



META
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BENEFICIAL ROAD WATER MANAGEMENT

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Overview

1. Introduction

2. Roads  Water

3. Roads  Water

4. Harvesting water from roads: Ethiopia

5. Harvesting water from roads: Kenya

6. Hydrological impacts

7. Socio-economic impacts

1. Introduction

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- Road development changes runoff patterns; often causing concentrated water flow.
- Concentrated water flow is a resource, if harvested/managed.
- ***How could roads be used to harvest/ manage water?***



1. Intro: Making Roads Work for Resilience

Big impact

Roads are major investment globally

- 1-2 Tr USD/year
- 6 Tr USD/ year in Asia for all infrastructure in next 15 years

Roads have major impact on (surface) hydrology and flood patterns

Triple win can be generated

- reduced damage to landscape (erosion, flooding etc)
- reduced damage to roads
- water for productive and consumptive use important for drought mitigation

2. Roads vs Water: Water damage triggered by roads can be huge (Arsi, Ethiopia)



2. Roads vs Water



2. Roads vs Water: Gully erosion and infrastructures (e.g. Nigeria)

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3. Roads ♥ Water: Examples

Roadside cisterns in Yemen

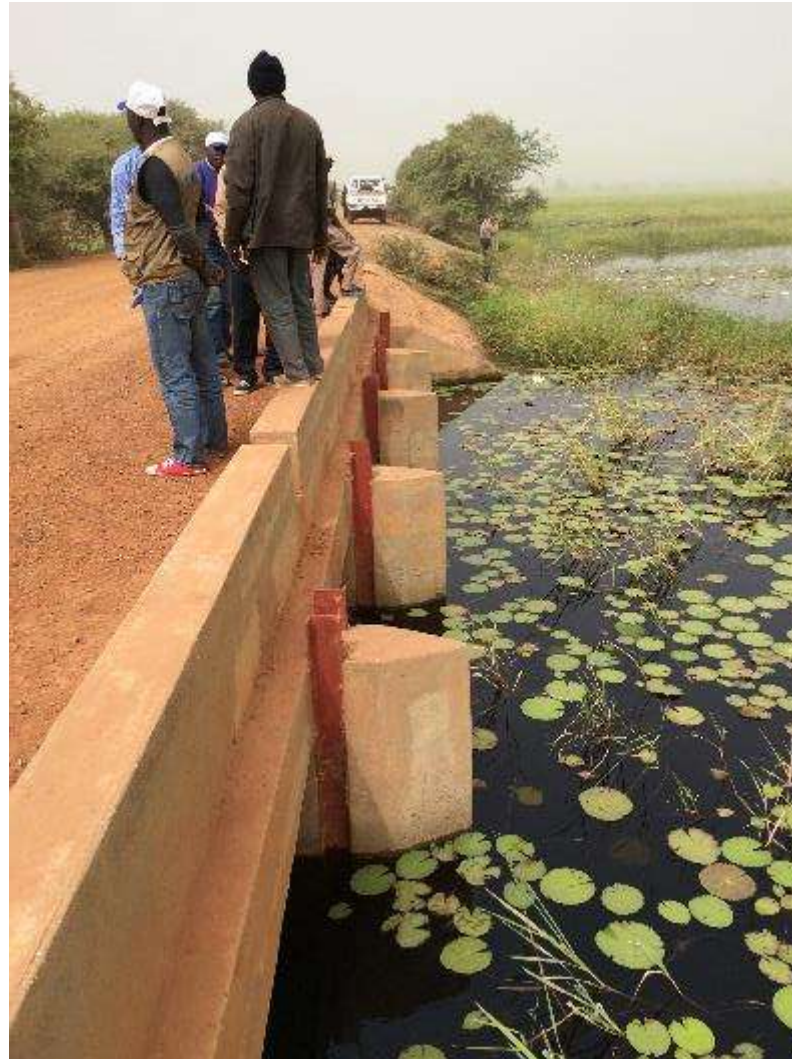


3. Roads ♥ Water: Examples Road drifts acting as sand-dams in Kenya



3. Roads ♥ Water: Examples

Road embankment = reservoir in Mali



3. Roads ♥ Water: Examples

Road = flood water spreader in Niger



3. Roads ♥ Water: Examples

Water harvesting from retreating wetland/floods



Borrow pit provide water as the wetland retreats



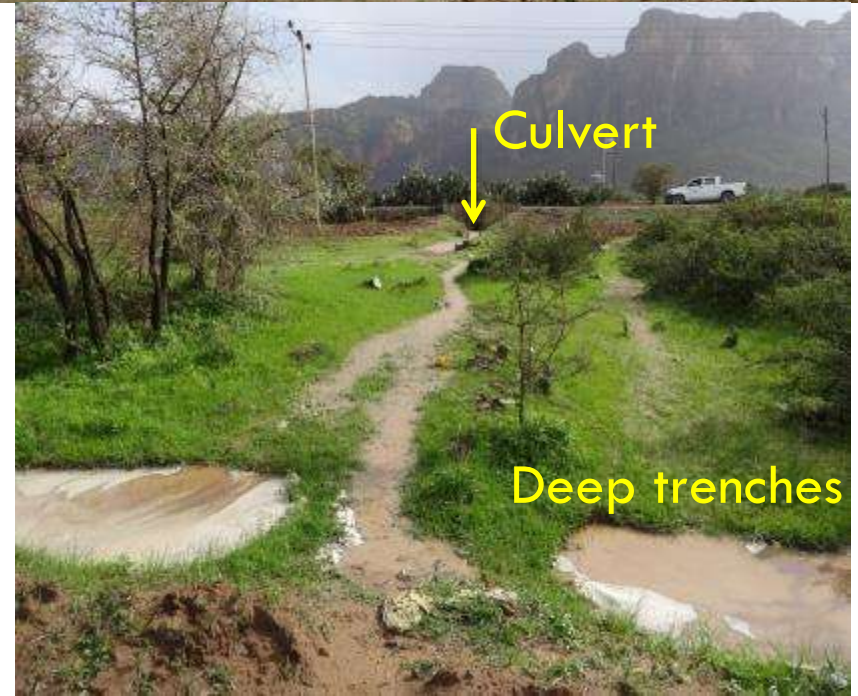
SOUTH SUDAN – DRY SEASON IRRIGATION FROM BORROW PITS

4. Harvesting water from roads in Ethiopia

- Capturing high rainfall
- Implemented since 2014
- Dealing with 2015 El Nino
- Engaged > 2.25 M people in 2015/7 campaigns
- Benefitted 1.1 M people
- Guidelines being prepared
- Outscaling now to Kenya, Sudan, Uganda, Mozambique



(a) Construction of **Deep trenches** at downstream side of roads to recharge the groundwater and improve moisture conditions of soils.



(b) Road side ponds/ pits to recharge groundwater and enhance in-situ moisture in soils.



2016



(c) Road side runoff diverted into ponds for surface water storage and groundwater recharge.

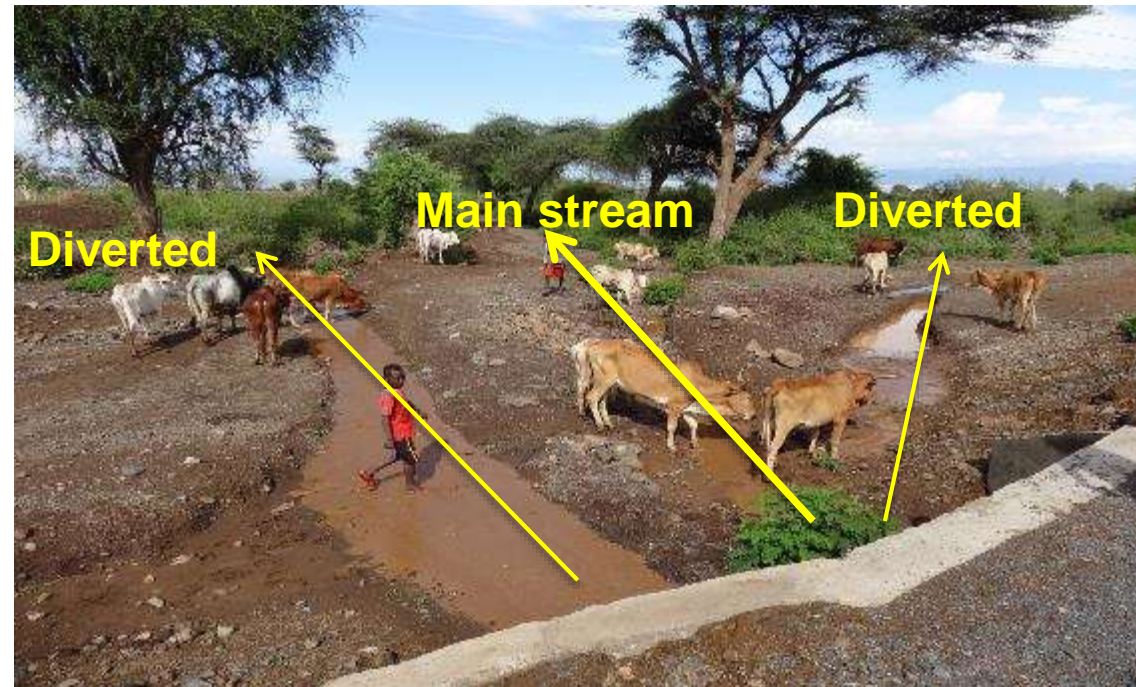
*Water from culvert
channeled into series
of ponds*



Tigray region

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(d) Water from a culvert is channeled into farmlands (used for groundwater recharge and improving soil moisture).



SNNP region

Tigray region

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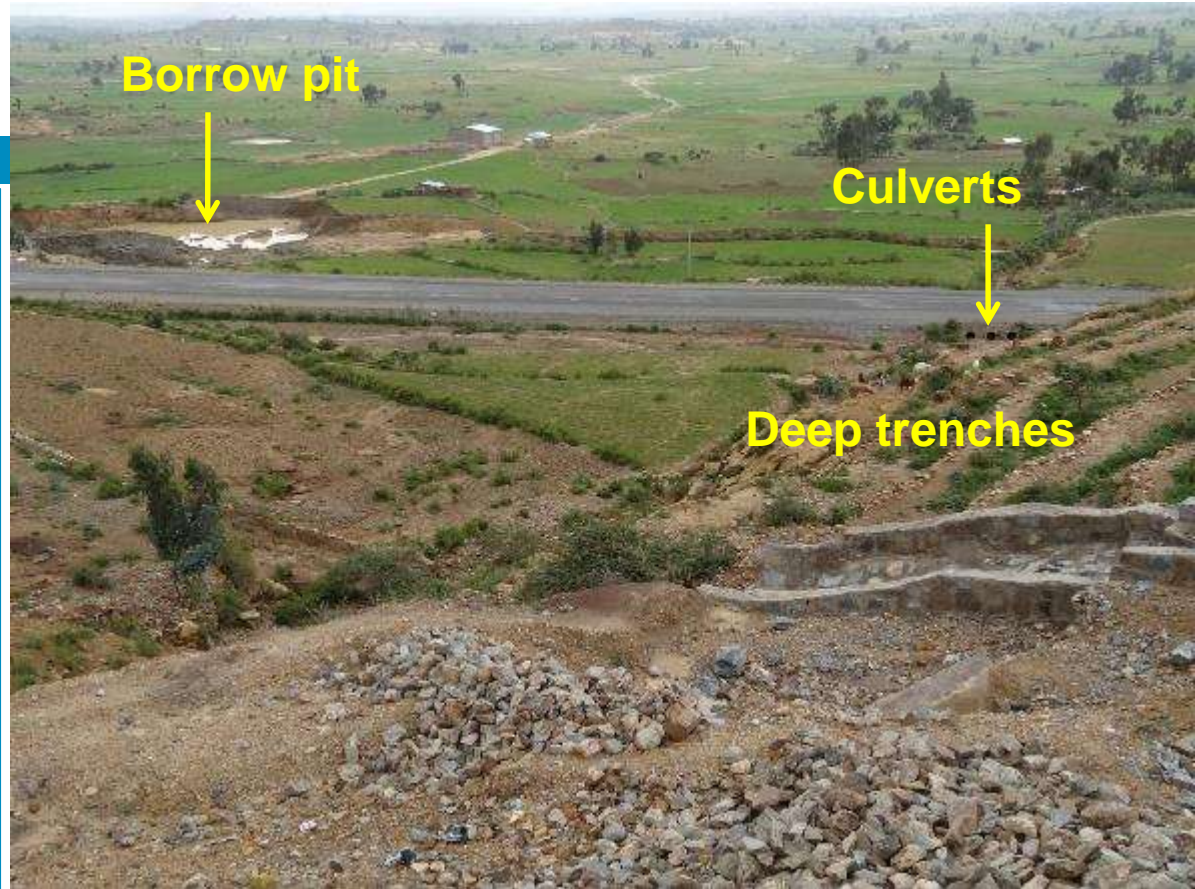
(e) Road side runoff is channeled into farmlands (used to improve soil moisture and reduce runoff to downstream areas).



SNNP region

(f) Runoff from a town (Freweign) is managed through a number of options:

- Construction of deep trenches to reduce runoff and enhance groundwater recharge.
- Diverting water from culverts into a borrow pit for surface water storage and groundwater recharge.



Communities which used to have been affected by flooding are saved from flooding.

Additionally: roadside planting for erosion and dust protection



5. Harvesting water from roads in Kenya

- Working with three counties (Makueni, Machakos, Kitui)
- Farmer/market trainings
- Model roads for water road in Machakos
- Three Task forces working on aligning current government programs with roads for water

5. Harvesting water from roads in Kenya: Examples

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5. Harvesting water from roads in Kenya: Examples: Yatta canal



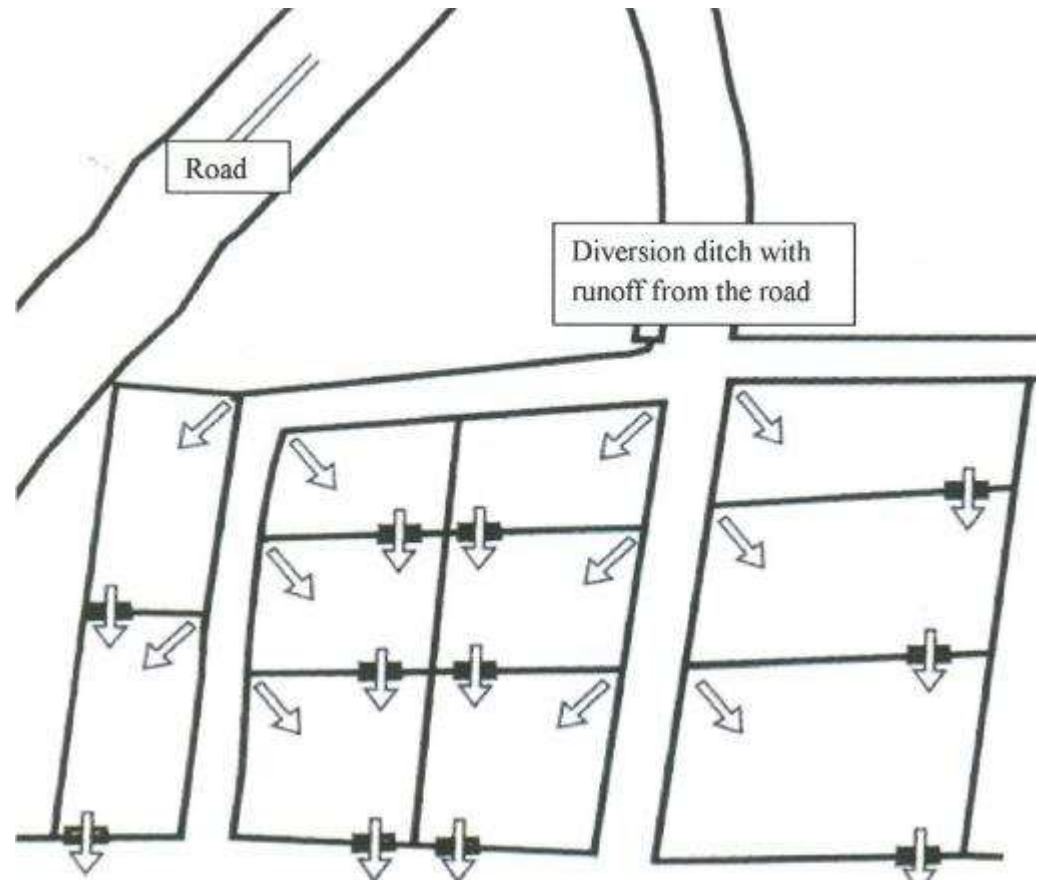
5. Harvesting water from roads in Kenya: Examples

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5. Harvesting water from roads in Kenya: Examples

Runoff water from long sloping roads can be diverted by gravity through diversion ditches to irrigate fields situated at some distance from roads

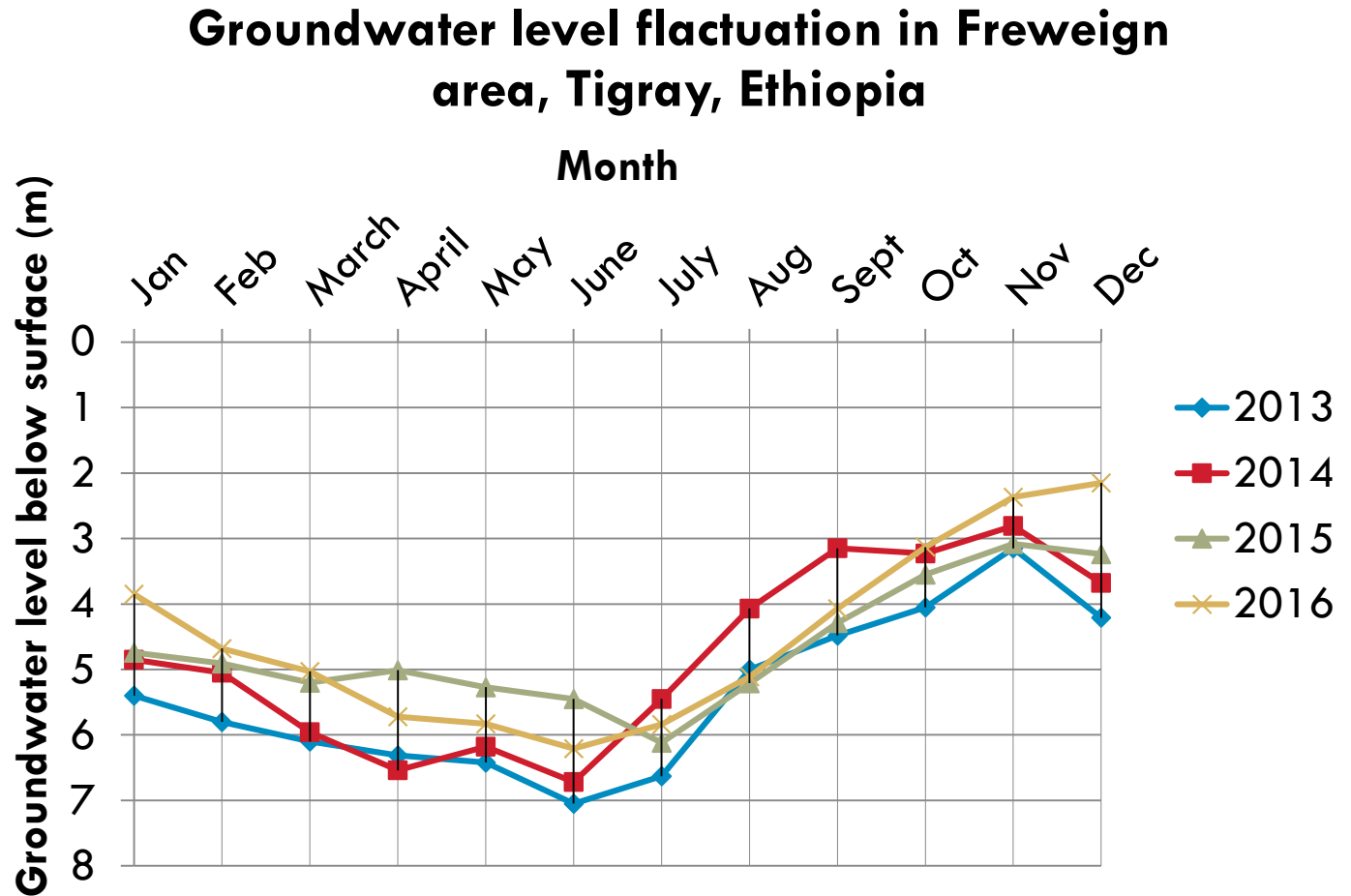


6.1 Effects on groundwater level

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Water from a culvert and road side drainage channeled into a pond:

- Enhanced the shallow groundwater



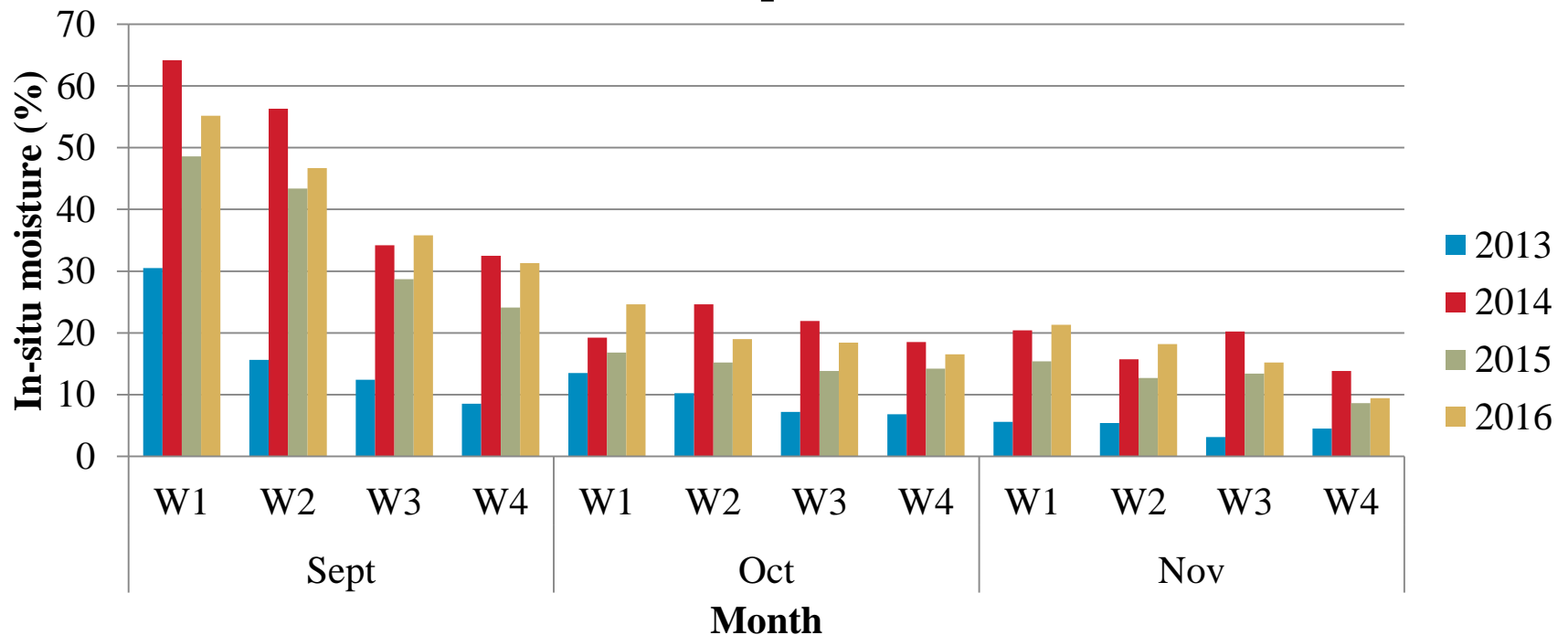
Note: Borrow pit was used as water storage in the month of July 2014.

6.2 Effects on soil moisture

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In-situ moisture distribution in soils (Megab area, Tigray, Ethiopia)



7. Socio-economic benefits: example from Kenya

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- Income comparison from sales of farm produce

	Average total value of production in 1 season (KSH)	Average total income from sales in 1 season (KSH)
Farmers practising RRH	16.475	5.374
Farmers not practising RRH	9.735	3.358
Positive benefit of RRH	6.740 (67 USD)	2.016 (20 USD)

7. Socio-economic benefits: example from Ethiopia

Cluster	Category	Mean yield (kg/ha)
1 (less than 1 min from road)	Non-user	454.22
	User	993.87
2 (up to 2 min from road)	Non-user	713.17
	User	821.47
3 (more than 2 min from road)	Non-user	799.21
	User	916.78
Pooled	Non-user	754.64
	User	932.64

7. Socio-economic benefits: example from Ethiopia

Main uses of water
from road in the study
areas of Ethiopia

Use	N	%
Irrigation	206	55.4%
Livestock watering	84	22.6%
Sanitation	38	10.2%
Roadside plantations	13	3.5%
Pastureland irrigation	31	8.3%

Conclusion: Roads for Water = Triple Win

REDUCED WATER
DAMAGE
TO ROADS
(-35%, -80%)
AND INCENTIVE
FOR FEEDER ROAD
MAINTENANCE



WATER MANAGED
FOR PRODUCTIVE USE

RISING GROUNDWATER
LEVELS

INCREASED SOIL
MOISTURE

WATER RETENTION

REDUCED
DAMAGE FROM ROADS
THROUGH FLOODING,
EROSION AND SEDIMENT
DEPOSITION



Thank you!

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