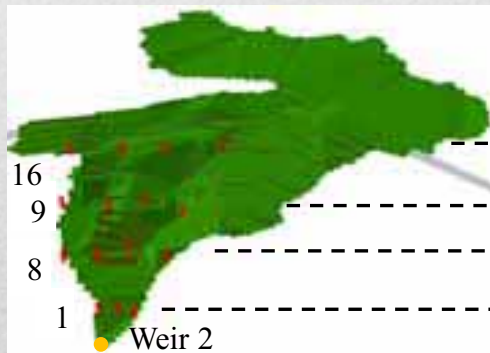
Research aims



Debre Mawi

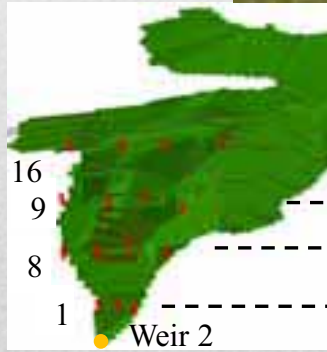


Basin 2



- Upslope (16, 15, 14, 13)
- Midslope-2 (9, 10, 11, 12)
- Midslope-1 (8, 7, 6, 5)
- Downslope (1, 2, 3, 4)

Method



Method

Hydrology



Rain gauge



Piezometer wells



Grab samples

Erosion Mapping

Universal Soil Loss Equation

$$A = R * K * L * S * C * P$$

(Hurni, 1985; Wischmeier and Smith 1978)



Erosion pins



Focus group discussion



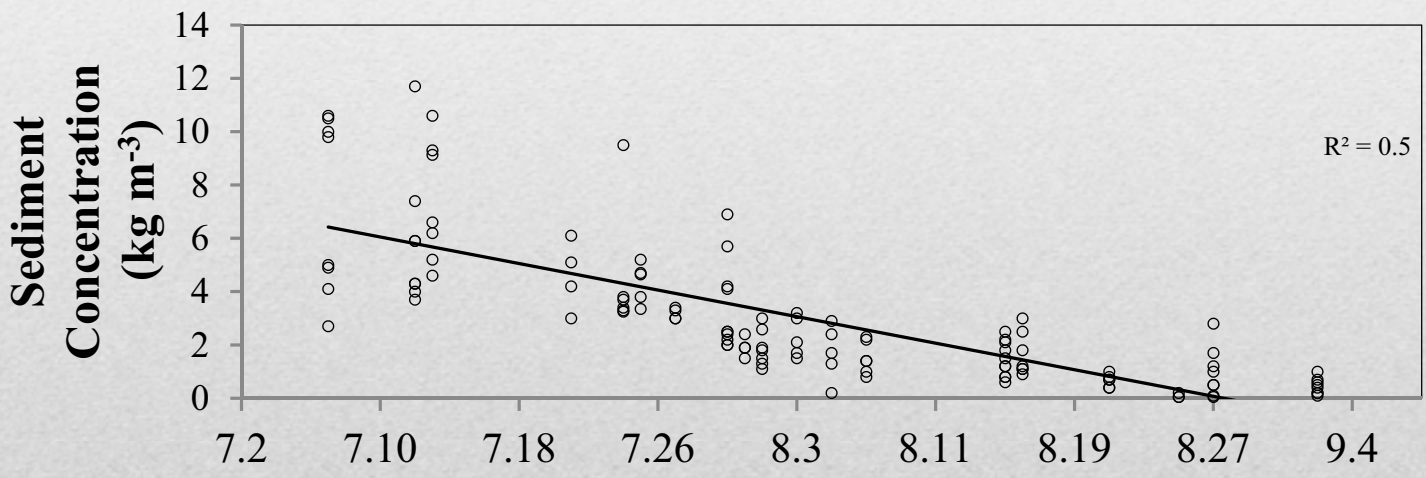
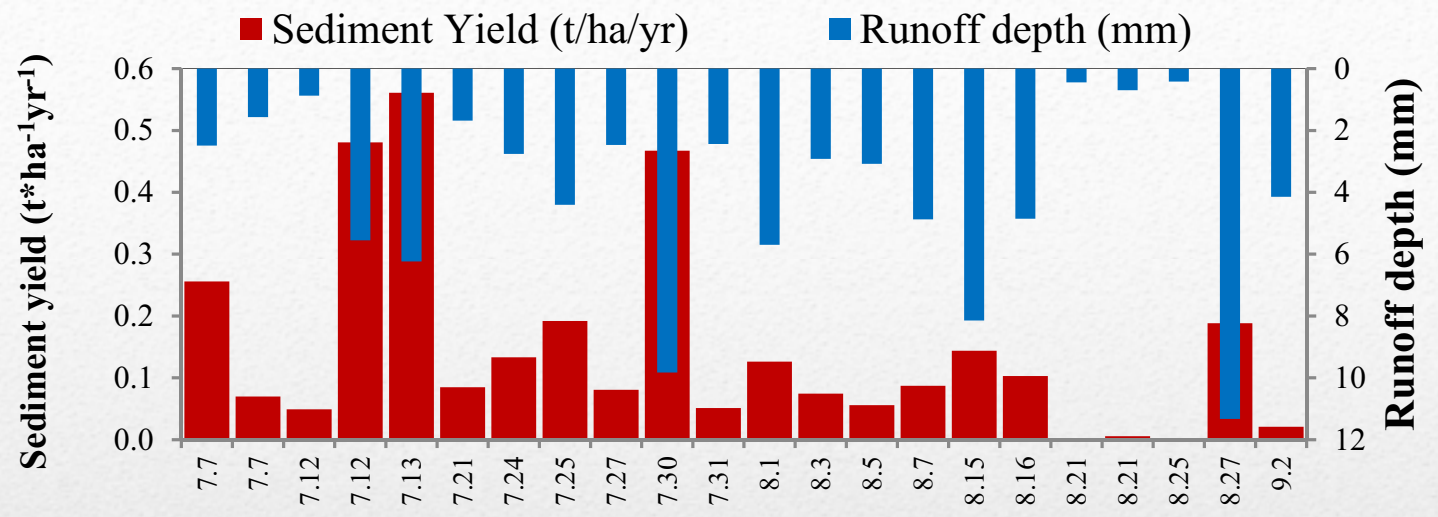
Transect walks

Soil Nutrients

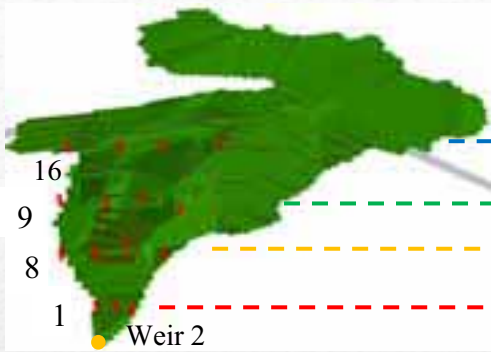


Composite soil sampling: N, P, K, Ca, Mg

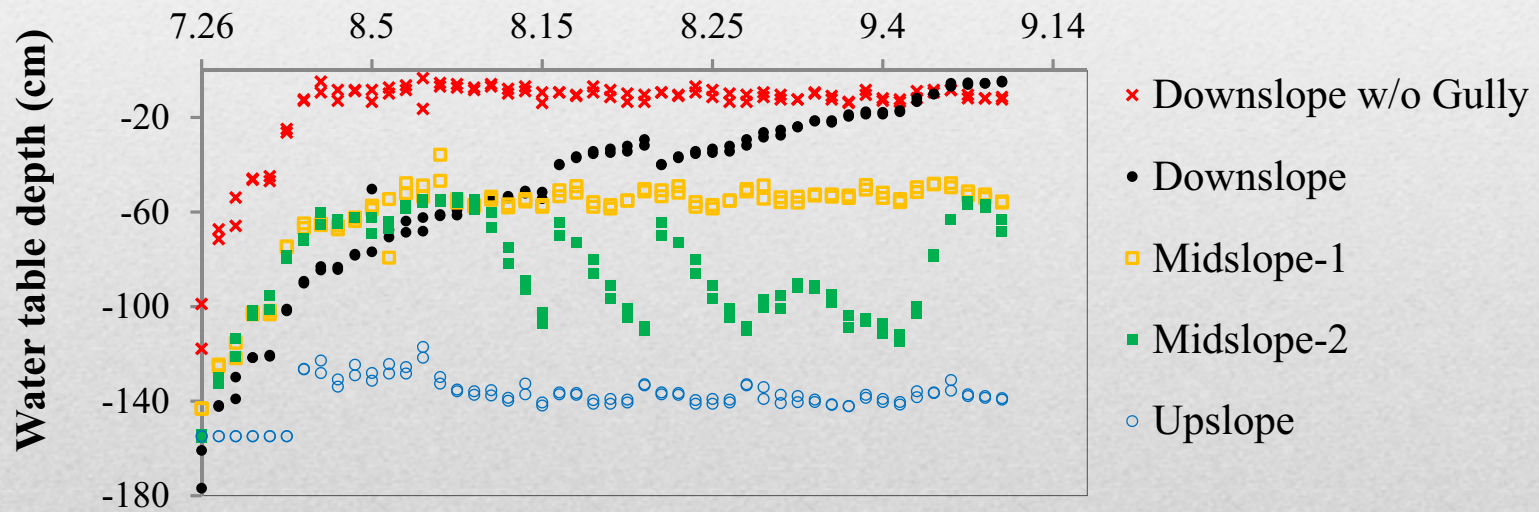
Method



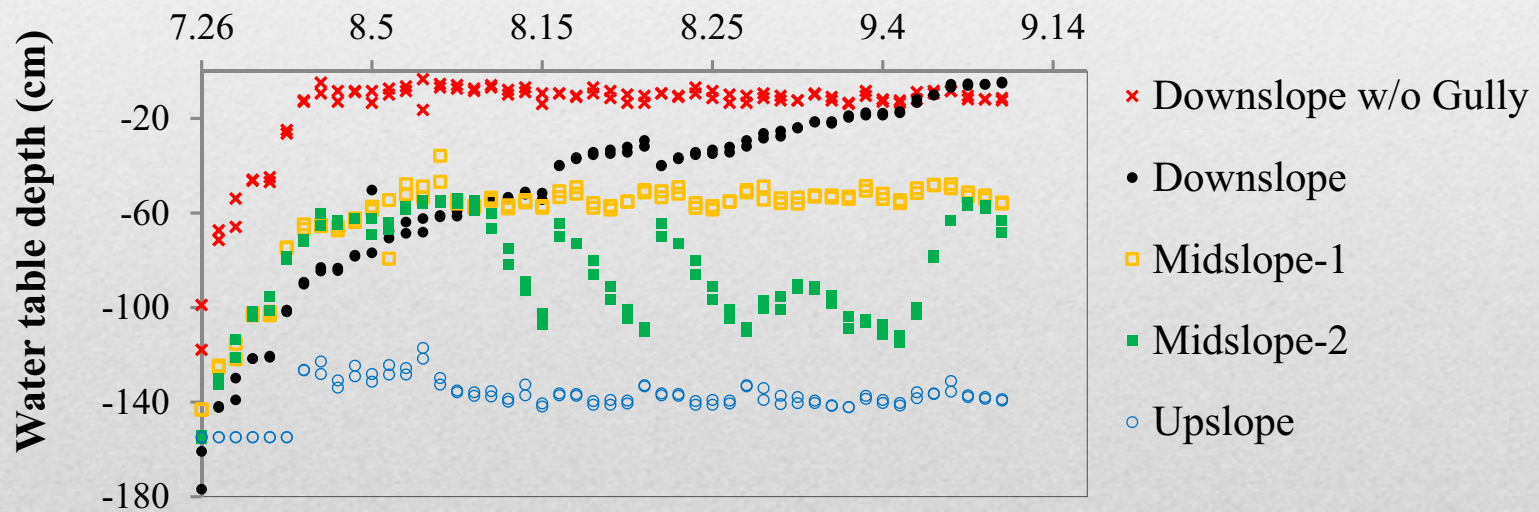
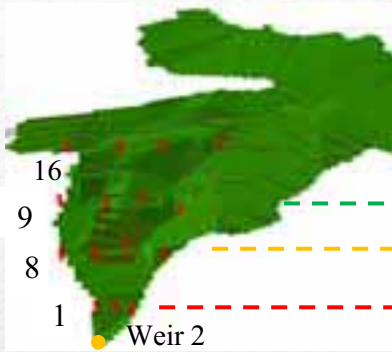
Results



Upslope (16, 15, 14, 13)
 Midslope-2 (9, 10, 11, 12)
 Midslope-1 (8, 7, 6, 5)
 Downslope (1, 2, 3, 4)

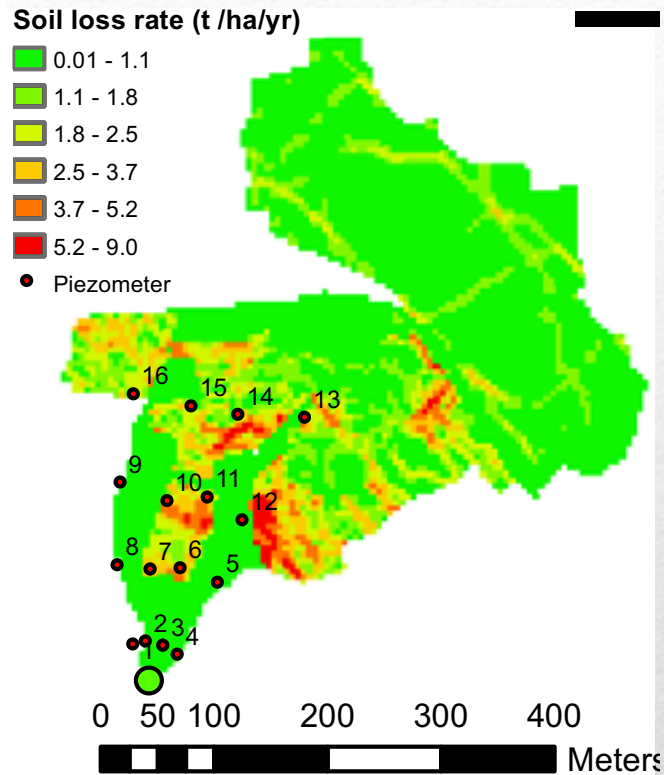


Results

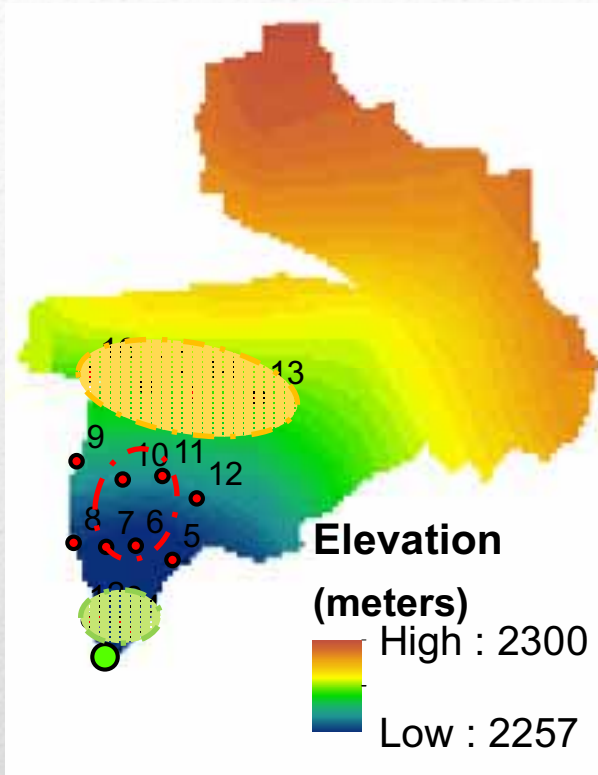


Results

USLE-GIS



Erosion pins



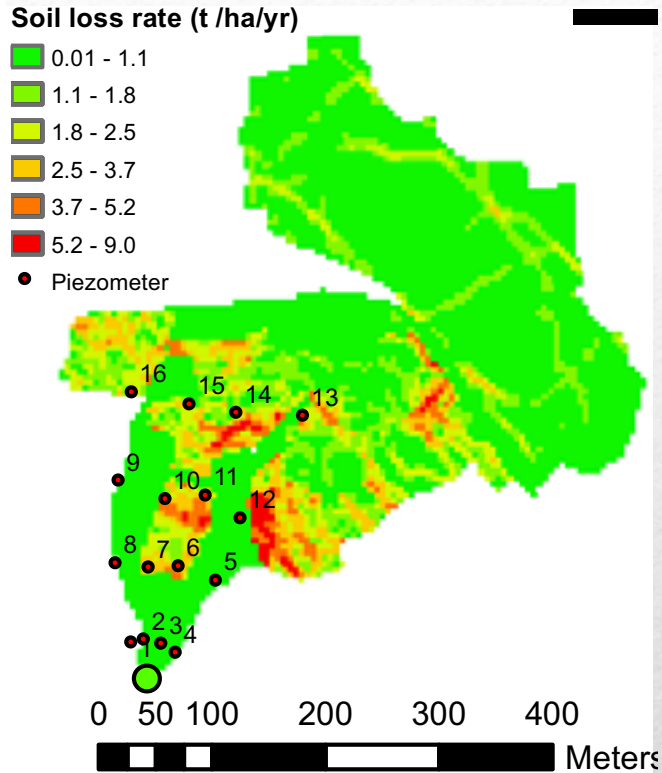
Community map



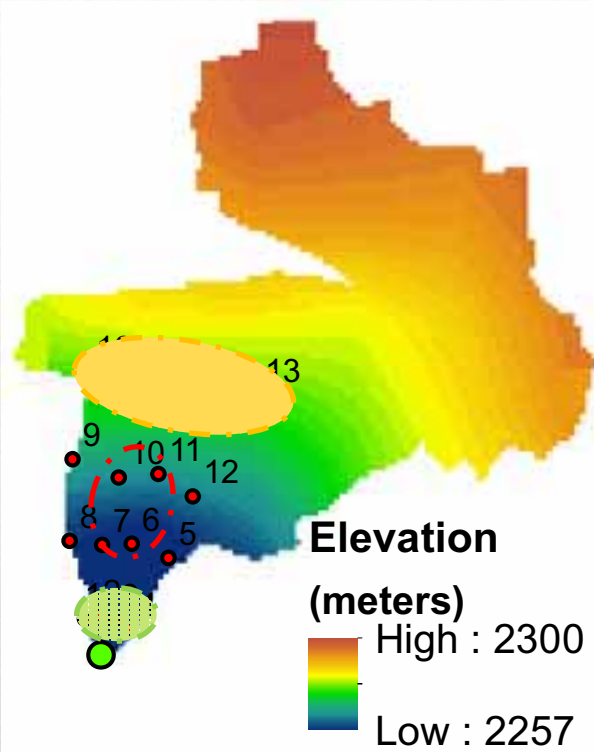
Results



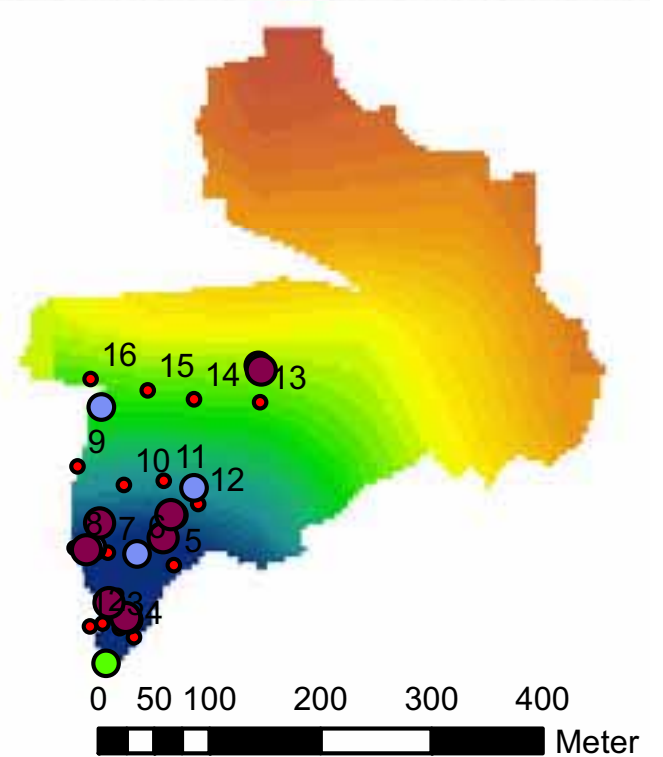
USLE-GIS



Erosion pins



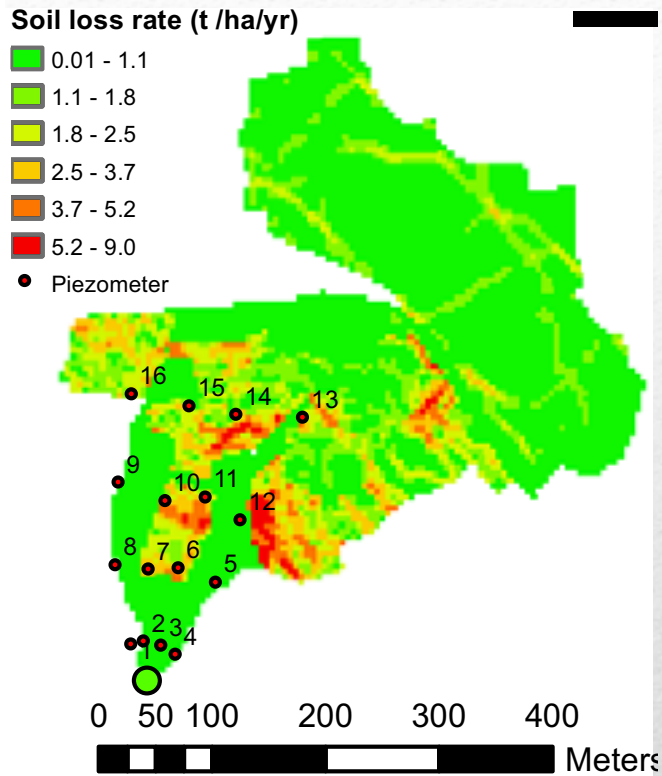
Community map



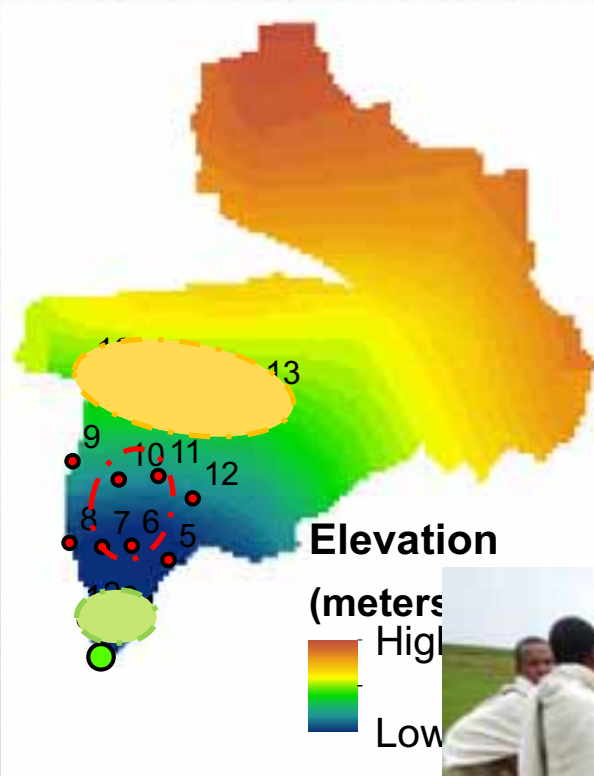
Results



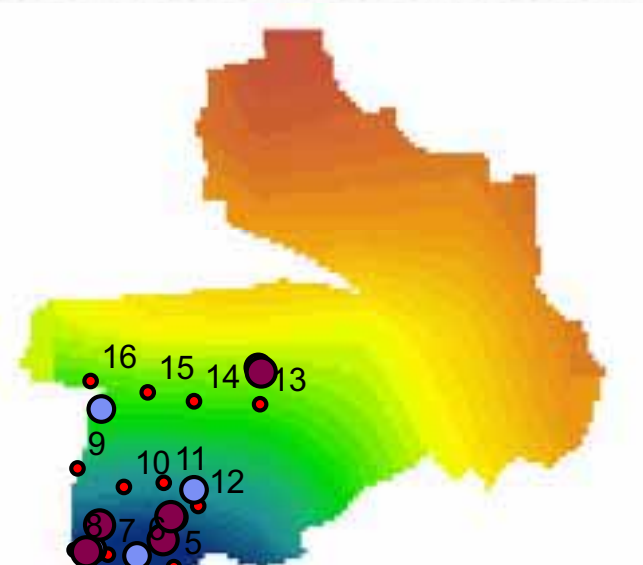
USLE-GIS



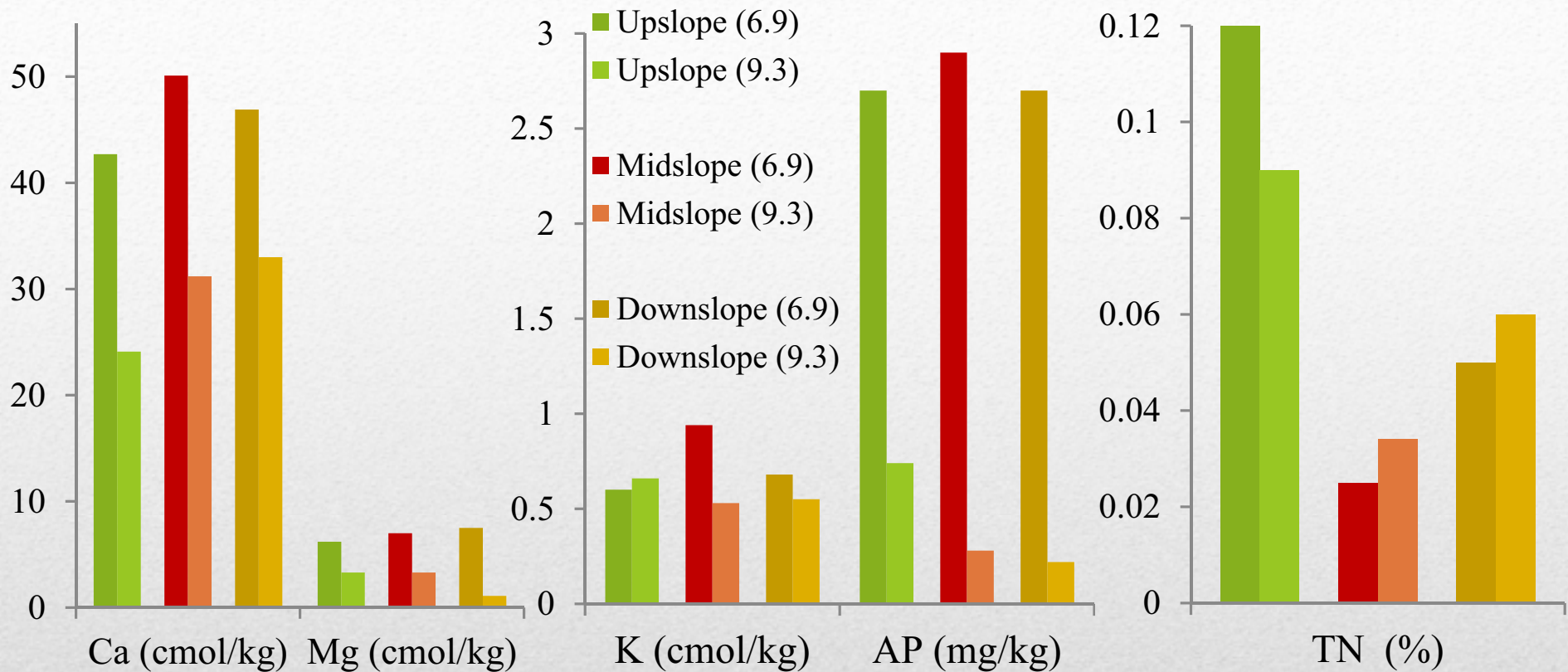
Erosion pins



Community map



Results



Soil nutrient concentration before rainy season (June 9) and during rainy season (September 3) for calcium (Ca), magnesium (Mg), potassium (K), total nitrogen (TN), and available phosphorus (AP).

Results

Ca, Mg, K, P



~N, K



Hydrology

- Rainfall moderate to low, erosion estimates also moderate
- Some deposition where not saturated and some erosion where saturated

Erosion Mapping

- Cropland exhibits most soil depth change by erosion pins and most vulnerable according to USLE
- Conservation bunds supported by middle aged adults and young children but less so by the elderly and young adults
- Saturated zones are areas of gully formation

Soil Nutrient

- Nitrogen most valued, seem to be increasing
- Ca, Mg, K, needed for plant growth, decreasing, P also
- Farmer's perceive decreasing soil fertility, increase in fertilizer quantity

Discussion

- USLE agrees with farmers views of erodibility on farm land and slope effects.
- Gully formation and locations are not predicted by USLE or many other models.
- In focus group discussions and transect walks overland flow and saturated zones are primary areas of concern.
- Most important time for erosion processes first weeks; most important places steep cropped land and saturated pathways
- Developing theory in coordination with communities can be a powerful way to develop soil conservation strategies that work and are supported by the people.

Conclusion

- **Bahir Dar University Undergraduate Assistants:** Ali Yassin, Hiwot Berhie, Fikir Mulugate
- **Field Research Assistants:** Adunga Takele, Gedif Admas, Tsaga Alena, Walelign Yineabat, Tewachew Alabatew
- **ARARI:** Assefe Derebe, Tesfaye Feyisa, Birru Yitaferu
- **Bahir Dar University:** Seifu Admassu, Essayas Kaba, Fasikaw Atanaw
- **Cornell University:** Tammo Steenhuis, Fouad Makki, Rebecca Nelson, Beth Medvecky, Chris Barrett, Carol Coffey, Davydd Greenwood
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