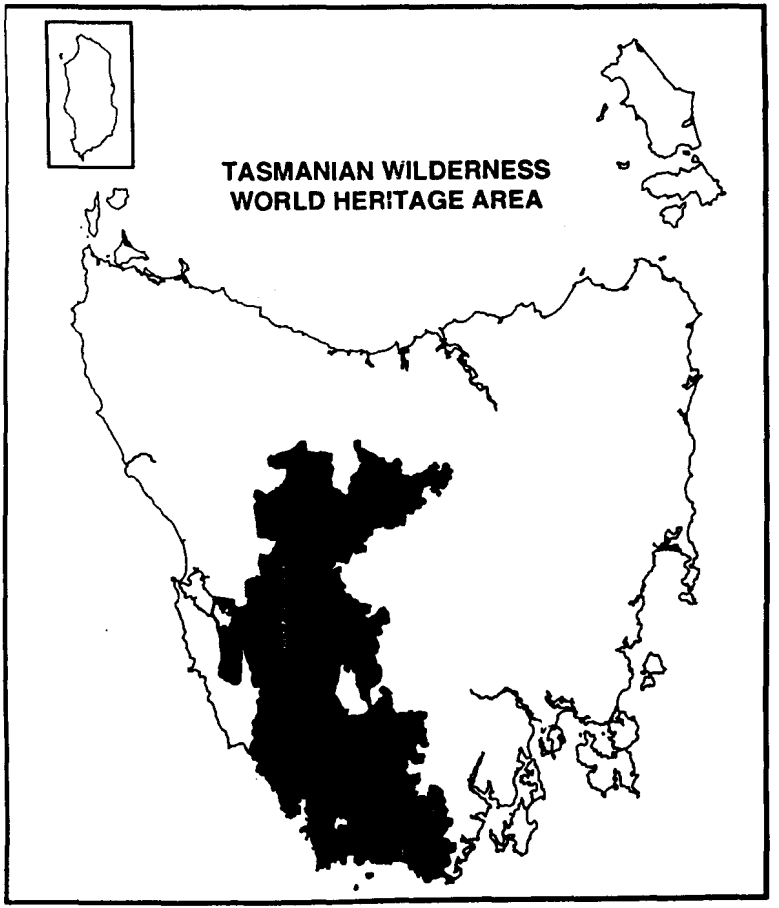
TASMANIAN WILDERNESS
WORLD HERITAGE AREA

SPECIAL ISSUE

Management Of The Tasmanian Wilderness World Heritage Area

CONTENTS

INTRODUCTION

by Robert Taylor
Editor

In December 1989 1.38 million ha of central, west and south-west Tasmania was inscribed on the World Heritage list as the Tasmanian Wilderness World Heritage Area (WHA). This inscription was, however, preceded by a long history of intense public controversy over land use. The battles to save Lake Pedder and the Franklin River from inundation for hydro-electric power development received world-wide publicity. The first section of the WHA was listed in 1982 and consisted of the Cradle Mountain-Lake St Clair National Park, Franklin-Lower Gordon Wild Rivers National Park and Southwest National Park. Despite its status as being of international significance, both a Labor and Liberal State government proceeded with plans to construct a dam in the Wild Rivers National Park. In 1983 the incoming Federal Labor government passed legislation to give force to its international obligations under the World Heritage convention to protect the area and the power scheme was subsequently halted.

Controversy over logging of forests surrounding the WHA led to the Commonwealth setting up the Commission of Enquiry into the Lemonthyme and Southern Forests in 1987. This eventually led the Federal Government to nominate significant areas of forest adjoining the already listed WHA. Following the State election in 1989 the Green Independents in the parliament negotiated an increase in the size of the nominated areas in return for supporting the formation of a Labor government.

Declaration of the WHA, however, has not dampened public debate over use of the area. The process of developing a management plan for the WHA has involved seeking the public's views with over 600 submissions being received. A draft of the plan was prepared by the Department of Parks, Wildlife and Heritage (DPWH), after taking account of these submissions, and then reviewed by the WHA Consultative Committee (consisting of independent experts from a variety of relevant fields) and State and Commonwealth agencies. This draft plan was released for public comment and attracted 1,300 submissions. A proposed final management plan was endorsed by the WHA Standing Committee. However, a change of State Government in early 1992 led to a review of this plan being undertaken by the new Minister for Parks, Wildlife and Heritage. One hundred and thirty changes to the plan were made by the Premier's office without reference to those in the DPWH who had formulated the plan. These changes allowed greater use of the WHA by so-called traditional users and permitted further development of tourist facilities. Further controversy has

recently erupted over the closure of Benders Quarry in the WHA with a jobs versus environment debate ensuing.

This special issue of *The Tasmanian Naturalist* is intended to provide readers with a more informed background to the controversies which have accompanied the WHA Management Plan than that usually presented in the media. For instance, what is so important about Exit Cave, and what damage, if any, is quarrying causing?

In the first paper, Prof. Jamie Kirkpatrick examines the plan in terms of the goal of maintaining biodiversity. While praising the plan as one of the best documents of its type prepared in Australia, Prof. Kirkpatrick points out features of the plan which threaten biodiversity conservation. Simon Cubit puts the case for the recognition of the European uses of the area as being of great cultural significance requiring recognition in the plan. He remains totally disillusioned with the plan despite the most recent changes increasing recreational access. Rolan Eberhard provides us with a background to the controversy over Benders Quarry. The significance of the area (and of karst in general) and the effects of quarrying are explained. Scott Poynton details the proposals for the construction of a forestry road across the Snowy divide. In the next two articles, officers of DPWH (Sally Bryant, Jennie Whinam and Jane Balmer) outline the research and management activities undertaken by the Department in the area of flora and fauna management. Pierre Horwitz provides his views of the DPWH's flora and fauna program in the WHA. While agreeing with the need for applied research, Pierre questions the value of inventory-type research and the emphasis that seems to be placed on particular groups of species or communities to the detriment of others. In the final article, Janet Slater outlines some of the impacts of marine debris on coastal environments in the WHA.

POSSIBLE IMPACTS OF THE WORLD HERITAGE AREA MANAGEMENT PLAN ON THE MAINTENANCE OF BIOLOGICAL DIVERSITY

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Abstract While the Tasmanian Wilderness World Heritage Area (WHA) management plan is one of the best of its type to be produced in Australia, it contains several features that may endanger elements of biological diversity in the long term. These relate to the threatening processes of exotic species invasion, stock grazing, unwise recreational use, fire and infrastructure development.

INTRODUCTION

Biological diversity has been defined as the variety of life. The concept includes communities, species and genotypes. The goal of maintenance of biological diversity implies no loss of any members of these elements beyond that attributable to natural extinction rates. As it is almost impossible to recognise a natural extinction among the many losses that are occurring with accelerated human use and misuse of the biosphere, the operational goal becomes the avoidance of extinction. As undescribed communities, species and genotypes almost certainly outnumber those that are known, the operational goal necessarily becomes the avoidance of extinction of all identified elements of biological diversity.

The Tasmanian Wilderness World Heritage Area (WHA) is one of the most important areas in Australia for the maintenance of biological diversity. Its size and environmental diversity ensure that, if managed properly, a large proportion of Tasmania's biological diversity will be able to survive and flourish, even with likely substantial macroclimatic change. It is thus a classical ecological reserve in the sense of Specht *et al.* (1974).

While the management objective for the WHA is to protect, conserve, present and, where necessary, rehabilitate the natural and cultural heritage (Department of Parks, Wildlife and Heritage, Tasmania (DPWH) 1992), many of the uses of the area that are allowed under the management plan have damaged, or have the potential to damage, biota and communities. The most recent revisions incorporated in the plan have increased this potential, as most of them have ultimately emanated from the self-termed 'traditional users' and resource

developers whose interests are elsewhere than biological diversity. In this paper I assess the potential impact on the maintenance of biological diversity of the types of activities that are permitted in the final statutory document. I organise this assessment by threat rather than activity, as different activities can contribute to the same endangering process.

THREATENING PROCESSES

Introduced Organisms

A small group of introduced organisms pose the most serious threat to the biological diversity of the WHA. Feral cats and European wasps are the only introduced organisms that occur over the greater part of the area of the WHA. Their impacts on biological diversity are uncertain, but probably significant. Goats, dogs and rabbits are established on the Central Plateau/Western Tiers section of the WHA. The latter species has combined with sheep grazing and firing to create some of the worst sheet erosion in Australia. This erosion transformed the nature of several alpine communities (Jackson 1973). The grazing activity changed the relative abundance and total cover of many plant species (Gibson and Kirkpatrick 1989). Despite the abundant scientific evidence of deleterious effects of stock grazing on the vegetation and soils of the subalpine and alpine zones of Australia (e.g. Wimbush and Costin 1979abc) the final management plan provides only a short moratorium on stock grazing until its affects can be determined scientifically. This reflects the attitude that no scientific results can be accepted unless the work is done at the local level. The *reductio ad absurdum* of this argument is a need for replicated experimental exclosures in every environment in every potential lease. Implied in the argument is the granting of the benefit of the doubt to the grazier rather than the native biological diversity. Thus, DPWH is expected to prove grazing harmful, rather than the graziers proving it to be harmless. A similar situation prevails with the European bee, which is assumed to be harmless until proven otherwise.

A potentially disastrous goat problem on the Plateau has been addressed in the plan. However, the dog problem has been exacerbated. Wild dogs may pose a significant threat to some small native animals, yet the plan allows shooters to be accompanied by three adult dogs and a puppy each, all unleashed.

The trout is the introduced animal that most threatens the biological diversity of the aquatic ecosystems of the WHA. The management plan allows trout fishing in all WHA waters, thus providing an incentive for illegal stocking of previously trout-free lakes and streams.

One introduced higher plant threatens the extinction of native species. Marram grass (*Ammophila arenaria*)can displace the native sand binders, such as

Spinifex sericeus, from sand dunes. If it were used in an attempt to stabilise dunes to protect archeological deposits, its spread in the South West would be accelerated. Fortunately, the management plan effectively precludes this option.

The cinnamon fungus, *Phytophthora cinnamomi*, has the greatest potential of any plant to reduce the biological diversity of the WHA (Podger and Brown 1989; Podger *et al.* 1990ab). At present it is found along many of the four wheel drive and walking tracks of the WHA. Four wheel drive vehicles have a great potential to accelerate its spread. Although the management plan provides for the closure of several four wheel drive tracks, many are left open, without imposing immediate hygiene measures. Regulations are also needed to ensure that walkers clean their boots and tent pegs when moving from infested to uninfested areas. Again, while there is provision for the development of a strategy, there are no immediate measures proposed.

Fire

During the last 200 years fire has destroyed large areas of alpine and rainforest vegetation dominated by gymnosperms and deciduous beech (*Nothofagus gunnii*) (Brown *et al.* 1983; Kirkpatrick and Dickinson 1984; Brown 1988). Most fires in the WHA are ignited by people. The potential for ignition is increased by road access and the use of camp fires by walkers, fishermen, drivers, horse-riders and shooters. The probability of ignition is likely to have a positive relationship with the numbers of people using any area. Fuel stove only conditions have been imposed over much of the WHA. However, the Central Plateau is one of the major exceptions. The maintenance of four wheel drive access to the Pillans Lake area is particularly disturbing in this respect.

Access and Tourism Development

The wheels of off-road vehicles, the hoofs of horses and the boots of people are capable of totally eliminating vegetation at relatively low levels of use (e.g. Calais and Kirkpatrick 1986; Gibson 1984). Although the total area thus affected is small in comparison to the WHA as a whole, the location of tracks and roads is environmentally selective. The management plan promises access for horse riders to several areas, some of which will only be available for this activity if DPWH cannot show that horse riding would lead to unnacceptable damage. The plan provides for walking track closure and the regulation of numbers of users. It is to be hoped that such action takes place quickly, as the high altitude unconstructed tracks are an exponentiating problem. Immediate closure of the Arthur Range tracks should be seriously contemplated.

The construction of roads and tourist facilities have immediate defoliating affects, and downstream affects related to waste disposal and increased usage of

the natural environment. Visitor service zones and sites are all available for this type of development.

CONCLUSION

While it is probably true that the types of damage to the biota allowed under the management plan do not threaten the survival of any element of biological diversity during the five year period of the plan, they will, if continued, almost certainly reduce the long term survival probabilities of many genotypes, species and communities. A more biological diversity-oriented management plan would ensure that damage did not exceed the restorative capacities of the WHA ecosystems, and would certainly give the benefit of the doubt to the biological diversity, not the developer or recreationalist. Nevertheless, despite the problems discussed above, the WHA management plan is one of the best documents of its type to be produced in Australia. Its deficiencies relate to the outcomes of a political process rather than the competencies of its producers.

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WHO GOES THERE! — TRADITIONAL RECREATION AND THE WORLD HERITAGE AREA

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The June/July 1992 edition of the *Tasmanian Conservationist* carried a letter of complaint from the Director of the Tasmanian Conservation Trust, Peg Putt, to the Federal Minister for the Environment, Ros Kelly, about last minute alterations to the World Heritage Area Management Plan. In urging the Minister to refuse the suggested changes, Putt made three interesting points. Firstly, she put the view that the changes flew in the face oi an extensive and exhaustive public consultation process; secondly, that the plan was compiled by experts; and thirdly, that the government was exhibiting gross favouritism in only consulting selected so-called traditional user groups. While she was right in one sense, to a significant section of the Tasmanian population she was dead wrong on every count!

The explanation of this apparent contradiction largely rests on our differing cultural perceptions of the World Heritage Area, perceptions conditioned by European understandings of the Tasmanian environment. Historian Richard Flanagan has written of the development of the myth of south west Tasmania as a desolate waste land, of a land without people, of a place without history (Flanagan 1985). It was a modern expression of this myth that led scientists to believe that Aboriginals abandoned the south west after the last ice age, that no-

one could live in the rainforests. The same myth, albeit in different form, has sustained the environmental movement. In portraying the same country as wilderness it became important to claim that people had never lived there and that European use was necessarily exploitative and damaging.

This cultural view of the south-west (now the World Heritage Area) as an empty wilderness, as a land devoid of human heritage and spirit, still persists. It persists in the sense that while there are many scientists who study elements of the World Heritage Area there are few historians. It is reflected in the World Heritage nomination document where, apart from the 'scientific' values of previous Aboriginal occupation, the only cultural values identified of any importance were the remains of the convict gulag in Macquarie Harbour. It is a particular view reinforced by the fact that the majority of those whose task it is to manage the World Heritage Area are middle class, urban and cocooned in the warm partiality of their own scientific training.

The World Heritage Area is, of course, very much a human landscape. Its Aboriginal heritage is now much better appreciated. Its European heritage, however, is not so well understood or even acknowledged. For those who came to this island over the last two hundred years, the World Heritage Area was a frontier. For those individuals who crossed the frontier, people like the piners, the hunters, the graziers and the prospectors and those who chose to live beside it like the bush farmers, the frontier was a cultural forcing ground. Time and the generations of humanity did the rest, turning Europeans into Tasmanians. While the ways of the original frontiersmen may have passed, their ways of viewing the landscape have continued. They have continued with those who call themselves traditional recreationists, individuals who hark back to generations on the frontier, and who, through activities like hunting, horseriding or fishing, recreate the lifestyles of their forebears (Cubit 1991).

The annexation of areas of great significance to traditional recreationists such as the Central Plateau and Macquarie Harbour into the World Heritage Area in 1989, threw into sharp relief these two differing conceptions of the one landscape. What was wilderness to one, was a familiar and comfortable landscape to the other. What one saw as an empty land, the other read as the pages of a family chronicle. Whereas one saw the future best served by regulating and even excluding people, the other saw their cultural heritage under fundamental threat. Yet it was the bureaucrats, encouraged by Green support to see only the natural values of the area, who were responsible for designing, constructing and running the public consultation programme. They had the power of fabricating reality with their Draft Management Strategy, of defining the issues with their planning notesheets and of controlling responses by insisting on written submissions. They were responsible for reviewing the comments of others and

wrote the Draft Management Plan and early copies of the final Plan in their own image. In controlling the consultation process, they controlled the outcomes ignoring community comments that did not fit with their image of the world.

Thus, when Peg Putt spoke of an extensive and exhaustive public consultation process by the Department of Parks, Wildlife and Heritage, she was right. There was such a process but it had little value to the traditional recreationists whose views were devalued, whose values were seen as anachronistic and whose activities were regarded as 'inappropriate' in a World Heritage Area. She was also right when she said the Plan was compiled by experts. Their expertise, however, was in science and in natural landscapes. Without historians, sociologists or anthropologists on staff, they had little experience or sensitivity in recognising or understanding cultural landscapes. Finally, she was also correct in stating that, in so far as user groups were concerned, the government exhibited gross favouritism in only consulting traditional recreationists. What she may or may not have known or appreciated, however, was that those consultations were one of the few times when traditional groups were able to make themselves heard. Far from acting improperly, in sitting down with traditional recreationists the new government merely righted the wrongs and excesses permitted by the previous administration.

The claims the traditional recreationists put to the new government were the same that had been put to their predecessors for nearly three years. They are commonly known and included concerns about the curtailing of wallaby hunting in the Lake Augusta area, concerns about limitations imposed on horse riding access on the Plateau and other traditional areas, concerns about constraints on access by fishermen, and concerns about restrictions on recreational access around Macquarie Harbour. These activities, which pre-dated the nomination of the World Heritage Area, had been opposed by the bureaucrats, ostensibly on environmental grounds. In the majority of cases it was an argument that had little credibility. The reality is that all use, whatever its source, creates impacts. The challenge of management is to reduce those impacts to acceptable levels. In terms of, say, horse-riding, it was pointless and unfair to attempt to ban what amounted to one hundred horse-rider-days on the Plateau a year for their potential impacts when five thousand walkers a year used the same area without restriction. The arguments about impacts that should have been based on science always drifted, upon challenge, to arguments about perception, about who a horse might offend or whether or not it was 'right' to hunt for wallaby in a World Heritage Area. For groups for whom such activities are part of a long standing cultural tradition and who are more than willing to reduce their actual environmental impacts, such arguments were irrelevant and elitist.

With the final form of the plan not yet known, it is not possible to comment

on how the World Heritage Area Ministerial Council responded to the views of the traditional recreationists or to the arguments of Putt and others. Enough work has now been done, however, to demonstrate that the idea of an empty wilderness is both barren and incorrect. Decisions about the place of humans in the World Heritage Area can now not proceed in ignorance of the rich cultural heritage of the place. If those Tasmanians who have used and cared for the area for generations are excluded, it will be because of a conscious decision. In relation to the future management and acceptance of the World Heritage Area, that decision will be important. The fact, however, that objections to the vast majority of the concessions extracted from the bureaucrats under political duress had more to do with ideological images of 'appropriateness' than with actual environmental impacts, does not augur well for the future. It suggests a continued gulf in perception about the landscape and may well confirm the view of traditional recreationists that World Heritage Area status is a liability rather than an asset.

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POSTSCRIPT

I believe the final WHA Management Plan, released on September 18 1992, still fails to recognize the legitimate and responsible requests from traditional recreationists for reasonable access to the WHA. In some cases quite fundamental aspects of traditional activity and cultural identity have been denied A response by traditional recreationists is still being formulated.

LIMESTONE QUARRYING VERSUS KARST[1] CONSERVATION AT IDA BAY

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INTRODUCTION

There is evidence to suggest that limestone caves at Ida Bay provided shelter for aboriginal people who occupied southern Tasmania during colder climatic conditions that prevailed in the late Pleistocene. In historical times, it was timber workers who discovered the spacious outflow entrance of Exit Cave in the 1890s. Mystery Creek Cave, an inflow cave 2 km away on the opposite side of Marble Hill, was also located around this time. Magnificent displays of glow worms (the luminous larvae of the fly *Arachnocampa tasmaniensis*) that are a feature of both these caves attracted early attention. In 1895 a note in *Scientific American* reported the impressions of an early visitor who enthused how "on the lights carried by the party being extinguished, the ceiling and sides of the caves seemed studded with diamonds".

Systematic exploration of caves at Ida Bay commenced in the 1940s - Exit Cave was followed upstream to an area of rockfall that temporarily halted progress nearly 1 km from the entrance. The subsequent discovery of a route through this obstacle led to many more kilometres of cave passages, massive underground chambers, and areas of spectacular calcite and gypsum formations. An additional entrance located high on Marble Hill was found to drop in a series of vertical shafts to join the main passages in Exit Cave some 220 m below the surface. This gave Exit Cave the title of Australia's deepest as well as longest cave system at that time. Despite more than four decades of intensive exploratory work by cavers, the potential for the discovery of additional caves and new passages in known caves at Ida Bay remains enormous.

Many other caves that are present on Marble Hill form part of a larger system associated with Exit Cave. It is possible for humans to negotiate the passages linking some of these caves to Exit Cave (Goede 1969; Kiernan 1991), while in other instances sections of submerged passage or rockfalls prevent connections that are known to exist from being made. For example, dye tracing has shown

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1 *Karst* refers to terrain which results from the enhanced solubility of certain rock types, notably limestone and dolomite, in natural waters. Caves are just one landform that characterises karst environments.

that streams in Mystery Creek Cave and Little Grunt flow to Exit Cave, but cavers have so far been unable to physically traverse the link between these caves. As a consequence of the integrated nature of the caves, impacts which may ostensibly be confined to a small area have the potential to be transferred to other parts of the wider karst system.

WORLD HERITAGE STATUS & SUBSEQUENT DEVELOPMENTS

In 1988 the Helsham Inquiry recognised Exit Cave as a site of "outstanding universal significance from the scientific point of view" (DASETT 1988). Evidence presented at the Inquiry stressed Exit Cave's value as a habitat for specialised invertebrate fauna. Many of these species occur only at Ida Bay, such as an unusual blind cave beetle (*Goedetrechus mendumae*) known only from Exit Cave (Richards and Ollier 1976). The importance of Exit Cave from a geomorphological perspective was also argued during the Inquiry. Its significance in this respect relates not only to its intrinsic value as a major karst system with a long evolutionary history, but also to evidence within the cave which is likely to contribute to research into wider questions of landscape evolution and past climates (Houshold and Davey 1987).

The Ida Bay karst was subsequently nominated for inclusion within an expanded Western Tasmanian World Heritage Area. Implicit in the successful nomination was the importance of the undisturbed state of the cave system and the need to protect its catchment area. The entire Ida Bay karst and its catchment was therefore nominated.

Concern over the issue of limestone quarrying by Benders Pty Ltd on the eastern side of Marble Hill and within several hundred metres of mapped passages in Exit Cave, arose at aro nd the time of the World Heritage debate. The quarry site was included within the World Heritage nomination, although a 77 ha area in the vicinity of the quarry was excluded from a new South West National Park that was proclaimed shortly afterwards. The quarry area was given the lesser protection afforded by Conservation Area status and limestone extraction continued. In 1990 a proposal to extend operations into an area of high purity limestone containing many caves to the immediate south of the existing quarry highlighted the uncertainties associated with the impact of quarrying on karst values at Ida Bay. The incentive for this expansion was provided in large measure by changes to the grade requirements of the major user of limestone from Ida Bay - Pasminco Metals-EZ. The proposal stimulated a series of studies to address the impacts of quarrying on natural values at the site.

Two outcomes of the studies are particularly relevant in relation to the conservation status of Exit Cave. Firstly, it was found that Bradley Chesterman Cave - a cave of modest extent not far from the quarry - had been heavily

impacted. Runoff from the quarry appeared to be responsible for thick clay deposits clogging the streamway in the cave, and organic and inorganic pollution probably derived from wastes disposed of within the quarry area, were found to be present (Houshold and Spate 1990). A biological survey revealed that in comparison to up to 8 invertebrate species found in streams in comparable caves nearby, the stream fauna in Bradley Chesterman Cave consisted almost entirely of planarians (Eberhard 1990). The changes which resulted in the local extinction of other acquatic fauna in the cave had apparently produced highly favourable conditions for the planarians. Here was a clear indication of the potentially deleterious effects of quarrying on caves and their biological contents.

A further important finding was the probability that drainage from the quarry area also found its way to Exit Cave. A dye tracing experiment showed that a stream sinking underground less than 300 m from the edge of the quarry contributed to the flow in a major tributary stream in Exit Cave. The proximity of this streamsink to the quarry, and reports of turbid water entering Exit Cave from the same tributary that had been dye traced, suggested that the impacts of existing quarry operations were not merely confined to Bradley Chesterman Cave.

Confirmation that the quarry area formed part of Exit Cave's catchment was provided by further water tracing in November 1991. These showed that water sinking underground into a hole on the middle quarry benches, and into a cave named Little Grunt at the top of the quarry, drained rapidly to Exit Cave (Kiernan 1991). This information encouraged cavers to look at an unexplored passage that had been noted on a previous trip to Little Grunt. The result was the discovery of several kilometres of large tunnels extending directly beneath the quarry floor in one direction, and back to within a short distance of the known extent of Exit Cave in the other. A feature of the passages in Little Grunt which received runoff from the quarry area was the presence of clay deposits resembling those mobilised in large quantities on the quarry face. As with Bradley Chesterman Cave, there was evidence of changes in the composition of acquatic fauna in Little Grunt.

Shortly after these discoveries were made, the Department of Environment and Planning released a Draft Environmental Management Plan for Benders Quarry. This document, which maintained that the quarry could be significantly expanded without major impacts on the karst system, was heavily criticised.

TOWARDS A RESOLUTION?

In August 1992 the Minister for the Environment, Mrs Ros Kelly, announced that the Federal Government would exercise its powers under the *World Heritage Properties and Conservation Act 1983* and ordered the cessation of limestone

quarrying at Ida Bay. However, a subsequent announcement that limestone extraction would continue in the guise of rehabilitatory measures has aroused concern about new impacts that such activities may cause, and the real strength of commitment to protecting the Ida Bay karst system.

The fight to protect Exit Cave has attracted considerable public interest and been widely publicised. In contrast, other cave and karst conservation issues in Tasmania have passed virtually unnoticed. In 1991, caves in the Nelson River valley joined those in no less than five other Tasmanian karst areas that have been wholly or partly submerged in hydro-electric impoundments. Ida Bay is only one of several sites where limestone quarrying has occurred to the detriment of nearby caves. Other caves are subject to less dramatic degradation in the form of impacts associated with use by recreational cavers. Thus, a failure to recognise the importance and uniqueness of Tasmania's karst estate would seem to be well entrenched in this state's recent history. This fact does not augur well for the conservation status of those karst areas which do not contain the longest or the deepest caves, or which lack the emotive connotations that go with World Heritage status, but which may be important for a myriad of other reasons.

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FORESTRY ROAD CONSTRUCTION IN THE WORLD HERITAGE AREA

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The State forests of the Australian Newsprint Mills (ANM) Concession in the Derwent Valley and the Huon Valley produce about 50% of Tasmania's Crown resource of veneer, sawlog and pulp-grade timber. The two areas, although in close proximity, are geographically separated by the mountain ranges which extend west from Mt Wellington into the World Heritage Area. Currently the only transport route for wood from one area to the other is via Hobart. A link road over the dividing range would enable the two areas to be effectively managed and marketed as a single forest unit.

Since the mid 1980s, the Tasmanian Government has been trying to encourage new forest industry development based on the available resources from these forests, following the closure of APM's Huon pulp mill and ANM's changed pulpwood requirements. In 1991 expressions of interest were sought for the utilisation of this resource. A short list of project proponents are preparing more detailed proposals for the Government. Some of the proposals rely on access to the forest resources of both the ANM Concession and the Huon Valley. A forest road link has been proposed as part of the proposal to enable wood to be transported from the ANM Concession to new processing facilities likely to be developed in the Port Huon area. It is estimated that up to 430,000 tonnes of wood per annum could be transported from the ANM Concession to the Huon. This is the equivalent of 20,000 truck loads.

Options for the location of a link road over the mountains were first seriously evaluated when Huon Forest Products (HFP) expressed an interest in establishing an integrated wood processing facility at Port Huon in the 1980's. Forest engineers investigated a number of potential routes and judged them against three criteria. A road must be:

- feasible to construct within required design standards
- justified on a cost-benefit basis
- environmentally and socially acceptable.

A road through a saddle between the Snowy Range and Mt Styx (the Snowy divide), connecting the Styx and Russell river valleys, was identified as the best option. Other options investigated are less favourable for the transport of logs from north to south. These options included routes connecting Geeveston with the Scotts Peak road which cannot be justified on a cost-benefit basis, Crabtree with Lachlan which has difficult terrain and steep grades and New Norfolk with

Judbury which has difficult terrain on the southern end of the route.

The Snowy divide was subsequently included in the Tasmanian Wilderness World Heritage Area (WHA) in December 1989. The boundary in this vicinity was decided with the full knowledge that construction of a link road was likely to be required. No known specific values were attributed to this particular location, other than it approximates the eastern boundary of the Snowy Range, which has values related to alpine flora and glacial geomorphology. When the divide was included in the WHA nomination, the State Government sought and received a specific commitment from the Commonwealth Government to allow the construction of the road if required.

A road through the Snowy divide would link existing forestry roads on either side of the WHA. A road location has been identified that would traverse about two kilometres of the WHA resulting in the disturbance of less than five ha. A possible alternative route through a higher saddle just to the east of the WHA has also been identified. While a road on this route would avoid the WHA (except perhaps for a small intrusion), it would cost an additional $1.6 million to construct. Transport costs would be $0.25 million per year more due to the longer distance and greater height traversed. If constructed, the road would be paid for by forest industry to a logging road standard. The multimillion dollar construction cost would be recouped over time through transport cost savings. While the road would be a forestry road, it undoubtedly would also be utilised by tourist and inter-regional traffic, providing an alternative round trip to the Huon.

FLORA MANAGEMENT WITHIN THE WORLD HERITAGE AREA

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INTRODUCTION

The WHA contains many of the vegetation communities which occur within Tasmania. Cool temperate rainforest, alpine moorland and upland freshwater communities are rich in groups with Gondwanan affinities, and include many Tasmanian endemics. The vegetation of the WHA demonstrates a variety of responses to fire and may be divided into 'fire sensitive' communities (dominated by conifers and deciduous beech (*Nothofagus gunnii*), rainforest and alpine communities); 'fire adapted' types that require fire for their perpetuation but

may be degraded by a frequent fire regime (most *Acacia, Eucalyptus* and *Leptospermum* dominated communities); and 'pyrogenic' vegetation which is very flammable and recovers well after fire (such as buttongrass moorland).

Management issues relating to the protection and perpetuation of vegetation in the WHA include fire management, factors affecting species rarity, control of exotic plant taxa and diseases and the appropriate control of disturbance, such as trampling and developments associated with park management and visitor facilities.

VEGETATION MAPPING

Vegetation mapping of major areas of the WHA is a project that was initiated, with the assistance of Prof. J.B. Kirkpatrick (University of Tasmania), in 1989. The project officer was initially Rachel Mackie and is currently Sib Corbett. The work has two main aims. Firstly, to evaluate the floral resource of the WHA and secondly, to guide management options. Mapping, at 1:25 000 scale, has been completed for the Central Plateau, the Lyell Highway (WHA), and is now concentrated on the Cradle Mountain-Lake St. Clair National Park. The program will then move to southwest Tasmania, concentrated along the eastern edge of the WHA.

PHYTOPHTORA

Phytophthora cinnamomi is an introduced microscopic soil fungus that causes root rot in some plants. It poses a severe threat to moorland, heath and scrub communities and *Eucalyptus nitida* forests in the WHA where the mean annual temperature is greater than 7.5°C and rainfall is greater than 600 mm. The fungus attacks a wide range of plants with varying severity and can cause death in many species of the Epacridaceae, Proteaceae and Fabaceae, with more than 120 species in the WHA being identified as susceptible to *Phythopthora*. The fungus is spread by soil, fire and water and as it is difficult to contain, the best that can be expected is to slow the rate of infestation. Departmental officers are currently involved in programs to address this managment issue. Actions include: mapping the distribution and movement/spread of *Phytophthora*; assessing the effects of the fungus on rare and threatened plant species; producing a management plan for combatting the spread of the fungus; and education to inform the public of the risk of *Phytophthora*.

FIRE ECOLOGY OF TALL FORESTS

Tall forests are a superlative natural feature defined as any forest dominated by trees exceeding 30 m in height. In Tasmania, however, they are represented by forests reaching heights in excess of 90 metres. The species achieving the

greatest height of any flowering tree in the world is the swamp gum or mountain ash *Eucalyptus regnans*. In days gone by incredibly tall *E. regnans* forests (the species most valuable for commercial exploitation) which were in excess of 100m were present in Victoria and Tasmania. The reasons for the demise in eucalypt heights is in part due to forest clearance of these highly productive lands, with some 20% of Tasmanian tall forests having been cleared since 1800 (Kirkpatrick *et al.* 1988). The last extension of Tasmania's World Heritage Area resulted in a significant increase in the conservation of tall eucalypt forest (19% reserved).

A tall forest fire ecology project has been conducted (by J. B.) to investigate age diversity and firing responses of these forests so that their fire requirements within the WHA can be determined and appropriate management strategies determined. While the literature on tall forest ecology contains the assumption that eucalypts are usually killed by fire due to their fire-prone habitat, data collected during this project has contradicted this by documenting the presence of at least 20% and possibly as much as 50% of forests dominated by at least two different ages of eucalypt. This provides evidence that eucalypts can survive fire in tall wet forests. Interestingly, the multiple aged eucalypt forests were on average predicted to be in drier locations (by the climatic model BIOCLIM) than even aged eucalypt forests. This may be explained in several ways. It is likely that in drier situations fire is more frequent and fuel development between fires events is reduced giving rise to cooler fires which are less likely to destroy all the eucalypts. Rainforest understoreys were less common beneath multi-aged eucalypt forests than they were beneath even-aged eucalypt forest.

The conclusion reached was that most tall forests within the WHA have relatively young eucalypts emergent over an understorey of wet sclerophyll species. Whilst there are areas of old growth forests well over 350 years that will succeed to pure rainforest provided they are not burnt within the next 100 years, fire is not needed to ensure the perpetuation of tall forests as a whole within the WHA for at least the next 150 years. In that time period it is likely that there will be many uncontrollable wildfires which will further ensure the regeneration of the tall forests. There may well be a need to protect forests from fire if a greater proportion of oldgrowth mixed forests is to be retained within the WHA. This is particularly important given the likely elimination of forests of that type within forests managed for wood production on a 80 to 100 year rotation.

CENTRAL PLATEAU AND THE IMPACT OF HORSE RIDING

The Central Plateau is a special and distinct part of the Tasmanian environment. Much of the Central Plateau has been shaped by its past history of glaciation, which has left a legacy of scraped surfaces and a landscape dotted with lakes, tarns and watercourses. The Central Plateau is an area containing fragile alpine

and sub-alpine ecosystems. Some of the 140 plant species which are of restricted distribution in Tasmania are found only on the Central Plateau. For example, the Central Plateau is a stronghold for the Tasmanian endemic pencil pine (*Athrotaxis cupressoides*) communities. Many endemic species are of Gondwanic origin and thus are also of significance for studies in the evolution of biota in the southern hemisphere during the Tertiary. The previously glaciated areas of the western Central Plateau contain many groups in which speciation is active, for example *Gonocarpus, Ranunculus* and *Plantago*.

Other vegetation types for which the Plateau provides an important conservation reserve include pencil pines, alpine vegetation, native grassy vegetation and wetland communities. As well, the myriad of lakes and streams on the Plateau support a range of aquatic and riparian plant communities. Some of the alpine communities which show adverse effects of trampling include *Sphagnum* bogs, cushion plant communities, sedgelands and riverine communities. Trampling of these sensitive environments can be caused by a single activity or a combination of several activities, including four wheel driving, horses riding, fishing and walking.

To assess some of the impacts of horse riding on the Central Plateau, the Department of Parks Wildlife and Heritage (by J. W.), in conjunction with the University of Tasmania and the High Country Trail Riders Association, has conducted experimental trials across a range of vegetation types. The experimental design mirrors the design of similar experiments established in New South Wales, Victoria and the A.C.T. This is the first time that experiments to scientifically assess the impacts of horse riding in the high country of Tasmania have been established. Basically, the trials concentrate on two aspects, the affects of horses after a number of passes in different high country vegetation communities and the germination (and subsequent survival) of weeds in horse manure.

Data on vegetation cover, reproductive stage, and condition of species were recorded prior to horse passes, after one pass, again after two passes, and (on an adjacent area) after twenty passes. Data on surface soils, micro reflief, compaction/ water infiltration, etc. were recorded simultaneously. Data from horse riding groups and experiments in mainland States suggest that over a period of time horses and riders (like walkers) have favoured routes. It is therefore considered valid to assess cumulative effects, as has been done in other studies. The horse passes were carried out in three different vegetation communities: sheet-eroded ridge shrubland, grassland and herbfield. In addition, similar recordings were made after both one and two passes in cushion plant communities.

Two rabbit and marsupial exclosures were constructed in each of the grassland and sheet-eroded dry shrubland environments. In each exclosure horse manure was introduced into half the exclosure, with the other half manure free. An

adjacent control area (not fenced from grazing pressures) was subjected to similar manure/manure free treatments. The soils and vegetation of these exclosure and control plots were described in detail before the addition of manure. These exclosure and control plots are being monitored monthly for at least 12 months to identify weed germination and subsequent survival rates under different experimental conditions. The experimental treatments can be summarised as:

- with and without horse manure;
- with and without marsupial and rabbit grazing;
- with and without surface disturbance;
- over the climatic extremes of all seasons.

Weeds were systematically counted throughout the year, to monitor germination and to determine whether the weeds could reach reproductive stage (i.e. be able to spread) in the climatic conditions of the Central Plateau. The weeds were traced to their germination source to ensure that the weeds observed did actually originate from the horse manure.

The data outlined above is currently being analysed. Initial results suggest that the type and extent of damage varies in different vegetation and soil types and that recovery rates also vary. The survival of weeds is most favoured by the combination of freedom from grazing and bare ground covered by horse manure. Not all weeds that germinated had reached reproductive stage 12 months after the trial commenced.

FAUNA MANAGEMENT IN THE WORLD HERITAGE AREA

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RESEARCH AIMS

The World Heritage Area (WHA), comprising approximately 20% of Tasmania's land mass (~1.38 million hectares), contains a diversity and uniqueness of fauna which is of world significance. The priorities for work to be conducted in the field of zoology in the WHA are: inventory of the fauna; fire ecology; monitoring and management of environmental changes and communication

(i.e. interpretation and training). This work involves surveying new areas (terrestrial, aquatic and caves), monitoring established sites, management of threatened species, investigating species/habitat relationships, and determining impacts such as feral species and public usage. The WHA comprises a number of state and commonwealth land tenures. Management actions must therefore be sensitive to the needs of all stakeholders and compatible with the four management zones proposed in the WHA Management Plan (Department of Parks, Wildlife and Heritage, Tasmania 1992) i.e. wilderness zone, self-reliant recreational zone, recreational zone and visitor services zone.

FAUNAL INVENTORY

A program called Directed Wildlife Research (DWR) operated between 1986 and 1989. Its aim was to establish an inventory of flora, fauna and wildlife resources of the WHA. The program operated by providing funds for travel and logistic support to volunteer specialists who collected information from many locations in the WHA. Although successful, the information collected was fragmentary as different scientists undertook work in different areas. In 1990 DWR was superseded by the Wilderness Ecosystems Baseline Study (WEBS). This new program concentrates research in two remote and very different locations; Mt. Ossa - Pelion Valley and Bathurst Harbour - Melaleuca. Examples of some of the 40 or so fauna projects undertaken to date are: ecology and microhabitat of reptiles and amphibians; fish assemblages of Bathurst Harbour; and species inventories of terrestrial and freshwater invertebrates, freshwater fish, crustaceans, small mammals and birds. WEBS has provided three years of valuable information on the physical environment, fauna, flora and ecology of the WHA. Many new species have been discovered; for instance, during the Bathurst Harbour fish inventory a previously undescribed species of skate was found (Edgar 1991). The use of gill nets has been prohibited from the Bathurst Harbour estuary in order to provide protection for this and other species. The DWR and WEBS programs have provided a much greater understanding of the biological diversity of the WHA and ultimately Tasmania.

MONITORING THREATENED SPECIES

The WHA is the last refuge for a number of rare and threatened species and implementing conservation plans for these species has become an integral part of the fauna directive. The orange-bellied parrot (*Neophema chrysogaster*) breeds exclusively in the southwest of Tasmania and every year volunteers record the colour bands and numbers of birds returning from the mainland. This information is providing important biological data on an endangered species and is essential in directing the long term management program.

The flooding of Lake Pedder in the 1970's has led to the demise of one of Tasmania's native galaxiid fish, *Galaxias pedderensis*, due to competion and predation from introduced trout (*Salmo trutta*) and the invasion of another native galaxiid (*G. brevipinnis*). The total population of *G. pedderensis* has been reduced to between 50 and 200 individuals and is continuing to decline. A captive breeding program undertaken by the Inland Fisheries Commission has been unable to produce fertilized eggs and so, in an effort to save the species from extinction, a small number of individuals have been introduced into an alpine lake in the WHA which was free of predators (Davies 1991).

Another threatened species in the WHA, the ptunarra brown butterfly (*Oreixenica ptunarra*) is located at a few sites in the Central Plateau Conservation Area. Implementation of a recovery program for the species has involved fencing areas of *Poa* tussock grassland to assess the impact of grazing and fire on the numbers of this species (Neyland 1991).

Other vertebrate species at risk and monitored on a regular basis in the WHA are the Pedra Branca skink (*Niveoscinus palfreymani*), ground parrot (*Pezoporus wallicus*), swift parrot (*Lathamus discolor*) and hooded plover (*Charadrius cucullatus*), combined with an even longer list of threatened invertebrates including onychopherans, crustaceans and molluscs.

FERAL SPECIES

The WHA Management Plan (1992) states that actions for management shall include eradicating introduced rodents and rabbits at disturbed sites and controlling other feral and introduced species, such as goats, cats, dogs, fish, starlings, bees and wasps. Because of their tenacious nest building habits the European starling (*Sturnus vulgaris*) has an impact on the endangered orange-bellied parrot and vulnerable swift parrot in regions of the southwest, Hartz Mountains and Central Plateau Conservation Area. Monitoring and eradication of starlings is undertaken jointly by the DPWH and Department of Primary Industry. A rabbit eradication program is planned for the Strathgordon/ Maydena area in 1993 whereby an intensive period of poisoning and shooting rabbits around inhabited areas bordering the WHA will be undertaken by SW rangers and contract staff.

Feral goats are causing widespread damage through browsing, soil erosion and spread of disease in a number of regions, particularly the Central Plateau Conservation Area. A control program administered jointly by the DPWH, Department of Primary Industry and Forestry Commission involves tracking and destroying feral goats. Goats wearing radio collars (Judas goats) are released to aid in the location of feral herds. Aerial surveillance using fire spotting aircraft from the Forestry Commission has been employed to locate herds in areas of

difficult terrain (G. Atkinson, pers. comm.).

CENTRAL PLATEAU FISHING

A Trout Fisheries Management Plan for the Central Plateau (Sloane 1991) has provided important information on use, access and facilities at fishing sites at the Western Lakes. Results from a questionnaire found that since the 1986/87 season on average some 2,000 anglers have fished in the Western Lakes each season, spending approximately 5 days a year for an annual harvest of around 15,000 trout. The report makes a number of recommendations, one being that the bag limit is reduced from 12 to 6 fish per day for the entire Western Lakes region. This is in keeping with a philosophy of maintaining the area as essentially a wild trout fishery and to encourage the conservation of fish stocks thereby reducing the need to extend stocking programs.

HUMAN IMPACTS

While encouraging visitation to the WHA, the presence of people is not without its problems. Sewage disposal, litter, escape of camp fires and bacterial contamination of water are all problems in wilderness area. Observations at Lake St. Clair and Cradle Mountain indicate that buttongrass moorlands and subalpine tussock grassland have limited abilities in absorbing and assimilating high-nutrient sewage effluent (Smith 1990). Faecal material entering waterways has in the past caused the outbreak of giardia, a bacteria causing diarrhoea and gastrointerritus in humans. Disposal and treatment of effluent in natural areas has therefore become an important management issue facing the WHA. Designing new composting toilets and educating the public on hygiene are two methods employed to deal with the problem.

FIRE RESEARCH

The use of fire as a management tool in the WHA remains a controversial one. The fire management plan for the Southwest National Park (1988) allows for the controlled use of fire to maintain a diversity of plant and animal communities. Over summer the orange-bellied parrot is dependant on moorland vegetation in the age range of 5 to 12 years (Brown and Wilson 1983), therefore burning to maintain a mosaic of this food source is undertaken when required. The ground parrot also prefers specific aged vegetation, however, the size of the population at present does not warrant a prescribed fire management program (Bryant 1991).

The broad tooth rat *Pseudomys fuscus* (formerly *Mastacomys*) has its stronghold in the WHA where it occupies heathland copses. A research program is currently investigating the interrelationship between this species and age of

moorland vegetation to determine its distribution and the age at which regenerating heathland becomes suitable for habitation by broad tooth rats (M. Driessen, pers. comm.).

APPRAISAL

Past and current research programs have uncovered a wealth of faunal information in the WHA. The discovery of new species including fossil evidence of relic species have highlighted Tasmania's Gondwanan affinities and biological uniqueness. Research information is continually being translated into management actions so that the biological integrity of the WHA can be maintained for future generations.

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SCIENTIFIC RESEARCH AND THE WORLD HERITAGE AREA: A VIEW FROM AFAR

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Throughout the period of advancement of technology and science, and associated with an increase in human population numbers, there has been an increased recognition that areas free of western interference have substantial natural values. Such areas are relics of the natural environment which existed everywhere prior to the broadscale changes which occurred with 'advancement'. Through analytical techniques such as exploration, description and classification, scientific research has identified natural values and has therefore been a substantial contributor to the conservation/reservation process. In this sense science has been used as a political tool to justify areas being set aside from intensive human use, or (more rarely) it can be used to generate the process in the first instance. In Tasmania, the identification of natural values has been important in the initial establishment of the World Heritage Area (WHA), and subsequent additions to it.

But the juggernaut rolls on: the processes of exploration, collection, description and classification continue in the WHA, and until very recently the processes have remained virtually unchecked. They continue to be successful in highlighting values, particularly those with ecological or economic manifestations. This essay briefly addresses these continuing processes: underwhat conditions are the activities of science and scientists in the World Heritage Area appropriate?

There seems to be a perception in the wider community that scientific research can be undertaken above and beyond the normal processes of land and people management. Rarely is scientific research perceived as a threatening process in its own right; it is my contention here that there is a potential for scientific research to affect natural communities and perhaps even have a profound impact on them. Scientists therefore require regulation much like any other members of the public, and their activities require scrutiny.

The most serious threat from scientific research in natural areas is the potential for the spread of diseases or as a mechanism for the translocation of other flora and fauna. Scientific research offers many vehicles for the transport of infected soil, such as mammal traps, nets or other sampling equipment, car tyres, boots, digging or camping equipment etc. Consider the biologist or geologist who troops from one sampling location to another, in an extensive

sweep of the southwest of Tasmania without taking precautions. He or she might easily distribute diseases, or alien or native (but formerly restricted) species, throughout. For invertebrate and plant biology at least, western Tasmania is a biogeographical paradise, but, already, some of these fascinating distribution patterns may have been compromised by the very act of science that seeks to describe them. This might be considered ecology's uncertainty principle, and the probability of it occurring would increase when exploratory research takes place over a wide geographical area.

On another level, management prescriptions based on scientific research can result in a loss or a change in natural values. Examples include some deliberate but well meaning acts, and some mistakes. For instance, where management prescribes activities which will selectively advantage one species, say a threatened species, other species may well be disadvantaged. An oft cited example of this is the management of land for the orange-bellied parrot (*Neophema chrysogaster*): this programme prescribed, as a result of research into the species, a fire regime which would make available seed as food. The programme appears to have made a contribution to saving an endangered species, but in the process considerable damage has occurred to organic rich soils burnt over a wide area as a result of escaped prescription burns. The programme has therefore been to the detriment of flora and fauna requiring organic rich soils. Hazard reduction burns fall into the same category, favouring some species to the detriment of others.

Research is also selective with respect to the types of flora, fauna or landform or landscape we would like to preserve. In any research programme we commence with a presupposition about the values we would like to keep or protect from disturbance. Rainforest communities and mammalian species are good examples; in comparative terms these forms of life receive the lion's share of resources and research effort. Management effort will then be directed to these forms, to their benefit and also those species and communities that benefit from flow-on effects. Buttongrass and invertebrate communities, for instance, have been seen as poor relations of rainforests and mammals, despite their widespread occurrence in the WHA. This results in, for instance, the diversion of roads or tracks, or other activities, from forests into buttongrass moorlands so as not to violate the rainforest values, and other examples like those cited above.

An excellent example of this selectivity comes from the research and management of the Pedder galaxiid (*Galaxias pedderensis*). This fish species has been regarded as endangered for some time now; in 1991 it was recognised as urgently requiring help to recover following its demise after hydroelectric developments, the spread of a predatory native galaxiid, and the introduction of trout in southwest Tasmania. Small numbers of the species were located in one

creek system and it was deemed that the species would slide into extinction if something was not done quickly. The solution proposed and undertaken, with almost no discussion, consultation or debate, was to release a small number of these fish into an alpine lake which had no fish in it. This solution was proposed despite the fact that it violated IUCN guidelines on translocations, and despite the fact that this galaxiid was endemic to a lowland lake, the former Lake Pedder. In this instance, therefore, and under the guise of scientific expertise, it was deemed that a lake flora and fauna which had evolved without fish was less valuable than a population of galaxiid fish.

Scientific research is a potentially threatening process itself, and so are the management prescriptions which result. As the examples above show, both are selective in their approach and deal with components of the ecosystem rather than the system as a whole. Some people even suggest that science will never achieve this latter goal of treating ecosystems holistically.

Fortunately the most predominant form of scientific work undertaken in the WHA is research designed to determine appropriate management for problems of an applied nature. This includes a wide variety of activities, primarily directed towards research on the affects or impacts of processes which threaten natural features like habitats, communities or species. Such threatening processes include fire, road and track building, mining, bushwalking, effluent from septic systems, introduced species and diseases like *Phytophthora*, river bank erosion, and horse riding, fishing, bee keeping etc. There is a plethora of threatening activities currently underway in the WHA; these threatening activities will eventually disturb systems so that they no longer have the same features as they started with. These features are those that the WHA designation seeks to retain. Where these threatening processes are occurring in the WHA there is certainly justification for research programmes to be established in the WHA, but only provided the research techniques themselves don't represent too great a risk to the valued features. It might be argued that most of the work should be done outside the WHA to minimise the risk. Realistically, however, it would be better to monitor the threatening process in situ, if research is required to respond quickly to management issues.

Other research activities underway include exploration for scientific curiosity and/or systematic research, exploration of resources, undisturbed systems research (i.e. greenhouse research), or research for education purposes. A case can be made to exclude these from justifiable activities in the WHA. For instance, the intentions of exploration are often questionable. For non-economic values, why should we continue to investigate the values of the WHA when its values are already acknowledged as being outstanding? The examples above indicate that the values could be potentially weakened in the process. Exploration for

economic exploitation will have the same effect with the added impact of the invasive techniques used to extract the resource, and these impacts are usually aesthetically and ecologically extreme.

Undisturbed systems are undoubtedly valuable as benchmarks for environmental change, particularly so when the change is subtle and of a long-term nature. But undisturbed systems are also valuable because they are just that; undisturbed. Placement of monitoring equipment and regular visitation render the systems subject to the same disturbances as experienced elsewhere in the world. Unless non-invasive monitoring techniques can be developed we should consider monitoring other parts of the landscape which are presently subject to known environmental change. Viewed from this perspective there is no need to have undisturbed controls anyway.

There is no doubt that the educational value of the WHA is extremely high. On the other hand, disturbed systems like urban, agricultural and/or forestry areas are also excellent environmental classrooms and they are almost ubiquitous. Some would argue that ecological research for the purposes of education in these areas is required more urgently anyway.

Perhaps my main goal in writing this article has been to shake the pedestal of science and scientists in WHA management a little, rather than condemn it outright. From this narrow perspective, as discussed above, scientific research activities can result in disturbance to natural systems. Where the risk of disturbance becomes too great these activities should be curtailed. Where the benefits to in situ management are great these activities seem valid. Thus, to be justifiable, in my opinion, scientific research in the WHA should be issue or management oriented, and broad, acknowledging all elements of the biotic and abiotic environment. This way knowledge will continue to accumulate but potential damage caused by the research itself will be limited and outweighed by benefits to problem solving. Policies for the WHA which allow for the open slather, inventory-type ecological research which has been practiced in the past, whether intensive or extensive, should be critically re-examined. Viewed from this perspective, ecological research in the WHA of the exploratory type, monitoring type or for the purposes of education, are similarly difficult to justify.

As a final note (disclaimer), I acknowledge that a fuller treatment of this subject must include at least a discussion on the concept of "naturalness" as it applies to "wilderness" areas like part of the WHA. Similarly, a detailed discussion of the role of science in decision making, in determining the values which society upholds, is required. Perhaps these topics might form the basis for further articles.

THE INCIDENCE OF MARINE DEBRIS IN THE SOUTH-WEST OF THE WORLD HERITAGE AREA

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INTRODUCTION

Plastic items and other human sourced debris are now common pollutants of the world's oceans, with an estimated 6.4 million tons of debris discarded into them each year (Laist 1987; Younger 1992). In Australia, we are now discovering that our coasts are increasingly polluted with debris. This debris washed ashore presents problems for land, wildlife and fisheries management. It diminishes the scenic value of beaches, incurrs hefty costs in tourism loss and cleanups and can be a navigation hazard, causing damage to equipment and vessels. Most alarmingly, debris which is adrift endangers many species of marine wildlife through entanglement or ingestion, a threat that is now well documented for marine mammals (Fowler 1988), seabirds (Day *et al.*1985) and other animals (Laist 1987).

For effective action to be taken, it is important to determine the type, quantity, distribution and sources of debris. This information is being collected in many countries through beach surveys. Here in Tasmania, a community based marine debris research/education program was established in January 1990 (Slater 1991), and is the first such comprehensive, state-wide survey in Australia. This paper reports the results of the beach surveys within the southwest of the WHA and discusses their management applications.

METHODS

A survey form was designed for the project which records information about 49 items of 19 categories (Slater 1992). Between January 1990-June 1991 ten beaches and one island in the southwestern section of the WHA were surveyed: Prion Beach, New River Beach, Window Pane Bay, Hidden Bay, Wilsons Bight, New harbour, Noyhemer Bay, Ketcham Bay, Osmiridium Bay, Louisa Bay and Louisa Island. Fourteen sites were included covering a distance of 15.7 km. Statewide a total of 150 sites were surveyed during the same period.

RESULTS

Debris from the WHA sites accounted for 5% of the State total (50,211 items). This represented an average of 165 items/km compared with an average of 300 /km statewide. The debris was composed of plastic (61%), foam (2%), metal

(21%) and glass (16%). Non-plastic items consisted mostly of drink cans and bottles (stubbies!). Fishing debris made up 80% of the 1,528 plastic items recorded, which is twice the statewide average. The most common items of fishing debris were nylon rope, strapping bands, bait holders (baskets) and ice bags/liners. Sixty-four plastic containers were recorded, mostly large buckets, crates, drums and barrels, probably also sourced to fishing. One 300m length of nylon longline was found on Louisa Bay and a tangled 200m long ball of black plastic packing twine on South Cape Bay. In the WHA, items identified as harmful to wildlife through entanglement or ingestion (Manski *et al* 1991) accounted for 40% of plastic. On a statewide basis they comprise 59%. Five cases of entangled wildlife were recorded from sites in the WHA:

- Fairy penguin (*Euclyptula minor*), in fishing rope, South Cape Bay, 1992
- Gannet(*Morus serrator*), in plastic strapping, Pedra Branca Island 1991
- Gannet, in nylon line, Pedra Branca Island 1991
- Australian Fur Seal(*Arctocephalus pusillus*), in plastic strapping, Pedra Branca Island 1990
- Australian Fur Seal, orange-roughy trawl net, Pedra Branca Island 1991.

Five foreign items were found. Four were Japanese (plastic buoys, saki bottle, tin) and one was French (food container).

DISCUSSION

Although featuring some of the most remote and unspoilt coastline in the southern hemisphere, a closer look reveals the WHA coastline to be littered with a large amount of potentially harmful and enduring plastic debris. Similar findings have been made in debris surveys elsewhere, with plastic always dominating (Slip 1991; Debenham and Younger 1991; Ryan 1989). Most of the WHA debris seems to be derived from oceanic sources, indicating significant pollution occurring from activities like fishing, boating and shipping. For example, the large ball of packing twine probably came from a factory ship. Land-based recreational debris, e.g. drink cans and bottles were mainly found at popular campsites and anchorages (e.g. Louisa Island, Noyhemer Bay, New harbour) highlighting the need for more public education about camping and boating habits.

The main commercial fishing operations in the WHA region are trawling, longlining and cray fishing. Most gear now used is plastic. In this and other Tasmanian studies (Kirkwood *et al.* 1992) it has been found that debris from these operations, such as fishing line, net, rope and strapping bands, are the major causes of entanglement of marine animals in this region. For example, strapping bands in our waters can be confidently sourced to both local and international fishing where they are used to secure cardboard cartons of fishbait (2-3 straps/

carton). This material is a hazard to both birds and marine mammals by causing entanglement. It is estimated that the Japanese longline fleet, in Tasmanian waters from April-August, remove 4,900-6000 straps a week from bait boxes and many are discarded overboard. The findings of this study have since been used to support the development of a new bait box for fishermen without the strapping (Slater 1991).

The amount and variety of nets recorded reflect the intensity of commercial trawling and recreational netting occurring off the WHA. For example, the orange-roughy trawl fishery is presently concentrated off the WHA coast, south of Pedra Branca and Maatsuyker islands. The nets average 60m and are of distinctive braided bright green nylon. Over six thousand net tows are deployed annually in the WHA region to a depth of 1500m over rugged seamounts where the fish form spawning aggregations. Nets are regularly 'hooked up' or lost on this rugged bottom, contributing to the growing debris problem from this fishery (see Dec.1990 issue of *Fishing Today*). Marine mammals such as sperm whales and elephant seals risk entanglement in these snared nets when deep diving in the region. Nets are also repaired at sea accounting for the large amount of offcuts washed ashore. The large piece of nylon longline found at Louisa bay could have come from local or Japanese longline fishing in the region.

Rope, the most frequently occurring debris item for both the WHA and the State, is also sourced to many types of fishing and is responsible for the penguin entanglement recorded. Australasian gannets breeding in the WHA have been observed lining their nests with rope, mistaken for traditional nesting material (seaweed) (Mooney pers. comm.). This results in entanglement of chicks and adults.

The interplay of oceanic and local currents means our debris problem is also part of the global garbage. Two major currents meet in the WHA region: the Antarctic circumpolar currents from the west, sweeping debris across the South Atlantic and Indian oceans and the Eastern Australian current from the Pacific. Experiments with ocean driftcards deposited in the Atlantic show that the Antarctic circumpolar current carries debris to Australia's souhern beaches (Wace 1990). In summer, both currents merge just near Pedra Branca island, where any debris is likely to accumulate until washed ashore by local winds and swells. It is ironic that such an isolated place is suffering the effects of such global and local pollution. A fact reflected in the entanglement of its wildlife.

The information collected during this study has already been of use to wildlife, fisheries and WHA managers in identifying and targetting groups for education programs, such as the recently launched Department of Parks, Wildlife and Heritage Environmentally Friendly Fishing and Boating Education Program and the WHA track rangers program. It also assists managers in identifying pollution hot spots along the coast so that costly cleanups can be better targetted.

For example, in Tasmania's WHA the collection of only 20 bags of coastal debris cost the DPW&H approximately $4000 to remove and ship back to Hobart.

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TASMANIAN FIELD NATURALISTS CLUB INC.

G.P.O. Box 68A, Hobart, Tas. 7001
Founded 1904

OBJECTS

The Tasmanian Field Naturalists Club aims to encourage the study of all aspects of natural history and to advocate the conservation of our natural heritage. The club is comprised of both amateur and professionals who share a common interest in the natural world.

ACTIVITIES

Members meet each month in the Biological Sciences Building at the University of Tasmania Sandy Bay. These meeting include a guest speaker who provides an illustrated talk. This is followed by an excursion on the next Saturday to a suitable site to allow field observations of the subject of that week's talk. A mammal survey group also undertakes trapping and recording of native mammals each month. The Clubs' committee coordinates input from members of the Club into management plans and other issues of interest to members.

THE TASMANIAN NATURALIST

The Club publishes the journal, *The Tasmanian Naturalist*. This journal provides a forum for the presentation of observations on natural history and views on the management of natural values in both formal and informal styles. Examples of material included are flora and fauna surveys, observations of unusual or unknown aspects of a species' natural history, overviews of contemporary issues, views on the management of natural values and book reviews.

MEMBERSHIP

Membership of the Tasmanian Field Naturalists Club Inc. is open to any person interested in natural history. *The Tasmanian Naturalist* is distributed free to all members, the club's library is available for use and a quarterly bulletin is issued with information covering forthcoming activities. Enquiries regarding membership should be sent to The Secretary at the above address or to the Clubs' President Don Hird can be contacted by phoning 344293.

Membership Rates 1992	
Adults	$17
Families	$20
Concession	$13
Junior	$13

Subscription Rates for *The Tasmanian Naturalist*	
Individuals	$12
Libraries	$16
Overseas postage	$2