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Soil Texture as Physical Driver of Forest and Grassland Occurrence in Kibale National Park, Uganda

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Deforestation is a global issue, threatening carbon stock and biodiversity worldwide. African tropical regions are experiencing intense deforestation, primarily driven by agricultural expansion. The strong reliance of rapidly growing populations on forest resources further increases pressure on these ecosystems. Smallholder subsistence farming, combined with weak governance and limited soil and forestry management, has contributed to progressive forest fragmentation, declines in biodiversity, and reductions in ecosystem resilience. The rapid decline of African tropical forests raises critical questions about their ability to recover naturally. This study investigates the role of soil in explaining the persistence of grassland vegetation and the consequent limited forest recovery. Specifically, soil samples from grassland-dominated areas of Kibale National Park in Uganda are collected, air-dried, and analysed to determine key properties influencing soil water availability, including bulk density, gravel content, and soil texture. Bulk density and gravel content are measured because of their influence on porosity and soil water availability. Soil texture is obtained using spectroscopy and used to help explain potential vegetation patterns due to its effect on soil water availability. These properties are also compared with soil data from forested areas within the same park. The results reveal clear differences between grassland and forest soils. Grassland soils contain less clay and show lower porosity than forest soils. These characteristics help explain the persistence of grassland vegetation in the studied tropical landscape and support the conclusion that soil physical properties influence vegetation distribution through their effect on soil-water-plant interactions.