Small-scale irrigation: the answer to ecosystem health?

SIWI World Water Week 2018 – 26th August

SSI and risks of intensification: Case study on water quality in the Ethiopian Highlands

Seifu A Tilahun, Feleke K. Sishu, Petra Schmitter, Tammo Steenhuis

Wisdom at the source of the Blue Nile

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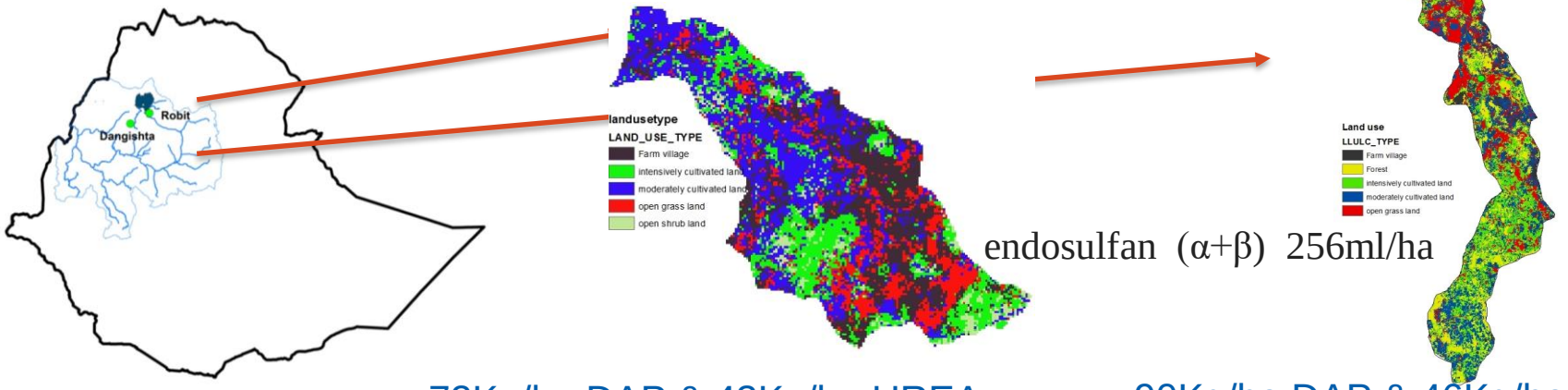
Aim: Evaluate the effect of intensification on water quality: shallow groundwater, streams and lake water bodies

Different intensification levels & topography

Robit (intensified)
~911 ha

Dangila (less intensified)
5700 ha



endosulfan (α+β) 256ml/ha

72Kg/ha DAP & 43Kg/ha UREA

90Kg/ha DAP & 46Kg/ha UREA

- Agricultural land use: 80% (Robit) and 60% (Dangila)
- 0-10% slope class: 55% (Robit) and 80% (Dangila)
- Irrigation in Robit > Dangila
- Rainfall and OM of Soil in Dangila > Robit

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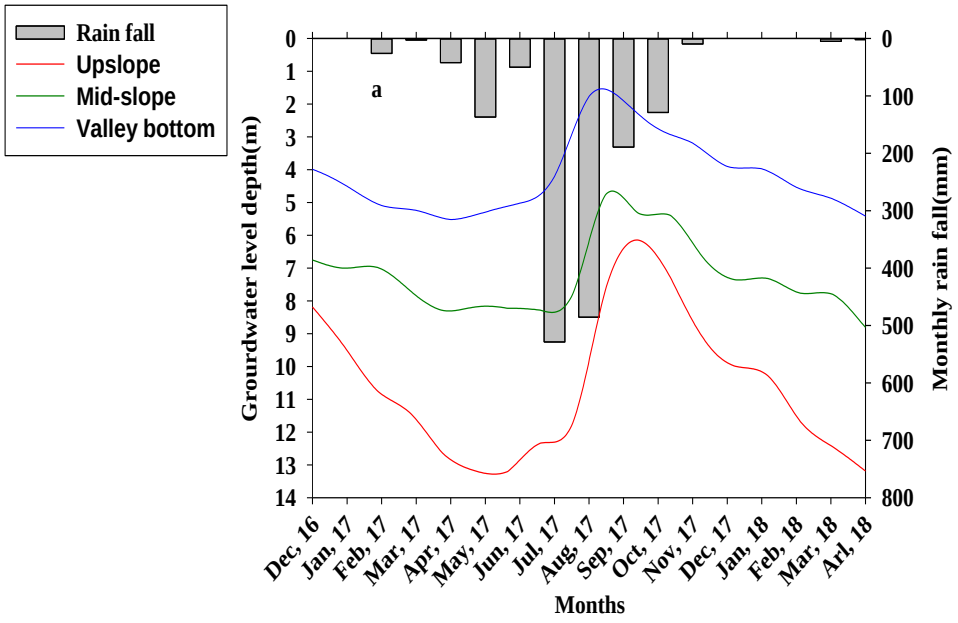
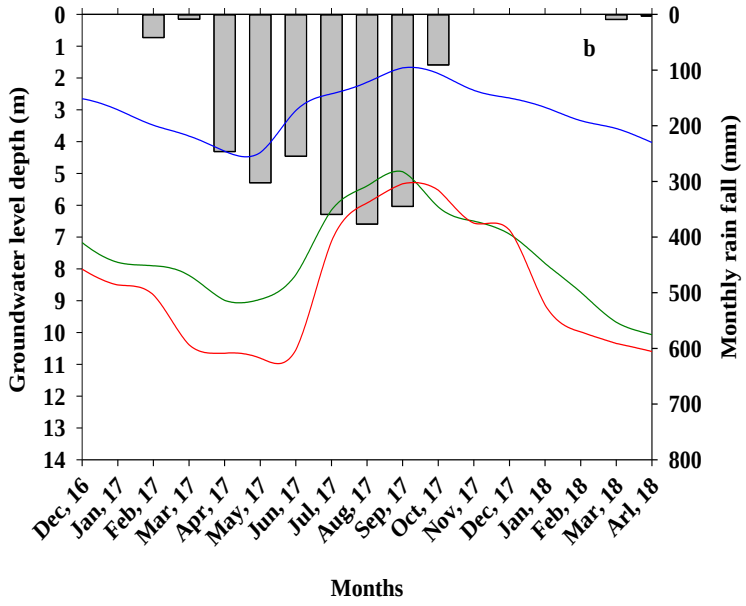
Groundwater Level Variation Over Time

Robit



Dangila



Groundwater is preferred as a source for potable water

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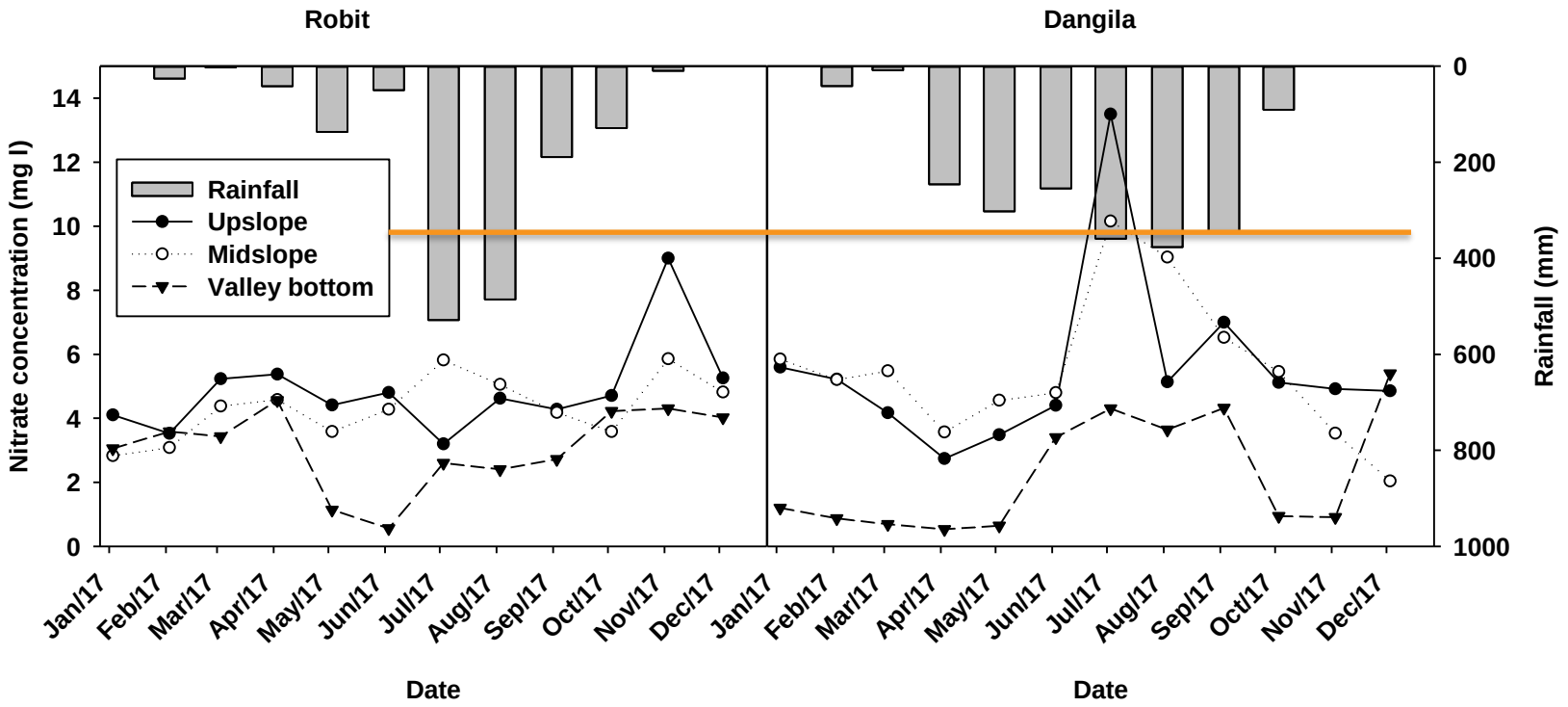
Groundwater monitoring: Nitrate



- Rainy season: risk of levels above EPA drinking guidelines (10 mg l^{-1})
- NO_3^- signficantly lower in valley bottom and lowest in Dangila ($p<0.05$)
- Nitrate in GW during dry period is higher in intensified areas than non-intensified areas while rain-fed depends on the amount of fertilizer applied

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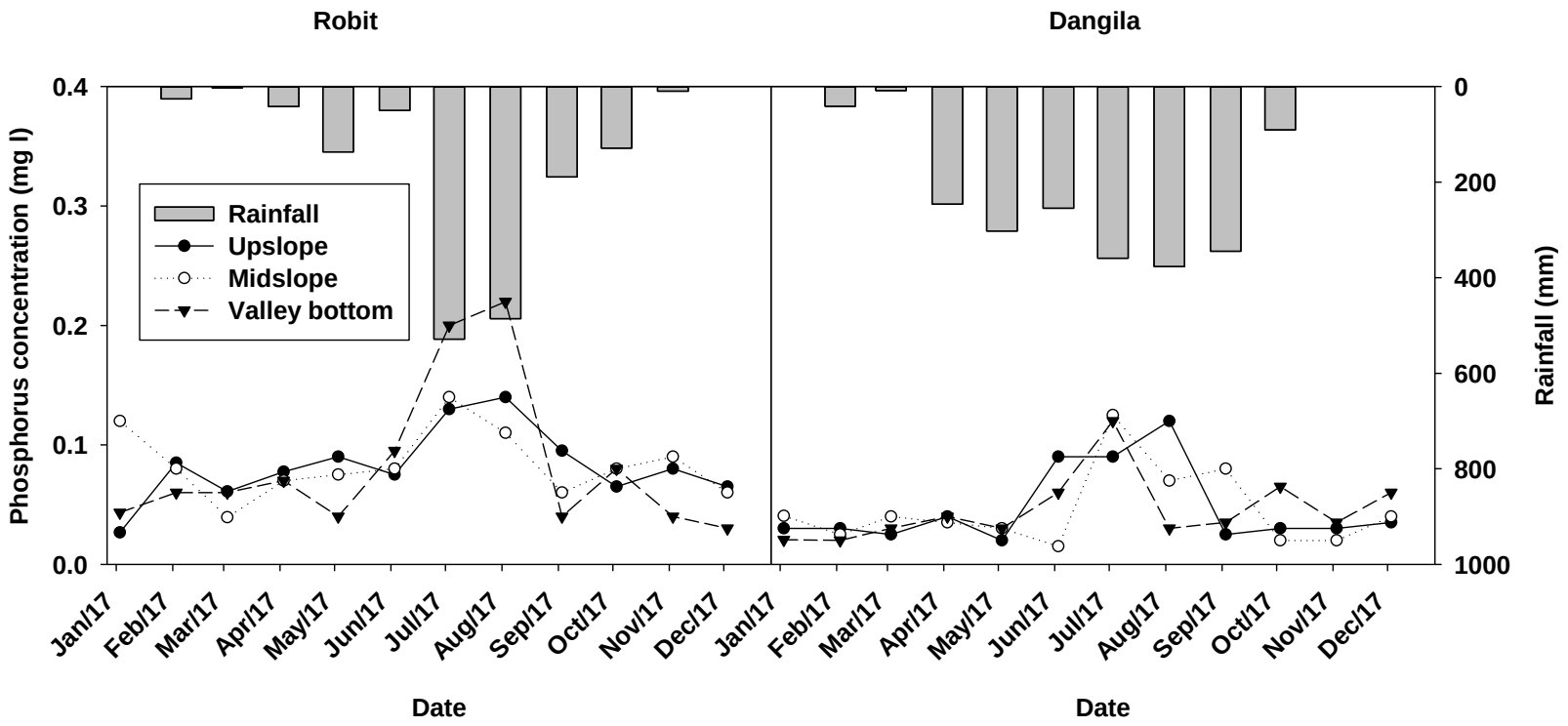
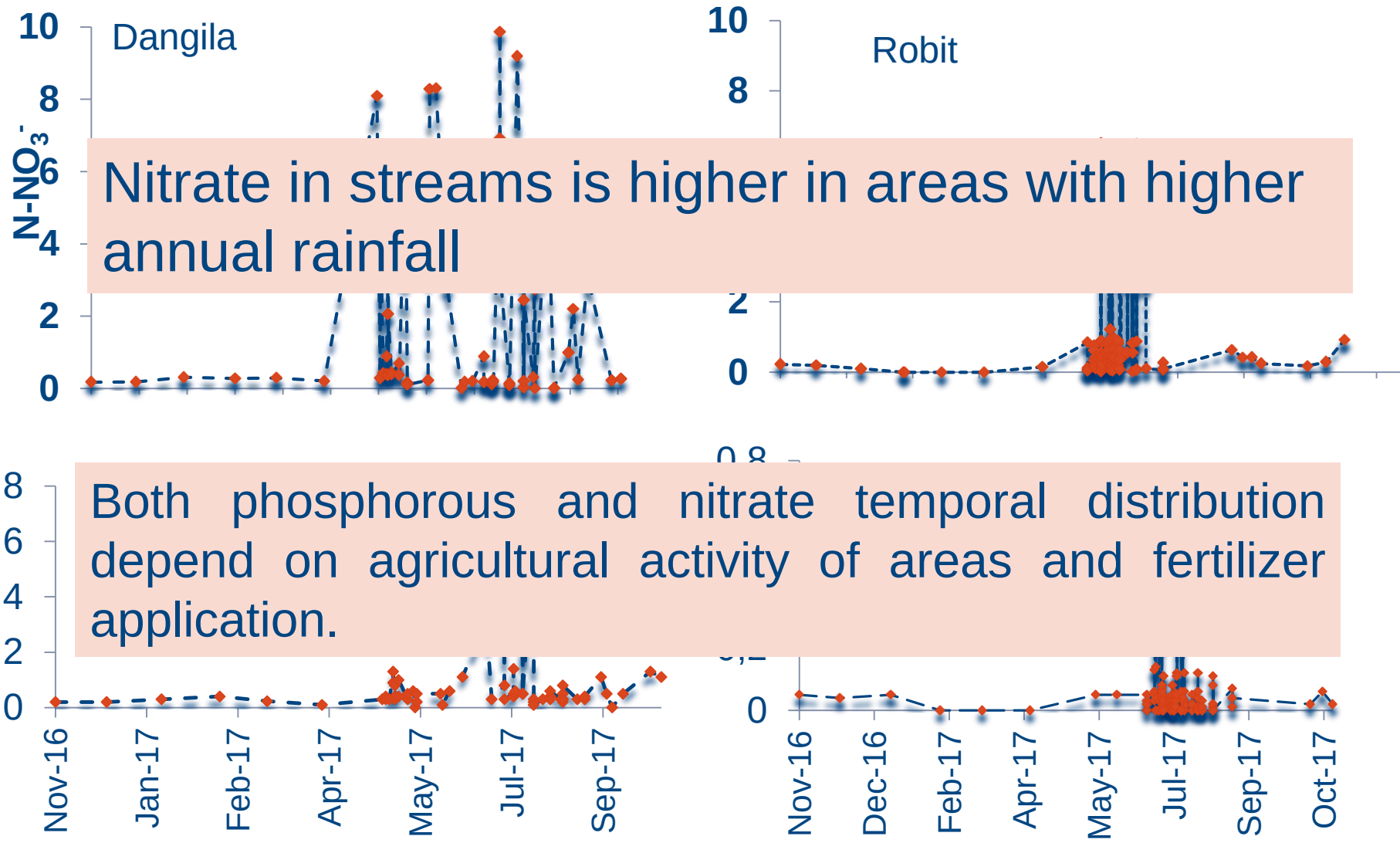
Groundwater monitoring: Phosphorus



- Higher concentration levels in Robit likely related to water transport in the landscape and soil OM (Robit < Dangila in OM)
- Phosphorous in GW is likely related to the relative steepness of the watershed and OM condition.

Streams: Nitrate and Phosphorus



Nitrate in streams is higher in areas with higher annual rainfall

Both phosphorous and nitrate temporal distribution depend on agricultural activity of areas and fertilizer application.

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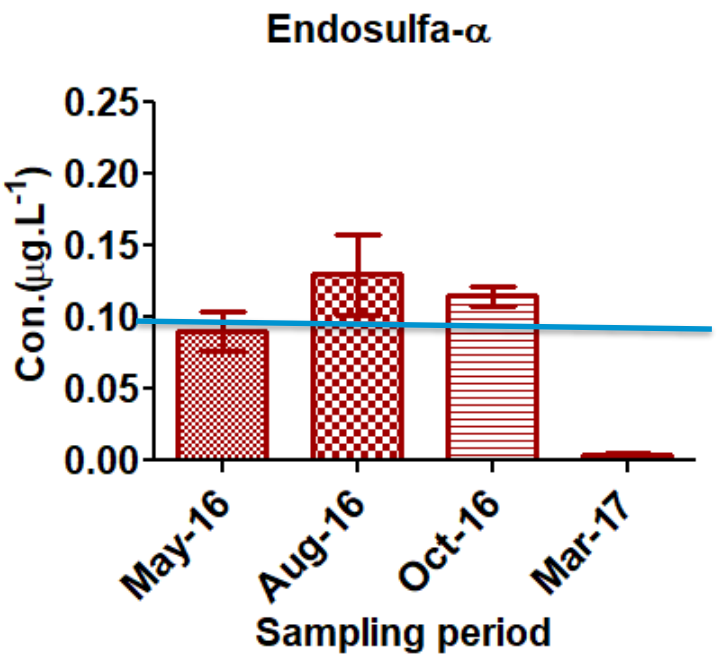
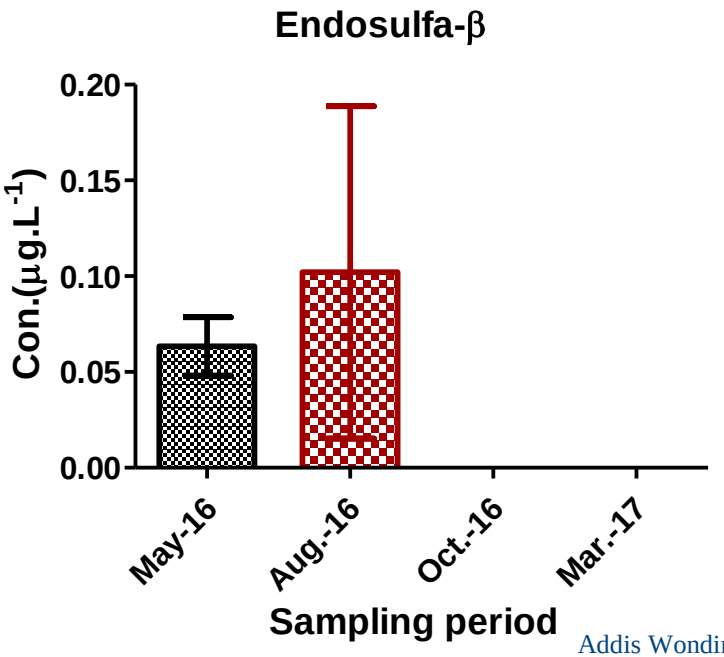
Groundwater monitoring: Pesticides





Addis Wondimnew, MSc. 2017

- Endosulfa-α concentrations higher in summer (August) and the irrigation (October) period. The **values exceeded MAL-** value of EU 0.1 µg L^{-1}
- Endosulfa-β in groundwater was not detected during dry season

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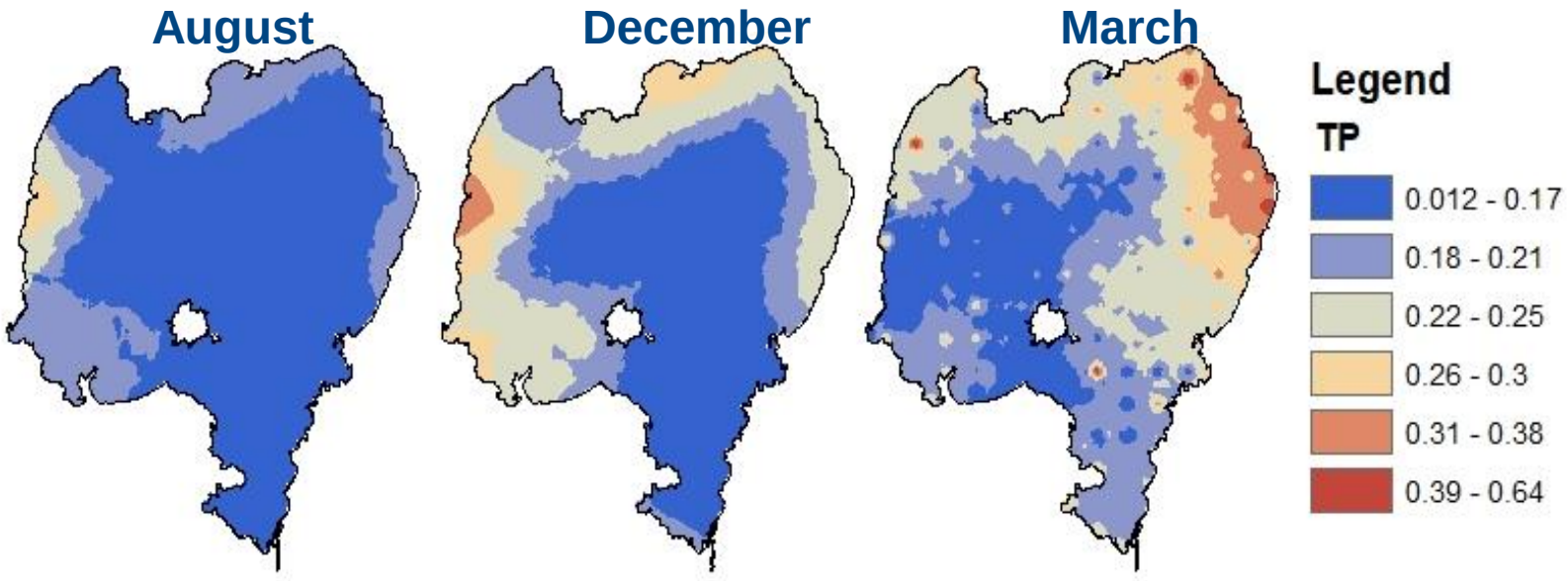
Total Phosphorus: spatial



Ateka et al. (draft)

- The largest freshwater body (Lake Tana) started to exceed the 0.2 mg/L of P - minimum level for eutrophication
- Increasing trend in TP during Aug 2016 to Mar 2017 could be with high internal loading.

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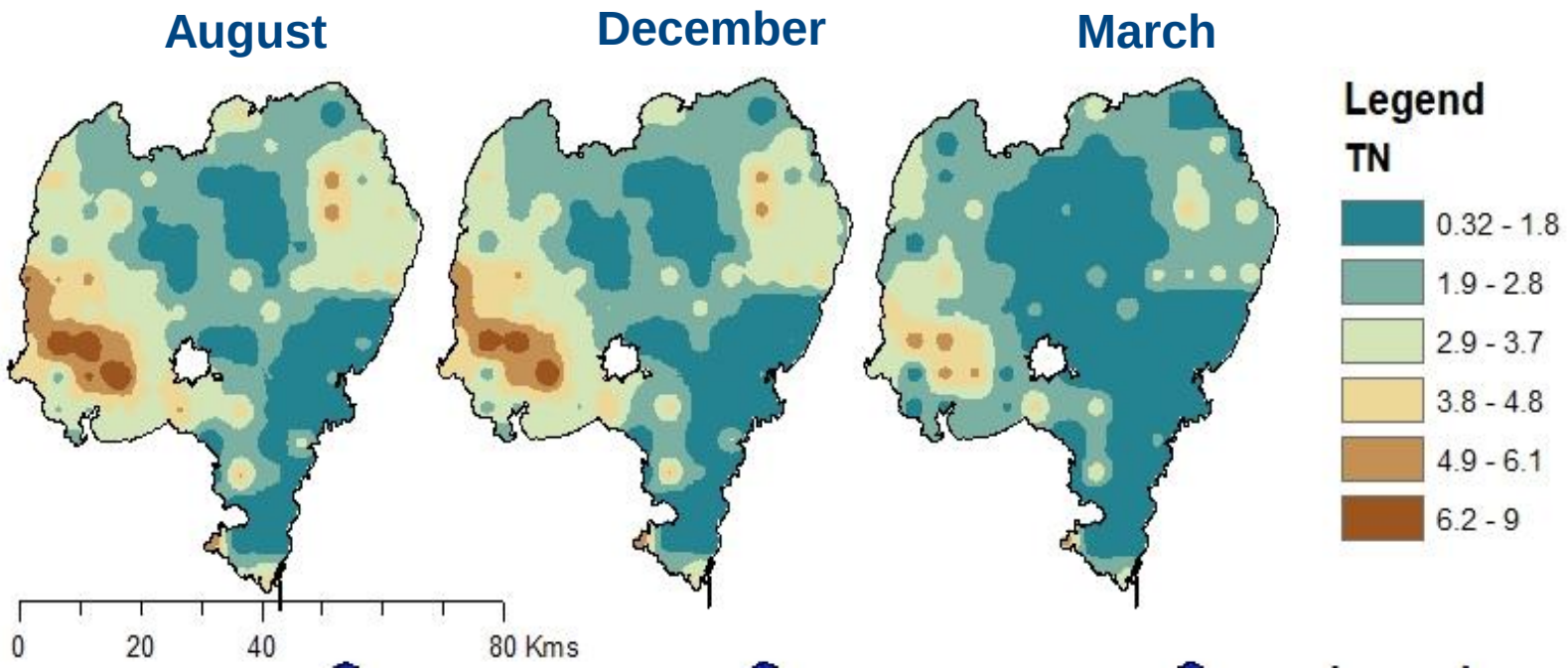
Total Nitrogen: spatial



Ateka et al. (draft)

- Concentration of TN is generally lower than WHO permissible limit
- Decrease in load and increase in biological activity drive lower TN concentration.

Key messages: Recommendations for ensuring small-scale irrigation and ecosystem health

- ⇒ **Target and promote intensified SSI in suitable areas through evidence-base on agriculture-water-environment-health system**
- ⇒ **Reverse degradation and rehabilitate watersheds (river basins) for improved SSI**
- ⇒ **Link watershed management with irrigation**
- ⇒ **Support institutional changes and building to set guidelines, monitor, regulate agrochemical use and occurance in water bodies**
- ⇒ **Increase smallholder awarness on the impact of agrochemicals on water quality**

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Thank you

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