



# SOIL CONSERVATION (TERRACES) FOR YEMEN

## TECHNOLOGY DESCRIPTION

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Agricultural terraces are a historical technique in Yemen, used for thousands of years to transform barren mountain slopes into productive agricultural areas while preserving soil and preventing erosion and runoff. These terraces are constructed by creating stone barriers on slopes parallel to the contour lines, aligned with the topography. The barriers allow soil to accumulate, either naturally or brought from other locations. Terrace walls range in height from several decimeters to a few meters and can be continuous or intermittent, comprising single walls or complex series of walls.

Farmers enhance the fertility of terrace soil—whether new or reused—by adding organic fertilizers like animal manure and plant waste, or chemical fertilizers containing essential nutrients such as nitrogen and phosphorus. The sizes of terraces vary based on the mountainous terrain but are generally small, averaging 0.29 to 0.5 hectares. They are irrigated by diverting floodwaters through canals from main streams or using pipe networks from wells or water collection tanks.

Despite their historical significance and widespread use, many terraces have deteriorated due to Yemen's economic challenges, farmers' inability to maintain them, and the impacts of climate change, including floods and droughts. However, there are ongoing efforts to revive these terraces, supported by farmers, national organizations such as the Social Fund for Development, and international organizations. These initiatives aim to restore and sustain this traditional agricultural practice that is vital for food security and environmental conservation in Yemen's mountainous regions.

### CURRENT TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

The technology readiness level (TRL) in Yemen is level 7, because it has already been tested for thousands of years and operated on several scales. Terraces are currently at level 2 in the Commercial Readiness Index (CRI), because it is not commercially available in the market, but part of the technologies such as soil and stone transfer, and building stone walls exist on a very small scale in the market. The main challenge is transforming the technology from the traditional system to the commercial arena.

### CLIMATE RATIONALE OF THE TECHNOLOGY

.Based on the future climate scenarios, water scarcity and rainfall variability in Yemen, terrace technology is very important to maintain in order to address water shortages and preserve traditional agriculture which has helped and is helping small farmers to withstand long periods of drought or floods. Terraces also help farmers adapt to climate change, especially drought because they improve rainfall absorption, reduce soil erosion, mitigate extreme summer temperatures, and mitigate flood risk while maintaining biodiversity and ecosystem services. The deterioration of one terrace can harm others so strong and properly built terraces can prevent soil large soil erosions. Terraces also a green infrastructure so it has a role on mitigation with absorbing greenhouse gases. Climate change and food security remain major challenges in Yemen, exacerbated by war and economic difficulty, and the abandonment of terraces amplifies the impacts of climate change and increases the vulnerability of local communities.



## AMBITION OF THE TECHNOLOGY

### SCALE FOR IMPLEMENTATION AND TIMELINE

A 10-year (2025-2035) terrace maintenance program will focus on conserving 66,200 hectares across the southern highlands (Taiz, Aldhale, Lahej, and Abyan), targeting small farmers and crops like sorghum, wheat, barley, and coffee. In the first two years, the program will build new terraces for coffee conservation on 2,400 hectares, benefiting 2,400 farmers. The long-term goal is to create terraces on 12,000 hectares over 10 years.

### AMBITION FOR TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

The ambition for terraces is to achieve a TRL of 9, signifying widespread operational deployment and integration into Yemen's modern agricultural practices. This includes enhancing traditional terrace systems with advanced techniques for water and soil conservation, ensuring resilience to climate impacts, and scaling up their application to cover vulnerable agricultural areas. Therefore the ambition for terraces is to reach a CRI level of 5-6, indicating a robust market where terrace technologies and related services are commercially available and accessible. This includes scaling up the local market for tools, materials, and expertise required for terrace construction and maintenance, supported by policies that incentivize private sector engagement and farmer adoption.

## EXPECTED IMPACTS OF THE TECHNOLOGY

- Farmers in Yemen have used terraces to serve their living needs, and have made the mountain slopes a safe food basket, from which they eat their daily sustenance and save what is left over in anticipation of hard years that may be imposed by climate change causing lack of rain and scarcity of water in some seasons.
- Reducing surface water runoff and mitigating floods, which is an important means of flood management.
- Rationalizing water consumption and increasing the rate of internal infiltration, as water is distributed over large areas instead of being concentrated in the wadies. This allows feeding the soil with water, and thus feed springs and waterways and increase their flow and continuity, which constitutes support for the water reserve from surface and groundwater reservoirs.
- Prevents soil erosion by reducing the formation of water tables, and allowing water to remain in the terraces for long enough to help form new soil. It also helps maintain soil cover and fertility as water flows do not wash away topsoil and nutrients.
- It increases crop productivity, by being suitable for rain-fed and irrigated agriculture, making use of available water and controlling irrigation processes. It also helps in crop productivity due to the possibility of growing various crops in addition to increasing agricultural area in barren or rocky areas.
- Conserving the natural environment, as different levels of terraces can create a variety of microclimates, which can support a variety of plant and animal species. Increasing plant and animal diversity and agricultural practices on terraces can be beneficial for pest control and pollination, as well as contributing to the overall health of the ecosystem.
- Terracing creates a cultural landscape that reflects human wisdom in understanding the relationship between man and a specific environment
- Terraces improve the standard of living, especially for small farmers. Terraces are considered a historical cultural heritage. Terraces are an important technology for environmental conservation.



## POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

### EXISTING POLICIES ABOUT THE TECHNOLOGY

1-National Action Plan to Combat Desertification, 2000:The plan highlighted the current threats facing the terraces, including declining income from the terraces, the state's late recognition of the importance of the terraces, subsidized imported crops, and severe drought cycles. It also highlighted the importance of rehabilitating the terraces and encouraging investment in them as a means of protecting watersheds.

2-Water Law 2002: Protection and maintenance of agricultural terraces to reduce the severity of floods and enhance rainwater harvesting systems.

3-National Water Sector Strategy and Investment Program, 2004:The plan focused on investment in infrastructure such as terrace rehabilitation as a tool for Watershed management.

4-Republican Decree No. (61) of 2008 regarding the organizational regulations of the Ministry of Agriculture and Irrigation: One of the responsibilities of the Ministry of Agriculture is preserving agricultural lands and protecting them from floods and other natural factors, and protecting agricultural terraces and valleys from erosion.

5-National Biodiversity Strategy and Action Plan II, 2017; achieving a resilient, productive, and sustainable socio-ecosystem by 2050:The strategy focused greatly on agricultural terraces as a tool for ecosystems restoration, by protecting them from erosion, and paying attention to neglected terraces. It pointed out some of the reasons for the deterioration of terraces, such as government support for grain imports and the government's inability to reduce poverty levels, especially in rural areas, which led to the abandonment of terraces and excessive logging. The action plan identified the implementation of programs to restore degraded ecosystems, including focusing on afforestation and rehabilitating terraces.

### PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

1. Developing a special policy within the Ministry of Agriculture that cares for agricultural terraces, and their maintenance, encouraging investment in them, and preventing any factors that lead to their deterioration.
2. Integrating agricultural terraces into the state's general policies, including water, climate change, environmental, investment, and other policies.
3. Develop a plan to finance the management and maintenance of agricultural terraces and activate the available financial tools, such as CACB, AFPPF and SFD
4. Incorporating traditional, scientific and technical knowledge related to agricultural terraces into basic and university curricula and encouraging research related to agricultural terraces.

## USEFUL INFORMATION

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## LINKS TO TNA REPORTS

<https://tech-action.unepccc.org/country/yemen/>