CARBON SEQUESTRATION THROUGH AGROFORESTRY SYSTEMS IN LESOTHO

TECHNOLOGY DESCRIPTION

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Agroforestry combines production of trees with crops or grasses. The agroclimatology of Lesotho is suitable for fruit trees production. In addition to potential greenhouse gas (GHG) mitigation benefits depending on operational management practices, this can also provide other social and ecosystem-related services including food security and nutrition, fodder for animals and land rehabilitation. Trees in this system provide shading which reduces evapotranspiration, prevents soil erosion and increases nutrient cycling. They also protect crops from strong winds and storms. Agroforestry technologies aim to reduce GHG emissions through carbon sequestration by planted biomass, prevention of land degradation and organic improvement of soil health.

Land degradation, a challenge that has existed for a long time, provides a great opportunity for agroforestry applications that can be used to conserve soil. Although supplementation with irrigation may be necessary on some occasions, cold temperatures and several snow occurrences in winter are favourable for cultivation of Mediterranean fruit trees including grapes, apricots and citrus.

Improvement of agroforestry assists by storing carbon in the terrestrial systems and prevents carbon loss through land degradation. This technology can mitigate emissions by restoring degraded grazing lands through a combination of intensive and extensive agroforestry (silvopastoral) livestock systems and planting of improved and nutritious forage trees. Trees are planted at strategic points in the field to allow for production of crops together with them. Agroforestry enhances biomass production and therefore do carbon sequestration. Since roots of trees extends to deeper soil levels, they avoid competition for resources with other crops and other trees which they are integrated with.

Agroforestry systems improve soil carbon content which improves overall soil fertility. As a result, crop and tree yields produced in agroforestry required 14–34% less land or fewer resources in terms of light, water, nutrients, compared to monoculture systems. A fraction of farmers prefer to produce either trees or grasses separately. With enhanced promotion and resources, the technology could be readily applied in the country. National planning documents including National Strategic Development Plan II recommend adoption of this technology.

Farmers will need to be assisted with capital to practice this technology. The market can adopt this technology if promoted effectively.

CLIMATE RATIONALE OF THE TECHNOLOGY AND OTHER ENVIRONMENTAL BENEFITS

Climate Change Mitigation:

- **Carbon Sequestration**: Agroforestry offers great potential for carbon sequestration. Agroforestry systems integrate trees and shrubs into agricultural landscapes, which helps sequester CO_2 from the atmosphere. The trees capture CO_2 through photosynthesis and store it in their biomass above and below the ground, reducing the overall concentration of CO_2 in the atmosphere.
- **Reduced Emissions**: Agroforestry can reduce the need for chemical fertilizers and pesticides, which are associated with the emission of GHGs such as nitrous oxide (N_2O). It can also lead to reduced deforestation and forest degradation, which are major sources of CO_2 emissions.

- Reduction of carbon emissions from land degradation.

Climate Change Adaptation:

- **Resilience to Climate Extremes**: Agroforestry systems enhance the resilience of agricultural landscapes to climate extremes such as droughts, heavy rains, and temperature fluctuations. Trees and shrubs act as windbreaks, reduce soil erosion, and improve water infiltration and retention in the soil.
- **Diversified Income and Livelihoods**: By integrating various crops, trees, and livestock, agroforestry provides diversified sources of income and food, reducing the vulnerability of farmers to climate-related shocks and improving food security.

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

Pilot projects can be implemented in different agroecological zones (i.e., Northern Lowlands, Southern Lowlands and Foothills) of the country with more emphasis on degraded lands. The focus will be to target degraded lands in these zones. Depending on the suitability of the crops and trees that can be produced based on the agroclimatology, some pilots can implement a combination of trees and fodder for animals while other pilots can focus on tress and crops. The purpose of pilot projects is to gradually develop local capacity and conduct research to establish suitable and productive crops (grasses and trees). The distribution of the pilot projects will be equal throughout the zones and the implementation will take four years.

The ambition for this technology is to:

1. Produce a plantation of 1 000 ha of agroforestry systems that consists of forests and fodder grasses in five years in the lowlands of Lesotho.
2. Achieve between 0.50 $tCO_2e\ ha^{-1}\ year^{-1}$ and 17 $tCO_2e\ ha^{-1}\ year^{-1}$ of carbon sequestration depending on the tree species and up to 2 $tCO_2e\ ha^{-1}\ year^{-1}$ from grass species.
3. Reduce land degradation by increasing soil cover, productivity of the land, improving soil organic carbon, soil fertility and soil water holding capacity.

EXPECTED IMPACTS OF THE TECHNOLOGY

In addition to climate change mitigation, other expected impacts of the technology are listed below:

Environmental Protection:

- **Soil Health Improvement**: Trees in agroforestry systems contribute to soil fertility through the decomposition of leaf litter and root biomass, which adds organic matter to the soil. This enhances soil structure, nutrient availability, and microbial activity.
- **Biodiversity Conservation**: Agroforestry practices promote biodiversity by providing habitats for various plant and animal species. This diversity can improve ecosystem stability and resilience.

Water Management:

- **Improved Water Cycle**: Trees in agroforestry systems play a crucial role in the water cycle by intercepting rainfall, reducing surface runoff, and enhancing groundwater recharge. This helps maintain water availability in the landscape, which is particularly important in arid and semi-arid regions like Lesotho.

- **Reduced Erosion and Sedimentation**: The root systems of trees and shrubs help anchor the soil, reducing erosion and preventing sedimentation in water bodies, which can improve water quality and reduce the impacts of floods.

Socio-Economic Benefits:

- **Enhanced Food Security**: Agroforestry systems can improve food security by increasing the availability of diverse food products such as fruits, nuts, and vegetables, alongside traditional crops. This contributes to a more balanced and nutritious diet for local communities.
- **Economic Opportunities**: The integration of trees and shrubs into farming systems can provide additional sources of income through the sale of timber, fruits, nuts, and other tree products. This economic diversification can enhance the resilience of rural livelihoods.
- Increase fodder production for livestock.

Sustainable Land Management:

- Agroforestry practices promote sustainable land management by reducing the pressure on natural forests and promoting the sustainable use of land resources. This can help combat desertification and land degradation, which are significant issues in Lesotho.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

Existing policies are the following:

1. National Strategic Development Plan II (2018/19 – 2022/23).
2. National Climate Change Policy (2017 – 2027).
3. National Climate Change Policy Implementation Plan (2017 – 2027).
4. Nationally Determined Contribution (2017).
5. National Range Resources Management Policy.
6. National Forestry Policy (2008).

PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

Proposed policies that through their effective implementation, can enhance technology implementation include the following:

1. Development of technology specific policies can further enhance implementation of this technology.
2. Policy to provide sustainable funding for the technology
3. Policy to support women involved in this technology
4. Policy to improve institutional and human capacity regarding this technology

COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

Strengthening the Regulatory Framework: USD 120 000 per year. This cost includes development and enforcement of policy and regulations for agroforestry systems in the country.

Providing Financial Incentives and Financing: USD 350 000 per year. The cost includes capital costs for pilot projects including purchases of inputs and machinery.

Strengthening Institutional Capacity and Coordination: USD 500 000 per year. The cost includes provision of resources to enable institutions to employ people with required skills, collect data and conduct research.

Promoting Public Awareness and Behaviour Change: USD 50 000 per year. This cost will assist fund educational campaigns that will be used to promote the technology to the farmers and the public.

Monitoring, Evaluation, and Continuous Improvement: USD 250 000 per year. This cost includes procurement and maintenance of equipment that can be used to monitor implementation of the technology.

USEFUL INFORMATION

CONTACT DETAILS

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LINKS TO TNA REPORTS

https://tech-action.unepccc.org/country/lesotho/