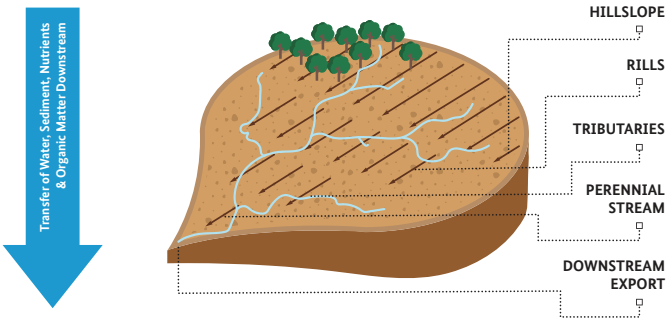
LANDSCAPE RESTORATION THROUGH ECOHYDROLOGY IN THE LAKE HAWASSA SUB-CATCHMENT

Land degradation is a global challenge, which impacts the lives of millions of people, many of whom are living in extreme poverty. In Ethiopia, soil erosion and desertification have negatively affected water bodies and ecosystems and have led to a decrease in land productivity.

The Lake Hawassa sub-catchment is testament to this, with significantly increased soil erosion in the past decade, largely due to deforestation and unsustainable farming practices. Faced with population growth, resulting in increased pressure on natural resources, the sub-catchment has seen 45% of its natural vegetation cleared between 1965 to 2001[1], with the freed-up space being used for animal grazing and agriculture. The ensuing soil erosion has led to increased siltation of Lake Hawassa, lowering both the lake's storage capacity and water quality.



Overview of the overland water flow.

DID YOU KNOW...

...that land degradation directly affects 1.5 billion people globally[2]?

...that sediment flowing into Lake Hawassa mainly comes from gully erosion? It's estimated that there are over 750 actives gullies in the Lake Hawassa sub-catchment.

...that Lake Hawassa has lost about 4% of its storage capacity to siltation in just over 10 years[3]?

1 Reliefweb. (2015). Climate Action: Irish Aid supports locals to restore damaged land around Lake Hawassa. https://reliefweb.int/report/ethiopia/climate-action-irish-aid-supports-locals-restore-damaged-land-around-lake-hawassa

2 Agostini, P., & Edie, P. (2017). Landscape degradation: a world of landscape restoration opportunities. World bank blogs.

3 Abebe, Y., Bitew, M., Ayenew, T., Alo, C., Cherinet, A. & Dadi, M. (2018). Morphometric Change Detection of Lake Hawassa in the Ethiopian Rift Valley. Water Vol. 10 Issue 5.

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Comparative satellite images showing the change in vegetation in the Lake Hawassa sub-catchment between 1984 (on the left) and 2021 (on the right).

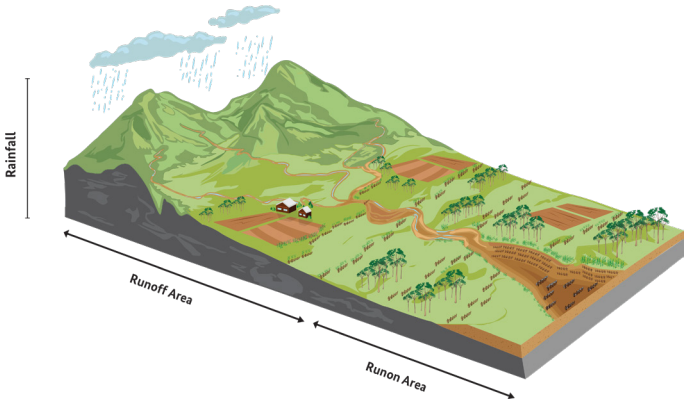
Local authorities, as well as civil society organizations and private companies active in the Hawassa area, have long recognized the severity of the threat that land degradation poses to the lake and its sub-catchment. This is why they have joined forces and formed the Protecting Lake Hawassa Partnership (PLH), which has allowed for more coordinated collective action between stakeholders. The Hawassa University, as part of PLH, has worked on ecohydrology in the Lake Hawassa sub-catchment, and was able to upscale its approach and implement the ecohydrological approach more widely in the sub-catchment with financial support from PVH, an American clothing company producing in the Hawassa Industrial Park.

The **Protecting Lake Hawassa Partnership (PLH)** *is a multi-stakeholder platform, bringing together stakeholders in the Lake Hawassa sub-catchment to jointly improve natural resources management . Including public sector entities, private sector companies and civil society organizations, the partnership works towards safeguarding Lake Hawassa and its ecosystem for future generations, while ensuring sustainable economic growth in Hawassa City and its surrounding districts.*

The Natural Resources Stewardship Programme (NatuReS) of the Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ), funded by the German Federal Ministry for Economic Cooperation and Development, currently holds the secretariat of the partnership.

WHAT IS ECOHYDROLOGY?

Ecohydrology focuses on the interactions between water and ecological systems. Applying the ecohydrological approach, water flows are regulated through ecologically engineered physical structures, while planted vegetation supports water infiltration as well as soil and nutrient retention. This creates better conditions for vegetation growth, further reducing runoff and allowing for more percolation of water into the ground. These combined measures lead to improved ground water recharge upstream and reduced sedimentation of the water bodies downstream.



Graphic visualization of the ecohydrological approach at landscape level.

Combining a wooden physical structure with grass vegetation for a two-fold regulation of the water flow.

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In the Hawassa Lake sub-catchment, the ecohydrological approach helps stakeholders to regulate the water flow in an integrated manner, starting upstream from the hillsides all the way downstream, crossing farm- and grazeland, as well as communal land. As the water flow descends, more and larger gullies appear, which further aggravate the water and soil erosion towards the lake. To counter this, wooden structures, next to which grass or other vegetation is planted, are placed against the slope, which slows down the erosion by reducing the speed of the water and soil moving downstream. The integrated system creates a favorable condition for vegetation growth and is designed to function in a way that runoff is redistributed from bare to vegetated patches, depositing critical resources of water, sediment, nutrients, and organic matters in the process.

THE BENEFITS OF ECOHYDROLOGY

Applying an ecohydrological approach and working with wooden structures and natural vegetation to reduce soil erosion and restore landscapes has multiple benefits compared to convention soil and water conservation methods.

One of the critical challenges of soil and water conservation measures is the amount of productive space lost to physical structures. Among the most used conservation structures are fanyaa juu, terraces that occupy about 2 to 15% of the total area it serves. Stone bunds, also frequently applied to decrease erosion, use up 5 to 25%, while soil bunds require between 2 and 20% of the area in which they aim to reduce soil erosion[4]. The ecohydrological approach instead works with slim wooden structures which use up much less space. This has several advantages:

- Heavy earth works, necessary for the foundations of more conventional methods, are no longer needed. This means less destabilizing of soil and less damage to vegetation during the construction phase, as well as less incursion the ecosystem.

4 Teshome, A., Rolker, D. & Graaff, J. (2013). Financial viability of soil and water conservation technologies in Northwestern Ethiopian highlands. Applied Geogr., 37: 139-149.

Fanya juu terrace *are made by digging a trench across the slop and throwing the soil uphill to form an embankment of up to 50cm in height.*

Stone bunds *are constructed across the slop by digging a trench and stacking stones in the trench to slow the water flowing down the slope.*

Soil bunds *are embankments constructed across the slop by placing soil dug from a water collection basin down slope.*

Farmers building ecohydrological structures on their land.

Achievements

- *1.220m³ of dry sediment trapped by 26 monitored wooden structures on farmlands*
- *6.813 m³ of dry sediment trapped from 75 similar structures installed in gullies*
- *Total of 8.033 m³ of sediment trapped, which would otherwise have ended up in Lake Hawassa – the equivalent of over 500 dump trucks!*

- Materials are available locally, meaning that local communities can source, place and repair the structures themselves at costs that are significantly lower than the conventional methods.

- Approaching landscape restoration in an integrated manner, ecohydrology emphasizes the need to treat gullies throughout their entire length. This includes upstream treatment, where the gullies are still relatively small, through planted vegetation and small physical structures on the base and sides of the gully to reduce the speed and volume of the runoff from upstream. The increased retention time of the run-off, as well as the higher rates of sediment and nutrient trapping, create favourable conditions for vegetation growth, which in turn contributes to improved moisture retainment and water storage. With the reduced flow energy and flow peaks, water and soil flows going downstream are stabilized and regulated, which, as a side effect, reduces the risk of flash floods during the rainy season.

LOCAL BUY-IN

The benefits of ecohydrology make it preferable to conventional methods, with many farmers in the Hawassa Lake sub-catchment showing interest in applying similar interventions on their own land. Since the inception of the ecohydrological approach in the Shalla and Hawassa Zuria districts, over 300 hectares of degraded land have been rehabilitated. Local communities have seen firsthand that the interventions have reduced flood risks and improved fertility of the soil. As a testament to the local buy-in, communities in the Hawassa Zuria district have adopted a local tradition, called Tare, to protect the structures. As part of the Tare, a wooden sign is erected next to the structure, forbidding their disruption on sanction of bad karma for anyone dismantling the structures, ensuring its longevity beyond the end of the project cycle.

Dual regulation

Vegetation, in Hawassa mainly grass and bamboo, is planted next to the physical structures. Initially, the vegetation will benefit from the physical structure, which supplies moisture, nutrients, and fertile soil. In time, the vegetation will outgrow the physical structure – which itself only has a limited lifetime – and take over the role of the physical structure in regulating the runoff flow. This dual regulation mechanism is the basic essence of ecohydrology.

Gully rehabilitation in the Shalla district, using the ecohydrological approach.

The local Tare tradition contributes to protecting the structures.

CONCLUDING REMARKS

Interventions considering the environmental and social conditions in which they are implemented stand a better chance of adoption and sustainability. Since the introduction of ecohydrology in the Lake Hawassa sub-catchment, a considerable amount of silt has been trapped by the structures, reducing sedimentation of the lake, mitigating the loss of storage capacity and the decrease of water quality. Soil erosion reduction as such contributes to the preservation of the lake's biodiversity and enables farmers to improve their productivity, thanks to the improved nutrient retention and soil moisture of their land. The ecohydrological approach to landscape restoration also enhances groundwater recharge through improved water infiltration, which ensures high-quality water supply to communities and businesses in the sub-catchment. Mitigating complex issues like soil erosion, which impacts different stakeholders in different ways, requires collective action and natural resources stewardship. Stewardship partnerships like PLH are essential to upscaling ecohydrology and other innovative approaches.

ABOUT NATURES

The partnership is part of the Natural Resources Stewardship Programme (NatuReS), a multi-stakeholder programme funded by the German Ministry for Economic Cooperation and Development (BMZ), the European Union (EU) and the Foreign, Commonwealth and Development Office (FCDO).

The programme enables private-public-civil society partnerships to sustainably manage the natural resources they need for improved livelihoods and continued economic development. NatuReS is implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), which is a trusted partner within the international community of natural resource stewardship practitioners.

It is currently active in Ethiopia, Tanzania, Uganda, Zambia and South-Africa. NatuReS is a continuation of the International Water Stewardship Programme (IWaSP), which was active from 2013 to 2019. The predecessor programme has reached more than 2.7 million people with more than 180 partners in 38 partnerships and leveraged private sector investments of EUR 15 million.

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