**Above: Part of the Huntly mine in 1980 with South Dandalup dam in the background. Main picture: The same view in 2001 after mine site rehabilitation.**

# Unearthing geckos and truffles

After some 35 years at the forefront of mine site rehabilitation, Alcoa World Alumina Australia (Alcoa) has received a Golden Gecko Award from the Western Australian Department of Minerals and Petroleum Resources.

The award recognises the company's innovative environmental rehabilitation program, which has succeeded in restoring the botanical richness of its bauxite mine sites in Western Australia.

Not only has Alcoa achieved a plant richness equivalent to that in adjacent, un-mined jarrah forest, but other aspects of a functional ecosystem, including fungi, insects, reptiles and birds, are following suit.

One of Alcoa's mine sites has even yielded a serendipitous discovery.

For the past three years, Dr Neale Bougher, a fungal ecologist with CSIRO Forestry and Forest Products, in collaboration with scientists from Alcoa and Murdoch University, has been collecting fungi from rehabilitated sites, to see if they are re-establishing at their original levels.

'We're comparing the fungi in mine sites of different ages, to see whether we're getting a trajectory of return approaching that which we would see in native forest,' Bougher says.

While the collection is still being evaluated, the research received an unexpected boost last year, when Bougher struck taxonomic gold.

'I unearthed a truffle that had a look and feel that suggested it could be a relative of *Amanita*, the fairy tale mushroom with the red cap and white spots,' Bougher says.

'I couldn't wait to get back to the lab to have a look under the microscope. And when I did, I realised that we had found it; the long sought after truffle relative of *Amanita*.'

Unlike mushrooms, which have fruiting bodies (caps and spores) above ground, the spore-bearing tissue of truffles remains enclosed and below ground. In between these two forms is a third structure, which Bougher describes as a 'truffle-on-a-stem'. Most mushrooms or toadstools (depending on your perspective) have truffle relatives. But no such relative for *Amanita* had been discovered, until now.

Bougher describes the new truffle, named *Amarrendia oleosa*, as a missing link in the knowledge of world fungi.

'We have an evolutionary series now,' Bougher says. 'At one end is the new truffle, *Amarrendia*, at the other is the mushroom, *Amanita*. And in between is their truffle-on-a-stem relative, *Torrendia*.'

Bougher says the discovery of the truffle, which forms symbiotic 'mycorrhizal' associations with the roots of eucalypts, casuarinas, acacias, shrub wattles, peas, and other shrubs, indicates that critical soil processes are returning to the rehabilitated mine sites. This bodes well for the return and long-term health of native biodiversity at all levels.

'Plants are the tip of the biodiversity pyramid,' Bougher says. 'At the bottom of the pyramid are soil organisms, which break down wood and litter, and provide food for other organisms. So a good diversity of

**A disused mine pit is ripped to a depth of 1.5 metres in preparation for seed application by an air-seeder mounted on a bulldozer. Deep-ripping breaks up the compacted ground and the ripping mounds prevent soil erosion.**

these is essential if the ecosystem is going to function properly.'

Previous work by Bougher and other CSIRO scientists, on re-establishing native vegetation in agricultural areas, has shown that many Australian native fungi do not readily return to disturbed soils in the short term. So how did Alcoa succeed so quickly?

According to Dr Ian Colquhoun, a senior research scientist for Alcoa's Environmental Department, the best way to restore plant, fungal and microbial biodiversity is to retain topsoil from a mined area to use in rehabilitation.

'There's about half a metre of soil above the ore and all of that soil is returned in the rehabilitation process,' Colquhoun says.

'But we make sure the top five to 10 centimetres is stripped off separately and returned at the top: that's where all the seeds and soil organisms are.'

To encourage the return of 100% of the original native plant species, however, the company needed more innovative ideas.

This included the development of seed treatments, such as smoke, to enhance germination; development of a computer controlled air-seeding machine to evenly broadcast seed onto freshly ripped ground; and the development of micropropagation (tissue culture) techniques for recalcitrant plant species.

Alcoa-sponsored projects such as that being undertaken by Bougher and his colleagues are now evaluating the success of the rehabilitation scheme in re-establishing other parts of the jarrah forest ecosystem.

## More about fungi and mine site rehabilitation


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The Alcoa website can be found at: www.alcoa.com.au/index.shtml



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*Wendy Pyper*

**From top: Alcoa's Larry Hantler inspects mine site plantings.**

**Alcoa employee Linda Wright with tissue cultured dieback-resistant jarrahs. The company aims to return all original plant species.**

**Discovery of the truffle, *Amarrendia oleosa*, completes an evolutionary series that includes the red and white 'fairy' mushrooms, *Amanita*.**