

Thirty years of ecological restoration of mining-degraded areas in New Caledonia: Comparative analysis and recommendations.

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Introduction

During the last decades, many revegetation/restoration projects on ultramafic areas degraded by nickel opencast mining operations have been performed in New Caledonia. A practical synthetic review became necessary to determine the state of know-how in this domain, highlight the most effective techniques and guide future researches. Indeed, if many tests have been performed, results arising from the majority of these works are scattered and not all known. This was the aim of the CNRT RECO SYNTH project that has consisted in evaluating 35 restoration operations reflecting the maximum diversity of the field conditions and techniques used to establish recommendations.

Methods

Random quadrats (with variable size depending on the surface of the restored area) have been placed on the different studied zones (a same zone can include several assays) and variables measured to evaluate ecosystem productivity and dynamic. Based on 34 variables (calculated or directly obtained from field measurement), a stochastic algorithm permitted to select 12 variables, which have the most significant effect to compare the different used treatments. Results analysis was performed with hierarchical classification applied on ordination.

Results

In terms of ecological restoration techniques, use of topsoil appears to be one of the most effective as it permits to enhance both productivity and dynamic guaranteeing the resiliency of the ecosystem. Without topsoil, differences exist regarding planted soil type, both in terms of success and of plant species behaviour and diversity. Use of *Acacia spirorbis*, known for its capacity to fix nitrogen, can help restoration on ultramafic soils poor in nutrients. But at the same time it blocks the ecological succession when used at high density. An evaluation done to establish effects of different inputs highlights that organic matter is essential for plant productivity. Finally, the use of windbreak systems plays a major role for restoration success in areas subject to main winds direction.



Illustration of the topsoil effects on right side on plant density and diversity at Goro, New Caledonia