Botanical characteristics of New Caledonia

Constraints for mining industry and an opportunity for restoration





Mining

Revegetation



One of the main biological characteristics of New Caledonia is its high biodiversity

« There is probably no region of comparable area in the world with such a rich, archaic, pecular and endemic seed plant flora as that of New Caledonia » (Thorne 1965)



Amborella trichopoda

- •3300 indigenous species
- 2475 (75%) endemics

Primitive species



Parasitaxus usta



Conifers diversity : (43 species all endemics of New Caledonia)



Araucaria humboldtiana



Araucaria muelleri



Dacrydium guillauminii





Araucaria scopulorum

Diversity of Palms and various families

38 species, 37 endemics



Kentiopsis piriformis



Pritchardiopsis jeanneneyi



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Cunonia atrorubens (Cunoniaceae 92 species)



(*Metrosideros Humboldtiana*) (Myrtaceae 236 species)











New Caledonia was recognised by « International Conservation » as one of the world's most important biodiversity « hot spots » (Myers, 1988) largely because of the exceptional number of endemic taxa



The ten "Hot Spots" in tropical forest (Myers 1998). Characterised by exceptional concentration of species with high level of endemism.



Floristic (vascular plants) richness and endemicity on ultramafic soils in New Caledonia

Flora	Number of species	Endemicity	Percentage of the indigenous flora
Indigenous flora of New Caledonia	3300	75,8 %	100 %
Indigenous flora of ultramafic soils	<u>2200</u>	80,5 %	<u>66,7 %</u>
Indigenous flora found only on ultramafic soils	1180	96,6 %	35,8 %
Endemic flora found only on ultramafics soils	<u>1140</u>	100 %	<u>34,5 %</u>

2200 species (66,7% of the native flora) are found on ultramafic soils containing low levels of P, Ca, K, N and high levels of Ni, Cr and Mn.

About 1140 species, (nearly 35%) of the total native flora, are found only on ultramafic soils. So ultramafic biotopes in New Caledonia may also be considered as a « hot spot » for plants growing on Ni mining soils



Concerning Mining and Biodiversity

As the ultramafic outcrops are the focus of increasing nickel mining, the revegetation of the old mine sites is now a major environmental concern in New caledonia

« The protection of biodiversity depends on the protection of ecosystems. However economic poverty is biodiversities worst enemy, and a compromise must be found between the environmental protection and the development constraints » (Ch. Lévèque, 1994)

So, its appears that the integrity of the floristic diversity of ultramafic flora in New Caledonia is highly dependent on nickel mining and rehabilitation methods



The aims of revegetation in New Caledonia

- To protect slopes against erosion
- To regulate hydrology
- to reconstruct the initial biotopes and their biodivertsity by initiating a primary succession
- For this purpose, revegetation of barren mine sites will be based on the establishment of pioneer native species of ultramafic soils, able to form pioneer groups, evolving into vegetation associations similar to those existing before destruction



To prevent soil surface erosion

Grassy species including various belonging to Cyperaceae family



Baumea deplanchei

Fasciculate root systems







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Schoenus juvenis



For stabilisation of sub-surface soil

Ligneous species to stabilize the soil at depth



Arillastrum gummiferum





Tristaniopsis glauca

Stenocarpus umbelliferus



For improvement of plant nutrition conditions

 species of Leguminosae and Casuarinaceae families because of their nitrogen fixing symbiosis









Gymnostoma species (N fixing plants) are adapted to various kinds of sols



G. poissonianum



G. deplancheanum



G. intermedium



G. chamaecyparis



 some species, which have the ability to mobilise mineral elements (Ca, K), restored to the soil as fallen leaves, are useful



(N and P) Storckiella pancheri





(K) Scaevola montana







(Ca) Phyllanthus aeneus





(Ca) Peripterygia marginata





N and K by Agatea deplanchei





N and K by *Hybanthus caledonicus*





Plants have to be adapted to various edaphic conditions







Soils Chemical variations





D1:Red laterite D2:Yellow laterite D3: Yellow laterite M:Alluvial soil T:Slope o f Quarry TR:Excavation bunch



Plantations and seedings of adapted species will initiate primary succession, which evolve towards forests











What must be avoided plantation of invasive species which stop the plant succession



Acacia spirorbis



Casuarina collina









Research undertaken by IRD

•Better knowledge of ecological features of some potentially useful species that will increase establishment succes and the growth rate of species.

•Research to improve the performances of the symbiotic associations with bacteria's and fungus actinorhizal symbiosis, between *Gymnostoma* and *Frankia*, endo and ectomycorhizeae reported for a number of ultramafic species



Frankia nodules





Myco-nodules

Revegetation - Primary successions - Ecosystems restoration A dream yesterday - An imperious necessity today







