

Improving Livelihoods Through Better Road and Water Integration and Planning

Poorly planned roads can negatively affect rural dwellers by damaging land-based assets, through water logging and erosion. However, by modifying the flows of water and the quantity of surface and groundwater available, roads can also have positive impacts on the lives and livelihoods of affected populations. Research undertaken in Tigray, Ethiopia shows that these effects are unequally distributed, and depend on several factors including topographical considerations, type of roads, and people's collective and individual assets. Multifunctional roads that better integrate people's needs, resources and knowledge into road design and construction are required to improve people's livelihoods and wellbeing and contribute to poverty reduction.

Roads and water: the missing link

In sub-Saharan Africa, road construction that better encompasses the hydrology would result in more durable roads and lower maintenance costs. Water-related damage currently accounts for, respectively, 35 and 60 per cent of the defects in paved roads and un-paved roads (World Bank 2006). Yet despite the effects of roads on livelihoods being deemed globally positive there is surprisingly little evidence on the impact of roads on water flows and livelihoods. With countries like Ethiopia, a country with one of the lowest road density in the world, investing in large-scale public investment programmes such as the Road Sector Development Program (RSDP) it is critical that more is done to understand how these investments can be targeted effectively to ensure positive impacts on the livelihoods and wellbeing of the country's citizens.

Water from roads: goods and harms

Road water from road run-offs can seriously harm people's assets and productive capacity, with short- and long-term consequences on their livelihoods and wellbeing. In Tigray negative impacts included flooding, waterlogging, siltation and erosion of fields and houses, subsidence of the soil, erosion of house walls and the complete collapse of houses. It also decreased people's mobility and increased the risk of contaminating groundwater. People had to cope with the damage generated by the run-off, re-plough and re-sow what had been washed away, clear off the silt, and as a last resort abandon their fields and

houses. It also led to crops being grown that were less valuable in the market but more resistant.

Roads can also have positive effects on water availability, and therefore on livelihoods. In Megab, a village crossed by an untarred feeder road, it was estimated that up to 25 of 260 households benefitted from road rain water that could be diverted to the fields. Allowing them to grow crops in a dry year and in a normal year, nearly double their yields. In dryland like Tigray, where a significant part of the population is food insecure for three to nine months a year, supplemental irrigation for rain-fed crops can make a significant difference.

Roads also helped recharge ponds, deep trenches and shallow wells that could be used for irrigation and watering cattle during the dry season, increasing yields and incomes when food is scarce and prices are higher. In other areas, increased run-off from the road and adjacent areas had been canalised to the fields and pastures, and as a result, fields had benefitted and grazing land downstream enriched.

In the village of Megab, a ford that had been built to cross a seasonal stream had created a sand dam. It had increased and spread water retention and moisture upstream and decreased and regulated the amount of peak run-off, making it more even across time. While the area above and below used to be severely degraded, it had become much greener and more forested than before, leading to more availability of wood, fodder, and groundwater for household consumption and irrigation.

How are the impacts distributed?

Roads modify the flow of surface and ground water, often in ways that are difficult to predict. In Sinkata for instance, people noticed that after the road was upgraded, a well had run dry whereas the quantity of water that could be pumped in another had increased. Hence, the distribution of road water is geographically determined and depends on the land of the place: weather regime, gradient of the slope, type of soil, size of the catchment area, and location of people's assets.

It also depends on the alignment and type of roads: the larger the road, the bigger the impacts on hydrology, land and people. Community and feeder roads that are locally built increase the amount of interactions between the roads and water departments, the use of local resources, and theoretically people's ability to influence the alignment and design of road related infrastructure (although this tends to be rather limited in practice).

The ability to cope with road water's harms and seize its benefits – whether to build protection, rebuild destroy assets, build diverting canals, dig a well or a trench and buy or operate a water pump to irrigate –

depend on people's financial assets, access to land, and ability to mobilise labour. If everyone benefits from more ground water, those with land use rights and access to irrigation will benefit relatively more and their income will be higher. At the collective level, village leaders' political and social capital and their ability to mobilise resources and labour do also play a critical role in coping with negative impacts and harnessing the benefits of road water.

How to maximise positive impacts and reduce negative ones

Roads have to be thought, planned and built as multifunctional infrastructure, and serve needs in terms of water retention, recharge and re-use, to benefit people. Better inclusion of local populations into the planning and construction process is necessary in order to better serve their needs. By integrating local knowledge, roads could be more adapted to local specificities (geology and climate), and construction and maintenance costs could be lowered. By understanding road impacts on hydrology and livelihoods, by building multifunctional roads, and ensuring more inclusive road planning processes, roads can be made a central tool in poverty alleviation.

Policy recommendations

Adopting an approach that integrates water considerations into road design and construction requires:

1. **Understanding surface and ground water flows**, and how the road affects them.
2. **Adopting an ecosystemic approach**. For instance, it may be necessary to consider the entire watershed to limit run-off and siltation and include the totality of changes triggered by road construction into the process: limiting siltation may sometimes require checking the flow and slope far upstream of the road, while water harvesting can happen far downstream.
3. **Consulting people during the planning** and construction process and ensure local knowledge is taken into account
4. **Promoting the use of local resources** (material, capital and labour) and pursue labour-intensive methods to benefit communities by maximising employment and income creation is also crucial; this also increases the amount of income that can be invested into further adaptation and developing livelihoods.
5. **Increasing coordination** between the different offices in charge of roads and water.



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Further reading

Demenge, J.; Alba, R.; Welle, K.; Manjur, K.; Addisu, A.; Mehta, L. and Woldearegay, K. (2015) 'Multifunctional Roads: The Potential Effects of Combined Roads and Water Harvesting Infrastructure on Livelihoods and Poverty in Ethiopia'. *Journal of Infrastructure Development* 7.2: 165-180.

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Credits

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