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EXTENSION DOCUMENT
TECHNICAL GUIDELINES

HOW TO MEASURE TERRACE FORMATION ON SLOPING LAND?

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ABOUT THE PROJECT

The Project ***"Agroforestry: potential for sustainable development in the uplands"*** aims to contribute to sustainable development in sloping upland areas, with focus on evaluating agroforestry practices and systems addressing production and productivity, soil conservation, management practices such as nutrient application and weeding, and competitive effects between trees, crops and forage grass in young and mature agroforestry systems, study fruit value chains and market links, and assess opportunities and bottle-necks for wider agroforestry adoption and increasing of scale.

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TERRACE FORMATION

Terraces play a crucial role in minimizing soil erosion, preserving soil moisture, enhancing landscape quality, and increasing land value (Foster, 2004). These structures effectively reduce erosion by shortening slopes and intercepting surface runoff through the separation of slope segments (Koomson et al., 2020). Instead of constructing terraces individually up the hill, a progressive establishment approach involves forming terraces over time in conjunction with vegetation, such as grass strips and shrubs/trees, planted along contour lines (Do et al., 2023). Various tree, crop, and grass species can be utilized for this purpose, serving as living barriers against erosion and representing a low-input soil conservation technique (Tripp, 2017; Wojtkowski, 2008). This naturally initiated terrace creation can be a significant element of green infrastructure as a nature-based solution for sustainable land use (Simelton et al., 2021). When integrated with other agricultural practices, terraces developed in steeply sloping areas have the potential to substantially enhance agricultural production and water-use efficiency (Chai et al., 2014).

Measuring the amount of topsoil eroded in the formation of the terrace is essential for assessing the effectiveness of terrace farming in preventing soil erosion and conserving soil.

ESTIMATION OF THE VOLUME OF TERRACES FORMED BY TREE-GRASS STRIPS IN AGROFORESTRY

To determine the volume of eroded soil which has accumulated above the vegetation strips, forming a terrace, you can use the following method by Sjödell and Thelberg (2020) (refer to Fig.1 and Equations 1-3).

The terrace volume (V) is estimated from its cross-sectional area (Aterrace) and its length along the contour. For a 1 m length, the volume in cubic meters can be calculated sas follows:

$V1 = (h1 \times w)/2$ *(Eq.1)*

$V2 = (h2 \times w)/2$ *(Eq.2)*

$V_{terrace} = V1 - V2$ *(Eq.3)*

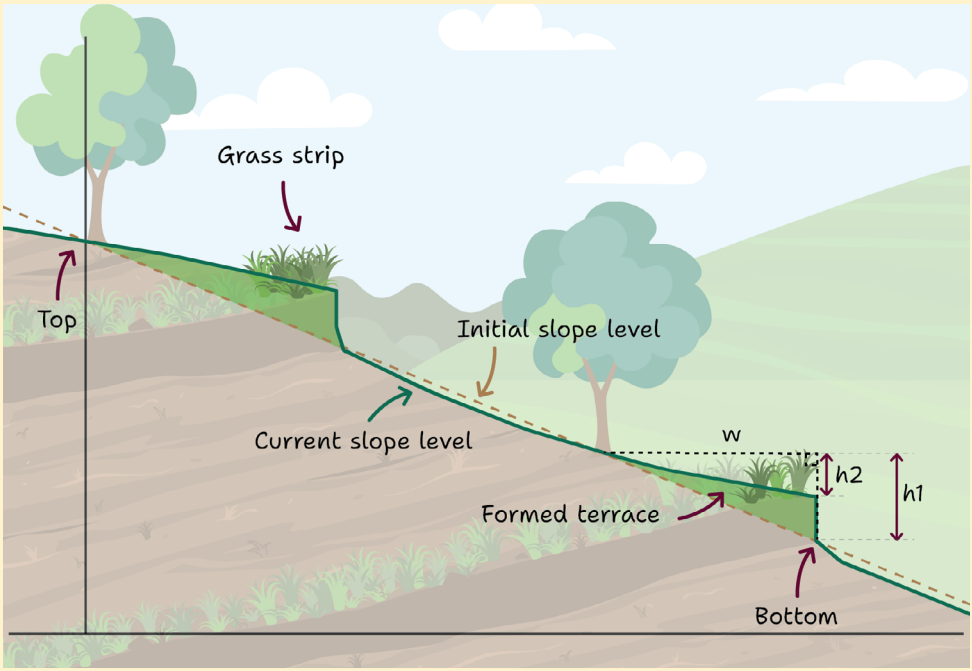

Figure 1. *Method used to estimate the volume of terraces formed by trees and grass strips in agroforestry models including fruit trees rows and forage grass strips*

Where:

h1 = Height from the base of the terrace to the tree trunk above object

h2 = Height from the second grass strip to the base of the tree trunk above

w = Horizontal width from the trees to the second grass strips (Fig. 1)

V1 = Volume of soil + no soil

V2 = Volume of no soil

Vtot = Volume of the soil (i.e. terrace)

N.B. All measurements should be made in the meter unit for calculations to provide the volume of 1 m terrace length.

Figure 2. *Measurement of terrace formation formed by trees and grass strips in a longan-mango-maize-forage grass agroforestry trial (after 5 planting seasons) in Mai Son district, Son La province*

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NOTES

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