

## 6 • Production figures

To date, the Goro Nickel team has succeeded in germinating 186 of the species encountered in the area impacted by the project and has created a plant production structure with the capacity to accommodate 45 000 plants per year, with modest facilities.

With the new nursery facilities, it will be possible to build on these results and to germinate the other 200 or so species of mining scrub which were not priority (common) species or are difficult to produce.

The germination rate is highly variable; it can be as low as 1% and as high as 90%, depending on the species.



Revegetation of the Great South

### In figures:

Over 60 species have been selected and studied over a period of more than 10 years on the basis of strict criteria as regards their suitability for revegetation; these are the plentiful pioneer species.

All of the rare species and fragile plant communities have been incorporated into a safety plan. Of the sixty or so rare species existing in the project area, around thirty have been produced in the nursery.

Production of the rare species contained in the provincial reserves is not part of Goro Nickel's responsibility.

11 rare species have been transplanted.

In 2003, some 3200 plants were offered to the Blue River Park along with 7 different rare species. 12 species are in the process of propagation from cuttings, which is being done in partnership with the New Caledonian Institute of Agronomy (IAC).

## 7 • Environmental monitoring of species (in the forest)

There has been program in existence, in the form of regular checks, for over 10 years now. Special attention is being given to Planchonella Latihila, a new species discovered by the IRD experts in the Kwe West basin in 2005. Goro Nickel has

safeguarded its habitat by diverting a road and has initiated a cutting propagation study in collaboration with the IAC.

### Monitoring of permanent plots: assessment of the risks to vegetation caused by atmospheric emissions.

The forests of the Great South Forest are remarkable for the nature and composition of their flora. Some of these are actually in the vicinity of the Goro Nickel plant site, where they are at risk of being adversely affected by the atmospheric emissions from the industrial site.

The impact of these gases on the surrounding forest needs to be monitored in order to facilitate a rapid response in the event of any anomalies being observed. To this end, a monitoring system has been put in place covering a series of permanent plots within the forests adjoining the industrial site.

#### • Positioning of the plots

For each established plot, an inventory has been produced and the plot has been indexed and its GPS coordinates recorded. Each forest (the two reserves located in the line of emission, the North Forest and the Pic du Grand Kaori, and the forest identified as the control, the Pic du Pin) will feature plots of different sizes.

In order to evaluate any changes, three monitoring axes are being studied.

#### • Flora composition analysis

This involves an evaluation of the number of plant species present on the site and their respective abundance, as well as the total diversity observed. Any changes which may be observed in these parameters could be indicative of changes in the environment.

The presence of invasive species, which is a sign of disturbance to the environment, will also be taken into consideration.

#### • Structure of the forest

Within a forest, the canopy is the structure most sensitive to atmospheric changes. Tree height measurements for a given species, along with their diameters measured 130 cm from the ground and vegetation cover, would therefore appear to be good indicators of any disturbance to the canopy.

#### • State of health of the forest

Random samples will be taken from the soil, leaves and ground litter on each plot.

These will be analysed to determine their chemical composition: nitrogen, phosphorus, pH measurements, together with a full extract for the following elements: EC, K, Ca, Mg, Cl, S, B, Ni and Mn.

#### • Plant physiology: Measurement of photosynthetic activity

The Hansatech "Handy PEA meter" is an instrument used to study plant activity and provide a quantitative evaluation of its state of health. It has shown itself to be an effective tool for the evaluation of stresses due to atmospheric emissions.



The Plant Efficiency Analyser Meter: a lightweight and efficient tool

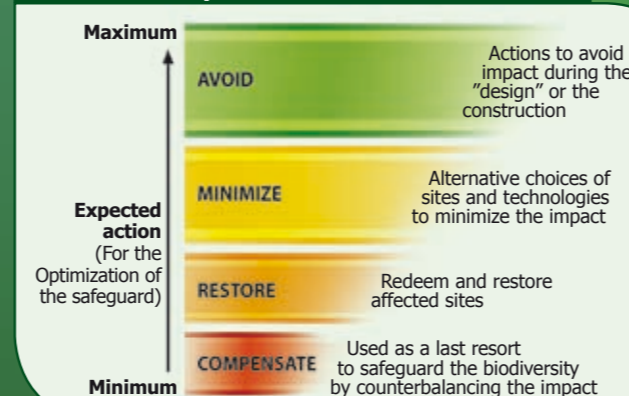
#### • Monitoring frequency

The plots will be monitored at quarterly intervals for one year prior to the commencement of emissions as well as during the first year of Prony Energies production. Once this baseline study has been completed, measurements will be taken at one-yearly intervals throughout the operational period.

## IN BRIEF

In the context of revegetation, the general strategy adopted by Goro Nickel is as follows:

### GNI decision-making process concerning the biodiversity conservation.



Through its experimental nursery which is now more than 10 years old, Goro Nickel has managed to perfect its germination techniques so as to achieve a new target of 1 million plants per year in a new nursery. This nursery will become a research station. For over 10 years now, an environmental monitoring program in relation to forest species has been in progress based on the development of individual plots.

To date, Goro Nickel has succeeded in germinating 186 different species.



GORO NICKEL  
Avenue Maréchal Foch  
B.P. 218 - 98845 Nouméa CEDEX  
Tél. 24 60 20 / Fax 27 37 10  
www.goronickel.nc

*With you,*

NOVEMBER 2007

# NEWS

GORO NICKEL NEWSLETTER N°5

## Production of mining scrub plants



### IN THIS ISSUE

- History of the nursery
- The nursery team
- The new nursery under construction
- Species impacted by the project
- What exactly is revegetation?
- Production figures
- Environmental monitoring of species





**This information letter aims to explain what Goro Nickel is doing to protect the terrestrial ecosystems in the area impacted by the project.**

**The general strategy adopted is as follows:**

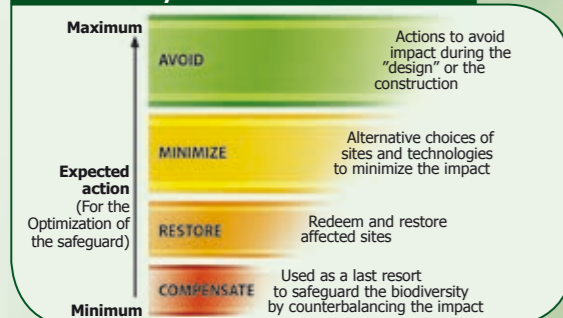
**First, avoid, minimize and reduce the impact:**

We do this by establishing our operations in an area where the plant communities contain the fewest rare or fragile species. We try as far as possible not to interfere with these communities. We set ourselves strict environmental standards (for example with regard to air quality).

**Then, rehabilitate the affected sites:**

This is the part played by the revegetation carried out by the Goro Nickel nursery, which will undertake the rehabilitation of the areas cleared by construction operations first of all, followed by the Kwe West (residue storage facility) and then the mine.

**GNi decision-making process concerning the biodiversity conservation.**



**Finally compensate for any impact**, with particular emphasis on safeguarding fragile communities (forest, riparian scrub), producing rare species and using them in operations designed to enrich their population. It is also planned to implement a program for the re-establishment of forest corridors.

By the same token, it is essential to monitor the health of the ecosystems in the vicinity of the industrial complex.

The experimental nursery



**Goro Nickel is engaging in vegetational rehabilitation (or revegetation), not reforestation. The objective of revegetation is to recreate in self-sufficient form the same kind of vegetation as that which was originally present. Reforestation may be restricted to one single species, which is not necessarily endemic.**

## 1 • History of the nursery

**From its experimental research objective to the present day.**

Goro Nickel's experimental nursery has been studying the mining scrub of the South since 1996. Its objective to date has not been to engage in replanting large cleared areas but to draw up of an inventory of the species and to endeavour to propagate and grow them under different mining conditions.

A new, large-scale nursery is currently under construction with a view to meeting Goro Nickel's future needs.

The results achieved from 10 years of research on endemic species and managing the vegetational environment are numerous.

In partnership with the Research and Development Institute (IRD), inventories have been drawn up of the flora of every area impacted by (or in the vicinity of) the project.

Since 1998, over 73,000 plants have been produced and planted by hand (one by one in topsoil or laterites + wood chips). Hessian is used on slopes as a means of countering erosion.

Right from the outset, Goro Nickel can therefore be described as having made a remarkable effort in the area of revegetation, even before the plant and mine are operational.

## 2 • The nursery team

**Men and women who are passionate about their jobs.**

The Goro Nickel nursery has a team of around ten people made up of several botanists, labourers and technicians, all of whom have had a number of years of training. It is led by a doctor of botany whose thesis, produced in partnership with IRD, was on the subject of plants from the South massif; he was recruited at the start of the project. The team is set to double by the end of 2008.

The seeds are harvested in partnership with the local population.

18 people from the commune of Yaté have been trained in the identification and harvesting of pioneer species. These seasonal activities have even given rise to the establishment of a business which takes care of the harvesting of the seeds.

## 3 • The new nursery under construction

**Target: 1 million plants per year.**

A new large-scale industrial nursery is under construction at the Plaine des Lacs.

It will become operational in 2008. The development of the mine is predicted to impact on 30 ha per year; in order to rehabilitate these areas, roughly 200,000 plants will be required per year.

The new nursery will therefore have a reforestation capacity well in excess of these requirements. The Goro Nickel revegetation program also provides for the rehabilitation of the damaged areas of the Great South (former mines, fires, etc.) and the establishment of plant sanctuaries containing rare plants.

The experimental nursery currently has a storage capacity of 45 000 seedlings. Our ultimate goal is

New nursery under construction



to produce 1 million seedlings per year in this new nursery.

By the end of 2008, the storage capacity will be equivalent to 500 000 plants. The figure of one million plants will be achieved via a partnership currently being finalised with the Yaté nurseries.

**The nursery, a future centre for applied research...**

The new nursery will also meet the needs of major scientific research on the techniques of germination and growth on different substrates, including residues, as well as studies relating to the use of mycorrhizas to improve growing conditions.

The new nursery will be a place where students, trainees and scientists from all over the world can share their knowledge and expertise in an environment boasting every advantage in terms of office equipment and computer facilities right there on the site. It will therefore provide the opportunity to combine theory with practice.

## 4 • Species impacted by the project

**The various ecosystems, those that will be impacted and those that won't.**

Since 1996, the nursery team has produced inventories of approximately 250 hectares to complete or expand the work of the IRD (Research and development Institute) and has succeeded in identifying 30 rare species in the area impacted by the project. These species, along with the numerous fragile communities such as the rainforests and riparian scrub in the Kwe and Wadjana basins, have been incorporated into a safety plan. In this context, inventories have been produced for several types of ecosystem:

**Over 800 species have been identified in these communities. These include:**

**400 rainforest species**, especially in the North Forest and the Pic du Grand kaori which are provincial botanical reserves with a large number of rare species.



**400 scrubland species**, including the Goro plateau scrubland which will be impacted by the Goro Nickel mine.

**The different ecosystems :**

Minimal Impact	Some Impact
Riparian scrub Rainforest	Low wooded scrub Para-forest scrub Dense scrub

## 5 • What exactly is revegetation?

Revegetation consists of endeavouring to reproduce, as closely as possible, the ecosystems impacted by mining or construction activity.

All of the chosen species are from the South; there is no question of our using exogenous plants or exogenous substrates.

**The revegetation program consists of:**

- Managing the plant biomass of the mine with a view to its reutilisation for revegetation operations.
- Studying techniques for the harvesting, germination and growth of mining scrub plants from the Goro plateau with a view to using them in the revegetation of the future mine.
- Describing the flora as well as drawing up safety plans for the fragile habitats and rare species.

The nursery has also conducted studies of plants in pots to gather information on their growth in the industrial residues produced by the pilot plant and the potential offered by the mud from the sewage treatment plant as a biological fertilizer.

**Different priorities:**

- The pioneer species (around forty in number): these need to be introduced before the others, as they encourage the appearance of the so-called secondary species and offer them protection.
- The secondary species of scrub.
- The pioneer forest species.
- The rare species.



Production in the nursery

In order to manage the plant biomass, the Mine team is recovering all of the plants along with the topsoil. Chips produced from the vegetation from the mining exercise have already been used for revegetation operations.

**The future objectives for the nursery team may be encapsulated in the following 4 points:**

- 1 • Development (at industrial nursery level) of technologies designed to increase the germination rate and the number of species produced.
- 2 • Testing these species in different environments, such as for example on the residues in the vicinity of the pilot plant.
- 3 • Ensuring that a constant supply of plants is produced to meet the needs of the project and the other operations to come (orphan mines, areas ravaged by fire...).
- 4 • Establishing forest corridors between isolated patches of forest (project for the medium and long term).

