

Road water harvesting in Ethiopia: turning floods and erosion into social and environmental benefits

Road construction often changes the hydrology and the runoff patterns causing negative effects, among others, on farm lands, infrastructures, and the environment. In many cases, roads cause flooding and water logging along the way, whereas the more concentrated run-off from roadside drains, culverts and bridges leads to land degradation and sedimentation. This negative effect can be turned around by using roads as instruments for water harvesting.

Water from roads and road catchments can be diverted into farm lands, surface water storage structures (like ponds, check-dams, micro-dams, and other reservoirs) and can also be used to recharge groundwater wells. This can generate substantial positive impact especially when destructive climate events such El Niño and La Niña take place, causing droughts and floods in many parts of Ethiopia.

Water harvesting leads to better returns to land and labour and a higher ability of people, households and communities to deal with and prosper regardless of shocks and stresses.



Gully created by excessive run-off from culvert
Photo credit: Mekelle University

Harvesting water from roads can also contribute to road longevity. In Ethiopia for instance problematic drainage is the most common factor in construction delays and water is the cause of 35% of the road damage (ERA, 2012). Yet proper drainage on unpaved feeder roads is not only the essence of preventing damage but also creates the opportunities to divert water to adjacent farm land and storage reservoirs.

Another example is that culverts, bridges and river crossings often trigger the development of gullies because they concentrate run-off. Eventually, these gullies will undermine the road itself too. Here again the foe can be turned into a friend by diverting and utilizing the water that exits from the culverts.

With the investment in roads in many countries exceeding that of any other programmes, there is a large range of opportunities to improve the productive environment and increase the climate resilience of the roadside communities through managing water from roads.



Roadside pond newly built in Amhara
Photo credit: Amhara Bureau of Agriculture

Approach	Techniques	Benefits
Adapting to the road	Spreading water from road surface and culverts	Groundwater recharge Soil moisture increase Erosion/flooding control
	Harvesting water from culverts, side drains and depressions	Groundwater recharge Water storage Soil moisture increase Erosion/flooding control Pollution control by naturally filtering
	Gully plugging	Soil moisture increase Erosion control Groundwater recharge
	Spring capture	Reliable source of clean water
Adjusting the road	Fords combined with sand-dams	Groundwater recharge Water storage Flood control
	Carefully planning road alignment and culvert location	Groundwater recharge Water storage Erosion/flooding control
	Permeable road foundations	Groundwater recharge Pollution control by filtering

There is a large range of options to collect water with roads most of them falling within two main approaches: “adapting to the road” and “adjusting the road”. The first approach involves utilizing directly or indirectly the run-off and water flows generated by roads. The latter relates to optimizing road design for water harvesting and erosion control. Making roads climate and water proof through costly structural and foundation treatment techniques is often not the best solution. Instead, road development should be optimized to lead to climate resilience through integrating water management concepts in the design and construction of roads

Scope for road water harvesting in Ethiopia

The scope for harvesting water from road catchments and for safeguarding roads from water damage is great and varies between different parts of the country:

- In the lowlands of the Ethiopian rift system (altitude below 1500m) the rainfall is generally low and variable. In these areas, water is a scarce resource and options of water harvesting from road culverts, bridges and roadside drainages is an option of high priority.



Communities digging a trench to divert water from the road to farmland

Photo credit:
Mekelle University

- In middle lands (altitude between 1500 and 2000mm) in Ethiopia where the rainfall is less than 800mm but variable (spatially and temporally), there is a need to consider road water harvesting for supplementary irrigation as well as irrigation during the dry season.

- In the highlands of western and central Ethiopia where the rainfall is high (up to 1400mm), there is generally excess water during rainy season. However, during dry season there is shortage of water for various purposes. There is, therefore, a need to consider road water harvesting using ponds and other techniques to store water for the dry period.

Benefits from road water harvesting

Since 2014, road water harvesting has been widely implemented in Tigray and Amhara regions as part of the soil and water conservation campaigns. The implementation has created the following benefits:

1. Increased water availability for livestock and crop production
2. Decreased erosion, sedimentation and water-logging
3. Increased road longevity
4. Increased resilience of roadside communities
5. Increased groundwater levels and soil moisture

Policy recommendations

The main bottlenecks for the implementation of road water harvesting are the current practice in road engineering and the lack of coordination between different agencies.

Most road engineering guidelines concentrate on how to evacuate water from the road to avoid damage. Harvesting water from roads and their associated infrastructure is not considered an option in road design. In addition, roads, water and agriculture departments in Ethiopia and elsewhere often work independently and collaborations are rare despite their interdependence.

To systematically implement road water harvesting it is necessary to have a solid collaboration between government agencies dealing with road development, agriculture and environment.

Opportunities in Ethiopia

- Integrate in watershed management programmes
- Incorporate in Productive Safety Net Program
- Align with road development programmes
- Integrate in road design guidelines

Current Road Practice

- Erosion, flooding and waterlogging
- Large-scale land degradation
- 35% of road damage by water
- Insecurity and reduced resilience



Integration of road water harvesting

- Harvest water for productive use
- Agriculture, rangeland, fisheries
- New livelihood opportunities
- Reduced erosion and land loss
- Lower road damage



Communities building roadside trenches during the mass mobilization campaign



Building a pond to protect the road



Swallow for groundwater recharge in the Netherlands



Spring developed after road construction



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