V[th] World Parks Congress (WPC)
Durban, Republic of South Africa, 8[th] – 17[th] September 2003

Natural Resource Management in Western Australia- Case studies related to mining and the conservation of biodiversity.

By Frank Batini BSc For (WA), Dip For (Canb), MSc (Oxon)

Abstract
The paper provides an overview of the author's twenty-five years of experiences in Western Australia, working at the interface between the protection, conservation and enhancement of biodiversity and the mining and petroleum industries. More detailed assessment of each case study is possible, if required. The main conclusions drawn are that case-by case assessment of each proposal for limited access by industry to areas reserved for conservation is warranted, under appropriately designed conditions, and that this may lead to a better environmental outcome overall. There is a need to co-operatively develop integrated, whole of Government, fully participatory, land-use planning models that allow for an expansion of the reserve system to occur, within the context of social and economic sustainability. The industry needs to acknowledge that some parts of these reserve areas are so important that access for even limited development would be denied. There could also be benefits to conservation were IUCN to revise some of its guidelines for protected area management categories, so as to incorporate those areas that are managed conservatively, but are not part of the formal reserve system. Successful negotiations between the parties must be based on a significant level of goodwill, mutual respect and trust.

Introduction

The Federation of Australia consists of a Federal (Commonwealth) Government, six State Governments, two mainland Territories (Northern and Australian Capital Territory) and some island Territories. Under the Constitution, all matters relating to land use and the management of natural resources are the responsibility of the States. The Federal Government is responsible for such matters as Defence, Foreign Policy and Income Tax. It is also responsible for some land management, including the management of lands within State borders held for defence training purposes, National Parks such as Kakadu and Uluru in the Northern Territory, and off-shore islands such as Cocos and Heard island. The Federal government is also responsible for signing of International Agreements such as Kyoto, Ramsar and Biodiversity Conservation. In a number of cases these have been entered into with minimal consultation with the States and with an inadequate knowledge of all the potential consequences on future land uses.

Each State can take a different approach based on that State Government's Policies and Legislation. In some States, access to mineral and petroleum resources from National Parks and Nature Reserves is prohibited. In South Australia, large Regional

reserves have been established in the rangelands for the conservation of biodiversity. These allow access for exploration, mining and pastoral grazing as well as for tourism. In Queensland, some reserves are jointly vested so as to allow mining access on conservation areas. In Western Australia, the Mining Act theoretically allows access for mining on all public lands, including National Parks, subject to Ministerial and parliamentary approvals. The Petroleum Act also allows for access to reserve land, subject to approvals. Western Australia and Queensland are the major Australian mineral producers and exporters of iron ore, gold, bauxite, mineral sands, nickel, diamonds and natural gas and of coal, bauxite and gold respectively.

Western Australia produces half of Australia's mineral production. It is a large State (250 million hectares), with a low population (1.85 million) most of whom live in Perth. Mining accounts for 25 percent of the Gross State Product (GSP $A 110 000 million) and reserves for the conservation of biodiversity cover about nine percent of the land area.

Legislation

The key Acts that regulate the conservation of biodiversity and mining access in Western Australia are the Mining Act, the Conservation and Land Management (CALM) Act, the Wildlife Conservation Act and the Environmental Protection Act. There are also requirements on companies under the Native Title Act and the Aboriginal Heritage Act covering matters such as access, archaeology, ethnographic and site clearances.

The Mining Act (Section 24) allows access onto all classes of public lands, subject to the concurrence of the Minister for the Environment and of Parliament (for National Parks) or the recommendation of the Minister (for most Nature Reserves). Owners of land in fee simple have a right to veto mining access in most circumstances. The Petroleum Act allows for the grant of titles over all lands (or specified parts of a particular title), but the activities proposed are then subject to specific approval, particularly on conservation reserves. Approval of the activity is the subject to the recommendations of the Minister for the Environment.

The Conservation and Land Management Act (Section 4) states that this Act cannot derogate from the operations of the Mining Act. The Wildlife Conservation Act makes provision for the protection of all flora and fauna, and gives particular protection to species of "declared rare"(threatened) flora and fauna. In these cases, permission from the Minister for the Environment is required to "take" these species. Currently, threatened ecological communities are not protected by the Act, but this is proposed when the Legislation is reviewed.

The Environmental Protection Act allows for the provision of specific advice to the Minister, for the promulgation of Environmental Protection Policies, for Environmental Impact Assessment, for the Prevention of Pollution and for the management of Waste. The EPA is an independent, statutory Authority, with a full-time chairman and four other part-time members drawn from the community. It is assisted in its work by staff from the Department of Environment

Although the Federal Government cannot control land use and natural resources management directly on State land, it may well intervene or exert considerable influence on States through its powers to influence Federal funding and to control matters such as Exports, Foreign investments, International Agreements and the Environmental Protection and Biodiversity Conservation (EPBC) Act. For example, the EPCB Act allows Federal intervention in areas such as World Heritage and Ramsar sites and in relation to threatened species (both flora and fauna) and threatened ecological communities. These lists differ between the Federal and State legislation, though they are mostly compatible.

There is an Inter Government Agreement on the Environment (IGAE) on environmental impact assessment that means that Federal EIA assessment usually "piggy-backs" on to the State assessment by the EPA. However, each jurisdiction has to approve a particularly sensitive project, such as a proposal for mining in a National Park.

The EPA process is the key forum for advice to the Minister for the Environment (and also Government and the community) on all major land use decisions that have environmental consequences. This is a very public process, with various stages of advertising, several stages when appeals are possible, the provision for consultation, review of the proposal and for public input. The EPA process requires detailed submission by the proponent on the project, on the geological and mining potential and methods for extraction, treatment and transport of the ore, on the biodiversity values in the area, of any effects on threatened plant or animal species or on vegetative communities, on the degree of community consultation undertaken (including Traditional Owners). Economic and social considerations are normally provided in the proponent's documentation.

The EPA's recommendations to the Minister and any proposed conditions required by EPA or commitments by the proponent are then made public in an EPA Bulletin, the latest of which was numbered 1098. The EPA's recommendations to the Minister can then be appealed by any interested party, including the project's proponent.

The appeals are then evaluated by an Appeals Convenor who then advises the Minister. The Minister (and Cabinet) then either reject the proposal or approve it with conditions set to minimise environmental impacts. The Appeals Convenor's report and the detailed reasons for the Minister's decisions are not made public.

Policy Framework in Western Australia

Although the Mining Act allows access onto National Parks and reserves**,** Government Policy may not. Over the past two decades, several Policy changes have occurred. In general, the Coalition (Conservative) Government's approach has been to permit mining access on reserve lands (subject to evaluation by EPA and conditions being set) whereas the Labor Party Policy platform has been to prohibit access for exploration and mining. The Conservation Commission, in whom these conservation reserves are vested, also has an input and a Policy position on this matter.

After the Labor party was elected in 1983, it stated that its Policy would not allow mining to occur on National Parks (however exploration and mining could be permitted in Nature reserves and other classes of conservation lands, in accordance with various Acts). There was an immediate problem with five National Parks that either contained important ore-bodies (eg Kintyre uranium within Karlyamini NP and Marandoo iron ore within Karijini NP), or where the park had high prospectivity (eg D'Entrecasteaux NP for mineral sands). There was also a small deposit of bentonite within Watheroo NP and a small operating limestone quarry at Neerabup NP. The Government, after review, published a document "Balancing the Scales", that agreed to excise the prospective areas from these Parks and proposed additions to each Park that would be seen to compensate for any loss in biodiversity values. These actions required Parliamentary approval from both Houses and this was received in due course and the Policy implemented in all five cases. . In each of these five cases, there were significant conservation benefits, and the resource access therefore contributed directly to conservation improvements.

There followed a period during most of the 1990's when the Coalition formed a Government during which all exploration and mining proposals were assessed in accordance with the existing legislation. During this period it was noticeable that there was little targeting of National Parks for access, even though there are highly prospective rocks in some of them. This shows that the resource industry representatives do have respect for, and also recognise the difficulties associated with access to National Parks.

In 2001, Labor was again re-elected to Government. Prior to this election, Labor had stated that its Policy Platform was to prohibit all future exploration, mining and petroleum developments from all National Parks and Nature Reserves. However, this Policy Platform was not to be retrospective and all existing applications for tenements already received by Minerals and Energy would be processed. This Policy Platform presents difficulties, and an example will be discussed later in the Chevron-Texaco $A11 (initially $A4) Billion Gorgon proposal, that is currently under Government review. The Party's Policy Platform has not yet been promulgated as an approved Government Policy position, though the matter has reputedly been before Cabinet on more than one occasion. Until these matters are resolved, the Minister for Mines is opposing most proposals to create additional conservation reserves.

The conservation reserves and State forest are vested in the Conservation Commission of Western Australia (previously the National Parks and Nature Conservation Authority NPNCA), a statutory body made up of a full-time chairman, another ten members selected from the community and a small support staff. These lands are managed by the Department of Conservation and Land Management. The NPNCA developed a policy on mining in National Parks and Nature Reserves (1993) that is still current and which is fundamentally opposed to mining, but acknowledges the Government's prerogative to determine policy in this area. The Authority stated that it was likely to recommend against a proposal unless there is a strategic need, the resource is rare, of high value and its exploitation of significant benefit to the State or it is not available on other tenures of land.

During the 1990's, the Department of Minerals and Energy issued Information Series No 11 titled " Guidelines for Mineral Exploration and Mining within Conservation reserves and other Environmentally Sensitive lands in Western Australia" (revised July 1998". This comprehensive 47 page document was prepared in consultation with staff from conservation agencies.

Overarching Land Use Objectives

Management of natural resources is delegated by the State to several Government Agencies, notably, Agriculture, Pastoral Lands Board, Conservation and Land Management. Industry and Resources (formerly Minerals and Energy), Land Administration, Indigenous Affairs, Planning and Infrastructure, Fisheries, Water and Rivers and Environment. The more significant land-holders are Land Administration, Pastoral Lands Board, Indigenous Affairs and Conservation and Land Management. These four Agencies between them are responsible for management over 85 percent of the State, including nearly all of the active mining areas. Although each Agency seeks to implement its own land use objectives, there are no mutually agreed, overarching land use objectives, criteria and indicators for these lands. Recognising this deficiency, the EPA recently decided to address this need. Mr Underwood and I won the tender for this study, consulted widely with Agencies and prepared a report covering the rangelands areas, that is the 85 percent of the State outside the South-West land division. The balance of the State was reviewed in a similar study that addressed salinity management, primarily on freehold lands. Another report for EPA addressed the environmental performance of nine key Natural Resource Management Agencies in this State.

Five overarching objectives were proposed for consideration by the EPA: the conservation and enhancement of biodiversity; the maintenance and enhancement of soil and water values; the maintenance of ecosystem health; the maintenance, enhancement and restoration of productivity; and enhancement of economic and social values. In addition, ten indicators were proposed for periodic measurement by the Agencies so that progress towards the goals and trends could be determined by EPA and reported on to Government and the public

For areas of State forest, the overarching objectives are contained in several forest management plans, the latest of which is currently being finalised (Interim Proposed Forest Management Plan, Draft April 2003).

Some Case Studies of Mining in National Parks and sensitive areas.

i) Where access for mining was refused

a) Fitzgerald River National Park- In 1970 a proposal was received to mine a fairly low-grade deposit of lignite within this C class reserve. There was a major outcry and a sustained campaign in opposition to mining. Access for mining was refused by Government. The National Park was then declared in 1974 and is a major centre for biodiversity,

with upwards of 1600 plant species collected, as well as containing species of declared rare flora and fauna and outstanding landscape values. It is classified as a World Biosphere Reserve.

b) Fitzgerald River National Park- During the early 1990's an entrepreneur applied for extensive exploration leases in the Park. This application was quickly refused by the Minister for Mines, in the public interest, after advice from the Minister for the Environment.

c) Mt Lesueur National Park- this Park is also highly diverse and contains upward of 1500 plant species. It also has high landscape values. In the late 1980's, Rio Tinto proposed to develop an open-cut coal mine on long-granted tenements that pre-dated the declaration of the Park and to generate electricity from a power station located just outside the Park's boundary. This proposal was vigorously opposed by conservationists, local farmers, fishermen and many residents of coastal communities. The company was required to prepare a comprehensive Environmental Review and Management Program (the highest level of EPA assessment). The EPA received many submissions including a very comprehensive document prepared by Conservation and Land Management and did not recommend in favour of the proposal. The Government agreed with the EPA, although very large compensation payments may have been possible. The tenements were subsequently relinquished.

ii) Where access for exploration was approved

Access for exploration has been approved in many National Parks and Nature Reserves, including the D'Entrecasteaux, Karijini and Karlyamini National Parks. These programs were carried out from non-ground disturbing operations through to extensive drilling(of hundreds of RAB and diamond drill holes spread over several years) and were closely supervised by company staff, Mines and CALM staff. The crews worked extremely hard to implement best-practice and to minimise and mitigate deleterious effects with a great deal of success. Details of some of these programs and of the environmental audits were presented at workshops in Darwin (Batini et al 1995) and Townsville.

The D'Entrecasteaux program revealed three potential mineral sands ore-bodies. Two of the sites were considered too sensitive, costly and difficult to develop and these areas were then "relinquished". Another ore body worth about $250-300 million, was considered suitable for development. Parliament then approved the excision of about 350 ha from this Park of 115,500 ha, subject to evaluation of the proposal by EPA and the transfer of 1000 ha of private land held by the company into the Park This land transfer has been completed and an ERMP is in preparation.

The Karijini program located some small ore bodies of magnetite, but insufficient to warrant a mine. These tenements were subsequently relinquished.

The Karlyamini program discovered the valuable Kintyre uranium ore body, with an estimated worth of about $1.5-2 billion. A large prospective area surrounding this ore was then excised from the Park and a 15,000 ha addition was added to the Park's western boundary.

iii) Where an excision occurred and a mine was then approved

After a considerable degree of debate, the Government excised about 5,000 ha from the Karijini National Park for an iron ore mine and an access corridor to be developed by Hamersley Iron on tenements located at Marandoo that had pre-dated the declaration of the Park. The ore above water-table was estimated to be worth over $A500 million. The State required that a ERMP be prepared by Hamersley Iron for recommendation by the EPA to the Minster. After considerable negotiations on the conditions for approval, the State approved the project.

Soon after, three key areas totalling 20,800 ha were added to the Park. Agreement was reached between CALM and Hamersley Iron on cooperative management for the minesite area and for three adjacent pastoral leases held by the company (Stoddart and Batini 1996). Immediate benefits are management to natural rather than cadastral boundaries, integrated pest, fire and weed control programs, fencing to natural boundaries and the closure of some troublesome water points. Longer-term goals relate to research, education and extension.

There are other examples where the EPA recommended in favour of mining and petroleum developments on Nature Reserves and where these were subsequently approved by Government and Parliament. These include, but are not restricted to approvals given to Western Mining on Wanjarri for a waste dump, gypsum mining on Lake Chinocup and petroleum developments such as those by WAPET on Thevenard, Western Mining on Airlie and Apache on Varanus islands.

iv) there are yet no mining examples where the EPA recommended in favour of a mining project and where the Government then refused to approve the project.

v) At Lake Campion, the EPA recommended against the approval of a small mining proposal for gypsum from dunes that contained unusual and threatened species and plant communities. The Government agreed and the proposal did not proceed.

vi) Recently, Portman Mining sought approval from EPA for access to develop a $A120 million extension to its existing iron ore mine. A key ore body, both in terms of size and quality for blending was located below the only population of 2700 plants of *Tetratheca payntery*, a declared rare

species classified as “endangered”. Originally the company sought to mine 90% but then amended this to 60% of the population, which meant that about 1000 plants would be retained in the wild and the species classified as ‘critically endangered”. The company showed that survival “ex situ” was possible by collecting and storing seed and by growing seedlings and cuttings. It also offered the State various additional environmental offsets.

The EPA recommended against this development on environmental grounds and published its Bulletin, also noting that refusal would have negative economic and social effects on regional developments. The EPA’s recommendation was then appealed to the Minister by the company and by other parties. The appeals were then evaluated by the Appeals Convenor who reported to the Minister. The Minister subsequently approved development of the mine, subject to 30% of the ore body being mined initially. Conditional approval to mine up to 50% may be given when research could show that the species could remain viable “in situ”. Various environmental offsets are being negotiated.

vii) Chevron-Texaco has discovered a major gas field offshore in the North-West Shelf and has been evaluating alternatives for its $A11 Billion development based on a triple bottom line approach (Environment, Social and Economic Review). The favoured site for economic reasons and for greenhouse gas injection is limited access (300 ha) on Barrow island, a very important Nature Reserve of about 23,500 ha, where WAPET has operated an oil field since the 1960’s.

In this case, the State and the company have agreed on a different process to the normal EPA assessment. The company is seeking an “in principle” approval to proceed, and has prepared an ESE proposal based on triple bottom line considerations for public review and advice (Chevron-Texaco 2002). Three key bodies will now give advice to Government, with public input-the EPA, the Conservation Commission (in whom the island is vested) and the Department of Industry and Resources (formerly Minerals and Energy).

Should approval be given, a detailed environmental review would be done in accordance with the EPA Act. An “in principle” decision by Government is expected by about September 2003. This will be an interesting “litmus test” of the Government’s pre-election Policy position that was opposed to new petroleum developments in National Parks and Nature Reserves. It is possible that, should this evaluation process be deemed a success, that this will become a new model for the environmental impact assessment of major projects.

The Conservation of biodiversity

Areas have been selected for additions to the Conservation estate through many different processes. The original land use planners were various explorers and land surveyors employed by the Lands Department. These men surveyed the areas to be released for agriculture and for grazing, the future townsites, access routes and reserves. Some reserves were well selected, but, more often these reserves were those areas that were considered to be unsuited for agriculture or grazing, for example the 20,000 ha Dryandra State forest, now a National Park, or inaccessible and semi-desert areas. Cadastral boundaries generally run North-South and East-West, and most reserve boundaries follow these cardinal compass points rather than appropriate ecological or management boundaries.

During the 1960's, the Australian Academy of Science conducted a more systematic review and published a report detailing other areas that could be added to the conservation estate. These proposals were generally based on areas of unallocated Crown land or areas such as Karijini where pastoral activities had failed because of the rugged nature of the lease. Later, the EPA reviewed the State's needs for conservation and published a series of "Red Books" that covered 12 Systems (regions), proposing that additional reserves be established in each. Probably the more controversial were those for Systems 1,2 and 6 that were located in the more populous south-west portion of the State. These EPA proposals were then extensively reviewed by stakeholder groups, including those with a mining interest, in a very public process. Many of the more controversial proposals are still not implemented.

More recently, CALM has actively sought to purchase pastoral leases on the open market with funds provided by both State and Federal governments in order to increase the representation of reserve lands in the Gascoyne-Murchison Region where as a major gap in Comprehensive, Adequate and Representative (CAR) reserves had been identified. To date, 3.6 million hectares have been purchased for an expenditure of $A 8.6 million. These areas were selected on a number of criteria, for example: the vegetation types represented, both in terms of number, area and gaps within the existing reserve system; the condition of the land; the total area and its shape; the cost; the existing infrastructure and the potential for conflict with mining. Interim guidelines for management were then prepared and the areas were destocked.

The process for creation and vesting of a new reserve is complex and requires negotiation and approvals from the Local Government Authority, the Indigenous Native Title claimants and the Minister for Mines. The Minister (through Cabinet) can veto proposed additions to the conservation estate. Recognising this, CALM and Minerals and Energy (now Department of Industry and Resources) staff maintained a long-term and close liaison and geologists in the Department were asked to review all areas purchased and to assess their prospectivity for minerals and for petroleum, before finalising any decision on the appropriate conservation classification and purpose for each area (Smurthwaite, Batini and Gao-Mai, 2000).

The Department also reviewed various proposals for additions to the conservation estate such as those contained in CALM's Goldfields and South Coast Regional Plans. Ranford et al (1996) noted that there are over 700 reserve proposals, many of which have potential to impact the mining industry as they overly prospective land. Land that is of geological interest with diverse rock types often contains unusual

suites of flora and fauna. The challenge is to evolve a management system that caters for both these needs. However Figgis 1999 states that "there are no compelling reasons in Australia to move away from strict protection as the core of nature conservation in Australia"

Additional reserves of 600 000 hectares have recently been proposed in the forested areas of the south-west through the implementation of Government policy. Through these various efforts, the size of the conservation estate has grown by about 40 percent in the last 20 years to just under 10 percent of the State's area of 250 million hectares, and is still continuing to increase in area by the addition of both terrestrial and marine reserves. This is in general accord with guidelines that initially suggested that five percent of the State's land area should be reserved for conservation purposes, which were then increased to ten percent and, more recently in this State's forest areas, to fifteen percent of each ecosystem based on the estimated area for that ecosystem that existed prior to 1750.

Hopkins et al (1996) reviewed the adequacy of reservation, using the Caracas model that ten percent of vegetative systems should be in reserves, and based on Beard's vegetation mapping for Western Australia. The study showed that, of the 769 Vegetation types that were recognised:

20 percent are adequately reserved
34 percent are represented, but below levels accepted as adequate
46 percent are not represented at all in formal reserves.

Other studies by CALM (pers comm) show that many of the declared rare (threatened) species of plant and of threatened ecological communities also occupy sites that are not on located on conservation reserves.

It is increasingly obvious that not all lands and waters that are managed for the conservation of biodiversity can be or should be contained within reserves. Though a vested, protected and well-managed reserve system based on CAR principles must remain as a core conservation objective, this system needs to be supported by areas managed with a conservation objective located on other Government, leasehold and private lands. Because threatening processes such as salinity, fire, weeds and ferals are landscape processes that do not recognise cadastral boundaries, the area managed for biodiversity should then be contained within a landscape (forest, farmland, rangeland, minesites) that is managed sympathetically, with the consideration of corridors and with sustainable development objectives in mind. In the marine area, the Government Policy "New Horizons" proposed that marine National Parks and marine Nature Reserves be embedded within much larger marine Management Areas where controlled commercial activities could be permitted. All of these areas were to be managed by CALM.

This concept, which is applicable to both terrestrial and marine areas, with its emphasis on sound management rather than simply on tenure, provides a strategic and practical approach to sustainability that is based on the UNESCO "biosphere reserve" model, requiring full partnership arrangements between apparently conflicting interest groups. (see Bridgewater et al 1996)

In this context, it is very important to note that lands other than those that are specifically managed for conservation (IUCN classes I-IV) have great value for the

conservation of biodiversity in this State. These lands include the 95 million hectares of Unallocated Crown Lands and the 27 million hectares of Indigenous lands, as well as other areas on leasehold and freehold lands. Department of Agriculture surveys indicate that some 44 million hectares of rangelands are deemed in "good condition". These lands that are managed conservatively and that have retained much of the original structure and species composition exceed the areas managed by CALM by a factor of at least seven-fold. In total, at least 70 percent of the State has great value for the conservation of biodiversity, though some areas (including lands held as National Parks and Reserves) are impacted by too-frequent fire, by weeds and by feral animals. It is important that IUCN be asked to review its methods for classifying lands that are considered useful for the conservation of biodiversity.

Both the State of Western Australia and the Nation are signatories to the National Strategy for the Conservation of Australia's Biological Diversity 1996. Australia's major environmental issues are related to loss of habitat by land clearing for agriculture and urban developments; to increasing salinity and pollution of lands, rivers, wetlands and estuaries resulting from agricultural clearing and fertiliser application; to soil loss caused by poor agricultural and pastoral management; to dieback (Phytophthora cinnamomi) disease of native plants; to weed invasions of both lands and waters; to feral animals (both herbivores and predators) and their effects on native plants and animals; to too frequent and unplanned use of fire; to population growth and its increasing affluence and to climate change.

The negative impacts of mining on landscape are obvious when viewing the large pits, tailings dams and waste dumps at Kalgoorlie and at Whaleback, but these effects are localised and limited in area. In my opinion, mining and petroleum do not rate in the "Big League" of environmental problems faced by this State, either in terms of severity or of aerial extent. In fact the industry can play and has played a major role in assisting to solve some of the "Big League" concerns.

Some examples of successful cooperation between the mining/petroleum industry and conservation Agencies in enhancing the conservation of biodiversity include:

- The agreement to establish the 225,000 ha Kennedy Range National Park
- Successful negotiations for major additions to the Cape Range National Park and Lake Cronin Nature Reserve (which are now likely to be blocked)
- The agreement by Minerals and Energy to the upgrading of 672 Nature Reserves from C to A class and the establishment of a further 65 Nature Reserves
- Watheroo – In 1991, Government approved the excision of 39 ha from this National Park for a bentonite mine where the product was estimated to be worth $A 100 million. The company was required to purchase private land that contained a major population of a threatened eucalypt, *E.rhodantha*. The site has been purchased, re-fenced, and rehabilitated with understorey species native to the area. Ownership was transferred to the Conservation Commission.
- WesternShield- This is a major CALM fauna protection and enhancement program, directed at controlling feral animals, particularly foxes and cats, over an area of over 3 million hectares. This is then followed up by reintroductions and reconstruction of faunal assemblages. CALM has obtained significant

sponsorship from Alcoa World Alumina, Cable Sands, Iluka, WAPET and Apache Energy. As a result, the woylie, *Bettongia penicillata*, has recovered so well that its status has been reviewed in accordance with International protocols and the species has been removed from the list of threatened fauna.

- Research and survey by Hamersley Iron provided much improved data on the range and security for the pebble mound mouse, *Pseudomys chapmani*, leading CALM to recommend that its threatened status also be amended.
- There are numerous examples with flora where survey work for mining companies has contributed significantly to the State's data base.
- At the time CALM assumed management of Penguin island in 1985, the place consisted of run down shacks, degraded vegetation, environmental damage and erosion. A management plan was prepared, major rehabilitation and clean-up undertaken, and substantial construction work done. The island now caters for many more visitors, but in a controlled way, with minimal damage. Financial support from Western Mining has enhanced the environmental experience by assistance with the construction of a Research, Education and Management centre.
- Mining companies currently pay CALM over $A3 million compensation each year, at a rate of $A5000- 6000 per hectare mined or affected by mining. Compensation agreements are contained in all conditions for mining leases on reserve land, for service corridors and for petroleum bases on islands. Compensation can be paid in cash, in kind or with land considered by CALM to be suitable for addition to the conservation estate. Wherever possible, the industry and company involved are publicly credited for the conservation benefits that ensue. As an example, the Goldfields Gas Transmission pipeline was routed through the Wanjarri Nature Reserve, avoiding much more rugged country to the west and a much longer route to the east. GGT funded the cost of CALM developing a management plan, it rehabilitated the route as well as an equivalent additional area with historical damage, and also assisted with the upgrading of some roads and fencelines.
- There are also several examples of Memoranda of Understanding agreeing to cooperative off-reserve management arrangements between CALM and mining companies eg Western Mining, Dominion, Hamersley Iron and Rio Tinto on areas held as pastoral and mining leases.
- A number of companies have negotiated to purchase uncleared private property as conservation offsets to allow proposals that have a significant impact on native vegetation to proceed.

However, the current Government's pre-election Policy position on future access has caused great concern within the Department of Industry and Resources and the resources industry, with the consequence that many future reserve proposals (with the exception of those on State forest), even those agreed to " in principle" but not yet finalised, are now "on hold". The process and outcome of the Chevron-Texaco proposal will be closely watched.

Sustainable Development

Sustainable Development requires the attainment of a degree of balance between the three tenets of environmental impact, social advancement and economic benefit. Creation of high-level conservation reserves as protected areas is recognised by many as the best way to ensure biodiversity conservation is achieved as a key requirement of environmental protection. However, many of these areas were created with only this issue as the driver.

Mineral and petroleum resources preserved below the ground surface are located only after extensive exploration which usually takes considerable time and funding. Protection of future access to locate buried deposits requires continuous access to the broadest areas of prospective lands (but this is balanced by most extraction areas having insignificant footprint areas compared with most other land uses), supported by sound and stable investment regimes of respective Governments. Future deposits will be located at ever-greater depths, requiring more time and financial resources. Without locating these deposits, future people may be disadvantaged.

Mineral and petroleum exploration usually commences with low-impact activities, usually over large areas and proceeds on ever-smaller areas with increasing impacts. In essence, exploration should be regarded as a land assessment process rather than as a land-use, and as such unsuccessful exploration should cause minimal impact. There are impacts as the activities become more intensive and management is essential. Progressive consideration of the impacts of the activities should be undertaken and suitable management regimes imposed to protect the environmental values. Detailed documentation of the conservation values needs to continue during these phases to enable sound decisions to be made by industry and Government during the development of the exploration project.

Creation of single-use conservation reserves may not be in the best interests of sustainable development. Protection of the biodiversity could be achieved by the creation of reserve systems with policies and procedures in place that do not necessarily prohibit all mineral and petroleum resource access.

Planning Studies

Land use decisions essentially involve a process of conflict resolution which becomes more difficult when dealing with a range of very complex, interrelated issues, and when many of the factors are uncertain or ill-defined, and not subject to normal market forces. Some examples of land use studies that the author has been involved with include:

The Murray River Land Use Study

This study took a systems approach to the hypothetical allocation of land and water resources among competing uses in the catchment of the Murray River. The Murray is the largest stream in the northern jarrah forest that is not dammed. Its catchment is located some 100 kilometres to the south of Perth, has an area of 660 000 hectares and

extends eastwards well into the agricultural area. Some 45 per cent of the catchment has already been cleared, causing severe dryland and water salinity. Other resources include wood, agricultural products, minerals (bauxite and gold) and various recreational and conservation values. Government departments, private companies and individual landowners use the resources.

A team was formed to study the uses of the land and the resolution of conflicts. The study team comprised a core of 14 experts drawn from CSIRO and the state government, with additional assistance from specialist advisers and interest groups. A mathematical model was built that used linear programming techniques to examine land use allocations in various economic and planning scenarios. The model accounted for 41 zones (based on landform, rainfall and vegetation), 11 land use activities per zone and five budgets per activity per zone. The budgets included were a cost-benefit comparison for each economic activity and water, salinity, recreation and conservation budgets. The model simulated the catchment under alternative water supply schemes and optimised land use allocation for each.

A large number of different assumptions about data values, discount rates, land use options and water exploitation strategies were examined, thus allowing for sensitivity analyses to be done.

This approach was not widely accepted for either government or private planning. Factors inhibiting acceptance included the doubts of the scientists, who knew that the analysts' numbers did not have the rigour of their own work. For many of them, modelling is mere speculation. There were also those individuals and decision makers who neither understood nor trusted the "black-box" nature and technicalities of mathematical models and those who clearly saw that their interests were not served by exposing their arguments and activities to detailed analysis, yet their own decisions were made on an inadequate data set. Finally, there was a concern that the 'soulless' analyst would have failed to consider, or to cater adequately for, humanity's real needs and values. The general conclusion on the value of systems analysis to land use planning was that "its potential is large, but that its realisation is at least as much dependent on more open government as on the perfection of existing methods or the introduction of new techniques".

System 6 Study

This study involved the hinterland of Perth, much of which is State forest. It was the culmination of a series of studies initiated by the report of the WA sub-committee of the National Park Committee of the Australian Academy of Science in 1962. The report had highlighted the need for a set of reserves for conservation and recreation. Consequently, the Environmental Protection Authority (EPA) appointed a Conservation Through Reserves Committee (WA. EPA.1975). This committee divided the state into 12 systems (or regions) and made recommendations for additional conservation reserves to be established on 11 of these between 1974 and 1981. The exception was System 6, which the committee felt should be the subject of a more comprehensive study.

The study began in 1976, produced its proposals in 1981 (WA. Dept. of Conservation and Environment 1981) and led to the EPA recommendations to Government in 1983.

The main approaches were to identify the areas that could be set aside for conservation and recreation under the Land Act and the areas where planning and management should permit and encourage protection of conservation and scenic values, and increase public access to them. It was not intended to be a comprehensive land use study. Relevant data were assembled, public submissions were received, and proposals developed through six committees dealing with tourism and recreation; conservation and land use; local government and urban planning; ecosystem and land use inventory; conservation reserves and national parks; and commercial and productive uses.

Within System 6, the bulk of Crown land is State forest. There were only a few small National Parks and one substantial reserve for flora and fauna. The Forest Department recognised the deficiency and selected a number of areas where management priority would be given to flora, fauna and landscape. These were scheduled in its General Working Plan No. 86, 1977 and were part of the department's submission to the System 6 study. These proposals were included in the System 6 report with only minor modifications (W.A. Dept. of Conservation and Environment 1981).

The procedure was expensive, time consuming, and did not provide fully acceptable mechanisms for resolving conflict. The implementation of recommendations dealing with private land was particularly difficult. Alcoa World Alumina did willingly forgo access to substantial resources of bauxite to allow several of these reserve proposals to proceed, whilst retaining its rights to some future access corridors and to its Lease area (ML1SA). Worsley Alumina also agreed to some of the reserve proposals, but, with a smaller total bauxite resource, did not forgo future access rights to a number of the proposed reserves.

Task Forces

In contrast to the two long studies described above, the government also used small multi-disciplinary groups to obtain advice about using the State's jarrah forests. This was a complex and controversial issue for three main reasons: there was concern that the expansion of bauxite mining to feed new refineries would destroy large parts of the original forest and that rehabilitation would be unsuccessful; the root rot fungus, *Phytophthora cinammomi,* which kills jarrah trees and understorey species was spreading over large areas; and the salinity of several rivers and water supplies was rising to unacceptable levels. Two examples of task or study groups are described here.

i) Technical Advisory Group

In 1978, Alcoa of Australia Ltd submitted an Environmental Review and Management Program for bauxite mining to supply a new refinery to be built at Wagerup. The EPA sought submissions from government departments and the public, and because the issues were complex and the Government wanted immediate advice it appointed a Technical Advisory Group to review Alcoa's proposal.

The group consisted of seven specialists from CSIRO, Murdoch University, the Western Australian Museum and government (W.A. Dept. of Conservation and Environment Technical Advisory Group 1978). They worked full-time and reported to EPA in five weeks. Their team approach enabled them to make a coordinated multi-objective assessment, which was considered to be more independent than that of 'mission-oriented' Government departments. Most of their recommendations were incorporated into the EPA'S own report and were accepted by the Government.

The major changes were to the company's proposal on the initial capacity of the Wagerup refinery, the need for 5, 10 and 25-year mining plans, limits to the capacity of other refineries at Pinjarra and Kwinana, and the urgent need to conduct mining trials in the saline eastern portion of the catchments. Marginal analysis showed that there was considerable scope for influencing the direction of mining away from areas of the forests that were highly valuable for other uses. The Government set up a Mining and Management Planning Liaison Group, which liaises with Alcoa in preparing the mining plans and assesses whether they fill Departmental and Government objectives. The Technical Advisory Group also argued the need for integrated planning and recommended that the government should establish a means for developing land use policies and coordinating regional planning.

ii) Darling Range Study Group

In June 1979, the Cabinet approved the establishment of a Darling Range Study Group to carry out a comprehensive study of land use in the Darling Range and to advise government on land use policy and the coordination of land use planning by departments.

The Study Group, comprising four professionals (two water supply engineers, an agricultural scientist and a forester) with backup office staff, began its work in January 1980. The group interacted with government, industry, public interest groups and those with expertise in the resolution of land use problems, not only in Western Australia but also in other Australian States and in New Zealand and the USA. A newsletter was widely distributed three monthly indicating progress and areas of concern.

The group was involved primarily at a policy level but also worked at a management and technical level when required. The group's report of 259 pages addressed Planning approaches, Existing plans and policies, Land use issues (short, medium, long-term), Future land use policies, Improving the technical basis for decisions, Interdepartmental planning, Research, Communication and participation, Structures and Legislation and included various approaches, ranging from simple to complex and from subjective to objective (Darling Range Study Group 1982). The more complex approaches involved the use of enhancing and digitising landsat imagery, combining these data into a sophisticated geographic database system, and analysis by computer overlay techniques. Alternative mining options prepared by Alcoa were examined to see which alternative increased or reduced the achievement of stated objectives relating to all legitimate users.

A card index system was prepared giving estimates of bauxite resources within regions that were identified by particular sets of attributes. Using these data, decision makers could assess the implications of both single and multiple constraints on the total availability of the bauxite resource. However, several recommendations about other matters were based on a subjective evaluation of needs, and of public and political acceptance for the proposed changes.

After almost two and a half years, the final report and its executive summary were given to the Premier in May 1982. The report made 13 recommendations within the terms of reference and 66 recommendations on particular land use issues. A major recommendation was that a land use advisory committee be established, together with an analytical support group, to advise the Premier and Cabinet on sensitive and complex land use issues.

Land Use Planning by the Forest Department

In order to refine and implement its policy of multiple use, the Forests Department initiated a series of comprehensive land use plans for State forests in consultation with interest groups. These include the Perspective for Multiple Use Planning (1978), the Land Use Management Plan for the Northern Jarrah Forest (1980a), for the Swan Coastal Plain (1981a) and then the revised General Working Plan No 87 for State forests (1982a).

These documents outline departmental policies and attempt to integrate land use activities into priority areas, based on land capability factors and the various economic, legal and social constraints. Drafts of each document were circulated to government departments, authorities and selected interest groups for comment, before a final draft was produced for distribution to a wider audience.

The Land Use Management Plan for the Northern Jarrah Forest prepared in 1980 was the first attempt to provide an integrated land use plan for State forests. Areas of forest were allocated to six primary land use categories – water production, catchment protection, recreation, timber production, scientific and conservation. For each category, secondary, tertiary and incompatible uses were defined. Management and operational job prescriptions then had to be made compatible with the needs of the primary land use category. Sample prescriptions were prepared as guides for field officers.

In addition to these changes to departmental planning, in July 1985 the Government established a high-level body to provide policy advice on land resources and to improve coordination of land use and development. The Land Resource Policy Council comprised the heads of government departments concerned with land use and members drawn from community groups. A small secretariat supported the council. This structure is similar to that proposed in several reports, including that of the Darling Range Study Group. The Premier said that the council would fill an important policy vacuum and provide a forum where conflicting issues that arise in land management can be addressed. He stressed the need to reconcile concerns about environment and conservation with the development required for agriculture, mining

and recreation. However, after a period of only 18 months this Council was disbanded.

Deferred Forest Assessments (DFA), Regional Forest Assessments (RFA) and the recent Draft Forest Management Plan (FMP)

During the mid 1980's, the author's interest switched from land use and forest planning to environmental management. The comments on the DFA, RFA and recent FMP process are more those of an interested bystander than of one who was actively involved.

Since the early 1970's, controversy has raged over forest management in Australia, concentrating primarily on the following issues: the clearing of native forest to establish plantations of exotic species, primarily *Pinus*; prescribed burning, especially spring burning; the level of sawlog cut; the cutting of old-growth forest; clearfelling techniques that replaced the more traditional group selection system; the export and production of woodchips and the lack of adequate National Parks within forested landscapes.

Within Western Australia, these issues were driven primarily by Non Government Organisations (NGO's) such as the Conservation Council (the local umbrella body), the Australian Conservation Foundation, the Wilderness Society, the Campaign to Save Native Forests, the Forest Defence Foundation and World Wide Fund for Nature. These campaigns were fought with zeal and expertise over decades and generally had the support of local print and television media and generated wide public interest, concern and support for political change. These NGO's are influential with all political parties (especially Labor) and have moulded policy not only on forest issues but also on mining and petroleum.

Concern at both State and Federal level led to the DFA and RFA processes. During the mid 19990's, the Federal and State Governments in several States agreed to a joint evaluation of forest land-use allocation and management in selected Regions, hence the Regional Forest Assessments and their predecessors, the DFA's. With the use of Federal, State and consulting staff, a major assessment was undertaken in Western Australia. The study encompassed all values; eg social, economic, biodiversity, declared rare fauna and flora, mineral, petroleum, water and forest resources, levels of cut, tourism and recreation, reservation for National Parks etc. It provided for a whole-of Government rather than a sectoral approach to land-use planning. There was very extensive communication and consultation with Peak interest groups, including Aboriginal interests, as well as the wider public.

After some years, a very considerable expenditure and the issue of many draft documents for public comment, there was agreement to reduce the level of sawlog cut (from 490000 to 286000 m3/an for jarrah and 212000 to 178000 m3/an for karri, the two main native sawlog species). There was also agreement to create some new National Parks and to jointly assist the financial restructure of the timber industry and the people and towns dependent on this industry.

The RFA agreement was then signed by the State's Premier (Liberal Party) and the Federal Prime Minister (also Liberal Party) in May 1999.

Of particular for mineral and petroleum resource access was the proposal for a new type of conservation reserve to allow ongoing access for exploration while protecting the forest from timber cutting and other related activities. A Forest Conservation Area would be a Protected Reserve in that the vesting cannot be changed unless approved by Parliament, but from the Mining Act and the Petroleum Act perspective the lands remain as State Forest and hence are recognised as multi-purpose lands.

However, within months, as a result of both internal Party, NGO and public pressures this agreement began to unravel. The State then set up a Ministerial Advisory Group that recommended changes, primarily in the level of cut of karri and of tingle (a species with very restricted distribution) and the reservation of more land to National Parks. By December 1999 a different position had been reached at a State level.

The Liberal coalition lost the next election which was held in February 2001 to Labor, whose pre-election platform was to cease all cutting in old-growth forests, to create up to 30 new National Parks in the south-west of the State (increasing the area of reserves from about 700 000 to 1 300 000 hectares) and to compensate and restructure the timber industry. As mentioned previously, the Labor Party also had a pre-election policy platform of no new mineral or petroleum developments in National Parks and Nature Reserves that was supported by key NGO's. Although this policy platform has not been formalised yet, it is anticipated that access for mineral, petroleum and water developments (dams or borefields) within these National Parks and reserves will be severely curtailed.

This change in forest policy required that a new Forest Management Plan be prepared, in consultation with all parties. This process is still proceeding and a draft FMP was issued by the Conservation Commission for public comment, in July 2002. These comments are currently being evaluated and Cabinet, the Conservation Commission and the EPA are expected to make a final decision on the level of cut, the boundaries of new National Parks and industry restructure by September 2003. It is anticipated that the level of sawlog cut will be further reduced, possibly to about 150000m3/an of jarrah and 50000 m3/an of karri, that is less than one-third of the pre-RFA level.

Some $ 150 million has been spent by the State in purchasing back of existing medium-term timber contracts and other means of industry restructure. Because the Federal government believes that the original RFA agreement has been voided, some $15 million of Federal funds that were promised originally for restructuring purposes have not been made available.

Conflict Resolution

There is a tendency for some people to think that all land use issues can be resolved by rational and scientific analysis. This attitude belies the reality that natural resources are a source of wealth and power, competing uses can be mutually

exclusive, and competition for exploitation, ownership and management control is often intense. The crucial problems are human rather than technical or scientific, although these aspects must also be considered. No effective solution to land use management issues is likely unless the solutions proposed are politically and socially acceptable to the community.

Consultation between parties is necessary, but this may not be sufficient to resolve all differences. In many cases there is no real incentive for the negotiators to reach agreement by compromise. To do so may prejudice the interests of their own organisations as defined in the various, often conflicting, statutory provisions of Acts and Agreements.

Few Departments are required by statute or otherwise to look to wider community benefits or to consider the multiple-use of resources. The disadvantages of this single-purpose approach is that decisions on land uses may then be made by Government without the benefit of coordinated or comprehensive analysis of possible alternatives and of trade-offs.

My experience over many years is that the mid-level managers can often manage to liaise and cooperate across their Departments, but that this becomes increasingly difficult at Director or CEO levels. The whole system of Ministers, Departments, Divisions and Branches promotes a mission-oriented competition for scarce human and financial resources, rather than a whole-of–government approach. When Agencies or groups are set up specifically to integrate these activities, they are regarded with suspicion by the established Agencies and given minimal support.

Discussion

The State Government has now released a State Sustainability Strategy (2002), based on a triple bottom line approach, for public input. The Strategy recognises the importance of the mining industry to the State economy eg 25% of Gross State Product, 49% of investment, 71% of exports and 17% of direct and indirect employment. However it does not address the vexed question of potential mining and petroleum access on to sensitive lands and waters. Several companies within the mining industry (eg Argyle Diamonds, Premier Coal) have also developed and published their sustainability strategies based on social, economic, environmental and governance criteria that extend to beyond the expected mine life.

The mining industry and local communities are also aware of concerns in Regional areas with the increasing use of fly-in fly-out operations based from Perth and some are now proposing to reverse this trend. In addition, many Regional communities and politicians representing these areas justifiably argue that the share of the employment and wealth generated by mining is distributed very unevenly between the metropolitan area and most rural populations.

Some companies eg Hamersley Iron, BHPBilliton, Rio Tinto, Premier and Anaconda have developed Aboriginal training programs that provide for apprentices, assistance with tertiary studies, employment and assistance with business ventures such as nurseries. A number of companies have now set future employment targets for Aboriginal peoples. There are also opportunities in land management activities such as traditional burning, ethnobotany and rehabilitation practices.

The recognition of Native Title by Federal Courts has improved Aboriginal access to and their involvement in the decision-making processes for project proposals, both within Government, the mining industry and other developers. There are still many uncertainties with the Act, with millions of dollars already spent on litigation, decisions of the Court that are often reversed on appeal and judgements that clarify some areas whilst not addressing others. However there is also the opportunity in the Act to negotiate agreements that are mutually satisfactory. This has also been done, both by the State and by mining companies

Successful negotiation between parties relies heavily on mutual trust that is often only built up over significant periods of time. In my experience, the staff turnover within companies in the mining industry is very considerable. Government staff are often less transient, but significant staff changes still occur. As an example, six key Government "middle-managers" working on the conservation and mining interface developed a good understanding and sound personal relationships and friendship over the twenty years during which most of the case studies discussed here were developed and implemented. Recently, within a short period, two had been offered and accepted a voluntary redundancy, three had been transferred to a separate Division within their Agency and only one now remains in his original position.

The landmark agreement reached between two former "sparring partners", the National Farmers Federation and the Australian Conservation Foundation, lead to the establishment of Landcare in Australia, with consequential major funding by Federal and State Governments and major input by many farmers, that benefited conservation and sustainable use objectives on agricultural and some pastoral areas.

The challenge before the IUCN and the ICMM is to see whether a similar agreement is possible that would benefit both the conservation of biodiversity and access to specific mineral/petroleum resources. Do these parties wish to take an "in principle" position (eg **No** mining in IUCN class I-IV/ **No** new conservation reserves) or is it better to review and negotiate each proposal on a case-by- case basis? Also, the mining industry needs to recognise, as we did in Western Australia, that not all areas should be available for mining access and that inclusive, consultative and integrated land use planning models that would allow for an expansion of the existing reserve system to occur within the context of sustainable social and economic structures need to be jointly evaluated. As discussed earlier, the IUCN may also benefit from a review of its guidelines for protected area management categories.

The State Premier has been recently quoted as follows (the "West Australian" newspaper) " Politics is about finding the balance between equally desirable but irreconcilable objectives"

However, it is my experience that desirable objectives need not always be irreconcilably opposed.

The case studies provided here clearly indicate that the achievement of multiple objectives is possible in most cases, through goodwill between the parties and a detailed analysis of each proposal.

Acknowledgement

It has been my pleasure to work with and make friends in several key Government Departments (Conservation and Land Management, Environmental Protection, Minerals and Petroleum Resources and Resources Development) as well as in industry and NGO's. In particular, my thanks to Ms J Allan and Mr N Caporn (Environmental Protection Branch at CALM) and Mr W Carr, Mr M Freeman and Mr A Smurthwaite (formerly at Land Access Branch, DMPR).

Selected Bibliography

Batini F, N Caporn and J Allan 1995- Mineral exploration in two National Parks. Proceedings 20th Annual Minerals Council of Australia Environmental Workshop, Darwin, Northern Territory.

Batini F 1997-Multiple and Sequential Use- A land manager's viewpoint on mining and conservation. Proceedings 22nd Annual Minerals Council of Australia Environmental Workshop, Adelaide, South Australia.

Bennett D and J Thomas (eds) 1982-On Rational Grounds-Systems Analysis in catchment land use planning Elsevier pp 362

Bridgewater P, A Phillips, M Green and B Amos 1996 - Biosphere Reserves and the IUCN System of Protected Area Management Categories. ANCA/IUCN/MAB

Carr W and F Batini 1993- Exploration and mining in National Parks and Conservation reserves in Western Australia. 1993 National meeting of the American Society for surface mining and reclamation. Spokane, Washington, USA. .

Chevron-Texaco 2003 -Environmental, Social and Economic Review of the Gorgon Gas Development on Barrow Island, Western Australia.

Conservation Commission 2002 Draft Forest Management Plan

Darling Range Study Group 1982- Land Use in the Darling Range Western Australia- A report to the Premier pp259

Environmental Protection Authority 1976- Conservation reserves for Western Australia. Systems 1,2 3and 5.

Figgis P 1999 Australia's National Parks and Protected Areas Future Directions ACIUCN Occasional Paper 8

Forests Department of Western Australia 1978.-A perspective for multiple land use planning in the northern jarrah forest of Western Australia.

Forests Department of Western Australia 1980 – Land use management plan, northern jarrah forests. Management priority areas.

Government of Western Australia 2002- Focus on the Future- The Western Australian State Sustainability Strategy – Consultation Draft pp236

Ranford L, W Carr, A Smurthwaite and M Freeman 1996- Resource Access in Western Australia Department of Minerals and Energy WA.

Smurthwaite A, F Batini and Gao-Mai 2000- Achieving a balance between mineral resources and reserves for biodiversity in the rangelands of Western Australia. Proceedings 25th Annual Minerals Council of Australia Environmental Workshop, Perth, Western Australia.

Stoddart J A and F Batini 1996-Integrated management of core and buffer areas for the Karijini National Park Multiple and sequential land use technical symposium. Bureau of Natural Resources. Canberra.

Stoddart J A and F Batini 1999- the role of non-traditional reserves in reconciling biodiversity and regional development. Proceedings 24th Annual Minerals Council of Australia Environmental Workshop, Townsville Queensland.

Technical Advisory Group 1978- Bauxite mining in the Darling Range Western Australia- A report to the Environmental Protection Authority pp126.