

## Can restoration efforts improve soils in degraded grasslands at the Knuckles Conservation Forest, Sri Lanka?

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Most of the abandoned tea plantations in the Knuckles Conservation Forest (KCF) were converted into grasslands due to many biotic and abiotic stresses. The conversion of natural forests to grasslands causes drastic changes to the soil biota which result in less biodiverse and low productive soils. In this study, we investigated whether the establishment of native plants islands in the grassland with the presence of *G. sepium* as a shade plant and also with the application of Biofilmed Biofertilizer (BFBF) affect the fungal: bacterial ratio of degraded lands at KCF. Inside the three different islands (2 m<sup>2</sup>, 4 m<sup>2</sup>, 8 m<sup>2</sup>) four native plants (*M. indica*, *B. ceylanica*, *S. cochinchinensis*, *E. bracteata*) were randomly established using treatments, namely with *G. sepium* (+G) as shade plant and the application of BFBF (+B). This resulted in four treatments {(+G+B), (-G+B), (+G-B) and (-G-B)}. Fungal: bacterial ratio was determined in the soil collected from different island sizes and the nearby grassland before initiation of the field experiment and after two years from the four different treatments in the three different tree island sizes. The soil samples were analyzed for fungi and bacteria in the region of 4,000-400 cm<sup>-1</sup> at a resolution of 4 cm<sup>-1</sup> using FTIR. Two-way ANOVA and Tukey's HSD in Minitab 17.1.0.0 were used to analyse the data. The fungal to bacterial ratio was significantly higher (p<0.05) in the grassland than in the different island sizes. Nutrients released from the thick mulch of dead leaves might be a reason for the recorded improvement in fungal to bacterial ratio. However, the presence of *G. sepium* as the nurse plant and the application of BFBF (+G+B) in the different island sizes had the second-largest fungal to bacterial ratio which was significantly (p<0.05) higher than the initial ratios in the bare land and the other three treatments {(-G+B), (+G-B) and (-G-B)}. The recorded significantly lower fungal to bacterial ratio in bare land compared to the treatments might be due to the removal of all the organic litter in the land preparation of selected sites. The highest relative growth rate and survival were observed with the application of treatment of (+G+B) in the islands. Therefore, the fungal to bacterial ratio has been increased due to improvement of the above ground vegetation of the native plants with the application of (+G+B). We conclude that established native tree species in the tree islands with the treatment of (+G+B) enhances the fungal: bacterial ratio and leads to restore the degraded soil at the KCF.

**Keywords:** Fungal: bacterial, Restoration, Native plants