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Water-Food-Energy Nexus: with the perspective of watershed management

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The presentation is based on the results from the graduate program of PhD in Integrated Water Management.

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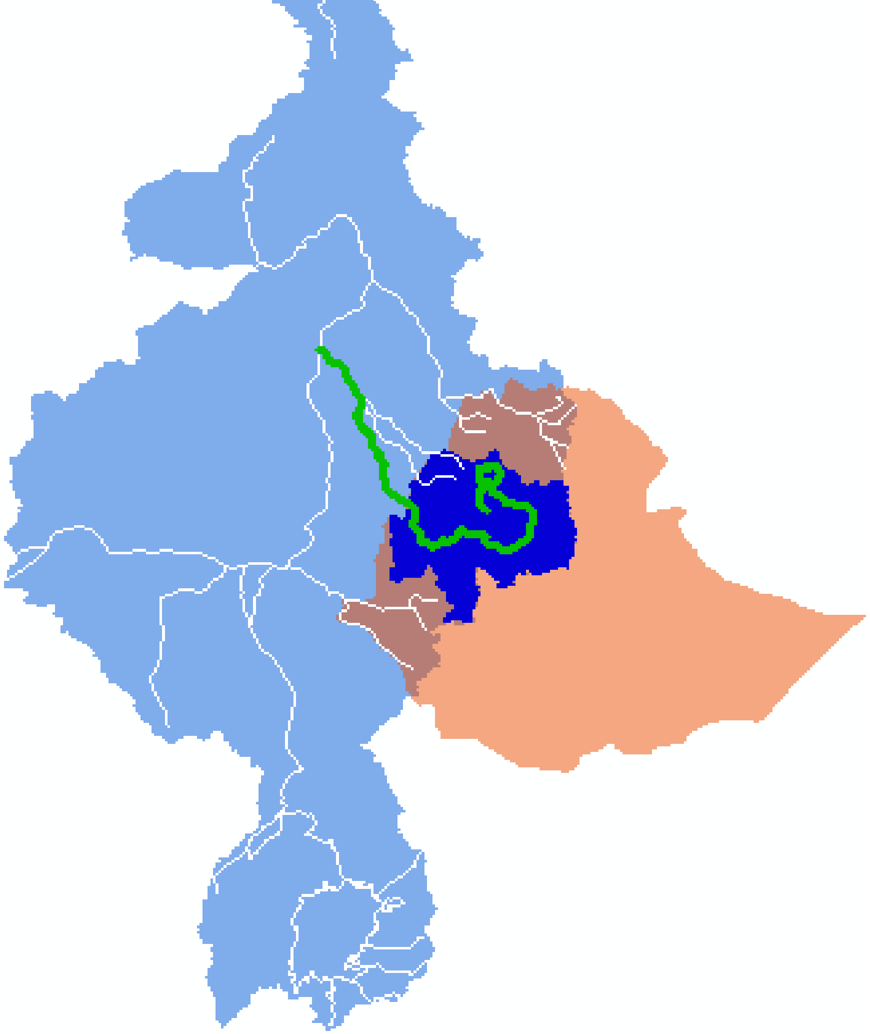
Content

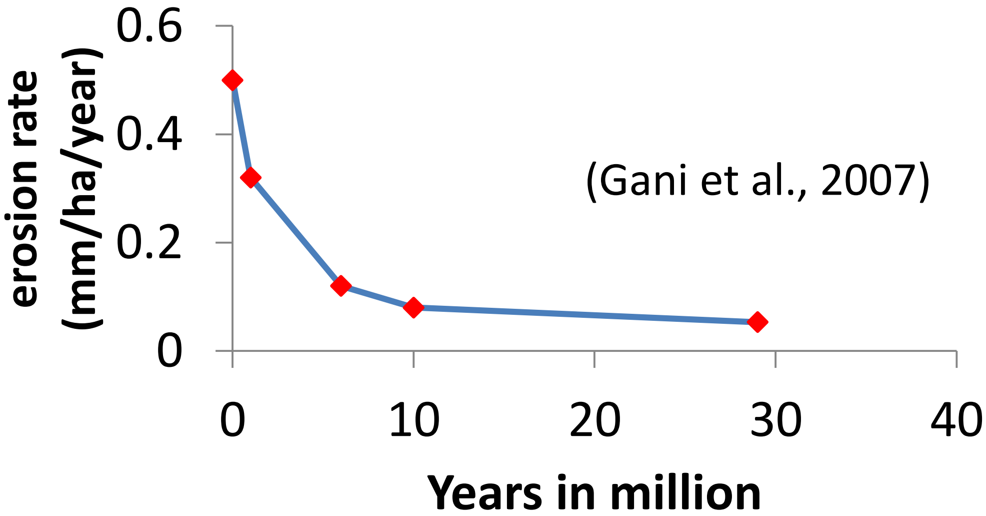
Outlines

- Blue Nile Basin-erosion
- Hydrology and landscape change
- Soil loss and Nutrient
- Landscape interventions: Successes and Challenges
- Nexus Development

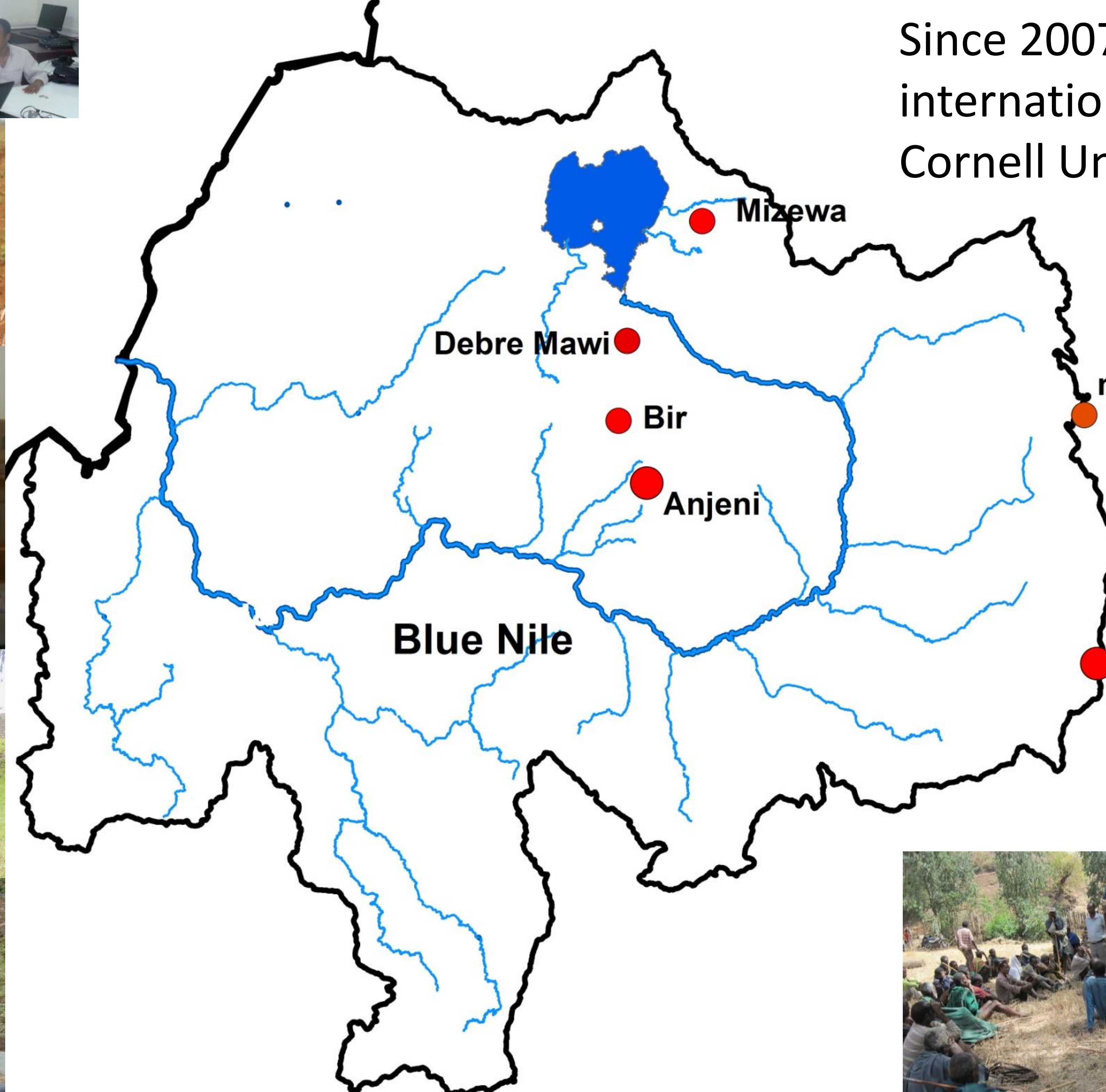
- Blue Nile contributes 60% of the Nile flow and sediment



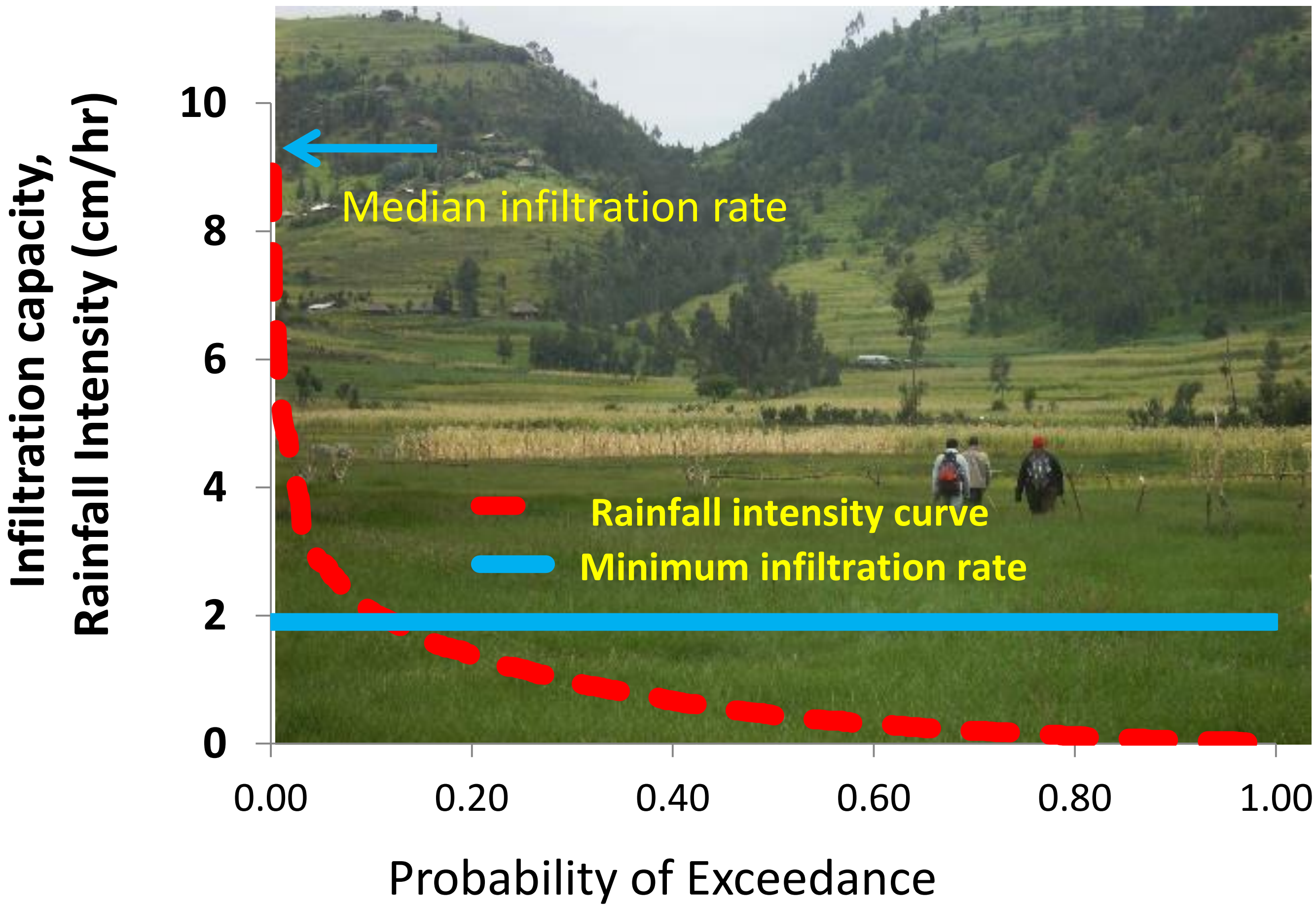
Blue Nile River



Since 2007 with
international partr
Cornell University



Soil's infiltration rate has exceeded the rainfall intensity



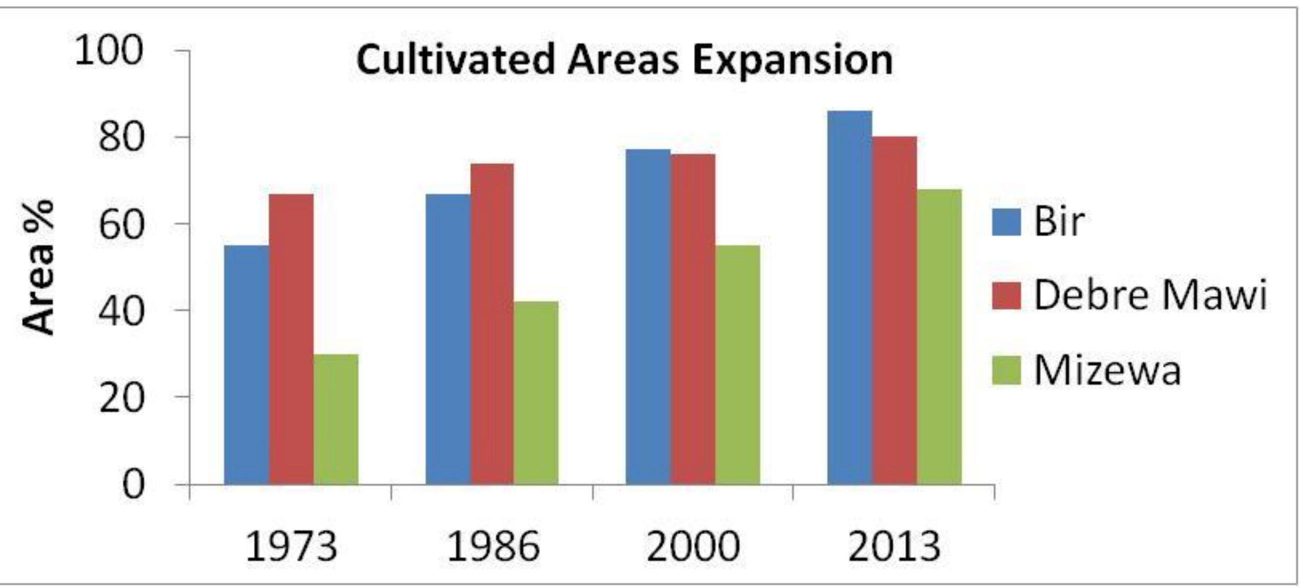
Mechanism:

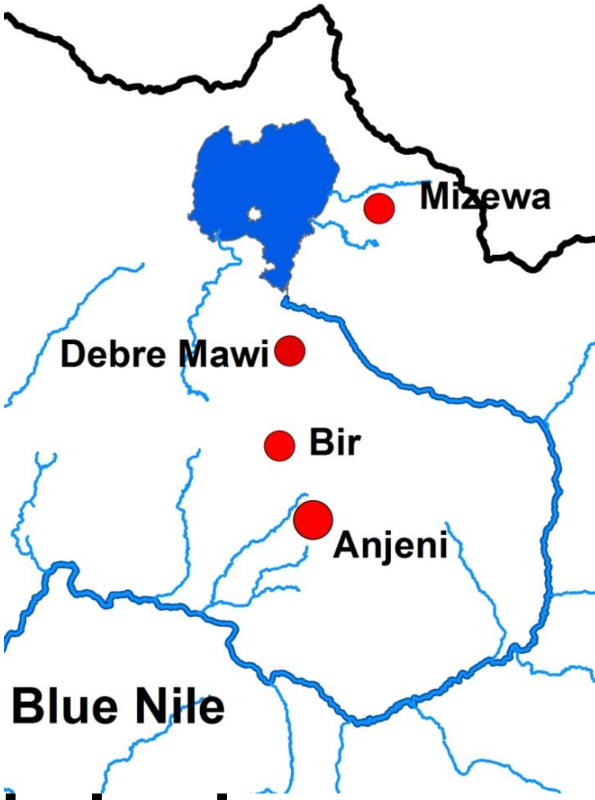
-Hortonian
(Horton, 1933)

-Dunnean

Landscape is changing

- **Cultivated land is increasing at the cost of forests and shrub land.**

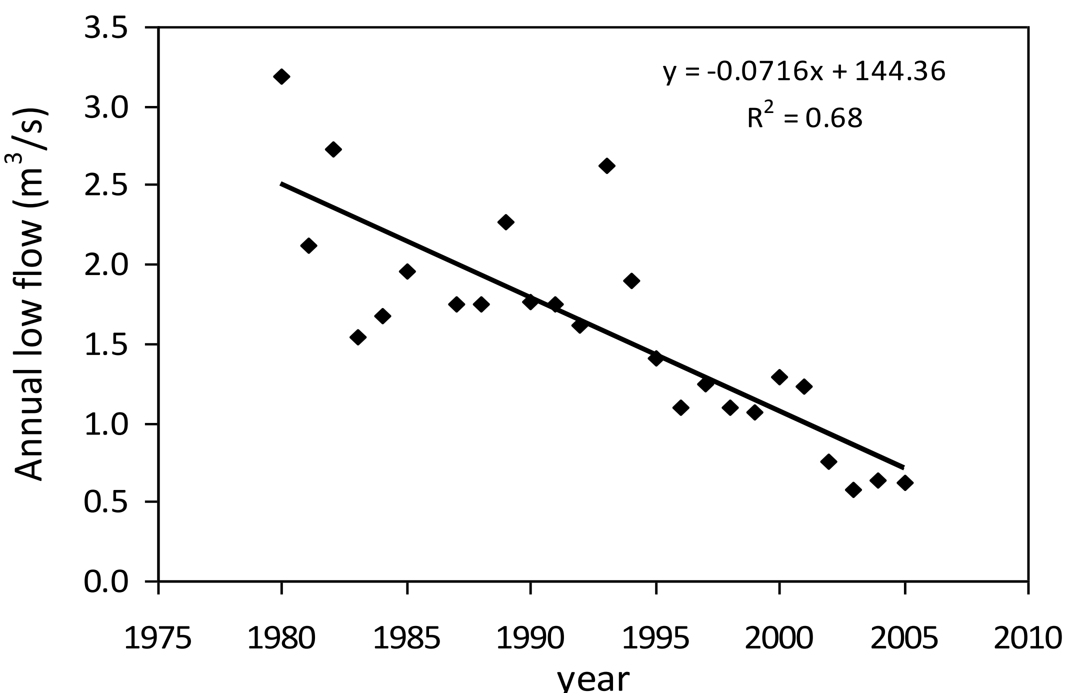




- **flow paths become shallower due to land degradation**

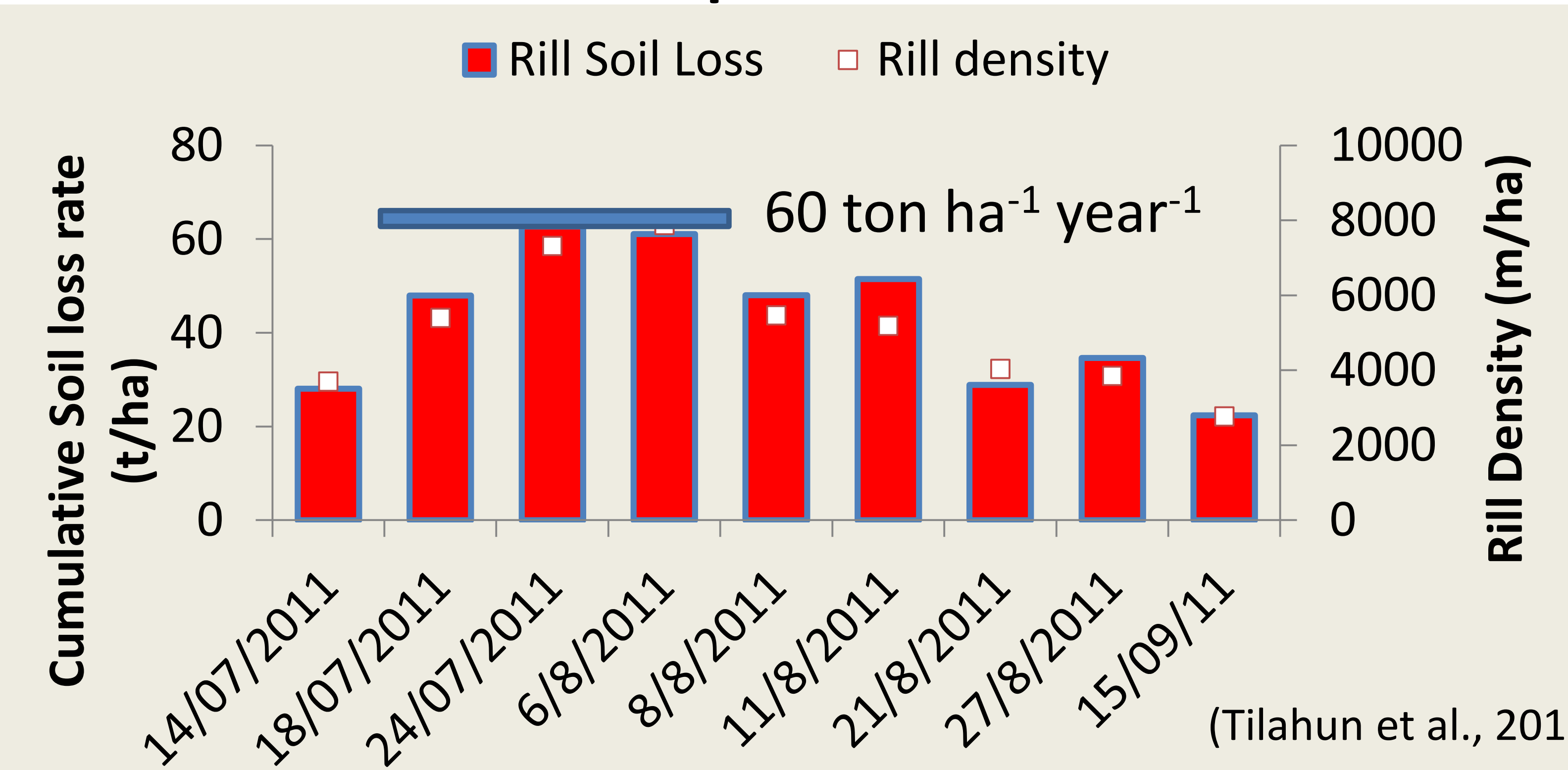
Stream flows with time in the highland

- Low flows during dry period is decreasing
- Flows during the rainy period is increasing
  - 5% approximate surface runoff increase at Sudan boarder



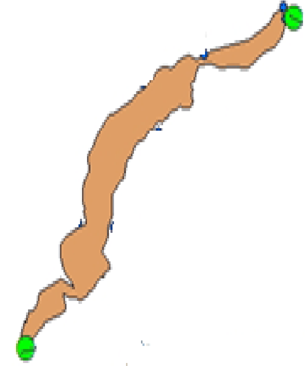
Low flows at Gilgel Abbay (Enku et al., 2014)

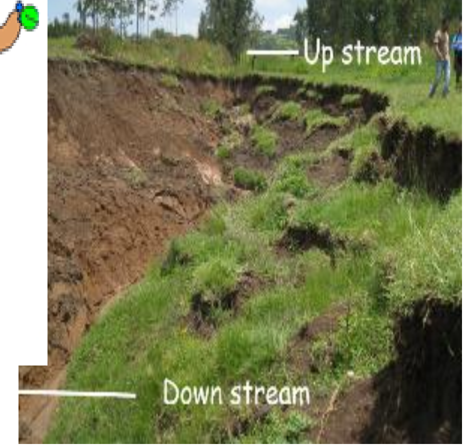
Soil loss by runoff from agricultural plots



(Tilahun et al., 2015)

Soil loss from Gullies



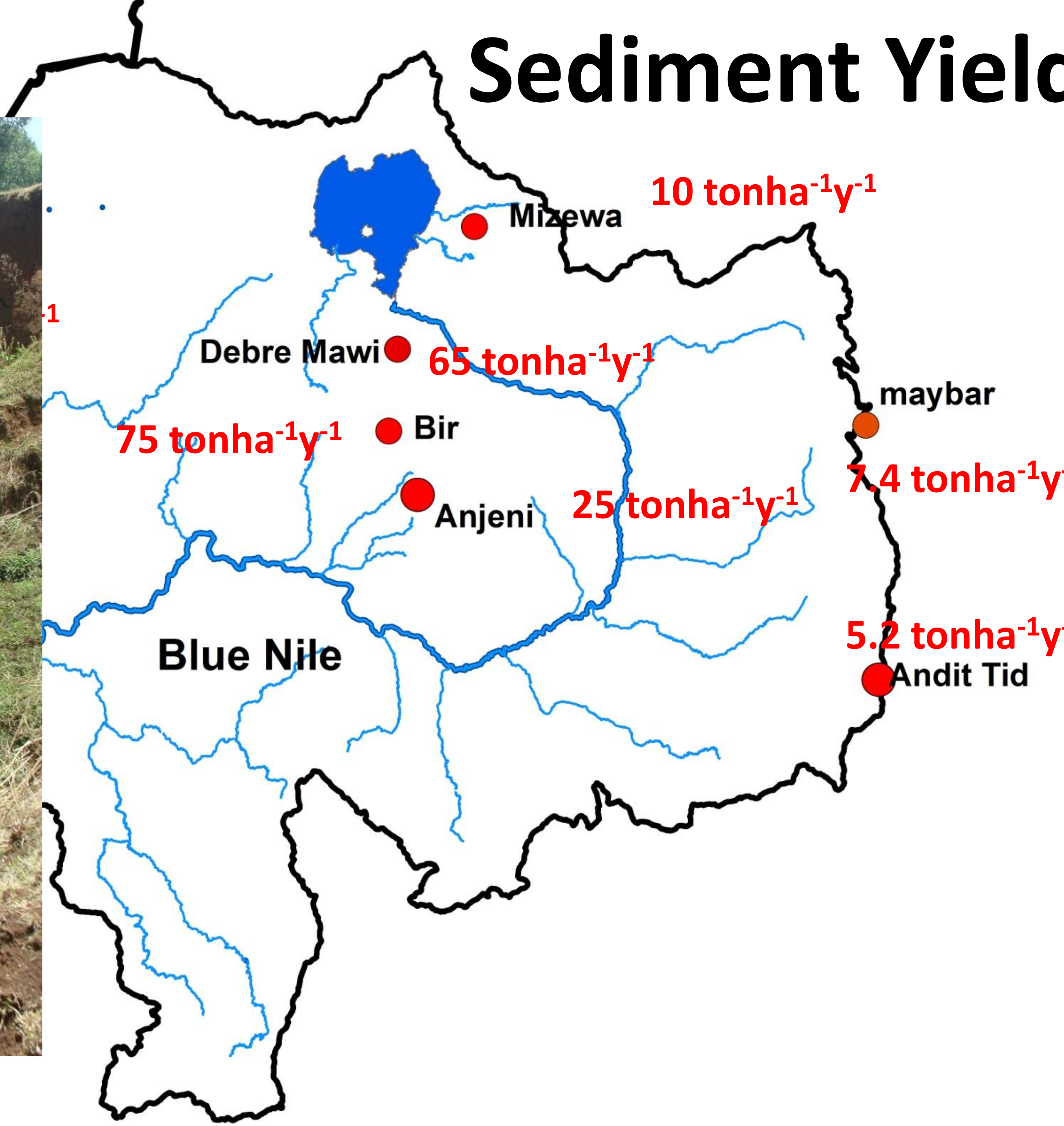


Upstream (Inlet)

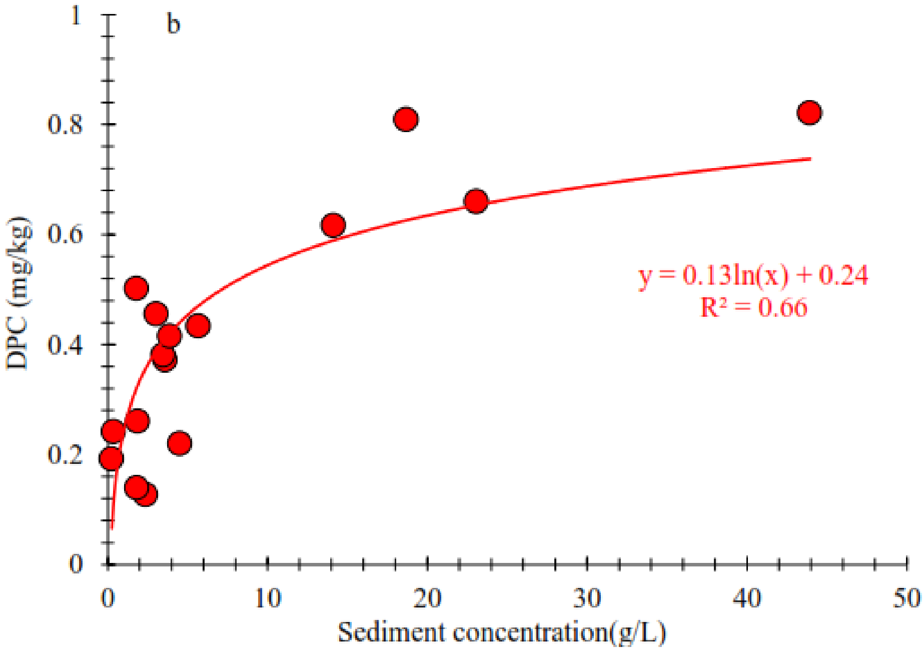
Down stream (outlet)

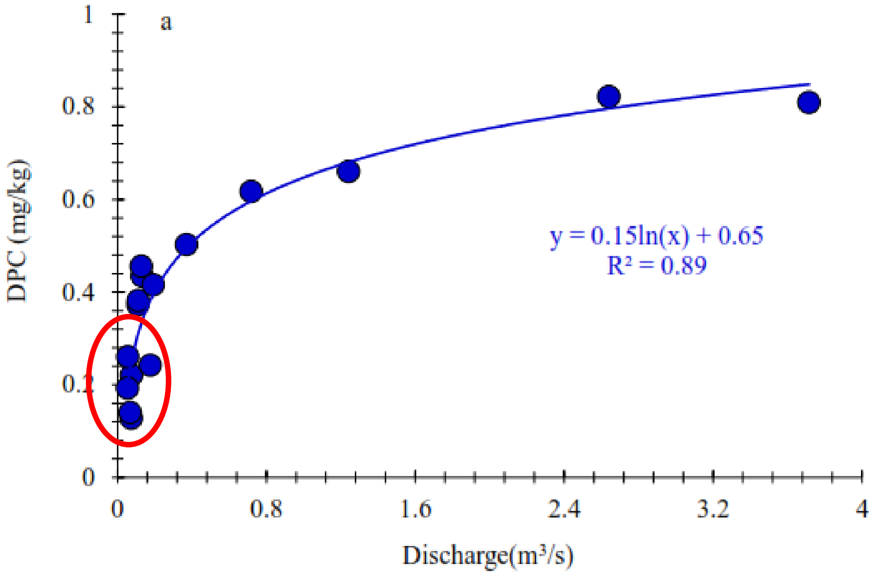
400 ton ha^{-1} year^{-1}

Sediment Yiel



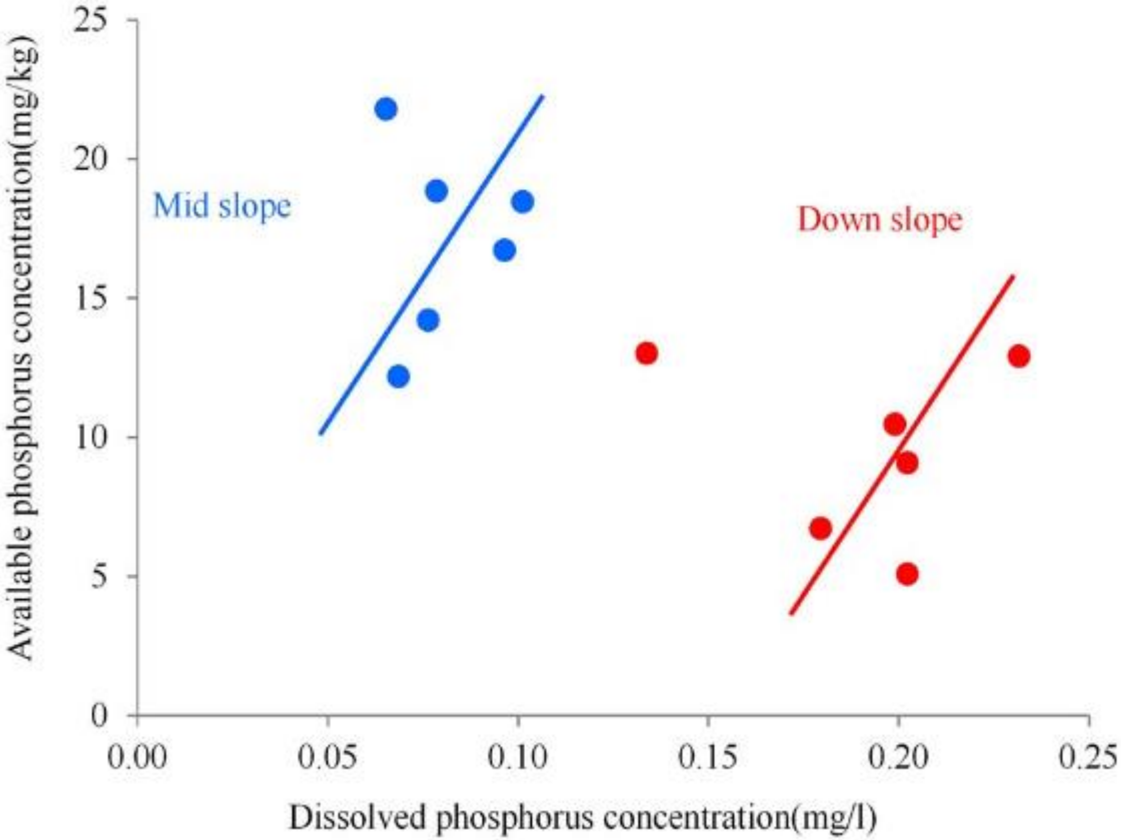
Sediment concentration vs Dissolved phosphorus (DP)



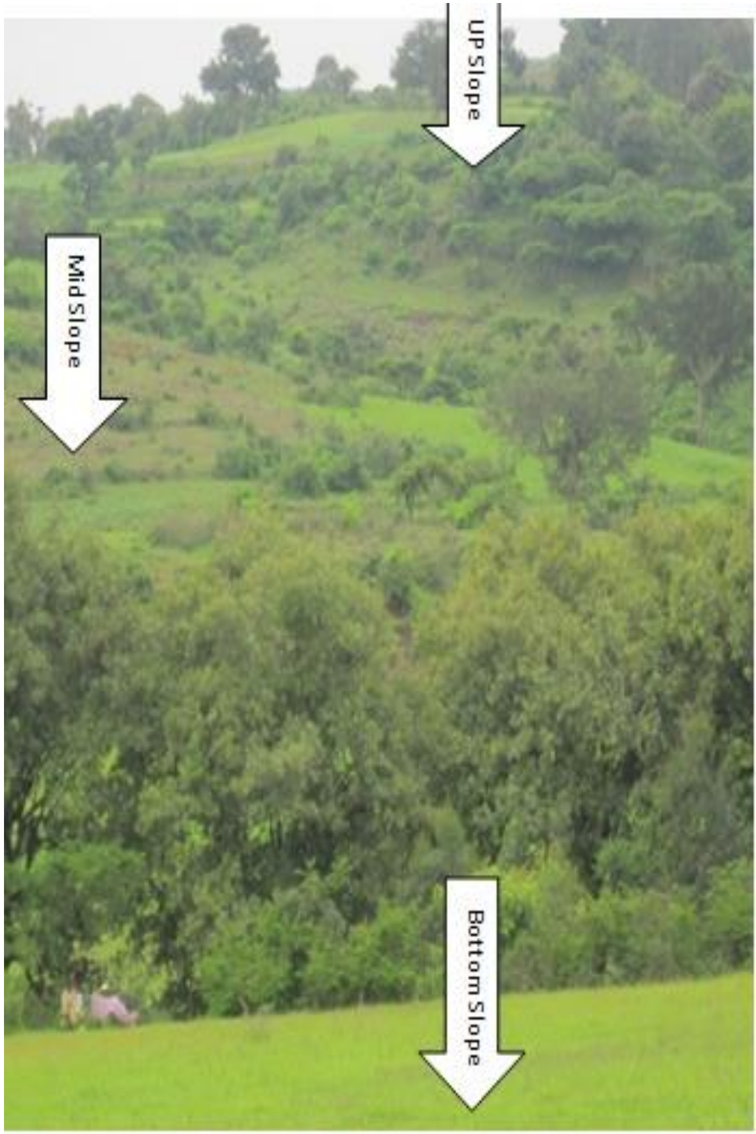


Moges et al., (2016) at Mizewa watershed

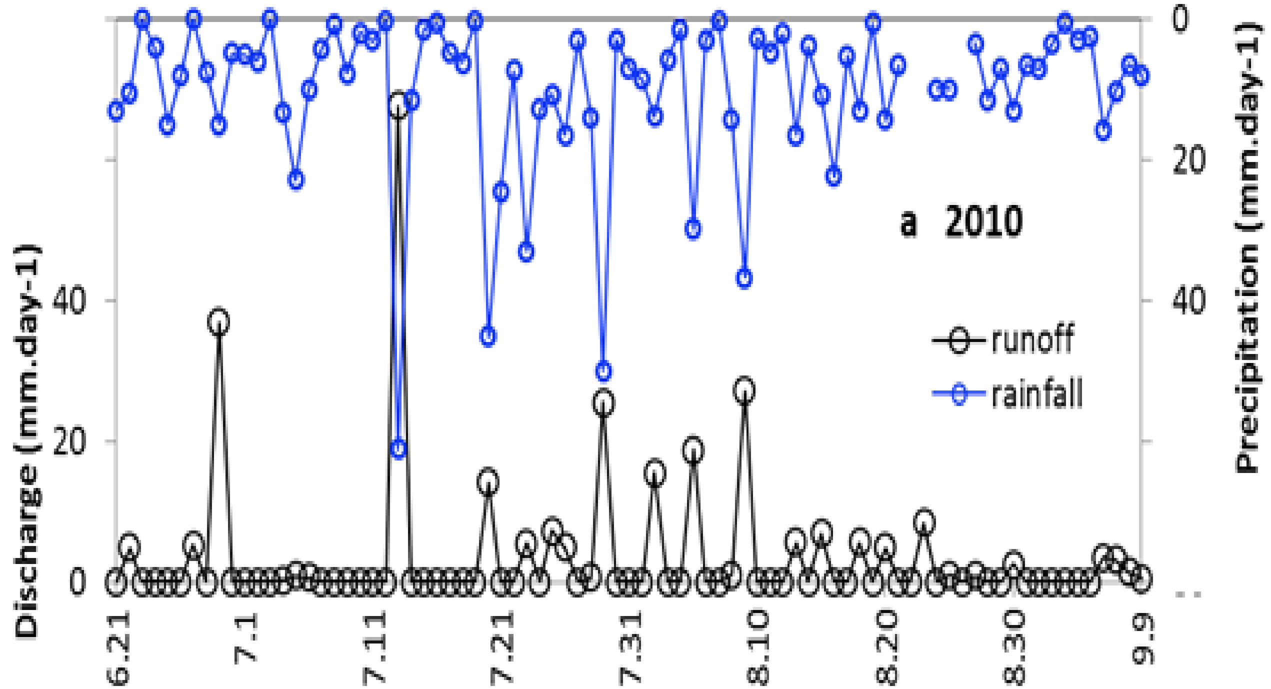
Dissolved phosphorus (DP) at shallow wells



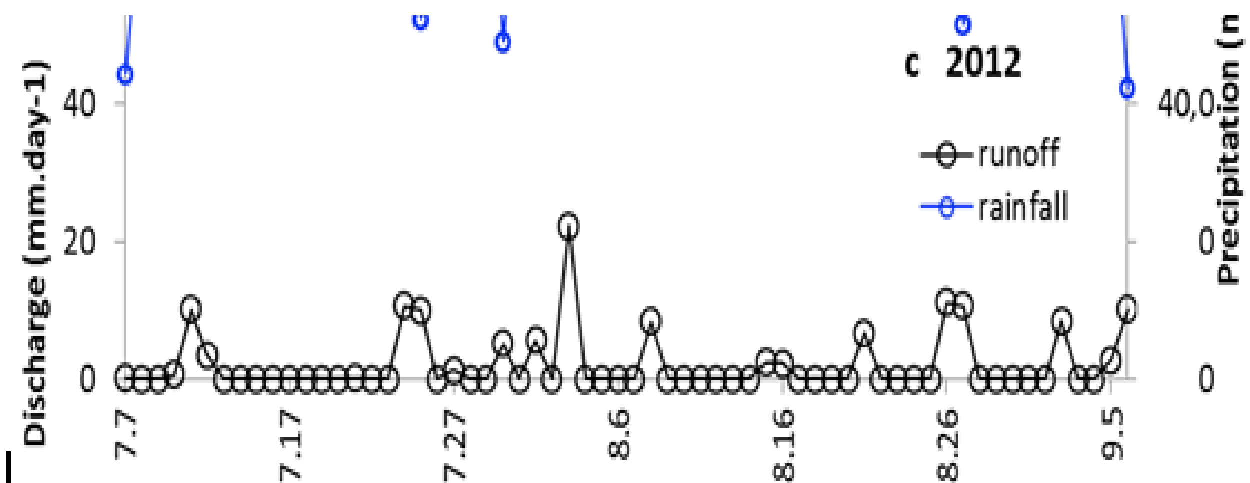
(Moges et al., 2016)



Landscape interventions
Success and Challenges



Water was conserved with infiltration furrows due to interventions 2012



Debra Mawi sediment loads

Table 2. Monthly and annual sediment yield for the Debre Mawi watershed.

	Monthly sediment yield (ton ha^{-1})			
	2010	2011	2012	2013
June	17.6	11.3	0	0
July	37.8	30.9	4.2	11.0
August	8.6	7.5	4.3	1.9
September	1.5	0.6	0.5	0.1
Total	65.5	49.8	9.0	13.0

Sediment load decreased with infiltration furrows

Debra Mawi sediment concentrations

Table 3. Suspended se... ...awi watershed from 2010–2...

Mean	[illegible]	[illegible]	[illegible]	[illegible]
Std. deviation	10.5	10.3	7.6	[illegible]
Minimum	0.0	0.2	0.8	0.1
Maximum	93.4	62.6	42.1	57.8

What do we need to do to reverse land degradation?

Nexus Development: balancing demands for water, food and energy

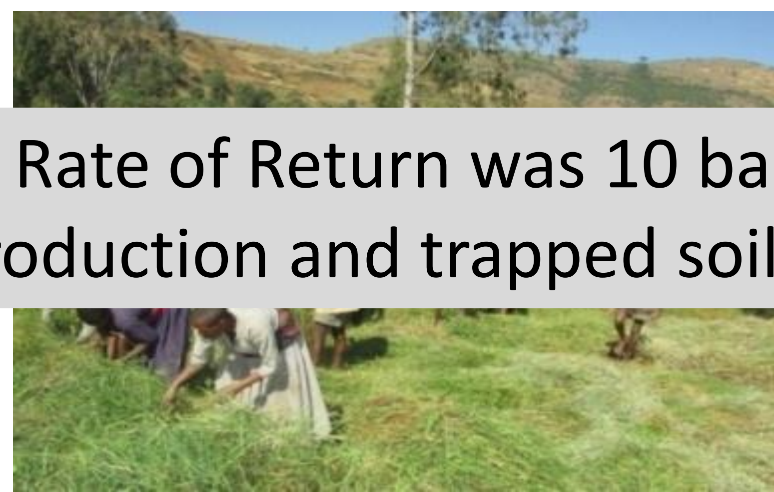
Changing gullies to feed livestocke

The case of Bir watershed

(Ayele et al., 2015)

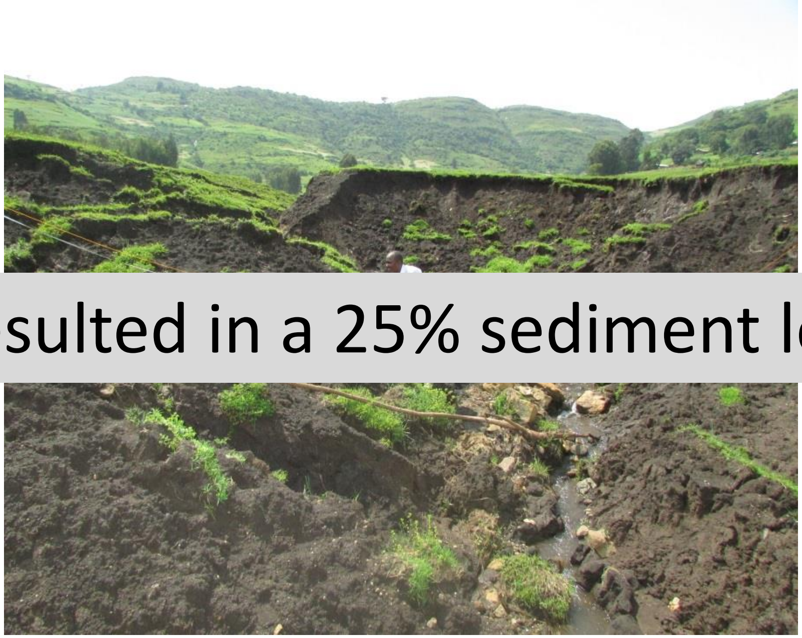
One gully selected by the community and Participatory gully rehabilitation was conducted

before (2013) and after rehabilitation (2015)



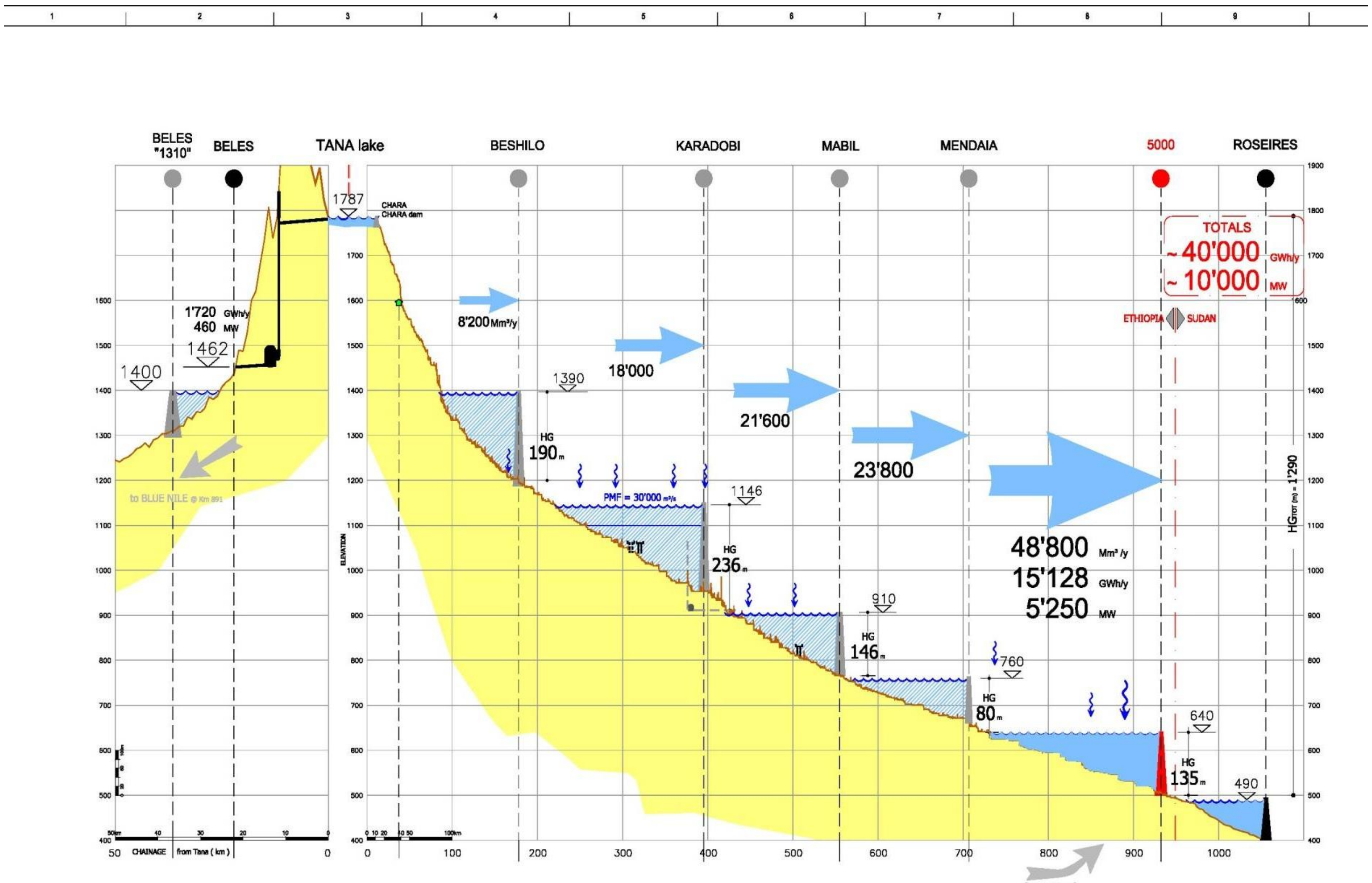
Marginal Rate of Return was 10 based on the value of increased forage production and trapped soil nutrient values.

Five more gullies rehabilitated in 2014 by the farmers, before (2014) and after (2015) rehabilitation

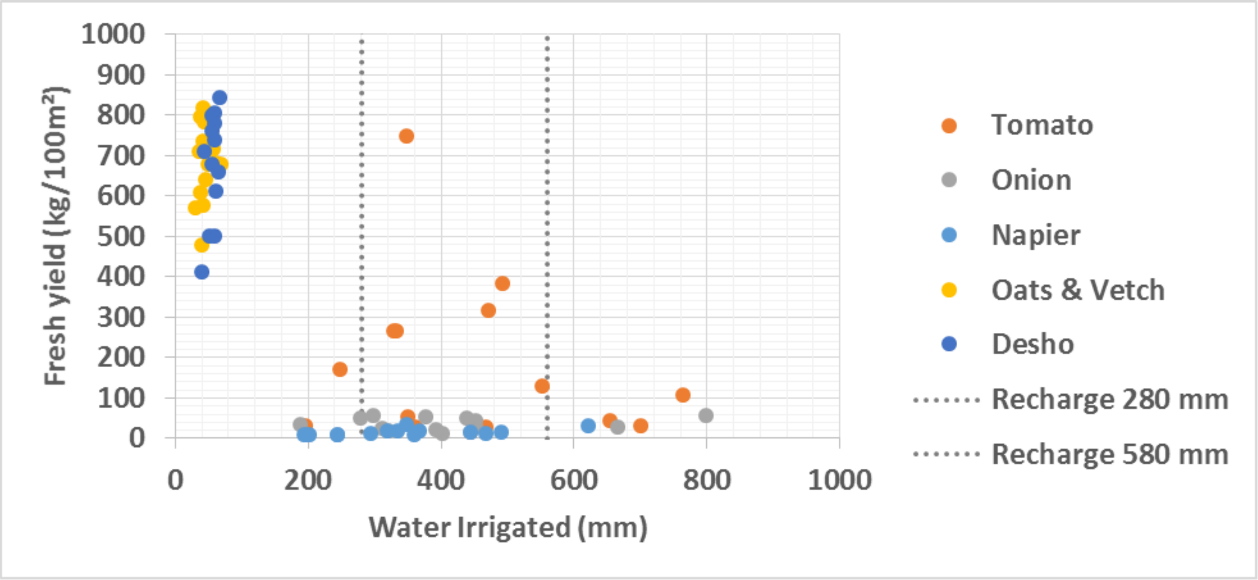


Resulted in a 25% sediment load reduction in 2014 from 2013.

Built dams for hydropower and irrigation



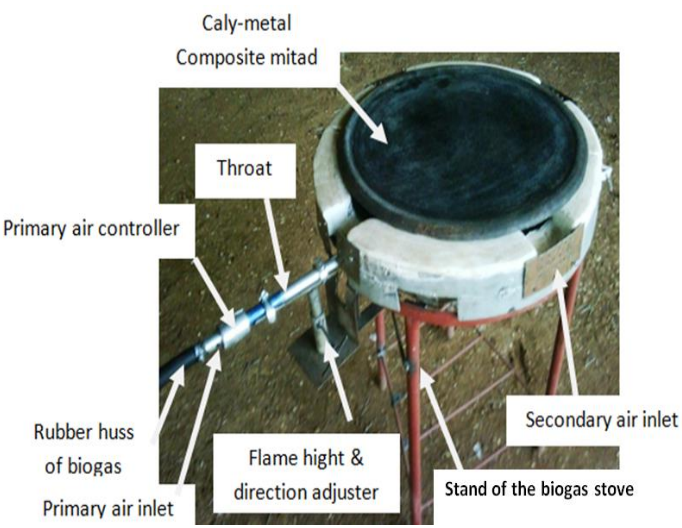
CROP PRODUCTIVITY
at hosehold level by managing water & other resources



- **Fresh yield variability influenced by water lifting, water management & gender**
- Large variability in vegetable production without significant increases in yield
- Oats & Vetch and Desho promising irrigated crops (annual vs. perennial)

(Source data: M. Tesema, T. Ewnetie, H. Mulugeta and D. Tegegne, 2015)

Improve household level energy use



Conclusions

- Erosion is a natural processes controlled by geology but its rate is currently increasing exponentially
- Part of the infiltrated water at hillslope will be interflow down the slope to saturate the valley bottoms—expand gullies
- Bottom lands (gullies and DP sources) are the hydrologic sensitive areas

Conclusions

"Our research has really to produce a cost effective way of producing food and alternative energy to reverse degradation in the Ethiopian highland."