



Green Roads for Water

ROAD INFRASTRUCTURE IN SUPPORT OF WATER
MANAGEMENT AND CLIMATE RESILIENCE

Introduction and Global Experience

PMI Learning event – Green Roads for Water: Supporting and Financing Green
Development of Smallholder Farmers and Producers

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Introduction to MetaMeta



- **MetaMeta is a social enterprise, established in 2004, with registered country offices in the Netherlands, Ethiopia, Kenya, Turkey, Yemen, Nepal and Sudan and more than 35 staff**
- Our mission is to **contribute with practical solutions and introduce them at scale**
- We **bring the practice in key water, agriculture and climate themes to a higher level** by implementing projects on the ground, by research and learning and by developing capacity and engaging in policies



Green Roads for Water program



- Initiated in 2015, supported by various organizations (GRP, World Bank, ADB, IRF)
- **Global Road Achievement Award**
- **Aim:** To have roads systematically used for water management, greening and climate resilience and introduce as standard in **at least 50% of countries in the world by 2030**
- Active in more **than 10 countries**
- Various types of activities: **scoping, capacity building, supporting implementation, developing guidelines**
- Resource base: www.roadswater.org



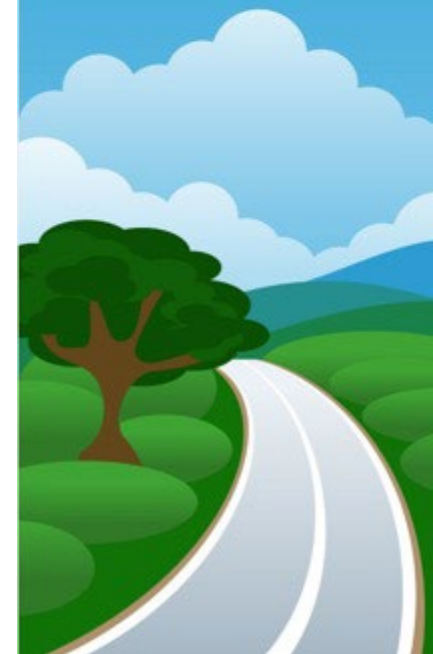
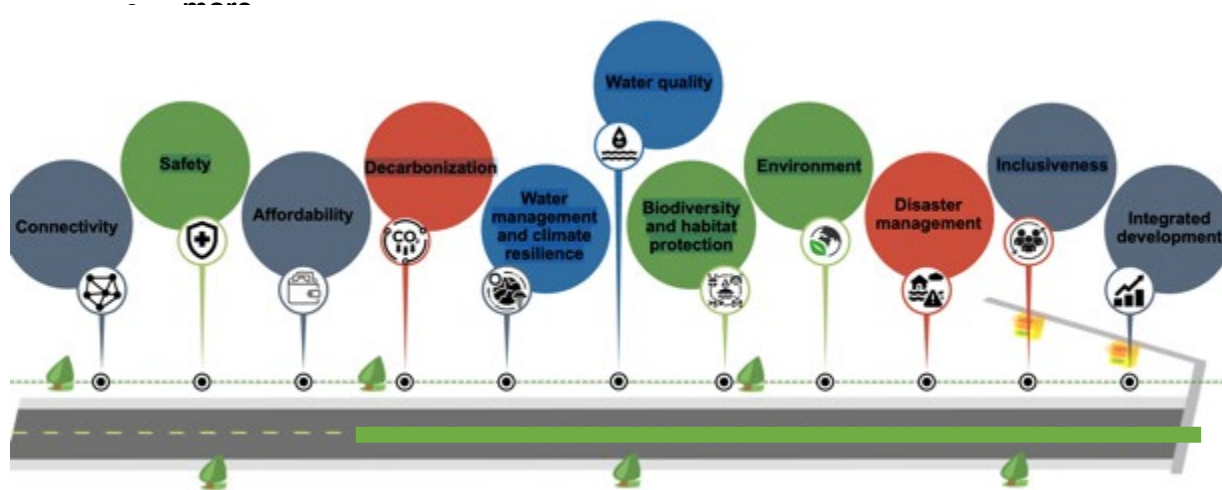
Green Roads for Water Guideline by World Bank

- explains the Green Roads for Water concept
- provides strategies to use roads for beneficial water management tailored to diverse landscapes and climates, including **watershed areas, semiarid climates, coastal lowlands, mountainous areas, and floodplains**
- discusses the management of Green Roads for Water interventions (community engagement and governance)
- Discusses the costs & benefits of Green Roads for Water in Ethiopia, Kenya and Bangladesh



Developing a Green Roads Toolkit/Scan and Certification with ADB

- **Changing the narrative of roads – many aspects in road development :**
 - Green Roads for Water
 - Decarbonization
 - Biodiversity and habitat protection
 - Disaster management
 - Safe sourcing of materials
 - Inclusive development



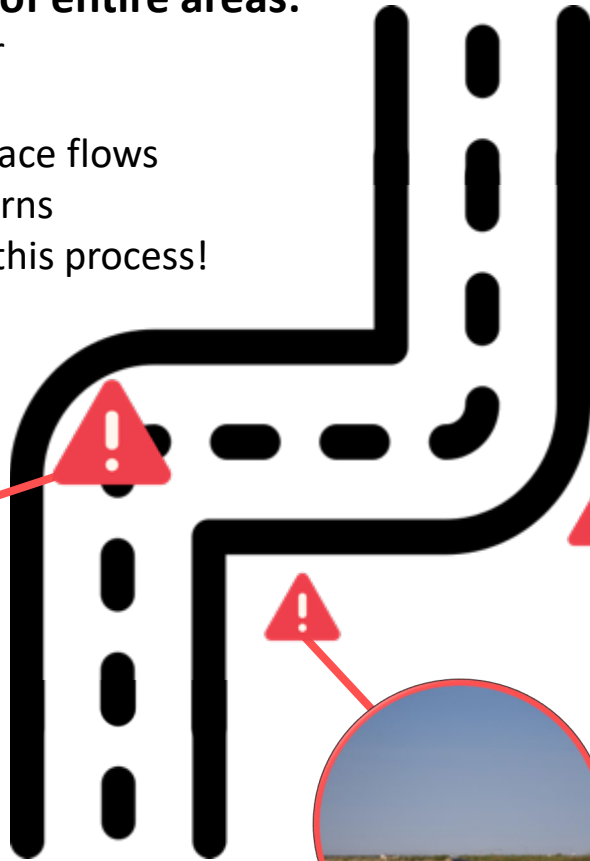
Green Roads for Water

Roads affect the hydrology of entire areas:

- They block and guide water
- They concentrate runoff
- They interfere with subsurface flows
- They change flooding patterns
- And roads get damaged in this process!



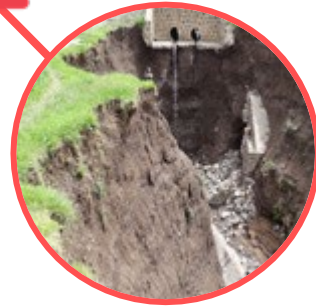
Water-related road damage
(water causes 35-80% of road damage)



Flooding



Water logging



**Erosion
(gullies and landslides)**



**Biodiversity
loss**

This can be



roads can become **GREEN ROADS**

Green Roads present a triple win with very little additional investment:

1. **reduced road maintenance costs**
2. **reduced degradation of the landscape around roads and**
3. **Beneficial use of water for roadside communities**



In different geographies: moving towards a new system of road resilience

Regular Roads

Green Roads

Level of Road Resilience	Basic Resilience: Protective	Resilience Plus 1: Adaptive	Resilience Plus 2: Proactive
Key words	Protecting road infrastructure	Making best use of and adapting to changed hydrology	Redesigning road infrastructure to optimize the area's water management/climate resilience
Geographies			
Semiarid areas	Catchment measures to reduce water damage to roads	Use runoff guided from roads for recharge and storage; upper catchment protection	Design roads and cross- drainage facilities to collect runoff and guide to recharge area
Watersheds and catchments	Catchment protection to protect road infrastructure	Catchment protection to protect road infrastructure	Plan road alignment and drainage structures in support of catchment management
Coastal areas and floodplains	Increase height of flood embankments to deal with higher floods	Convert village roads for water-level management with gated structures	Consider low embankment roads with controlled floodways develop road levees in flood-prone areas; use roads for land accreditation
High- and medium-altitude areas	Have safe road water crossing and protection measures; have adequate road drainage; reconsider road alignment to higher areas; train mountain rivers to reduce exposure of roads to mountain floods	Using water-retention and land-management measures suitable to mountain areas to stabilize mountain catchment and retain moisture and snowmelt; systematic spring management	Use cut and fill instead of cut and throw methods; observe maximum slope and gentle alignments; combine roads with additional storage to and drift for torrent stabilization
Desert areas		Revegetation and dune stabilization using road runoff. Develop small roadside oases taking road runoff to depression areas	Adjust road directions to deal with wind directions to control sand dune formation



GR4W adaptive resilience: examples from around the world:



Field trench from road



Field storage pond from road



Converted lined borrow pit



Road-side tree planting



Gated culvert

GR4W pro-active resilience: examples from around the world:



Road side bio-engineering



Road made from excavation of drainage canal



Road drift cum sand dam



Road reservoir embankment



Overflow road



Green Roads Aligning to Paris Climate Agenda

Climate Change mitigation strategies/measures

Roadside Tree Planting is a climate mitigation measure. If trees are managed well, they can sequester CO₂ function as carbon sinks – this can off-set 10-15% of emissions

[Read this Blog on roadside trees to offset CO₂](#)



Climate Change adaptation strategies/measures

GR4W provides several measures aiming at reducing the negative impacts of climate change to roads, the surrounding of the roads landscape and the livelihoods of local communities by using roads as instruments for beneficial water management.



Why Green Roads:

Big Scale and Big Impact: The Trillion USD Gap



Roads are major investment globally

(1-2 Tr USD/year)



Road expansion

(25 million km of paved road-lanes and 335,000 km of rail-track will be added from 2010 to 2050. About 60% increase!)



Water now causes 35-80% of road damage

(Road transect surveys in upland Ethiopia and Uganda show that in every 10 km of roads there may be 8 to 25 flash points, such as local erosion, flooding, sedimentation, or waterlogging.)



GR4W measures are low cost in comparison to total road investment (<5%)

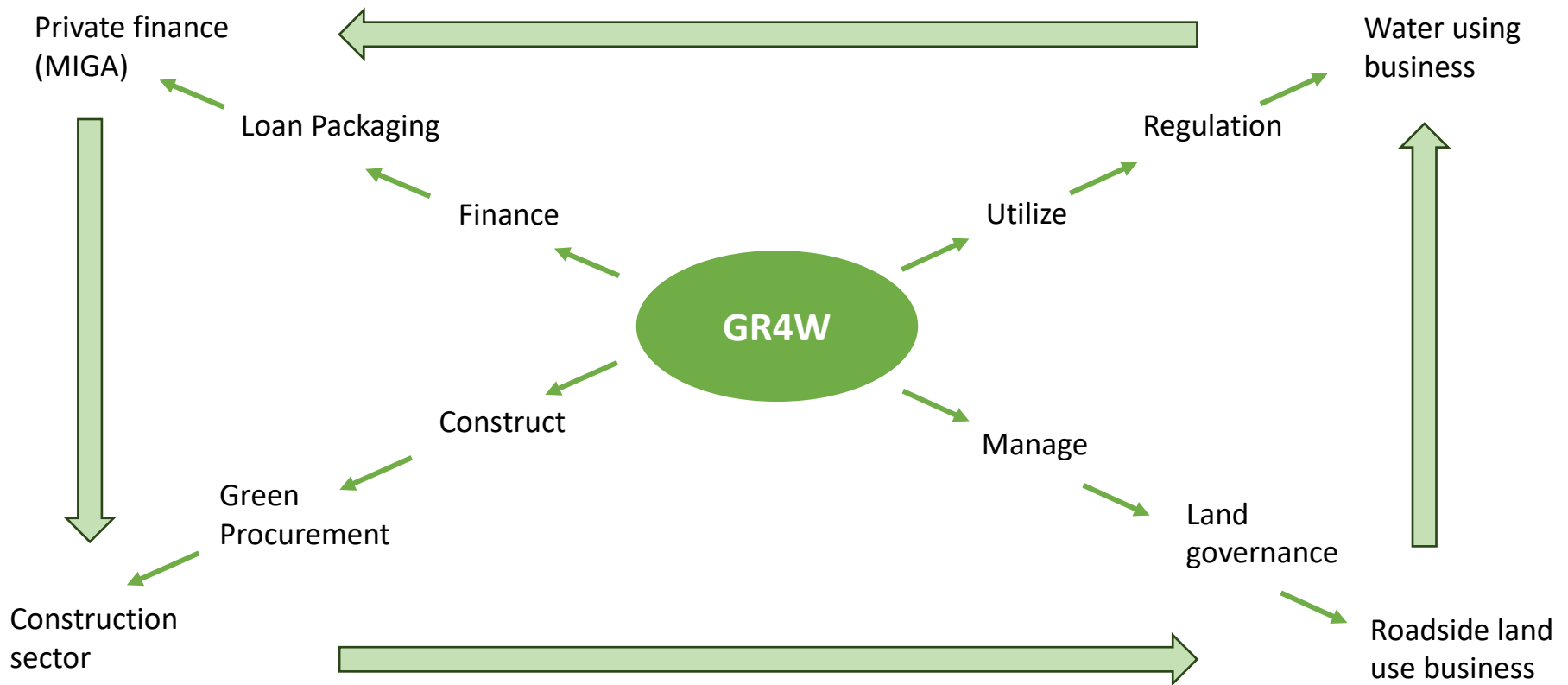
and bring high returns (>4 in a year)

(Based on C&B Analysis from the GR4W implementation in Ethiopia)

GR4W can bring climate resilience at a transformative scale



Crowding in the private sector needs an effort



Green Roads: Multiple Benefits

Water security

- Improved soil moisture and subsurface water storage
- Controlled water table
- Springs and wells
- Extended supplementary irrigation

Food and Nutrition Security

- Increased agricultural production, cattle drenching
- Better value chain

Land protection

- Reduced erosion
- Land accretion
- Reduced sedimentation
- Regreening borrow pits

Connectivity

- Economic integration
- Access to vital services
- Communication

Climate resilience

- Reduced carbon emissions from roads
- Better prepared to the negative effects of climate change
- Climate resilient communities and roads

Biodiversity preservation and wildlife protection

- Maintene hydrological connectivity across the road
- Wildlife crossings and corridors
- Minimize Habitat Fragmentation



Benefits of GR4W in Ethiopia, Kenya and Bangladesh

Return tends to be high and additional costs low

Ethiopia (Tigray) - water harvesting from roads

- Investment (incl capacity building): USD 3600/10 km
- Returns/year USD 16879/10 km = factor 4 in one year
- Reduced maintenance and downtime; reduced land damage; benefits of water retained
- Independently verified

Bangladesh (polder 26) – improving road drainage

- Reduced water logging and better water level control (benefitting area 1680 ha)
- Investment USD 200,000; returns/year USD 3.1 M

Kenya (Kitui and Machakos counties) – water harvesting from roads

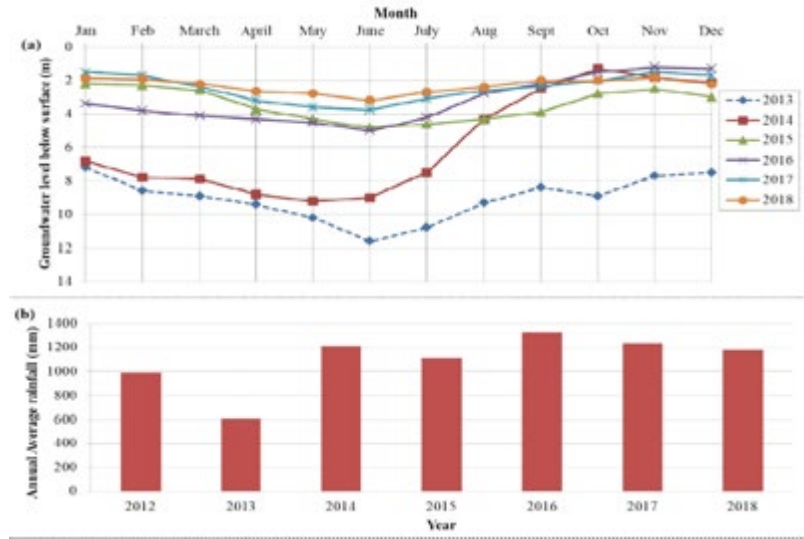
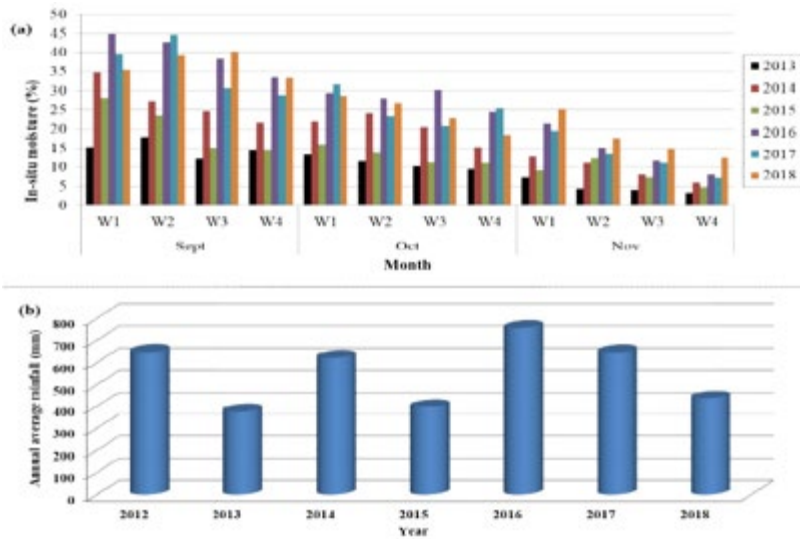
- Initial average investment for road water division and land preparation: USD 421 per farmer
- Average benefits in the first year: USD 1,048 per farmer



Impacts of Green Roads in Ethiopia

Raised water availability after implementing Green Roads in Ethiopia at a large scale

Additional information on the benefits of GR4W on rural livelihoods. This blog was published by GRP after a site visit at the road-water-harvesting sites implemented in Northern Ethiopia during the GR4W program



(a) In-situ moisture distribution in soils (before and after the construction of structures that divert runoff from culverts into farmlands along the Mekelle road (Kihen), Tigray, Ethiopia. Construction of the diversion structures was done on May-June 2014. Monitoring was done for the period September years 2013 to 2018. (W1= Week one; W2=Week two; W3=Week three and W4=Week four). (b) Rainfall distribution for (ENMSA, 2018).

Source: [Kifle et al., 2019](#)

a) Groundwater fluctuation in Selekleka area, Tigray, Ethiopia (at downstream of a check-dam which was constructed in the period January is designed to store improved at downstream of the box culvert b) Rainfall distribution for the year 2012 to 2018 (ENMSA, 2018)

Source: [Kifle et al., 2019](#)





Our mission

- **To make Green Roads a standard:** to have roads systematically used for water management, greening and climate resilience and introduce as standard in at least 50% of countries in the world by 2030
- **To work with other organizations to adopt and support the same practices**
- **To fast-track climate change adaptation** by retooling roads for water and greening and at the same time have more reliable transport connections
 - Include in investments in road development
 - Include in road maintenance and rehabilitation
 - Include in climate and watershed programs
 - Encourage community action and private sector engagement



Thank you!

For more information visit www.roadsforwater.org
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