

Topsoil storage and mined areas restoration in New Caledonia: evolution of fertility parameters during storage

Mr Hamid Amir¹, Mr Laurent Bordez^{1,2}, Yvon Calvadoc¹

¹University of New Caledonia, ²New Caledonian Agronomy Institute (IAC)

The revegetation of mined areas is an important challenge in New Caledonia, because of the high poverty and metal toxicity of local ultramafic soils and the low growth rates of the native species. However recent improvements have been recorded and an evolution toward ecological restoration is now a realistic goal. The reuse of the topsoil is a key factor for the restoration success because its complexity is necessary to ecosystem resilience; but the topsoil is commonly stored before use.

We studied the evolution of two stored topsoils recovered from two different ecosystems, in Koniambo massif. The storage was performed in a waste pile of 10 m depth. We analysed different physico-chemical and biological parameters of the topsoils, related to their fertility, during 18 months and for three depth values.

We noticed a progressive reduction of organic C, total N, CEC and C/N ratio during the storage; but without significant differences between the 3 tested depths. The topsoil density increased with the time and with depth and the porosity decreased. Topsoil pH increased after 6 months and then stabilized.

The density of heterotrophic cultivable bacteria, used as an indicator, and the activity of carbon mineralization highly dropped after 6 to 9 months. The density of arbuscular mycorrhizal fungi spores also decreased 5 to 10 times after 6 to 9 months and the decrease was worse in depth soils.

Bacterial and fungal diversity (estimated by 454 pyrosequencing) were not significantly affected by the storage and the depth, but microbial community structures were affected by these two parameters; with probably reduction of taxa dependent on plants and energetic carbon and reduction of highly aerobic taxa in depth layers.

It appeared than clear that topsoil storage must be reduced to not more than three to six months and must be revitalized if stored more.