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Urban Bush Management

URBAN BUSH MANAGEMENT

Proceedings of a Seminar
held at Gosnells, WA
on 23rd June, 1992

by

Australian Institute of Urban Studies
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Department of Conservation and Land Management
The Tree Society

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FOREWORD

It was just under 10 years ago that the then Western Australian Department of Fisheries and Wildlife held a seminar titled *The Management of Small Bush Areas in the Perth Metropolitan Region*, in 1983. It was intended that the seminar ***Urban Bush Management***, of which these proceedings are a record, would examine much the same theme and investigate progress over the intervening period. Several people participated in both seminars, either as speakers or in the audience.

The first seminar made pleas for:

1. More research

2. Stronger environmental protection

3. More extensive use of management plans

4. Greater integration of development and conservation matters.

Since 1983 more research has indeed been carried out, some of which is documented in these proceedings.

In relation to stronger environmental protection, the State of Western Australia took a quantum leap with the *Environmental Protection Act 1986*, which many would say was, and still is, the best legislation of its type in Australia. And there has certainly been, over the past nine to ten years, much more extensive use of management plans, some of which, again, is documented within these proceedings.

In relation to the last item, greater integration of development and conservation matters, there has however been little progress. I addressed that seminar almost 10 years ago on this topic and made the following points:

"The National Conversation Strategy for Australia (NCSA) formally adopted in 1983, identified insufficient knowledge and understanding of issues and inadequate planning for integration of conservation and development, as presenting major obstacles to achieving NCSA objectives. Two priority national actions were highlighted for improving the capacity to manage:

> *28(c) Integrate land use planning and environmental assessment by encouraging a multidisciplinary approach (including socio-economic effects) to ensure that conservation and development issues are not addressed in isolation.*

> *28(g) Review, and where appropriate revise, the charters of single purpose government authorities to enable them to take account of both conservation and development objectives."*
>
> NCSA(1983)

Then, as now, both the State's environmental protection and town planning acts were subject to review but were unlikely to be combined.

In the *Western Australian* newspaper the day before the *Urban Bush Management* seminar there was a report that the Conservation Council of Western Australia, in its submission on the review of the *Environmental Protection Act* opposed suggestions that the Environmental Protection Authority be merged with the Department of Planning and Urban Development. This was at variance with the Council's long held view that there should be more integration and has arisen from growing mistrust of the town planners' impartiality in the land development process.*

It is my firm belief that the administrative functions of these two agencies do need to be more closely co-ordinated, but that we still need an independent environmental protection watchdog. Because a combined administrative agency is unlikely to become a reality in the short term, it is probably more productive at present to concentrate on correcting the imbalance of the existing town planning legislation, by incorporating direct reference to wildlife conservation, which is now lacking.

Western Australia's *Town Planning and Development Act* (TPDA) of 1928, as amended, makes scant reference to the natural environment. An amendment in the mid 1970s permits (State) Statements of Planning Policy to include 'conservation of natural resources for social, economic, environmental, ecological and scientific purposes'. However the closest references to wildlife conservation in the First Schedule to the act, which specifies matters which may be dealt with by local town planning schemes, are as follows:

> *2. Parks and open spaces generally; and particularly public reserves, gardens, playgrounds, sports and recreation grounds, public and private camping grounds and reserves, drill grounds, aviation grounds, public squares and other open public spaces, and fences, railings, monuments, statues, buildings, and other erections or works on parks, open spaces, public squares, and other public places.*
>
> *11. Conservation of the natural beauties of the area, including lakes and other inland waters, banks of rivers, foreshores of harbours, and other parts of the sea, hill slopes and summits, and valleys.*
>
> *12. The preservation of historic buildings and objects of historical or scientific interest.*
>
> TPDA (1928)

In 1986 clause 11A was added to the act, to include the preservation of trees and shrubs and the planting and replanting of trees and shrubs, which was a significant step forward. There is still no direct reference to wildlife, fauna or fisheries, although it can be argued

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* See Hipkins M (1992) *Enivronmental Imperatives in Strategic Planning in Western Australia,* paper to 11th National Environmental Law Conference, Perth, 20-22 September 1992

that these items are indirectly covered by broad interpretation of the words 'park', 'conservation of natural beauty' and 'objects of scientific interest'. By its omission from the TPDA, wildlife conservation is discounted in importance by most people associated with town planning and the development process. The fact that the act does not recognise wildlife conservation as a legitimate land use in its own right creates severe impediments for the preservation and management of bush areas.

An amendment to the First Schedule of the act, to allow wildlife conservation to be addressed in town planning schemes, would be beneficial to both development and conservation interests. The more each knows of the other's concern, the greater the likelihood that energies currently being directed to confrontation can be re-directed, so that private interests can accept greater responsibility for conserving bush areas.

I made all of the above points at the *Urban Bush Management* seminar. Many of these points and a wide variety of others relevant to the subject were taken up in discussion both at the seminar and subsequently at Urban Bushland Workshops organised by the Wildflower Society of WA and Conservation Council of WA.

The conflicts between development and conservation interests over preservation of urban bushland were of such intensity in Western Australia that the later part of 1992 saw a number of positive initiatives:

- release of a Discussion Paper *Towards an Urban Bushland Policy for the National Trust.*
- the decision to form an Urban Bushland Council, for policy development by a coalition of interested groups, arising from work of the Conservation Council and National Trust.
- a state budget allocation to determine the extent of metropolitan bushland with conservation values.
- the availability of federal and state government grant funds for resident groups to preserve local bushlands.
- preparation of a manual on how to manage urban bushland, by Greening Western Australia.
- formation of The Confederation of Affiliated Residents and Ratepayers Associations of Western Australia (Inc) (CARRA), with general objectives of conservation and community involvement in government decision making.
- the reaching of an agreement whereby the Department of Conservation and Land Management (CALM) accepted responsibility for managing Perth's regional parks, although with the unsatisfactory financial arrangement of an ad hoc initial annual budget allocation of the paltry sum of a little over $1 million to cover everything from capital works to wages. (Compare this with the more financially secure and equitable situation in Victoria, where Melbourne Water manages Melbourne's regional parks, with funding through a percentage of rates, within the framework of *Open Space 2000*, which is part of an integrated plan for cleaning up Port Philip Bay).
- pro-urban conservation promises by both major parties in the lead-up to the 1993 state election.

Just why the subject of urban bushland preservation has such a high profile in Western Australia probably arises from Perth being unique among Australia's capital cities, in that surrounding lands are largely infertile and have not been intensively used for rural purposes, allowing large tracts of bushland to survive within urban areas to the present day. The value of these areas has now been recognised and with this the need for proper management to ensure their survival.

The timing of the *Urban Bush Management* seminar was certainly opportune and has relevance to all of Australia's urban areas.

Max Hipkins
National Chairman
AIUS

WELCOME

Pat Morris, Mayor
City of Gosnells

The City of Gosnells was previously involved with the AIUS when it hosted a seminar on Urban Crime in 1990. That seminar had resulted in some positive action and I hope that similar results will flow from this seminar on Urban Bush Management.

I am personally involved in urban bushland conservation through chairing the Greening Gosnells Advisory Committee, a Council/community committee concerned with the natural environment of the municipality. I am well aware of some of the touchy situations which arise when residents and bushland come into conflict.

I support and understand the importance of retention of significant areas of urban bushland. In this regard the City of Gosnells has two major undertakings:

Hester Park, Langford, a System 6 area which is now in the initial stages of development, includes protection and consolidation of several large conservation areas on the Canning River foreshore.

Ellis Brook Valley Reserve, Martin, where Council has undertaken the management of a 1400 hectare area of the Darling Scarp surrounding the actual Ellis Brook and the locally famous Sixty Foot Falls. This reserve is well known for its floral diversity and complexity.

The City of Gosnells is very pleased to participate in frank on open discussions on the subject of Urban Bush Management, to make the most of the opportunity presented by today's seminar, so that all may benefit from the experience of others.

OPENING

Hon Bob Pearce, MLA
Minister for the Environment

My personal view is that there is a need for greater co-ordination between planning and environmental legislation in Western Australia. Things are not so well done here and there is a significant mis-match between the legislation. However we are better off than most.

Both the environmental protection and town planning and development acts and their agencies have considerable areas of overlap but they also have substantial independent areas.

There is a rare opportunity now with both acts under review at the same time. I have asked the people drafting the legislation to be aware of this. A wide variety of groups, including the AIUS, have been asking for a single act for many years. This is a mammoth task and the more controls on legislation the more we strangle what is going on. However the State Government does need to address this issue in the next few years.

Management of urban bushland has been occupying many people's minds for a considerable time. Perth is really a backwater, where there was little urban growth until the 1950s. It was then that forward planning emerged – planning as good as most, which produced a city, in environmental terms, which was better than most. We don't have problems of other cities of our size. There are some things such as air pollution which are creeping up but, by and large, the corridor planning for our city has resulted in more areas of bushland accessible to the urban population than most other cities. The bush didn't have to be planned and a good part of it did not require management.

Eventually many bush areas became surrounded by urban development which posed threats to their existence. The way we manage these areas is now important and it is something we need to do better.

The City of Gosnells here is part of my electorate and it has experienced both good and bad management.

Mary Carroll Park was once very neglected and run-down. The Gosnells Council re-shaped the area to create a proper lake, a bird sanctuary and attractive natural surroundings. But then it became degraded again, not by being left alone but through excessive human use - people left rubbish, botulism killed wildlife, etc. It was students from Gosnells High School who saved the park when they approached Council for assistance and took over responsibility for maintenance. The area is now well managed again.

The example demonstrates problems and solutions with bush management and the importance of co-operative effort.

A century ago Australians were regarded as bush people. I don't know if it was true or not but from mythology Western Australian cities are not like larger cities such as Sydney, London or Los Angeles – we still live in more natural surroundings and we have the opportunity to retain the difference. To do this we must plan ahead and there is a need for good management of bushland. In this sense today's seminar, through the exchange of management ideas, makes a large contribution to maintenance of our lifestyle.

PAPERS

THE ENVIRONMENT OF PERTH

Bert Main
Emeritus Professor of Zoology
University of Western Australia

Introduction

The surroundings of Perth are its environment. Broadly, it can be considered as being composed of two parts – the landscape and the atmosphere. Under natural conditions the former changes slowly and the latter continuously, each contributes to the characteristic environment of the region.

Landscape

Perth is situated on a coastal plain with a long history. The eastern boundary of the landscape unit is known to have begun more than a billion years ago when the geological fault that now shows as the Darling Scarp, first developed. Later the fault developed into a rift valley, such as is common in Africa. Still later the land on the western part of the rift drifted away to become India and expose the floor of the indian Ocean. The characteristic elements of the Perth landscape have been shaped by subsequent events, particularly the deposition of sediments supplied from both the land and the sea in recent geological times. These now form the visible surface material of the coastal plain.

The origins of the sediments of the plain can be readily identified by their appearance as being derived from the hard rocks to the east of the scarp and the ocean floor to the west. Those with former origin are the gravels of the foot of the scarp and the Guildford clays to the west of them. The clays are the erosion products of streams flowing over the landscape to the east of the Darling fault. The principal streams are the Swan and Helena Rivers and their tributaries. The Bassendean Sands, the Coastal Limestones and the calcareous sands of the present coastline have a marine origin. A generalised geological map is illustrated in Figure 1.

The accumulation of marine sediments has been possible because sea levels have fluctuated during the recent geological past. Sea level changes have been caused by the advances and retreats of the polar ice caps. With each advance and retreat of the polar ice caps, in the numerous cycles of the pleistocene, water was withdrawn and then replaced in the oceans. These events lead to sea level changes of between one and two hundred metres. Thus sea levels were both higher, or lower, than the present. The falling sea levels exposed large areas of former ocean floor and the shelly and sandy sediments characteristic of such

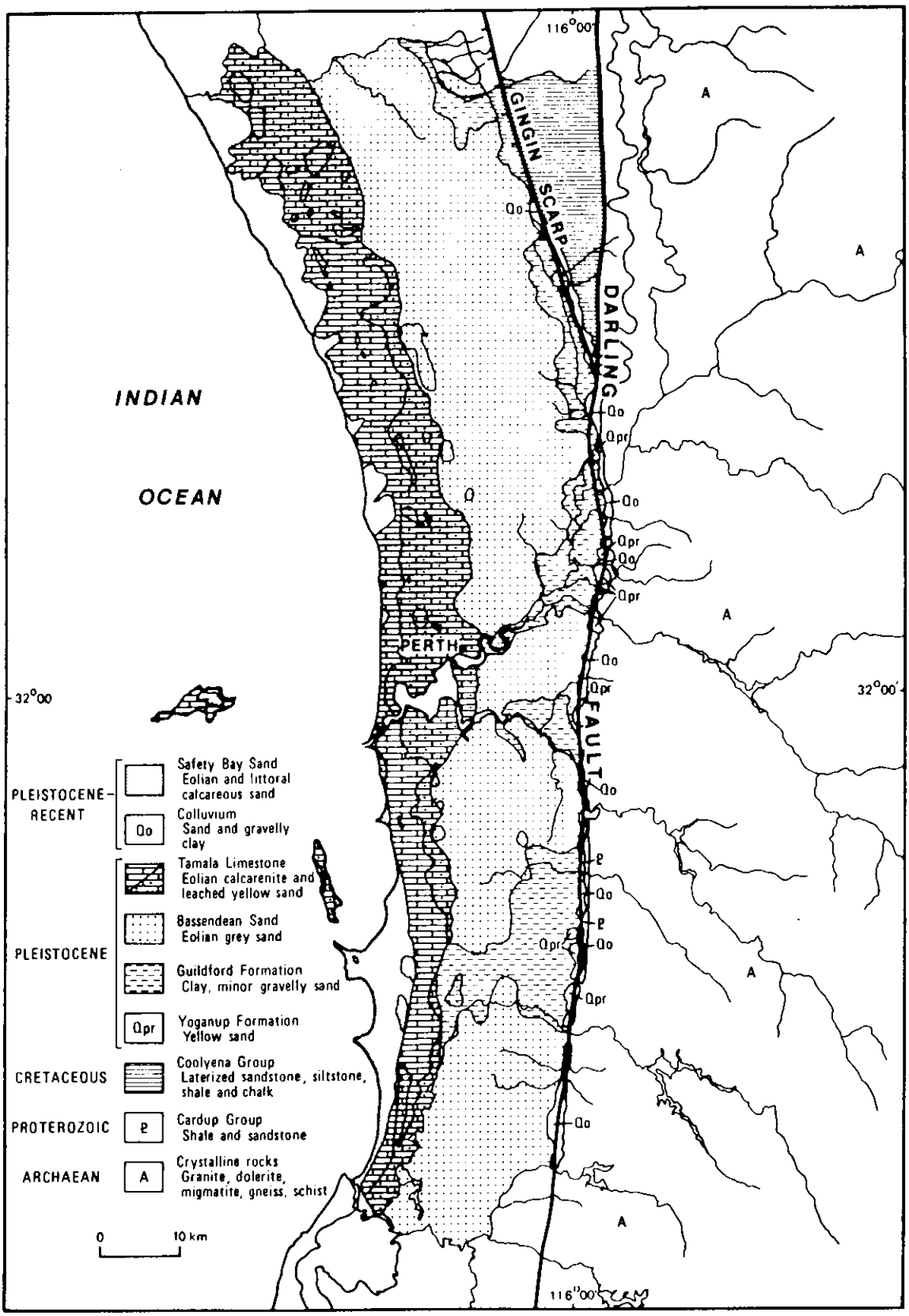

Figure 1. Generalised Geology of the Perth Region

a marine environment. With melting ice caps these sediments were flooded by the rising seas. At such times sediments were carried in front of the advancing seas and deposited as dunes. When the sands contained sufficient shelly fragments they later, after solution of the shells by rainwater, became the coastal limestone.

At times of lower sea level rivers incised their valleys into the coastal plain. When the seas were high these valleys were flooded. The present estuary of the Swan, as it crosses the coastal plain, represents such a drowned river valley.

The Atmosphere

The atmosphere affects Perth's environment through weather associated with the passage of a series of eddies in the global atmospheric circulation which pass from west to east around the world. We recognise these eddies by the atmospheric pressure associated with them. They are commonly referred to as low(cyclonic), or high (anticyclonic), pressure cells. The former is associated with wet, and the latter with fine weather. As the seasons progress the latitude at which these cells circulate in the atmosphere changes. Thus in winter lows are at low latitudes (a more northerly track), and so tend to occur more frequently at the latitude of Perth. The cold fronts associated with them produce the typical winter rainfall. During summer the lows are at high latitudes (further south), and Perth comes under the influence of high pressure systems centred over the continent. These are well known for their hot dry easterly or north-easterly winds which may be accompanied by dust clouds. On most days of summer the hot conditions are relieved by local sea breezes caused by the differential heating of the continent and ocean. The heat-wave conditions which are common between January and March should serve as a reminder that Perth is located on a narrow strip between the ocean and the desert.

When pressure gradients are diffuse, as between adjacent high pressure cells, winds are weak or absent and air moves very little. Moreover, at such times the normal decline in temperature with altitude may be reduced or reversed resulting in a temperature inversion. Under such conditions polluted air within the city and adjacent industrial areas is neither diluted not dispersed. Furthermore, during summer the sea breezes tend to carry air from the industrial areas south west of the city over the city and these may be returned overnight when the easterlies re-establish. Over time these polluting events may influence the persistence of native vegetation within the Perth region.

Soils

The sand soils around Perth have a high capacity to absorb water especially from winter rainfall. This water accumulates as ground water and, when the soils are fully charged, emerges at the surface in low lying areas as swamps, marshes, or lakes. The depth of the water-table depends on a balance between: sea level, rainfall, through-flow to the sea, transpiration by plants and abstraction by humans. The nature of the soils and the depth and accessibility of the ground water determines the natural vegetation characteristic of the various habitats found around Perth.

Discussion

The foregoing brief review makes it clear that the environment of Perth has been determined by its history. What nature was able to do with the products of history was very distinctive and if we wish to pursue a policy of sustainable development the historical legacy cannot be ignored. The environment will impose limits on us just as rigorous as it did on Nature. For example atmospheric circulation will determine where what is discharged into it will be

carried. Similarly the characteristics of the water table will determine what modifications can be tolerated while retaining acceptable qualities. Thus acceptability of discharging pollutants into the ground water will depend on toxicity, quantities, and where it will be transported by through flow. Finally withdrawal of ground water, which is an immensely valuable resource, is constrained by any perceived need to retain the present wetlands. However even in areas where withdrawal of ground water is unlikely to lead to loss of wetlands care must be taken to avoid taking so much that fresh water is replaced by an intrusion of salt water.

But the environment is not static. It should be remembered that many of the present permanent wetlands are only of recent origin. They have been formed by a rising water table when one source of water loss, namely transpiration of water by plants, had been removed by the clearing of adjacent land. Moreover, the present wetland situation differs markedly from that of the cold drier glacial periods when sea levels were much lower than at present. These circumstances probably lowered the ground water table so reducing the amount of surface fresh water on the coastal plain.

Successful management of urban bushland will need to take into account history and natural dynamics of the environment as well as urban impacts, as will become clear from the papers which follow.

PLANNING FOR BUSHLAND PROTECTION AT THE REGIONAL LEVEL

Ian MacRae, Acting Manager
Metropolitan Strategy Branch
Department of Planning and Urban Development

Introduction

I will make a few comments relating to the regional issues associated with the protection of urban bushland. Firstly relating to the extent to which the planning system does accommodate bushland protection, and secondly the extent to which ever greater requests for bushland protection can be afforded or are really needed.

Planning for Environmental Protection

Regional Open Space

The metropolitan region has 35,420 hectares of regional open space. At a cost of $110 million, 15,500 hectares have been purchased over the past 30 years. The regional open space system is an incredible achievement with no parallel in Australia. In addition one can feel reasonably confident that the 150,000 hectares of State Forest will remain as a bushland resource for the long term. In this region of 532,000 hectares it is unlikely that more than 40 percent would ever be urban – 18 percent is currently committed for urban, industrial, public purposes or transport uses. Within the so-called urban areas, over 10 percent is set aside for public open space and outside of these areas sizeable areas are formally reserved as Regional Open Space or to some degree serve an open space function. (Refer Figure 1).

The regional open space system aims to protect natural landscapes of regional significance. When you think about the main physical features of the region it is difficult to think of one not represented in the regional open space system. The scarp, the wetlands, the rivers, the ocean foreshore are the obvious features. While not all of the scarp, wetlands, rivers or foreshore are protected, certainly a large portion is and there are certainly large representative portions of each feature protected.

In addition regional open space has been, and is being, set aside for the protection of bushland containing environments representative of the original vegetation of the coastal plain. Those characteristic of the Bassendean dune system in particular, where the extreme infertility of the areas have resulted in relatively little clearing, are areas where regional parks are being established north and south of Perth. Whiteman Park is regarded by some as the best protected banksia woodland in Perth. It has grown back with good management. In the future the Jandakot botanic Park may offer similar protection.

Corridor Planning

Early planning of subregions now takes place in a more thorough fashion than ever before. The Department of Planning and Urban Development's corridor structure plans are undertaken with the assistance of environmental audits which identify the physical resources and the ecological priorities for protection. By the act of undertaking such an audit we are not necessarily saying that every environmental value identified will, or could be, protected. In the final analysis judgements have to be made using this information along with information comparing the resource with areas elsewhere in the region, taking account of the cost of

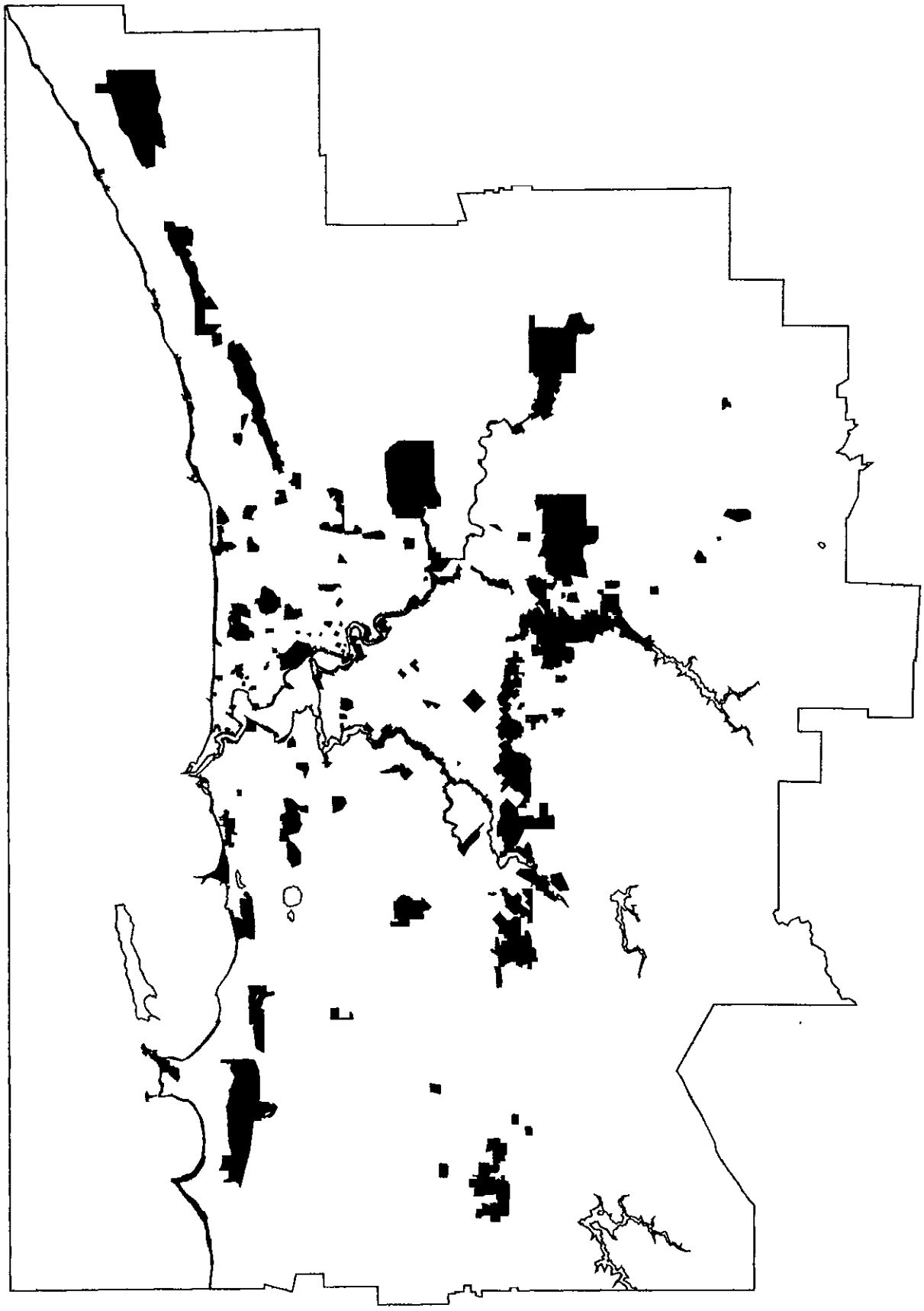

Figure 1. Regional Open Space Reserves in the Metropolitan Region Scheme
Source: Cartographic Services Branch, DPUD

protecting the resource and the possibility of producing the plan for urban development in the interests of the whole community. But it needs to be stated that the structure plan provides a long term framework for the planning of urban corridors which uses as a starting point a full assessment of the physical environment.

Increasingly this physical resource assessment is being accompanied by a very large commitment to canvassing the public views. Both in the South West and North East Corridors major public participation programs have been recently established to assist in the development of the structure plans. Whether the community advisory committees place a high priory on bushland protection remains to be seen.

At a region-wide level the Department of Planning and Urban Development is intent on preparing an environmental plan for Perth to examine long term appropriate regional open space areas. This will also help us to address developing issues relating to the nomination to the Australian Heritage Commission of areas for the National Estate. Recent nominations, such as for Hepburn Heights, Bushmead and Jandakot airport, are for bushland areas that need to be assessed in a region-wide context.

Landscape Interest Zoning

There is a move towards using zoning to protect regional landscapes where public access is not required. Since the early 1980s we have been investigating the means by which we can protect natural areas without creating a greater burden of public debt.

It is particularly in areas such as the scarp and the foothills where it is the protection of the view which is paramount – and this includes the associated vegetation – that landscape interest zoning is likely to be successful. From a survey I undertook of landowners in 1982 it was apparent that affected landowners where public access was not involved, would often welcome strict zoning as a way of ensuring that their wider environment was secured in perpetuity. Planners in Western Australia do tend to be too conservative with zonings that take away rights without giving anything back. It tends to be overlooked that in selected areas landowners are as keen to protect the environment as we are. Moreover the fear planners have at having to prosecute a landowner who chops a tree down is rarely put to the test.

To date the Metropolitan Region Scheme (MRS – refer Figure 1) has not included such a zoning although some local authority schemes do. It is likely that a landscape and/or conservation zoning will be introduced into the MRS in the near future to address the growing demands from the public for landscape protection while recognising that reservation and acquisition of vast areas are beyond the means of the public purse and may in some cases be unnecessary. Certainly this is a policy of the Metropolitan Strategy as outlined in *Metroplan*.

That's the good news.

The Implications of Over Planning for Bushland

The most difficult issue to address relates not to the major undisputed areas of regional landscape, but the areas of remnant vegetation occurring in land earmarked for future development. In some recent instances the values in this vegetation are not unique.

As pointed our earlier, the Perth region's main natural physical features and their associated vegetation are represented somewhere in the regional open space system. But to many it is not sufficient to have the major example of, say, banksia woodland, protected. An example is wanted in each sub region – in each locality or wherever it is found. There is always some small attribute of one area that appears to make it unique from others.

The direct cost of reservation and acquisition of larger and larger areas is becoming prohibitive.

The continual management cost is of growing concern. Moreover often the advice we receive from experts inside and outside government is that while a particular parcel of land should be protected from development, no one wants to manage it. No wonder, who has the budget? It was recently estimated that Sydney councils spend $85 million a year maintaining open space (*Outdoor Recreation and Open Space*, Department of Planning, 1992). Landscape interest zoning may be suitable for some areas where public access is not required. But in other instances, if the owners are not willing, or within closely settled urban areas, the bushland will surely be lost if not properly managed.

There are less obvious indirect costs to us all of what I would call over-zealous bushland protection.

The cost of protecting urban bushland is reflected in the price of residential land. Where urban services have to pass by, and when additional parcels have to be given up on subdivision, developers have more overheads and less purchasers to spread it around. These costs are passed on. They are not insignificant. When we are talking in terms of figures of $100 million or so to provide basic services to a new major urban cell, to suggest taking out 100 hectares (and the resulting 1000 lots) results in very significant costs being passed on to the other buyers. Moreover in the longer term additional costs are passed onto future residents in being forced further out, with all that implies to our would-be sustainable city, and to the general community through government services having to be spread across a wider area.

To illustrate this take the example of the South West Corridor. If we plan around all claims for existing and proposed open space, remnant vegetation, landscape protection and various buffers for industry and environmental concerns, we end up with a yield of 2 dwellings per hectare for the urban corridor. How do you justify a $300 million rail system for that density?

A similar situation is developing in the North East Corridor. There comes a point where you do not have an urban corridor, yet people still expect to enjoy full urban services.

Everyone can agree that it would be nice to protect bushland within an urban setting. But those campaigning for it rarely perceive of the impact it will have on them and their families in paying for it and having to forego other things to secure it and manage it. Moreover there is no point in protecting something that will be lost through bad or inadequate management.

Conclusions

Our regional open space system is an incredible achievement of foresight and planning. More recently we are planning our corridor development more closely with environmental issues foremost. In addition new techniques of protection are being developed, such as landscape interest zoning. The emphasis of the long term metropolitan strategy is to further reserve and acquire land for the establishment of key regional parks focused on the major wetland chains (in Wanneroo and Beeliar), the Jandakot area, the Darling Scarp, the Swan

and Canning river foreshores, and coastal areas at Woodman Point and Port Kennedy.

But let us not overlook the costs to the community in over zealous protection of bushland. Direct costs in purchase and management are one thing – but the costs resulting from a distended urban form are more serious and pernicious in the long term such a distended urban form puts pressure on a vaster area wherein bushland is currently not under threat. This is a metropolitan region. The land within it must primarily serve the population.

We should protect the best where it can be managed as a sizeable unit. The example of Whiteman park stands out – with management a denuded landscape can grow back if managed and located in the right place. To set aside land does not necessarily guarantee its proper management.

This is a well planned city and we have achieved much in the protection of regional landscapes over the past 30 years. Elsewhere in Australia they might argue passionately for the protection of remnant vegetation. But no wonder, their cities have not been planned so early and so well with the protection of large parcels of regional bushland in mind.

URBAN CONSERVATION: WORKING TOGETHER TO LOOK AFTER BUSHLAND

Fiona Keating, Manager
Urban Conservation Branch
Environmental Protection Authority

Introduction

We all know that bushland areas are important. They provide habitat for native fauna and conserve unique flora. It is not only large wilderness areas that provide sanctuaries for our plants and animals, many small reserves in urban areas fulfil such roles. Our bushland is also important for recreation and education. It is also vital for maintaining air and water quality. In our cities bushland has an irreplaceable scenic value by dividing the urban sprawl. Bush also makes people feel good.

Given this range of values and functions it is not surprising that so many people and groups have a role to play in looking after our bushland, particularly in urban areas where there is the greatest number of people and where the land use pressure is most intense. Governments (Local, State, Commonwealth), communities, businesses, educational institutions, voluntary conservation groups with broad and specific interests, and national and international institutions can all contribute to looking after urban bushland.

I would like to discuss the vision of the Environmental Protection Authority (EPA) for urban conservation in Perth, the various people and groups we interact with in the course of our work, and give some examples of achievements made through people working together.

Urban Conservation in Perth: The Vision

In the early 1970s the EPA appointed a committee to formulate proposals for a statewide network of parks and reserves throughout Western Australia.

For the purposes of their study, the committee divided Western Australia into twelve regions which they called Systems, and they labelled Perth and its hinterland the greater metropolitan region as System 6.

The System 6 study aimed to identify the special parts of the environment near Perth which should be set aside for conservation, recreation and landscape purposes. In its identification of these special areas, the study recognised that the metropolitan area would continue to grow and that land would be required for a range of uses. It thus sought to achieve a balance between conservation and development.

In the metropolitan area the System 6 nominations included large portions of the Darling Scarp; proposals for our rivers and their foreshores – the Swan and Canning estuaries and their tributaries; many wetlands close to Perth and on the fringes of the metropolitan region around Wanneroo and Rockingham; and areas along our mainland coast, adjoining marine environments and offshore islands such as Rottnest. Being able to see and enjoy these areas is taken for granted by most of us and accepted as being a part of the Perth lifestyle.

The report highlighted the importance of making these areas secure for conservation or a similar purpose and the need for them to be managed under a plan prepared with public comment.

There was extensive community consultation and participation by interest groups during the formulation of the System 6 report before its endorsement in principle by the State Government in 1984.

Urban Conservation In Perth: The Players

After Government endorsement of the System 6 report, considerable success was achieved in setting aside areas recommended for conservation in the forest part of the region outside Perth.

Some progress was being made in the metropolitan area, but concern about the lack of security for many of the System 6 areas close to Perth, the fact that a lot of these areas were losing their special values through lack of management, and that others were coming under pressure to be developed led to several of Perth's conservation groups approaching the EPA in late 1990 to see how the matter could be redressed.

The EPA responded to the concerns by agreeing to work co-operatively with these groups to help raise the profile of System 6 in the community and to develop public ownership of these areas.

The need to raise awareness about System 6 was based on the belief that although the study had received extensive publicity during its formulation, since it was finalised many people had forgotten about it, or thought that because of its apparent low profile it was no longer relevant. At the same time, there were many groups forming to respond to issues affecting their local bushland area some of which were included in System 6, some of which weren't.

The EPA respected the rights of people to develop and express views on what was happening in their local environment, but was concerned that many people had forgotten or were unaware of the System 6 report and its status. For what the System 6 study attempted to provide was a clear statement of the special conservation areas near Perth which should be afforded appropriate security; and conversely give an indication that areas outside the System 6 nominations would not have the same conservation constraints to development. This does not necessarily mean that all areas outside System 6 are not environmentally significant. But while it was not perfect or absolute, the System 6 study provided a high degree of security and a solid framework for conservation and development areas in Perth.

In our efforts to revitalise System 6 within the community we thought the net should be cast wide to include the general public, service clubs, environmental groups and schools. With this in mind we prepared information packages to help spread our message, and in the process sought the assistance of teachers and the Ministry of Education for the schools component.

In April 1991 **System 6 – Ecoplan** was jointly launched by the Minister for the Environment and the President of the Conservation Council. The scene was then set to involve more schools and the broader community.

We involve the community mainly by recruiting and training volunteers who have an interest in urban conservation.

Through these training programmes we invite Government and non-Government organisations to make presentations. This includes various community-based groups and schools who are already active in looking after bushland areas, plus key Government

agencies who have a role to play in the setting aside and on-going management of System 6 areas. This includes the Department of Planning and Urban Development, the Department of Conservation and Land Management and the Swan River Trust. Local authorities are also very important for System 6 and many have participated in the training programmes.

By involving these groups and agencies we hope to increase people's awareness about the role of these organisations in urban conservation, the factors they consider in the course of their work, and how the community can be involved in their processes. It also serves the purpose of opening up the communication channels between the bureaucracy and the community, and provides insight into how the various Government and non-government agencies interact with each other on urban conservation matters.

More recently, the EPA has established closer links with Government agencies and local authority groups in an effort to achieve the System 6 objectives through the necessary bureaucratic processes. This programme has also been formed on the basis of people working together, and although limited resources will constrain progress it is hoped that we will achieve greater things for urban conservation by more direct and regular communication.

I haven't mentioned developers and their consultants yet. Although they haven't been directly involved in any of the major programmes aimed at implementing the System 6 recommendations, they have an interest and important role to play when they own land or are developing a proposal which encompasses or adjoins a conservation area. Developers and their consultants normally liaise with agencies such as the EPA about the impact of their project on urban conservation areas and are increasingly speaking directly with interested communities.

Urban Conservation: The Outcomes of People Working Together

So what can be achieved by people working together on urban conservation issues? I have a few examples of success stories from throughout the metropolitan area which I would like to share with you. Some of these are a direct outcome of System 6 – Ecoplan, others have arisen independently but have connected in to Ecoplan in some way.

What they highlight is that many people are involved in looking after Perth's conservation estate and that with the skills, time and enthusiasm of communities combined with assistance from local authorities, Government departments and other organisations that there are on the ground benefits for our bush.

Armadale and Gosnells

The Armadale Settlers Common is an area of land near Churchman Brook. It is largely vested in a local authority - the City of Armadale, with a significant portion owned by the Department of Planning and Urban Development. A community advisory group prepared a management plan for the area which has been endorsed by the Armadale Council. The group with assistance from the Council and Greening Western Australia is undertaking tree plantings to rehabilitate portions of the area degraded by past land uses. With the help of the Department of Planning and Urban Development, the group has now acquired a disused building on-site and is working towards the setting up of an environmental education facility for use by schools and local groups.

Also in this area, the City of Gosnells and their local residents and schools have for some time worked together on a range of wetlands and bushland areas in the district such as the Hume Road reserve, Mary Carroll Park and Ellis Brook valley. In the coming months the

Council, with money from the Commonwealth Save the Bush programme, the Gordon Reid Foundation, two local service clubs and a little bit of help from the EPA, will run a bush regeneration course for the local community. This course will give people the skills necessary to care for bushland areas in the Gosnells district. The long term benefits of this for the community and the bushland will be enormous.

Bayswater

The Bayswater Greenwork group decided a year ago that they would become caretakers of the Swan River foreshore reserve near Garratt Road bridge. The vegetation and hydrology of the area were considerably altered by the establishment of a cycleway through the wetland. The group conducts regular Saturday morning clean-ups of the area which involves pulling out large areas of pampas grass and typha, and they will be regenerating with rushes being grown by the Kings Park Board. The Swan River Trust has provided assistance to the Greenwork group to enable it to work towards a long term plan of rehabilitating the area. The Gordon Reid Foundation has provided funding to the group for the purchase of equipment necessary to do its work.

Parkerville

The Parkerville Primary School has adopted a bushland reserve adjoining the school grounds. The school makes use of the reserve as a teaching resource for environmental education and for mainstream subjects such as maths, science and writing. Students at the school have been involved in recording plant species on the reserve and through this are increasing our knowledge about that local environment. Parents, teachers, school staff and friends, with technical advice from the Department of Conservation and Land Management, are working to treat die-back infested trees on the reserve. The successful incorporation of the reserve in the school's teaching programme was suitably rewarded last year when they received a Ministry of Education innovation award.

Wanneroo

Residents living in the Joondalup area have formed a Friends of Yellagonga group. The Department of Planning and Urban Development has released a proposal to establish the Yellagonga regional park under which Lake Joondalup and nearby wetlands would be set aside and managed for conservation and recreation. The friends group is in its early stages and recently held a meeting well attended by local members of parliament, local councillors, representatives of Government agencies, local recreation groups and other interested individuals. They now have draft aims and objectives which seek to ensure the long term environmental sustainability of the area. Once again, the Department of Planning and Urban Development has been very supportive of the friends group offering assistance for upcoming activities such as busy bees.

Working Together: The Challenge

Many players are obviously involved and contribute to urban conservation in Perth. Some provide money, some technical advice, some other forms of support such as use of facilities, with many doing the work of managing, regenerating and caring for Perth's reserves.

If anyone is under the illusion that achieving results is easy then think again about what is involved. The issues are complex. Sometimes there are a number of Government agencies and local authorities with an interest in an area and these need to be dealt with. Community groups are generally composed of a diverse group of individuals with many different ideas

that need to be talked through. Then there are the issues affecting the reserve itself and how it is best managed. The views of the Government agencies, local authorities and communities and the needs of the bush then have to be brought together and converted into an action plan.

The ingredients of the successes I have witnessed have been a little bit of money put in by various departments, local authorities and funding groups; a lot of skills and time particularly by the community; there has been a mutual commitment by all parties to work through the issues; and there has been a lot of perseverance.

The challenge for us in Perth is to further combine our skills and resources so that as the metropolitan area expands our bush has a better than even chance against the pressures of a growing city. Communities need to translate their obvious environmental concern into action, Government departments need to strive to make sure that community involvement becomes an integral part of their operations where appropriate, and local authorities who are closest to the people and the bush need to take a pro-active approach in urban conservation. These things are already happening to some extent but they need to occur on a much wider scale.

I would like to end by referring to the new world conservation strategy. It has as its philosophical basis that caring for the earth is everyone's business. This is as fundamental to looking after our bushland areas here in Perth as it is to dealing with any other environmental issue in any other part of the earth.

FLORA OF THE SWAN COASTAL PLAIN

Robert Powell, Special Projects Officer
Department of Conservation and Land Management

Vegetation Types

The Swan Coastal Plain is part of the South-West Botanical Province, the south-west corner of Western Australia between Shark Bay and Esperance; like the Province in general, the Swan Coastal Plain has a rich flora. The richness is in the small plants: the vast majority of the species are low shrubs, ground-covers and herbs (soft plants).

The main factor that determines the different types of vegetation on the coastal plain is soil. Apart from the sandy/gravelly soils at the foot of the Darling Scarp, the soils of the coastal plain have three origins:

aeolian: deposited on the coast by the ocean, then blown by the wind to form dunes
alluvial: carried down from the Darling Scarp or Darling Plateau by water
estuarine: deposited round estuaries

Below is a brief summary of the soils of the coastal plain and the vegetation associated with them, taken from Powell (1988 & 1990). For more detailed accounts, see Seddon (1972).

Aeolian Soils

Quindalup
White sand of the coastal dunes. Heath; scrub of wattle (and formerly Rottnest cypress and moonah); tuart on sheltered sites.

Cottesloe
Brown or rich yellow sand with limestone near the surface or cropping out. Forest and woodland of tuart, sometimes with marri and jarrah; low woodland of banksia and pricklybark (in the north of the metropolitan region); scrub and heath on shallowest soils.

Karrakatta
Yellow sand; no limestone near the surface. Woodland of jarrah, often with marri or tuart, with understorey of banksia and sheoak.

Bassendean
Pale grey or grey sand. Low woodland of banksia and pricklybark, with jarrah south of Wanneroo; marri on lower, moister sites.

Herdsman
Dark, peaty sand round lakes and swamps within the belts of alluvial soils. Forest and woodland of flooded gum; low forest of paperbark; rushes and sedges.

Alluvial Soils

Guildford
Clayey soils in flat plain. Forest of marri, wandoo and flooded gum.

Beermullah
Clayey, salty soils in flat plain. Low forest of salt sheoak; some woodland of marri, flooded gum and wandoo; some scrub of melaleuca.

Swan
Alluvial soils along the upper reaches (on the coastal plain) of the Swan and Canning Rivers. Forest and woodland of flooded gum; low forest of paperbark and salt sheoak.

Other Types
Other types of alluvial soils in the metropolitan region are the Yanga, Dardanup and Serpentine River.

Aeolian Over Alluvial

Southern River
Hills similar to Bassendean; valleys similar to Guildford.

Estuarine Soils

Vasse
Variable soils on low lying areas beside the Swan Estuary. Samphire; melaleuca and flooded gum; forest of tuart, marri and jarrah on high ground.

Ridge Hill Shelf

Forrestfield
The gravelly and sandy spurs of the Darling Scarp. Forest of jarrah and marri; woodland of jarrah with understorey of banksia, sheoak and woody pear.

Conserving Perth's Flora

Perth's flora is declining. With the exploding human population, remnants are continually being destroyed to accommodate still more people; and patches of vegetation that remain often suffer from unsuitable uses and competition from weeds. It is therefore appropriate to consider how this flora might be conserved. The discussion here is confined to two topics: the representation of the above vegetation types in bush reserves; and the conservation of Perth's flora in parks and open spaces.

The Representation in Bush Reserves of the Vegetation of Perth's Coastal Plain

The Swan Coastal Plain is where conservation needs special emphasis in the metropolitan region. Here the land is very largely cleared. Moreover, this is where most of the people live, and where remnants of vegetation can serve the very important need of environmental education. A report in 1978 for the System Six Study (System Six, 1978) documented the representation of the different types of vegetation in existing and proposed reserves, and this is still a useful guide today.

There are two main categories of land whose vegetation is particularly poorly conserved. One is the alluvial, clayey soils on the eastern side of the plain, where there are several distinct vegetation types. Practically all of the land has been cleared for agriculture, and high priority needs to be given to reserving or otherwise protecting as much as possible of what there is left. The other is wetlands. There is little wetland vegetation on the coastal plain that has not been highly disturbed. Most of that which borders rivers and streams has been grazed or is heavily invaded by exotic plants, and most lakes and swamps have been drained or substantially altered. The vegetation of swamps in the belt of clay soils is especially rich and interesting, and every effort should be made to protect the few good examples that remain.

The final report in the System Six Study (Darling System, 1983) contained many important recommendations for the control and management of areas of vegetation in the Perth metropolitan region and beyond. Although the report was endorsed by the State Cabinet at the time, many of the recommendations have yet to be implemented. An increased effort has recently been made to remedy this, with the setting up of a System Six Working Group. Another initiative is the *System Six Ecoplan*. The Environmental Protection Authority in conjunction with Greening Western Australia and local conservation groups aims to encourage public interest and involvement in looking after bush remnants.

The Conservation of Perth's Flora in Parks and Open Spaces

Perth's parks and open spaces are numerous and well distributed; collectively they cover a large area. Take as an example the City of Stirling. The table below shows that the number of parks (the 'passive' and 'active' reserves) is very large compared to the number of bush reserves. Although Stirling has a greater than average proportion of its area set aside as bush reserves, their combined area is less than a third of the total of the areas for the parks and open spaces.

Table 1

RESERVES AND OPEN SPACE IN THE CITY OF STIRLING

Total Area of Municipality: 10,940ha

Reserves Managed as Bush		'Passive' Reserves		'Active' Reserves		Areas of Coastal Open Space	
No.	Area(ha)	No.	Area	No.	Area	No.	Area
6	330	403	299	63	587	1	126

Source: City of Stirling
Note:
'Reserves' include freehold land owned by the City but used as parkland.
"eserves managed as bush' do not include reserves largely devoted to other uses, and whose bush component is very small.
'Active' reserves are those that contain playing fields, whereas 'passive' reserves do not.
'Passive' reserves as designated here do not include reserves managed as bush.

Many of these parks and open spaces contain remnants of the local flora, particularly the trees; and there is, of course, the opportunity to re-establish local flora in others. The usual treatment of these areas, however, is to plant an assortment of different trees and shrubs, almost all of which are non-local species (many are Australian natives, but from parts well outside the Perth region). This often has the following effects:

- It hides the local plants from view, particularly where planting is round the borders of the park, and distracts attention from the local plants.

- It harms the local plants by competition, particularly where the cultivated plants are taller species.

- It can exhaust the space available for any future planting of local plants.

- It can create an effect that is discordant and confusing, and decrease the park's usefulness to environmental education.

- It creates uniformity rather than diversity: although many different species are often planted in a park, the same species tend to be planted in many different parks. Natural vegetation, by contrast, varies from place to place reflecting subtle changes in the natural environment.

Our local flora is disappearing from our parks and open spaces. Most of these areas are grassed, and mowing prevents remnant trees from reproducing. Once local trees in grassed parks die (from old age, or other causes such as canker fungi) they are gone, and the space is usually taken by planted non-local trees or shrubs.

Is this loss significant? I believe it is. Consider the values of local plants.

Local plants have high conservation value both in themselves, as the natural plant-life of the area, and because, being the plants with which our animals evolved, they provide the best support for those animals - particularly insect larvae. (That local plants usually support a greater number and diversity of insect larvae than non-local plants can often be readily observed - see Figure 1.)

Local plants have a special beauty too. They reflect the natural environment of the site on which they grow. And because they are used by their associated insects, local trees and shrubs develop interesting irregularities and much fine detail; non-local species often look very plain and bold by comparison. Moreover, different species of local plants harmonise with one another, being members of the same plant community.

Local plants also have enormous educational value in telling us about our natural environment. This, of course, is especially true of bush remnants, where the plants can be seen in their natural associations ('communities'), which reflect subtle changes in soil, water-table or salinity. And their condition alerts us to the degree to which we are disturbing their environment.

By simply learning to recognise some of our local plant species, we can begin to learn and understand a lot more about our natural environment. The more examples of our local flora we have in our parks, the more chance we have of being able to do so.

In order to preserve and increase remnants of the local flora in parks, local authorities could consider preparing what I shall call district management plans.

District Management Plans

The Department of Conservation and Land Management produces regional management plans in order to determine the purpose and management of all the lands it controls within a particular region of the State. By 'district management plans' I mean a similar approach

Above: Typical twig from a flooded gum (*Eucalyptus rudis*), a species that occurs naturally in Perth. It shows signs of associated insect life in the leaves and stems. The larger holes were probably made by birds in extracting the insects. Nevertheless there is still plenty of leaf surface left for photosynthesis. Most flooded gums cope quite happily with their insect dependants, having evolved with them.

Below: Twig of a non-local species commonly planted in Perth: the river gum (*E. camaldulensis*). This small sample is typical of the foliage of many of the thousands of non-local eucalypts planted in Perth: their associated insect life is usually very limited.
(Drawings by S. Patrick)

Source: Powell R 'Parks and Gardens as Wildlife Habitat'. *Proceedings: Wildlife Rehabilitation Conference,* October 19-20, 1985, Murdoch University, Alcoa, 1985.

Figure 1. Foliage of Local and Non-local Eucalypts

by local authorities: a plan to determine the management of all the bush reserves, parks and open spaces under their control within their boundaries.

By considering all such areas as a system, there is an excellent opportunity to determine how the different ones can be treated in different ways so that collectively they best serve the variety of purposes for which they are needed. As part of that process, the plan could detail which areas, or parts of areas, should have local flora as they landscaping theme. Examples are those that contain existing remnants of the local flora; or where the establishment of local trees and shrubs would form a corridor for the movement of wildlife between areas of good habitat; or, simply, areas that cannot easily be given much maintenance.

The plan could also spell out specific management measures for the different areas. In parks where the local flora is the theme, a possible measure might be to create garden-beds under stands of naturally occurring trees: this would serve the dual purpose of allowing the trees to reproduce and offering the opportunity to plant some of the local understorey species that have disappeared from the site.

The success of a district management plan will, of course, depend to a large degree on how well it encourages public participation. By doing so, it may act as a catalyst for the formation of 'friends' groups, which pay a valuable role in looking after our biological heritage.

Now is surely an excellent time to consider this sort of approach. The Department of Conservation and Land Management is embarking on a series of workshops on management planning, and Greening Western Australia will soon be providing written advice on the subject in a manual being prepared on Urban Bush Management. Moreover, the public is rapidly becoming more involved in conservation and, with bush-regeneration courses now available, more skilled.

References

Powell R (1991). 'Landscaping for Wildlife'. *Landscope,* Vol. 6, No. 3: Autumn 1991. Department of Conservation and Land Management,.

Powell R(1990). *Leaf and Branch: Trees and Tall Shrubs of Perth.* Department of Conservation and Land Management.

Powell R(1988). *Trees and Tall Shrubs of Perth.* Information Sheet No. 1/88. Department of Conservation and Land Management.

Seddon G(1972). *Sense of Place: A response to an Environment: The Swan Coastal Plain, Western Australia.* University of WA Press.

System Six Study: Conservation Reserves and National Parks Committee Report. Department of Conservation and Environment, Western Australia, Perth, 1978.

The Darling System - System Six: Conservation Reserves for Western Australia as Recommended by the Environmental Protection Authority - 1983: Parts I & II. Report 13, Department of Conservation and Environment, Western Australia, Perth, 1983.

Parts of this paper have been previously published in a different form in the proceedings of the 16th Biennial Conference of the Association of Societies for Growing Australian Plants (Perth, 1991).

VERTEBRATE FAUNA OF THE PERTH METROPLITAN REGION: CONSEQUENCES OF A MODIFIED ENVIRONMENT

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Introduction

Nowhere has the impact of man on indigenous fauna been more destructive than in areas of urban development. All major cities have extensive urban areas surrounded by large regions of intensive agriculture where native vegetation has been largely cleared or altered. Perth is no exception.

The Swan River Colony was founded in 1829 with the establishment of Perth and over the ensuing 163 years there has been a rapid and continuing growth of the capital city. This growth initially followed the Swan River but in later years has extended far to the north, south and east resulting in largely modified ecosystems and the loss of, or alteration to, most of the native bushland and its composite fauna. Whilst acknowledging the importance of all faunal groups to the patterns and processes of natural ecosystems, this paper focuses on the vertebrates of the greater metropolitan region because of the historical perspective they present and because their taxonomy and natural history are well known.

In 1978 the Western Australian Museum undertook a study to document the fauna of the Northern Swan Coastal Plain and to assess the impact of the first 150 years of European settlement. This resulted in papers on the mammals (Kitchener *et al* 1978), birds (Storr *et al* 1978a) and herpetofauna (Storr et al 1978b). In the last 14 years there has been a growing interest in the study of vertebrates remaining in the greater Perth metropolitan region (see references).

In a recent publication on the role of ecological studies in management Hopkins and Saunders (1987) stated: "If management is to be based on informed decision, then three types of knowledge are required for any area – the what, where and how. What species are present ... Where each species is located in that area, especially in relation to its occurrences elsewhere ... How each species persists on that site."

This paper documents the vertebrate fauna of the urban and adjacent areas of Perth using literature sources, collections of the Western Australian Museum and current research in the area and discusses the significance of changes to the fauna since settlement. The taxa have been broadly assigned to the major geomorphic units defined by Sappal (1983) and outlined by Main (this publ.).

The Vertebrate Fauna

Amphibians

Fifteen species of amphibians, representing two families and nine genera are known from the Perth metropolitan region (Appendix 1).

All these frog species, except *Myobatrachus gouldii*, require water for the development of their larval (tadpole) stages. Consequently, frogs reach their greatest diversity and abundance in areas where swamps, lakes or streams are more prominent such as the Ridge

Hill Shelf and Pinjarra Plain landforms (Appendix 1). Few species occur on the Quindalup and Spearwood dune systems in the west where the deep sands support few ephemeral wetlands.

There is no historical data on the changes in abundance or distribution of amphibians since settlement. However, the draining of wetlands and large scale replacement of natural ecosystems with agricultural ones will have markedly reduced the habitat available for most species. Responses to fire by frogs on the Swan Coastal Plain was documented by Bamford (1992) who concluded that *Heleioporus eyrei* was not greatly affected by fire, but that Limnodynastes dorsalis and *Myobatrachus gouldii* were more abundant in long-unburnt areas. Most other species do not occur outside the vicinity of wetlands.

Recent work by Dell (unpublished) suggests that species such as *Crinia georgiana* have been advantaged in the Darling Scarp and Plateau areas by the creation of numerous small dams for horticultural use and by the provision of extensive roadside ditches which provide shallow temporary water in winter. *C. georgiana* has a tadpole which metamorphoses and becomes independent from the water after about 35-40 days. Other species eg. *Heleioporus eyrei* may have become more widely distributed as a consequence of sand and soil transported for building. Some of these translocated males establish and call from burrows but may not successfully breed in gardens in Kalamunda and nearby areas.

Birds

This review is based on the historic literature, particularly Alexander (1921) and Serventy (1948), recent literature, particularly Storr *et al* (1978a), Storr and Johnstone (1988), Dell (1983) and How and Dell (1990), Museum collections and the wide field experience of one of us (JD) especially in the Darling Scarp and Plateau. It includes all birds reliably reported from the region excepting sea birds and the trans-equatorial migrant waders which are specialised occupants of lake-edge and river mudflats.

Storr and Johnstone (1988) listed 311 species of birds recorded from the Swan Coastal Plain and adjacent seas. Of these, 176 species (including introduced) are (or were) resident or regular visitors to the Perth metropolitan region. These 176 species comprise 104 non-passerines and 72 passerine species and are listed on Appendix 2 together with an assessment of whether they have increased or decreased since European settlement. Their presence on the five landform units is indicated also. For completeness, Appendix 2 also includes eight species which occasionally visit the Swan Coastal Plain.

Since European settlement six species have become locally extinct. These are Australian Bustard, Brush Bronzewing (except for Garden Island), Western Long-billed Corella, Barking Owl, Crested Shrike-tit and Western Whipbird. Others have declined markedly and are discussed below.

Appendix 2 shows that of the 104 non-passerine species, 37 have declined and of these, 16 have undergone a dramatic decline since European settlement. The most severe decline has been across a wide cross-section of trophic groups, including wide-ranging omnivores such as the Emu and Australian Bustard, swamp thicket inhabiting carnivores such as the Black and Brown Bittern, diurnal birds of prey including the Whistling Kite and Brown Falcon, seed-eaters such as the Common and Brush Bronzewing, Western Rosella and Western Long-billed Corella, and the blossom feeding Purple-crowned Lorikeet. A less dramatic decline of other non-passerine species has similarly been across a broad spectrum of trophic groups.

Ten naturally occurring non-passerine species have increased as a result of the provision of farmland paddocks, particularly those that are seasonally inundated. This has benefited the herons and some of the ducks. Of particular note has been the colonisation of the Perth metropolitan area and other parts of the Swan Coastal Plain by species occupying seasonal wetlands (often paddocks). Species which have colonised include Little and Cattle Egret, Sacred, Straw-necked and Glossy Ibis and Royal and Yellow-billed Spoonbill. Dates of colonisation and an outline of their current status are included in Storr and Johnstone (1988).

Among the diurnal birds of prey, the Whistling Kite has suffered a major decline because of the change to fringing woodlands around wetlands. The removal of the Flooded Gum, *Eucalyptus rudis* and Paperbark, *Melaleuca preissii* woodlands has almost destroyed this species' breeding locations. The Wedge-tailed Eagle is now hardly ever recorded from the Perth metropolitan area and the Square-tailed Kite, Brown Goshawk and Collared Sparrowhawk have all suffered population declines because of the removal of woodlands. It is encouraging that the Brown Goshawk has recently become a breeding species in King's Park and Bold Park since 1990 and may be increasing in numbers in urban bushlands. The Brown Falcon was previously common across the Swan Coastal Plain but is now rarely reported in the Perth area. This decline was reported by Serventy (1948) who considered it had "diminished in numbers"; this decline has continued to the present day.

The Little Eagle apparently appeared in the Perth area since the arrival of the introduced Rabbit as the first record was 1929. It can now be seen hunting over grassed woodlands around the Perth Airport, at Victoria Park and in the Wanneroo and Whiteman Park areas.

Appendix 2 shows that at least 46 of the 70 naturally occurring passerine bird species have decreased since European settlement and only eight have increased. The White-backed Swallow has taken advantage of sandpits for excavating roosting and breeding burrows, the Welcome Swallow breeds extensively in man-made structures such as buildings and bridges, Richard's Pipit is common in grasslands, Red-capped Robin occupies partly cleared vegetation around the Perth Airport and at Bibra Lake, Singing Honeyeater is a notable feature of most suburban gardens and parks, Magpie-lark has become a common breeding species this century (Storr and Johnstone 1988) and Australian Magpie and Australian Raven have increased as a result of new food resources. After an initial decline the Tree Martin is increasing as a breeding species by using man-made nesting sites especially hollows in street lights.

Nearly all of the insectivorous and nectarivorous passerine species have declined since European settlement as a direct result of the clearing of the natural vegetation. Some of them, such as Scarlet Robin, Golden Whistler, Grey Shrike-thrush, Broad-tailed Thornbill, Western Thornbill, White-browed Scrubwren, Splendid Fairy-wren, Australian Sittella, Rufous Treecreeper, Tawny-crowned Honeyeater, Black-faced Woodswallow and Grey Currawong are now absent from most of that part of the Swan Coastal Plain considered in this paper, although most still occur in the Darling Scarp or Darling Plateau. Some of these including the Western Thornbill and Splendid Fairy-wren are surviving on urban remnants only recently isolated and may not persist long-term (Dell and Turpin, unpub.). In addition, the Yellow Robin, Crested Shrike-tit, Crested Bellbird, Western Whipbird, Restless Flycatcher, Red-winged Fairy-wren, Southern Emu-wren, Red-eared Firetail and Brown-headed Honeyeater no longer occur in the Coastal Plain part of the Perth metropolitan area and one, the Western Whipbird now only occurs in coastal and near-coastal parts of the south coast.

Appendix 2 shows that the Quindalup/Spearwood dune systems has the highest number of bird species and the Jarrah forested plateau the lowest number. There is a decreasing

number of species in each landform unit away from the coast with the five units having 155, 157, 143, 107 and 96 species respectively.

Few species were naturally restricted to only one landform unit. The Rock Parrot only occurs on the Quindalup/Spearwood unit and its breeding areas are restricted to coastal islands. The Western Whipbird has only been recorded in coastal thickets but is now locally extinct. The Variegated Fairy-wren was naturally restricted to the Quindalup dune system but has recently colonised areas along the Swan River and the Botanic Gardens in Kings Park.

Mammals

Mammals, together with birds, were amongst the first faunal groups collected and documented from the Swan River Colony. Early mammal specimens sent to museums often had vague or broad locality records associated with them, and this was recognised in the seminal paper by Kitchener *et al* (1978) on the mammals recorded from the Northern Swan Coastal Plain.

Appendix 3 provides information on the past distribution and current status of mammal species from the urban regions of Perth. The data is collated from the collections of the Western Australian Museum, Shortridge (1909, 1936) and Kitchener *et al* (1978), subsequent taxonomic revisions by Kitchener and recent studies on urban bushland remnants including the unpublished survey of Yanchep National Park (Burbidge, AH pers. com.). The distribution of the species across the major landform units is presented, although the majority of species were, and are not, confined to specific landforms or habitats.

This information documents 35 native and 7 introduced species as having been collected from the region with the possibility that a further 4 native species may have been collected there. An extensive survey in 1978 and subsequent work on the coastal plain confirmed the presence of only 15 native species (Grey Kangaroo, Western Brush Wallaby, Brushtail Possum, Honey Possum, Southern Brown Bandicoot, Bush Rat, Water Rat, Ashy-grey Mouse, Gould's, Great and Lesser Long-eared Bats, Southern Little Bat, Gould's Wattled Bat, White-striped Mastiff Bat and Echidna) with the possibility that another three (Chuditch, Western Pygmy Possum and Chocolate Bat) may still be extant, as they are known from the Darling Scarp and Plateau.

The status of many species of mammals has declined further in the last 14 years. There has been no systematic survey of bats, consequently there is no new information on the status of these volant species. Recent surveys of urban bushland remnants indicate that of the native mammals, only Western Grey Kangaroo, Western Brush Wallaby, Brushtail Possum and Southern Brown Bandicoot survive, and that the first two only persist in larger remnants that have been recently isolated from larger tracts of native bushland peripheral to urban areas (Dell & Turpin unpubl., How & Dell 1989, 1990). All the native species from the families Burramyidae, Tarsipedidae, Dasyuridae and Muridae have disappeared from urban bushlands and persist only in adjacent National Parks or forests. The Water Rat, Bush Rat and Mardo all prefer dense vegetation associated with swamps, lakes and waterways, and all have declined markedly around Perth, only persisting in small populations in surrounding areas. The Honey Possum, and Ashy-grey Mouse, occur in the heaths north of Mullaloo where they occupy long-unburnt habitats (Kitchener *et al* 1978). Later work on sensitivity to fire by mammals (Bamford 1986) on the Swan Coastal Plain, but north of the Perth region, showed that the House Mouse and Little Long-tailed Dunnart *Sminthopsis dolichura* were more abundant in bushland 0-3 years after fire, the Ashy-grey Mouse between 3-6 years after fire, and the Honey Possum and Western Pygmy Possum, in the longest-unburnt (11 years) vegetation.

With the exception of the Brushtail Possum, no native mammals have become commensal with urban man. All other native species only persist in small remnants of bushland or swamps.

Introduced mammals have generally thrived in urban bushland remnants. The House Mouse is the most abundant and widespread of all mammal species in bushland and urban areas, while the Rabbit is also common in larger remnants and in adjacent agricultural areas. Foxes occur even in inner city bushlands such as Kings Park and Bold Park and Cats are widespread throughout all urban areas.

Reptiles

The reptile assemblage of the Perth region consists of 71 species representing 37 genera in 9 families (Appendix 4) and is one of the richest recorded in Australia. The juxtaposition of diverse landform units and the varied habitats they contain is, in large part, the explanation for this diverse assemblage.

There is very little historical data on the herpetofauna of the Perth area, and it is only as a result of the systematic work of Storr *et al* (1981,1983,1986,1990) that the richness of the reptile fauna has been acknowledged.

The detailed documentation and survey of the herpetofauna of the North Swan Coastal Plain by Storr *et al* (1978b) provided the foundation for later assessments by Dell (1983) on the Darling Scarp and How and Dell (1989, 1990) on urban bushland remnants. This paper relies on the information published in these papers, the collections of the Western Australian Museum and recent unpublished surveys and reports.

The north-south trending sands of the Quindalup, Spearwood and Bassendean Landform Units provide ideal substrates and habitats for fossorial (below ground living) and litter inhabiting reptiles. This is reflected by the high diversity on the Swan Coastal Plain of legless lizards (Pygopodidae), burrowing skinks (*Lerista* spp) and burrowing snakes (Vermicella spp) that feed on lizards. Geckos are more abundant on the Quindalup and Spearwood Landform Units of the west coast, although increased fire frequency has presumably led to their persistence only on larger bushland remnants. Dragons (Agamidae) are nowhere abundant in the Perth region and prefer the habitats of the semi-arid interior (Cogger and Heatwole 1981) where they reach their maximum diversity. Very little is known of the biology or habitat requirements of the blind snakes (Typhlopidae). Both the monitors and pythons were widespread. Reptile diversity decreases from 52 species on the western near-coastal dunes to 35 species on the Darling Plateau in the east of the area (Appendix 4).

The greater metropolitan region contains the only population of Australia's most threatened vertebrate species, the Western Swamp Turtle, a species which is now the focus of a major international conservation and management effort. Several species are scarce or rare in the area, including the skinks *Lerista christinae* and *L. lineata* which have relatively localised distributions, while others such as the gecko *Heteronotia binoei*, legless lizard *Aclys concinna* and snakes *Acanthophis antarcticus*, and *Pseudonaja modesta* are uncommon in the metropolitan region but more abundant elsewhere. The latter species is now locally extinct. It appears that some species eg. *Diplodactylus granariensis* and *Pseudechis australis* became established by translocation since settlement but did not persist (Storr and Johnstone 1983).

Plate 1. The insectivorous Pygmy Possum *Cercartetus concinnus* no longer occurs in bushland on Perth remnants but is still found in the Darling Range.

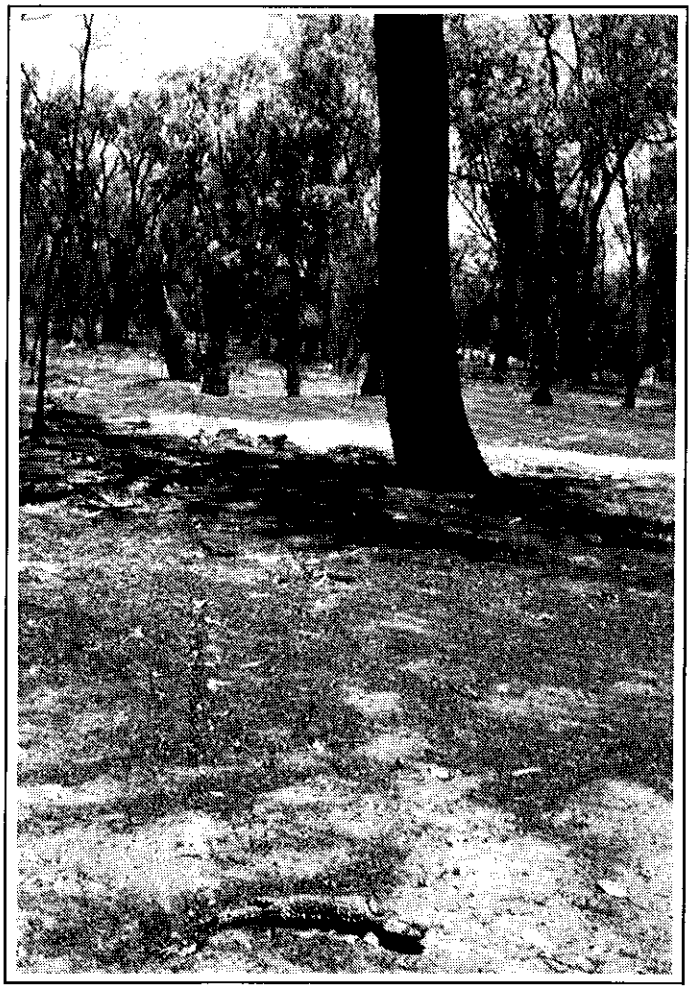

Plate 2. Uncontrolled fire can devastate animal communities on isolated remnants. Note the scorched Bobtail in the foreground.

No introduced reptiles have become established in Perth although the Museum has specimens of the gecko *Hemidactylus frenatus* from Fremantle and the Perth Airport which were presumably brought in with cargo from south-east Asia.

The Dugite has been decidedly advantaged since European settlement and has become relatively common in urban bushland remnants and areas marginal to the metropolitan region. The cause of this increase is its adaptation to using the introduced abundant and widespread House Mouse as a principal prey item. The Bobtail is another species that has tolerated settlement, using a wide variety of introduced plants as part of its diet and remaining relatively abundant in modified bushlands.

Most species, however, have declined in both local distribution and abundance and usually persist only on the remaining remnants of bushland. Only two species, the Marbled Gecko and the Fence Skink, occur in inner city areas although the skink, *Hemiergis quadrilineata* is frequently found in urban gardens. The species most severely affected by urban development have been the larger predators in the genus *Varanus* (monitors) and *Morelia* (pythons). These species prey on a large variety of native mammals, reptiles and frogs that have become far less numerous and are now confined to a very few larger remnant bushlands. Other species have declined as a result of alteration to their specific habitats. The skink *Egernia luctuosa* has declined dramatically due to the draining and reduction of wetland habitats and the dragon, *Ctenophorus ornatus*, and gecko, *Gehyra variegata*, have declined in the Darling Scarp and Range as a result of removing exfoliated granites to enhance urban gardens (Dell 1983).

Discussion

Changes in the vertebrate fauna of the Northern Swan Coastal Plain are a consequence of one or several modifications imposed by European settlement - these being urban and agricultural development, fire frequency and intensity, introduced exotic species and the draining and filling of wetlands (How 1978). It is axiomatic that the clearing of native bushland leads to the destruction of the composite communities and the fragmentation of remaining bushland.

Wetlands have been drastically altered and Riggert (1966) estimated that 49 percent of wetlands between Yanchep and Rockingham had been drained. This loss has continued and current estimates put this loss at over 60 percent. The most serious consequence has been the reduction in fringing forests and thickets with the complete local extinction of such birds as the Red-eared Firetail, Red-winged Fairy-wren and Brush Bronzewing, and mammals including the Quokka, Tammar, Western Ringtail Possum, Mardo and Bush Rat. Many other species in all vertebrate groups have declined as a result of changes to the margins of lakes and swamps.

The amount of surface water in winter and spring has increased since clearing as a result of rises in the water table. This has advantaged some species, particularly birds which utilise these seasonally inundated areas for feeding. Herons and some species of ducks have increased and a number of other species including egrets, ibises and spoonbills have colonised the Perth metropolitan area.

Bird and mammal assemblages in the greater Perth metropolitan region have been changed markedly over the last 160 years. Over half the native mammal species known from the area are now locally extinct, and all species have declined in distribution and abundance since the colony was founded. These changes have been dramatic to the extent that only four native mammal species are now found on bushland remnants in inner urban areas. Six

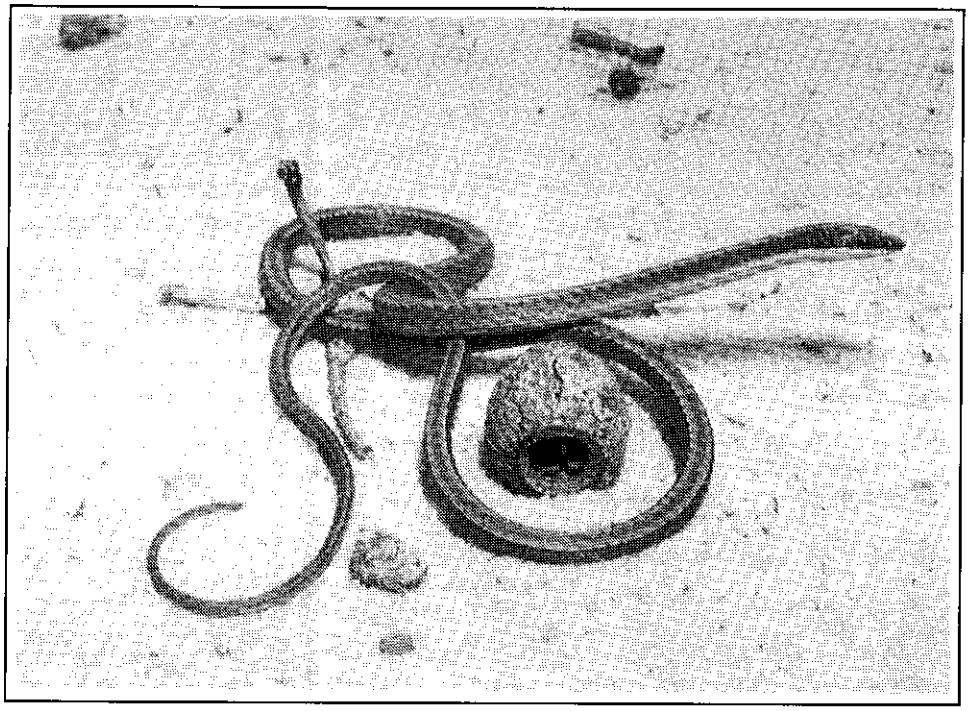

Plate 3. The Slender Legless Lizard *Pletholax gracilis* has declined and is now only found in low numbers in very few urban bushlands.

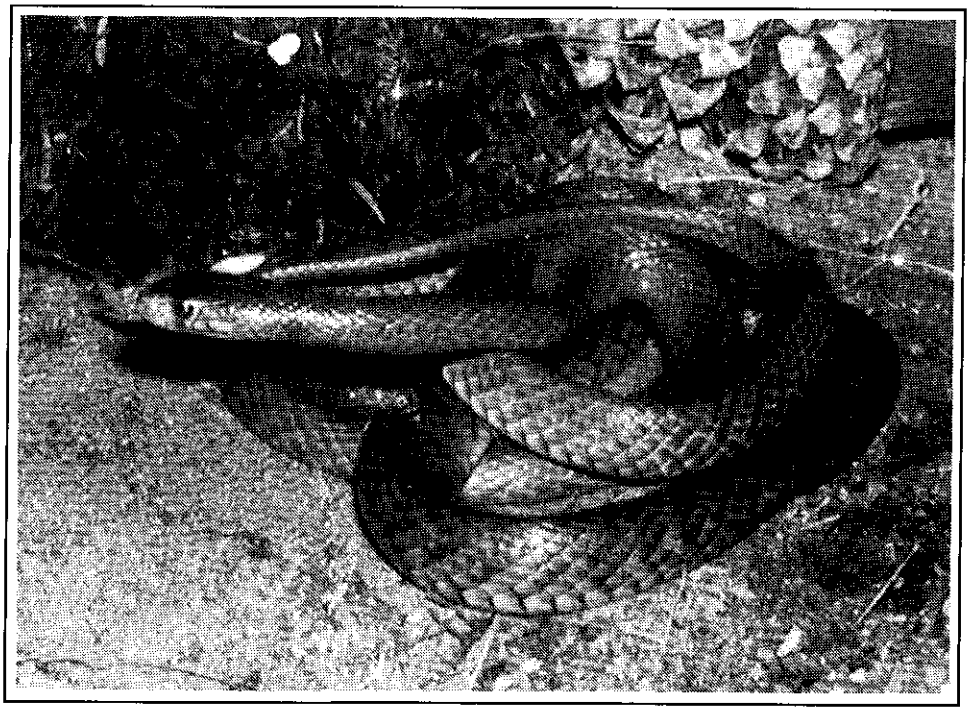

Plate 4. The Dugite *Pseudonaja affinis* feeds on introduced House Mice *Mus musculus* and has increased in abundance since European settlement.

(4 percent) of the birds known from the region are now locally extinct and over 50 percent have declined and contracted since settlement. There are no historical data for amphibians and reptiles, however, it appears that at least two reptiles are now locally extinct.

These data are similar to the situation described in the Western Australian wheatbelt (Kitchener *et al* 1980a, 1980b,1982) where mammals have declined markedly since the widespread clearing for agriculture commenced around the turn of the century. Birds were less severely affected by this more recent fragmentation and they found that no species of lizards had become extinct. The causal mechanisms proposed to explain this decline in mammal species have been varied and numerous and the synergistic effects of several are probably responsible for the present state (Burbidge & McKenzie 1989, Kitchener 1980). Kitchener *et al* (1978) stated "The evidence in Western Australia is that many mammal species had begun to disappear long before the landscape was substantially altered by Europeans, and also before the introduction of foxes and rabbits". The situation in the Perth region is compounded by the human population density, urban development and the environmental consequences of these such as habitat loss, increased fire frequency and fox and cat predation. There is only one endemic vertebrate species known from the greater Perth metropolitan region, the rare and threatened Western Swamp Turtle. Some species have relatively restricted distributions and are confined to the Swan Coastal Plain, eg. *Lerista lineata, Vermicella calonotos*, and their populations have become fragmented and possibly endangered as a result of urbanisation transgressing landscapes. Most species however are wide-ranging, have distributions outside the region and are not directly threatened or endangered by urbanisation. However, there is growing international awareness of the importance of frogs as bioindicators of the environmental health of ecosystems and with their sensitivity to changes in water quality and habitat availability (Tyler 1989) they may soon become as threatened as other vertebrate species.

Recent surveys of the vertebrates on bushland remnants in inner urban areas have shown that the great majority of species have been adversely affected by urban development (Dell and How 1987, How and Dell 1989, 1990: Turpin 1990, 1991a, 1991b) These studies on remnants ranging from 1 - 350 hectares have been undertaken to evaluate the relationship between species number and environmental correlates in the area of major habitat modification. It is apparent that no small ground dwelling mammals persist in urban remnants of this size range. Only the Brushtail Possum persists in urban areas, although the Western Grey Kangaroo, Western Brush Wallaby and Southern Brown Bandicoot may persist on larger remnants only recently isolated by urban areas (Dell and Turpin unpubl). These data, although preliminary, are very different from those described from small remnants of native vegetation in the nearby Western Australian wheatbelt (Kitchener *et al* 1980a,b, 1982). In the wheatbelt areas as small as 30 hectares for mammals and lizards and 80 hectares for birds were found to provide valuable sanctuaries for these taxa, although larger areas were preferable. Kitchener (1982) re-evaluated this data to point out that there was a need to understand the ecological requirements of species, specifically their habitat type, before conservation measures could be evaluated and implemented. It is apparent that the value for conservation of bushland remnants will depend on the purpose for which the remnant is managed.

The greater number of birds and reptiles on western landforms is of considerable conservation significance considering the paucity of gazetted conservation reserves on the western landform units. The retention of patches of natural vegetation in the Quindalup/Spearwood, Bassendean and Ridge Hill Shelf/Pinjarra Plain units is a priority to maintain populations of small landbirds, particularly the insectivorous and nectarivorous species which depend on natural vegetation, and representative assemblages of the rich fossorial reptile groups.

The impact of the introduced predators, cats and foxes, on native wildlife was highlighted by Kitchener *et al* (1978) who proposed this as one of the major factors in species decline. They went on to state "We consider that while introduced diseases cannot be discounted as an important agency responsible for the disappearance of many mammal species it is likely that the Domestic Cat, widespread throughout Australia, almost certainly played a principal role." They noted that 37 mammal species in the collections of the Western Australian Museum had been caught by cats.

Vertebrate species exhibit a wide array of responses to the effects of fire. In Banksia communities north of Perth, Bamford (1986) found that several species were more abundant in recently burnt areas (0-3 years post fire), others preferred areas burnt 3-6 years previously, while a few were present only in habitats that had been unburnt for more than 11 years. This latter group of fire sensitive vertebrate species are those that are in greatest need of conservation and management. The impact of fire on the vertebrates of small bushland remnants is devastating. Prior to European settlement, Friend (1987) postulated sharp declines and even the extinction of species in local areas as a consequence of climatic events or wildfire. However, recovery was facilitated by immigration and increased reproduction among remaining individuals. In small remnants of urban bushland few individuals survive fire as refugia are very small or absent, while there is virtually no immigration as colonising sources are small, remote and separated by intensive urban development.

In the Perth area the management of bushland remnants must be multipurpose with consideration given to recreational, educational and conservational values.

The educational significance of city bushlands has been highlighted by Feinsinger (1987) who pointed out the need to use local environments and biota to develop an environmental and conservation ethic among young people. The conservation value of city bushlands also should consider their potential as reserves for rare species, as areas for the retention of representatives of the biotic communities and to preserve habitats in a regional setting for such processes as refugia for migratory and nomadic species (Main 1987).

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References

Alexander WB (1921). The Birds of the Swan River District, W.A. *Emu* 20: 149-168.

Bamford MJ (1986). The dynamics of small vertebrates in relation to fire in Banksia woodland near Perth, Western Australia. Unpbl. PhD thesis, Murdoch University.

Bamford MJ (1992). The impact of fire and increasing time after fire upon Heleioporus eyrei, Limnodynastes dorsalis and Myobatrachus gouldii (Anura: Leptodactylidae) in Banksia Woodland near Perth, Western Australia. *Wildl. Res.*, 19: 169-178.

Burbidge AA and McKenzie NL (1989). Patterns in the modern decline of Western Australia's vertebrate fauna: causes and conservation implications. *Biol. Cons.* 50: 143-198.

Conservation Through Reserves Committee (CTRC) (1981). The Darling System, Western Australia. Proposals for parks and reserves. *The System 6 Study Report to the Env. Protection Authority.* Dept. of Cons. and Env. Report No. 8.

Chapman A (1981). Habitat preference and reproduction of feral House Mice, Mus musculus, during plague and non-plague situations in Western Australia. *Aust. Wildl. Res.* 8: 567-79.

Cogger HG and Heatwole H (1981). The Australian reptiles: origines, biogeography, distribution patterns and island evolution. pp 1331-74. In: Keast, A (Ed.) *Ecological Biogeography of Australia* (3 vols) Dr W Junk Publ., The Hague, Netherlands.

Davidge C (1979). A census of a community of small terrestrial vertebrates. *Aust. J. Ecol.* 4: 165-170.

Dell J (1983). The importance of the Darling Scarp to fauna, pp 17-28. In *Scarp Symposium.* Ed. JD Majer. WAIT, Bentley, WA.

Dell J and How RA (1988). Mammals of the Darling Scarp. *West. Aust. Nat.* 17: 86-93.

Feinsinger P (1987). Professional ecologists and the education of young children. *Trends Ecol. Evo.*, 2: 51-52.

Friend JA (1987). Local decline, extinction and recovery: relevance to mammal populations in vegetation remnants. pp 53-64. In: Saunders DA, Arnold GW, Burbidge AA and Hopkins, AJM (Eds). *Nature Conservation: The Role of Remnants of Nature Vegetation.* Surrey Beatty & Sons, Chipping Norton.

Hopkins AJM and Saunders DA (1987). Ecological Studies as the basis for management. pp 15-28 In: Saunders DA, Arnold GW, Burbidge AA and Hopkins, AJM (Eds). *Nature Conservation: The Role of Remnants of Nature Vegetation.* Surrey Beatty & Sons, Chipping Norton.

How RA (1978). The environment of the Northern Swan Coastal Plain: A consideration of faunal changes and recommendations. pp 1-53. In: *Faunal Studies of the Northern Swan Coastal Plain: A consideration of Past and Future Changes.* West. Aust. Mus. Rpt to Dept Cons. & Env. WA

How RA and Dell J (1989). Vertebrate Fauna in Banksia Woodlands. In: Banksia Woodlands Symposium. *Jour. Roy.* Soc. WA 71: 97-98.

How RA and Dell J (1990). Vertebrate Fauna of Bold Park, *West. Aust. Nat.* 18: 122-130.

Kitchener DJ (1982). Predictors of vertebrates species richness in nature reserves in the Western Australian wheatbelt. *Aust. Wildl. Res.* 9: 1-7.

Kitchener DJ, Chapman A and Barron G (1978). Mammals of the northern Swan Coastal Plain. pp 54-92. In: *Faunal Studies of the Northern Swan Coastal Plain: A consideration of Past and Future Changes.* West. Aust. Mus. Rpt. to Dept Cons. & Env. WA

Kitchener DJ, Chapman A, Dell J, Muir BG and Palmer M (1980a). Lizard assemblages and reserve size and structure in the Western Australian wheatbelt - some implications for conservation. *Biol Conserv.* 17: 25-62.

Kitchener DJ, Chapman A, Muir BG and Palmer M (1980b). The conservation value for mammals of reserves in the Western Australian wheatbelt. Biol. Conserv. 18: 179-207.

Kitchener DJ, Dell J, Muir BG and Palmer M (1982). Birds in Australian Wheatbelt reserves - implications for conservation. *Biol. Conserv.* 22: 127-63.

Main AR (1987). Management of remnants of native vegetation: a review of the problems and the development of an approach with reference to the wheatelt of Western Australia. pp 1-13 In: Saunders DA, Arnold GW, Burbidge AA and Hopkins AJM (Eds). *Nature Conservation: The Role of Remnants of Nature Vegetation.* Surrey Beatty & Sons, Chiping Norton.

Riggert TL (1966). *Wetlands of Western Australia, 1964-66.* Department of Fisheries and Fauna, Perth.

Sappal KK (1983). Geology of the Darling Scarp. pp 3-10. In: *Scarp Symposium.* Ed. JD Majer. WAIT, Bentley, WA.

Serventy DL (1948). The Birds of the Swan River District, Western Australia. *Emu* 47: 241-286.

Serventy DL (1954). The recent increase of rarer native mammals *West. Aust. Nat.* 4: 128-141.

Shortridge GC (1909). An account of the geographical distribution of the marsupials and monotremes of south-west Australia having special reference to the specimens collected during the Balston Expedition of 1904-1907. *Proc. Zool. Soc. (Lond.)* 1909: 803-848.

Shortridge GC (1936). Field notes (hitherto unpublished) of Western Australian mammals south of the Tropic of Capricorn (exclusive of Marsupialia and Monotremata), and records of specimens collected during the Balston Expeditions (November 1904 to June 1907). *Proc. Zool. Soc. (Lond.)* Part 3.

Storr GM, Johnstone RE and Harold G (1978a). Birds of the Northern Swan Coastal Plain W.A. pp 93-171. In: *Faunal Studies of the Northern Swan Coastal Plain: A consideration of Past and Future Changes.* West. Aust. Mus. Rpt to Dept Cons. & Env. WA

Storr, GM/ Harold, G and Barron G (1978b). Amphibians and Reptiles of the Northern Swan Coastal Plain. pp 172-203. In: *Faunal Studies of the Northern Swan Coastal Plain: A consideration of Past and Future Changes.* West. Aust. Mus. Rpt to Dept Cons. & Env. WA.

Storr GM and Johnstone RE (1983). Snakes of the Perth Metropolitan Region. *Swans* 13: 20-24.

Storr GM and Johnstone RE (1985). *A field guide to the birds of Western Australia.* West. Aust. Mus., Perth.

Storr GM and Johnstone RE (1988). Birds of the Swan Coastal Plain. *Rec. W. Aust. Mus.* Suppl 28.

Storr GM, Smith LA and Johnstone,RE (1981). *Lizards of Western Australia I. Skinks.* West. Aust. Mus., Perth.

Storr GM, Smith LA and Johnstone RE (1983). *Lizards of Western Australia II. Dragons and Monitors.* West. Aust. Mus., Perth.

Storr GM, Smith LA and Johnstone RE (1986). *Snakes of Western Australia.* West. Aust. Mus., Perth.

Storr GM, Smith LA and Johnstone RE (1990). *Lizards of Western Australia III. Geckos and Pygopods.* West. Aust. Mus., Perth.

Turpin MC (1990). Ecological Appraisal of an Isolated Banksia Woodland Reserve No. 3694 South of the Swan River, Perth. *West. Aust. Nat.* 18: 131-138.

Turpin MC (1991a). Additions to the Fauna of Reserve 3694, Victoria Park. *West. Aust. Nat.* 18: 168-169.

Turpin MC (1991b). Notes on the Fauna of a Remnant Bushland in Victoria Park. *West. Aust. Nat.* 18: 233-234.

Tyler MJ (1989). *Australian Frogs.* Viking Penguin Books, London.

Appendix 1

AMPHIBIANS RECORDED FROM THE PERTH METROPOLITAN REGION
Quindalup and Spearwood (QS); Bassendean (B); Ridge Hill Shelf and Pinjarra Plain (RHS); Darling Scarp (DS); Darling Plateau (DP); (? status uncertain).

FAMILY Species	Landform Units QS	B	RHS	DS	DP
LEPTODACTYLIDAE (GROUND FROGS)					
Crinia georgiana	x	x	x		
Geocrinia leai	?	x			
Heleioporus barycragus	x	x	x		
Heleioporus eyrei Moaning Frog	x	x	x		
Heleioporus inornatus			x	x	
Heleioporus psammophilus		x			
Limnodynastes dorsalis Banjo Frog	x	x	x	x	x
Myobatrachus gouldii Turtle Frog	x	x			
Neobatrachus pelobatoides Humming Frog					x
Pseudophryne guentheri Gunther's Toadlet			x	x	x
Ranidella glauerti	x	x	x	x	
Ranidella insignifera		x	x		
Ranidella pseudinsignifera			x	x	x
HYLIDAE (TREE FROGS)					
Litoria adelaidensis Slender Tree Frog	x	x	x	x	x
Litoria moorei Mottled Tree Frog	x	x	x	x	x

Appendix 2

BIRDS RECORDED FROM THE PERTH METROPOLITAN REGION, EXCLUDING SEABIRDS AND TRANS-EQUATORIAL MIGRANT WADERS
Quindalup and Spearwood (QS); Bassendean (B); Ridge Hill Shelf and Pinjarra Plain (RHS); Darling Scarp (DS); Darling Plateau (DP); (N occasional visitor, ? status uncertain, * introduced species, ++ marked increase in abundance, + increase in abundance, - decrease in abundance, -- marked decrease in abundance and/or local extinction).

SPECIES	Status	Landform Units QS	B	RHS	DS	DP
Emu *Dromaius novaehollandiae*	--	x	x	x	x	x
Black-throated Grebe *Podiceps novaehollandiae*	?	x	x	x	x	x
Hoary-headed Grebe *Podiceps poliocephalus*	?	x	x			
Great Crested Grebe *Podiceps cristatus*	+	x				
Australian Pelican *Pelecanus conspicillatus*	?	x	x			
Little Black Cormorant *Phalacrocorax sulcirostris*	?	x	x	x	x	x
Great Cormorant *Phalacrocorax carbo*	?	x	x	x		
Little Pied Cormorant *Phalacrocorax melanoleucos*	?	x	x	x	x	x
Darter *Anhinga melanogaster*	+	x	x			
Pacific Heron *Ardea pacifica*	+	x	x	x	x	x
White-faced Heron *Ardea novaehollandiae*	+	x	x	x	x	x
Great Egret *Egretta alba*	+	x	x	x		
*Little Egret *Egretta garzetta*	+	x	x	x		
*Cattle Egret *Egretta ibis*	+	x	x	x		
Rufous Night Heron *Nycticorax caledonicus*	-	x	x			

continued over...

Appendix 2 (continued)

SPECIES	Status	Landform Units QS	B	RHS	DS	DP
Little Bittern *Ixobrychus minutus*	-	x	x			
Black Bittern *Ixobrychus flavicollis*	--	x	x	x		
Brown Bittern *Botaurus pociloptilus*	--	x	x			
*Sacred Ibis *Threskiornis aethiopicus*	+	x	x	x		
*Straw-necked Ibis *Threskiornis spinicollis*	++	x	x	x		
*Glossy Ibis *Plegadis falcinellus*	+	x	x	x		
*Royal Spoonbill *Platalea regia*	+	x	x	?		
*Yellow-billed Spoonbill *Platalea flavipes*	+	x	x	?		
Chestnut Whistling Duck *Dendrocygna arcuata*	N	x	x			
Black Swan *Cygnus atratus*	-	x	x	x		
Freckled Duck *Stictonetta naevosa*	+	?	x	?		
*Muscovy Duck *Carina moschata*	+	x	x			
Mountain Duck *Tadorna tadornoides*	+	x	x	x	x	x
*Mallard *Anas platyrhynchos*	+	x	x			
Black Duck *Anas superciliosa*	?	x	x	x	x	x
Chestnut Teal *Anas castanea*	?					
Grey Teal *Anas gibberifrons*	?	x	x	x	x	x
Blue-winged Shoveler *Anas rhynchotis*	?	x	x	x		
Pink-eared Duck *Malacorhynchus membranaceus*	+	x	x	x		
Hardhead *Aythya australis*	-	x	x	x		
Wood Duck *Chenonetta jubata*	+		x	x	x	x
Blue-billed Duck *Oxyura australis*	-	x	x	x		
Musk Duck *Biziura lobata*	-	x	x	x	x	x
Black-shouldered Kite *Elanus caeruleus*	+	x	x	x	x	x
Square-tailed Kite *Lophoictinia isura*	-	x	x	x	x	x
Whistling Kite *Haliastur sphenurus*	--	x	x	x	x	
Brown Goshawk *Accipiter fasciatus*	-	x	x	x	x	x
Collared Sparrowhawk *Accipiter cirrocephalus*	-	x	x	x	x	x
Little Eagle *Aquila morphnoides*	-	x	x	x	x	x
Wedge-tailed Eagle *Aquila audax*	-	x	x	x	x	x
Marsh Harrier *Circus approximans*	-	x	x	x		
Peregrine Falcon *Falco peregrinus*	?	x	x	x	x	x
Australian Hobby *Falco longipennis*	?	x	x	x	x	x
Brown Falcon *Falco berigora*	--	x	x	x	x	x
Australian Kestrel *Falco cenchroides*	?	x	x	x	x	x
Stubble Quail *Coturnix novaezelandiae*	?	x	x	x	?	
Painted Button-quail *Turnix varia*	--	x	x	x	x	x
Banded Land-rail *Gallirallus philippensis*	?	x	x	x	x	x
Baillon's Crake *Porzana pusilla*	?	x	x	x		
Spotted Crake *Porzana fluminea*	-	x	x	x		
Spotless Crake *Porzana tabuensis*	-	x	x	x	x	x
Swamphen *Porphyrio porphyrio*	?	x	x	x		
Black-tailed Native Hen *Gallinula ventralis*	?	x	x	x	x	x
Dusky Moorhen *Gallinula tenebrosa*	-	x	x	x	x	x
Coot *Fulica atra*	+	x	x	x	x	x
Australian Bustard *Otis australis*	--	x	x	x		
*Banded Plover *Vanellus tricolor*	+	x	x	x	x	x
Black-fronted Plover *Charadrius melanops*	+	x	x	x	x	x
Black-winged Stilt *Himantopus himantopus*	?	x	x	x		
Banded Stilt *Cladorhynchus leucocephalus*	?	x	x	x		
Red-necked Avocet *Recurvirostra novaehollandiae*	?	x	x	x		
Bush Stone-curlew *Burhinus grallarius*	--	x	x	x		

continued over...

Appendix 2 (continued)

SPECIES	Status	Landform Units QS	B	RHS	DS	DP
Whiskered Tern *Sterna hybrida*	?	x	x	x		
*Domestic Pigeon *Columba livia*	+	x	x	x	x	
*Spotted Dove *Streptopelia chinensis*	+	x	x	x	x	x
*Laughing Dove *Streptopelia senegalensis*	+	x	x	x	x	x
Common Bronzewing *Phaps chalcoptera*	--	x	x	x	x	x
Brush Bronzewing *Phaps elegans*	--	x	x	x	?	?
*Crested Pigeon *Ocyphaps lophotes*	+	x	x	?		
*Rainbow Lorikeet *Trichoglossus haematodus*	+	x	x			
Purple-crowned Lorikeet *Glossopsitta porphyrocephala*	--	x	x	x	x	x
Regent Parrot *Polytel is anthopeplus*	?	x	x	x		
Ring-necked Parrot *Platycercus zonarius*	+	x	x	x	x	x
Red-capped Parrot *Platycercus spurius*	-	x	x	x	x	x
Western Rosella *Platycercus icterotis*	--	x	x	x	x	x
Elegant Parrot *Neophema elegans*	?	x	x	x	x	x
Rock Parrot *Neophema petrophila*	?	x				
Carnaby's Cockatoo *Calyptorhynchus latirostris*	?	x	x	x	x	x
Baudin's Cockatoo *Calyptorhynchus baudinii*	?			x	x	x
Red-tailed Black Cockatoo *Calyptorhynchus magnificus*	-			x	x	x
*Galah *Cacatua roseicapilla*	+	x	x	x	x	x
*Little Corella *Cacatua sanguinea*	+	x	x	x	x	
Sulphur-crested Cockatoo *Cacatua galerita*	+			x		
Western Long-billed Corella *Cacatua pastinator*	--			x		
Pallid Cuckoo *Cuculus pallidus*	-	x	x	x	x	x
Fan-tailed Cuckoo *Cacomantis flabelliformis*	--	x	x	x	x	x
Horsfield's Bronze Cuckoo *Chrysococcyx basalis*	-	x	x	x	x	
Shining Bronze Cuckoo *Chrysococcyx lucidus*	-	x	x	x	x	x
Barn Owl*Tyto alba*	?	x	x	x	x	x
Masked Owl *Tyto novaehollandiae*	?	x	x	x	?	?
Barking Owl *Ninox connivens*	--		x			x
Boobook Owl *Ninox novaeseelandiae*	-	x	x	x	x	x
Tawny Frogmouth *Podargus strigoides*	--	x	x	x	x	x
Australian Owlet-nightjar *Aegotheles cristatus*	?	?	?	x	x	x
Spotted Nightjar *Eurostopodus argus*	?	x	x	x	?	x
Fork-tailed Swift *Apus pacificus*	N	x	x	x	x	x
*Laughing Kookaburra *Dacelo gigas*	+	x	x	x	x	x
Sacred Kingfisher *Halcyon sancta*	-	x	x	x	x	x
Rainbow Bee-eater *Merops ornatus*	?	x	x	x	x	x
White-backed Swallow *Cheramoeca leucosterna*	+	x	x			
Welcome Swallow *Hirundo neoxena*	+	x	x	x	x	
Barn Swallow *Hirundo rustica*	N		x			
Tree Martin *Hirundo nigricans*	-	x	x	x	x	x
Fairy Martin *Hirundo ariel*	+			x		
Richard's Pipit *Anthus novaeseelandiae*	+	x	x	x	x	x
Yellow Wagtail *Motacilla flava*	N		x			
Black-faced Cuckoo-shrike *Coracina novaehollandiae*	-	x	x	x	x	x
Ground Cuckoo-Shrike *Coracina maxima*	-			x		
White-winged Triller *Lalage sueurii*	-	x	x	x	x	
Red-capped Robin *Petroica goodenovii*	+		x		x	x
Scarlet Robin *Petroica multicolor*	--	x	x	x	x	x

continued over...

Appendix 2 (continued)

SPECIES	Status	Landform Units QS	B	RHS	DS	DP
Hooded Robin *Petroica cucullata*	--	x	x	x		
Yellow Robin *Eopsaltria australis*	--	x	x	x	x	x
Golden Whistler *Pachycephala pectoralis*	--	x	x	x	x	x
Rufous Whistler *Pachycephala rufiventris*	-	x	x	x	x	
Grey Shrike-thrush *Colluricincla harmonica*	--	x	x	x	x	x
Crested Shrike-tit *Falcunculus frontatus*	--				x	
Crested Bellbird *Oreoica gutturalis*	--	x	x	x		
Western Whipbird *Psophodes nigrogularis*	--	x				
Grey Fantail *Rhipidura fuliginosa*	-	x	x	x	x	x
Willy Wagtail *Rhipidura leucophrys*	-	x	x	x	x	x
Restless Flycatcher *Myiagra inquieta*	-	x	x	x		
Western Flyeater *Gerygone fusca*	-	x	x	x	x	x
Weebill *Smicrornis brevirostris*	-	x		x	x	?
Broad-tailed Thornbill *Acanthiza apicalis*	--	x	x	x	x	x
Western Thornbill *Acanthiza inornata*	--	x	x	x	x	x
Yellow-rumped Thornbill *Acanthiza chrysorrhoa*	-	x	x	x	x	x
White-browed Scrubwren *Sericornis frontalis*	--	x	x	x	x	x
Splendid Fairy-wren *Malurus splendens*	--	x	x	x	x	x
Variegated Fairy-wren *Malurus lamberti*	-	x				
Red-winged Fairy-wren *Malurus elegans*	--		x	x	x	x
White-winged Fairy-wren *Malurus leucopterus*	+	x	x			
Southern Emu-wren *Stipiturus malachurus*	--	x	x	x	x	
Clamorous Reed-warbler *Acrocephalus stentoreus*	-	x	x	x	x	x
Little Grassbird *Megalurus gramineus*	-	x	x	x		
Rufous Songlark *Cincloramphus mathewsi*	?		x	x		
Brown Songlark *Cincloramphus cruralis*	+		x	x		
Australian Sittella *Daphoenositta chrysoptera*	--	x	x	x	x	x
Rufous Treecreeper *Climacteris rufa*	--	x		x	x	x
Mistletoebird *Dicaeum hirundinaceum*	-	x	x	x	x	x
Spotted Pardalote *Pardalotus punctatus*	-	x	x	x	x	x
Striated Pardalote *Pardalotus striatus*	-	x	x	x	x	x
Grey-breasted White-eye *Zosterops lateralis*	?	x	x	x	x	x
Brown Honeyeater *Lichmera indistincta*	?	x	x	x	x	x
Singing Honeyeater *Meliphaga virescens*	+	x	x	x	x	x
Yellow-plumed Honeyeater *Meliphaga ornata*	N	x				
White-plumed Honeyeater *Meliphaga penicillata*	N		x			
White-naped Honeyeater *Melithreptus lunatus*	--	x	x	x	x	x
Brown-headed Honeyeater *Melithreptus brevirostris*	--	x	x		x	
New Holland Honeyeater *Phylidonyris novaehollandiae*	--	x	x	x	x	x
White-cheeked Honeyeater *Phylidonyris nigra*	-	x	x	x	x	x
Tawny-crowned Honeyeater *Phylidonyris melanops*	--	x	x	x	x	
Western Spinebill *Acanthorhynchus superciliosus*	-	x	x	x	x	x
Yellow-throated Miner *Manorina flavigula*	--	x	x	x		
Little Wattlebird *Anthochaera chrysoptera*	-	x	x	x	x	x
Red Wattlebird *Anthochaera carunculata*	-	x	x	x	x	x
White-fronted Chat *Epthianura albifrons*	+	x	x	x	x	x
Crimson Chat *Epthianura tricolor*	N	x		x		
Red-eared Firetail *Emblema oculatum*	--		x	x	x	x

continued over...

Appendix 2 (continued)

SPECIES	Status	Landform Units QS	B	RHS	DS	DP
*Zebra Finch *Poephila guttata*	+	x				
*Chestnut-breasted Mannikin *Lonchura castaneothorax*	+	x	x			
Magpie-lark *Grallina cyanoleuca*	+	x	x	x	x	x
Black-faced Woodswallow *Artamus cinereus*	--	x	x	x		
Dusky Woodswallow *Artamus cyanopterus*	--	x	x	x	x	x
Masked Woodswallow *Artamus personatus*	N	x	x	x	x	x
Grey Butcherbird *Cracticus torquatus*	--	x	x	x	x	x
Pied Butcherbird *Cracticus nigrogularis*	N	x	x			
Australian Magpie *Cracticus tibicen*	+	x	x	x	x	x
Grey Currawong *Strepera versicolor*	--	x	x	x	x	x
Little Crow *Corvus bennetti*	N			x	x	x
Australian Raven *Corvus coronoides*	+	x	x	x	x	x

Appendix 3

MAMMALS RECORDED FROM THE PERTH METROPLITAN REGION

Quindalup and Spearwood (QS); Bassendean (B); Ridge Hill Shelf and Pinjarra Plain (RHS); Darling Scarp (DS); Darling Plateau (DP); (? status uncertain, * introduced species, ++ marked increase in abundance, + increase in abundance, - decrease in abundance, -- marked decrease in abundance and local extinction)

FAMILY Species	Status	Landform Units QS	B	RHS	DS	DP
TACHYGLOSSIDAE						
Echidna *Tachyglossus aculeatus*	-		x	x	x	x
MACROPODIDAE						
Burrowing Bettong *Bettongia lesueur*	--	?	?	?		
Brush-tailed Bettong *Bettongia penicillata*	--	?	?	?		
Western Grey Kangaroo *Macropus fuliginosus*	-	x	x	x	x	x
Western Brush Wallaby *Macropus irma*	-	x	x	x	x	x
Tammar *Macropus eugenii*	--	?	?	?	?	?
Banded Hare-wallaby *Lagostrophus fasciatus*	--		?			
Crescent Nailtail Wallaby *Onychogalea lunata*	?				?	?
Black-footed Rock-wallaby *Petrogale lateralis*	?				?	
Quokka *Setonix brachyurus*	--	?	x	?	x	x
PHALANGERIDAE						
Brushtail Possum *Trichosurus vulpecula*	-	x	x	x	x	x
PETAURIDAE						
Ringtail Possum *Pseudocheirus peregrinus*	--	?	?	?	?	
BURRAMYIDAE						
Western Pygmy Possum *Cercartetus concinnus*	-	x	x	x	x	x
TARSIPEDIDAE						
Honey Possum *Tarsipes rostratus*	-	x	x	x	x	
PERAMELIDAE						
Southern Brown Bandicoot *Isoodon obesulus*	-	x	x	x	x	x

continued over ...

Appendix 3 (continued)

FAMILY Species	Status	Landform Units QS	B	RHS	DS	DP
THYLACOMYIDAE						
Dalgyte or Bilby *Macrotis lagotis*	--			x	x	x
DASYURIDAE						
Chuditch *Dasyurus geoffroii*	-	x	x	x	x	x
Dibbler *Parantechinus apicalis*	--	?	?			
Mardo *Pseudantechinus flavipes*	-	?	?	x	x	x
Brush-tailed Wambenger *Phascogale tapoatafa*	-		?	x	x	x
Fat-tailed Dunnart *Sminthopsis crassicaudata*	--	x				
Gilbert's Dunnart *Sminthopsis gilberti*	-			?	x	x
Grey-bellied Dunnart *Sminthopsis griseoventer*	-	x	x	x	x	x
MYRMECOBIIDAE						
Numbat *Myrmecobius fasciatus*	--		x	x	x	x
MURIDAE						
Bush Rat *Rattus fuscipes*	-	x	x			
*Sewer Rat *Rattus norvegicus*	+	x	x			
*Black Rat *Rattus rattus*	++	x	x	x	x	x
Tunney's Rat *Rattus tunneyi*	--	?	?			
Water Rat *Hydromys chrysogaster*	-	x	x	x	x	x
Ashy-grey Mouse *Pseudomys albocinereus*	-	x	x			
*House Mouse *Mus musculus*	++	x	x	x	x	x
LEPORIDAE						
*European Rabbit *Oryctolagus cuniculus*	++	x	x	x	x	x
MEGADERMATIDAE						
Ghost Bat *Macroderma gigas*	?	?	?			
VESPERTILIONIDAE						
Gould's Long-eared Bat *Nyctophilus gouldi*	-				x	x
Great Long-eared Bat *Nyctophilus major*	-		?	?	?	x
Lesser Long-eared Bat *Nyctophilus geoffroyi*	-		x	x	x	x
Southern Little Bat *Eptesicus regulus*	-	x	x	x	x	x
Gould's Wattled Bat *Chalinolobus gouldii*	-		x	x	x	x
Chocolate Bat *Chalinolobus morio*	--		?	?		
MOLOSSIDAE						
White-striped Mastiff bat *Tadarida australis*	-	?	x	x	x	x
Little Mastiff-bat *Mormopterus planiceps*	?				x	x
PTEROPODIDAE						
Red Flying Fox *Pteropus scapulatus*	?		x			
CANIDAE						
Dingo *Canis familiaris*	--	x	x	x	x	x
*Red Fox *Vulpes vulpes*	+	x	x	x	x	x
FELIDAE						
*Domestic Cat *Felis catus*	++	x	x	x	x	x
MUSTELIDAE						
*Ferret *Mustela putorius*	+	x	x			

Appendix 4

REPTILES RECORDED FROM THE PERTH METROPOLITAN REGION

Quindalup and Spearwood (QS); Bassendean (B); Ridge Hill Shelf and Pinjarra Plain (RHS); Darling Scarp (DS); Darling Plateau (DP); (? status uncertain).

FAMILY Species	Landform Units QS	B	RHS	DS	DP
CHELUIDAE (Side Necked Turtles)					
Oblong Turtle *Chelodina oblonga*	x	x	x	x	
Western Swamp Turtle *Pseudemydura umbrina*			x		
GEKKONIDAE (Geckos)					
Clawless Gecko *Crenadactylus ocellatus*	x			x	
Spotted Gecko *Diplodactylus alboguttatus*	x	x			
Diplodactylus granariensis				x	?
Diplodactylus polyophthalmus	x	x	?	x	x
Spiny-tailed Gecko *Diplodactylus spinigerus*	x	x	x	x	x
Common D'tella *Gehyra variegata*				x	x
Binoe's Gecko *Heteronotia binoei*	x				
Marbled Gecko *Phyllodactylus marmoratus*	x	x	x	x	x
Barking Gecko *Underwoodisaurus milii*	x	?	?	x	x
PYGOPODIDAE (Legless Lizards)					
Aclys concinna	x				
Aprasia pulchella		x	x	x	x
Aprasia repens	x	x	x	x	x
Delma fraseri	x	x	x	?	
Delma grayii	x		x	x	?
Burton's Legless Lizard *Lialis burtonis*	x	x	x	x	x
Pletholax gracilis	x	x			
Scalefoot *Pygopus lepidopodus*	?	x	x	x	x
AGAMIDAE (Dragon Lizards)					
Ornate Dragon *Ctenophorus ornatus*				x	x
Western Bearded Dragon *Pogona minor*	x	x	x	x	x
Tympanocryptis adelaidensis	x	x			
SCINCIDAE (Skink Lizards)					
Fence Skink *Cryptoblepharus plagiocephalus*	x	x	x	x	x
Ctenotus delli					x
Striped Skink *Ctenotus fallens*	x	x	x	x	x
Ctenotus gemmula	?	x			
Ctenotus impar		x			
Ctenotus labillardieri		?	?	x	x
Ctenotus lesueurii	x	x			
Cyclodomorphus branchialis	x				
King Skink *Egernia kingii*	x	?	?	x	x
Mourning Skink *Egernia luctuosa*	x	?			
Egernia napoleonis	x	x	x	x	x
Hemiergis initialis				x	x
Yellow-bellied Skink *Hemiergis quadrilineata*	x	x	x		
Leiolopisma trilineata	x	x	x	x	x
Lerista christinae	?	x			
Lerista distinguenda		x	x	x	x
Lerista elegans	x	x			
Lerista lineata	x	x			
Lerista lineopunctulata	x	x			
Lerista praepedita	x	x			

continued over...

APPENDIX 4 (continued)

FAMILY Species	Landform Units QS	B	RHS	DS	DP
Menetia greyii	x	x	x	x	x
Morethia lineoocellata	x				
Morethia obscura	x	x	x	x	x
Blue Tongue *Tiliqua occipitalis*	x	x	x	x	
Bobtail *Tiliqua rugosa*	x	x	x	x	x
VARANIDAE (Goannas)					
Gould's Goanna *Varanus gouldii*	x	x	x	x	x
Rosenberg's Goanna *Varanus rosenbergi*	x	x	x	x	x
Racehorse Goanna *Varanus tristis*	x	x	x	x	x
TYPHLOPIDAE (Blind Snakes)					
Ramphotyphlops australis	x	x	x	x	x
Ramphotyphlops pinguis			x	?	
Ramphotyphlops waitii			x	x	
BOIDAE (Pythons)					
Carpet Python *Morelia spilota*	x	x	x	x	x
Stimson's Python *Morelia stimsoni*	x		x	x	x
ELAPIDAE (Front-Fanged Snakes)					
Southern Death Adder *Acanthophis antarcticus*					x
Yellow-faced Whipsnake *Demansia psammophis*	x	x	x		
Crowned Snake *Notechis coronatus*	x	x	x		
Bardick *Notechis curtus*	x	x	x		
Tiger Snake *Notechis scutatus*	x	x	x	x	x
Mulga Snake *Pseudechis australis*	?	?	x	?	
Dugite *Pseudonaja affinis*	x	x	x	x	x
Ringed Brown Snake *Pseudonaja modesta*	x	x			
Gwardar *Pseudonaja nuchalis*		x	x		
Gould's Snake *Rhinoplocephalus gouldii*	x	x	x	x	x
Black-backed Snake *Rhinoplocephalus nigriceps*			x	?	x
Jan's Banded Snake *Vermicella bertholdi*	x	x	x		
Black-naped Snake *Vermicella bimaculata*	x	x	x		
Black-striped Snake *Vermicella calonotos*	x	x	x		
Narrow-banded Snake *Vermicella fasciolata*	x	x	x		
Southern Shovel-nosed Snake *Vermicella semifasciata*	x	x	x	x	x

WATER RESOURCES MANAGEMENT AND URBAN BUSHLAND

Alan Hill, Research Officer
Water Resources Planning Branch
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Introduction

Water resources management and bushland management have long been recognised to be closely related. Forest thinning to increase streamflow was recognised by engineers in 1908 to have induced a rise in the salinity of the Helena River and remedial planting of pine took place (Sadler & Williams, 1980). The understanding of the processes involved in salinity management and the importance of a broader approach to water resources planning and management have continued to develop since that time.

The evidence of good water and bush management is the maintenance of water resources quality, quantity, beneficial uses including biodiversity and functioning bushland systems, past this generation and into subsequent generations. Good management will be recognisable at regional and local scales.

Landsat images show how in the south west of Western Australia, and in Perth, bushland remains mainly in water supply catchments (often also state forest), and on other conservation reserves, see Figure 1, Figure 2.

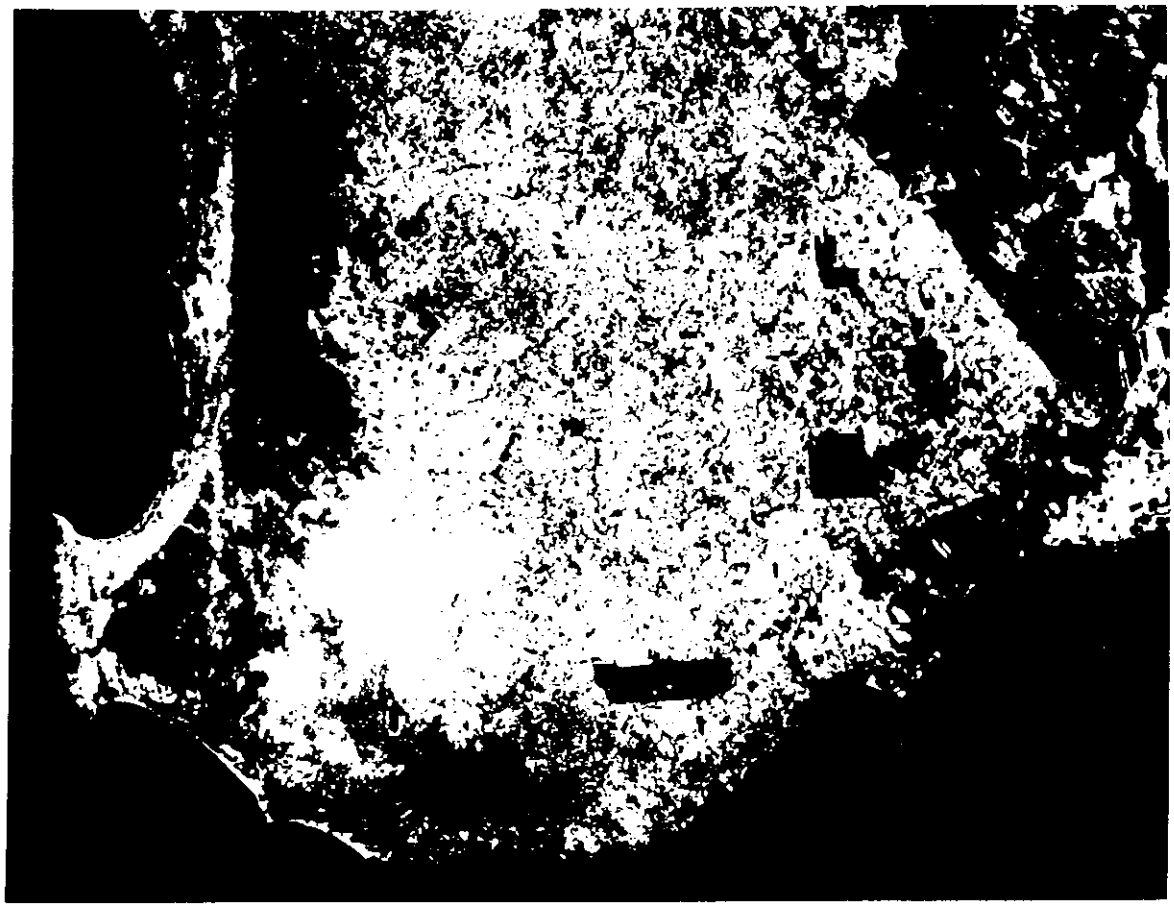

Figure 1. Landsat Mosaic of the South West
Source: (DOLA, 1987)

Figure 2. Landsat Image of Perth
(after DOLA, 1988)

Land outside these areas has been predominantly cleared. At the macro and micro level this has had an significant degrading impact on the environmental and water supply values of the state's water resources.

Today, while a quiet greening is occurring in rural areas, the remaining small areas of urban bushland, including those protecting creeklines and wetlands are still being cleared or alienated, see Figure 3. Water sensitive design is one of a number of water and land planning initiatives which will assist the many departments in state and local governments to address these important issues in a more coordinated and enlightened way (AIUS, 1991).

Perth's Hinterland: The South West

Agricultural clearing has led to salination of over 50 percent of the divertible water resources in the South West. Fortunately the high rainfall catchments providing the bulk of the current water supplies remained under native forest because their soils historically were considered too poor for agricultural use, and because more recently these areas are subject to catchment protection: are state forests or subject to clearing controls (Sadler & Williams, 1980; Schofield et al, 1988). The current situation is nearly 50 percent of the water resources of the South West are fresh and protected with forest (Steering Committee for Research on Land Use and Water Supply, 1989).

Currently it is estimated 78 percent of the Swan Coastal Plain, 61 percent of the Northern Jarrah Forest and 93 percent of the Wheatbelt vegetation regions are cleared (Beard,1990), see Table 1.

Table 1

VEGETATION REGIONS AND CLEARING IN THE SOUTH WEST REGION
(after Beard, 1990)

Region	Area Sq km		% cleared
Southwest Forest Region		69005	
Swan Coastal Plain	14637		78
Northern Jarrah Forest	19473		61
Southern Jarrah Forest	26572		57
Karri Forest Subregion	8323		31
Northern Sandplains		39656	59
Wheatbelt Region		93520	93
Mallee Region		78957	44
Esperance Plains		28702	52

Reports on the environmental impact on wetlands and rivers in the South West have been documented by Sanders (1990), see Figure 4 and Figure 5 and also by Olsen & Skitmore (1991). On a positive note, a recent Department of Agriculture bulletin detailed what approaches should be taken in revegetation of the central wheatbelt (Lefroy et al, 1991). The priority role that revegetation of drainage corridors have is salutory to this seminar, see Figure 6, 7, and is supported by Olsen & Skitmore (1991)

> " ...the single most effective treatment for the southwest rivers is to revegetate them. Strategies vary in different areas but a minimum requirement is to exclude stock from the river to allow native trees and understorey to re-establish"

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Creek 'now open drain'

By TESSA HOPKINS

CLEARING in the Forrestfield cell 10 subdivision has brought a new rash of criticisms.

An Environmental Protection Authority officer said Woodlupine Creek had been turned into "an open drain", while Wattle Grove resident Bob Holze said the area was inhabited by short-nose bandicoots, brushtail possums, bobtail lizards and goannas.

He said he had found about 12 dead bandicoots on Hale Road since site work started three months ago, disturbing their habitat.

EPA spokesman John Sutton said officers had taken photos of the clearing. This included undergrowth around the creek which would have been the animal's main habitat.

"They have effectively converted a brook into an open drain and that's not in anyone's interest," he said.

"There needs to be adequate vegetation in and along a watercourse to protect the water quality. This type of thing will just result in nutrients being flushed from one point to another, causing algal problems in compensating basins."

He questioned the WA Water Authority's wisdom in not recognising the need to preserve water quality and was investigating the WAWA processes.

"The management of tributaries is very important because this creek ends up in the Canning and Swan river system. On a large scale this type of action can have a major impact on water quality," he said.

"I'm very concerned that the planning process hasn't considered water-quality issues or taken the option of getting developers to rehabilitate the area."

Senior zoologist with the Department of Conservation and Land Management Gordon Wyre said CALM was relocating short-nose bandicoot colonies in the urban area whose habitats were threatened by development.

If developers had come forward it might have been possible to either relocate or design the development around them.

Although bandicoots were put on the protected species list last year, the Wildlife Conservation Act needed to be changed to protect their habitat.

Figure 3. Newspaper Clipping

The Department of Conservation and Land Management (CALM) has recently published draft management plans which include recommendations for increased protection of river and stream zones in the Southern, Central and Swan Regions (includes the Perth metropolitan area), see Figure 8 (Walker, 1992). The effect of these recommendations for increased protection of creek corridors from disruption, if accepted, will assist in protecting beneficial uses of these water resources.

Perth Environs

Due to the large impact of clearing in the Perth region predominantly for agriculture, the large areas of bushland remaining are mainly near to Perth and can be seen to be regionally and locally significant.

The Department of Planning and Urban Development has published plans for parks and recreation areas and a regional open space concept plan (DPUD, 1991) which adresses some of the bushland identified for regional parks and as specific locations in the System 6 study (EPA, 1983).

Bushland identified for parks will have the effect of protecting a number of Perth's major wetlands. In a regional context bushland remains most significantly on surface and groundwater, water supply 'catchment' areas, see Figure 9.

The protection of these areas in many ways reflects the historical rigor and emphasis of the Water Authority on its water supply responsibilities, and the ability to co-manage the catchment with CALM for timber and forest conservation.

A complimentary concern for the environmental requirements for water is also developing in the water industry (O'Brien et al, 1983), see Table 2.

In Western Australian water resource allocation work (WAWRC, 1991) and in water resource planning for the instream and environmental use of water, work is underway in areas like; water sensitive design; wetlands mapping, classification and evaluation; water conservation; and planning for recreation and other cultural uses.

Work is also underway to improve the environmental record of the utility functions of the organisation in areas such as planning, construction and operation of water supply, sewerage (Moore & Arrowsmith, 1992) and stormwater management (Becu, unpublished).

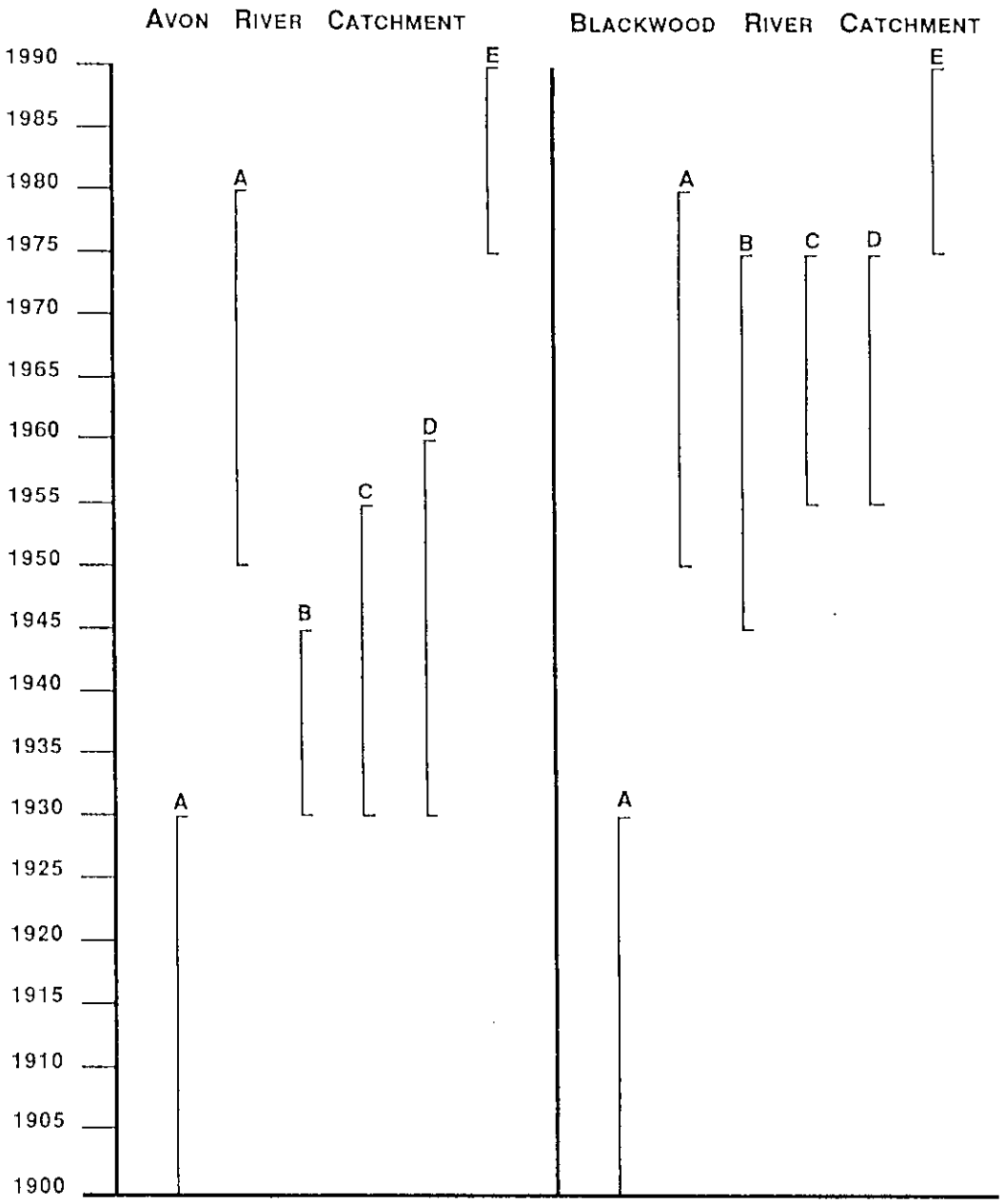
Investigations in these areas have provided some relevant information for today's seminar.

Wetland Mapping, Classification and Evaluation

Detailed wetland mapping at a scale of 1:25 000 has been recently carried out by the Water Authority see Figure 10.

This mapping provides a basis for identifying the current extent of wetlands for better identification of environmentally sensitive and significant areas for water resource assessment and allocation and for town planning.

It also provides a foundation for better buffer prescription and wetland protection.



Trends in environmental changes in wetlands of the Avon and Blackwood River catchments.

Figure 4. Sequence of Wetland Degratation

Source: (Sanders, 1990)

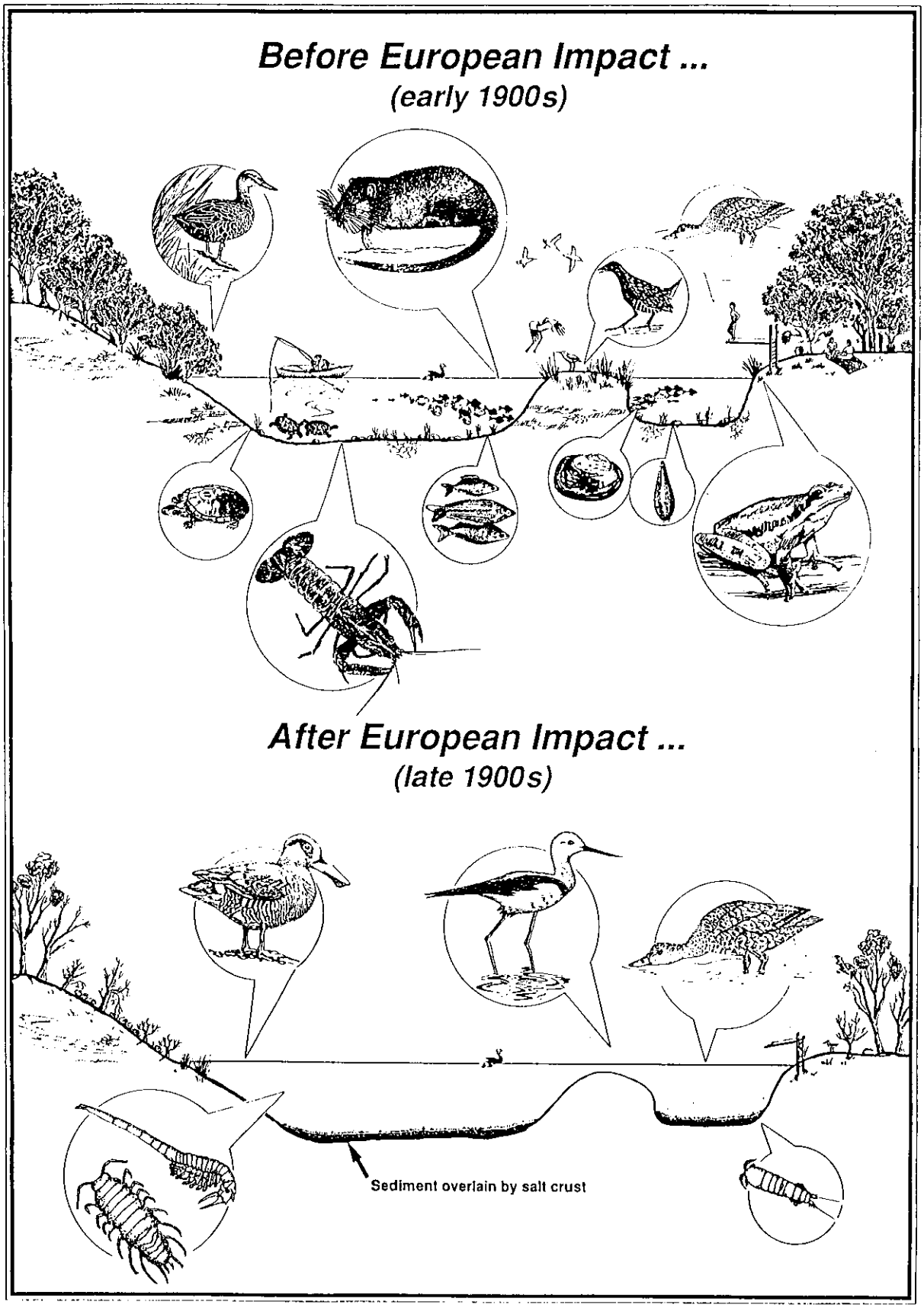


Figure 5. Illustration of Changes to Wetlands
Source: (Sanders, 1990)

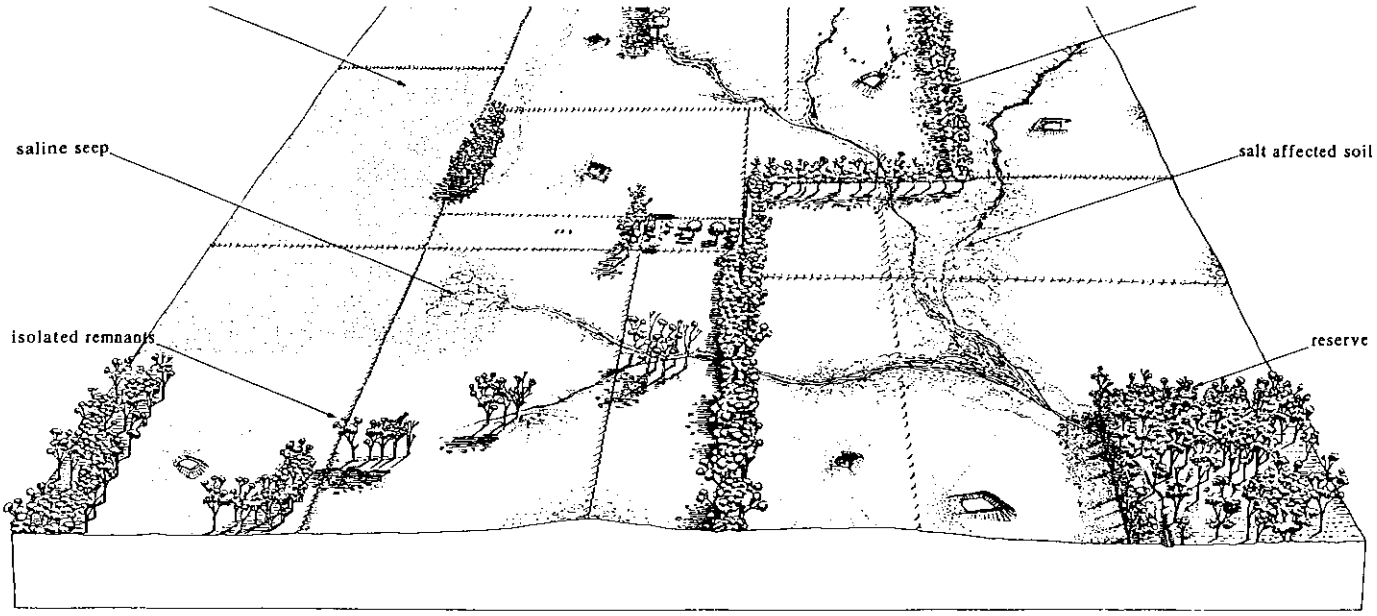


Figure 6. Revegetation Site Plan
Source: (Lefroy et al, 1991)

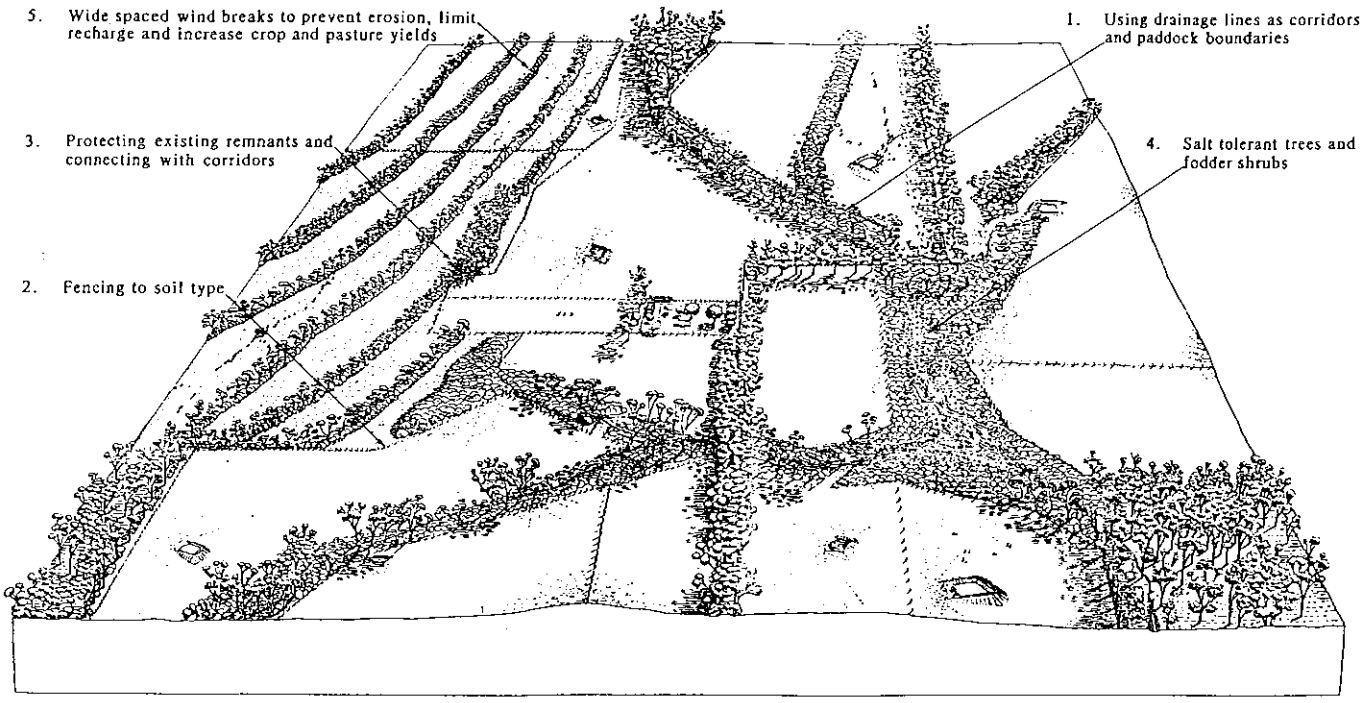
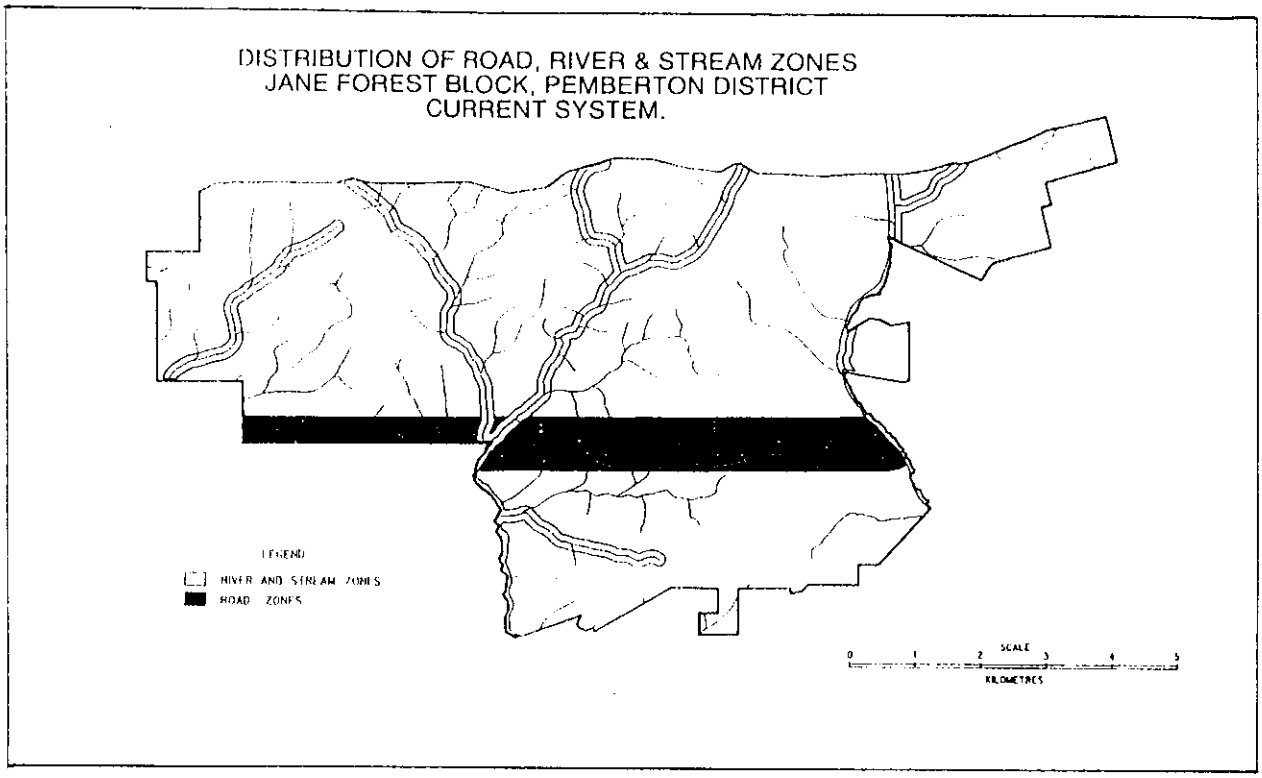


Figure 7. Revegetation Plan
Source: (Lefroy et al, 1991)



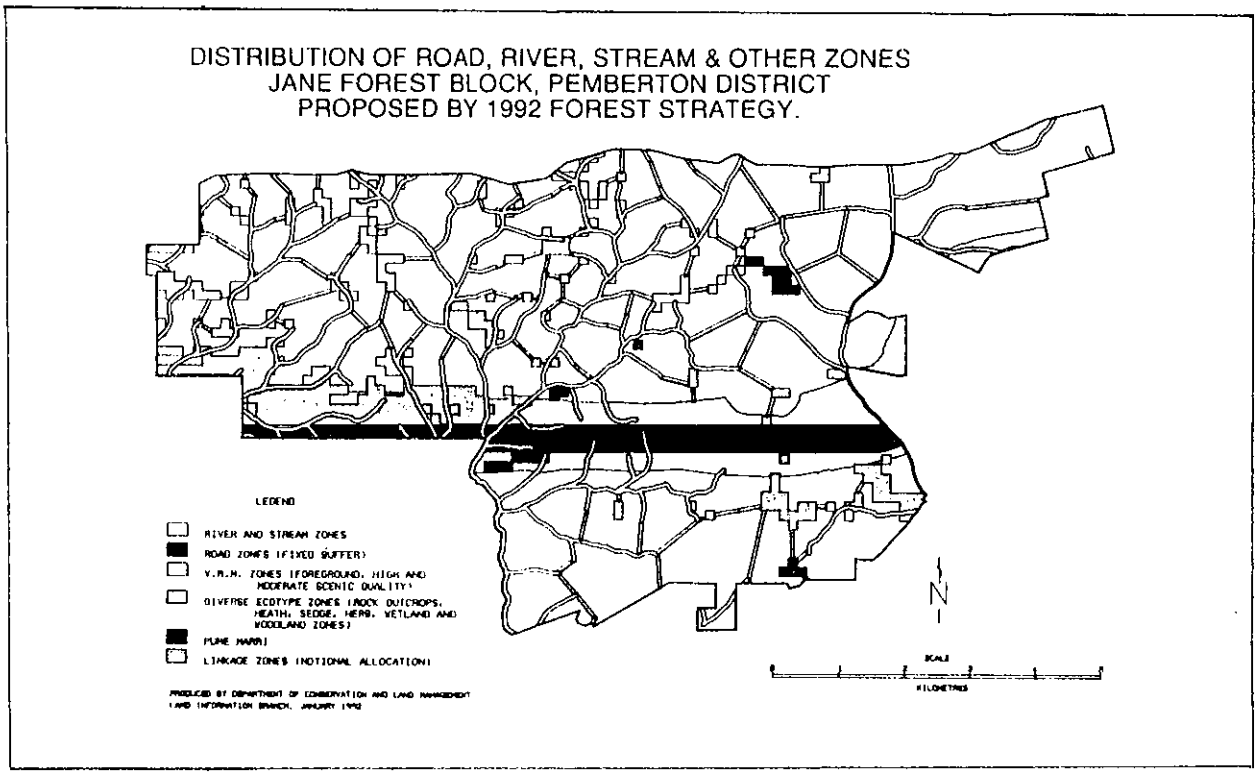


Figure 8. CALM Proposals for Stream Zones
Source: (Walker, 1992)

Table 2

INSTREAM USES OF WATER IN AUSTRALIA:
(Summary Of Contents, O'Brien et at, 1983)

Instream uses, values and trends: an overview

- Identification of Instream Uses
- Values and Trends - recreation and tourism
  - ecosystems
  - cultural and scientific
  - commercial

Major Issues, Conflicts and Management Options

- Downstream effects of dams
- Ecological effects of physical barriers in streams
- Inundation effects of dams
- Deterioration of waterways in urban areas
- Recreational use of urban water supply resevoirs and catchments
- Catchment management
- The recognition and protection of wild and scenic rivers
- River improvement and flood mitigation works
- Protection and management of estuaries
- Protection and management of wetlands
- Pest and exotic species
- Biological effects of water contaminants
- Water quality constraints on recreational activities
- Rare and endangered species
- Extractive industries associated with watercourses
- Impacts of water-related recreation

Protection of bushland on and adjacent to wetlands is important for soil conservation, water resource management wildlife conservation and for human quality of life issues including recreation (Lefroy et al,1990; Olsen & Skitmore,1991; Majer, 1979; EPA, 1980; Cummins, 1986; Chambers & Davis 1986; Davis, 1991; Bennet, 1990; Breckwoldt et al,1990; Land Conservation Council,1986; Pen et al, 1988; Saunders et al, 1990; Thorburn, 1992; Williams et al 1992; Blyth, 1984; Cummins, 1986; Mitchell 1990; Lake et al, 1990; Pinder et al, 1991; Feilman Planning, 1987). It has been neglected in the past.

Consistent with the approach of Majer (1979), wetland buffers need to be defined up slope of wetlands to include the ecologically important transition from wetland to upland vegetation, see Figure 11 (V & C Semeniuk Research Group, in prep).

A distance of 50m to 200m is the buffer recommended for optimum protection of the wetland resource. This allows conservation corridors of 100m width alongside creeks, the minimum recommended width of bush corridors in woodland by Hussey et al (1990). In some instances such as where midges are a problem (Pinder et al, 1991) or adjacent to scenic rivers, larger buffers may be appropiate.

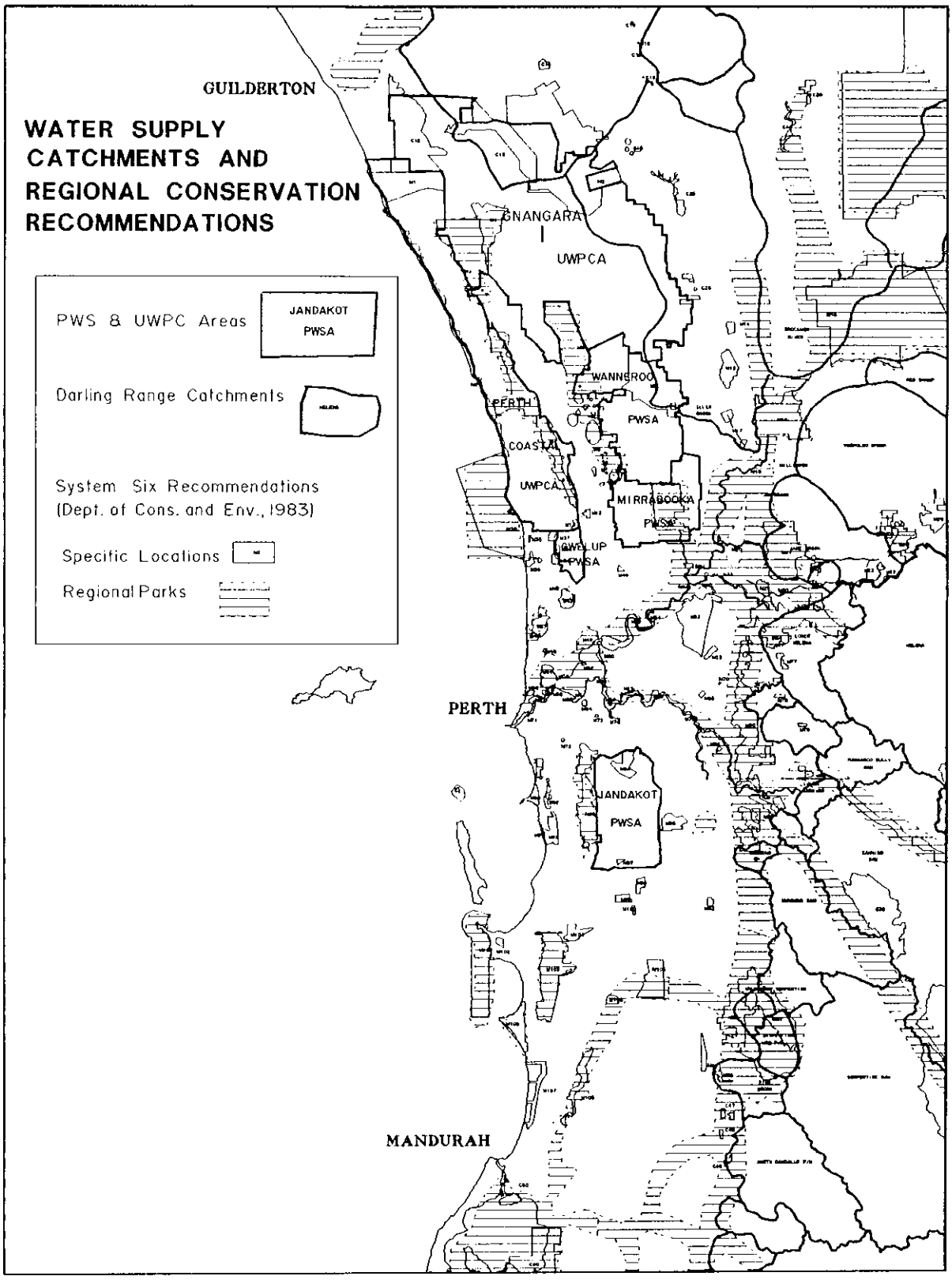


Figure 9. Catchments and Regional Conservation Areas

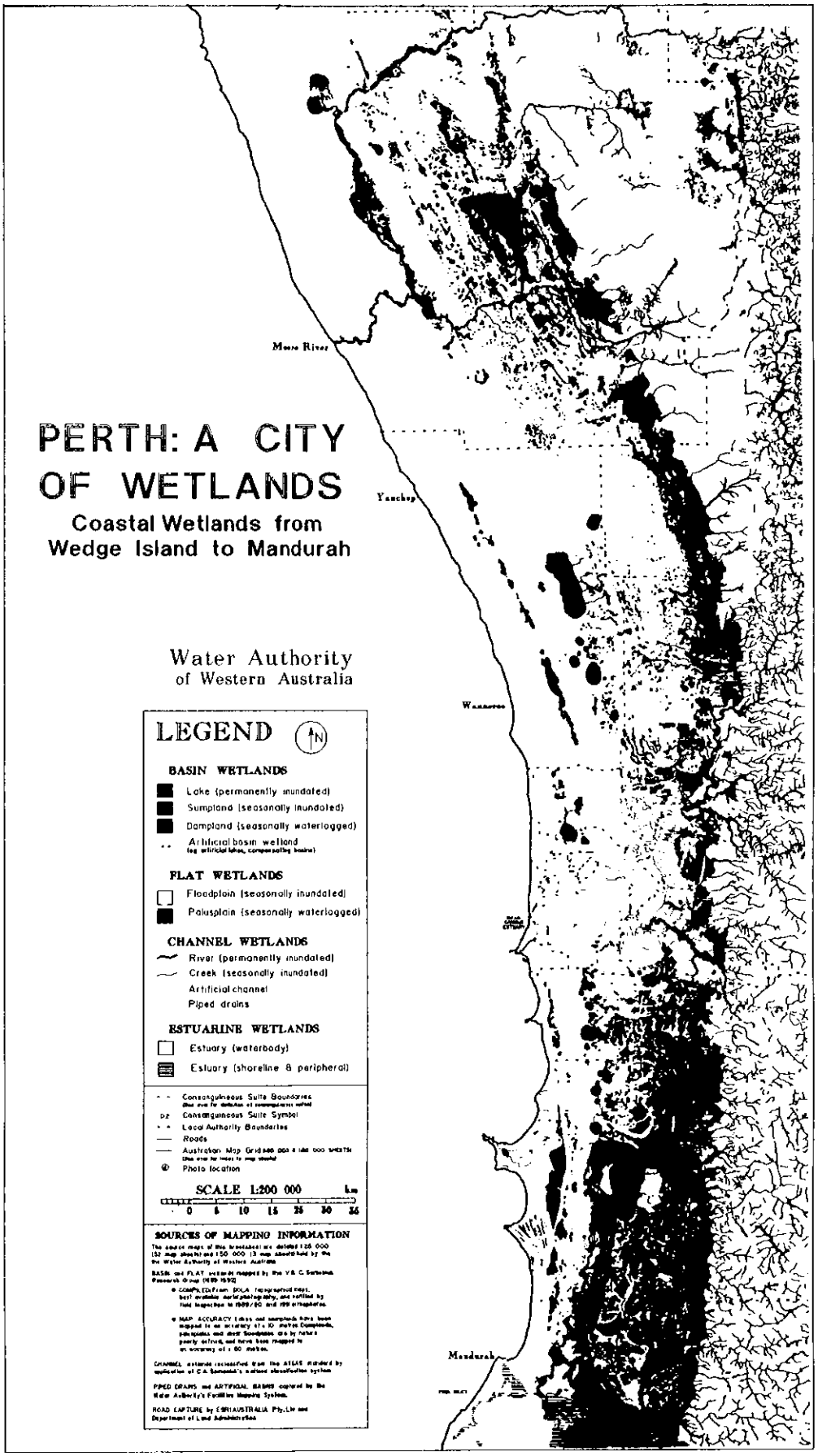


Figure 10. Wetland Mapping
Source: (Delmarco, 1992)

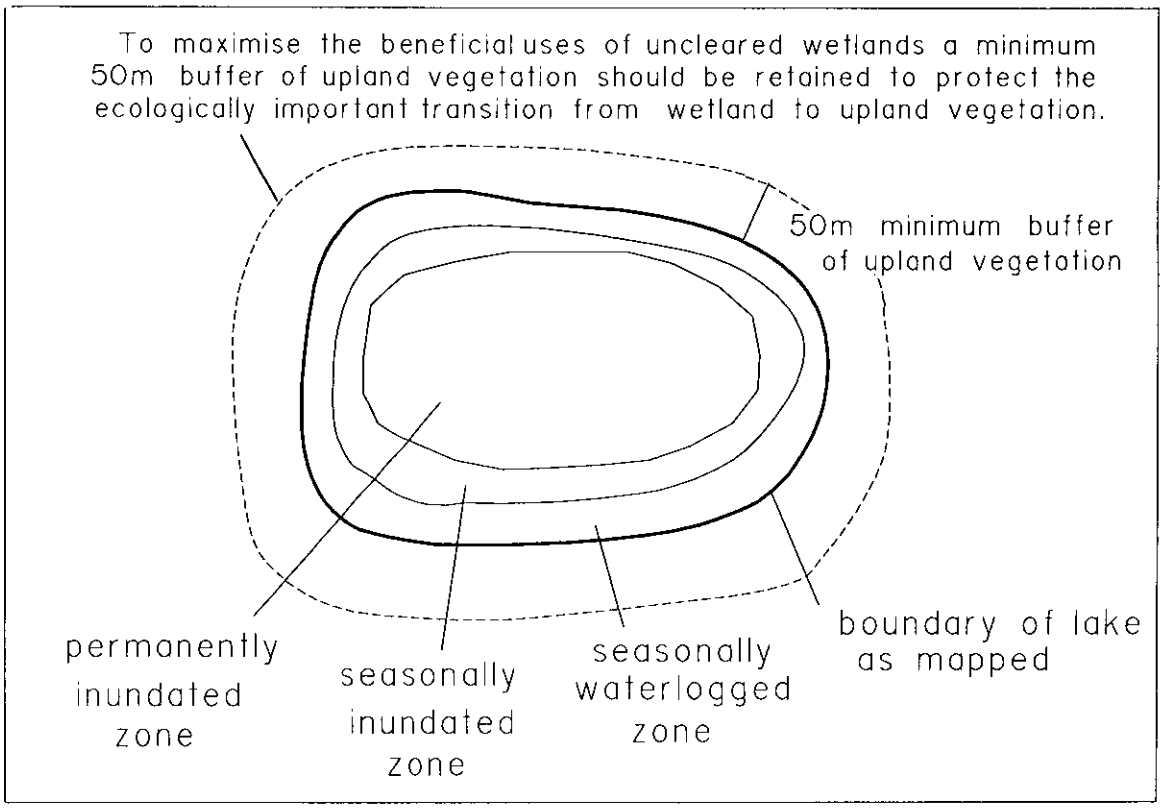


Figure 11. Wetland Zone and Buffer
Source: (Delmarco, 1992)

Vegetation Mapping

For the purposes of wetland evaluation the presence or absence of bushland adjacent to wetlands becomes fundamental to assessment. Best available digital vegetation mapping has been collated to be used in conjunction with the Water Authority's geomorphic wetland mapping, see Figure 12.

This data has been collected from the Department of Agriculture, Department of Land Administration (Topographic Services Branch) and the Pinjarra Community Catchment Centre to produce a map showing the remnant vegetation of Perth at scales of 1:25 000 and 1:50 000.

The approach taken was influenced by information provided to the Water Authority on the status of existing map coverage in a report to the Water Authority (AGC Woodward Clyde, 1991), see Figure 13. This study entitled *Vegetation Mapping of the Perth Metropolitan Region, Feasiblity Study* also described the options and costs of a consistent vegetation mapping coverage across Perth.

It is worth noting that the preferred method recommended for improving bushland mapping coverage was by utilising recent 1:25 000 orthophotos. Orthophotos were flown over the Perth Metropolitan Area in 1991 and are now available for use from the Department of Land Administration.

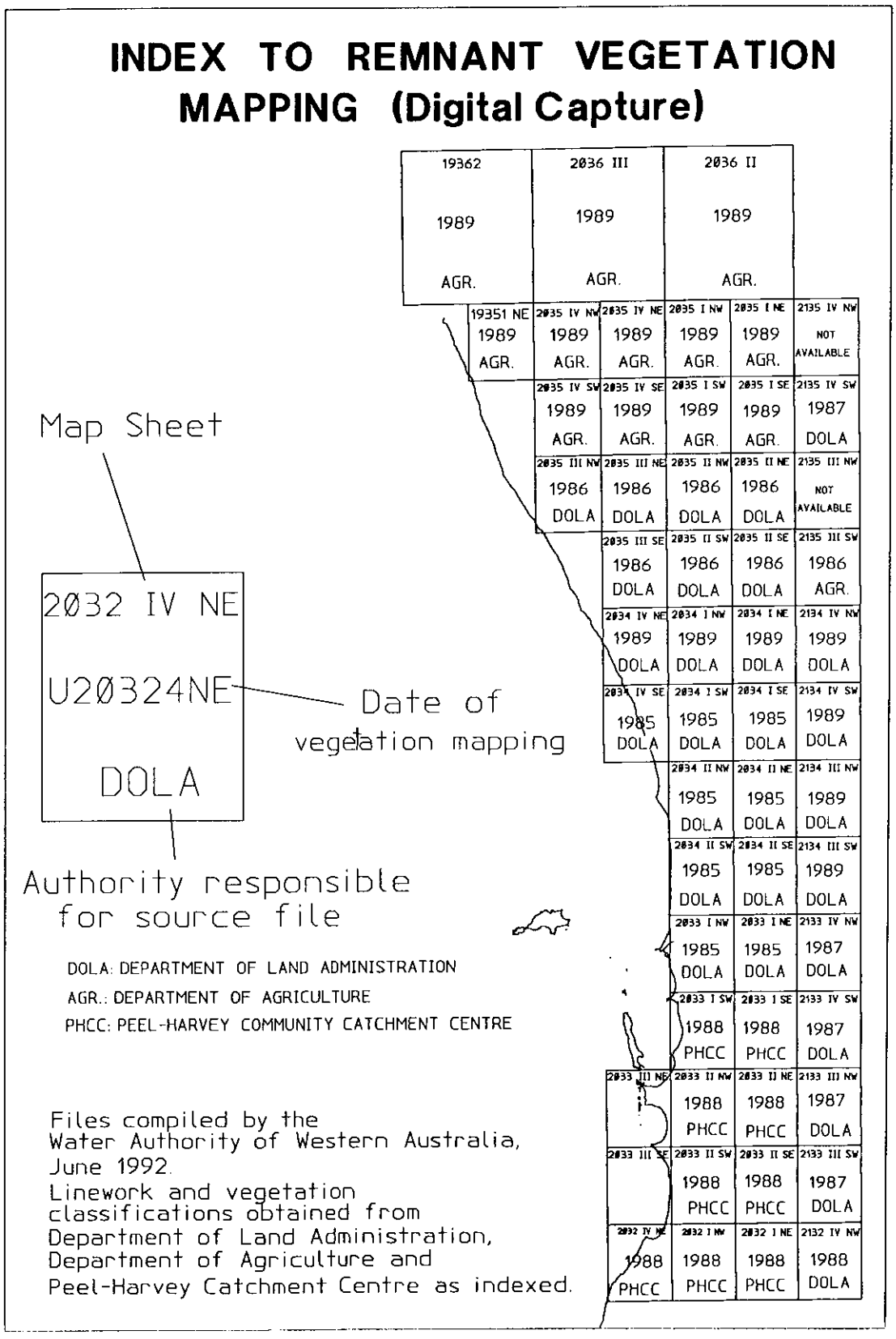


Figure 12. Digital Vegetation Information for Perth

Water Sensitive Design

The complex interplay that urban bush management has on water quality, water balance and water conservation is an important area of water sensitive design.

The importance of urban bushland management for water resource management, particularly the role that creek conservation corridors carry out, has been discussed in 3.1 above. It was stressed in a water sensitive design context by Hill & Nicholson (1989), see Table 3.

It has been afforded policy recognition in Policy No DC 6.3 by the State Planning Commission (1989), but has yet to be translated into practice at the local planning level.

Following publication of a discussion paper by Hedgcock & Moritz (1989), the Water Sensitive Residential Design Research Group (1990) and the recent Australian Institute of Urban Studies (AIUS) seminar on water sensitive design (AIUS 1991), some valuable recent work by consultants is approaching completion.

Including some treatment of riparian vegetation and other urban bushland and its water resource benefits, this project provides detailed water sensitive design guidelines with recommendations for implementation, by developers and government (Whelans et al, in prep). It is proceeding under the broad direction of a state, local authority and housing industry based steering committee. Benefits encouraging such an approach include critical nutrient management benefits for the Swan Canning System, the conservation of flora and fauna and allowance for future increases in demand for water oriented recreation.

Water Conservation

Powell & Emberson (1979), Powell (1986), Powell (1990), Sargent (1987) and various Wildflower Society publications have provided valuable information necessary for parks and garden managers, rehabilitators and house gardeners, to consider local native plants for a low water using alternative to the growing of European or eastern states plants.

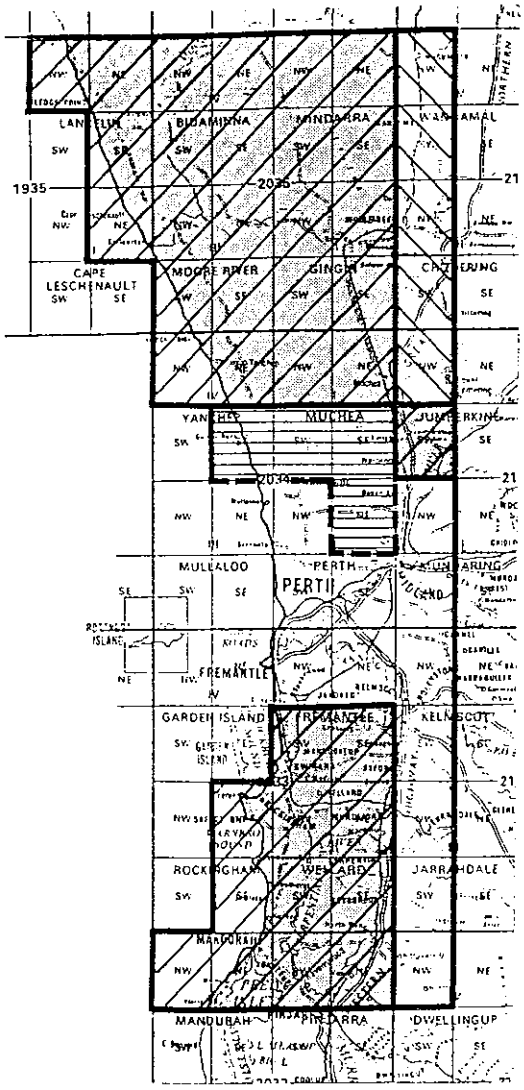
However while this information and skills reside only with skilled individuals, the Wildflower Society and similar groups, the propogation of local plants will continue to be a minority pursuit. This is not in the interests of good water resources management or good bushland management.

There is an obvious need for education resources in the area of utilisation of local plants for landscaping.

Potential bushland projects needed in this area include: *Greening Australian Gardens for Wildlife and Water Conservation,* (similar to Powell (1986)) or *Putting Nature into the Nature Strip* (build on Sargent (1987) targeting issues and managers) or *Revegetation Guides for the Perth Metropolitan Area,* (making similar revegetation guides to that prepared by Lefroy et al (1991) for the Central Wheatbelt).

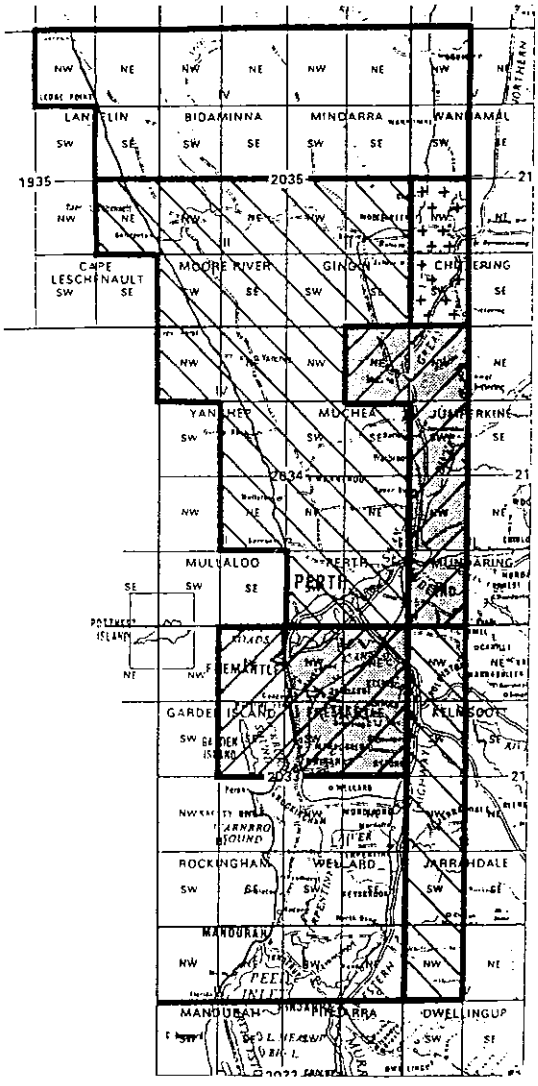
While it is unlikely a big change in garden composition would be immediate, the information should be available for use by gardeners and the nursery industry. Some preliminary discussions have occurred to address this need, however, it is reported here to flag an important task that must be well addressed in future urban bushland management.

REMNANT VEGETATION SERIES
Dept. Agriculture



Digital 1989
Non digital - pre 1989
Digital pre 1989
Nil data

TOPOGRAPHIC SERIES/VEGETATION COMPONENT
Dept. Land Administration



Digital 1989
Non digital - pre 1989
- North of Perth - New Series
- South of Perth - Old Series
Digital - pre 1989
No vegetation data

Figure 13. Existing Digital Vegetation Information
Source: (AGC Woodward-Clyde, 1991)

Table 3

WATER CONSERVING DESIGN FOR GARDENS AND OPEN SPACE
(Hiill and Nicholson, 1989)

DESIGN RESPONSE	HOUSE LOT	LOCAL AREA	REGION
Patterns of housing	• Smaller blocks as private open space becomes local area and regional space.	• Houses within remnant vegetation or clusters of houses or units on high ground overlooking wetlands in green belt.	• Structure plans topographically determined and compatible with regional water balance objectives.
Patterns of open space	• Local area open space, more important for recreation than on conventional house lot. • Paving or turf used in high use areas. • Infiltration areas on house lot linked to local area drains.	• Drains creeks, floodplains and other wetlands in local open space. • Remnant vegetation protected. • Local parks part of linked open space system.	• Open space used to satisfy regional user needs, resource management and landscape integrity. • Conservation corridors linking island reserves.
Areas zoned by intensity of human use: To conserve water 'areas are downzoned' towards elemental zone Primary Hydrozone Secondary Hydrozone Minimal Hydrozone Elemental Hydrozone	• Lawn and vegetable garden. • Exotics garden. • Native garden. • Remnant vegetation.	• Park areas and civic flowerbeds. • Shrubberies. • Limited irrigation 'dry' parks. • Remnant vegetation, conservation corridors.	• Ovals, major parks. • Horticultural areas. • Grazing areas. • Remnant vegetation, conservation corridors.
Soil amendment need for surface protection, water infiltration and storage.	• Improve soil for lawn, vegetable and exotic garden areas.	• Improve soil for park, flowerbeds and shrubberies.	• Improve soil for ovals and horticultural areas.
Turf Management well designed turf areas have efficient management of water and fertilizer.	• Water efficient species. • Good irrigation and fertilizer practice.	• Water effecient species. • Good irrigation and fertilizer practice.	• Water efficient species. • Good irrigation and fertilizer practice.
Local native plants retention or restoration of remnant vegetation where possible, replacement with local native vegetation adapted to soils and climate when landscaping.	• Front garden and wind break.	• Dry parks. • Conservation corridors, road verges, drainage lines, other utility corridors.	• Bush reserves, wetlands, drainage lines, conservation corridors.
Windbreaks reducing wind speed and evapotranspiration.	• Around house lot.	• Around parks.	• Around city (e.g. Broken Hill).
Water harvesting rain replaces irrigation.	• Off roof, paving onto turf, vegetable and exotics garden.	• Off roads, landscaped swales, compensating basins in parks.	• Runoff regime allows infiltration and maintains contribution to regional water balance.
Private water supply irrigation replacing high quality scheme water.	• Increased number of houses owning or sharing backyard bores, but with lower application rates.	• Increased number of parks irrigated by private bore.	• Ovals, parks and horticultural areas.
Waste water irrigation replacing high quality rainwater.	• Irrigate lawn and garden with grey water.	• Innovative reclaimation at a suburb scale e.g. Ormond Beach, Florida U.S.A., irrigated local area open space from local treatment plant.	• Innovative water reclaimation for irrigation of ovals and horticultural land from water treatment plant.
Water quality management reduce nutrients and sediment transport.	• Dished grass basins for infiltration in backyard, linked with vegetated local area swales.	• Vegetated swales linked to artificial basins acting as detention basins and pollution control ponds. • Prepare nutrient and irrigation management plan for parks.	• Wetlands including streams and drains to be incorporated in vegetated open space (conservation corridors) acting as biological filters and pollution control ponds. Prepare nutrient and irrigation management plan for ovals and horticultural properties.
Water balance management maintain acceptable water regimes, maintaining wetland ecosystems.	• Infiltration in dished areas on house lots with overflow linked to swales. • Trees and bores used as part of water balance management effort to part compensate for decreased evopotranspiration.	• Houses located on high ground. • Wetlands water table rise allowed for in open space. • Trees and irrigation from bores used as part of water balance management effort to part compensate for changes in water balance as recommended in local water resource management strategies.	• Wetlands including streams and drains to be incorporated in vegetated open space, conservation corridors detaining water and increasing infiltration. • Maintain water storage for possible public or private use.
Town planning regulation and water sensitive design.	• Water sensitive building codes.	• Incorporated in development control policies and reflected in structure plans of State and Local Authority Town Planning.	• Urban expansion and development control policies compatible with maintenance of wetlands and efficient management of water resources.

There is also a need for the maintenance of local areas of remnant vegetation for seed stock for when its value will be recognised.

Planning, Construction and Operation of Water Utility Facilties

The planning, construction and operation of water supply, stormwater management, and sewerage facilities will continue to change in the next decade as the newly accepted role of the Water Authority as an environmental manager matures (Moore & Arrowsmith, 1992). Improvements in the way projects are planned and executed are likely to reduce impacts on urban bushland.

Recent plant deaths on the Gnangara Mound will focus attention on the process, and improve the science used for determining water allocations, quotas, borefield design and facility operation (Arrowsmith, 1992).

Conclusion

The conservation of large areas of urban bushland has been encouraged through Water Authority efforts in protecting water supply source areas. This was easier to do in the days of the corridor plan when the groundwater mounds were viewed as 'rural' wedges.

Recent initiatives in the management of land used for agricultural and forestry purposes display a recognition of the importance of riparian vegetation and creeks as conservation corridors for water resource and environmental management.

This recognition of the importance of creeklines as conservation corridors is not being reflected in urban land allocation in the Perth Metropolitan Area. This is in spite of the opportunity that creeks, wetlands and urban bushland provide for a linked park system, for uses including increases in recreation near where people live and tourists have access.

City managers can learn from some of the recent work from Department of Conservation and Land Management and the Department of Agriculture.

Water sensitive design describes the processes and techniques needed to address some of these water issues in the land planning and management process and will reinforce the importance of bushland management as a water quantity, quality management influence and as a protector of ecological and social uses.

Recent wetland mapping, classification and evaluation has provided important information for improving the definition of basin wetland buffers.

Landsat imagery reinforces the regional and local significance of remaining urban bushland. Recent orthophotos provide an opportunity for detailed vegetation mapping and possibly flag a process for regular updates and auditing of the status of our urban bushland.

The Water Authority recognises the need for improved information on local plants to assist in reducing water use and the greening of parks and gardens for wildlife and water conservation.

The Water Authority will continue to improve its water resources management skills and information base. Urban bushland management will continue to be an important concern in this area.

As a water, sewerage and stormwater management utility also, there is a continuing challenge to reduce the impact that these operations have on urban bushland and as a dynamic and flexible organisation I have no doubt that we will continue to progress in these areas.

References

Arrowsmith N (1992). *Gnangara Mound Vegetation Stress Study: Results of Investigations,* Report No WG 127, Water Authority of Western Australia, February 1992.

Australian Institute of Urban Studies (AIUS) (1991). *Water Sensitive Urban Design,* AIUS(WA) and Western Australian Water Resources Council, Publication No WRC 7/91, December 1991

Beard JS (1990.) *Plant Life of Western Australia,* Kangaroo Press, Kenthurst NSW.

Becu R (in prep). Discussion Paper on Strategic Stormwater Management Planning, Water Authority of Western Australia

Bennett AF (1990). *Habitat Corridors: Their Role in Wildlife Management and Conservation,* Department of Conservation and Environment, Victoria, Arthur Rylah Institute for Environmental Research.

Blyth JD (1984). Rapid Stream Survey to Assess Conservation Value and Habitats Available for Invertebrates, In: *Survey Methods for Nature Conservation* (Eds. K Meyers et al) CSIRO Division of Water and Land Resources. Vol. 1, pp. 343-375, Canberra.

Breckwoldt R & Others (1990). *Living Corridors,* Greening Australia, Canberra, 1990.

Chambers JM and Davis JA (1988). How Wetlands Work, in *Proceedings of the Swan Coastal Plain Groundwater Management Conference,* pp 91-103, Western Australian Water Resources Council.

Cummins KW (1986). Riparian Influence on Stream Ecosystems In: Campbell IC (Ed). *The Management of Rivers for Instream Uses,* Water Studies Centre, Chisholm Institute of Technology, Victoria, Australia.

Davis J, Bradley J and Rosich R (in prep). Wetland Classification on the Basis of Water Quality and Invertebrate Community Data

Del Marco A (1992). *Perth: A City of Wetlands,* broadsheet, Water Authority of Western Australia, June 1992.

Department of Planning and Urban Development (1991) .*The Facts about Parks in Dollars and Sense,* broadsheet, Department of Planning and Urban Development, October 1991.

Environmental Protection Authority (1980) .*Wetlands: Guidelines for Protection and Management,* Department of Conservation and Environment, Bulletin 79, February 1980.

Environmental Protection Authority (1983). Conservation Reserves as Recommended by the Environmental Protection Authority - 1983, *The Darling System - System 6,* Part 1 & Part 2, Department of Conservation and Environment, October 1983.

Feilman Planning Consultants (1987). *Recreational Opportunities of Rivers and Wetlands in the Perth to Bunbury Region,* Western Australian Water Resource Council, Water Authority of Western Australia, December, 1987.

Hedgcock & Moritz (1989). Water Sensitive Urban Design: A Critique of Existing Practice and Potential Reform, in Western Autralian Water Resources Council (1989) *Swan Coastal Plain Groundwater Management Conference,* Perth October 1988.

Hill AL & Nicholson CJ (1989). *Water Conserving Design for Gardens and Open Space,* Water Authority of Western Australia, Dec 1989.

Hussey BMJ, Hobbs RJ and Saunders DA (1991). Guidelines for Bush Corridors, in *Nature Conservation: The Role of Corridors* Workshop/Conference Organising Committee; CSIRO Division of Wildlife and Ecology, Department of Conservation and Land Management, Main Roads Department, Roadside Conservation Committee, Perth ,Western Australia.

Lake PS and Marchant R (1990). Australian Upland Streams: Ecological Degradation and Possible Restoration, in Saunders DA, Hopkins AJM and How RA (1990) Australian Ecosystems: 200 Years of Utilisation, Degradation and Reconstruction, *Proceedings of the Ecological Society of Australia* Vol 16, Surrey Beatty & Sons, Chipping Norton NSW.

Land Conservation Council (1986). *East Gippsland Area Review: Proposed Recommendations,* Land Conservation Council, Melbourne, Victoria.

Lefroy EC, Hobbs RJ and Atkins LJ (1991). *Revegetation Guide To The Central Wheatbelt,* Department of Agriculture Western Australia, Bulletin 4231, Perth, September 1991.

LeProvost, Semeniuk and Chalmer (1987). *Environmental Significance of Wetlands in the Perth to Bunbury Region* , Western Australian Water Resources Council, Water Authority of Western Australia, December, 1987.

Majer K (1979). *Wetlands of the Darling System: Wetland Reserves and their Management,* Department of Conservation and Environment, Bulletin No 62, December 1979.

McGregor A (1989). *A Guide to the Preparation of Local Conservation Strategies,* A Report to the Minister for Planning and Environment, Victoria.

Mitchell P (1990).*The Environmental Condition of Victorian Streams,* Department of Water Resources, Victoria.

Moore L and Arrowsmith N (1992). *Environmental Handbook,* Water Authority of Western Australia.

Nicholson C and Edgecombe W (1986). Water Harvesting and Native Plants in Low Water Public and Home Landscaping, in Australian Water Resources Council and Western Australian Water Resources Council, *Working Papers for the National Workshop on Urban Water Demand Management,* Perth, May 1986.

O'Brien WT, McGregor AM and Crawshaw BW (1983). Instream Uses of Water in Australia, in Department of Resources and Energy (1983) *Water 2000: Consultants Report No 9: Instream and Environmental Issues,* AGPS, Canberra 1983.

Olsen G and Skitmore E (1991). *State of the Rivers of the South West Drainage Division,* Western Australian Water Resources Council, Leederville Western Australia, May 1991.

Pen LJ and Hilliard RW (1988). Conserving permanent streamline pools - the importance of maintaining adequate buffer strips and fencelines. Submission to Western Australian Water Resources Council on Draft Management Plans for Water Allocation in the Perth-Bunbury Region. School of Biological and Environmental Sciences, Murdoch University.

Pinder AM, Trayler KM and Davis JA (1991). *Chironomid Control in Perth Wetlands: Final Report and Recommendations,* Murdoch University, 1991.

Powell R and Emberson J (1979). *The Self Effacing Gardener: A Natural Plant Community in the Garden,* Organic Growers Association, Perth.

Powell R (1986). *Greening Urban Parks and Gardens for Wildlife,* Department of Conservation and Land Management, Como, Western Australia.

Powell R (1990). *Leaf and Branch,* Department of Conservation and Land Management, Perth.

Sadler BS and Williams PJ (1980). The Evolution of a Regional Approach to Salinity Management in Western Australia, in *Land and Stream Salinity Seminar,* Western Australia, Government of Western Australia, November 1980.

Sanders A (1991). *Oral Histories Documenting Changes in Wheatbelt Wetlands,* Department of Conservation and Land Management, Como, Western Australia, May 1991.

Sargent PA (1987). *Putting Nature back into the Nature Strip: Guidelines for the Planning and Landscaping of Roads in Perth,* Unpublished Graduate Diploma in Urban & Regional Planning Thesis, Curtin University of Technology.

Saunders DA and Hobbs RJ (Ed) (1991). *Nature Conservation 2: The Role of Corridors,* Surrey Beatty & Sons, Chipping Norton NSW in association with CSIRO Division of Wildlife and Ecology, Department of Conservation and Land Management, Roadside Conservation Committee, and Main Roads Department, Perth, May 1991.

Saunders DA, Hopkins AJM and How RA (1990). Australian Ecosystems: 200 Years of Utilisation, Degradation and Reconstruction, *Proceedings of the Ecological Society of Australia,* Vol 16, Surrey Beatty & Sons, Chipping Norton NSW.

Schofield NJ, Ruprecht JK and Loh IC (1988). *The Impact of Agricultural Development on the Salinity of Surface Water, Resources of South West Western Australia,* Water Authority of Western Australia, Report No WS 27, August 1988.

Select Committee into Land Conservation (1991) .Final Report 1991, Western Australian Legislative Assembly, Perth, December 1991.

Semeniuk CA (1987). Wetlands of the Darling System: A Geomorphic Approach to Habitat Classification, *Journal of the Royal Society of Western Australia,* 69 : 95-112.

State Planning Commission (1989). *Development Control Policy Manual 1,* State Planning Commission, Western Australia.

Steering Committee for Research on Land Use and Water Supply (1989) .*Stream Salinity and its Reclamation in South-West Western Australia,* Water Authority of Western Australia, November 1989.

Thorburn L (1992). *Channel Wetlands: An Investigation of the Application of Simple Evaluation Procedures,* Report No WP 153, Water Authority of Western Australia, March 1992.

Walker A (1992). Webs of the Forest, in *Landscope* Vol 7, No 3 pp 17-21, Department of Conservation and Land Management, Autumn 1992.

Water Sensitive Urban Design Research Group (WSUDRG) (1990). *Water Sensitive Residential Design: An investigation into its purpose and potential in the Perth Metropolitan Region,* Western Australian Water Resources Council, February 1990.

Western Australian Water Resources Council (1986) .*Water Conservation Through Good Design: A Guide for Planners, Architects, Engineers, Landscape Architects and Land Managers,* Publication No WRC4/86, Perth.

Western Australian Water Resources Council (1991) .*Safeguarding Our Water Resources: Perth - Bunbury Draft Regional Allocation Plan,* Western Australian Water Resources Council, September 1991.

Whelans and Halpern Glick Mannsell in association with Thompson Palmer & Mouritz M (1992) .*Water Sensitive Residential (Urban) Design Guidelines for the Perth Metroplitan Region,* prepared for the Department of Planning and Urban Development, Water Authority of Western Australia and Environmental Protection Authority, Vol s I and II

Williams PJ and Hill AL (1992). The State of the Rivers and Other Wetlands of the South West of Western Australia and the Role of Vegetated Buffers in their Preservation and Restoration, Catchments of Green, *Greening Australia 2nd National Conference,* Adelaide, February 1992, unpublished.

NEW FINANCIAL REPORTING REQUIREMENTS FOR LOCAL GOVERNMENT AND THEIR IMPLICATIONS FOR BUSH MANAGEMENT

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Ernst & Young

I propose to provide a brief overview of current directions in local government reporting requirements and how that may have an impact on the management of urban parks and bushland.

My first source of reference is the Public Accounts Committee Report No. 53, issued in January 1991 by the Government of New South Wales entitled *Report on the Auditing of Local Government*. This report, whilst primarily concerned with auditing issues, in its Summary of Recommendations (some thirty-three in all) at No.33, recommends as follows:

> 'It is recommended that the form and content of the Council's Annual reports be in line with reporting requirements for public companies.'

This recommendation has now been given substance in the form of Australian Accounting Standard (AAS) No.27 issued by the Australian Accounting Research Foundation (AARF) as developed by the Public Sector Accounting Standards Board (PSASB). This AAS 27 was issued in July 1991.

AAS 27: Financial Reporting by Local Government

Local government throughout Australia has embarked on a process of micro-reform. As part of that process significant changes are being made to financial reporting requirements to redirect thinking about how resources are managed and financed by local government.

Purpose

The purpose of the standard is to prescribe the basis upon which local governments should report their assets, liabilities, revenues, expenses and equity.

The information required will identify the cost of goods and services provided by the local government; the recovery of those costs, whether by user charges, rates or grants, the assets controlled for the provision of goods and services; and debts and other liabilities incurred.

Main Requirements

The major features of AAS 27 are summarised below:

The financial statements of local government must consist of:

- an operating statement, prepared in accordance with AAS 1: Profit and Loss or Other Operating Statements;

- a statement of financial position showing assets, liabilities and equity as at the reporting date;

- a statement of changes in equity; and
- a statement of Cash Flows in accordance with AASB 1025.

Implications for Local Government

The application of AAS 27 through revised jurisdictional regulations will result in an entirely new financial reporting framework requiring substantial changes to the way in which local governments presently report and account for their operations.

Important practical implications for accounting practices include:

- application of full accrual accounting;
- replacement of fund reporting with aggregation and consolidation reporting. This will require the identification of controlled entities which must be consolidated in the local government's consolidated financial statements;
- identification and measurement of infrastructure and heritage assets not previously brought to account. Asset lives, depreciation methods and the adequacy of asset registers will need to be addressed;
- ensuring compliance with Statements of Accounting Concepts and all other Australian Accounting Standards - except for some specifically not applicable as stated by AAS 27; and
- full recognition of assets and liabilities, income and expenditure as defined in AAS 27. This will result both in the recognition of lease assets and liabilities, and in reserves, provisions, trusts, depreciation, grants loan principle and sinking funds being treated differently.

There will also be important management implications.

- While financial reporting and budgeting will be performed on an accruals basis, the estimates - the subject of the budget which determines the level of (cash) expenditure to be funded by (cash) rate income - will continue to be prepared on a cash basis.
- Funding of reserves and provisions will become an issue on which each local government will decide its own policy. This will require an increased emphasis of financial information, highlights the need for asset management and cost recovery strategies.

Perhaps the most significant change will be the recognition, measurement and depreciation of assets. All assets that meet the recognition criteria of AAS 27 are to be recognised in the financial statements.

Recognition

The recognition criteria set out in AAS 27 are as follows:

An asset of the local government shall be recognised in the statement of financial position when, and only when, the following criteria are satisfied:

(a) it is probably that the service potential or future economic benefits embodied in the asset will eventuate; and

(b) it possesses a cost or other value that can be measured reliably.

This will require assets never previously brought to account as assets, being identified, valued and included in the books. These include infrastructure assets such as roads, bridges and monuments.

The standard does not distinguish between different types of assets such as "heritage" assets (eg. parks) and infrastructure assets.

All assets that meet the recognition criteria are to be recognised. This approach may lead to practical difficulties in measuring long-lived assets.

Measurement

Assets are to be measured at cost or at valuation in accordance with AAS 10: Accounting for the Revaluation of Non-Current Assets.

An acceptable method of initially recognising assets previously acquired, which have not been recognised in the statement of financial position, is to record them at written down current cost, identifying separately where possible their current cost and any accumulated depreciation. This would apply to infrastructure assets not previously recognised. This method is not proscribed by the standard, but merely suggested as one method of initially recognising such assets.

The standard recognises that significant practical problems may arise in determining the carrying amounts of assets. Accordingly, the transitional provisions allow until reporting periods ending on or after 1 July 1996 for the recognition of assets such as existing infrastructure assets.

However, any new capital expenditure on infrastructure made after the commencement of the standard will need to be recognised as an asset. If the transitional provisions are adopted then the local government must disclose the types of assets not recognised and the policy adopted in respect of them.

Depreciation

All non-current assets with limited useful lives are to be depreciated in accordance with AAS 4: Depreciation of non-current Assets. This recognises that certain long-lived assets, while requiring extensive maintenance, do not have infinite lives.

Application of the Standard

The standard applies to each Local Government in Australia for reporting periods ending on or after 1 July 1993, with the transitional provisions available as referred to above.

Conclusion

I have tried to outline very briefly the changes to the reporting environment in which local government will be operating and the impact that will have on the information requirements to meet those needs.

I am sure I have probably raised more questions than I have answered, but the purpose of this paper was to provoke inquiry and alert you to the need for information hitherto not called for to identify and measure assets. There are other matters in the standard upon which I have purposely not touched in the time allowed. I have dwelt on assets in which parks, gardens and open space could be classified.

A MANAGEMENT OVERVIEW

Leon Griffiths, Project Officer
Department of Conservation and Land Management

Management of urban bush areas can be described as management by purpose.

Purpose Determining Proprietorship

Many areas are managed historically by the holders of the original parcel of land. Planners have largely identified areas of significance in a variety of reports such as the *System 6 Report* (EPA, 1983), in environmental audits and other studies. These areas are mostly currently managed by government and local authorities. Significant areas of urban bushland are still in private ownership and these are rapidly diminishing with the spread of new developments.

Issues

It is important to identify the correct managers with the relevant expertise and supporting resource.

Areas need to be properly assessed to determine their value for retention.

Selected land parcels should be protected and adequately funded.

Any form of interim management undertaken should not compromise identified values and should be beneficial to the final managers.

Areas should link into the 'bigger picture' of urban management and should be viable to manage.

Small land parcels require more intensive management.

Private land owners should be encouraged to undertake responsible environmental management.

Perception of Purpose

Perception falls into two distinct categories. The perception of how the managers see the area being managed and the perception of the public as to the way it is being managed.

It is important that these perceptions achieve a common plane and that the communication between the manager and the public is maintained.

The public needs to be informed of the reasons why management practices are undertaken in a certain way. This can be done in a variety of ways such as:

- community involvement in programs
- volunteer participation
- planning and review processes
- management advisory bodies
- schools and educational programs

- publications and media coverage
- research programs and reports, etc.

There is strong competition for space between conservation and recreation needs which has to be addressed and compatible pursuits identified.

Also management practices themselves need to be reviewed from time to time to meet objectives.

Issues

The land purpose should be clearly identified. A specific purpose sometimes determines a particular management approach that may appear contrary to normal practices eg. exclusion of fire (Ellenbrook/Twin Swamps, for the protection of the Western Swamp Tortoise).

Detailed surveys are required to determine the total range of values that are being managed.

Education and interpretive programs, information, dissemination and public participation are essential to avoid conflicts occurring.

Identification of recreational pursuits and determination of how they can be accommodated are necessary.

A management fund contribution on proposals impacting on reserves should be considered as a condition of development.

Purpose Defines Protection

'People pressure' is the greatest threat to management control. In a densely populated urban environment we face the greatest threat. The major challenge for managers is to meet these pressures and develop means by which to address them.

Some of the issues will be addressed by fellow speakers so I will broadly list a range of problems we as manager face today. Many of these are inter-linked.

Issues

Fire – threat to life, property and ecosystem

Weeds – prevention of uncontrolled spread

Feral animals – displacement and loss of native species

Disease – prevent introduction and treatment of what is found

Erosion – prevent and revegetate

Nutrients – prevent pollution

Health – midge/mosquito control. Balance in the food chain

Illegal activities – dumping/vandalism/wildlife offences/arson and destruction of native vegetation

Movement control – maintaining integrity of the area.

Each issue needs to be addressed by specific actions.

Plan for the Purpose

A plan should be developed to clearly identify management actions for the land in question. These may range from a simple action plan to interim management guidelines and eventually to a full scale management plan. It is essential that any management action does not impinge on any of the eventual recommendations.

Finally we must remember that the -

Purpose of Management is for the People

I am sure we all love the bush but unfortunately we have taken it for granted over the years. We need to put some purpose into our future management to ensure what remains is not lost forever.

We owe it to everyone to use our management skills to preserve ecosystems and habitats as we know them so that they are still a treasured part of the lifestyle of future generations.

LARGE TREE DECLINE

Rob Bodenstaff, Executive Member
The Tree Society, and
Senior Arboriculturist
Arbor Centre Pty Ltd

What is the cause of tree decline in our urban bush?

The answer is - People and their activities.

Leading tree scientist, Dr Alex Shigo has termed this as PPD (People Pressure Disease). He points out that less than 10 percent of tree decline is due to natural causes. In other words it's us and the things we do as individuals and as a community that are the primary cause of trees declining.

The reasons why we impact so severely on trees are many. Historically, our focus has always been on the above ground parts of trees, the bits we see, how they fit into or compliment the landscape or bush setting.

It's common for people to think trees are timeless and that all they need to survive is unstinted admiration or that their sometimes awesome size symbolises strength and the ability to withstand all.

Unfortunately none of this is true. Trees die (they'd live longer, however if our activities were kept away from them, but that's not what urban bush management is all about). Further, the bigger and older trees are the more susceptible they are to our surrounding activities. Of overwhelming significance here are the false ideas we have of their root systems. The below ground parts; the bits we can't see.

The vast majority (approx 90+ percent) of tree problems are initiated through direct interference with or secondary impact on the root zone. Some practical information about root systems may help us appreciate this factor a little better.

Directly Associated with the tree are:

- **Tap Roots** - Believe it or not, most mature trees don't have tap roots. (A couple of the exceptions are Jarrahs and Brachychitons). I challenge you all to check this out for yourself. In your travels take a close look at trees that have been blown over in paddocks or along roadways or wherever. In some instances you may notice a remnant of what was its original tap root when it germinated.

- **Root Zone Depth** - Something else you'll notice when looking at dislodged root balls is the sallow nature of its essentially lateral root system. Most of our native trees have approximately 80 percent of their root system in the first 600mm of soil. These service the feeding roots that predominantly function in the top 200-300mm of soil.

- **Lateral Spread of Roots** - Studies in Victoria have shown that as a rule of thumb the radius of lateral root zone spread is equal to the tree's height (not to the dripline). For some Eucalypts it was measured to multiples of height.

Comments

These three basic factors alone mean that surface activity of any kind within felling distance from an endemic tree will initiate some degree of decline in the tree. It's no wonder we are the major cause of their decline.

- **Reaction Time** - A factor which deceives many of us is that trees take time to respond. The reaction time between root zone damage and the physical display of symptoms by the tree often takes several years, and by which time it is usually too late to rectify the problem.
  Unfortunately a few years is time enough for the offenders to lose sight of any connection between their action and its effect. They remain convinced that what they did was quite OK. It is important to appreciate here that sudden changes to a root zone environment have the same effect as severing roots. For a stand of trees that have adapted to a particular site over some hundreds of years, the installation of a pathway is a sudden change which can trigger a sequence of events that will cause the decline of many trees and the premature loss of others in the ensuing years.

- **Compaction** - In line with the realisation that tree root systems are shallow and spreading, research has shown that compaction is a major cause of tree decline. Even people traffic causes compaction which in turn kills roots and encourages weed invasion. In some Tasmanian National Parks raised walkways have been installed to overcome these compaction problems. Here in Perth we have a root zone decompaction machine (Terralift) to address such problems.

Factors Indirectly Affecting Trees

- **The Urban Environment** This is like no other environment. It is unique and by virtue of the existence of modern society and its facilities, such as power, water and sewer supplies, roads, fences, sports fields, parking... etc, it will always be in conflict with the neighbouring endemic bush environment. Facilitating urban expansion results in the permanent disruption of surface and ground water flows on a large scale. The remnant islands of urban bush are subjected to sudden and often permanent change with the expectation that they will survive if left alone.
  The irony is that with little or no additional expense, works can be undertaken to effectively negate the impact of such estate developments (as our involvement in recent Mandurah development has shown). Sweden has recognised that excavations and de-watering can cause trees to decline and become hazardous and has gone so far as to introduce environmental vandalism legislation in this regard.

- **Risk Management** Of real consequence also in causing tree decline in urban bushlands are the measures taken in public open spaces as part of the local or state bodies' responsibility to ensure that 'All Reasonable Care' has been taken to protect users of the area.

The good news is that most of what we can do which impacts on our urban bushland can be obviated given the arboricultural knowledge and technologies available. The challenge is creating awareness of what tree needs actually are so that timely remedial works can take place.

Trees cannot change, we must learn to accommodate the tree.

Dr Alex Shigo

MANAGING FIRE IN REMNANT BUSH AREAS

Jim Sharp, District Liaison Officer
Bush Fires Board

Introduction

The paper is in two parts - the role of fire management in an overall management context, based on the work of Robert Powell[1], and guidelines for fire management, with particular reference to road verges in outer urban areas, taken from the Roadside Conservation Committer's *Roadside Manual*[2].

Background

The purpose of managing areas of bush located within suburbs and outer areas is for the retention of wildlife and for people's enjoyment. Bush areas support not only many species of local plants but also a great diversity of associated animals, especially invertebrates (insects, spiders, etc.). By retaining areas of bush we can become familiar with the local flora and fauna. Such areas are most appropriate and convenient sites on which schools, both primary and secondary, could conduct field studies as part of their biology classes.

Even for those persons interested in learning about local flora and fauna, bush areas can provide a restful change from the many developed parks, and the historical insight into the past state of their local environment.

It should be remembered that there will not always be bush around the suburbs. Only 50 years ago there were extensive areas of bush in and around such suburbs as Nedlands, Attadale and Mosman Park, but very little remains today, as it has been replaced by roads and houses and largely artificial parks and gardens. In some of the older suburbs, residents are taking an increased interest in small remnants of bush, both in planning for their retention and management and in carrying our weeding and other management practices.

The System 6 Study report recognised the value of retaining areas of bush, and for over 30 years in the metropolitan region recommended that the growth and regeneration of local indigenous flora should be encouraged. Particular areas contain a range of plant species. Most of those species are typical of the soil types, some of them virtually combine to soils, while others are of more wide spread occurrence and are also found growing on similar or other soil types. Especially interesting features of some species are by no means uniformly distributed.

As managing natural vegetation involves the retention of the area as bush (ie. a natural association of species), no planting should be undertaken. The planting of species that do not grow here would only detract from the total effect, and serve as a perpetual reminder of human interference. Even the planting of species that do grow here could interfere with the natural patterns of the distribution of the various species. In the management of degraded areas of bush it is sometimes necessary to plant where there are bare patches to speed the process of recovery (taking care to plant only local species propagated from seed or cuttings taken from naturally occurring pants on or near the site), but this is unnecessary in areas with good covers of vegetation.

Management Plans

Management plans should be developed and the terms of these plans may be up to ten years or more. After that period, the management measures should be reviewed to determine their effectiveness, and a new management plan may be produced, either with the same or with modified management measures. The management aims of the new plan should remain unaltered.

Management Aims

1. To protect the local vegetation and maintain it in a state as close as possible to its natural one.

2. To encourage the use of the area by school children and/or volunteer groups in such a way as to help them to develop a familiarity with local vegetation and an understanding of its ecology.

Management Measures

1. Public Use

   - The careful design of pathways around or through the area to encourage people to keep to them and thus not trample the vegetation.
   - The use of signs, labels, etc, to help people to learn about local vegetation.

2. Weeding when and where necessary - for the purpose of reducing competition from introduced plants, and thus encouraging the growth and regeneration of naturally occurring plants. It should be adequately supervised to ensure that disturbance to naturally occurring plants is minimal. If necessary, advice should be sought from the Department of CALM, Main Roads Department and the Department of Agriculture.

3. Any rubbish that has been dumped should be promptly removed. Rubbish has several harmful effects. It looks unsightly and encourages further dumping. By acting as a fertiliser it harms local plants and at the same time encourages weeds. It may create a fire hazard and may harbour vermin.

4. The erection of barriers where necessary to encourage people to keep them off fragile areas (eg. steep slopes), and the erection of temporary fences if necessary to protect from trampling areas that have been accidentally burnt.

5. The taking of photographs from fixed points every two years, and their careful examination. If they indicate any deterioration in the plant cover, the causes of the deterioration and the appropriate remedial action can be carefully considered. If necessary advice should be sought from the Department of CALM, Main Roads Department and the Department of Agriculture.

6. Measures to Control Fire

   - Weeding will assist to reduce the incident and impact the fire.
   - The ploughing, mowing or chemical treatment of minor fire breaks around the borders of the area if necessary. Internal paths will act as further fire breaks, and will assist in confining any fires that occur and preventing them from burning the entire area.

- The asking of residents near the area to volunteer as fire informers, to notify the responsible body of outbreaks of fire.

Frequent fires do a lot of harm, by injuring and thinning the natural vegetation and reducing the leaf litter on the ground, and at the same time encouraging weeds. Vegetation that has been recently burnt is more accessible to people, and is thus vulnerable to trampling and soil disturbance. The aim should be to maintain an interval of at least 15 years between fires. Vegetation that remains unburnt for much longer still is of scientific interest because it provides information on such things as how long various plants live and how they reproduce in the absence of fire.

Guidelines for Fire Management

Preamble

Fires are a natural component of the Western Australian environment. Most plants have evolved strategies to cope with periodic fires.

Fire management for vegetation conservation involves ensuring that fires do not occur more frequently than the time needed for all plants to reach adequate reproductive capacity. The fire regime should be planned to be as varied as possible to encourage community diversity. It is assumed that, if vegetation health and diversity is maintained, so will animal use of the area.

Use of fire to abate fire hazards should be confined to those areas where distinct hazards, high ignition risks and high values can be identified. In general, these relate to roadsides where native plant species have been replaced by annual weeds and grasses.

Policy

1. Roadside burning should not take place without the consent of the managing authority.

2. Local government authorities should adopt by-laws to control roadside burning.

3. Roadside burning should be planned as part of a total Shire/area Fire Management Plan.

4. Only one side of a road should be burnt in any one year.

5. When designing a Fire Management Plan, the two principles which must be kept in mind are the ecological management of vegetation and the abatement of fire hazard.

6. No firebreaks should be permitted unless the width of the roadside vegetation is greater than 20m.

7. A firebreak on any road reserve should be permitted only when, in the opinion of the road manager, one is necessary for the protection of the roadside vegetation. The road manager shall specify the maximum width to which the break may be constructed.

8. In the case of any dispute concerning roadside fire management, the Bush Fires Board should be called in to arbitrate.

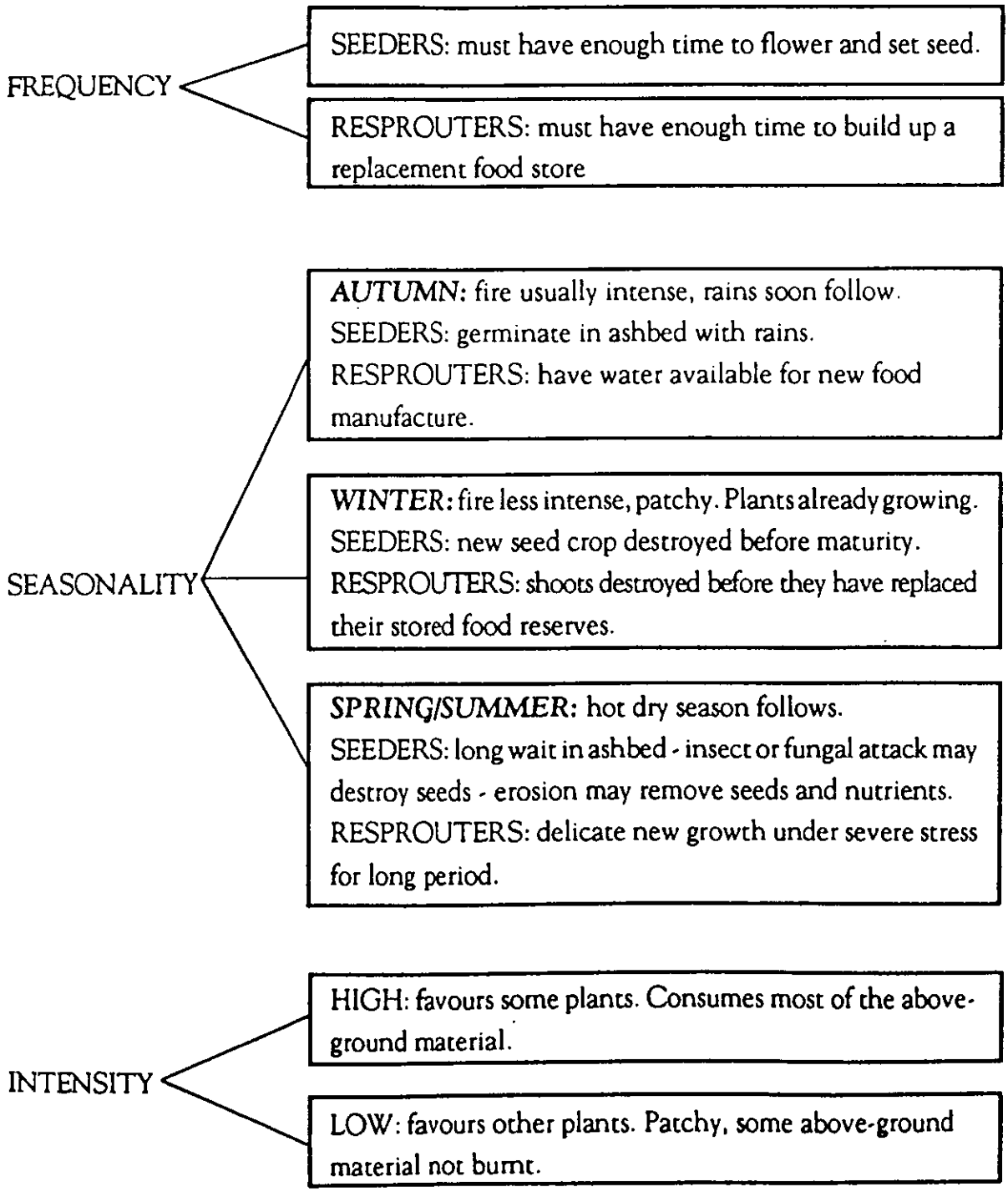

Figure 1. Effects of Fire Regime on Plant Regeneration on Roadsides in Outer Suburban Areas.

Fire and Plant Ecology

No two fires are alike!

Their effect on plant communities depends on four major factors:

- The **frequency** of fires.
- The **seasonality** (time of year) in which the fire occurs.
- The **intensity** of the fire.
- The **distribution** (patchiness) of the fire.

The effect of these factors are summarised in Figure 1.

FIRE FREQUENCY

Plants regenerate after fire in three main ways:

- by resprouting (resprouters)
- by seeds (seeders)

or

- by both resprouting and seeds.

Resprouters

After a fire, many native plants shoot again from buds protected beneath their bark or below ground on their rootstocks. To do this, they use up food reserves stored in roots and stem. Examples of resprouters are illustrated in Figure 2.

If fires are too frequent, they do not get enough time to build up new food reserves, so each resprouting becomes weaker until eventually the plant dies.

Seeders

If a plant is killed by fire, it will regenerate from seeds stored on the plant or in the soil. To replenish this seed bank, the seedlings must be able to reach maturity, flower and set more seeds.

Kangaroo Paws for example, need at least two years to produce more seed. Too frequent burning will eliminate them from the site. Other plants need four years to begin to produce seed. Tree species such as wandoo may take up to 12 years from the seedling stage to produce enough seed to ensure survival of the population (see Appendix for further details). Examples of seeders are illustrated in Figure 3.

Weeds such as Wild Oats, Veldt Grass and Wild Turnip (refer Figure 4.) produce copious seed annually, and have the capacity to take over from native plants.

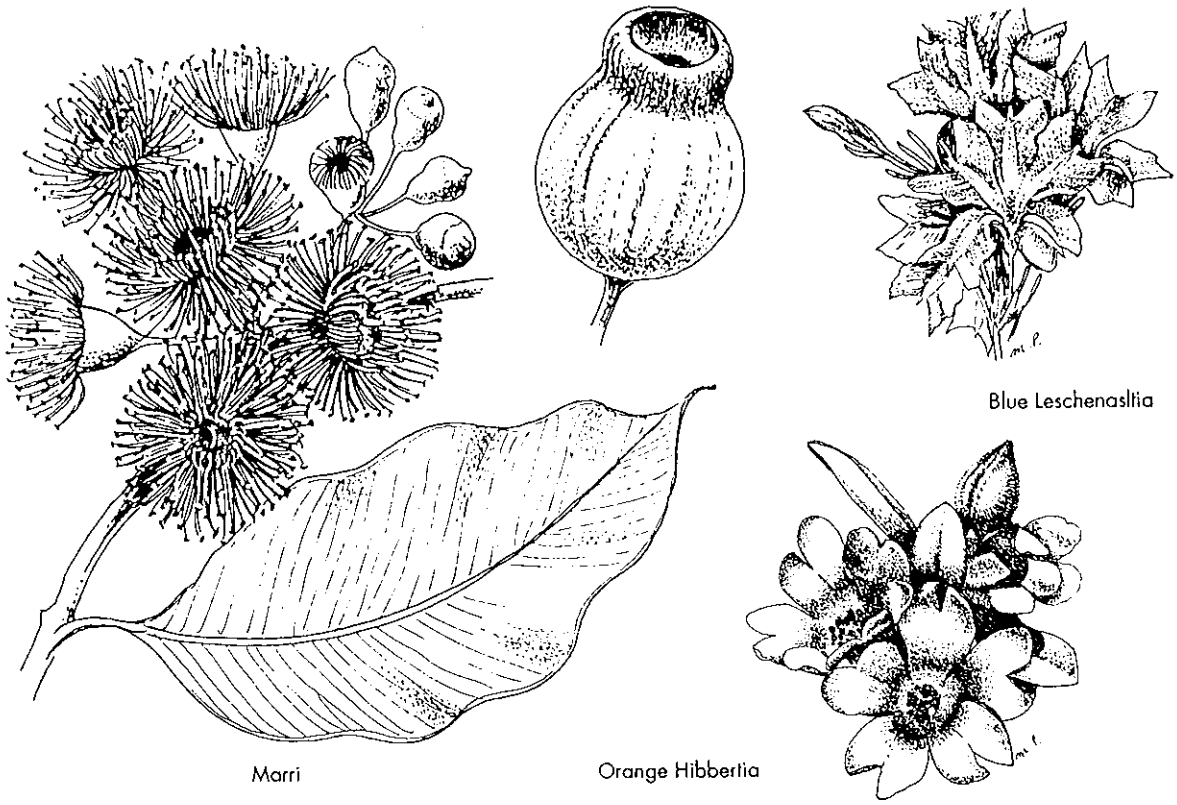

Figure 2. Examples of Resprouters

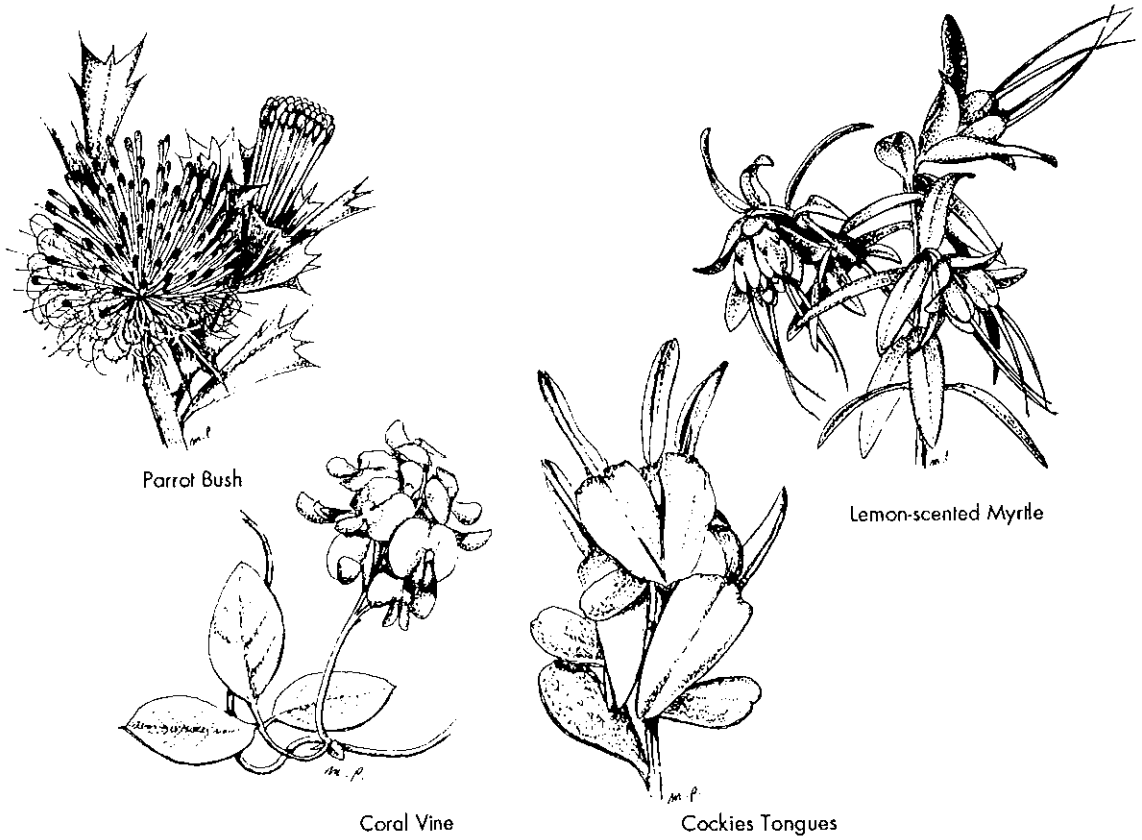

Figure 3. Examples of Seeders

Figure 4. Examples of Weeds

Burning too frequently, at the wrong time of year and at the wrong fire intensity encourages weeds and eventually eliminates native plants. (refer Figure 5.)

FIRE SEASONALITY

Long narrow strips of vegetation such as are found on roadsides in outer urban areas are particularly vulnerable to seasonal stress, and this increases in intensity in lower rain fall areas.

Spring burns subject regenerating vegetation to a long waiting period before the next effective rainfall. Seeds which have fallen in the ashbed may be destroyed by pests before they can germinate. Wind may erode the bare soil and remove both seeds and ashbed nutrients.

Wind-blown seeds of weeds such as grasses blow onto the bare area from surrounding land.

Spring burning is potentially detrimental to native vegetation on narrow strips such as roadsides, especially in low rainfall areas.

FIRE INTENSITY AND DISTRIBUTION

Fires of different intensity favour regeneration of different plants.

Some plants need an intense fire to open their fruits or crack their seed coats, others respond better to a cool burn. Intense fires may damage or kill mature trees.

Low intensity fires may leave patches of unburnt material that can be a seed source or an animal refuge.

Conditions for burning must therefore be carefully selected to provide maximum benefit to the plants to be regenerated.

Weeds and Fire Hazard

The presence of exotic weeds such as grasses, watsonia or wild turnip increases the roadside fire hazard.

Flammability

Most roadside weeds ignite more easily than do native plant fuels.

Fuel availability

Weeds (eg. wild oats) germinate, grow and die in one year, quickly becoming fuel for a bush fire. Depending on climate and growth rates, native plants take much longer to reach this state.

Continuity of fuel bed

Native plants usually have gaps between them. Weeds produce a continuous fuel bed, permitting a fire to spread quickly.

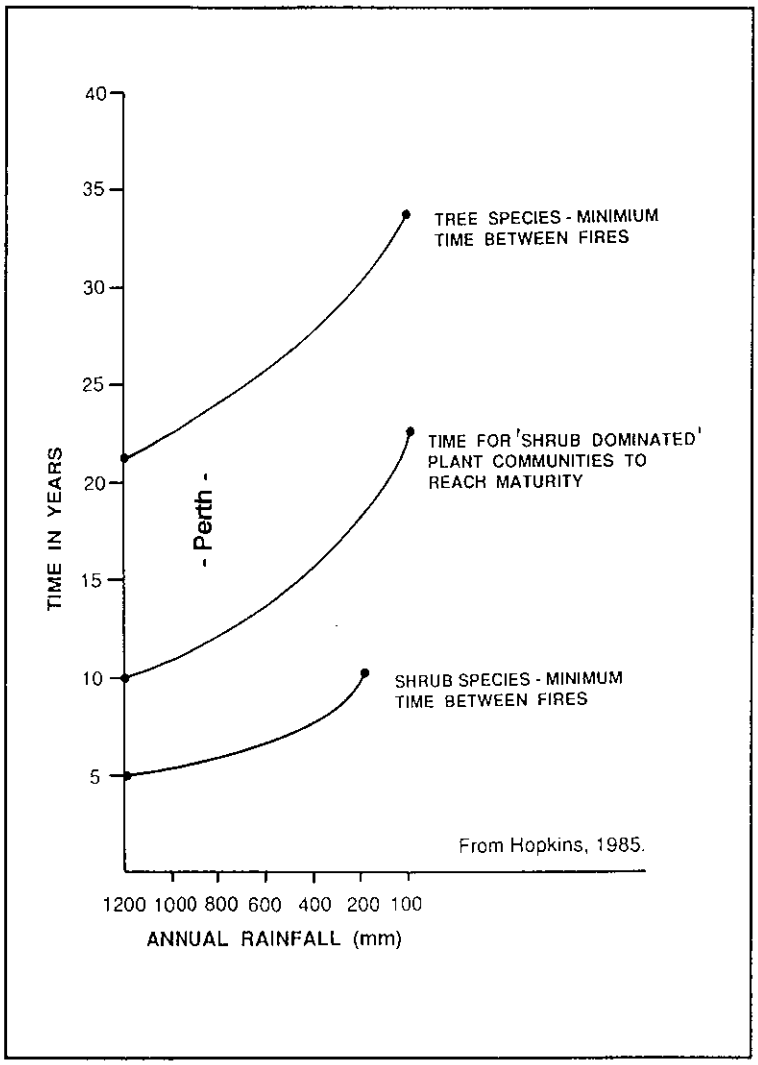

Figure 5. Effects of Fire on Plant Communities

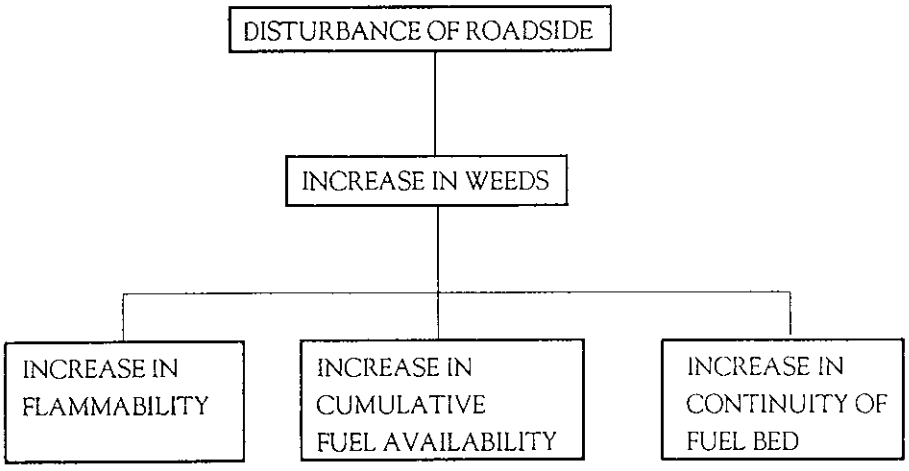

Figure 6. Weeds and Fire Hazard on Roadsides in Outer Suburban Areas

Any disturbance of the soil or vegetation on the roadside increases the weed component and so increases the fire hazard of that roadside (refer Figure 6.)

Fire Threat Assessment

The presence of flammable material does not constitute a fire threat of itself. A threat only exists when there is something of value nearby, such as a building or a fence, which could be burnt. There must also be a chance of ignition taking place.

Other fire behaviour factors such as rate of fire spread and flammability are important also, as they reflect the difficulty of fire suppression and therefore the potential to cause damage.

Flammability is the most critical factor for defining hazard on roadsides. It will be highest on roadsides covered in wild oats, other grasses and weeds.

It is important to ask the question: "Does the Roadside Vegetation Post a Fire Threat?" - refer Figure 7.

References

Powell R(1983). 'Management Planning for Metropolitan Bush Areas', in T*he Management of Small Bush Areas in the Perth Metropolitan Region,* proceedings of a seminar held on 20 September 1983 by the Department of Fisheries and Wildlife.

Roadside Conservation Committee (1985). *Roadside Manual.*

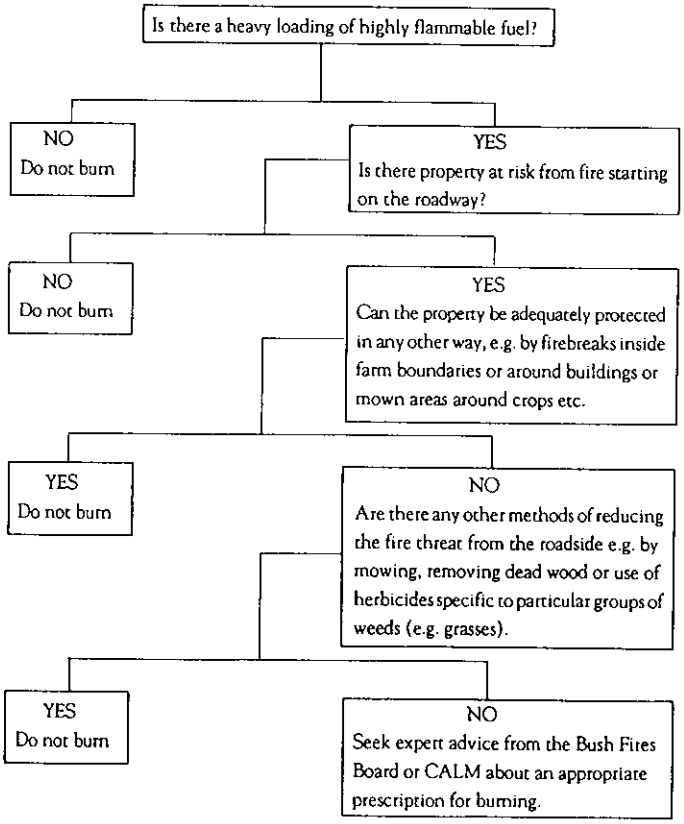

Figure 7. The Threat Test

Appendix

TIME OF FLOWERING FROM SEED IN VARIOUS WESTERN AUSTRALIAN PLANT SPECIES

NAME		GROWS ONLY FROM SEED	AGE AT FIRST FLOWERING AFTER SEED GERMINATION	ALSO RE-SPROUTS
Acacia acuminata	Jam		5	x
aneura	Mulga	x	4	
celastrifolia		x	3	
drummondii	Drummonds Wattle	x	2	
hemiteles		x	3	
lasiocalyx	Catkin Wattle	x	3	
merinthophora	Zigzag Wattle	x	3	
mixrobotrya	Manna Wattle	x	4	
pulchella	Prickly Moses	x	2	
saligna	Orange Wattle		3	x
tetragonophylla	Kurara	x	5	
Agonis flexuosa	WA Peppermint		5	x
juniperina			4	x
Allocasuarina acutivalvis		x	5	
campestris	Tamma	x	3	
fraseriana	Sheoak		3	x
huegeliana	Rockoak	x	4	
Alyogyne hakiefolia	Lilac Hibiscus	x	2	
Anigozanthos flavidus	Albany Roo Paw		3	x
humilis	Catspaw	x	2	
manglesii	Kangaroo Paw	x	2	
viridis	Green Kangaroo Paw	x	3	
Astartea fascicularis			6	x
Baeckea camphorosmae	Camphor Myrtle		4	x
Banksia attenuata	Slender Banksia		4	x
grandis	Bull Banksia	x	5	
menziesii	Firewood Banksia		3	x
prionotes	Orange Banksia		4	x
Beaufortia elegans		x	4	
micrantha		x	6	
purpurea		x	2	
Boronia heterophylla	Pink Boronia		4	x
megastigma	Brown Boronia		2	x
Bossiaea eriocarpa	Waterbush	x	4	
Brachychiton gregorii	Kurrajong		8	x
Callistemon phoeniceus	Fiery Bottlebrush		4	x
speciosus	Albany Bottlebrush		5	x
Calothamnus gilesii			4	x
quadrifidus	One-sided Bottlebrush		3	x
rupestris	Mouse-ears		3	x
Calytrix fraseri	Summer Star-Flower		3	x
Cassia nemophilla	Desert Cassia	x	5	
Casuarina obesa	Swamp Sheoak		5	x
Chamelaucium megalopetalum	Esperance Wax	x	4	
uncinatum	Geraldton Wax	x	2	
Darwinea citriodora	Lemon-scented Myrtle	x	2	
Dodonaea inaequifolia		x	3	
Dryandra cirsioides		x	6	
nobilis	Shaggy Dryandra	x	5	
sessilis	Parrot Bush	x	3	
Eremaea pauciflora	Orange Eremaea		4	x
violacea	Violet Eremaea		4	x

NAME		GROWS ONLY FROM SEED	AGE AT FIRST FLOWERING AFTER SEED GERMINATION	ALSO RE-SPROUTS
Eucalyptus caesia	Gungurru		5	x
calophylla	Marri		2	x
erythrocorys	Illyarrie		5	x
loxophleba	York Gum		4	x
macrocarpa	Mottlecah		3	x
salmonophloia	Salmon Gum		5	x
wandoo	Wandoo		7	x
Grevillea bipinnatifida	Fuschia Grevillea		2	x
leucopteris	Old Socks	x	4	
paniculata		x	4	
Hakea bucculenta	Red Pokers	x	3	
cucullata	Shell Hakea	x	6	
falcata		x	6	
incrassata	Marble Hakea		4	x
laurina	Pin-cushion Hakea	x	3	
multilineata		x	5	
subsulcata		x	6	
victoria	Royal Hakea	x	4	
Hypocalymma angustifolium	White Myrtle		4	x
robustum	Swan River Myrtle		4	x
Kunzea baxteri			4	x
recurva			4	x
Lechenaultia bilboba	Blue Leschenaultia		2	x
formosa	Red Leschenaultia		1	x
Leptospermum erubescens	Tea-Tree		4	x
Melaleuca cordata			6	x
fulgens	Scarlet Honeymyrtle		4	x
lateritia	Robin Redbreast Bush		5	x
radula	Granite Honeymyrtle		3	x
scabra	Rough Honeymyrtle		6	x
uncinata	Broom Honeymyrtle		6	x
Olearia axillaris	Daisybush	x	4	
Paraserianthes lophantha	Albizzia	x	2	
Petrophile serruriae			4	x
Phyllanthus calycinus	False Boronia		2	x
Pittosporum phylliraeoides	Weeping Pittosporum	x	7	
Regelia ciliata			5	x
Santalum acuminatum	Quandong		8	x
Verticordia chrysantha	Featherflower	x	6	
roei	Bush Cauliflower	x	5	
Xanthorrhoea nana	Dwarf Blackboy		6	x

PREDATORS AND URBAN WILDLIFE

Dr Jack Kinnear, Principal Research Scientist
Department of Conservation and Land Management

Australia has lost more species of mammals than the rest of the world combined. To make matters worse, wherever we find populations persisting, the numbers are invariably low. Such circumstances are a recipe for extinction - a scenario that has occurred time and time again across Australia.

The Australian environment has been subject to the same kind of disturbances imposed by colonisation as everywhere else, but for some reason(s) a large subset of Australian mammal fauna failed to cope. On other continents the fauna has managed to persist - albeit diminished (as one would expect), but nonetheless most of the fauna has survived. Why the difference? Is it because our mammal fauna is singularly inept in its ability to tolerate disturbance and environmental change? Some scientists believe so.

It is not hard to make a case for such a view, and while there may be a measure of truth for some of our mammals, I believe this view has been overstated to the detriment of conservation. It is also a view that sells our fauna short and implies that conserving our mammals will be a monumental task because of their alleged intolerance to disturbance. If they are so poorly adapted, then they will need to be husbanded and pampered forever.

In other countries including Britain, (despite wholesale changes to the landscape) some native species have even become pests. On mainland Australia, apart from kangaroos, we have almost no native mammals that rate as major pests. Why not?

The answer seems to be this: much of our native mammal fauna appears to be subject to biological control by the fox and possibly the feral/domestic cat as well.

The controlling impact of the fox has been demonstrated by simple field experiments; remove the fox by baiting and we observe a dramatic increase in native prey species, refer Figure 1. Fox control also enables one to re-establish species where they once existed.

To date these responses have been observed in the case of rock-wallabies, the numbat, brush and ring-tail possums, the brush-tailed rat kangaroo, the bandicoot, the tammar wallaby and lately the chuditch. Many other species are likely to be at risk including ground dwelling/nesting birds such as the mallee fowl.

How have these two introduced predators affected wildlife in urban areas? We simply do not know because nobody has tried to measure the impact. However, it seems reasonable to suspect that both the fox and cat could well be responsible for the absence of native mammals in urban areas.

The fox is well established in metropolitan Perth inhabiting cemeteries, parklands and remnant bushlands. If the fox were absent, then it is likely that the urban areas would support a wide array of marsupials such as scrub wallabies, bandicoots, possums, chuditch and the numbat. Anyone who has visited Rottnest Island would find it easy to conjure up an image of what it would be like to have wallabies about.

The urban cat is believed to be a threat to wildlife, but in reality, we know little about the impact. The WA Museum has recorded 32 species of native mammals eaten by feral cats.

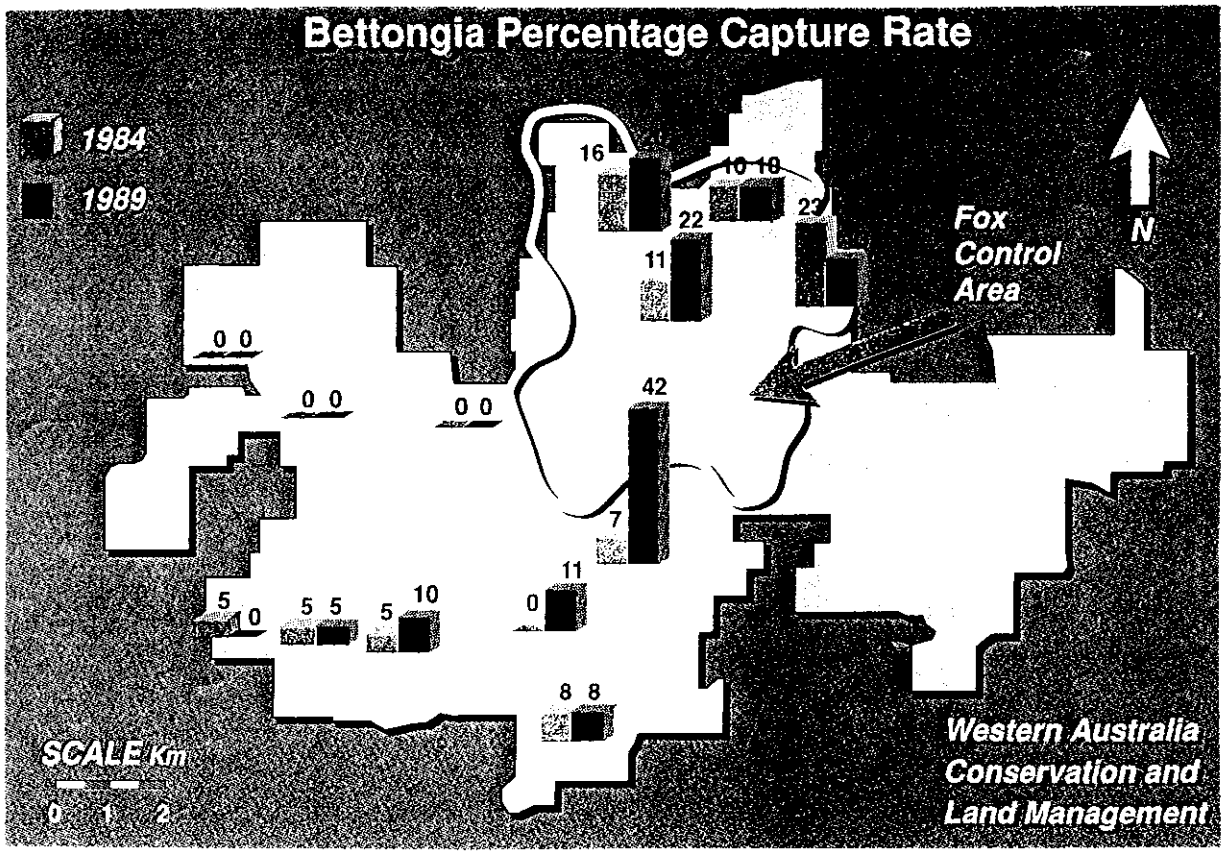

Figure 1. Impact of Fox Baiting in Dryandra State Forest

Birds and lizards are also commonly found in the stomachs of feral cats. Such statistics imply that the cat is a menace, but what we really want to know is what the cat is doing to populations. If the effect of the cat is comparable to the fox, then we will know that the cat is truly a threat and we can act accordingly.

Hopefully it is evident that a great deal of research is necessary. It seems certain that if we want to restore some of the fauna that formerly existed in our urban areas, we need to address the problems posed by introduced predators.

WEED CONTROL AND DEVELOPING A MANAGEMENT PLAN

Bob Dixon, Advisory Officer
Kings Park and Botanic Garden

Weed Control

At least 270 species of weeds are growing unaided (naturalised) in conservation areas or remnant bushland within the Perth region (Dixon and Keighery). As an example, Kings Park bushland has about 175 species of introduced plants which also includes eastern states native plants as well as some Western Australian natives eg. Geraldton Wax.

Therefore control of weeds is probably the most important issue facing us in urban bushland. However, don't lose sight of the fact weed control is only a tool in the overall management of bushland.

Weeds also have this nasty habit of changing from what we regard as minor or insignificant weeds to major weeds, particularly when areas are badly degraded. A good example of this is the control of veldgrass, when selective herbicides are used eg. Assure, Fusilade. You knock out veldtgrass then other resistant grasses or broad leaved weeds take over when there is insufficient seed store of native plants in the soil. This of course can be addressed by sowing seed and planting tube stock which originated as seed from this area or close by to retain genetic integrity.

Weed control, with the exception of veldtgrass and a few other grasses, (wild oats, etc), is a complex issue. Small infestations are often best removed by hand rather than using herbicides, as long as you don't disturb the soil too much.

We are also of the opinion, as with the Bradley method of weed control, it is often best to work from the least infested areas which with a little bit of help tend to be able to repair themselves relatively easily.

Plates 1 to 3 show examples of how effective weed (veldtgrass) control can be, using herbicides such as Assure, Sertin and Fusilade.

Probably the most comprehensive publication on environmental weeds in WA is *Weeds and Their Control* (Dixon and Keighery) - being published by Greening Australia. This publication includes introduction - life forms, origin etc, as well as comprehensive tables which cover botanical as well as common name (when known), some localities where they grow, vegetation types in which they occur, comments, control methods, life form and references.

Developing an Urban Bushland Management Plan

Some basic procedures/ideas:

<u>Preliminaries</u>

Establish who owns the bushland.
Is it reserved - zoning, etc (due for development ?)
Establish a small working group, especially local residents.
Evaluate the area (you have already decided it is worth preserving).
Approach owners with basic recommendations.

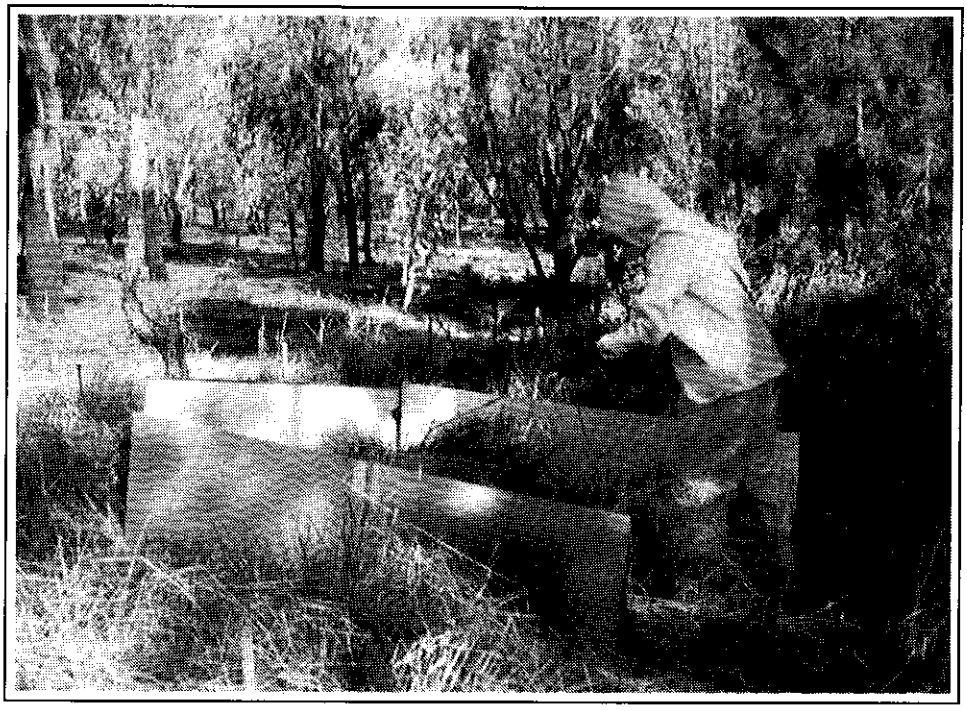

Plate 1. Winter 1985. Trials using Fusilade in an unburnt area

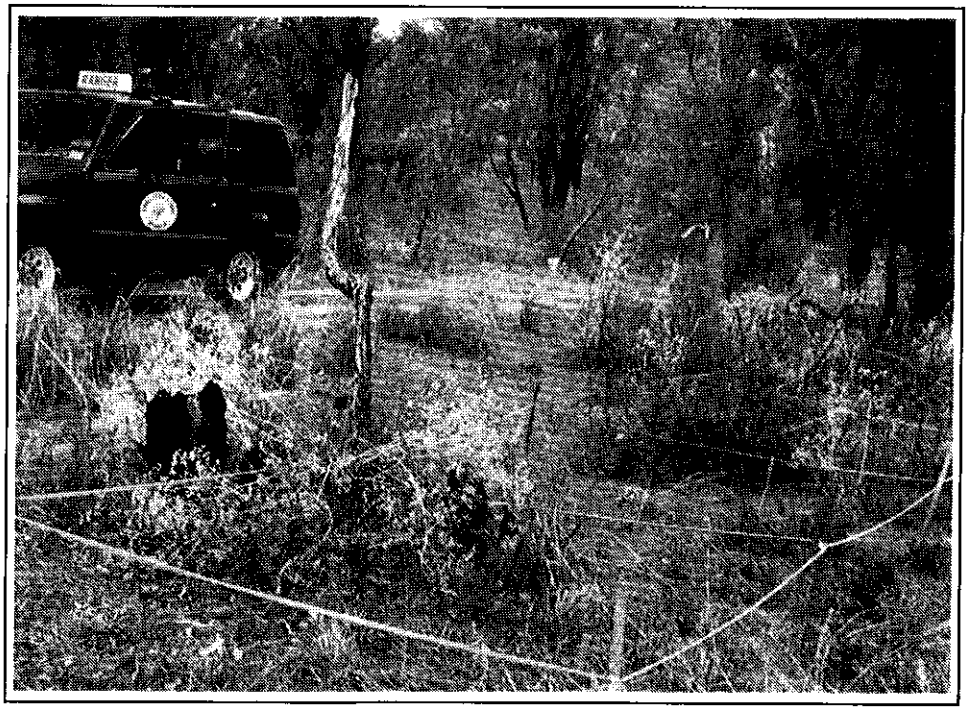

Plate 2. Autumn 1986. Same trials, showing effect
Note tape marking close to path has been removed by vandals

Public meeting, etc, to recommend a management plan be written/produced.
Funding for a plan - owners? - grants ? eg. Save the Bush, Gordon Reid Foundation.

Note: Different procedures may be required depending on who owns the land. Many local land managers are happy for volunteer groups to prepare or assist in the preparation of management plans.

Consult Other Management Plans

Read other management plans especially those similar to your area (although you will pick up different/new ideas from most plans). Produce a small document outlining recommendations for the production of the management plan - refer Appendix.

Preparation of the Management Plan

After acceptance of the recommendations set up your committee and proceed. Remember you must at all costs involve the community. They must feel ownership and seek advice from as many experts in their fields as possible to get a good overall view.

Identify any issues of concern. Good examples from Kings Park are as follows:

- Rubbish dumping
- Fire management
- Removal of dead trees
- Access (reducing number of tracks)
- Weed control

Reference

Dixon IR and Keighery GJ (in press). Weeds and their control, in *Urban Bush Manual,* Greening Western Australia.

Plate 3. Winter 1986. Same trials showing collapse of old veldgrass plants to form thick mulch

Appendix

RECOMMENDATIONS FOR THE PRODUCTION OF A MANAGEMENT PLAN FOR THE BUSHLAND OF KINGS PARK

Prepared for the Kings Park Board by Ray Paynter
and Bronwen Keighery July, 1991

Summary
The Kings Park Board produce a published Public Management Plan for the Bushland in the Park.

Introduction

Our bushland with its profusion of bright and beautiful wildflowers is a wonder of the world and an essential part of this State's Heritage.

The flora is appreciated by the WA community. Laws have been invoked for many years that prohibit the picking of wildflowers on public lands and these are generally well observed. Lands have been set aside for the protection of flora and fauna in conservation reserves such as Kings Park Bushland, Local Government Reserves, National Parks and Nature Reserves.

The Kings Park Bushland has a unique role to play as an area of inner suburban bushland accessible to a large number of people, especially children and their families and visitors from other States and countries. The Bushland of Kings Park is often the only bushland that many individuals experience and as such is a showpiece of the bushland of the State.

This Bushland is an urban reserve of long standing having been isolated from other bushland for many years. The problems this bushland experiences are those all urban reserves are being increasingly subjected to. As the Bushland epitomises the bushland of this State to many people in our urban areas its management should be an example of the procedures needed to manage urban bushland.

Aims of the Plan

The careful management of this Bushland is therefore essential to ensure that

1. The ecological integrity of the Bushland is sustained to conserve this unique remnant of urban bushland. That is the plants and animals of the Bushland be managed to enable the full suite of these organisms, and the ecological and evolutionary processes of each ecosystem be retained in the long term, even if short term changes may occur. (Adapted from CALM Workshop on Ecological Sustainability, May 1991.)

2. The users of the Bushland are able to appreciate the values of the Bushland and feel ownership of the Plan designed to manage the Bushland.

3. The Plan is endorsed by the community of biologists of the State, both amateur and professional, and can be held as a model for management of urban bushland.

Recommendations

To achieve these aims we make the following recommendations concerning the development of a Management Plan for the Bushland of Kings Park.

The Draft Plan will consider:

- Conservation
- Principal Management Directions
- Geology, Soils and Landforms
- Flora
- Vegetation
- Fauna
- History: Aboriginal, European
- Protection: Weeds and planted species, Feral Animals, Fire, Disease
- Recreation and Enjoyment: Principal Recreation Directions, Access
- Information/Interpretation and Education
- Research and Monitoring
- Implementation: Bushland Curator and Staff, Priorities and Funding, Community Liaison, Term of the Plan

Various management procedures exist for aspects of the Bushland management. These only address a few of the issues normally covered in a Plan and are not co-ordinated or available for public input.

An advisory Group be established to be consulted in the period of the production of the Plan.

An advisory Group with the appropriate governmental and community representation should be established to be consulted in the period of the production of the Plan.

The Draft Plan will be freely available and widely advertised to gain as much public comment as possible over a three month period for public submissions.

After a reasonable time for its production, approximately one year, the Plan will be printed and released for public comment. Considering the high profile of the Park in the community the public comment period should not be less than three months. The invitation to comment should be well advertised and the Plan be readily available to concerned parties.

The public submissions be assessed and an analysis of the submissions produced.

The public submissions be assessed and an analysis of the submissions, produced in consultation with the Planning Section of CALM, be published and distributed to all parties who made submissions concerning the Plan.

The Plan be published and distributed.

The Draft Plan be modified in accordance with the submissions considered acceptable and the final Plan published and distributed.

We need help to manage your bushland, for future generations.

Any comments/ideas can be sent to:

Bushland Management Plan Team Coordinator
Kings Park and Botanic Garden
West Perth WA 6005

HEGEMONY AND LANDSCAPE CHARACTER

"Has Anyone Noticed Australia is Disappearing?"

Steven Davies, Principal
Landmarc

The degradation of urban bushland occurs largely through default, because we place no value on its conservation. We need to valorise bushland landscapes. This can be promoted at both regional and site specific levels of planning and design. Two projects illustrating this approach are cited.

Through the process of hegemony (which, for the purpose of my talk, is taken to mean 'the replacement of a culture by another more dominant culture') it is not necessary to wield arms and use force to change the face of a nation. This can be done surreptitiously through a silent invasion. As bushland transforms to open parkland and medium density housing, Australia's landscape character is daily being eroded. Many influences contribute to this, including a pervasive 'international style' of landscape design including scenic preferences borrowed from another hemisphere - coined by George Seddon as 'eurocentricity'.

If landscapes had a voice (and since they have a kind of legibility - they indeed do) then our suburban landscapes speak clearly about our ignorance of Australia's natural heritage. To many, this may not appear as a problem. Isn't landscape preference, after all, just a reflection of our individual taste and philosophical standpoint? Considering that our attitudes are more than likely 'given to us' by our culture - it is unlikely that 'real thinking' or conscious choice has played much part in shaping our landscapes. Whilst the new landscapes that we build may sometimes have vitality, as could be said for urban malls and sports complexes, the majority are neither physically beautiful nor socially just, nor do they respond to the spirit of the place.

Someone else said much the same thing, perhaps a bit more colloquially:

> *People are no longer in places that can properly be called places - they are at shopping centres and at television sets. Now a shopping centre is of course no place, absolutely no place at all. There is only one shopping centre in existence. Every (Australian) has been there and has smelt it. It moves around the continent at the speed of light. You find it in Noranda, Melville and then get on an aeroplane to escape the horror of it and there it is, waiting for you at ...Doncaster (Melbourne or UK), Parramatta, Aspley....*

Our neglected, dwindled patches of remnant bush are sad reminders of what gives us a sense of place. How can we now uphold the natural character of our landscapes? At one level the answer is complex and lies in changing our deeply embedded attitudes, perceptions and values which dictate in turn our behaviour towards bushland and the Australian environment. At another level we cannot wait for attitudes to shift before we take action and our actions must be directed towards both maintaining and strengthening natural landscape character. Mostly bushland is fragmented and extremely depauperate. The task at hand, further than protecting what exists, is to reintroduce the plants that characterise distinct ecological zones at every opportunity.

Finding such opportunity is not hard. Bushland management is facilitated through regional and local planning initiatives. For example, to assist us to prepare a Rural Strategy for the

Shire of Serpentine/Jarrahdale that incorporated these values we have employed a system of planning that builds a progressive picture of the physical and social environment, starting first with people. A search conference was held for the residents of Serpentine/Jarrahdale, at which we identified their priority to conserve the Shire's rural landscape character, which owes a lot to its remnant vegetation. Current land use practices throughout large parts of the Shire are, however, contributing to the death of these landscapes by fragmentation and prevention of natural regeneration.

We then examined the status of the rural environment through 'capability' and 'suitability' analysis. This system capability means 'the ability of the land to sustain a particular land use' whilst suitability questions this basic capability with human needs and issues.

An area of land may be capable of sustaining a particular land use but may be unsuitable for the same owing to 'human' or social reasons. For example, urban capability examines the basic ability of the land to sustain urban development, but this alone is not sufficient information upon which to base decisions about locating urban development. Through a system of overlaying the base information and applying criteria developed by appropriate Authorities to question the data base for urban, peri-urban and rural capability and suitability, a framework for sustainable land use can be created.

Part of this framework is the establishment of what we call 'econet', which is abbreviated from 'ecological corridors network', linking together isolated fragments of remnant vegetation. On a regional scale this is achieved by looking for or creating opportunities to create an econet, incorporating farm shelter belts and buffer zones of local native plants that follow stream courses, drains, fence lines, road verges, ridge lines etc. These are designated as 'Nature Development' areas. They do not exclude urban development, but become organising elements for it, resulting in urban village configurations that have a strong sense of place and contact with the natural environment.

On a local scale we are often faced with large tracts of land with no or little remnant vegetation. At Altone Park (refer Figure 1), a highly degraded dampland on the border of the Shire of Swan and the City of Bayswater, we have created a whole series of wetlands, including permanent open water bodies that are linked drainage basins, with an outlet into Bennett Brook. Land fill was necessary to create recreation areas, but we achieved this without importing soil by using the cut from the lakes. Modifying the landform in this way to accommodate playing fields has created an opportunity to reinstate a whole succession of native vegetation from climax forest of jarrah, marri and tuart in the higher ground, through banksia open woodland to tea tree and sheoak wetland fringes with reed beds surrounding the lakes.

Starting by preserving the handful of trees left on site we then rationalised access from the adjacent urban hinterland and the recreational use of space within the reserve, so the new bush rehabilitation areas create a framework for recreation usage, rather than be experienced as a hindrance to access. Through a mixture of direct plantings of the dominant tree species and direct seeding of understorey plants characterising each habitat we intend to reinstate the natural ecological zones that would likely have defined themselves in such a landscape according to their relative positions above the ground water table.

Ultimately the only way to sustain viable urban bushland is to create an econet throughout the city. This would begin with an urban 'retrofit' strategy, looking for existing opportunities or inventing new possibilities for establishing connections between all pockets of bushland vegetation. This can be accomplished along road verges, drainage networks, etc, and will provide the necessary habitat for wildlife and vital landscape corridors that help to locate

us, relive some of the recreation pressures on remnant bushland and provide a sense of place within the city. Considering bushland conservation in isolation from the necessity to link in this way is contributing to the further decline of our remaining patches of good bush. It is currently the responsibility of a minority to preserve bushland, but having it be a part of everyone's everyday experience through econet will promote and valorise the fragments of Australia that remain.

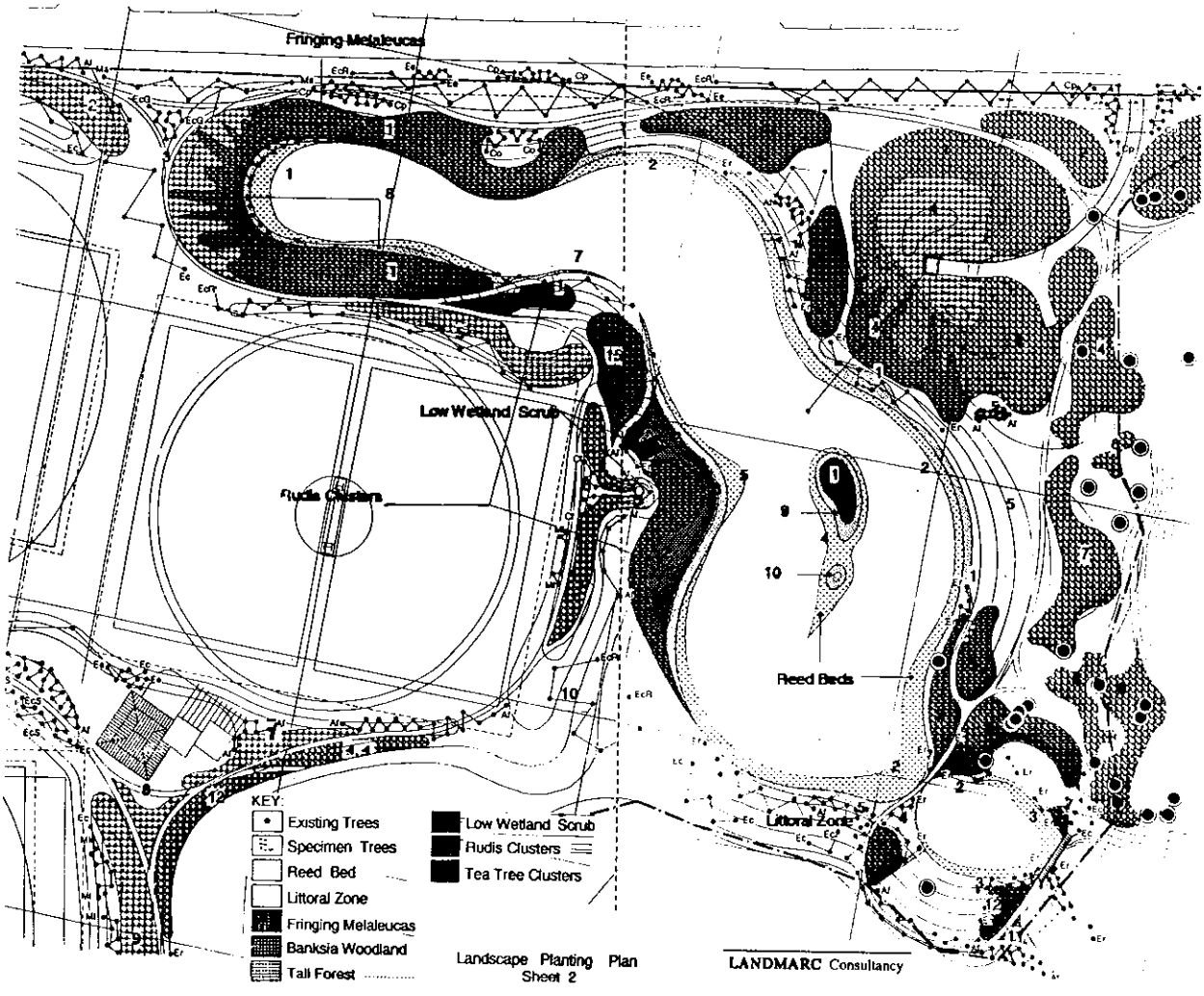

Figure 1. Altone Park, Beechboro

RESOURCES AVAILABLE FOR URBAN BUSHLAND MANAGEMENT

Martine Scheltema
Greening Western Australia

Introduction

Resources for projects are often thought of only in terms of dollars. However, there are several types of resources that can be accessed for urban bushland projects: people, information, materials and money. The resources needed for the management of urban bushland will change with time as the project develops from a predominantly planning phase into an action phase.

In managing urban bushland, we need to think in ecological time scales, rather than in terms of sporadic weekends of activity. The regeneration of bushland to something approaching its natural state may require a succession of local native species over several years and therefore five to ten year action plans. People need to think of the management of urban bushland not as an occasional weekend activity, but as a part of belonging to their community and of their lives.

Types of Resources

People

People are the most important resource of any project. Involve your local community in all stages of your project: in the planning of what needs to be done, in the collection of information, in working bees, and in the on-going maintenance. Tell them about the project through newsletters, articles in the local community newspaper and by community announcements on the radio.

Tap into the people resources within your own community: service clubs for assistance with labour and/or fundraising, 'friends of .... groups' (eg. Friends of Samson Park) and schools for help with expertise on species and management techniques, collection of information and possibly labour. Find your local plant or animal expert and ask them for guidance.

Information

The extent of bushland in the metropolitan region of the Swan Coastal Plain has decreased markedly in recent years. It is important that the remainder of the bushland in this region is managed to maximise its conservation values. Information about how to best manage urban bushland for its conservation value comes from a wide range of sources - both amateur (people who have developed expertise through hours of voluntary labour) and professional (people employed as biologists or environmental scientists by either government or private industry).

The speakers at this forum, and other people here today, have a lot of expertise and show the diversity of information sources: government agencies, local government agencies, environmental consultants and community groups.

The attached table lists some of the agencies and organisations which may be able to assist with information on various aspects of the management of urban bush. A list of the seminar participants is included as part of these proceedings.

A manual on how to manage urban bushland is being written and will be produced by Greening Western Australia in the near future. Several authors have contributed to the manual which will include information on the vegetation associations of Perth, how to plan a project, specific information about management issues such as weeds, access, fire, disease and pests, and where to go for more information.

In addition, the Australian Association of Bush Regenerators (AABR) is being formed in Western Australia to act as a forum for the exchange of information, and to educate and create awareness of urban bushland. An important function of AABR will be the facilitation of networking between groups and individuals involved in the management of urban bush.

Materials and Money

Often regarded as the most important resource of a project, I would suggest that the almighty dollar, while necessary, is not as important as having the involvement of committed, enthusiastic people and appropriate information from which to work.

There are several sources of funds and materials, some of which are listed below. However, if you can clearly identify the aims of your project, or the needs of your group, you will find that funding options beyond those listed here may become available.

(I) *Local Councils and Businesses*
Councils and businesses are often willing to support projects aimed at revegetation or at protecting existing vegetation. Councils may also assist in the development of a management plan for the site. Often businesses and Councils will provide a matching level of support or in-kind contributions for projects which have received funding from other sources.

Contributions to your project may take the form of the use of machinery, the donation of mulch, fencing, stakes or other materials, sponsorship of the group's newsletter or the provision of sausages for the BBQ after the working bee.

Sponsors or supporters of your project, whether the local Council, Rotary Club or a large corporation, will need to be convinced your group is capable of carrying out the project. Always remember you have an obligation to your sponsor and provide appropriate recognition at every opportunity. It is advisable to discuss with your sponsor what recognition and/or benefits they hope to gain from supporting your project.

When making unsolicited approaches for support to a company do some homework. Determine the organisation's goals and their record of involvement in community projects. Annual reports will often show a company's commitment to supporting community activities. In general, requests for cash are not as successful as requests for in-kind support.

(II) *Grants from the Federal Government*
The Federal Government has two programs which make financial grants to community groups for projects involving the management of urban bushland. The *Save the Bush* program is aimed at protecting existing vegetation while the *One Billion Trees* program is aimed at revegetation and regeneration activities.

(III) *Grants from the State Government*
Small grants are available for projects aimed at nature conservation through the Gordon Reid Foundation, which is funded through the Lotteries Commission.

Grants to community groups from both federal and state government programs are

advertised widely in local and metropolitan newspapers. Organisations such as Greening Western Australia also publicise the availability of such grants.

How to Apply for Grants

Irrespective of the source of funding, you will probably be required to complete an application form which will be used to assess the worthiness of funding your project.

The following points should be considered when making an application:

- Make sure your application meets the guidelines of the program to which you are applying. Most grant programs have clear guidelines and these should be understood before writing your application.

- Ring the contact person for the program (usually on the application form) if you are unsure of any aspect of how to apply. It is better to clarify a query, or your group's eligibility for funding, before submitting the application.

- Make sure you allow sufficient time for the application to reach the return address before the closing date. If you are running late, ring the contact person and ask them for an extension.

- Applications need to be as descriptive as possible, without being irrelevant. The people considering whether to fund your application may not have seen the site and need to be able to understand what you want to achieve.

- Include a map (to scale) showing the position of north, roads, drainage, existing areas of vegetation and the location of the proposed project with your application.

- Clear, well labelled photographs of the site, showing the problem to be addressed are a help to assessors. Photographs can be returned on request.

- Only include details which relate directly to the project. If other documents are necessary to the overall application, include them as an attachment. Supplementary documents can be returned on request.

- Be realistic in your cost estimates. Estimate as accurately as possible the amount of materials to be used in the project. Accurate estimates will establish realistic costs for the project.

- Obtain letters of support from groups such as the Council, service club or local school who are undertaking the project with you, and submit these together with your application. This will show the assessors that the groups mentioned in the application agree to the project and are aware of their role.

- A neatly written and well presented application will be received more favourably than a roughly hand written application. Applications do not need to be typed as long as the handwriting is legible.

- Keep a copy of the application for your own records.

Conclusion

The bushland of the Swan Coastal Plain is a part of our heritage. The community is placing a higher value on conservation than it has in the past, and is starting to recognise the importance of urban bushland.

It is necessary to use **all** the resources of the community: the expertise, commitment and enthusiasm of the human resource as well as its financial resources to manage the remaining bushland in an ecologically sustainable manner.

Table 1

WHERE TO GET ASSISTANCE WITH URBAN BUSH MANAGEMENT

Organisation/Agency	Address & Phone	Type of Information/Assistance
Appropriate Technology Development Group (APACE)	Winter House 1Johanna St North Fremantle 6159 Ph 09 336 1262	- courses in urban bush management - plant propogation
Australian Association of Bush Regenerators AABR)	C/- APACE Winter House 1 Johanna St North Fremantle 6159 Ph 09 336 1262	- network of groups/individuals interested in - urban bush management
Bush Fires Board	201 Kent St Kensington 6151 Ph 09 367 0777	- advice on fire prevention and control
Dept of Conservation and Land Management (CALM)	State Operations 50 Hayman Rd Como 6152 Ph 09 367 0333 Metropolitan Operations 16 Oligvie St Mt Pleasant 6153 Ph 09 364 0719 Wildlife Research Centre PO Box 51 Wanneroo 6065	- assistance with the development of management plans - advice on management techniques - fauna and flora surveys - flora and fauna identification
Dept of Land Administration (DOLA)	Cathederal Ave Perth 6000 Ph 09 323 1344	- aerial photographs - information on site history through photographic records
Environmental Protection Authority (EPA)	Environmental House 35 Mounts Bay Rd Perth 6000 Ph General 09 222 7000 Wetlands 09 222 7050 Ecoplan 09 222 7054	- environmental issues - System Six recommendations - Ecoplan Volunteers
Greening Western Australia (GWA)	1118 Hay St West Perth 6005 Ph 09 481 2144	- information of funding sources - networks with other groups - advice on project planning - information on management techniques

continued over...

Table 1 (continued)

Organisation/Agency	Address & Phone	Type of Information/Assistance
Herbarium of Western Australia	George St South Perth 6151 Ph 09 367 0335	- plant identification
Kings Park Board	Kings Park and Botanic Gardens West Perth 6005 Ph 321 5065	- plant identification - advice on management techniques - information on weed control
Museum of Western Australia	Francis St Perth 6000 Ph 09 328 4411	- fauna identification - fauna surveys
Naturalists Club of Western Australia (Inc)	63 Meriwa St Nedlands 6009 Ph 09 389 8085	- flora and fauna surveys
Royal Australasian Ornithologists Union (RAOU)	Room 218 15 Oligvie Rd Canning Bridge 6153 Ph 09 364 6202	- bird surveys
Royal Western Australian Historical Society	49 Broadway Nedlands 6009 Ph 09 386 3841	- information on the history of the site
The Tree Society	PO Box 106 Mount Lawley 6050 Ph 09 370 2201	- tree identification - advice on management techniques
Water Authority of Western Australia (WAWA)	John Tonkin Water Centre 629 Newcastle St Leederville 6007 Ph 09 420 2420	- management of wetlands
Western Australian Dept of Agriculture (WADA)	Baron Hay Court South Perth 6151 Ph 09 368 3333	- advice on soil conservation issues
Western Australian Wildflower Society (Inc)	PO Box 64 Nedlands 6009 Ph 09 332 5084	- plant identification - plant surveys - management techniques
Wetlands Conservation Society	C/- Assoc Prof Phillip Jennings 14 Stone Court Kardinya 6163 Ph 09 337 7113	- management of wetlands

INVOLVING THE COMMUNITY IN REMNANT BUSHLAND MANAGEMENT: CITY OF MELVILLE EXPERIENCE

Mark Street, Environmental Officer
City of Melville

Introduction

It is appropriate before saying anything else that I establish the context in which my comments will be made. Put simply, I will be coming purely from a local government background restricted to the City of Melville, the third largest municipality in Western Australia with approximately 60 remnant bushland reserves and a population approaching 95,000. I won't be making any grand philosophical statements about the need and importance of community involvement because I have neither the time nor qualifications to do so, and I will restrain from delving into technical details. Basically, what will be presented is a thumb nail sketch of one local authority's experience in this subject.

During my brief experience in local government park management, there have been two phrases which, while having been in use for some time, have rapidly risen only recently in WA to become the 'catch cries' of the ecology based conservation movement. These phrases, namely 'remnant bushland management' and 'community involvement' would together account for up to 70 percent of my time alone, as the Environmental Officer, not to mention other staff which also become involved at varying stages.

Briefly, the City of Melville established its first formal bushland community group (The Friends of Wireless Hill Park) in 1986. In 1992 there are now 10 bushland and wetland reserves which are the subject of volunteer groups or individuals, with a total of approximately 150 people actively involved in field work and the development of management and concept plans. These are by no means impressive figures by national or international standards, however they are significant by local government standards in Western Australia.

Community Group Formation

Historically, establishment of the various groups involved in bushlands in the City of Melville has been a reactive rather than pro-active process. That is while there has been a keenness to foster community involvement by both the Council and staff, it has been largely confined to those reserves about which considerable interest has been expressed by residents. While the more cynical may see this purely as a political response, it is proving to be an appropriate and workable practice in that it guards against the commitment of resources to groups which have only a superficial interest in becoming practically involved.

The structures of the existing groups range from a single resident looking after a neighbouring reserve of 0.4ha up to groups of 30 people with formal committees consisting of volunteers, Councillors and Council Officers. The structure adopted has tended to be a function of the amount of interest expressed and the size of the reserve in question.

Why Involve the Community?

The question "Why involve the Community?" has traditionally been answered on a cost-benefit basis for the agency concerned however the emphasis is rapidly shifting to focus more upon the benefits to volunteers and the broader community. This is very much

reflected in the City of Melville where community involvement in parks' management and planning is demanded by residents as a service which must be delivered by the Council. With regard to bushlands and wetlands this demand has been recognised through the appointment of an Environmental Officer for Parks Services in 1986, the first position of its kind in Western Australian local government and still only one of three in the state. These comments are not made to impress but rather to preface later remarks regarding the need to devote resources to community involvement in bush management if it is to be given genuine attention.

Benefits

So what have been the benefits of involving the community?

For the volunteers it has given the opportunity to:

- express an interest
- be creative
- recreate
- tackle challenges
- build friendships
- experience a sense of achievement.

For the Council the benefits have included:

- a healthy public image
- low cost labour
- an expansion and/or acceleration of works undertaken
- the incorporation of new ideas and knowledge.

For the community, much of the benefits take the form of 'intangibles' such as:

- the diffusion of positive attitudes through the community
- a growing sense of custodianship and vigilance in regard to natural resources
- increased knowledge and appreciation of local ecological processes
- the preservation of these resources and processes for future generations.

Costs and Dangers

There are numerous hidden costs and dangers inherent with involving well meaning, 'gung-ho' people who are unpaid and technically untrained. The most significant in our experience is the need for co-ordination by trained personnel if the activities undertaken by the group are to be cost and effort effective, and consistent with local ecological systems.

As mentioned earlier, this has been catered for through the appointment of an Environmental Officer and more recently has prompted moves towards the formation of an environmental field unit, to be trained in part for bushland management and community liaison. Selected group members will also be sponsored to undertake revegetation courses such as that now being offered by APACE Nursery in Fremantle.

Perhaps the greatest problem we have faced is loss of motivation associated with a lack of appreciation at the outset, of the intensity of work required to achieve significant results. In this regard there is much room for improvement in our groups for the setting of tasks and attainable objectives and including a greater social component to their activities to maintain

interest and diversity.

Problems can also arise with group dynamics where personal biases and aspirations can cause problems, although this has been the exception rather than the rule. Additionally, the works undertaken can be of variable quality no matter how much instruction is given.

Basic Principles

If the benefits of community involvement in bushland management are to be realised, some fundamental principals need to be followed:

- The allocation of adequate resources especially in terms of supervision and liaison.
- The setting of objectives and ensuring that subsequent tasks given to volunteers are clear and consistent with their interests and capabilities.
- Allowing volunteers to exercise decision making powers concerning works programmes and recognise their rights to express ideas and experiment.
- Being prepared to train and educate people towards greater independence from supervision.
- Making involvement an enjoyable and rewarding experience.

It would be misleading to claim that the City of Melville has 'got it all together' as far as these principles are concerned and it is still very much going through a learning process. However it is accurate to say that the basic foundations, namely a willingness to resource and an openness to accept community involvement in urban bushland management are present and are the major reasons for the City's relatively high profile in this subject in Western Australia.

REHABILITATION OF ROCKY BAY

David Kaesehagen, Landscape Ecologist
Ecoscape

In 1985 the North Fremantle Community Association was formed over local concerns about a proposal to mine an area in Rocky Bay and develop a marina. Fortunately the proposal met with strong opposition from relevant government authorities and was stopped.

Rocky Bay proved a major focus for the community of North Fremantle and the proposal resulted in a 'coming together' of stories, photographs and anecdotes of the natural and social histories of the area. Some of the photographs were fascinating in that they depicted scenes of forested cliffs which were in stark contrast to the relatively bare ones found in 1985.

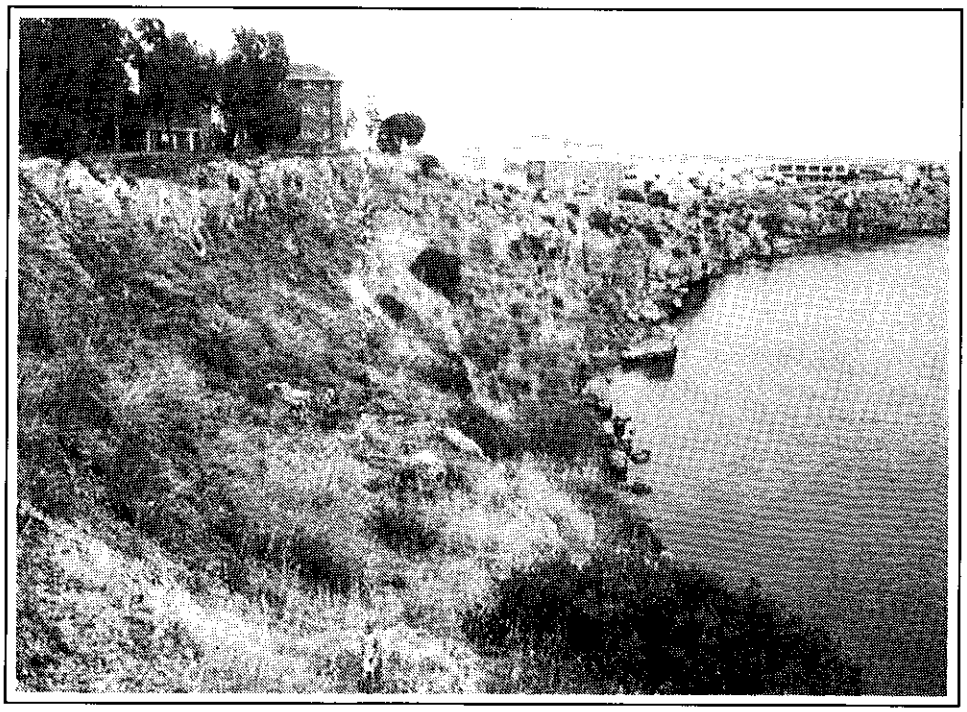

Plate 1. Rocky Bay in 1985 looking north

Furthermore the discovery of an illustration of the natural landform prior to early European quarrying operations was quite enchanting. The 'Seven Sisters' image shows beautiful relief of the shoreline which would have been quite stunning in its heyday. Today, five of the original 'Seven Sisters' are left, although somewhat modified through quarrying.

> *The foliage of the trees was quite exquisite, together with the many turnings of the river, one might fancy themselves in fairy-land.*
>
> James Turner, March 1830. (Downey, 1971)

The botanist Karl von Heugel while collecting specimens in the East Fremantle area in 1834 had this to say:

> *.....I felt how far away I was, and when I looked at my flowers, so beautiful and so diverse, I remembered I had no-one I could take them to; I dropped them and sadly climbed the nearest hill to find my way back; a magnificent prospect*

lay before me. The Swan River forms, two miles from its mouth, a broad basin, called Rocky Bay, barely a rifle-shot from the sea...

(Marchant, 1978).

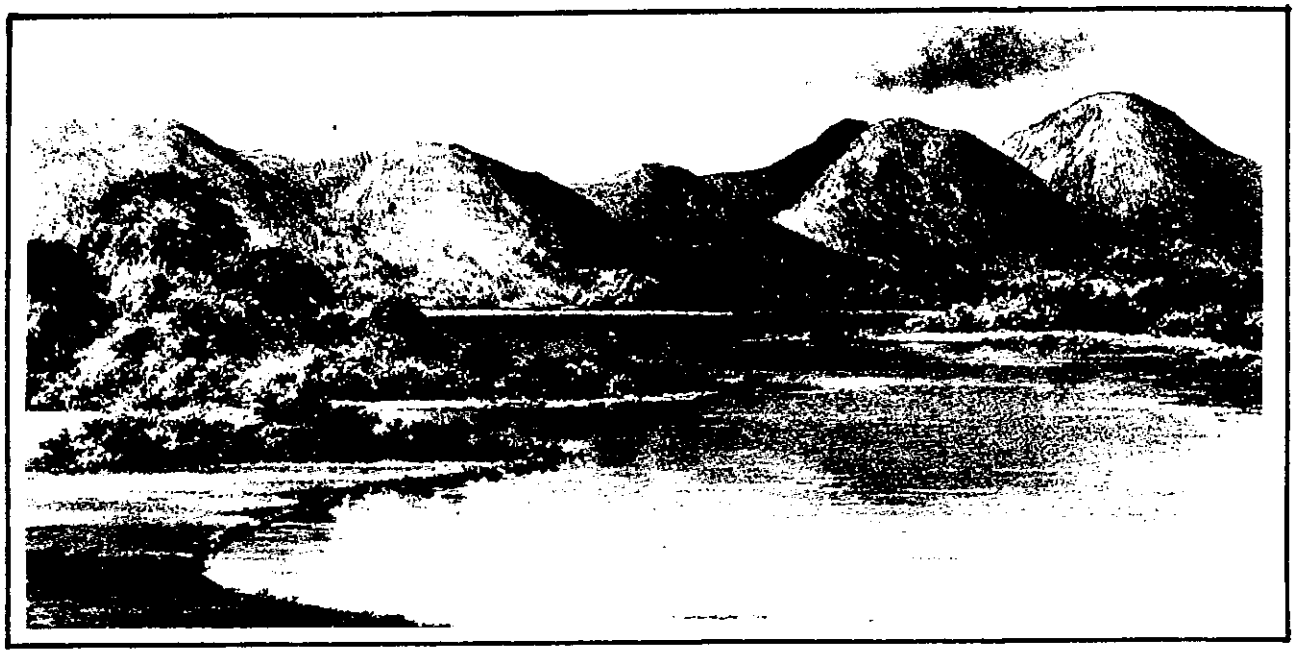

Plate 2. Rocky Bay and the 'Seven Sisters' c. 1880.
Source: E.Finnerty, *Glimpses of WA*

These glimpses of Rocky Bay's charming past provided further recognition of the area's inherent value.

More information came to light over the next two years and eventually spurred the Community Association into action. In 1987, together with Apace Aid, an application was made to both Greening Australia and the Heritage Secretariat for funding to establish a heritage trail and revegetate the cliffs of Rocky Bay. We also wrote to local industries requesting contributions to the project. Eventually we received $12,000.00 to grow and plant 8,000 indigenous plants, write a heritage trail brochure, design and construct the trail, design signage and co-ordinate the project.

With this budget and a great deal of inventiveness and enthusiasm we researched the natural and social history of Rocky Bay. In doing so it opened our awareness of the depth and diversity of the cultural landscape. Aboriginal people used 'Garangup' (Rocky Bay and environs) as a summer camping ground where fish and game abounded. Vlamingh visited the area in 1697 and from there discovered and named the Swan River. The stone quarried from Rocky Bay was used to construct the harbours (ie. the north and south moles), University of WA, Fremantle Goal and many other buildings.

Natural history elements were equally fascinating. We discovered that the richly vegetated cliffs shown in photographs from the turn of the century comprised a low closed forest dominated by the Rottnest Island Pine *(Callitris preissii)*.

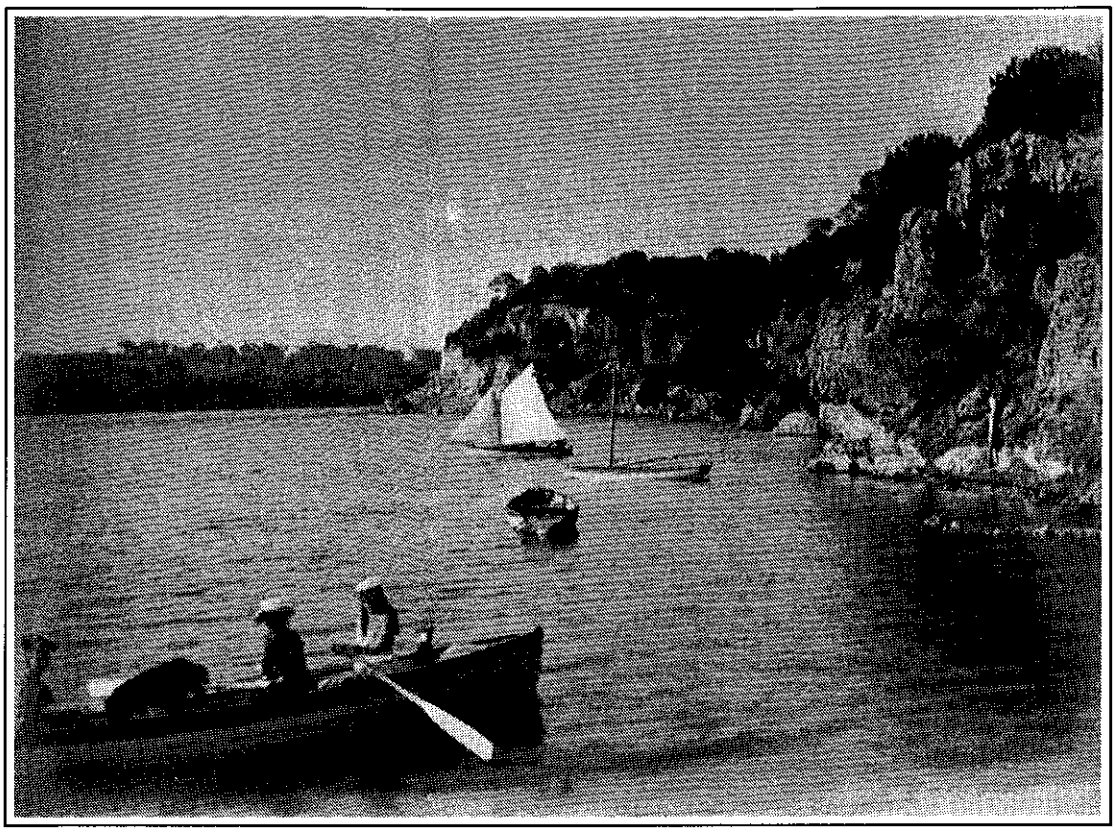

Plate 3. Boating in Rocky Bay c.1890
Source: Battye Library 374B/8

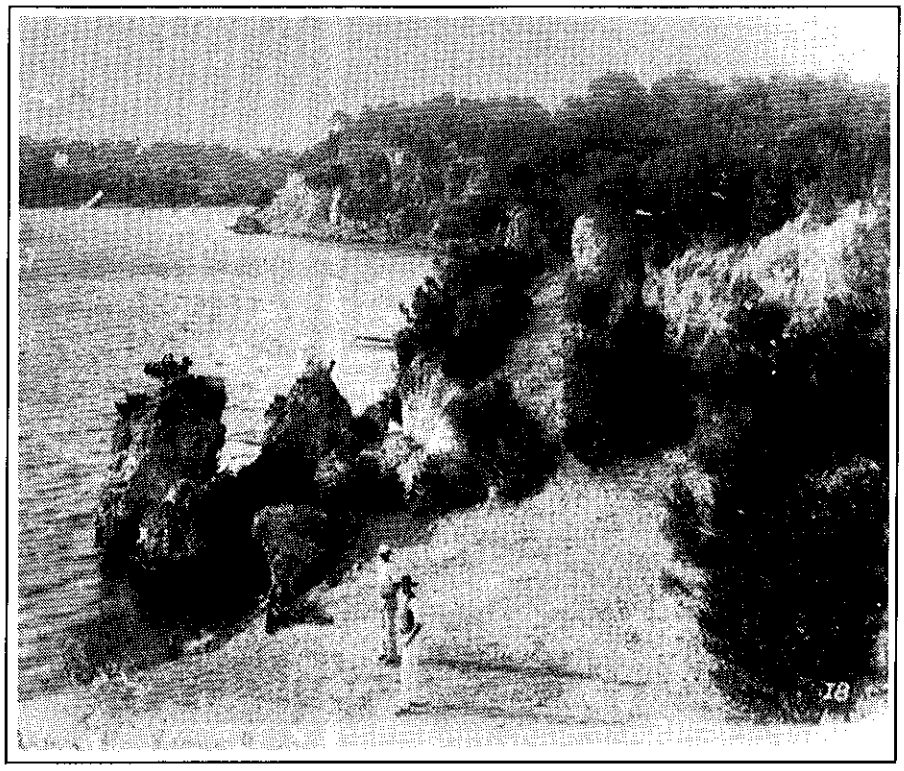

Plate 4. Low-closed Forest c.1890's
Source: Battye Library 336B/18

This was recognised by naming the popular picnic spot at the southern end of Rocky Bay 'Cypress Hill'. Furthermore, Charles Fraser, the colonial botanist accompanying Captain Stirling's 1827 reconnaissance visit to Fremantle, wrote of the *beautiful species of Calytris or Cypress, of the finest green colour, producing large "warted" cones that studded the hills in this locality* (Seddon, 1972).

Fire and clearing eventually destroyed much of it and today the vegetation found on the cliffs is more like a heath community in structure, although taller shrub and small tree species such as *Acacia xanthina, Pittosporum phylliraeoides* and *Agonis flexuosa* are found there.

Central to our revegetation program was the ecological restoration of this former community. We collected local seed, propagated seedlings, removed rubbish and undertook weed control programs such as removing the larger weeds eg. fennel and castor oil bush.

In 1988 we constructed the heritage trail (a trail which consisted of a footworn path which meanders along at cliff top level), planted seedlings using a number of novel methods including abseiling from the cliffs and ferrying plants to different parts of the foreshore by canoe. Around 7,500 seedlings were planted during June, July and August. Over 250 people were involved in the project including school children, local residents, local councillors, guides and other more regionally interested individuals.

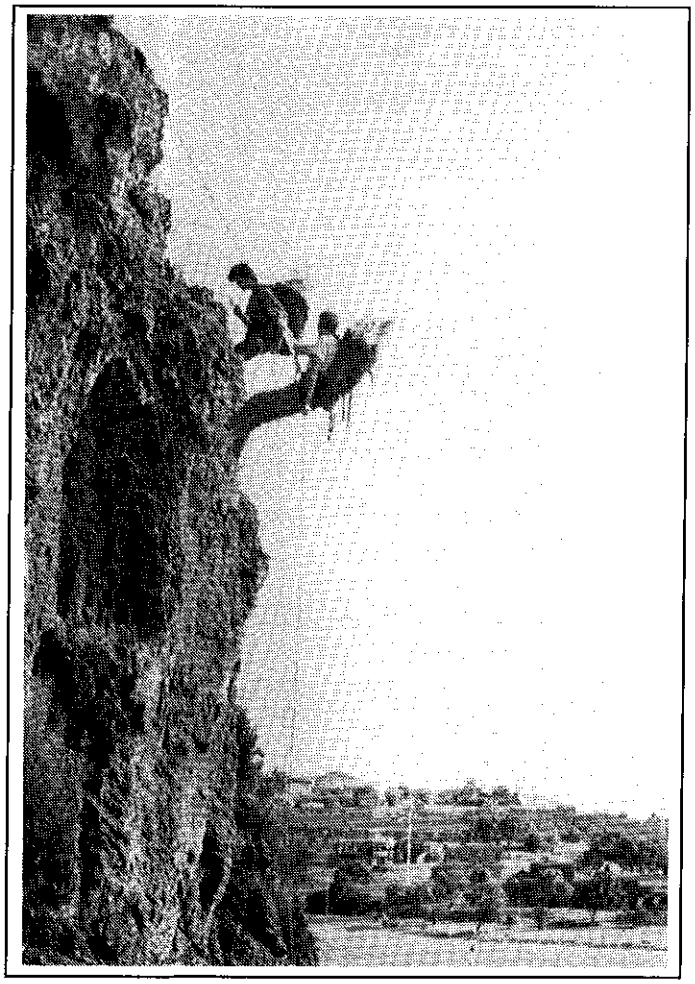

Plate 5. Abseiling to plant Rocky Bay, 1988

The media was used when opportunities arose to raise community awareness and publicise the wonderful efforts of the volunteers. We found the media support very useful and provided them with press releases and angles for stories. It was all part of the creative and proactive process and gave individuals additional skills.

At the end of 1988 the Heritage Trail was opened (amidst great fanfare), by the local member, Bill Hassell. Since then Council and the community have continued to revegetate the cliffs.

A management plan has recently been prepared for Rocky Bay which advocates ecological restoration of the area, formation of a 'Friends' group and the involvement of the community and artists. What started out as a reaction to a development proposal has turned into a positive focus for the community: shaping its integration and extending the quality of life for many individuals, not to mention doing something positive for the environment.

References

Downey HSG (1970). *Mosman Park*, Western Australia. University of WA Press

Marchant N (1978). *Early Botanical Observations of Fremantle.* Unpublished.

Seddon G (1972). *Sense of Place.* University of W.A. Press, Perth.

BUSH MANAGEMENT IN THE CITY OF FREMANTLE

Ian Hunter, Manager
Parks and Recreation
City of Fremantle

The City of Fremantle has jurisdiction over a number of precious bushland reserves.

These reserves have been mostly the result of remnant urban land not suitable for development purposes. What characterises Fremantle bushland is the intense human pressure these areas have been subjected to, especially as the economic and security imperatives of an ailing and insecure colony were being experienced.

However with this tremendous layering of history comes a bonus in the form of excellent historical material, such as photographs, references and stories.

In essence, Council has the responsibility of the management of three bushland reserves (refer Figure 1), namely:

- Sir Frederick Samson Park, Samson
- Cantonment Hill, Queen Victoria Street, Fremantle and
- Rocky Bay/North Fremantle Foreshore Reserve, North Fremantle

In the late 1980s the City of Fremantle set about correcting many decades of neglect and mis-management. Previously bushland management entailed the use of a single technique - that of an annual spring burn. In 1988, Council commissioned ecological consultants, Ecoscape, to prepare our first management plan for a bushland reserve. The need to actively 'manage' a bit of bush was largely a foreign concept for Council. There was a lengthy education programme to emphasise the benefits of proper protection and enhancement of our natural environment.

In 1989 Council formalised its Community Participation Philosophy. This report indicated that the role of Officers and Councillors was to tap into the desires, aspirations and concerns of the local community, so that negative energies were redirected into positive changes.

Council backed this up by employing a Project Liaison Officer, whose primary role is to facilitate opportunities that arise from the community, including those that relate to the 'Friends' groups, Resident Associations, schools and individual residents in the management of Fremantle's bushland.

The successful arrangement established at Samson Park, whereby educational, environmental, community and administrative issues are discussed in an open forum, is worth the initial pain and strain and subsequent occasional frustrating moments.

The efforts of the community, the local primary school and Council have since been recognised by Greening Western Australia and the Environmental Protection Authority with the (re)launch of the System 6 Ecoplan programme.

We've progressed since those initial days to have management plans established, or due for completion and Council endorsement, for the above-mentioned reserves by the end of 1992.

There are three fundamental threads running through the management of our bushland reserves:

- community participation
- sound environmental principles
- sympathetic design

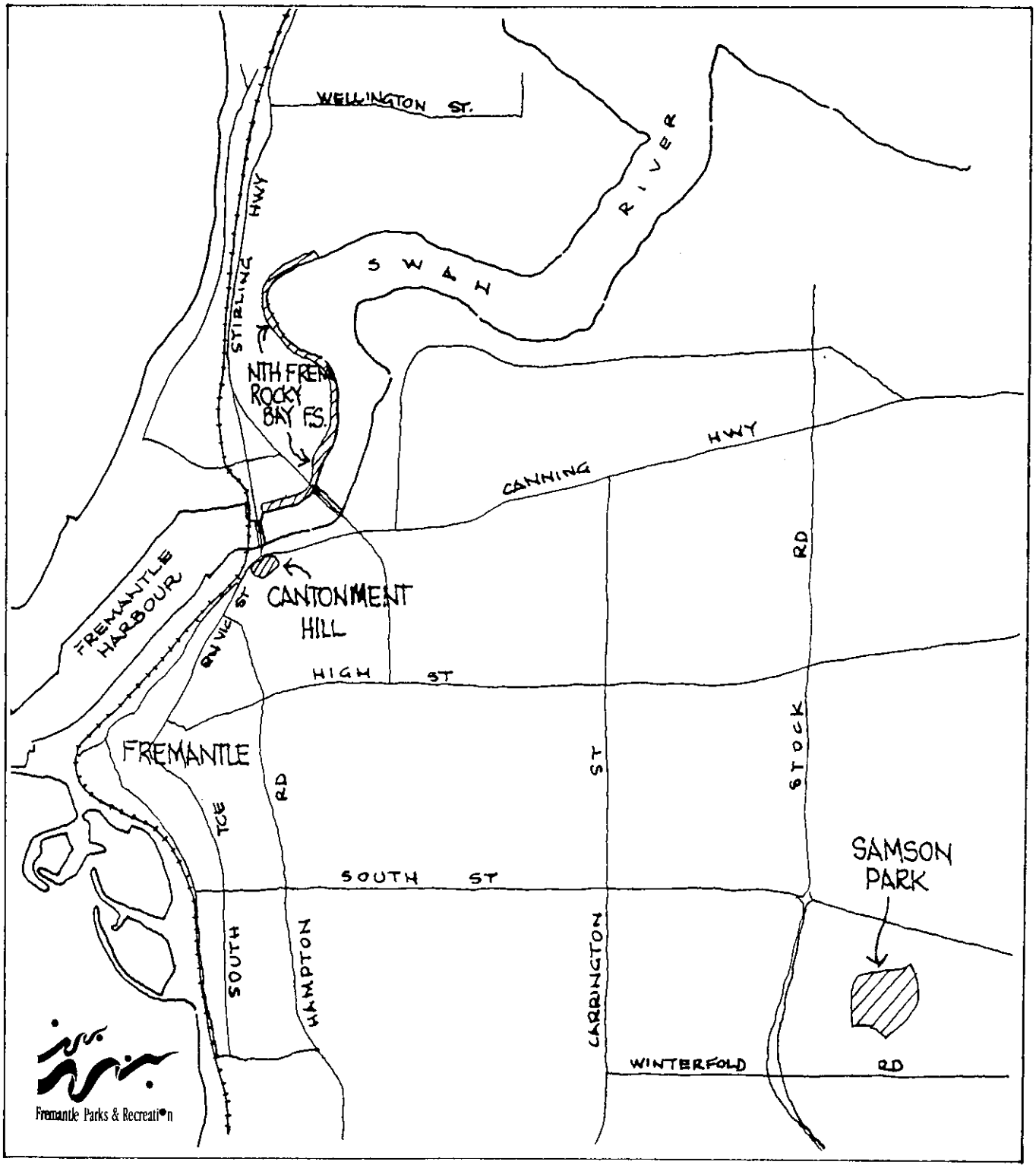

Figure 1. City of Fremantle Bushland Reserves

COMMUNITY INVOLVEMENT IN THE MANAGEMENT OF STAR SWAMP BUSHLAND

David Pike, President
Friends of Star Swamp

Introduction

Community involvement in Star Swamp began many years before the area was even declared a reserve. In fact it was persistent community pressure and lobbying over 10 years which saw it grow form a 2 hectare block containing only the southern half of the swamp, to the 100 hectare A-class reserve we have today.

Lupathons

The first management tasks undertaken in the bushland were lupin pulls, or lupathons as they were later named, and car body removal. The lupathons began over 15 years ago, and at that time the lupins formed a waist high sea of blue over most of the heath areas in spring. Lupathons have always had a good turnout of volunteers, mainly I think because they are organised events, no tools are required, people are within 'talking distance' of each other, they are of short enough duration, (2-3 hours seems to be the optimum time for most volunteers), we always stick to well defined, achievable areas, and everybody knows what a lupin looks like. The local scouts, guides and brownies have all been regular attenders at our lupathons over the years, although this year they are thinking of moving on to Lake Gwelup. We haven't got big enough lupins any more. In fact now we have only scattered unhealthy little lupins.

Car Body Removal

Car body removal was a more clandestine operation, because it was carried out while the area was still state government land. So early one weekend the bodies were manhandled one at a time onto a trailer, then dumped on the road verge, about 18 cars in all. The next Monday an 'irate ratepayer' phoned the City to complain about the mess, and by the end of the week it was cleared away. The message got back to us later that if the irate ratepayer could please phone his local councillor and complain about a week before it happens again, the Council could get the rubbish cleared away on Monday morning.

Planting

Planting has been carried out in the reserve by the Friends group for quite a few years now. The events are always advertised in the community newspaper so that we can get the local community more involved. Originally the plants were provided by Alcoa, but for the last few years they have been grown by the City of Stirling nursery from seed collected in the reserve. The majority of this seed has been collected by the Friends, and it is in these collecting and planting areas that the problems of lack of knowledge, and the need for training appear. Most people would like to collect seed, but can't name the plants are they are collecting from, and most enjoy planting, but don't have much idea of what they are planting, how big it grows, or where it belongs in the reserve, so both events have to be well controlled, with plenty of guidance given. Even basic information like how to plant from a tube has to be given to most groups, or you can end up with 'sand pyramids' around the plants instead of 'saucers'.

Earlier this month we had a group of 160 primary school children at Star Swamp for an Arbor Day planting. They planted nearly 600 tubes, they were so enthusiastic, and wanted to know all about their plants; it was really good to see. They all want to come back next year to plant some more, and are going to keep visiting their plants to see how well they are growing.

Clean-up

For the last two years we have been involved in National Clean-up Day, last year as an unofficial site, and this year as an official site. Last year we had mainly members of the Friends turn up. This year with the added (free) official advertising, we had 55 guides and their leaders plus a few other people waiting to sign on at the stroke of 9 o'clock. Most of them stayed until 11-30, and filled 27 bags between them. It is a good way of getting the community involved in a reserve and it reinforces the idea that bushland has to be looked after. One of the interesting results from last year's clean-up was the removal of three garbage bags full of bread wrappers from the swamp. It is no wonder that most of our wetlands have a nutrient problem.

Nature Walks

Other well attended events at Star Swamp are our regular monthly nature walks, which run for around an hour on the fourth Saturday morning of each month. We have some regular attenders, some occasional, and a few newcomers each month. The aim of the walks is to show people the different plant communities in the reserve, as well as some of the birds and insects, and perhaps more importantly show them how to look. This may seem a silly statement to some of you, but you would be surprised at how little some people actually observe as they walk through the bush. Last year a woman who had been on three walks said that before the first walk, there were just patches of green leaves and brown tree trunks, by the next month she could see that there were different shades of green and different shapes of leaves, and by the third walk she could see insects on some of the leaves and realised that she could even name some of the plants. People who can't see what the bush contains can't appreciate the bush.

We have run a few night walks over the last two years. They are very popular. Everybody wants to see frogs, spiders, and tawny frog mouths, but few of them would venture into the bush at night on their own these days.

Most of these activities not only get 'hands and feet' work done, but educate the community about the value of bushland, its fragility, and the difficulty of conserving these small islands of bush.

Management

This year we propose to apply for a grant to purchase display boards so that we can spread the message about the reserve to schools, shopping centres and libraries. There are a lot of people out there interested in helping out, but they don't know where to go. The Friends of Star Swamp are lucky in that, when the reserve was vested in the City of Stirling, a Management Advisory Committee was set up to act as a forum for advice and discussion on development and management of the reserve. This committee meets every second month, and consists of a Council services/maintenance sub-committee, an environmental sub-committee of Dr Bill Loneragan and Robert Powell, who were instrumental in the writing of Star Swamp's management plan, and a community liaison sub-committee, comprising members elected from the Friends of Star Swamp, the Friends of Trigg Bushland, and other

interested community groups.

At these meetings the Friends can inform the Council of any coming events, any management concerns or maintenance problems which are too big for the Friends to handle. The Council and environmental sub-committee can in turn let the Friends groups know of any concerns or maintenance work which would be too small or time consuming for the City to carry out. Problems such as dangerous tree branches, eroded tracks, and veldtgrass spraying are taken on by the Council, while general weed problems, rubbish removal and so on are left to the Friends groups. Advice is given to both groups by the environmental sub-committee, so hopefully everything is kept in line with the management plan.

Last year the City of Stirling also set up a Wetlands Management Advisory Committee, this was formed to set guidelines for the preservation of wetlands within the City. Representatives from various state authorities, Friends and ratepayer groups attend the meetings, including the Friends of Star Swamp. This is a committee where concerns we have about the swamp itself, water quality, drainage, etc. can be discussed. Hopefully it will lead to more indigenous fringing vegetation around our wetlands, rather than weeping willows and river red gums.

Other Activities

There are various other activities carried out by members of the Friends group, which really fall within the management area. Over the last five years we have been keeping and adding to a flora list for the reserve. It is surprising that after so many years there are still new plants to be found in the reserve. The list now really needs to specify locations for different species, and perhaps which plant community they are found in, so I suppose that will be the next project. I am also trying to set up a photographic record of every plant, both native and weed which grows in the reserve. Unfortunately like most of our committee, my time is limited. Most of us are members of several groups and various other committees. It is all too easy to reach a stage where your time is spread too thinly to get everything done which you would like.

And what of the future? We have a sub-committee working on terms of reference for a resource centre which will keep us busy for some time. Star Swamp, like most other reserves near the coast has large patches of wild *pelargonium*, ever expanding areas of freesias, *sparaxis* and cape tulip, and hopefully after two years of spraying, an ever decreasing patch of bridal creeper. I am quite sure though, with persistence and community support, they, like the lupins can be beaten.

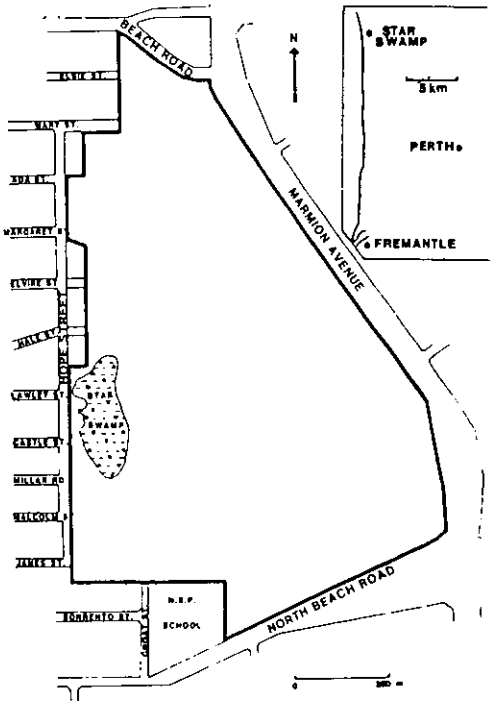

Figure 1. Star Swamp location and boundaries as defined in the Register of the National Estate.

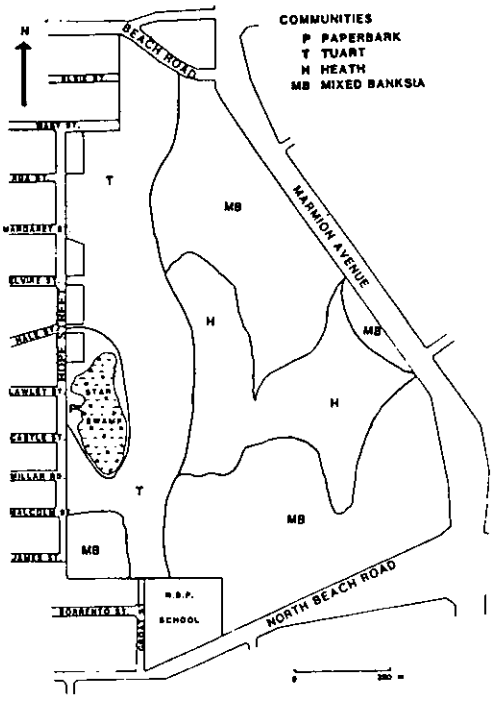

Figure 2. Distribution of major plant communities.

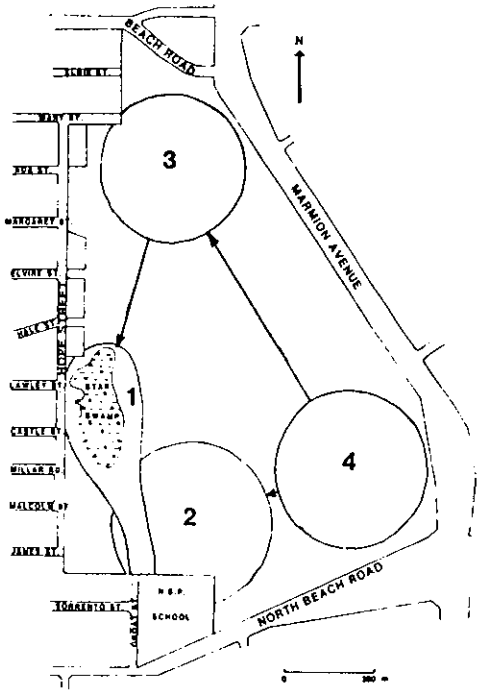

Figure 3. Major regions and possible sequence of development.

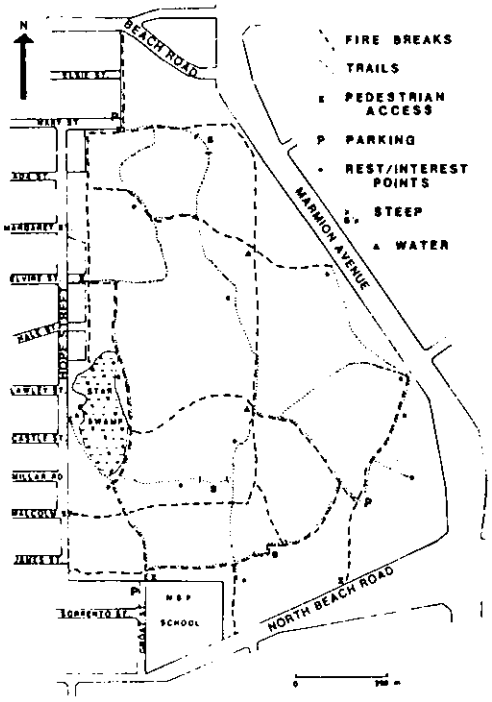

Figure 4. Proposed access, trails and interest points.

Source: City of Stirling (1985) *Star Swamp Bushland Reserve Draft Management Plan*

BUSH MANAGEMENT IN THE CITY OF GOSNELLS

Greg Miller, Manager of Parks
City of Gosnells

The City of Gosnells is a developing municipality which contains a diverse range of bushland environments. As such, the management of a variety of urban bushland or its remnants in the form of neighbourhood, district and regional parks falls to Council. Like the majority of local government bodies, we have no formal policy at present regarding bushland preservation and conservation, and physical action is currently on an ad hoc basis.

This issue is being addressed through the Greening Gosnells Advisory Committee, on which sit Council representatives and community members. An Urban Bushland Policy encompassing the provision and management of such areas is currently under investigation. Bushland belonging to, or vested in, the City of Gosnells falls into three categories:

- Neighbourhood Parks, which generally range from 4,000m^2 - 10,000m^2
- District Parks, which generally range from 1.0 - 4.0 ha
- Regional Parks, which generally range from 4.0 ha

Neighbourhood Parks, by definition, must service a localised recreation need. Development of these parks is of concern to the immediate and surrounding residents.

The subdivision process requires that Public Open Space (POS) be provided, and the management of this POS falls to the Parks and Gardens section. Parks and Gardens unfortunately has little or no input into the process of selecting this POS and as most of you will know, this parcel of land is usually that of least value to the developer. It is invariably cleared land or bushland in a degraded state, but occasionally significant remnant bushland survives in near-pristine condition. It is recognised that bushland in the latter category is a valuable asset, and attempts must be made to ensure its conservation.

We in the City of Gosnells include the public in the decision-making process through our 'Participark' meetings with the local residents prior to development. Public perception of remnant bushland and its conservation is changing, but we quite often find the majority of residents would prefer someone else's park to be bushland. Reasons for the stance are varied, and quite often ill-informed. These may be:

- "Criminal and undesirable elements frequent bushland - clean it up and the crime rate will fall." (a statement supported by local police with no data to substantiate the claim)

- "Land values won't appreciate as much as they would if the park was grassed and reticulated." (everyone else has grassed reserves!) European influence

- "There's no value in bushland."

- "Too many prickles" (adult perception)

- "There are snakes in the bush." (unfortunately more often not the case due to the size and insular nature of Neighbourhood Parks)

Council maintenance of bushland Neighbourhood Parks extends to rubbish collection and removal, and veldtgrass and other grass control.

District Parks and Regional Parks have, by the very nature of their size, a much high profile and wider community interest than Neighbourhood Parks. It is with these parks that bushland preservation on a larger scale is not only possible, but feasible.

Council manages the Ellis Brook Valley Reserve, a Regional Park of some 1,400 hectares in the foothills of the Darling Scarp. The Ellis Brook Valley Working Party works to implement a comprehensive management plan prepared for Council by Dames and Moore. The maintenance budget for this park allows for the gradual implementation of recommendations which include interpretation trails, parking, signage, weed control, revegetation, education, recreation nodes, etc.

Community involvement in the Ellis Brook Valley Reserve has been encouraged, and to date a corps of volunteers has undertaken floral surveys, seed collection, direct seeding, erosion control and walktrail maintenance. This volunteer involvement has just reached a crucial stage with a meeting in the Valley recently to discuss the formation of a 'friends' group.

Particular issues of concern are:

- indiscriminate use of off-road vehicles - 4 wheel drive and trailbikes
- horseriding
- vandalism (access gates, signage)
- dumping of rubbish/stolen vehicles
- erosion from elements
- dieback
- weed invasion
- fire

District Parks such as Mary Carroll Park, the Hume Road Wildlife Reserve and the proposed Hester Park all have management plans which stress habitat conservation as a high priority. Community involvement in these parks is a crucial element in the implementation of recommendations, and 'friends' groups of all ages are encouraged and supported by Council.

A limitation to the effectiveness of community involvement is access to current information and techniques relating to bushland conservation. What began as a tree-planting group has developed into a more skilled volunteer corps. Council has organised workshops on seed collection and processing, and direct-seeding. In addition to the workshops, a local service organisation funded two volunteers to attend bush regeneration workshops in 1991. Feedback from these people indicated the direct relevance of this discipline to our volunteer programme, and we have been successful in obtaining funding from federal, state and private bodies to contract David Kaesehagen of APACE to conduct workshops in the City of Gosnells commencing in July 1992. It is planned that this expertise will be put to good use in remnant bushland areas.

Council has allocated funding to contract a qualified Bush Regenerator to undertake regeneration works in the Ellis Brook Valley Reserve. In addition to these works, the contractor has undertaken to co-ordinate volunteers in the application of their newly-acquired bush regeneration skills.

A much slower process is the acquisition of discreet bushland work practices by Council staff. This has already commenced at the technical staff level, and in an impending project in the Ellis Brook Valley selected Council outside staff will work with CALM personnel to learn bushland work skills.

Recognising the importance of using indigenous seed for revegetation, Council has provided a five hectare site near the Ellis Brook Valley Reserve for the establishment of a seed orchard. The first direct-seedings have recently been completed by community volunteers who have followed the process through from the initial seed collection to this stage.

Gosnells Senior High School (GSHS), with Council's assistance, has been successful in obtaining funding from Greening Western Australia to establish a wetland seed orchard. A very healthy working relationship exists between Council and GSHS. This extends not only to the wetland seed orchard project, but to a joint Earthcare Centre at the school where, among other projects, a nursery exists for the propagation of indigenous vegetation.

The future of bushland preservation in the City of Gosnells is looking good. Up for consideration in next financial year's budget is a recommendation to appoint a full-time Co-ordinator to the Greening Gosnells Advisory Committee. This new position is proposed to liaise with schools and the community; continue and expand existing volunteer programmes; organise activities aimed at raising awareness of the immediate natural environment; conduct bushland workshops; and keep applying for funding.

Mary Carroll Park in need of friends

In place of a Group Profile, **JEREMY CHITTY** reports on an as-yet unformed "friends" organisation.

THE inspiration provided by a primary schoolteacher more than 50 years ago is the force behind the transformation of the Gosnells park named in her honour.

The 15-hectare Mary Carroll Park is made up mainly of swampland which is home to many resident and migratory birds. But high levels of water pollution and neglect have degraded the swamp over many years.

Now the Gosnells City Council has thrown its weight behind the park, commissioning a management plan and implementing its recommendations.

The council has employed professional bush regenerator John Robertson for 12 months to co-ordinate a community-based program to reverse the degradation.

One of his main aims is to organise an official Friends of Mary Carroll Park group to help maintain the park.

"Friends of Mary Carroll Park is a name that has been used by a number of people for a few years, but there isn't a group that actually exists," Mr Robertson said.

"The council is prepared to put money into the park to the point where it can be looked after by a friends group."

Mr Robertson said members would only need to put in a few hours a month to help. He intends to hold a public meeting early next year of interested people.

A group already meets in the park on the first and third Sunday of each month to remove weeds and rubbish. It also collects seeds.

Mary Carroll taught in Gosnells before and after World War I.

She was a primary schoolteacher and she often took her classes to study the flora and fauna in the swamp areas.

She retired in the 50s but left many locals with happy memories of how the park used to be.

Gosnells City Council horticultural technical officer Wayne van Lieven said the park was important because it was one of the biggest water bodies in the city's area, with many migratory and residential water birds.

"The main aim of the plan is to find where the high levels of ground pollution are coming from. A revegetation program has also begun," Mr van Lieven said.

"The lake has been pushed around over the years. We need to reintroduce a lot of species."

The council began the initial study because outbreaks of botulism over the years have raised concern about the condition of the swamp areas.

A working party was formed following a recommendation in the management plan put together by Barbara Pederson and Arthur Conacher from the University of WA's department of geography.

Gosnells and Thornlie high schools have set up nurseries to care for 2500 seedlings to be planted in the park next winter.

"We are proposing to incorporate six of the local primary schools into this," Mr van Lieven said.

"The children will adopt seedlings for a period of months before they are ready to be planted. The students will then get to plant their own seedling and care for it."

● Mary Carroll Park in Gosnells is home to many resident and migrating birds. Plans are underway to form a group to help regenerate the park by planting seedlings and to care for it. Picture: JOE WHEELER

THE WEST AUSTRALIAN MONDAY DECEMBER 7 1992

EARTH2000

INVOLVING SCHOOLS IN BUSH MANAGEMENT

Michael Erith
John Forrest Senior High School

Introduction

The paper is in two parts: a description of the project undertaken by John Forrest Senior High School and developing relationships with schools.

John Forrest Senior High School - Project Summary

The formation of a Science Club at John Forrest SHS preceded the decision to participate in the Ribbons of Blue programme. This programme involves a water analysis project to monitor water quality in the local Bayswater City Council area and Swan River Foreshore. After the second series of water testing the Bayswater City Council was approached and a proposal submitted. This proposal requested that two hectares of land being sampled be granted to the school for a rehabilitation project.

The area granted consists of four specialised habitats: an estuarine river; a freshwater creek; a river floodplain which abuts a sanitary landfill area. This unique combination of habitats provides students with a variety of research and planning projects. The overall project has a three to five year time frame and is currently at the stage of writing the strategic plan for rehabilitation projects. Figure 1 indicates the planning stage attained and the level required for submission to the Bayswater City Council and the Swan River Trust.

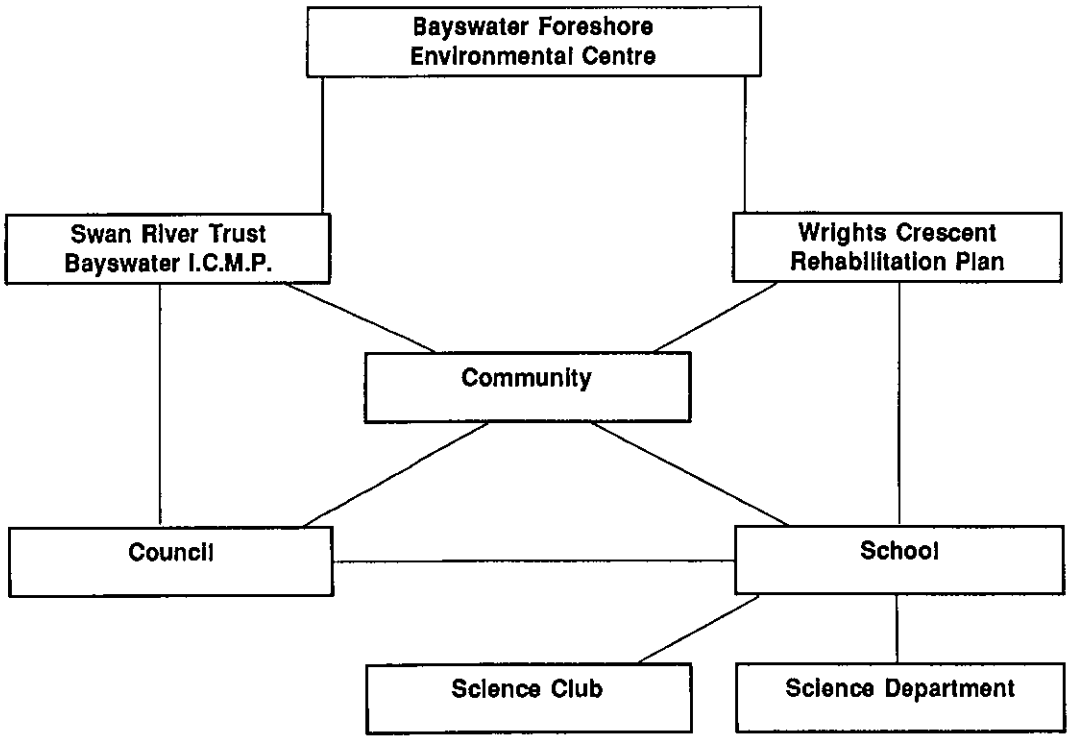

Figure 1. Project Interactions

The rehabilitation project involves the identification of indigenous species, clearing of exotic flora and then reintroduction of appropriate flora. Water analysis of the area, initially with the Ribbons of Blue and with the Bayswater Environmental Health Department officers is an important aspect of the project. The most challenging aspect is the research required to successfully plant a barren sanitary landfill site and its inherent problems.

A sub-programme of the rehabilitation project the Science Club is involved with is the Bayswater Integrated Catchment Management Plan. This is a community based action group to identify environmental problems associated with the Bayswater Main Drain. The Science Club is a recognised participant, achieving observer status on the steering committee chaired by Dr Judy Edwards MP. This provides the students an opportunity to contribute to existing local data as well as observing the decision making process. It is envisaged that students will take part in environmental research, surveys, other data collection techniques and interpretation of results. This involvement is seen as imperative in providing students with a thorough knowledge of the consequences of irresponsible attitudes.

Relationships with Schools

Which School?

- Primary or Secondary
- State or Private
  Consider location, transport

Know Your School

- 'The School' image, motto, school development plan - its goals and priorities.
- School's record and achievements.
- School structure: buildings - layout and facilities and personnel - decision making groups and key individuals.
- School schedules: timetables and procedures
- Teachers: extremely important for success. Conservative, charming and dynamic! Under pressure with varying social issues. Environmental awareness?

Establishing Working Relationships

The Principal: letter, phone and appointment (15 mins). Ultimate decision maker, school networks and staff interest and capability (school politics).

(I) Develop credibility: letter of introduction, brief summary of project, maybe a few photos, qualifications of those involved. Remember, concern with a neutral stance!

(II) Student advantage: school's main object must be addressed.

(III) Appeal to self interest: what will the school community get out of it? Publicity, positive image and community recognition.

(iv) What do 'You' have to offer? Time, resources, vision, enthusiasm (not too much) and maybe money.

(v) Timing: need to approach the school a full term before the required time.

The Teacher(s): Repeat above steps

(i) How is it to be presented: best to make it part of the curriculum, a key date - Arbor Day, World Environment Day or an ongoing study (based on a theme).

(ii) Resources: transport, equipment

(iii) Get to know your teacher(s): interests, idiosyncrasies and methods of working.

Don'ts

- give the impression of looking for free labour.
- play the negatives of a school.
- give the impression of being a GREENIE who has come to save the world.

Expectations

- This is going to be a long term relationship built on trust and confidence.
- It will depend greatly on the teacher and the nature of the project to fit into the curriculum.
- Have realistic expectations, start small with a pilot project where the rapport can be tried and tested.

Remember, few will have the expertise and therefore will require support.

"You are the cutting edge of environmental progress."

Activities

Build on what the school is already doing even if it does not fit your immediate objectives.

- Adopt a bushland
- Bush regeneration
- Make a nursery
- Raise awareness: art, music or theatre
- Promotions: environmental newspaper or video
- Lobbying: letters to editors, Councils, MP's (balanced views only)
- Small business

Schools are havens of dynamic individuals with great optimism and good will. Good Luck

Reference

James Mumme (1991). *Involving Local Schools* Gosnells SHS

BIG SWAMP AND THE BIGGER PICTURE

Max Margetts, Urban Designer
Max Margetts and Associates

Introduction

My presentation will look at the management question from an urban perspective. I intend to make a few introductory observations and then to focus briefly on a place known as Big Swamp in Bunbury.

My interest in this topic stems from a fascination with urban issues at the macro level - that is at the scale of entire towns, coastal villages, consolidated residential communities and their interface with surroundings.

Inevitably, physical planning on such a scale involves some resolution of competing land use values and an understanding of the contribution which open space, parkland and recreation areas play in the amenity and sustainability of the greater urban environment.

Today, when we talk of visionary urban planning, we are talking about a vital mixture of activities and a general consolidation and intensification of infrastructure and human-scaled buildings, spaces and landscape. This may not be so much a 'new world order' as a new Australian order.

At the same time, planners and decision-makers are being pressed to conserve and/or reinstate almost every as yet undeveloped piece of near urban land. Invariably, the stated objective is to safeguard declining ecological diversity. At times however, we tap into a powerful Australian icon - the anti-urban sentiment, where the city is viewed as some sort of aberration.

It seems to me that if cities were made more livable, then they would likely end up being more consolidated and in the process entire tracts of bushland and countryside could be conserved and perhaps more sustainably managed.

Since we are probably a long way removed from universally adopting the consolidated urban village solution, we are obliged to ensure that as densities increase, open space management should provide for not just conservation but also for public recreation, social interaction, contemplation and retreat. The interdependence between accessible urban open space and the development of higher residential densities becomes a very important planning consideration.

In a townscape sense, properly planned medium density residential development can provide a useful bookend or cordon between urban and open space areas. Provided views and/or access to such open space is available from consolidated housing then the product is likely to be marketable and more contiguous open space areas may result. In general, comprehensively planned medium density housing can be more easily controlled to visually harmonise with a particular landscape backdrop. Relative topography and landscape values become key factors in site selection.

Experiences from Big Swamp

Big Swamp in Bunbury provides an interesting case study. While it possesses important conservation values, it also represents an important urban open space resource around which residential densities could reasonably be expected to increase over time.

If you think about it, the name Big Swamp probably tells us quite a lot about the urban history of one of the least loved and (until recent years) most abused locations in the town.

The swamp and surrounds cover about 60 or so hectares south of the town centre and immediately inland from the main ocean beaches. The location which is now seen as both an important wetland habitat and an important recreation resource, has had an inglorious history as an artificially created drainage basin with associated uses including cattle grazing, market gardening and from 1962, rubbish dumping. Landfill operations continued for around 15 years.

Eventually the attraction of the waterbody as a habitat for wildlife began to be recognised. Various 'improvement plans' were proposed - including components such as football fields, an outdoor performing arts centre, a caravan park, play grounds, a bird sanctuary and perimeter roads.

In 1989, I was part of a study team* appointed to examine existing opportunities and constraints and to prepare an appropriate development/management strategy for the location. The widespread community interest in the area was reflected in a steering committee of no less than 15 persons.

Not many months before the study was initiated, Council completed construction of a perimeter road system. It was the view of the consultants that the new road links fragmented the core of the park from surrounding local housing areas. Instead of facilitating limited access to the park, the new roads in fact acted as a potentially high speed short cut to other destinations. The roads followed the traditional line of least resistance.

The consultants determined that a re-arrangement of this road system would be a fundamental pre-requisite for medium to long term rehabilitation, development and management. Inevitably, the recommendation was criticised by some as threatening valuable infrastructure investments. The view of the consultants was that the desirable interface between the park and its urban context made the removal of certain roads an essential and unavoidable task.

The recommended Structure Plan for rehabilitation development and management (refer Figure 1), was based on the following criteria:

- Conservation of natural resources should be given priority and wildlife park should be the predominant land use.
- There should be a diversity of habitats for birds and animals, including open water and ephemeral areas.
- The area east of Tuart Street should be integrated with the main body of the swamp.

* The team comprised Whelans, AGC Woodward Clyde, Max Margetts and Associates, Ernst & Young.

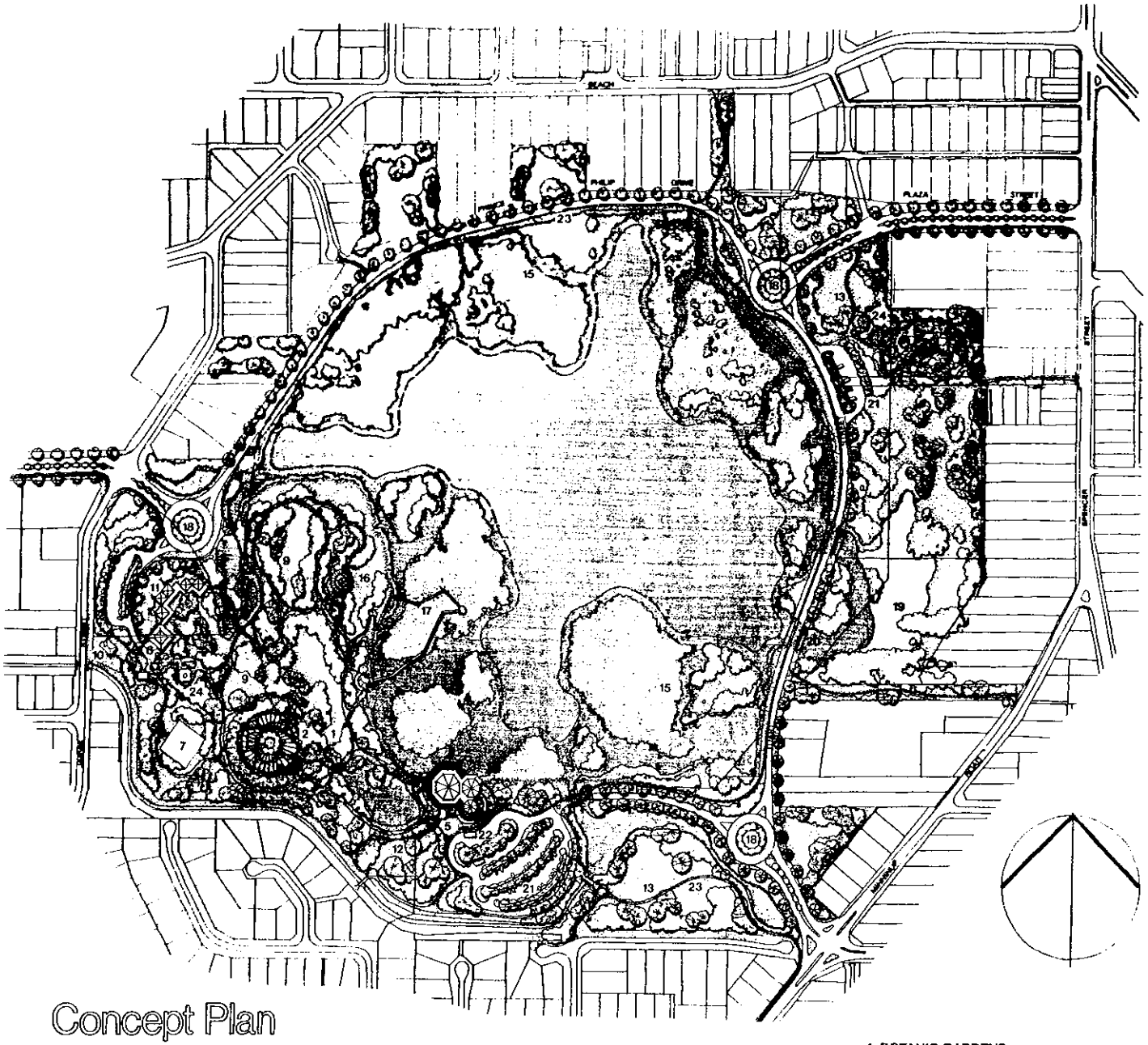

Figure 1. Big Swamp Conservation Park

- Natural areas should be concentrated inside the ring road with activity areas and buildings outside.

- Traffic and parking should be rationalised, giving priority to needs and appreciation of the park as opposed to through-traffic.

- The rubbish mound and filled areas should be used to create habitats and focus views into the park and over water.

- Re-profiling of edge conditions should extend the boundaries of water areas to transfer amenity to filled areas.

- Over time, the existing Bird Park should change its image and relocate to the principal water focus (main body of the swamp).

- The concept of the Bird Park should be broadened to include botanical gardens and other fauna, to create a total integrated environment, for recreation and tourism, research and education.

- An identifiable amenities node should be created to service both the Bird Park and the visitor needs of the rest of the park.

- The park should be planned so that it can be progressively implemented.

An implementation strategy was proposed which addressed issues such as the need for further research and the establishment of a monitoring programme, a staging of rehabilitation and development measures, possible funding and administrative arrangements.

While some of the recommendations of the consultants caused a degree of anxiety amongst certain Steering Committee members, the exercise demonstrated how urban land use issues outside of the immediate area need to be taken into account in such work.

References

Whelans, Australian Groundwater Consultants, Ernst & Young (1989). *Big Swamp Redevelopment Survey and Analysis Conclusions and Recommendations*, for South West Development Authority and Big Swamp Redevelopment Steering Committee.

Whelans, AGC Woodward-Clyde, Max Margetts & Associates, Ernst & Young (1991). *Big Swamp Conservation Park*, for Big Swamp Redevelopment Steering Committee.

CONCLUSIONS AND RECOMMENDATIONS

The following statements were made by speakers at the seminar or in discussions that followed and are proposed as a basis for further action:

THE IMPORTANCE OF BUSH PRESERVATION

- The purposes of urban bush conservation can be stated as:

  (a) to conserve endangered species

  (b) to conserve representative communities of biota (preferably more than one of each example to provide a safety net if one is damaged by fire)

  (c) to facilitate movement of migratory species (remnants provide 'stepping stones'; linear parks provide linkage corridors)

  (d) to provide reminders of the original landscape - stability and relief in contrast to the hard surfaces of a growing city.

- Many would argue that, all too often, environmental issues run second to economic and employment issues; that there is presently an unacceptable loss of urban bushland resources in the Perth metropolitan area and that this is adversely affecting the city's ambience and lifestyle. For example:

  (a) native mammals have largely disappeared from the metropolitan area

  (b) in local parks there is a blurring of conservation with recreation - there appears to be a pre-occupation with active open spaces and replacing local flora species with non-local ones

  (c) current reserves cover some eco-systems much better than others eg. bushland of the Ridge Hill Shelf is poorly represented in reserves.

- There is a need for both large and small bushlands for conservation and education purposes.

- It is often difficult to argue for retention of remnant bushland on the grounds of biological diversity.

- Perth is in the fortunate position of still having extensive bushlands within and adjoining its urban area. However, they are in rapid decline. The problem is how to retain and restore them.

Recommendations:

1. **The primary objective is to develop a widespread empathy for urban bushland.**

2. **As people are most likely to acquire a conservation ethic from bush they grow up with, there should ideally be bush within walking distance of every home and school to engender familiarity and respect.**

3. **Total clearance of bush for residential/industrial development should be discouraged ie., there should only be clearance for road pavements, services, building sites and access, with bush retained in road reserves and front/back yards.**

4. **Larger parks, which structure the metropolitan area, should be located between areas of urban concentration; institutional management of these large areas is desirable.**

5. **The value of small bush remnants should primarily be for passive recreation; there is scope for local groups in maintenance of these areas.**

6. **It is desirable that links are established to make bush remnants more sustainable - preferably in the form of linear parks. Where urban development precludes this option, then the required function could be provided by landscaped road verges and drainage lines and/or strict landscaping requirements for private property along the linkage corridors.**

7. **Art works in bushland should be encouraged to stimulate awareness of bush.**

8. **While legislative amendment may be desirable in some areas, it is important to focus on what can be achieved under existing law.**

EDUCATION

- The loss of much urban bushland arises through a lack of understanding of the value of irreplaceable natural resources, on the part of the community, planners and politicians.

- Most people in Perth have very little familiarity with their local flora. Few can recognise, for example, local species of eucalypt.

- Often people want to help save bushland but are at a loss as to how to go about it.

- Local Councils are becoming more experienced in the environmental area, but are often constrained by limited staff and financial resources and are heavily reliant on codes and regulations. Some Councils have employed environmental officers, but at present there is no policy framework available for urban bush management.

- The existing level of skills with people involved in bushland management is highly variable - work may be undertaken by university graduates but is often done by unemployed volunteers and children.

- Although there appears to be little co-ordination of education efforts, there is a precedent with the Swan River Trust working towards a national curriculum for school teachers in relation to water catchment planning.

- At the City of Gosnells a Junior Park Ranger program has been established with encouraging results (in association with other initiatives, the City has one of the lowest park vandalism rates in the Perth metropolitan region).

Recommendations:

9. **Education is a high priority for immediate action. Everyone should be educated in the value of urban bushland and its management. Particular groups such as the general community, planners, Council staff and politicians may have to be targeted with specific programs, but everyone should be taught such basic things as learning to recognise some of their local plant species.**

   The bulk of effort to lobby all levels of government for a greater allocation of funding for education should lie with voluntary conservation and resident groups.

10. **Organisations with wider interest, such as the National Trust of Australia and AIUS, have a special responsibility as honest brokers to put the case for bush management in the wider context, through cross-disciplinary seminars, workshops which encourage people to at least talk to each other, submissions to government, media contact, etc.**

11. **There is a need for commitment to proper bush management by organisations with standing and people in authority.**

12. **There is a need for models for others to follow:**

    - **administrative models**
    - **participatory models**
    - **clear, practical examples**

13. **Everyone involved in bushland management needs to be trained to some degree.**

14. **A variety of education should be available:**

    (i) **in pre-primary, primary and secondary schools**

    (ii) **at TAFE level**

    (iii) **at university level**

    (iv) **through professional institutes aimed at their members**

    (v) **through short courses for the public, available for a fee, at specialist groups eg. APACE**

    (vi) **through workshops or demonstrations, available at no charge, sponsored by conservation groups and local Councils.**

15. **The EPA should be provided with more resources for work with schools, local Councils, voluntary conservation groups and others, to co-ordinate education at state and national levels.**

THE NEED FOR AN URBAN BUSHLAND POLICY

- There is at present no urban bush policy for the Perth metropolitan region.
- DPUD's environmental audit is limited in scope and covers only sections of the Metropolitan Region Scheme. There is no accepted baseline study of the quantity and quality of remaining bushland within the metropolitan area.
- The *System 6 Conservation Through Reserves Study* was a good start to documenting resources, but this work is now more than 10 years old, gave little attention to privately owned lands and has always suffered from lack of an effective implementing mechanism.
- Many valuable bush areas occur outside the reserve system, often on private property and under pressure in hard economic times.
- Similarly many remnant bush areas occur on school and other institutional sites, not recognised or protected.
- Conflicts between conservation/resident groups and developers, often government agencies, absorb extensive resources and are all too frequent.
- Development plans are proponent driven; there are usually few guidelines relating to bushland areas that should not be touched and dedicated as public open space. This results in only the minimum of unwanted land being given up. If people object, recourse can usually only be obtained at the political level.
- There are significant differences and management implications between larger regional conservation parks and smaller remnant urban bush areas. There is the danger that conservation efforts might be confined to larger areas where the State Planning Commission is involved and/or to System 6 areas, to the neglect of small but still important remnant bush areas.
- There has been little planning for retention of urban bushland at the conceptual level - are sufficient areas reserved; are more needed?

Recommendations:

16. **Clear policy statements from government through the *Town Planning and Development Act, Wildlife Conservation Act* and *Environmental Protection Act* (ie. Statements of Planning Policy and Environmental Protection Policies) are needed to provide more pro-active mechanisms to protect remaining bushlands.**

17. **These policies should include:**

    (i) clear objectives

    (ii) an inventory of existing resources

    (iii) conceptual studies for achieving a representative and integrated bushland system, which is sustainable in the long term. (The Bushmead Rifle Range land in the Ridge Hill Shelf should be part of this system.)

    (iv) means of implementation.

18. **The inventory should comprise a comprehensive examination of the quantity and quality of all remaining bushland within the Perth metropolitan region, irrespective of land ownership.**

19. **The inventory should use the State Environmental Charter as the starting point; it should examine all bush-covered lands larger than 2,000 sq metres and be prepared with extensive public participation. The inventory should be published and freely available to all.**

20. **Pending completion of the inventory, there should be a moratorium on the clearing of bushland not subject to an environmental assessment process, irrespective of land use zoning.**

21. **The management of larger regional conservation parks by CALM is supported. However, present funding arrangements are unsatisfactory. To provide continuity, a fixed proportion of the Perth Region Metropolitan Improvement Tax should be allocated for the purpose of regional park management. The proportion should be decided by Parliament.**

22. **Local authorities are generally the best agencies to protect small bush remnants; it is their responsibility to find out what the community wants by encouraging public participation.**

23. **The EPA, while having its major interest in System 6 areas, should provide more assistance to local authorities to aid the management of small bush areas.**

24. **Resident groups should make more use of the National Trust in assessing the value of bush areas.**

25. **The AIUS, National Trust and similar groups should lobby the government and government agencies for the preparation of urban bushland policies as outlined above.**

MANAGEMENT PLANS

- The traditional management technique of the Local Council letting a contract to burn off bushland each year has now largely given way to more sensitive measures.

- Today a management plan framework exists, initially established many years ago by the then Department of Fisheries and Wildlife, a forerunner of CALM, and further refined by CALM. This is now in widespread use. (The proceedings of the 1983 seminar *The Management of Small Bush Areas in the Perth Metropolitan Region* includes model management plans).

- However CALM's resources are limited and concentrated mostly on larger parks; management plans for small bush areas are usually only compiled with community participation.

- Experience has demonstrated that individual members of the public often have divergent views on how lands should be managed.

- Information on bushland management is scarce, particularly related to Western Australian conditions.

- The major cause of disturbance of urban bushland has changed from uncontrolled fires to man-made degradation eg. cats, nutrients, cool burns.

- Experience has demonstrated that a common fault of management plans is that they rarely spell out actions that should be taken year by year.

Recommendations:

26. **Every bush reserve should have a management plan. The preparation of such plans should involve the public and interested organisations.**

27. **The community needs to play a large part in managing bushland, particularly small bush areas. Even for larger parks, this can help decide CALM priorities.**

28. **The existing CALM model management plans are a good starting point.**

29. **All management plans should contain**

    - **clear objectives**
    - **long-term goals**
    - **short-term actions, in order of priority**
    - **proposals for monitoring and review of effectiveness**

30. **Management plans need to pay more attention to subtle degrading influences on urban bushlands, in the absence of Council or State-wide controls.**

31. **Management groups need to be formalised in case there are personality clashes, but should be flexible enough to allow different conservation methods to make the most of available opportunities.**

32. **Greening Western Australia should expedite the release of its 'how to do it' management manual.**

33. **Local authorities should be encouraged to prepare district management plans, for the whole system of parks and bush reserves within their boundaries, taking particular account of preserving remnant trees and shrubs of the local flora. As a rule, local and non-local trees should not be intermixed.**

RESEARCH PRIORITIES

- Whilst there is a considerable body of information on the vertebrate fauna of the Perth region, knowledge of the invertebrate fauna and micro-organisms and the fundamental role they play in ecosystem processes are very deficient.

- Burning of bushland is encouraged by some local Councils and prohibited by others, without any real understanding of the implications for different ecosystems.

- There has been little research into the impact of cats on native fauna, particularly in urban bushland, but indications are that this could be considerable.

Recommendations:

34. **It is essential for effective, long-term management of urban bushlands that greater resources and time be given to documenting the invertebrate fauna of the Perth region and their role in maintaining remnant vegetation.**

35. **The frequency and intensity of fires that different bushland types can withstand need to be investigated and baseline studies established, with a view to building alternative fuel reduction strategies into management plans, while retaining biodiversity and long term sustainability.**

36. **More research into the affects of cats on native fauna is urgently required but this should not delay control measures being implemented.**

LEGISLATIVE CHANGE

- The *Environment Protection Act* generally reflects community attitudes and overall, appears to work well.

- The most obvious area where adjustment to the *Environmental Protection Act* is needed relates to appeals, where these are presently to the Minister for the Environment.

- Permanent protection of natural heritage should not be left to politicians, who typically have short-term horizons.

- The *Town Planning and Development Act* makes insufficient reference to wildlife conservation being able to be covered in town planning schemes.

- The *Environmental Protection* and *Town Planning and Development Acts* overlap to the detriment of both conservation and development projects; there is no present structure where planning decisions on land use are assessed within an environmental context.

- The town planning profession and Department of Planning and Urban Development are perceived by the community to have a pro-development bias, which results in a poor public image with respect to conservation matters.

- While the means of protecting flora appears to be adequate via a variety of legislation, there is no clear-cut legislation to protect fauna or habitat.

- Many weeds eg. bridal creeper, pampas grass, will never be controlled when some Councils have bans while others do not.

- The need for control of cats is not recognised in present legislation and is becoming more obvious in order to reduce their detrimental effect on wildlife.

- At the present time some Councils have outlawed burning of bush and there is no mechanism to allow burns if considered necessary to satisfy conservation objectives.

- There have been some environmental reports, prepared by public agencies, which are suspected of containing information critical of government actions, eg. the environmental audit of the northern part of the metropolitan region, which have not been made public. Western Australia has been one of the last states to consider Freedom of Information legislation.

- There have been examples of the state government proceeding with destruction of urban bushland despite overwhelming public opposition eg. Hepburn heights. Other than at election time, the government is not answerable to the public.

Recommendations:

37. **The *Environmental Protection Act* should remain basically unaltered, with the exception of the appeal provisions.**

38. **There is a need under the *Environmental Protection Act* for an independent adjudicating body, free from political interference, to protect natural resources for the long term. This could take the form of an Environmental Ombudsman or Court; perhaps combined with the present Town Planning Appeal Tribunal provided there were appropriate terms of reference.**

39. **A comprehensive review of the *Town Planning and Development Act* is urgently needed; it is essential that this clearly specifies that wildlife conservation in its broadest sense, may be addressed within planning schemes.**

40. **It is essential for environmental protection and development processes to be more closely integrated; consolidated legislation is one obvious means to ensure this.**

41. **To improve the community's confidence in the town planning profession the state planning agency should be seen to be impartial and must clearly address both conservation and development matters. The name of the agency is important in this respect.**

42. **The *Wildlife Conservation Act* should be amended to clearly cover habitat conservation as a means to preserve fauna.**

43. **There should be enabling legislation to declare environmental weeds, on a state-wide or at least regional basis.**

44. **Available information indicates that control of cats is urgently needed - beginning with a requirement for registration and incentives for de-sexing, if not for the whole state then at least for given local authorities.**

45. **There should be a mechanism available to over-ride Council requirements for burning of bushland, in the interest of conservation.**

46. **There should be Freedom of Information legislation enacted.**

47. **There should be a mechanism for legislation generated by citizen-initiated referenda.**

Max Hipkins
National Chairman
AIUS

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ROBERTSON, Margaret	Robertson Bush Regeneration
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ROSS, Jan	Shire of Mundaring
ROSS, Mary	City of Fremantle
ROWLEY, Terry	City of Armadale
RUNDLE, Cr Norma	City of Wanneroo
SAUNDERS, David	City of Wanneroo
SCHELTEMA, Martine	Greening WA
SHARP, Jim	Bush Fires Board
SHEPPARD, Aiton	City of Wanneroo
SMITH, Kevin	City of Wanneroo
STAFFORD, Matthew	DPUD
STAR, Jan	Shire of Serpentine/Jarradale
STEPHENS, Warren	City of Wanneroo
STEVENSON, Andrew	City of Fremantle
STREET, Mark	City of Melville
TAN, Steven	Shire of Kalamunda
TANNER, Stacy	Student
TAUSS, Kate	
TAUSS, Ray	
THORN, Peter	The Tree Society
TIZZARD, Brett	EPA
VAN ETTEN, Eddie	Edith Cowan University
VAN LIEVAN, Wayne	City of Gosnells
VLOK, Adrian	Martin Goff
WAKE, David	Quinns Rock Environmental Group
WALSH, Darren	Shire of Swan
WHITE, David	Joondalup Develt Corp
WILKINS, Brian	City of Stirling
WILSON, Duncan	Shire of Mundaring
WILLIAMS, Paul	Shire of Swan
WOOD, Kim	Kott Gunning

THE WEST AUSTRALIAN MONDAY SEPTEMBER 21 1992

Demand vs space proves the developer's dilemma

Urban bushland is disappearing in Perth as pressure increases to provide more housing for a growing population. Last week we looked at the arguments for preserving more of the urban bush. This week **CARINA TAN-VAN BAREN** talks to two men who have to balance conservation and development.

BUSHLAND preservation may be a fine objective but the fact remains that a booming population needs housing, say two proponents of Perth's development industry.

David Hatt, Department of Planning and Urban Development chief executive, and Simon Holthouse, president of the Urban Development Institute of Australia, believe the expansion of Perth's boundaries is inevitable.

But they add that the community must make big choices about the direction of expansion.

Mr Holthouse said there was no doubt that Perth's population would continue to grow and there were two possible scenarios for dealing with that growth — urban consolidation and the outward development of the metropolitan area.

Urban consolidation was a "hip" phrase of the moment but many people were not prepared to accept higher density housing within their own neighbourhoods.

"The view is: 'I don't want people living in high-rise apartments where I live, but if we want to accommodate the people who come in, we have to do it in that way but somewhere else'," he said.

Mr Holthouse said that to accommodate Perth's future population, housing density would have to be increased five to 10 times. Even then there would be a limit beyond which outward expansion was necessary.

"If you take the second scenario, which is outward growth, there is also a question of choice," he said.

If land was conserved for its particular value, somewhere else must be found farther out.

"If you put it farther out, you have to connect it with roads and sewers and provide infrastructure at a greater cost than you would normally pay," Mr Holthouse said.

The question was: what kind of community did Perth people want to live in?

"One of the concerns that people have is not only the preservation of bushland but also the quality of life of the people who live on the edges of our communities," he said.

"The solution which is offered — not to build on the periphery but to utilise land within the existing developed areas — will not satisfy the requirements for the future of Perth. At the same time, you have to build on the periphery.

"It is a simple supply and demand equation that the cost of the land will rise as there is less land available.

"On the one hand, you have the community saying: 'I want to preserve this land for my enjoyment' and on the other hand it is paying more for a house and land. The community really needs to make a choice and needs to know all the issues before making that choice."

Mr Holthouse said the UDIA would fully support an assessment and inventory of areas of significant preservation value. It would allow developers to choose sites without fear of last-minute conflict with conservationists.

"Land which is identified as important to the community can be reserved and, therefore by definition, land which was not deemed to be significant could then be made available for development," Mr Holthouse said.

"Having made that decision, there should be an agreement that it should not be altered, giving developers the certainty that they can develop once that process has been carried out."

Mr Hatt said the Department of Planning and Urban Development had started an environmental audit for the Perth metropolitan region. Audits for country areas were planned.

Admitting that the System Six report identifying significant areas for preservation was outdated, Mr Hatt said the report was under review by DPUD in conjunction with the Environmental Protection Authority.

"In the previous 30 years, Perth's population effectively doubled and we have to plan for the eventuality of that happening in the next 30 years," he said.

"But we are not planning to simply expand urban sprawl. What we are trying to do is allow for at least 20 per cent of the growth to take place by urban consolidation, particularly inner city and suburban areas.

"People on the edge of the urban sprawl say we have got to stop and consolidate our older suburbs and people who are in the inner suburbs say we don't want urban consolidation, we need to expand the existing corridors. That is the dilemma. We are damned if we do and damned if we don't."

Answering criticism that System Six only took into consideration publicly owned areas, Mr Hatt said some privately owned areas were under consideration for addition to the report's recommended reserves.

"We are acquiring at a cost of millions of dollars private and public land for conservation," he said.

"There should not be any conflict in the future because we are very conscious of our responsibility to conserve land that is worth conservation and we are very conscious of ensuring there are green belts through all our planning processes."

But Mr Hatt said there was no feasible way that all claims of environmental significance could be taken into account without severely compromising future housing development.

"For example, we are currently doing structure planning of the South-West corridor," he said. "Everyone thinks that their particular piece of bush or open space is the most valuable in the world.

"If we planned for housing around all the claims for the existing and proposed open space, remnant vegetation, landscape protection, conservation buffers and environmental concerns, we end up with a yield of two dwellings per hectare on average throughout the corridor."

He said that Perth had the lowest residential density of any city in Australia and still people were not satisfied.

● An artist's impression of the proposed Ellenbrook Estate in Upper Swan. The local conservation lobby wants more than half the site set aside to preserve wetlands and banksia woodlands.

Funding for WA projects

SAVING the bush and improving the quality of water in WA are two of 400 projects throughout Australia that will receive $2 million in funds announced this week by the Federal Government.

WA will receive a total of $472,737 to help support 82 conservation projects.

Environment Minister Ros Kelly said the funding was aimed at maintaining the country's biological diversity through the "Save The Bush" and "One Billion Trees" components of Australia's National Landcare Program.

"Urban and rural communities across Australia recognise the need to integrate conservation into land use practices," she said. "Retaining and restoring native vegetation is vital to ensure productive soils, quality water and healthy living environments for humans and wildlife."

The grants will assist WA landcare groups, councils, schools and Aboriginal communities involved in various conservation programs.

THE WEST AUSTRALIAN
SATURDAY SEPTEMBER 26 1992

Mr Smith

'Green' map plan for city

By BRENDAN NICHOLSON

IMPORTANT environmental areas of Perth will be listed in a "green" map to stop conflict between developers and conservationists.

Planning Minister David Smith said $325,000 had been allocated in the State Budget to produce the environmental plan and a data base over three years.

It would be an extensive record of the metropolitan region's environmental resources, such as wetlands, remnant vegetation, wildlife habitats and landscapes.

Much of the information is available publicly and privately in reports, maps and satellite images but is often held by different agencies and mapped with different methods.

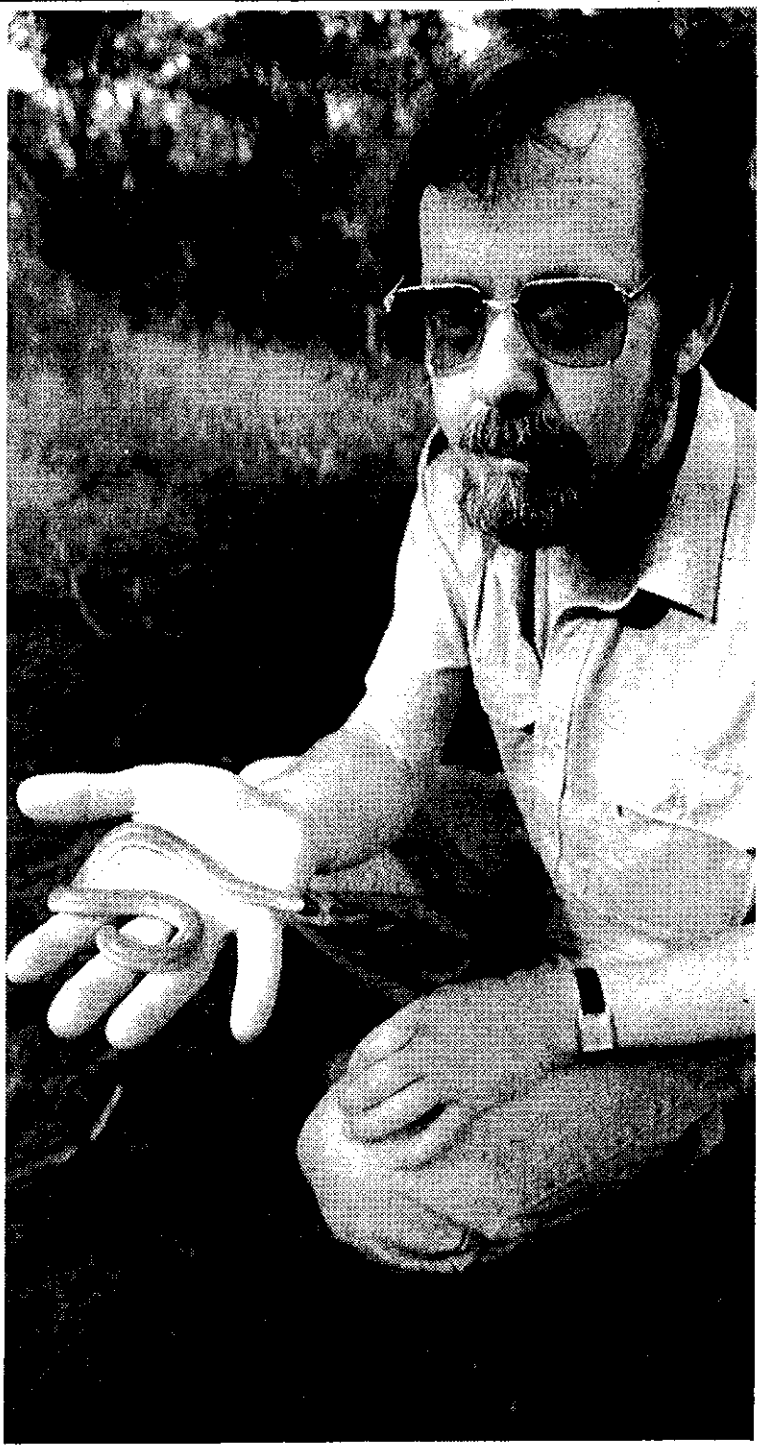
Mr Smith said the record would help developers minimise land use conflicts.

"The environmental plan will bring together this widely spread information in a standardised format on to a single data base which will be publicly available," he said.

"It will give us a comprehensive analysis of all the vegetation types and species so we can ensure that we protect a good representation of them all.

"We are not in a position where we can preserve all remnant vegetation but we can ensure no species is lost or endangered as a result of urban development."

THE WEST AUSTRALIAN SATURDAY OCTOBER 3, 1992



SAFE SNAKE: John Dell, of the WA Museum, examines a blind snake from Kings Park. Picture: JOHN MOKRZYCKI.

Study targets loss of species

By KERRI KAPERNICK

THE WA Museum has launched an environmental education package to help the public explore important bushland habitats before they disappear.

The clearing of city bushland is affecting many wildlife species in Perth, including blind snakes found in Kings Park.

Museum education officer Claire Wright said that, as well as Kings Park, Bold Park near City Beach and Whiteman Park, Whiteman, were included in the study package.

Ms Wright said a study of fauna in 1978 found that in 150 years of settlement only 12 of the 36 originally documented species of native mammals remained.

She said 13 of the original 223 bird varieties were also extinct.

WA Museum senior technical officer John Dell said although king browns, dugites and tiger snakes examined in the package were venomous, varieties such as the blind snake were harmless.

The package is available at the museum for $6.95 and also includes information on the Swan coastal plain's geology, climate and flora.

THE WEST AUSTRALIAN FRIDAY OCTOBER 30 1992

SUNDAY TIMES, OCTOBER 18, 1992 23

Forces gather to guard WA's urban bush

A MAJOR campaign to protect threatened areas of urban bushland is being launched by conservation groups.

An urban bushland coalition, made up of groups angered by what they claim has been the rape of suburban bush and wetlands by government and developers, will be formed next month at a workshop sponsored by the National Trust.

The coalition will combine groups fighting to have the value of bushland recognised.

Fury at the recent destruction at Hepburn Heights to make way for housing on Landcorp land, is the latest spur for an intensive campaign.

The coalition will not stand green candidates at the State election early next year but will use its group effort to force political parties to take a stand on suburban environmental issues.

The Whitford seat, narrowly held at the last State election by government minister Pam Beggs, will be a special target for conservationists and local residents devastated by their wishes being bulldozed at Hepburn Heights.

Local groups involved in the Port Kennedy campaign, lobbying on the bulldozed Jandakot wetlands, and battles over Ellen Brook, the Brixton wetlands and other threatened areas are likely to join forces in a hard-hitting campaign.

National Trust of Australia (WA) chief executive officer Tom Perrigo said the trust would support an organisation formed to work towards protecting remaining urban bushland.

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Battle lost, but not war

Hepburn Heights warriors assess campaign

GROUP PROFILE

PROTESTERS, police and a woman in a kangaroo costume gathered at Hepburn Heights last month to witness the climax of a five-year fight to preserve the area's bushland.

As bulldozers moved in to clear more than half the 56-hectare Padbury site for housing, some protesters cried, police handed out tea and biscuits and the costumed woman called for an end to human intervention in nature.

Most of those present believed the bulldozers represented the end of the fight — a fait accompli.

But the founding members of the vocal Hepburn Woodlands Conservation Group (HWPG) say their job is nowhere near finished.

Explaining that their 1000 members were not radicals — such as the kangaroo woman — who chained themselves to trees, Ann and Geoffrey Curtis said their feelings of failure did not last long.

On reflection, they say the HWPG actually won the fight after a court battle against developer Landcorp.

"We won the legal battle and they still didn't listen to the court," said Mrs Curtis.

"I think we achieved as much as anybody could possibly have achieved and it is only because of the dictatorship that we live in that we would seem to have lost."

Mrs Curtis said the Wanneroo community had been brought closer together because of the controversy over Hepburn Heights and was proud of the National Trust listing of the entire project site.

"Morally, it did a lot of damage to a lot of people in the sense that once (the bush) went they felt that that was the end of the fight," Mrs Curtis said.

"However, we gained a lot of emotional strength from people who know much more about these things botanically and ecologically than we do.

"They said: 'Look, that has been bulldozed but please don't lose heart. That 60 per cent can still be regenerated and we really should go on and fight to the bitter end'."

The Curtises feel HWPG's efforts have been effective in putting the environment on the community agenda and as a catalyst, inspiring other community groups to act on their beliefs.

"It has been very positive and has empowered local people to say we can stand up for what we believe is right," Mr Curtis said.

"It has also shown that the urban bushland is under great threat in the metropolitan area. We are one of the few states that haven't got an urban bushland policy or legislation to protect the natural environment."

Mr Curtis said the clearing of 60 per cent of the Hepburn Heights site did not signal the end of the Hepburn Woodlands Preservation Group — only its change of focus.

"I think it will devolve itself into the Friends of Hepburn Heights, very much like the Friends of Yellagonga Park," he said.

"That is, to work with the community in supporting the conservation of that land and educate people as to what has happened in the past and why areas must be preserved."

Mr Curtis, a teacher, said a series of bush workshops would be held in the Wanneroo area to explain conservation issues. He had already visited many of the 28 schools in the area.

"Wanneroo is the fastest-growing area in the whole country and fastest area for losing its bush and wetlands and the Government aren't listening," he said.

He thought the group had done well since its formation five years ago.

Environment education had to be on the agenda of everybody and the community could not pass the buck by leaving everything up to the local council, he said. Local communities themselves had to do something.

The Hepburn Woodlands Preservation group was formed when the Curtises noticed a billboard announcing the proposed development along Glengarry Drive.

After contacting the Wanneroo Council and local newspapers, a telephone poll was held to find out the extent of concern over the project and the first HWPG meeting was called.

"Setting it up was easy," Mrs Curtis said. "The response to our question (in the local paper) about the proposal was overwhelming."

The group began with about 56 people and grew to 120-130 in the first year.

Carina Tan-Van Baren

● Geoffrey and Ann Curtis with sons Warren, 7, and Adam, 9, on cleared bushland at Hepburn Heights. Picture: MAL FAIRCLOUGH.

Groups unite to oppose Minister

By JULIE BUTLER

MORE than 30 of Perth's major community action groups have united to fight controversial planning issues, vowing to ensure Planning Minister David Smith is not re-elected.

But Mr Smith branded their vow as futile and said it would be difficult to trust a group with such diverse interests.

The body's 33 member groups include the Helena-Boya Association, the Ellenbrook Conservation group, the Hepburn Woodland Preservation group and the Swan Valley Residents and Ratepayers' Association.

Interim chairman Patrick Weir, a former ALP fundraiser, said the associations had been forced to come together by the Government's arrogant and lip-service-only approach to the concerns of community groups.

"Where town planning is concerned, the Government has lost touch with the wishes of the communities and listens more to its bureaucrats than its electors," Mr Weir said.

He said the organisation's aims included encouraging a policy of decentralisation for Perth, making town planning processes more democratic and applying political pressure to the Government, the Minister, and the Planning and Urban Development Department to ensure community concerns were addressed.

"One political strategy we have is to ensure the political demise of David Smith and to give the message to whoever takes over as Planning minister that it's a hot seat," Mr Weir said.

The group would doorknock in Mr Smith's Bunbury electorate, telling voters why he should not be re-elected, he said.

Mr Smith said he would look forward to seeing the group during the campaign period, but the bid to thwart his re-election was futile.

"It won't have any impact on the next Minister and it won't change the mind of the present Minister," he said.

"You've got a group of protesters who basically move from area to area, and who also change their hats — they say they don't want urban consolidation and then say they don't want urban sprawl."

"How can you trust a group that represents both those positions?

"I would prefer to deal with community groups on an individual basis because then you really get direct information and the feelings of the people concerned."

THE WEST AUSTRALIAN SATURDAY NOVEMBER 14 1992

Court plans greenway links to city

By BRENDAN NICHOLSON

THE WA Opposition wants to create a system of green corridors linking central Perth with areas as far away as Yanchep, Mandurah and the Darling Range.

The seven-year greenways scheme, unveiled by Opposition Leader Richard Court and environment spokesman Phillip Pendal, would provide natural corridors linking public open spaces such as parks, stream reserves, wetlands and beaches to give city residents greater opportunities to get into the open to walk or cycle.

A greater Perth greenways advisory council would be set up to advise the Government and to involve local authorities.

Some private land might have to be bought, Mr Court said, and a study would take place to see if the railway reserves along the routes from Perth to Fremantle, Armadale, Midland and Joondalup could also serve as greenways.

The Government and local authorities would construct a coastal trail from Mandurah to Wanneroo as part of the wider grand circle that would extend inland along the Darling Scarp.

Mr Pendal said WA was among the most highly urbanised communities in the world, with most of its population concentrated around Perth.

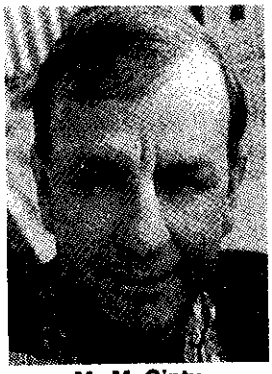
Greenways would bring social and medical pressure on people who needed exercise and who needed to experience the outdoors.

The corridors would also provide security and safe havens for wildlife.

The scheme also could be used to collect and store information about plants and animals.

THE WEST AUSTRALIAN MONDAY JANUARY 4 1993

Dr Lawrence



Mr McGinty

McGinty rejects wetland project

By IRENE WRINGE and CARINA TAN-VAN BAREN

ENVIRONMENT Minister Jim McGinty has scuttled plans for a residential canal development south of Mandurah, paving the way for an extension to the proposed Peel Regional Park.

Mr McGinty rejected much of the Harbour City proposal by Esplanade (Mandurah) Pty Ltd on the ground that the area had high conservation values.

The 197-hectare site includes three areas — woodland, samphire flats and an estuary buffer zone — listed in the Ramsar Convention, to which Australia is a signatory, as an internationally significant wetland.

The convention is an international treaty which protects the habitats of migratory birds.

"There is a greater awareness that loss of wetlands and bird habitat cannot continue," Mr McGinty said. "The Peel-Harvey estuarine system is recognised as one of the most important waterbird habitats in the South-West."

Mr McGinty said there was no reason why the project could not continue on the remaining woodland. But if the developers thought it was no longer viable he was prepared to discuss other uses for the site.

Conservationists, including the Peel Preservation Group and the Creery Wetlands Support Group, want the State Government to buy the land and include it in the proposed park.

A spokesman for Esplanade said last night he could not comment until he received official notification of Mr McGinty's decision.

Premier Carmen Lawrence launched the Peel Regional Park report in Mandurah yesterday, saying the proposed park would form a vital link in the State Government's proposed green zone around Perth.

The Yalgorup National Park and other land around the Peel-Harvey estuary and river system, together with the Peel Regional Park, would form the southern boundary of the zone.

"This draft report proposes creating the Peel Regional Park though the linking of existing regional reserves, other public lands and private land to provide habitat corridors for wildlife and some recreational use," Dr Lawrence said.

Election 93

Conservationists back coalition green policy

By BRENDAN NICHOLSON

CONSERVATION groups have thrown their support behind the coalition, which promised yesterday to set up an advisory council to help develop a comprehensive strategy for environmentally sound development.

The coalition's environment policy, released by Opposition Leader Richard Court and environment spokesman Phillip Pendal, targets several areas of concern to environmentalists, who have traditionally supported the ALP, Labor-green parties or independents.

Mr Pendal said that in government, the coalition would set up an advisory council on earth sciences which would involve key representatives of industry and community groups and spearhead the drafting of a 10-year environmental strategy for WA.

Conservation Council of WA president Beth Schultz was delighted with the policy's main thrust. But she was disappointed that the coalition apparently was determined to go along with plans for a coal-fired power station at Collie and with its lack of action to protect WA's surviving native forests.

However, there were many strong points in the policy, she said.

Green support could prove extremely important in an election likely to be decided in several marginal seats.

Dr Schultz said the ALP had begun its 10-year rule with an excellent environmental platform, but much had been left undone. The gap between the coalition and the ALP had closed.

Conservationists also welcomed the coalition's commitment to developing a system of urban and rural regional parks, including a banksia botanical park in the metropolitan area to safeguard species most threatened by the devastating dieback fungus.

RIGHT TRACK: Phillip Pendal discusses his environment plans with Dr Schultz. Picture: NIC ELLIS

Mr Court said 32 per cent of WA remained vacant crown land and a coalition government would identify and reserve additional areas that should be protected.

The coalition would introduce a new appeal system for the Environmental Protection Authority and review EPA processes to ensure they did not cause undue project delays.

It would also carry out a comprehensive biological survey of everything that lived and moved in WA.

Mr Court said a coalition government would launch a public inquiry into Perth's air pollution.

The Department of Conservation and Land Management's policy of controlled burns would be closely examined. But he said the coalition was satisfied CALM was an efficient manager of the state's timber resources.

Mr Pendal said the coalition would encourage the establishment of new forests on degraded farmland.

It would appoint a Greenhouse response commission.

Environment Minister Jim McGinty said that for an aspiring government which planned to allow uranium mining the coalition appeared to have done a good job of wooing green organisations.

He said the coalition parties had opposed such positive developments as the creation of the Shannon national park, the Bill outlawing duck shooting and the creation of the Mt Lesueur national park.

The coalition policy did not appear to contain solutions to any of the state's environmental problems, he said.

Environmental protection a must: Court

By BRENDAN NICHOLSON

ANY political party which does not take full account of the need to protect the environment is bound to fail, according to coalition leader Richard Court.

Commenting on his party's environment policy, Mr Court said no development would take place under a coalition government unless it could be proved it would not cause irreversible damage to the environment.

Mr Court and environment spokesman Phillip Pendal also gave details of a plan to build a solar power station capable of meeting the energy demands of a town with a population of about 1000.

The town had not been chosen, Mr Pendal said, but it might be announced later in the election campaign.

The station would provide a valuable prototype for much bigger renewable energy power stations throughout WA, he said.

It would be linked to an education strategy to encourage regional communities to adopt renewable energy systems similar to those installed in Aboriginal communities in the Pilbara and Kimberley.

The coalition plan is seen as a philosophically important step, though the power station involved would have about half the output of one recently announced by SECWA to run off gas from a rubbish dump near Perth.

While Mr Court stressed that the coalition stood for a strong and viable timber industry, his policy repeats a concern that during the term of the last coalition government it was recognised that the South-West forests were being over-cut.

"The coalition then imposed a 30-year program to reduce the cut," the environment policy document says.

The document also promises to overturn the Lawrence Government's plans for housing lots at Hepburn Heights and Leda, near Kwinana, "consistent with our strong actions over the past three years to ensure that the beautiful tracts of land are kept in their original state".

However, Mr Pendal said later that it was too late to stop developments which had already begun.

"We will not be tearing down houses and planting trees," he said.

Greens WA environment policy convener Alan Carter said the coalition's policy and the Government's reaction to it were both inconsistent and hypocritical.

"While the coalition is proposing some initiatives to protect the environment, this is not consistent with the fast-track approach to industrial and mining development the Opposition leader has suggested will follow their election to government," he said.

Election 93

ON THE STUMP

Election 93

THOSE who followed the drama at Hepburn Heights may recognise Greens candidate Vivienne Elanta.

Ms Elanta, who is running for the Legislative Assembly seat of Marmion, was one of the more colourful opponents of the controversial housing development site in Padbury.

In September, she spent a night perched up a tree in a bid to stop the bulldozers.

Ms Elanta was also the centre of media attention that month when protesters claimed a kangaroo had been badly injured by a bulldozer at the site.

Cameramen, photographers and reporters scrambled through the scrub in search of the wounded marsupial but the beast was nowhere to be found — until out bounded Ms Elanta in a kangaroo costume.

□□□

CONCERNED: Brenda Roy, who wants more public consultation. Picture: KEN MALEY

Public ignored, say Greens

PUBLIC consultation, higher density living and putting the environment first form the basis of the Greens (WA) urban planning policy.

The policy was launched yesterday in Padbury while bulldozers and tractors laid the foundations for the conservationally-sensitive Hepburn Heights housing development across the road.

Greens' Legislative Council candidate Brenda Roy said Hepburn Heights, developed despite vocal opposition, represented some of the problems of urban development.

"And many people are outraged that in fact their views were completely disregarded," she said.

Ms Roy said urban planning needed to be integrated with environmental protection to avoid degradation of valuable groundwater resources and natural bushland.

By SIMON DOWDING

And public input in all planning decisions was necessary to prevent the Government bulldozing land despite strong opposition, she said.

Other aspects of the Greens' urban planning policy include:

- Promoting higher density living and urging the State Government to prevent the continued urban sprawl.
- Preventing the continued use of landfill in local government areas and supporting community-based recycling.
- Halting the expansion of freeways and private transport facilities, including carparks, and improving public transport.
- Encouraging the development of urban centres as alternatives to the Perth metropolitan region.

The Greens' urban planning policy drew a favourable response from conservation groups.

The executive member of the apolitical Conservation Council of WA, Jane Blake, said the Greens' policy looked hopeful.

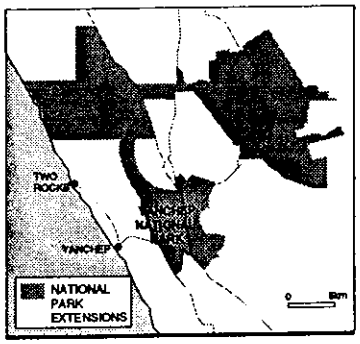
"The Conservation Council would always support a policy which called for more public consultation in urban planning," she said.

National Trust chief executive Tom Perrigo gave a nod of approval to the Greens' urban plan, although the trust had not yet endorsed any party's policy.

"We definitely want the political process to recognise the social and economic value of retaining urban bushland and we certainly support some of the major points of the Greens' policy," Mr Perrigo said.

Election 93

Yanchep park the key to Labor green zone



THE WA Government has pledged to increase Yanchep national park to 10 times its present size if re-elected, creating a green buffer that will block Perth's northern sprawl.

Launching the ALP's environmental policy yesterday, Premier Carmen Lawrence said 23,000 hectares would be added to the park.

The extra land would include a block at Wilbinga bought by the Court Liberal government in the 1970s as a site for a 1995 nuclear power station.

More conservation areas would be set aside south of the Yanchep park, which would create a 60km green belt from Duncraig to Moore River.

By BRENDAN NICHOLSON

Another national park of more than 5000 hectares would be created near Rockingham and would run from Leda to Port Kennedy and take in the Rockingham Lakes.

Dr Lawrence said the Government would also create the reserves in the Perth area recommended a decade ago under the Environmental Protection Authority's so-called "Red Book" or System 6 plan for the state.

She said that the public had been invited to nominate other areas that should be preserved because of their environmental importance.

The Government would ban the import or export of toxic waste and develop a strategy to deal with it within WA.

Dr Lawrence said that to ensure all WA children had a basic knowledge of environmental issues, the Ministry of Education and EPA would launch a joint environmental education program for the State's primary and secondary school students.

It would be prepared with the help of the voluntary conservation groups and would involve all students in field work to give them first-hand experience of problems such as soil degradation and solutions presented by rehabilitation and changes in farming techniques.

Dr Lawrence said the policy demonstrated that WA could have economic growth and still protect its near-pristine environment.

"To assist this process we must have a strong and independent EPA," she said.

Dr Lawrence said the Act would be strengthened and streamlined to give it more teeth while speeding its assessment processes.

The public would be given greater involvement and the EPA, which would establish more regional offices, would be given greater power to prosecute polluters.

Mining and mining exploration in national parks would be banned.

She said a Labor government would ban the export and import of hazardous waste from or to WA and would also establish a public register of contaminated sites and plans to clean them.

In a move designed to help slow the destruction of the Earth's protective ozone layer, halons — gases used in some fire extinguishers — would be banned from the end of next year.

The WA Waterways Commission would get more resources to help it fight pollution in the Swan River and a rapid response unit would be set up to cope with pollution incidents.

The Government would also give $20,000 to the Perth-based voluntary consumer group, Householders for Safe Pesticide Use, to publish and distribute a guide to chemical-free pest control.

To help strike a balance between development and environmental protection, regional environmental co-ordinators would be appointed in the South-West, the Great Southern, Mid-West, Pilbara, Kimberley and Goldfields-Esperance regions to establish local environment plans.

These co-ordinators would work with local communities, industry and local governments to help reduce environmental conflict.

A Greenhouse research fund would be set up to support local research into the likely impact of global warming on WA.

The Department of Conservation and Land Management would be given $300,000 to carry out a three-year research program into the threat to native animals posed by feral cats in WA's arid lands.

The Government would finalise a new Wildlife Conservation Act before the end of 1993 and would ensure that licence fees and royalties collected by CALM for the use of WA's plants and animals would be used directly for the management of wildlife, Dr Lawrence said.

Conservation Council of WA president Beth Schultz said she was delighted by the strength of the ALP platform.

But she said the platform would be worthless if it were not implemented.

"Thirty of the 70 ALP promises made prior to the 1989 State election have not been implemented, though the new Environment Minister, Jim McGinty has made great progress in the short time he has held the portfolio," Dr Schultz said.

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Election 93

Mr McGinty

Greens fear Labor's pledges are too late

Dr Schultz

Mr Pendal

By BRENDAN NICHOLSON

THE release of the State Government's policy on the environment at the weekend drove one local conservationist into an unusual state of depression.

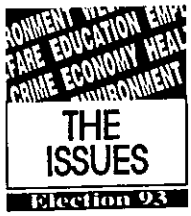
She was on the verge of tears, she said, that such a fantastic policy should be adopted by a Government that was probably on its way out of office.

The woman has a point.

The Government's policy is a blueprint containing many of the plans local green groups and scientists have wanted for years.

But to put much of it together the Government would not have had to go much further than whatever filing cabinet contains a recent letter from WA Conservation Council president Beth Schultz to Environment Minister Jim McGinty.

In her letter, Dr Schultz outlined 29 of the Government's unfulfilled promises, including commitments on air quality, environmental protection in the mineral sands industry, financial help for conservation groups, the creation of regional parks taking in the Rockingham lakes and the Peel-Harvey Estuary, phasing out of woodchipping and the creation of 105,000 hectares of hardwood plantations and the preservation of remnant vegetation on farmland.



Many of these ideas have been recycled in the new policy.

Both the Opposition and Government insist the environment can be protected without causing undue economic pain or slowing development.

In terms of the main environmental issues confronting the decision-makers after February 6, both platforms won strong praise from the main conservation groups.

Both the Government and Opposition have said they would review the operations of the Department of Conservation and Land Management, similar to last year's review of the Environmental Protection Act.

The Government has clarified a statement made by the Dowding government before the 1989 State election and now says woodchipping in old-growth native forests would be phased out by 2000.

Both sides would encourage establishment of forest plantations on cleared or degraded land and investigate CALM's prescribed burning practices.

To improve air quality, the Government says it would target vehicles with smoky exhausts, ban ozone-damaging halon gases used in some fire extinguishers and elsewhere and develop a plan to stop air pollution caused by prescribed burning and burnoffs for land clearing.

An independent study would be made of links between pollution and the high incidence of asthma in Perth.

The Government would also continue pressure on oil companies to reduce the lead levels in petrol and motorists would be given incentives to switch from petrol to gas.

A panel of technical specialists would be established to advise on new pollution control technologies.

The Opposition policy, drafted by environment spokesman Phillip Pendal, said consumers posed as big a threat to the environment as industry, so a coalition government would try to lessen the over-reliance on fossil fuels and private transport.

It would launch a parliamentary select committee investigation of Perth's air pollution.

To preserve what is left of the native bushland in the Perth area, a coalition government would develop an urban bushland policy in consultation with groups such as the National Trust, the Conservation Society of WA and the WA Wildflower Society.

It would also allow members of the community to remove species of native vegetation and seeds from development sites before clearing to prevent needless loss of species.

The Government has undertaken to create big new reserves in the suburbs and give community groups resources to help them identify areas that should be protected or developed.

Both Opposition and Government express concern about the Swan River and have promised to put resources into protecting it from pollution.

The Government has promised to set up a rapid response unit at the Waterways Commission to deal with pollution incidents.

Both say they will use more resources for tackling the devastating plant fungal disease, dieback.

To encourage promising alternative energy research in WA, a coalition government would set up a big solar power station at a town of about 1000 people.

The Government says it wants a pulp mill in the South-West and says it will try to feed it on plantation timber and not native forest woodchips. The Opposition says WA should have at least two pulp mills, one of them based on straw.

Save natural heritage

PERTH is a city founded on banksia woodlands and the Swan River against a backdrop of jarrah forest of the Darling Range.

These landscape features, unique to our state, give us our sense of place, our sense of identity.

As early as 1831, Kings Park was set aside as a reserve. It has always been much loved and enjoyed by the people of Perth as well as a continuous stream of visitors over the years.

The annual Kings Park wildflower show and the spring display of wildflowers along roadsides are international tourist attractions. Visitors come here to enjoy our unique and delicate natural heritage — nothing less than a "hot spot" of biodiversity on a world scale. Visitors appreciate our rich natural landscapes, but how much do we?

Last year saw the emergence of a community voice through a number of local conservation groups, formed to raise awareness and call for protection of local patches of urban bushland.

Many groups are quietly involved in caring for local bush by removing rubbish and weeds and providing a focus for community learning and participation.

The most controversial loss of bushland given attention in the media has been Hepburn Heights. Similarly in the news has been the region of Port Kennedy and Becher Point, a site of international geomorphological (landforms) significance. Also the Ellenbrook Estate, an area of banksia woodland, heathland and wetlands of regional and probably national significance, has been proposed for urban development. There are many more I could cite.

These conflicts between community and government would not occur if we had appropriate mechanisms for identification and protection of natural heritage.

The National Trust will be working vigorously this year in response to the voice of the community to achieve statutory protection of natural heritage, and to raise awareness of how we can better live in harmony with the bush that remains.

Urban bushland is clearly an issue of importance to the community, and politicians and decision-makers should be aware of this. — C. MARY GRAY, chairman, landscape and conservation committee of The National Trust of Australia (WA), 4 Havelock Street, West Perth.

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Green groups unite

MORE than 50 community groups are banding together to protect Perth's green heritage.

The Urban Bushland Council plans to present a united voice against what it called the destruction of the last vestiges of unspoilt vegetation.

Spokesman Geoffrey Curtis, a veteran of the Hepburn Heights saga, said the main aim was to stop conflict between the community and developers and find a way to save the bush while meeting Perth's housing needs.

Urban bush was an important environmental issue for Perth because it was one of the few Australian cities with significant areas of natural vegetation left, he said.

"We are setting up a network throughout the state to pass information and support to groups within and outside the Perth area," Mr Curtis said.

"We want to develop co-operation between the community and the development industry."

Among the 50-plus groups that have already signalled they will join the council are the waterbird and wetland conservation societies and Ellenbrook Conservation Group.

The Urban Bushland Council will be affiliated with the WA Conservation Council.

Mr Curtis said one of the first aims of the council would be to ask the Department of Planning and Urban Development to adopt the findings of its environmental audit of the Perth planning corridors.

● Green Crusaders, West Magazine

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ABOUT THE AIUS

The Australian Institute of Urban Studies is an independent non-profit organisation established through the initiatives of the Australian Planning Institute and the Social Research Council in 1967.

Members comprise representatives of federal, state and local government, a wide cross-section of the private sector, the academic institutions, and all the urban professions.

AIUS is supported by the subscriptions of its members, donations from commerce and industry, and modest grants from the Commonwealth and State Governments. This support, however, is merely sufficient to prime the Institute's operations. Each project undertaken by the Institute is generally self-supporting, with funding being provided by interested groups and individuals, supplemented by donations of members' time.

The Institute is Australia's only widely representative, multi-disciplinary, national organisation concerned with all aspects of urban affairs. It needs the support of perceptive, informed, responsible Australians in order to continue and expand its endeavours, preserve the integrity of its advice, and avoid undue dependence upon governments or a few major institutional donors. Membership fees and donations to the institute are generally tax deductible.

OBJECTIVES OF AIUS

- To encourage, promote and undertake practical, action-orientated research into all aspects of urban affairs.
- To disseminate authorative information and publicise and stimulate awareness of urban issues.
- To promote the quality and efficiency of life in Australia's cities and towns.
- To give independent advice to all levels of government on urban issues and evaluate the implications of public policies and practices for urban areas and their inhabitants.
- To co-operate with other organisations with interest in areas related to those concerning the Institute.
- To help developing countries to work effectively towards solving their own urban problems.