



Green Roads for Water

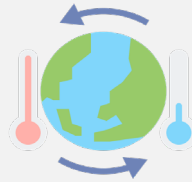
IRF Training “Building Climate Resilience into Roads & Transport Infrastructure”

November 9, 2020 4:00pm – 6:00pm CET

Presenter: Anastasia Deligianni – MetaMeta Research, Program Manager of the Green Roads for Water Program



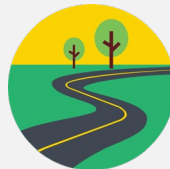
What are the Green Roads for Water?



Smart way of meeting climate resilience of roads



Smart way of collecting and using the road run-off



Smart way of reducing adverse weather impact on road bodies and the surrounding environment



Smart way of securing transport

INTRODUCTION: Impact of roads

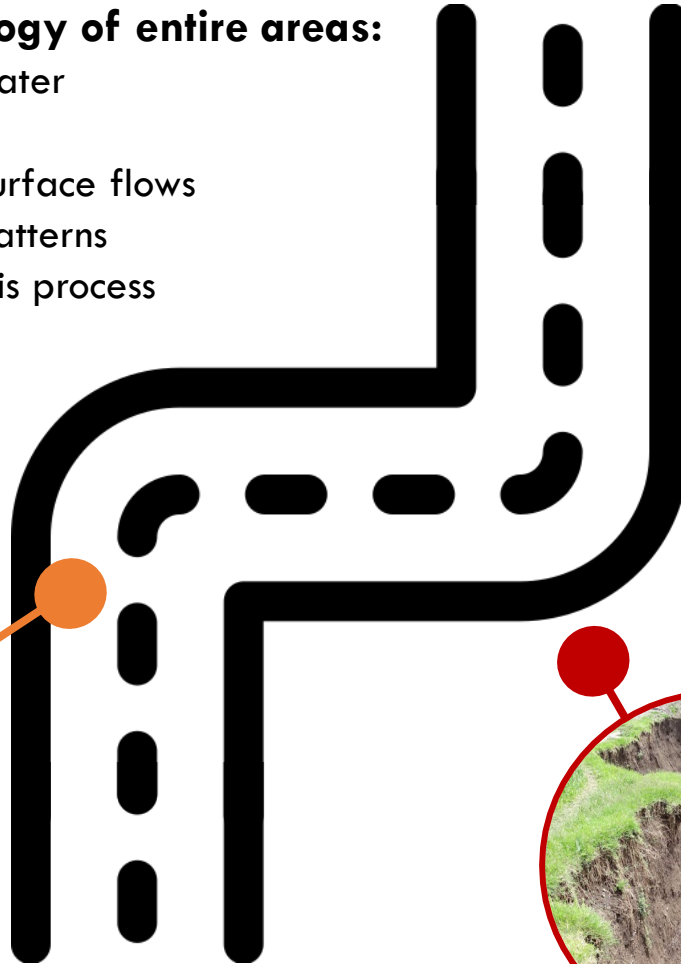
Roads affect the hydrology of entire areas:

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



Road damage

(on average there are 13-25 problem spots along a 10km stretch of road)



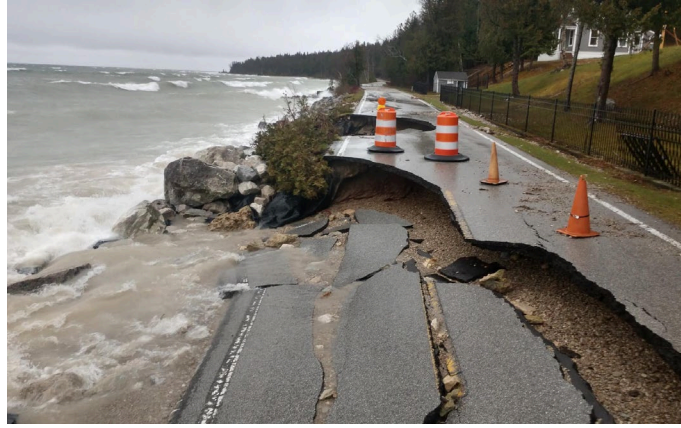
Flooding



Water logging



Erosion and sedimentation



This can be roads can become **GREEN ROADS**

Green Roads are instruments for climate resilience, better water management and regreening. Management of water with road infrastructure presents a triple win with very little additional investment: (1) **reduced road maintenance costs**, (2) **reduced degradation of the landscape around roads** and (3) **productive and consumptive use of the water harvested with roads**.



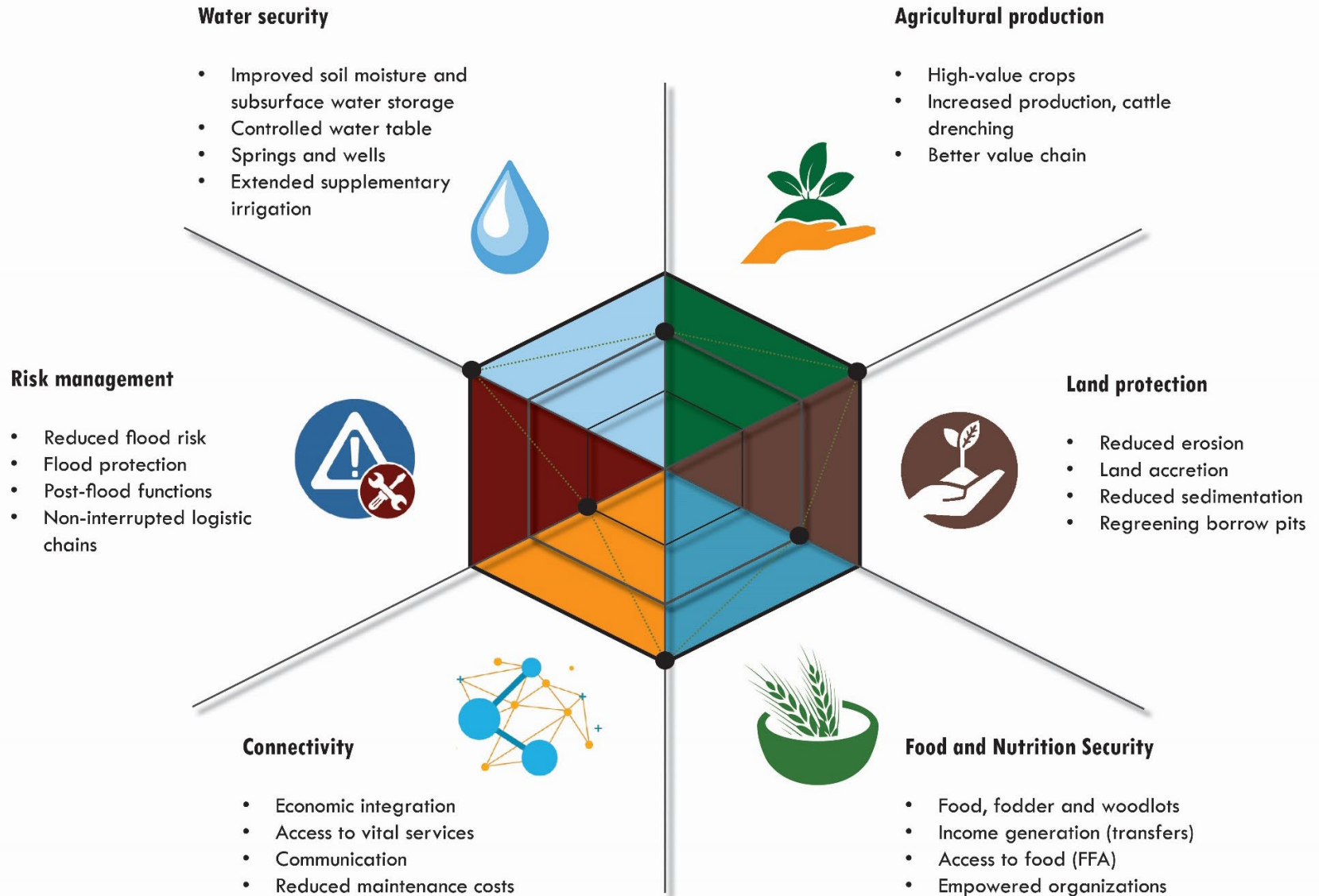
Levels of road resilience in different geographies

Level of Road Resilience	0	1	2
	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

Regular Roads

Green Roads

Green Roads co-benefits



Why Green Roads:

Big Scale and Big Impact: The Trillion USD Gap



**Roads are major investment globally
(1-2 Tr USD/year)**

For instance: It is estimated that 25 million km of paved road-lanes and 335,000 km of rail-track will be added from 2010 to 2050: a 60 percent increase.



At the same time, water causes 35- 80% of road damage

For instance: Transect surveys undertaken along roads 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.

Why Green Roads:

Big Scale and Big Impact: Positive perspectives



Many tested Green Roads measures exist, suited to different geographies



Green Roads can be a main instrument for climate resilience, health and increased agricultural production



Measures are low cost in comparison to total road investment (<5%) – and often saving cost of investment and maintenance

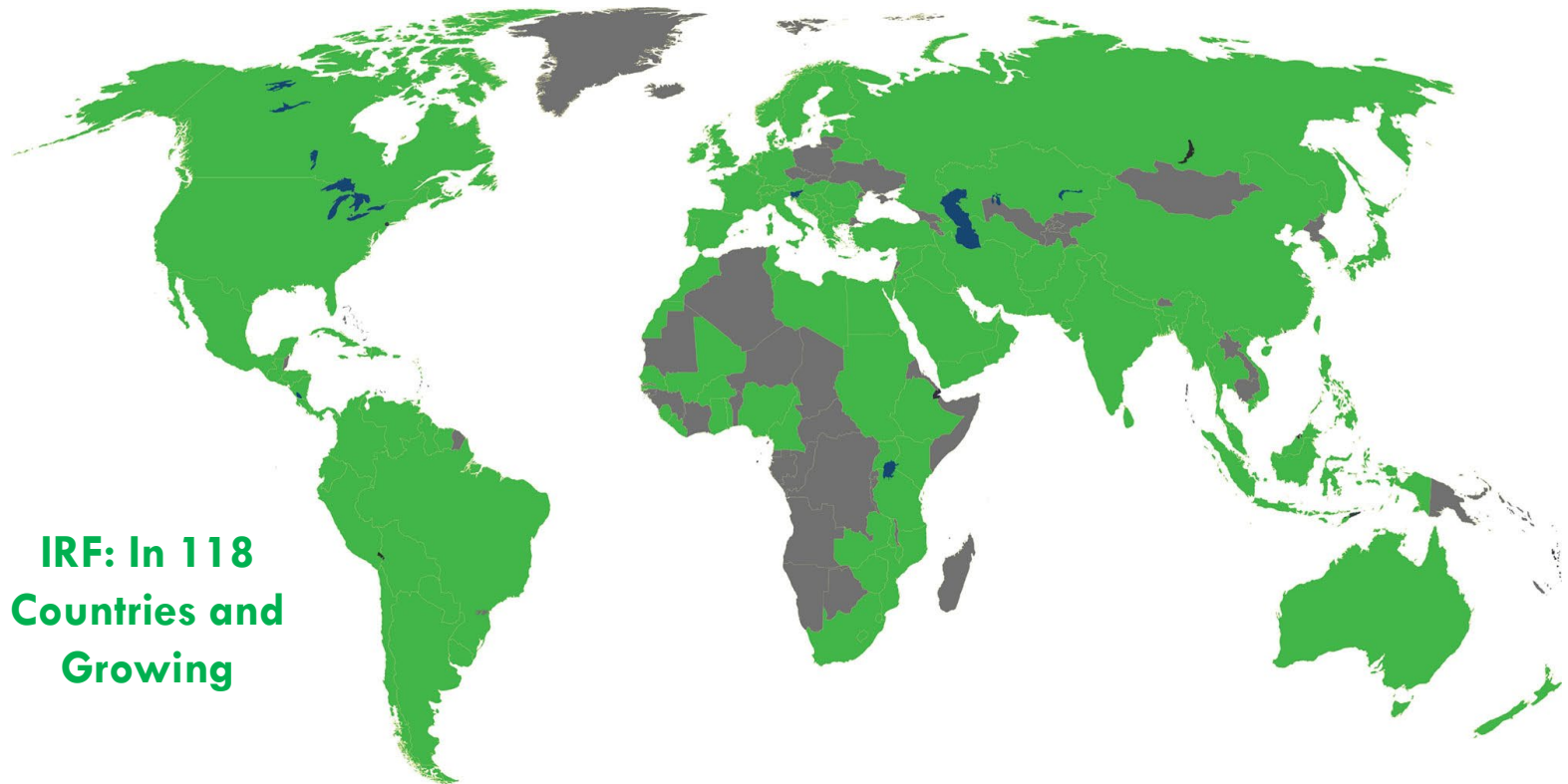


Rate of return high (>4 in a year)

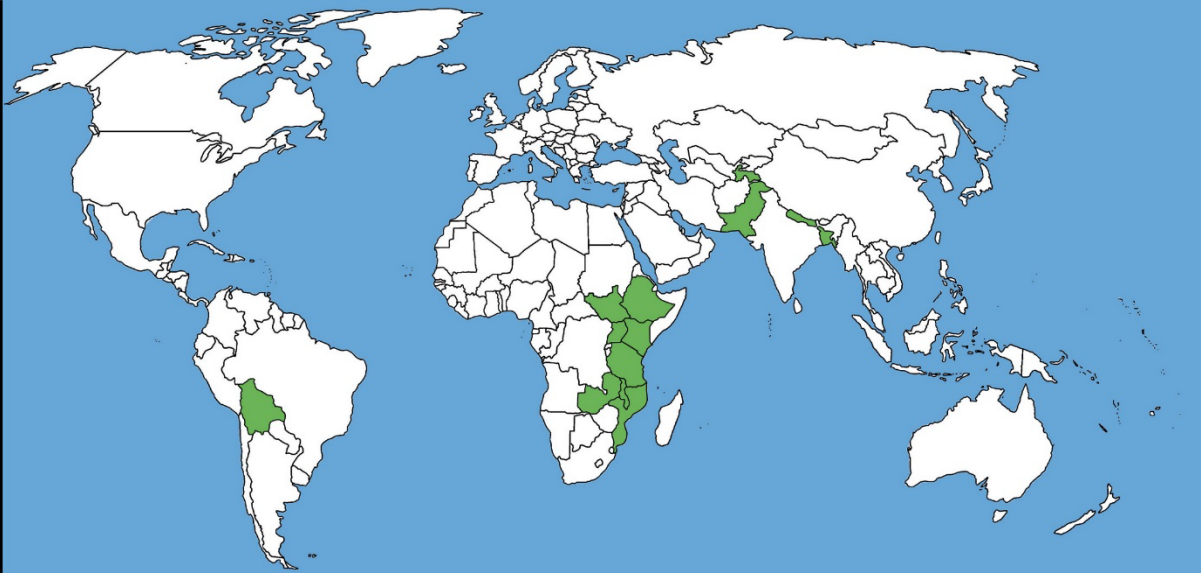
Why Green Roads:

Support IRF members in building resilient roads with multiple co-benefits

IRF's mission: to encourage and promote the development and maintenance of better, safer and more **sustainable roads** at a service of **economic growth and regional integration**



Green Roads for Water program



- Initiated by MetaMeta
- Aim: To have roads systematically used for water management, regreening and climate resilience and introduce as standard in at least 50% of countries in the world by 2025
- Supported by: The World Bank, GRP, NWO, NERC, RAP3, Blue Gold and more
- Development of GR4W Guidelines and Guided Learning packages
- Active in more than 10 countries
- Outreach > 6 M people

The Green Roads for Water Initiative



GLOBAL
RESILIENCE
PARTNERSHIP



IRF
GLOBAL



THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP



Connecting with (in progress):

National Programs



Green Finance Initiatives



Academia



United Nations



Bilateral & Multilateral Organizations



Private Sector foundations



Contractors



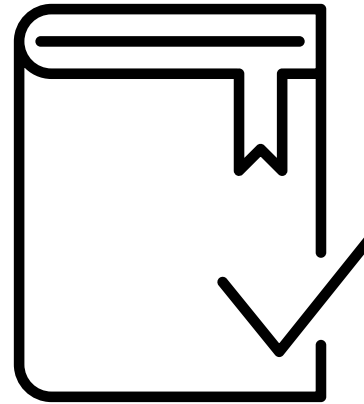
Main NGOs



Green Roads Guidelines

Supported by:  **WORLD BANK GROUP**

- Guidelines for integrating water management and climate-change adaptation in the design, construction and maintenance of roads.
- These Guidelines are targeted at road planners, infrastructure investors, private road developers – be it at the World Bank, the partner countries or elsewhere. They are also targeted at other communities of practice: those that work in flood prevention, land scape restoration, agricultural development, climate resilience, disaster risk reduction and environment in general.



- **Approach**
- **Geographies**
- **Techniques**
- **Governance**
- **Economics**
- **Technical**
- **Annexes**

Green Roads Guidelines

Supported by:  **WORLD BANK GROUP**

[Please access the draft version of the Green Roads for Water Guidelines through this link. The official version will be published soon by the World Bank.](#)



The GR4W approach has been adopted as national policy in Ethiopia and road water harvesting has been incorporated into the annual National Watershed Campaigns.

Gazgibla Woreda, Ethiopia (2019)

Green Roads:

Landscape level till spot interventions

A series of infiltration pits, percolation ponds and Swales that collect road run off constructed on a roadside field by local farmers who were trained on the GR4W approach.

Lilongwe District, Malawi (2019)

Green Roads in different geographies

Semi-Arid Areas

Challenges:

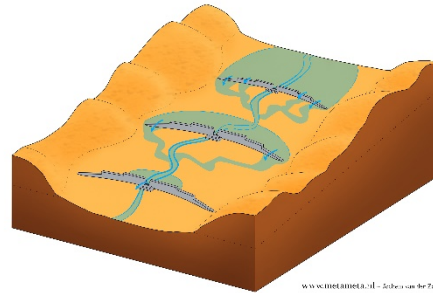
Road run-off causes extensive erosion, flooding and sedimentation but also damage to road bodies.

Opportunities:

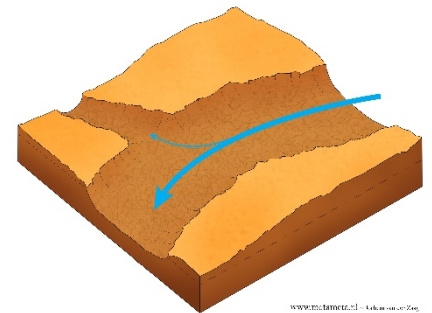
Use of road for water harvesting at large scale (use of harvested water for irrigation, livestock drinking water and groundwater recharge).

Techniques:

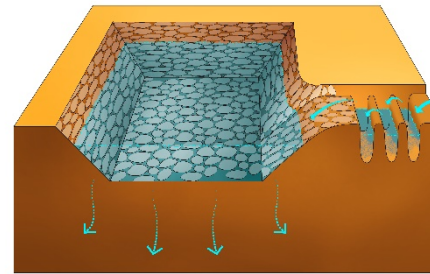
Use of flood water spreaders, flow dividers at culverts, road drifts or road embankments to divert the road run-off to water storage. Use infiltration trenches, converted borrow pits or farm ponds as water storage structures.



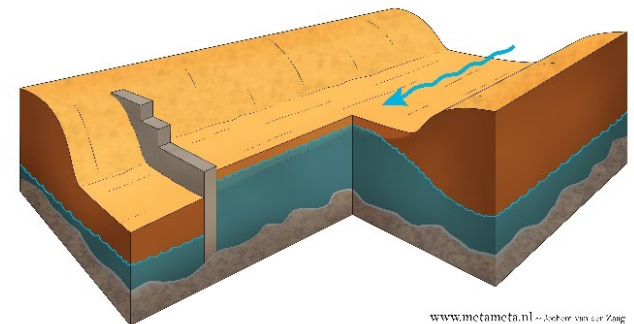
Floodwater spreader



Flow divider



Infiltration trenches



Road drift acting as sand dam

Green Roads in different geographies

Coastal areas

Challenges:

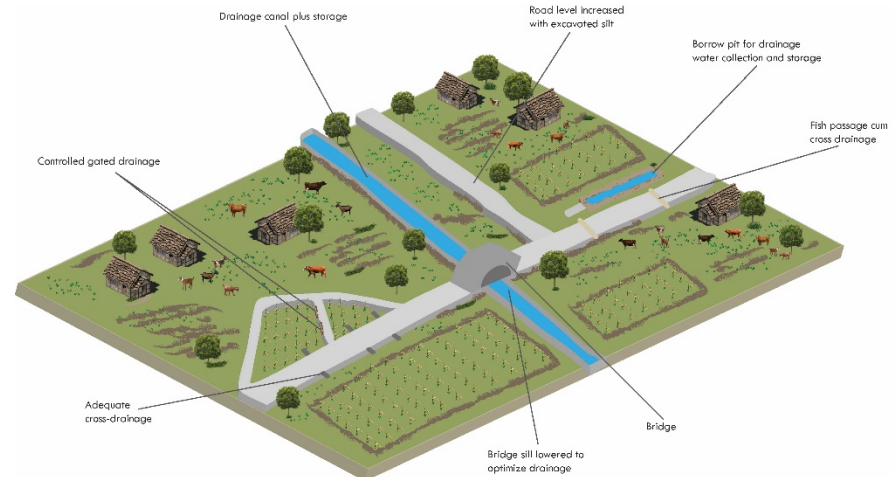
Roads have a major impact on water management which is often manifest in water logging.

Opportunities:

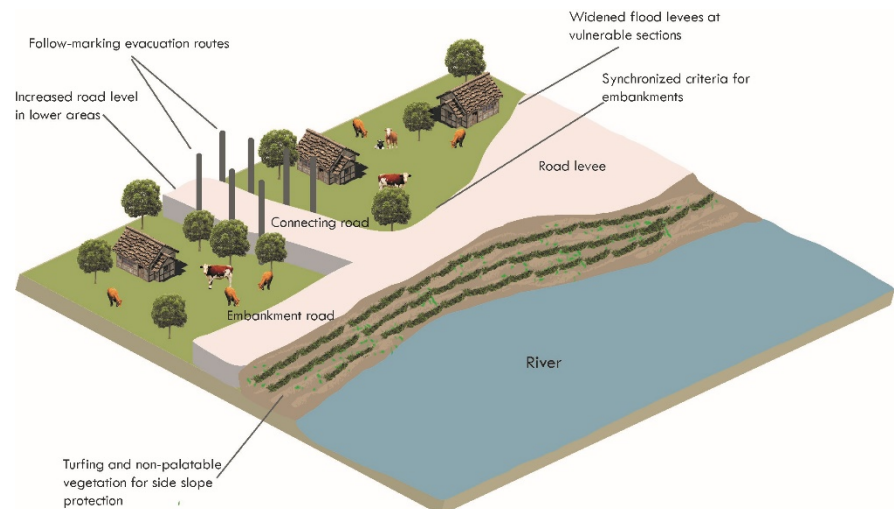
As roads are the main infrastructure in these areas, they can be used to control water levels for productive uses. Such measures contribute also to the longevity of road network. Roads can be also used as flood shelters and evacuation routes.

Techniques:

Use of road alignment to compartmentalize high and lowlands, adequate cross drainage to retain and release water, using gated culverts for water level control, making use of borrow pits for drainage and water storage using roads for land accreditation.



Recommended best practices in coastal lowland areas



Recommended good practices for roads combined with flood embankments

Green Roads in different geographies

Mountain areas

Challenges:

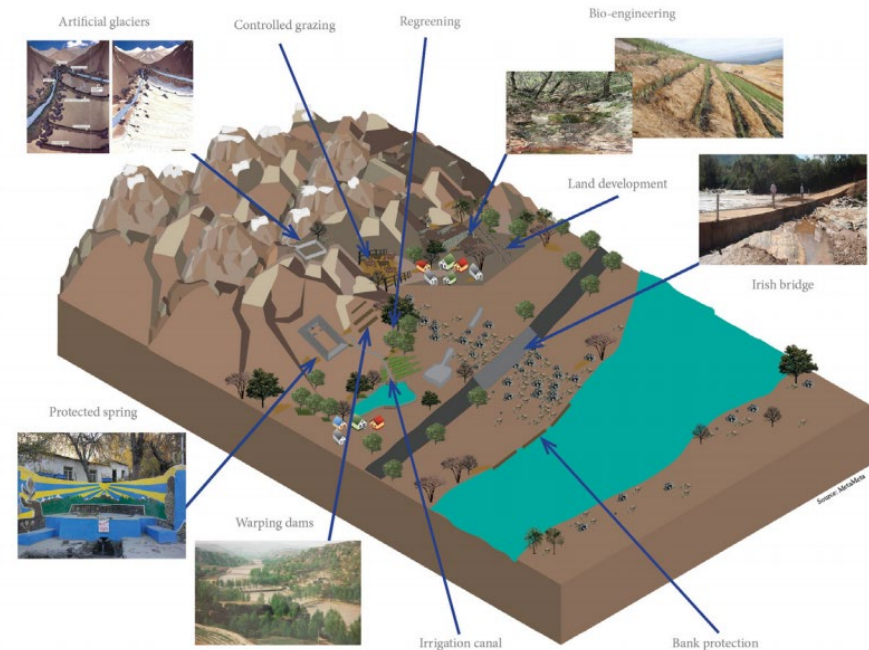
The development of roads in these areas can have a heavy negative impact on the surrounding environment and undermine climate resilience. Road development can change runoff patterns and cause areas to further dry out.

Opportunities:

Safeguard the road environment with measures that reduce the risk of disturbance whilst also improving the productive value of these areas.

Techniques:

For the development of new mountain roads, the mass balance method should be considered. Main techniques to manage the water road environment are **spring capture**, reinforced road water crossings and bio-engineering.



Landscape management measures for mountain areas (Ecosystemic approach)

Road-side Tree Planting

All areas

Advantages of road-side tree planting:

- Removes dust and other pollutants from the air, protecting crops, roadside communities, and livestock.
- Reduces soil erosion: holds soils in place.
- Wind breaks that reduce desiccation and wind erosion.
- Flood control: slows and absorbs road runoff.
- Carbon dioxide sequestration.
- Direct benefits: timber, fodder, fuelwood, fruits, pollinator habitat.
- Provides shade and keeps the road cool for road users.
- Beautification



[Roadside tree planting manual:](#)

step-by-step procedures for roadside tree planting, maintenance, and management practices as well as the benefits that can be accumulated by this activity.

Costs and benefits of Green Roads

	Mechanized method	Hybrid method (Mechanized and HIMO)	HIMO method (high intensity manual labor)
Unit Costs (averages) <i>for unpaved feeder road construction without GR4W</i>	39,000 USD/km (baseline)	35,100 USD/km	31,200 ¹ USD/km
Incremental unit cost with GR4W (one off)			+ 1,800 ¹ USD/km
Incremental benefit with GR4W (Cumulative Annual Dividend of GR4W)			~+ 17,000 ¹ USD/km
Benefits	~ 41 % (baseline)	~ +20% over baseline; or 46 %	~ +25% over baseline; or 51 %

¹ [World Bank Guidelines on Green Roads for Water](#)

Good news: many things can be done

Converting borrow pits to store water from roadside drains and culverts



Good news: many things can be done

Water from feeder road is collected and diverted into a water storage structure or a farm through a trench/ditch



Good news: many things can be done

Flood water spreaders from road surface to enhance soil moisture and recharge groundwater



Good news: many things can be done

Employment opportunities for rural communities on road construction





What are the ambitions?

- **To make Green Roads a standard: to have roads systematically used for water management, regreening and climate resilience and introduce as standard in at least 50% of the countries in Africa and South Asia by 2025**
- **To work with other organizations to adopt and support the same practices**
- **To fast track climate change adaptation by retooling roads for water and regreening and at the same time have more reliable transport connections**

Who does what	
World Bank	Promote within operations, expanding learning through contacts, leadership among international organizations, financial support
MetaMeta	Lead/ coordination, operate CoP learning alliance, on the ground support, documentation. update guidelines
International Road Federation	Promote within global road community, technical support
Global Resilience Partnership	Promote in resilience community, M&E, financial support, networking
Zurich RE	Develop insurance finance modalities



What will be done?

1. Mobilizing Green Finance

- Connect climate finance with road infrastructure in Bank
- Develop underlying numericals for additional costs and multiple benefits – co-benefits
- Prepare packages with Green Climate Fund
- Explore Green Bonds for verified Green Road programs
- Participation in co-benefits methodology

2. Community of Practice – Learning Alliance

- Expand Learning Alliance (building on www.roadswater.org)
- Transport resilience COP (DRR/Transport) – broaden it
- Promotional training (TED Talks, webinars, blogs, presentation at events)
- Introduce technical training with (country) training institutes
- E-learning
- Monitoring and learning: promote and update Guidelines as live document
- Outreach to programs of different organizations – contribute to regional conference – SSATP/ Climate Change

3. On the Ground Support

- Special support to road and water investment projects (training, assessment, design)
- Support to national guidelines and capacity building
- Feed into Community of Practice



Thank you!

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