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MINING REHABILITATION

The attached article is forwarded for your comments before it is put up to the Policy Review Committee.

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DIRECTOR
RESEARCH AND PLANNING

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JJH:BM

Mr R J Underwood, Como
Mr D E Grace, Como
Mr G Peet, Kelmscott
Dr Christensen, Como
Mr Bartle, Dwellingup

Mr A Hopkins, Woodvale: This refers solely to bauxite rehabilitation. I would like to repeat the exercise with you some time over the next two months with respect to sand mining at Eneabba.

MINING REHABILITATION POLICY

As I have been nominated to develop the above policy, I took the opportunity of going over some recent research with our Dwellingup staff, and discussing with them and with Dr Christensen some of the key findings of our recent research, in particular, how they might affect policy. We have reached the following conclusions:

1. Timing of a Change in Policy

   Quite apart from the decision taken by the Directors, the need for definition of a policy would have arisen anyway. There is a general feeling within our staff that we have done enough of broadscale experimentation, and it is time to settle down to more standard rehabilitation procedures. This is accentuated by Alcoa's growing assertiveness in defining the objectives of rehabilitation.

2. Before we begin to make such broadscale prescriptions, it is essential to define the objectives of rehabilitation clearly so that the procedure is less subject to day to day pressures. The most logical basis for defining such objectives are the management objectives for the region as a whole. In any foreseeable future mining operations of Alcoa are going to fall mainly into the Water Production MPAs with a smaller proportion falling into the Recreation MPAs. No mining falls into a reserve or MPA for Conservation, and the question of conservation of the jarrah forest ecosystems has been adequately taken care of in the System 6 proposals and subsequent negotiations.

3. In the light of (2), restoration of natural jarrah ecosystems to their pre-mining condition is not only not possible biologically, but is also not essential politically.

4. Although the 1977 and 1982 General Working Plans of the former Forests Department define water production and recreation as priorities over the areas to be mined, timber production is provided for as second priority. On the basis of the work so far done, there is no basic conflict in the rehabilitated areas between the three management objectives provided appropriate treatment can be carried out on schedule. There are successful examples of co-existence of the three objectives on the same area.

5. Detailed planning of mining and rehabilitation is already the responsibility of the Mining and Management Planning Group and the Directors should continue to look to this Group for detailed planning, only defining policy in broad terms. It is, however, appropriate to insist that the scope of planning should be enlarged from individual pits to whole landscapes. The need for this will be readily recognized as the recent thinking on fire protection is very much along these lines. There is already one example of this broader scale planning at Marrinup, but here the accent was on recreation, rather than on water or timber production.

6. It would appear from 17 years of experimentation that the dieback vulnerability of the mine sites has been greatly overstated. Although occurrences of death caused by Phytophthora have been recorded in some instances where jarrah has been planted, on the whole planted and sown

jarrah and other Monoeucalypt species such as Euc muelleriana have survived well, except on sites conducive to waterlogging, such as in sumps at the bottom of the pits. This means that jarrah and Euc muelleriana should not be left out of consideration because of the dieback factor.

7. There is now a number of species of proven good performance. The most widely planted of these are Euc maculata, Euc saligna and Euc globulus. By contrast some of the species initially favoured such as Euc microcorys, Euc resinifera, wandoo and powderbark wandoo have proved less satisfactory. In the case of some of the exotic species, the reason for poor performance appears to be inability to cope with the adverse site conditions, such as poor fertility and compaction of the subsoil. In the case of the local species, such as marri, wandoo and powderbark wandoo, the deficiency lies chiefly in poor form and mediocre growth. Even more disappointingly, some of the features that on first principles would be expected in local species, such as resistance to fire damage, have not eventuated. Recent burning-off trials of trash in a catchment planted with marri and wandoo resulted in severe fire damage and possible death. It could be argued that the fire was attempted too early in the development of the stand, but on the other hand an accidental wildfire could have easily arisen within the same timespan and would have had a similar impact. The key point is that fire resistance cannot be seen as a factor favouring these local species.

The most perplexing species ~~are~~ is paperbark wandoo, which on all known factors should do well on the upland sites, and has in fact done well on some isolated gravel pit plantings, yet in the broadscale plantings within bauxite pits the form appears consistently bad.

Bullich has shown a tremendous capacity to rapidly cover disturbed sites, both wet and dry, but there are big question marks about its fire tolerance, and its usefulness from the utilisation viewpoint. Given these factors, neither bullich nor paperbark wandoo could be recommended at present.

Jarrah is perhaps the greatest surprise in that in terms of performance survival it has greatly exceeded all our expectations and given the lie to our apprehensions about disease susceptibility, rate of growth and form, when grown in combination with other species.

8. Given these positive and negative features of the various species, it should now be possible to define a much smaller number of species to be used in rehabilitation, either singly or in combinations. Given that there is no basic incompatibility between timber production, recreation and water production, the final choice of species should therefore be on the basis of their capacity to produce saleable material, preferably at an early stage so that commercial, rather than non-commercial thinning operations can be carried out.

9. Although the water management must have a strong input into decisionmaking from the Water Authority, there is perhaps need to insist on more realistic standards of rehabilitation than currently imposed by the engineers. The standards of water purity as specified for the mine pits in terms of turbidity are higher than can be expected from even undisturbed catchments and the main source of turbidity appears to be the actual mining and the associated operations, such as road construction and use, rather than post-mining rehabilitation. Much more acceptable formation of the pits, and much less dieback risk from ponding of water in the sumps, would be feasible if the turbidity standards were less stringent. There is a need for better design of roads with respect to their potential of initiating dieback problems and the integrated mining plan for the Urbrae area is a step in the right direction.

10. From the fire protection measures attempted so far and from the experience with karri regeneration burning, several points become obvious. The burning-off of the dead leguminous understorey will only be safe if the same conditions prevail as in the karri regeneration, namely full and even crown cover. Unevenness of crown cover and of fuel distribution will inevitably result in flaring and damage to the young trees. The reduction of the understorey by slashing appears to be difficult, costly and relatively ineffective means of reducing fire risk. The protection option now being considered by the Northern

Forest Region appears to be the only viable alternative, that is the use of the intervening forest and perhaps some of the pits as fuel-reduced buffers separating areas of high risk. There are examples of a successful combination of Euc maculata with clover understorey in which the fire risk is minimised without losing the benefit of a leguminous understorey. As Alcoa appears to be willing to accept responsibility for the cost of planning and executing the protection plans, the offer should be taken up.

11. The treatment of the pits needs to be integrated with the treatment of the surrounding forest. The FIRS treatment has, on the whole, been successful in reducing banksia in the understorey and hence the risk of dieback intensification, but many of the earlier treated areas appear to be in need of a follow-up treatment to mop up banksia seedlings that have established subsequent to the treatment. If this objective and the germination of acacias is to be achieved, the prescribed burns will need to be carried out in autumn under dry soil conditions, rather than in spring as now sometimes happens. The benefits and risks of such an operation need to be weighed up. Thinning is no longer part of the FIRS treatment which is consistent with our stated objective of reducing the risk of dieback intensification. The idea should perhaps be taken further by integrating FIRS with the thinning of jarrah production stands in such a way that the forest is in top shape with full canopy before mining takes place.

The treatment of former dieback graveyard areas appears to have been quite successful with respect to the establishment of acacias. It is still difficult to decide what

priority should be given to returning tree species to those sites where water production is a high priority. Regeneration of some of the indigenous eucalypt species through planting or seeding is workable, but not promising in terms of production, as their form is often very poor at the very wide spacings that are common. Denser planting would go against water production objective.

13. If the need for planning at the landscape level is accepted, it will be necessary to ensure that Alcoa sticks with the 5-year and 25-year plans as far as possible. The current possible redirection of Alcoa's main thrust from going southwards across the Murray to going northwards from Huntly, would be a case in point. Whilst it would be desirable from many aspects, eg less clash with conservation, it would mean recasting of any broadscale plans of rehabilitation and protection.

14. There is a recognized need for monitoring, and where necessary, controlling exotic species. This varies widely. We have got ample experience with clover which is relatively easily controlled by the innate infertility of the jarrah forest soils. Once fertilisation ceases the clover subsides and seeding in of native shrubs is quite successful. The chief benefits of using exotics such as clover and some other agricultural species is that they provide an early complete cover useful in reducing turbidity, and build up the soil nitrogen and organic matter, but fade relatively readily. It would therefore be possible to use clover and some agricultural species such as vetches or peas in the first one or two years, then use such areas as fuel reduced buffers and finally reseed with native shrub

species later on. I have already alluded to the successful combination of Euc maculata and clover, which appears to create extremely low fire risk, yet gives good growth and form. Some tree acacias without invasive tendencies, eg A melanoxylon, could also be used to build up soil nitrogen without high fire risk.

15. There is now sufficient evidence that the pre-mining conditions of a given site are carried over into the post-mining stage. T-sites appear to give better regeneration and growth of jarrah than P-sites, both prior to and after mining. This is presumably due to the underlying subsoil structure, and hence relative ease or difficulty on root penetration. There may be therefore a case for mapping the sites prior to mining and planning the rehabilitation on the basis of site maps. A parallel, more readily available indicator of the ease of rehabilitation is the depth of the bauxite pod. There is a rough relationship between deep bauxite pods and good post-mining growth, and on the other hand shallow pods and poor post-mining growth.

16. It is now becoming painfully obvious that over the past 17 years we have paid inadequate attention to seed collection. This manifests itself in two ways. Extensive areas have been planted with exotics which probably have an extremely narrow genetic base, as the seed has been collected from relatively few trees in stands which themselves already had a narrow genetic basis. There is now a potential to broaden this basis with the seed collection in the Eastern States financed by Alcoa. It is my feeling that this seed should be first tested experimentally in provenance tests and only later expanded broadscale. There has been equally inadequate attention to sources of seed

for local species. The form of such species as wandoo, paperbark wandoo, yarri and marri is in most cases atrocious. It would appear that we may have fallen into the trap of collecting the most accessible seed. In the case of wandoo we now have a provenance trial established and future broadscale plantings should utilise knowledge obtained in these trials. It should be possible to get a better seed source purely on phenotypic basis. I understand that there have been repeated requests by the research and rehabilitation people that greater attention be paid to sources of seed, but this has to a large degree gone unheeded as seed collection has a very low priority in divisional activities.

SUMMARY

Summing up, I believe we are now in a position to define rehabilitation schemes which pay attention to management objectives and give regard to site conditions. The number of proven species that can be used to achieve an objective on a given site is relatively small, and the mixes should be determined in the light of this. On the better well-drained sites Euc muelleriana in conjunction with jarrah seems a highly desirable mix in that it has got a good production potential, yet mimics the original jarrah bush quite well. On the poorer upland sites Euc maculata in conjunction with jarrah or better strains of marri or wandoo would appear to have much to recommend it. On the wetter sites near the lower ends of the pigs, Euc saligna and yarri appear to offer similarly productive yet attractive combination.