

Effect of Soil Compaction by Livestock on Tree Roots in a Silvopastoral System in The Gambia (Giroba Kunda)

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Abstract

This study investigates the impact of soil compaction caused by livestock trampling on the root systems of trees in a silvopastoral system in Giroba Kunda, The Gambia. Using field measurements and laboratory analyses, we assessed soil bulk density, porosity, and root penetration resistance in areas with varying livestock grazing intensities. The results indicate a significant correlation between livestock trampling and reduced soil aeration, which adversely affects root growth and tree health. The findings underscore the need for sustainable grazing management to mitigate soil compaction and preserve tree vitality in Silvopastoral systems.

Keywords: Soil Compaction, Livestock Trampling, Tree Roots, Silvopastoral Systems, The Gambia, Grazing Impact

Introduction

Background

Silvopastoral systems, integrating trees with pasture and livestock, are vital for sustainable agriculture in The Gambia. However, livestock activity often leads to soil compaction, impairing soil structure and limiting tree root development.

Problem Statement

Despite the widespread adoption of silvopastoral systems, little is known about the extent to which livestock-induced soil compaction affects tree root systems in The Gambia, particularly in Giroba Kunda.

Objectives

This study aims to evaluate the effects of livestock trampling on soil compaction and its subsequent impact on tree root growth and development.

Literature Review

- **Silvopastoral Systems in Africa:** Importance for food security and ecological balance.
- **Livestock and Soil Compaction:** Effects of trampling on soil properties such as bulk density, porosity, and permeability.
- **Tree Roots and Soil Health:** The role of soil conditions in root growth and nutrient uptake.

Methodology

Study Area

Giroba Kunda, located in a semi-arid region of The Gambia, is characterized by mixed livestock farming and agroforestry practices [1].

Experimental Design

- **Site Selection:** Three grazing intensities: low, medium, and high.
- **Soil Sampling:** Collected from 0–30 cm depth for bulk density and porosity analysis.
- **Root Analysis:** Excavated tree roots to measure root length, diameter, and branching patterns.
- **Data Analysis:** Statistical analysis to correlate soil compaction levels with root characteristics [2].

Results

- **Soil Bulk Density:** Increased significantly with higher grazing intensity.
- **Porosity:** Reduced in compacted soils, limiting water infiltration and root growth.
- **Root Health:** Trees in high-compaction zones exhibited shorter and fewer roots, with limited branching.

Discussion

- **Impact of Livestock Activity:** Trampling increases soil compaction, disrupting root development.

- **Implications for Tree Growth:** Poor root systems reduce nutrient uptake, affecting tree health and productivity.
- **Management Strategies:** Recommendations include rotational grazing, fencing, and promoting cover crops to minimize soil disturbance [3].

Conclusion

Livestock-induced soil compaction poses significant challenges to tree root growth in silvopastoral systems. Adopting sustainable grazing practices can mitigate these effects, ensuring the

long-term viability of such systems in Giroba Kunda and beyond.

References

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