PROCEEDINGS
THREATENED ECOLOGICAL COMMUNITIES SYMPOSIUM
Technology Park, Bentley Western Australia
2nd December 2003
SUMMARY PROCEEDINGS

BACKGROUND

The Department of Conservation and Land Management (CALM) hosted a symposium to provide an update on progress with identifying and conserving Threatened Ecological Communities (TECs) in Western Australia.

Earlier workshops were held in November 1994, to invite public comment on the project to develop procedures to identify and conserve TECs in WA, and in August 1996 to provide information and gain feedback on the results of the first TEC project.

There is now a new draft Policy on Threatened Species and Communities (go to >>>) that describes the procedures for identifying and conserving TECs in this state. The objective of this symposium was to provide the rationale behind, and the methods used for, the identification and conservation of TECs and the implementation of Recovery Plans for them, using examples from this State. Also included in the program were information about the new policy and presentations by interstate experts on methods and procedures for classifying ecological communities in Tasmania and Victoria.

Background material includes the new draft Policy on Threatened Species and Communities (which incorporates the procedures for listing TECs), definitions used for TECs, definitions of the categories of threat, and criteria used to assign a category of threat to ecological communities.

These summary proceedings are intended to summarise the key points made at the symposium and to clarify this Department's role in, and commitments to, the identification, listing and conservation of threatened ecological communities in Western Australia.

Program

Keiran McNamara – Executive Director, Department of Conservation and Land Management (CALM). Welcome and Introduction: how conservation of TECs fits into CALM's Policy and program for Biodiversity Conservation.

John Blyth – WA Threatened Species and Communities Unit, (WATSCU) CALM. Three levels of biodiversity, discussion of the Recovery Process, new draft Policy on Threatened Species and Communities, and interactions with other agencies.

Val English – WATSCU, CALM. History of ranking and listing process for TECs, examples of different types of threatened communities.

Dr Mick Brown – former Chief Scientist with Forestry Tasmania. The ecological community concept. Procedures for classifying ecological communities based on analysis of species composition.

Greg Keighery – Senior Principal Research Scientist CALM. Common and rare limestone communities of the Swan Coastal Plain.

Adrian Moorrees –Victorian Department of Sustainability and Environment. Victorian examples of TECs.

Dr Bill Humphreys – WA Museum. Bundera Sinkhole – (Cape Range peninsula) a TEC based on Invertebrate biota.

Kim Williams – CALM's South West Region. Ironstone Heaths of the southern Swan Coastal Plain (Busselton area)

David Mitchell – CALM's Swan Region. TEC Recovery through an 'all of Government' approach (Bush Forever).

Rosemarie Rees – WATSCU. Examples of TECs in the WA Wheatbelt.

Discussion and interactive summary. Chair: Gordon Wyre, Acting Director Nature Conservation CALM.

MAIN POINTS FROM ADDRESSES

WELCOME AND INTRODUCTION
Keiran McNamara, Executive Director CALM

South western WA is one of the world's acknowledged biodiversity hotspots, and CALM has the responsibility for ensuring the maintenance of biological diversity. This includes preventing extinctions of species or loss of other biodiversity.

Legislation and policy relevant to this responsibility are the:

- *Wildlife Conservation Act 1950*
- *Conservation and Land Management Act* 1984
- Objective in our *Corporate Plan* - to *protect, conserve and where necessary and possible, restore Western Australia's natural biodiversity*

There are six major strategies for conserving biodiversity from the Department's Corporate Plan 2002-2005. One of these is to recover threatened flora, fauna and ecological communities by:

- Identifying and protecting threatened species and ecological communities;
- Priority ranking them for conservation action according to international (IUCN) criteria;
- Preparing and implementing recovery plans, with the highest priority threatened species and ecological communities being treated first (that is, the conservation of TECs is given attention alongside threatened species of plants and animals).

The *Wildlife Conservation Act 1950* is badly out of date and does not cover TECs. It is intended that the new Biodiversity Conservation Act (BC) for WA will give TECs protection similar to that for threatened species, so making it consistent with the Commonwealth's Environment Protection and Biodiversity Conservation Act 1999 (*EPBC* Act) and acts in NSW, Victoria, and ACT.

Intentions in respect of the new BC Act (subject to Parliamentary decisions) are that it will:

- Bind the Crown
- Consider listing and controlling Key Threatening Processes (KTPs)
- Consider, list and protect critical habitat
- Provide for adoption of recovery plans under the Act
- Create a single WA Threatened Species and Communities Scientific Committee
- Provide capacity for the public to nominate threatened species and ecological communities and threatening processes
- Give statutory backing to recovery plans for listed TECs and species.

A public consultation paper was circulated and publicized late in 2002 for public comment. About 150 submissions were received, a summary of submissions has recently been released and the Department is now working on drafting details. The Department will continue consulting with a wide range of stakeholders as this proceeds.

The aims of today's symposium are to:

- Describe the recovery process for TECs;
- Provide examples of the dependence on scientific information and analysis of the listing and classifying of TECs;
- Give illustrations of the rigor with which decisions as to listing and ranking TECs are made;
- Illustrate the ways in which TECs are identified and conserved in other jurisdictions;
- Allow discussion and create linkages.

Mr McNamara also made the following points.

- That the three levels of biodiversity, including the community level, are accepted internationally and nationally.
- That legislation for threatened ecological communities has been in force in other Australian jurisdictions for years, extending back well over a decade since the first Act was in place.
- While our approach has been non-statutory and therefore informal, we have approached it in a scientific manner in terms of Departmental criteria; we've attempted to apply the concept with rigor and consistency. This has led to an application of the concept that has achieved a high degree of credibility and acceptance, as indicated by the inclusion of TECs in conservation reserve design, and other land-use and planning decisions and EPA assessments.

RECOVERING THREATENED SPECIES AND ECOLOGICAL COMMUNITIES IN WESTERN AUSTRALIA

John Blyth, WA Threatened Species & Communities Unit, CALM

Three levels of biodiversity

- Species diversity
  - *Species as distinct groups of organisms that breed together.*
- Genetic diversity
  - *Individual variation within species across their distribution;*
  - *Sub-species and varieties as indicators of genetic variation.*
- Ecosystem diversity
  - *Species composition and abundance;*

- *Ecological processes and functions;*
- *Ecological community as surrogate for ecosystem diversity;*
- *Ecosystem diversity stems from variety in abiotic conditions.*

What is an ecological community?
- "A naturally occurring biological assemblage that occurs in a particular type of habitat";
- The community concept is sometimes questioned because species distribute themselves individually along resource gradients;
- Nevertheless, different habitats, and the assemblages of organisms occupying them, are recognizable, often with quite clear demarcation from others;
- Habitat (non-biological features of the ecosystem to which the community belongs) is a key descriptor;
- Modern analytical methods can order and nest the different levels at which communities occur;
- Operational value of community concept is widely accepted.

Why identify and manage TECs?
- Conserving ecosystems and their biological diversity is a mainstream part of biodiversity conservation;
- TECs and other ecological communities provide ecological services;
- Rare ecosystems are likely to contain rare organisms;
- The sheer number of species makes species by species management impossible;
- In any case, whole ecosystem management is necessary to conserve individual species and ecological communities;
- Whole ecosystem management is cost effective and provides 'spin-offs' for conservation of individual species, landscape protection and aesthetics.

Relevant legislation:
- Wildlife Conservation Act 1950
  - *Provides the legislative basis for prevention of extinction in WA;*
  - *But, it is very out of date;*
  - *The Act provides formal protection for threatened species, but **not** for TECs;*
  - *A New Biodiversity Conservation Act for WA is being prepared.*
- Various other State Acts can influence the conservation of TECs; these include *The Environmental Protection Act 1986*, *The Metropolitan Region Town Planning Scheme Act 1959* and *The Waterways Conservation Act 1976*;
- The Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth) incorporates:
  - *Public nominations for listing;*
  - *The same protection for threatened species and TECs;*
  - *Critically Endangered or Endangered species or communities trigger Act;*
  - *State assessment but Commonwealth approval;*
  - *Requirement to inform Commonwealth Minister if potential for damage to threatened species or ecological communities.*

The recovery process

1. Research/survey: need to establish what is threatened and why, and where it occurs

2. Scientific committees established to oversee identification and assessment of threatened elements of biological diversity.

Scientific committees: membership
- Six to ten people;

- From Universities, Museum, CALM, other Government agencies, community groups;
- Experts on WA biota.

Scientific committees: duties
- Assessing nominations for listing;
- Allocating species and TECs to threat categories;
- Reviewing lists and making recommendations (based on biological and ecological factors only) to Minister;
- Providing advice to Executive Director

3. Identifying, listing, ranking
   - Information used from:
     - *National action plans;*
     - *Detailed literature;*
     - *Regional surveys;*
     - *Other experts.*
   - Information must be adequate to:
     - *Show that the species or ecological community has been searched for thoroughly in most likely habitats by relevant experts;*
     - *show that the species or community can be consistently identified;*
     - *assign threat status.*

   - IUCN Red List categories of threat adapted for TECs:
     - *Critically Endangered (CR):extinction risk within approximately 10 years;*
     - *Endangered (EN): ~20 years;*
     - *Vulnerable (VU): ~50 years;*
     - *Also Totally Destroyed (TD), Near threatened (NT) and Least Concern (LC);*
     - *CALM's informal Priority lists.*

   - IUCN criteria for allocating species to a threat category:
   - *Reduction in population size over time period;*
   - *Limited geographic range and*
     - *Fragmentation*
     - *Continuing decline*
     - *Extreme fluctuations;*
   - *Population fewer than 250 mature individuals*
     - *And continuing decline;*
   - *Population fewer than 50 mature individuals;*
   - *Quantitative analysis of likelihood of extinction.*

4. Recovery Plans: Full or Interim Recovery Plans:
   - Deal with threatened species or TECs across their whole range;
   - Have a clear objective for recovery of the target TEC or species;
   - Contain measurable criteria for success or failure;
   - Provide appropriate background information on threats, biology, ecology;
   - List and describe actions needed to meet criteria for success;
   - Provide the cost and duration of each action;
   - Identify who is responsible for funding and implementing actions;
   - Identify stakeholders and liaison needed;
   - Include paragraphs meeting requirements under the EPBC Act;
   - Establish a Recovery Team or assign responsibilities to one already existing;
   - Must be approved by the Director, Nature Conservation;
   - Can be adopted under the EPBC Act.

5. Recovery Teams:
- Are approved by Director, Nature Conservation;
- Are made up of people able to aid recovery;
- Provide a forum for discussion and planning;
- Supervise/coordinate the writing of Recovery Plans;
- Oversee the implementation of Recovery Plans;
- Report annually to CALM and other funding bodies.

6. Implementing Recovery Plans:
- Find and allocate resources;
- Gain public support;
- Conduct liaison with stakeholders;
- Ensure actions implemented in approximate priority order.

7. Monitoring and Review:
- Monitor, assess and review progress against criteria;
- Recommend changes if necessary.

New Policy Statement No 9

Guiding Principles:

No listed threatened species or ecological community to be lost through human action;
Aims to conserve widest possible genetic and ecological variation;
Threatening processes to be identified and studied and control programs begun.

Issues addressed within or relevant to New Policy No 9:
- Formalises recovery processes;
- Gathers together several earlier separate policies;
- Threatened species are listed under *Wildlife Conservation Act* 1950;
- TECs currently recorded on Ministerially approved list (the intended Biodiversity Conservation legislation is to cover TECs also);
- Informal lists of Priority species and TECs maintained by the Department;
- Provides guidelines for translocations of threatened species;
- Provides the capacity for public nomination of threatened species and ecological communities;
- Recovery plans prepared and implemented on the basis of degree of threat;
- Advice to Minister from Scientific Committees to be based on biological and ecological criteria;
- Western Australian threatened species and TECs will be included in national lists;
- CALM will advise landowners of presence of threatened species and TECs and will provide advice and assistance.

Liaison with other stakeholders:
- TEC database is provided to other agencies for advice to stakeholders;
- Advice to other agencies, consultants, landholders;
- Influence on decisions by other agencies
  - *Department of the Environment - Environmental/ clearing assessments,*
  - *Department of Planning and Infrastructure - Planning decisions, Bush Forever,*
  - *Department of Industry and Resources - Advice to lease holders.*

TECs in other jurisdictions
- Commonwealth EPBC Act;

- Victoria, NSW, ACT include TECs in biodiversity conservation legislation and allow for public nomination and comment;
- Queensland: no legislation; significant ecosystems identified, conservation actions in train;
- Northern Territory, South Australia: no list of TECs, no formal recognition;
- Statutory habitat protection of some kind is in place in most Western nations.

Conclusions
- The Recovery process is well tested and effective;
- Identifying and recovering TECs is a mainstream part of modern biodiversity conservation;
- WA uses the best available information and proven and rigorous methods.

THREATENED ECOLOGICAL COMMUNITIES – METHODS, LISTING, EXAMPLES

Val English

Development of methods

- The procedures for identifying and conserving TECs in Western Australia were developed between 1994 and 1996, in a project funded by the Commonwealth Government's National Reserves System Program.
- The TEC Scientific Advisory Committee reviewed and provided comment on successive drafts of the procedures.
- Two workshops were held during the development of the procedures:
  - 1994: public input on the method of developing procedures for identifying and conserving TECs.
  - 1996: workshop to ensure procedures developed were understood and accepted by the wider community. The workshop included information on what had been listed as threatened to date, and why it had been listed.
  - a broad range of people were involved in both of the workshops.

Workshop Invitees included:

- Local Authorities and the Local Government Association
- Many Western Australian government departments (including the then Ministry for Planning, Agriculture WA, Department of Minerals and Energy)
- Conservation groups
- Universities and research organizations
- Environmental consultants
- Chamber of Minerals and Energy, other industry groups, representatives from peak farmers groups including the Soil and Land Conservation Committee, individual land owners

Methods to identify and conserve TECs

- Methods published in peer reviewed journal: English, V. and Blyth, J. 1999. Development and application of procedures to identify and conserve threatened ecological communities in the South-west Botanical Province of WA. *Pacific Conservation Biology*. 5:124-138.

Other opportunities for public comment in development of methods to identify and conserve TECs

- The procedures were included in Bush Plan which had a public comment period;
- The new Draft Policy on threatened species and communities was recently out for public comment.

Before a community can be allocated to a category of threat, the TEC Scientific Committee needs to be convinced of the following:

- the habitat has been defined including the abiotic characteristics of the place in which the community is found ie. substrata, hydrological & topographical features;
- the community is distinct from other assemblages;
- that variants of the community fit the description;
- the community has been searched for adequately;
- the point at which the community would be considered no longer extant or capable of being restored can be recognized.

Types of ecological communities:

- Terrestrial plant assemblages
- Wetland assemblages: fresh, brackish or naturally saline; based on plants and/or animals
- Terrestrial Invertebrate assemblages of caves
- Stygofaunal assemblages of caves and groundwater
- Aquatic microbial assemblages; eg stromatolites

Processes threatening TECs

- are often the same as those threatening species
- vary with the type of ecological community
- examples of processes that threaten wetland TECs include:
  - *Pollution, water drawdown, salinisation*
- examples of processes that threaten terrestrial plant communities include:
  - *Clearing, weed invasion, changed fire regimes, hydrological changes, dieback*

Criteria for allocating TECs to threat categories.
There are three main criteria, based on those used for many years for species by the World Conservation Union (IUCN), as follows:

1. Reduction in total area or number of occurrences and continuing decline in area or condition
2. Limited distribution and subject, or vulnerable to, known threatening processes
3. Level of modification of occurrences

Ranking of TECs into the following categories is done by the TEC Scientific Committee:

- Presumed Totally Destroyed:
  Community is unlikely to be able to be rehabilitated
- Critically Endangered

There are immediate threats throughout its range

- Endangered:
  Threatened throughout most of its range in near future
- Vulnerable
  Vulnerable to threatening processes/may move into higher threat category

Priority communities are defined as follows:

- May be threatened but don't meet survey criteria or are not adequately defined (Priority 1, Priority 2, or Priority 3);
- Are adequately known, rare but not threatened, Near Threatened, or recently removed from threatened list (Priority 4);
- Conservation Dependent - those that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened (Priority 5).

There are 69 TECs listed in WA, Endorsed by the Minister for Environment:

- 54 are plant assemblages
- 11 are invertebrate-based
- 4 are microbial-based

EXAMPLES OF TECS

Example 1: Root mat community (Critically Endangered)

- Communities were identified by Edyta Jasinska who was a PhD student at the University of WA
- Only occur in caves with permanent water
- At Yanchep there are six root mat caves, and on the Leeuwin Naturaliste Ridge there are four root mat caves
- These caves contain many Gondwanan relicts
- Many of the component species cannot survive drying
- The communities are threatened by falling water levels
- EPBC listed

Root mat community Yanchep

- Recovery Team includes Water and Rivers Commission, Water Corporation, University of WA Zoologists, Speleologists Group, Forest Products Commission, City of Wanneroo, CALM
- An Interim Recovery Plan was completed for the root mat community in 2000 by the Recovery Team
- Causes of water level decline are being investigated
- Management includes: monitoring, research and artificially maintaining water levels

Other invertebrate-based TECs include:

- Mound (tumulus) springs of the Swan Coastal Plain and some in the Kimberley region
- Leeuwin Naturaliste root mat Caves

- Camerson's cave troglobitic community
- Bundera sinkhole remipede community
- Roebuck Bay species rich community of intertidal mudflats
- Ethel Gorge aquifer stygobiont community

EXAMPLE 2: Lake Clifton Microbial Community (CR)

- Identified by Dr Linda Moore
- Formed by complex association of photosynthetic cyanobacteria, purple sulphur bacteria, eukaryotic microalgae and 'true bacteria'
- Lake Clifton is under threat from altered water quality – increases in salinity and nutrient levels
- Recovery Team formed 2002
- Membership of the Recovery Team: CALM, University of WA, Local Government Authority, Peel Preservation Group, Land Conservation District Committee, CSIRO, Water and Rivers Commission
- Recovery Plan is in late draft
- The priority recovery actions that are being implemented include: determining the main causes of changes to water quality, an information campaign, and monitoring of salinity and nutrient levels

Other Microbial TECs include:

- Lake Richmond microbial community
- Lake Thetis microbial community
- microbial community at Augusta

CLASSIFICATION AND CONSERVATION OF PLANT COMMUNITIES

Dr Mick Brown (former Chief Scientist with Forestry Tasmania)

Biodiversity is the diversity of life in all its forms: genes, species and ecosystems. However:

- most work has been done at the level of species, as enshrined in Threatened Species Acts, Wildlife Protection Acts etc;
- relatively little work has been done on genetics, and this has been mostly on genes of commercial significance: eg cold tolerant ecotypes in *Eucalyptus*; gene pollution;
- the ecosystem level is what concerns us here.

In recent years it has become widely accepted that we should conserve ecological communities because:

- They are a significant and integral part of overall biodiversity.
- There are many more species than we can ever hope to deal with individually.
- Most species aren't known - therefore we need to use surrogates.
- The protection of ecosystem diversity is basic to the concept of comprehensive, representative and adequate reserve systems.

- It is becoming increasingly recognized that ecosystems/ communities are at risk of disappearing from the earth as a result of human activities just as species are threatened with extinction.

The need to conserve plant and other ecological communities is now enshrined in many policy instruments. For example:

- Australia is signatory to the International Biodiversity Convention;
- the Governments of Australia have agreed on a national biodiversity conservation strategy;
- the Australian Government has recognized its responsibilities through the Environmental Protection and Biological Diversity Conservation (EPBC) Act; and
- most States have recognized their responsibilities through legislation and/or biodiversity or nature conservation strategies.

Conservation evaluation entails assessment of the status of one or more attributes of the natural environment - these include levels of reservation and depletion, degrees of disturbance and the management options available for maintenance or restoration.

A plant community is a sub unit of vegetation with identifiable common characteristics and which recurs across the landscape in suitable places. However, all vegetation shows continuous variation and ultimately every patch is different, so the aim of vegetation classification is to define relatively homogeneous units that repeat in the landscape. Such homogeneous units are found at different scales, global to regional to local.

There are three often stated concepts of the nature of plant communities:

- a random assortment of species thrown together by happenstance;
- interacting elements of vegetation growing in ecological harmony with each other and their environment; and
- the result of evolutionary processes in which species compete to find niches and optimise the probability of spatial and temporal gene transmission.

There is some evidence for all three of these concepts, and the specific environmental conditions at particular places will control which is the dominant process making that assemblage what it is.

Various classifications of communities and ecosystems are used to identify plant communities and these include:

- physiognomic classification: forest, heath, grassland
- structural: tall trees with 30% canopy cover
- dominance: *E.regnans* forest
- floristic: species composition eg dogwood/musk association
- environmental domains: for example, <6oo m elevation, well drained soils on basalt with high rainfall

Each of these classifications has its problems and advantages. For example:

- Dominance mapping may be misleading as many clearly different communities may be included under one dominant canopy, as can be seen in Tasmanian rainforests dominated by Nothofagus.

- Very different ecosystems can have the same structural and physiognomic classification as in ‘tall eucalypt forest’.
- Floristic classifications can incorporate all plant species present, can be hierarchical or fractal, but there may be debate over cut off levels, finer scales may not be mappable, and they may not always act as good predictors of the occurrence of associated fauna or non/vascular species.
- Environmental domains work well over large areas and are hierarchical, so that assemblages at different scales can be nested within one another, but they may be inefficient because at-risk subunits may not be differentiated from well-conserved ones
- In Tasmania environmental domains and species/forest mapping units showed high coincidence, but important differences.

Combinations of two or more of the above are likely to give better results

- Eg structure/dominance categories give coverage at comprehensive level
- then use floristics to evaluate representativeness across landscape
- floristics are long term integrators/indicators of averaged responses to environment.

Classification and ordination of vegetation

- Classification: hierarchical arrangement of groups based on similarities of objects within the groups (or on dissimilarities among the groups)
- Ordination: ordering of objects according to their resemblances so that objects close together are more similar than distant ones

Classification and ordination of vegetation

- Methods have been in use since the 1920s: Phytosociology was developed in Europe and has several scientific journals devoted entirely to the subject
- Initially done by hand sorting, but now mostly by computer methods

Numerical Classification

- Four main types based on whether they are:
  - *Divisive: dividing a large group into smaller groups*
  - *Agglomerative: joining subsets together*
  - *Monothetic: one attribute to divide or combine clusters*
  - *Polythetic: many attributes to divide or combine clusters*

Numerical Classification

- Output is a tree or dendrogram showing groups arranged according to their similarities
- Ultimately the dendrogram can be divided until every quadrat is shown separately.
- Dendrogram can be cut at different levels to suit purpose of conservation evaluation eg Tasmanian rainforests
- Classification must pass tests of utility, practicability and flexibility

Vegetation classification in Tasmania

Ordination techniques

- Direct gradient analysis: Display species occurrences along a predetermined gradient eg altitude, rainfall.
- Indirect gradient analysis: Numerical techniques are used to determine similarities among species or sites.
- These are displayed graphically and used to examine relationships with environmental factors.

Classification and ordination

- Both methods have an underlying reliance on some measure of similarity or dissimilarity among samples
- Many different measures available - need to consider which is appropriate
- Lots of packages, but require careful inspection, thought and understanding of the nature of variation being examined

Hierarchies and floristic classifications

- Hierarchical classifications can be used to evaluate finer levels of differentiation for conservation
- eg in Tasmania, instead of listing all *Nothofagus* rainforest, floristics can subdivide and only list those that are rare, unreserved.

Scale and hierarchical classifications

- Can set appropriate targets for each level
- eg WA RFA
  - *c. 26 forest ecosystems*
  - *c.120 ecological vegetation systems*
  - *c. 300 vegetation complexes*
  - *c. 1000 floristic units @1:5000-1:10 000*

Issues with floristic classification approach

- All vegetation shows continuous variation and classifications are human constructs
  - *communities recur through the landscape because the environmental conditions that produce them recur*
  - *variation is continuous in abstract, in practice sharp disjunctions occur eg geological boundaries*
  - *Need to classify for communication*
- There are no rules about number of groups to be recognised in the classification
  - *Some studies propose stopping rules generated statistically, but*
  - *in practice, 'natural' breaks are found*
  - *eg coincident with environmental features (geological boundaries, drainage patterns), or with vegetation structure.*
- Scale issues and reasons for evaluation will affect cut offs:
  - *eg global rainforests - use tropical, subtropical, temperate.*
  - *No-one would suggest that reserving 60% of Tasmanian rainforest does the job for Qld forests*

- *Victoria has a small subset of temperate rainforest variation, but still aims to conserve its relatively small areas of homogeneous forest.*
- *Within Tasmania, lower levels of classification are used to define sub units eg for protection of rainforest gullies in E. Tasmania.*

- Classification doesn't always yield satisfactory results
  - *may arise because of disturbance history: eg past fire and grazing on Maria Island National Park*
  - *may also arise when sampling species having random distributions within an otherwise homogeneous unit:*
  - *eg granite outcrops in WA, vegetation there is distinct from other floras, but no particular patterns within the habitat. Found also in some types of buttongrass moorlands in Tasmania*

Measuring vegetation units

- Define sampling universe:
  - *eg regional mapping Gibson et al. 1994 Swan coastal plain*
  - *vegetation of a National Park or Forest Block*
  - *mapped vegetation type(s) eg Tasmanian rainforest*
- field sampling: if local scale, visit all sites; otherwise use stratified random sampling

Information collected

- Quadrat: size, location, date, altitude etc
- Species and their abundances
- Vegetation attributes: structure, dominance, cover of vegetation layers, stags, dead wood, growth stage etc
- Details of physical environment
- Disturbance history: fire, disease grazing etc.

Data collation and analysis

- collate into database
- analyse by classification and ordination techniques
- investigate relationships among classificatory units and with environment to generate ecological hypotheses
- test and field validate hypotheses and classifications

Utility, practicability, flexibility of floristic classification

- Utility: eg provides convenient means of communication
- practicability: is easily recognised in the field and cost effective to apply. eg is mappable
- flexibility: accommodates natural variation, incorporate new data and is amenable to change if distinct new variants are found.

Examples of hierarchical classifications

Species plot data from wet forest at Warra LTER Site
Twinspan classification of Warra LTER data
Classification and ordination in ecology/conservation

- AUSRIVAS ausrivas.canberra.edu.au
- Bird communities eg Fleming (1991)
- lichen communities eg Kantvilas and Minchin (1994)
- fungal communities eg Packham *et al*. 2000
- Vegetation eg WA: Havel/ Mattiske, RFA, Gibson *et al.*1994
- Many examples in international literature.

Numerical classification and ordination

- Example: AUSRIVAS scheme for monitoring water quality of rivers using a bio assessment method
- National scheme, but depends on state level classifications of macro invertebrates in a defined set of reference rivers, which can then be used to gauge status of other rivers being monitored

AUSRIVAS

- Uses same techniques as vegetation classification and ordination
- Has national backing
- Requires collection of agreed suitable reference sites
- agreed classification ordination procedures
- agreed methods of establishing distinctiveness of groups
- Consensual expert evaluation of field validity

Application of numerical classifications to define TECs

- produce classification
- inspection and revision by authors and expert panel
- peer reviewed publication
- reify communities - eg give names related to some or all of character spp, dominants, habitat
- evaluate conservation status: reservation, management needs, depletion, threats

Making it practical

- Mappable units
- classification used is scientifically credible - independent peer reviewed assessment
- development of science guidelines independent of other considerations
- science panels/workshops
- appeals process

Why classify?

- 2 tenets of conservation:

    - *every patch of native vegetation has some value for nature conservation*
    - *most human activity in native bush will have adverse effects.*
- Polarised human value systems:
    - *"every sperm is sacred" (Monty Python)*
    - *"I'm gonna get my share before the whole shit heap explodes" (The Doors)*

Most people fall somewhere between these poles, ie:

- They have no desire to see species go extinct, but they have real needs
- Finding a practicable balance is what biodiversity conservation is about
- Numerical classifications of plant communities is a tool which can help.

Acknowledgments

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COMMON AND RARE LIMESTONE COMMUNITIES OF THE SWAN COASTAL PLAIN

GREG KEIGHERY, NEIL GIBSON, BILL MUIR, BRONWEN KEIGHERY

The Southern Swan Coastal Plain Floristic Survey completed in 1994 (Figure 1) identified a series of plant communities that are located on limestone rich soils on the Swan Coastal Plain.

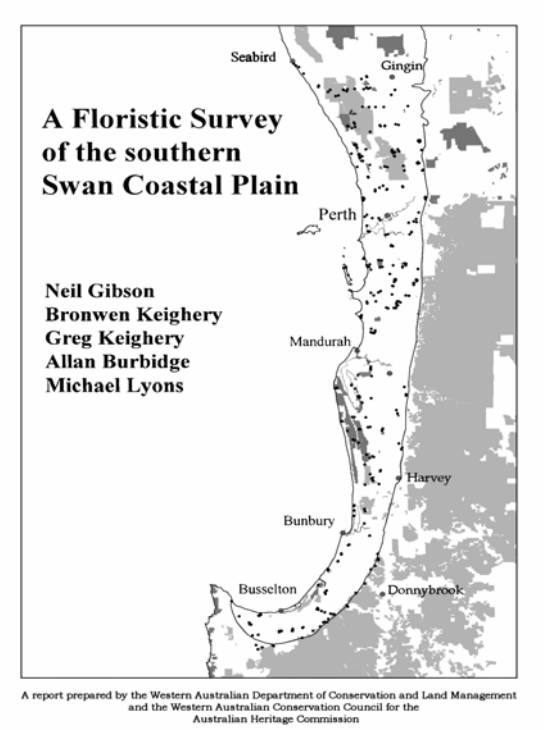


Figure 1: *Southern Swan Coastal Plain Floristic Survey*

Limestone rich soils are a common feature of the plain. They can be divided into two main groups. The first of these is limestone soils normally found either as Aoelian deposits near the coast on the Quindalup or Spearwood Sands, usually outcropping as Tamala Limestones. The latter have been heavily mined in the past and present, as seen in Figure 2 below from the Urban Geology series.

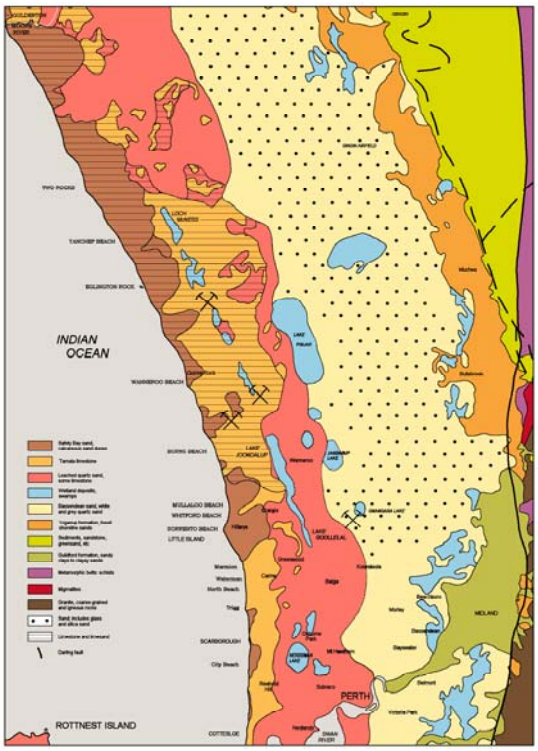


Figure 2 *Geomorphology of the Swan Coastal Plain*

The second group of limestones occur east of these bands, being solution deposits between the Spearwood and Bassendean sands (Calcareous clays and silts of the Yalgorup area) and the Muchea Limestones formed in the Pinjarra Plain.

Table 1

Limestone soils formed on three of the five major geomorphological units of the Swan Coastal Plain

QUINDALUP AND HOLOCENE DUNES (Offshore Islands)
- **(a) Woodlands (Callitris preissii/Melaleuca lanceolata):** (fire and weeds)
- (b) Shrublands
- (c) Wetlands

SPEARWOOD SANDS (Tamala Limestones)
- (a) Shrublands
- (b) Woodlands
- (c) Mallees
- **(d) Shrublands (Melaleuca huegelii-M. cf. systena):** (Mining, urban development, weeds, fire)

PINJARRA PLAIN
- (a) Calcareous clays and silts (Weeds, fire, clearing, hydrological change)
- (b) Shrublands
- **(c) Muchea Limestones** (Weeds, fire, clearing, hydrological change, pigs, mining)
- (d) Woodlands (Casuarina obesa)
- (e) Mallee Shrublands
- (f) Shrublands

Note: threatened ecological communities in bold.

An idealized transect (Figure 4 upper) of the Swan Coastal Plain shows the offshore Tamala Limestone (1), onshore Tamala limestone (2) in the Quindalup dunes, then the tall hills formed from Tamala limestones (3), the calcareous clays and silts between the Spearwood and Pinjarra Plain (4) and finally the Muchea limestones (5) on the east of the Pinjarra Plain. Thus limestone soils form in three of the 5 major geomorphic zones of the coastal plain.

The limestone soils of the Swan Coastal Plain as shown in Table (1) contain a wide variety of plant communities many of which are floristically distinct and some of which are highly localized. Those communities listed as threatened are shown in bold on the table. These are the Rottnest Pine (*Callitris preissii*) woodlands on the Quindalup, naturally rare threatened by frequent fire, clearing and weeds: Shrublands on massive limestones on the Spearwood sands, community 26a, threatened by mining, urban development, weeds and fire: and finally, the assemblages of the Muchea Limestones of the Pinjarra Plain, which have been largely cleared for agriculture and are threatened by weeds, fire, feral animals and hydrological change.

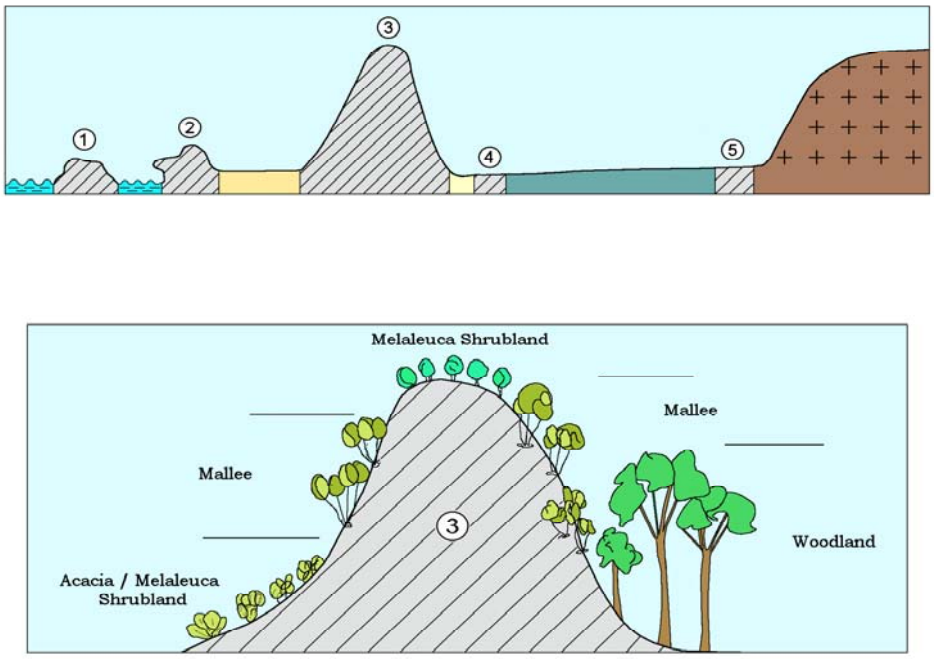


Figure 4: *Upper; transect across the Swan Coastal Plain; Lower; Plant communities of tall hills of the Tamala limestone*

The major areas of limestone-based plant communities of the Swan Coastal Plain were the large ridges of Tamala limestone that once extended from north of Yanchep to near Fremantle then re-occurred in the Yalgorup area between Bunbury and Mandurah. These tall ridges have a sequence of plant communities from summit to the base identified by the floristic survey (Figure 4 lower). The base of these hills with deeper soils have a series of woodlands usually dominated by Tuart (*Eucalyptus gomphocephala*). On shallower soils these woodlands are replaced by shrublands of *Dryandra sessilis-Calothamnus quadrifidus* or *Acacia* and *Melaleuca cardiophylla* shrublands: these two communities are the common plant associations of shallow sands over limestones of the Perth area.

The other communities, 26 and 27 (Figures 5, 6 and 7) are more restricted in occurrence, being found only on very shallow soils over limestone or massive limestone ridges. Community type 27 is restricted to the Yalgorup area and was either shrublands or Mallee shrublands dominated by *Eucalyptus decipiens* or *E. foecunda* or *Melaleuca systena*, *Acacia truncata* & *Hakea prostrata* shrublands. Community type 26 is composed of two distinct subgroups.

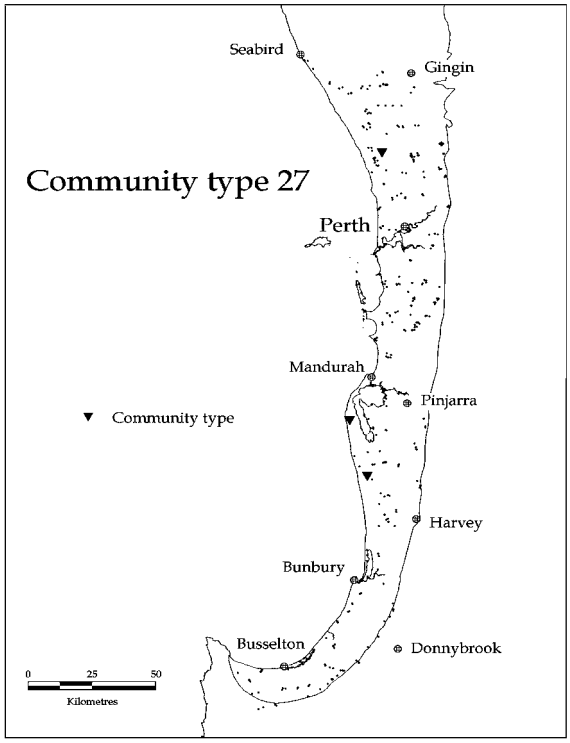


Figure 5: Distribution of Community type 27

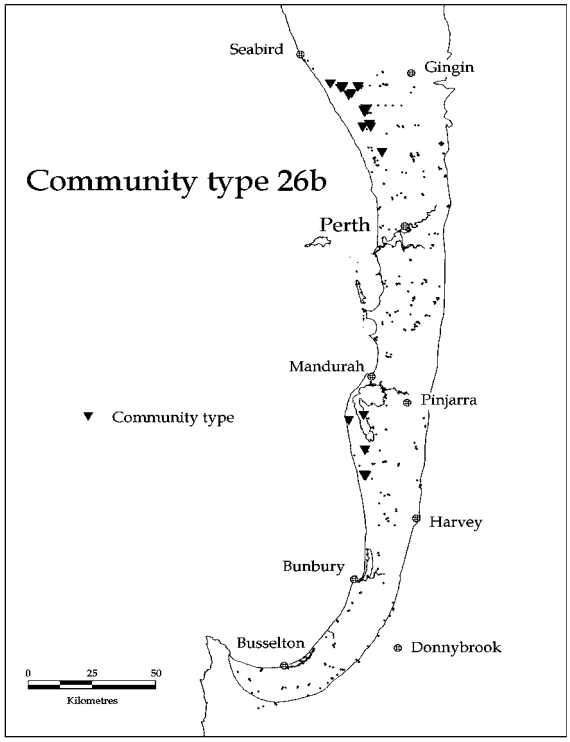


Figure 6: *Distribution of community type 26b*

Type 26b represents the normal shrublands or heaths on limestones, being dominated by low shrubs such as *Acacia lasiocarpha*, *Trymalium ledifolium* , *Melaleuca systena*, *Hibbertia hypericoides*, *Grevillea preissii* or on deeper soils Mallees or trees of *Eucalyptus gomphocephala*, *E. foecunda* and *E. petrensis* develop over the dense heath.

On the skeletal soils of the ridge tops and upper slopes community 26a is found. This community is highly restricted in occurrence to these sites. It consists of a shrubland of *Melaleuca huegelii*, *Melaleuca systena*, *Melaleuca* aff. *systena* often over scattered limestone heath species, such as *Dryandra sessilis*, *Grevillea* preissii. The community is often long unburnt and may be very attractive, developing a mossy ground cover with numerous herbs as the understorey over time. At least one unnamed *Haloragis* species may be endemic to this community.

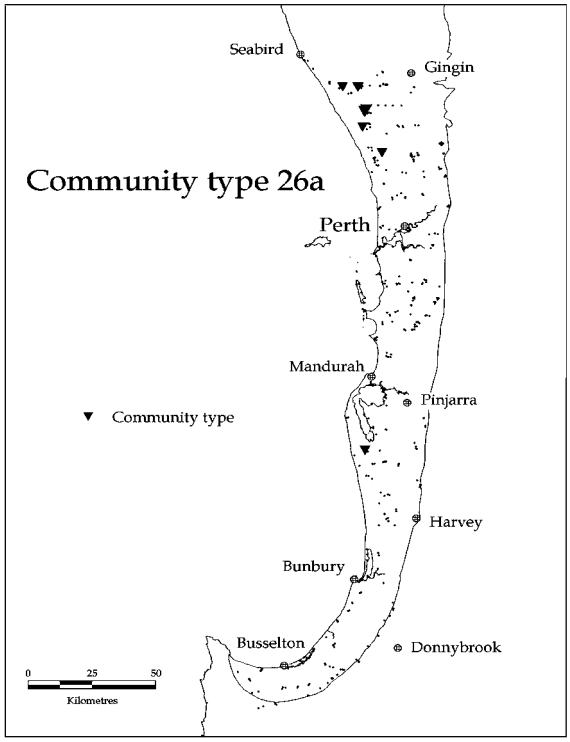


Figure 7: *Distribution of community type 26a*

Subsequent floristic surveys by Neil Gibson, Arthur Weston and the System Six update have confirmed the distinctive nature of community 26a and its very limited aerial extent, (figure 7) with about 145ha known.

THREATENED ECOLOGICAL COMMUNITIES IN VICTORIA

Adrian Moorrees
Biodiversity and Natural Resources Division
Department of Sustainability and Environment, Victoria

There are two pathways for conserving TECs in Victoria

- Threatened species legislation
- The planning system

Victorian Legislation

Flora and Fauna Guarantee Act 1988

- *Provides for conservation of threatened species and communities and management of potentially threatening processes*

Planning and Environment Act 1987

- *Establishes planning framework throughout Victoria*

Catchment and Land Protection Act 1994

- *Establishes Catchment Management Authorities*

- *Provides for management of land, including pest plants and animals*

Flora & Fauna Guarantee Act (FFG) 1988 provides for:

- *listing of threatened species, threatened ecological communities and potentially threatening processes*
- *preparation of a strategy*
- *preparation of Action Statements and Management Plans*
- *determination of Critical Habitat*
- *use of Interim Conservation Orders*
- *regulatory powers over handling of flora and listed fish*

FFG Listing of threatened ecological communities

35 threatened ecological communities currently listed

(cf. 465 taxa and 32 potentially threatening processes)

Listing Process:

- *Nomination*
- *Scientific Advisory Committee consideration*
- *Public comment*
- *Final recommendation to Minister and gazettal of Order*

Consequences of listing:

- *Floral component becomes protected (mainly applies to Crown land)*
- *Action Statement must be prepared*
- *Interim Conservation Order could be applied to protect Critical Habitat on Crown land only*

FFG Listing criteria I

I A community is eligible to be listed if it is in a demonstrable state of decline which is likely to result in extinction.

- *The community is in a demonstrable state of decline which is likely to result in a significant loss of its component taxa.*
- *The community's distribution has decreased markedly in a short time and the decrease is continuing.*
- *The community's composition has altered markedly in a short time and the alteration is continuing.*

II A community is eligible to be listed if it is significantly prone to future threats which are likely to result in extinction.

- *The community is very rare in terms of the total area it covers or it has a very restricted distribution or it has been recorded from only a few localities.*
- *The threat is currently operating and is expected to operate at a level in the future which is likely to result in the extinction of the community.*

Information requirements

A statement identifying the community must:

- *specify the community in accordance with relevant text or reference; or*
- *describe the community in such a way that it is distinguished from all other communities*

The community must be described with reference to:

- *the biological components .... and, if relevant ...., its non-biological components or environmental features; and*
- *if known to the nominator, the determining biological or non-biological components, environmental features or processes*

Evidence for nomination must show that at least one of the listing criteria is satisfied by the community.

Examples of TECs listed under the Flora and Fauna Guarantee Act

Communities defined by faunal assemblages:

- *Butterfly Community No. 1*
- *San Remo Marine Community*
- *Victorian Mallee Bird Community*
- *Lowland Riverine Fish Community of the Southern Murray-Darling Basin*

Communities defined by floral assemblages:

- *Coastal Moonah (*Melaleuca lanceolata *ssp.* lanceolata*) Woodland*
- *Creekline Grassy Woodland (Goldfields)*
- *Semi-arid Herbaceous Pine - Buloke Woodland*

Issues

- Neither Scientific Advisory Committee (SAC) nor DSE has established explicit minimum requirements for data or analysis as part of a nomination for listing a TEC under the FFG Act
- SAC has tended to adopt a precautionary approach (ie preferring to recommend listing) where data have been patchy or narrowly-based provided a good *prima facie* case has been put
- Confidence in identity and eligibility is greatest where the TEC nomination is based on comprehensive, systematic sampling across the landscape followed by quantitative analysis

Flora & Fauna Guarantee Strategy

Flora and Fauna Guarantee Strategy = “Victoria’s Biodiversity Strategy”

Published in 1997 under the Kennett Government and adopted:

- *the precautionary principle in regard to biodiversity conservation*
- *a bioregional approach*
- *the concept of “Net Gain” via an objective that:*
  “there is a reversal, across the entire landscape, of the long-term decline in the extent and quality of native vegetation, leading to a Net Gain”

Planning & Environment Act 1987 Establishes the Victorian planning framework:

- *Victorian Planning Provisions*
- *Statewide Planning Policy Framework*
- 'To assist the protection and conservation of biodiversity, including native vegetation retention and provision of habitats for native plants and animals and control of pest plants and animals.'
- *Native Vegetation Retention controls in all local planning schemes*
- *Planning approval (from local government) required to remove native vegetation on any parcel >0.4 ha (exemptions exist)*
- *DSE approval required if parcel is >10 ha*

Native Vegetation Management

- 10 Catchment Management Authorities in Victoria
- Each Catchment Management Authority is preparing a Regional Catchment Strategy (RCS) and Native Vegetation Plan (NVP)
- The NVP identifies depleted, rare and threatened Ecological Vegetation Classes (EVCs), based on historic and/or continuing depletion in the extent and/or condition of EVCs in the context of each bioregion.
- The Native Vegetation Plan will be an 'incorporated document' in relevant planning schemes - local planning authorities must have regard to NVP when considering applications
- Policy framework for native vegetation protection launched in 2002
- Guides the implementation of the 'Net Gain' principle through the planning process, in conjunction with NVPs
- Includes graded conservation guidelines depending on EVC conservation status
- Higher status = less discretion to approve clearing
- Introduces the 'habitat-hectare' concept, which combines extent and condition when estimating losses and offset requirements

Ecological Vegetation Classes

- native vegetation management classification system designed to be practical in planning and management
- each EVC includes one or more floristic communities
- floristic communities identified through quantitative analysis of floristic data and aggregated into EVCs qualitatively, based on life form, soils, landform, climate, etc.
- DSE has recently completed delineation and mapping of EVCs at 1:100,000
- Pre-1750 extent of EVCs has been modelled, based on remnants and soil, elevation, landform and climate attributes, to assess depletion

Reflections

- biodiversity conservation is here to stay: its importance is now recognised at global, national, State and regional levels
- biodiversity and the environments that support it are complex and varied
- recognisable patterns exist within the complexity
- ecological communities provide a generally useful surrogate for biodiversity conservation

- without an ecological community approach, conservation v. development issues would once again tend to revolve around species, including poorly known invertebrates and lower plants
- ecological community definition is part science and part human construct - so is species taxonomy
- need to persevere to improve sampling techniques and to adopt robust and repeatable analytical techniques
- best strategy is to undertake regional surveys, using optimum sampling levels and apply best-practice analytical tools

CONSERVING THE SHRUBLANDS OF THE SOUTHERN SWAN COASTAL PLAIN (THE BUSSELTON IRONSTONES)

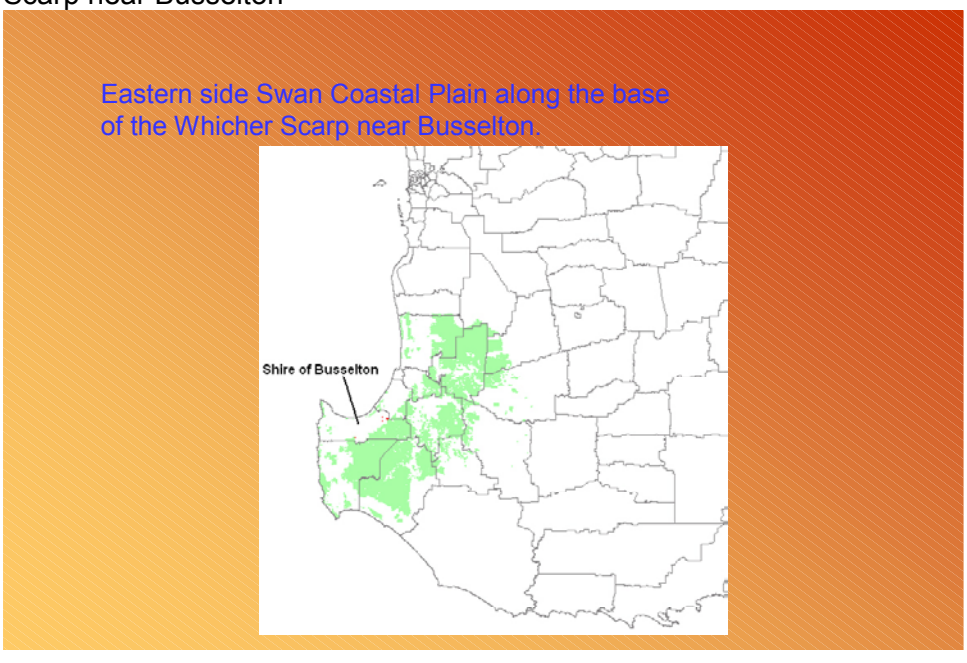
Kim Williams

What are they?

- Ironstone soils occur in a number of areas in the SW eg: Kalbarri, Eneabba, Scott River, Gingin and Busselton;
- Ironstone soils are extremely restricted in distribution on the Swan Coastal Plain;
- All ironstone occurrences are associated with unusual plant communities;
- Each ironstone plant community is comprised of different taxa;
- The Busselton Ironstone community contains 18 taxa of Threatened Flora (DRF), including 5 Critically Endangered Species, & Priority species;
- The community type is over 90% cleared, was 1200 ha now only approx 90 ha;

Where are they ?

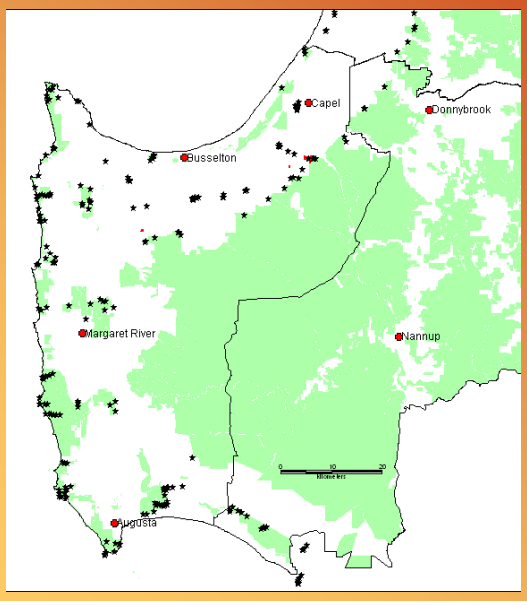
Eastern side of the southern Swan Coastal Plain along the base of the Whicher Scarp near Busselton



When & how were they recognised ?

- Busselton Soils mapped in 1990
- Floristic Survey of the southern Swan Coastal Plain 1994

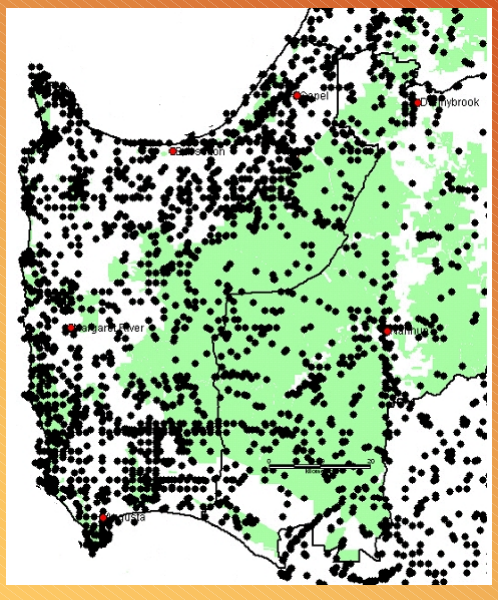
- Ranked Critically Endangered November 1995



Surveys of Bioregions;

- 200 + Flora Plots
- Swan Coastal Plain
- Warren
- RFA

CALM



8000+ Herbarium Voucher Specimens
as at 2001

CALM

Why are they threatened ?

- Habitat Loss and Clearing through:
  - Mining (gravel, mineral sands)
  - Road & firebreak maintenance
  - Illegal activities

- Fragmentation

- - 14 TEC Occurrences: Average size = 11ha
  - Limited connectivity; only Wonnerup- Tutanup Rd corridor

- Landuse management practices
- - Agricultural grazing
  - Broadscale fertilizer application

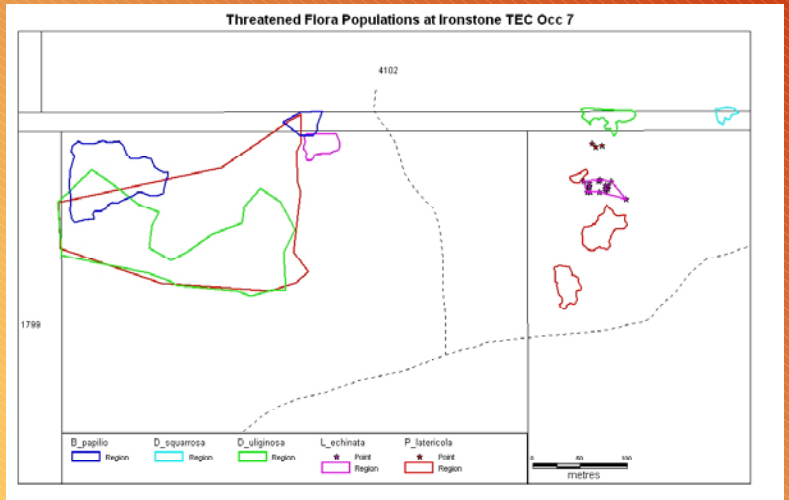
- Disease
- - Many species highly impacted by Phytophthora cinnamomi.
  - Other fungal diseases of foliage have been noted

- Weeds and Feral animals
- - Most sites have significant grass problems (small size, over long time)
  - Rabbit & kangaroo grazing impact on survival of plantings

- Considerable knowledge gaps:
  - species biology
  - disturbance ecology
  - community ecology

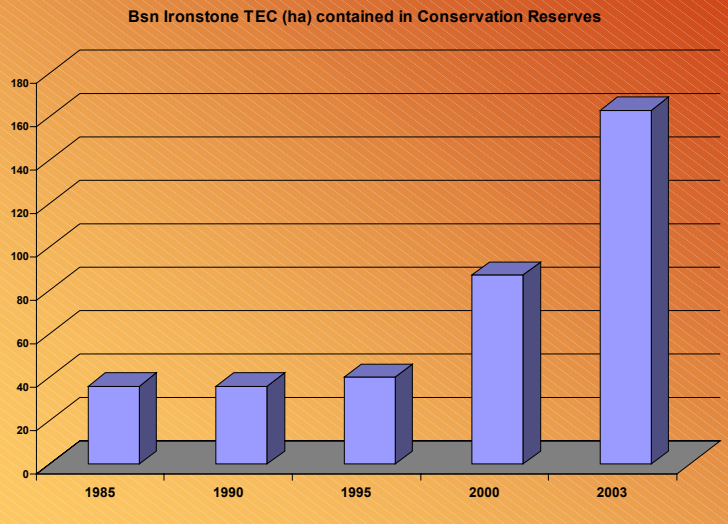
How are they being managed ?

Mapping and Distribution



All occurrences, and populations of threatened flora within them, are being accurately mapped with differential GPS.

Securing vesting and purpose



CALM

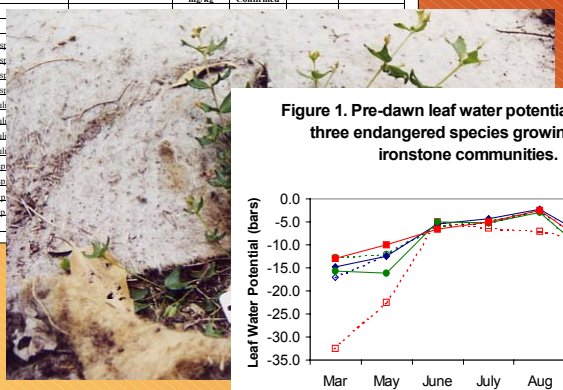
Since 1996 five sites containing the southern ironstones have been acquired for the conservation estate, increasing by a factor of four the area of the community being managed for conservation.

All sites within the conservation estate containing this TEC are managed for its recovery and conservation. Protective management includes habitat restoration, weed control, phosphite spraying to control Phytophthera dieback, rabbit control and translocations of threatened flora.

Research biology & ecology

Tissue analysis phosphite concentrations of 3 ironstone species, 2002

Species	Marks	Phosphite mg/kg	* Confirmed		
Dryandra squarrosa ssp					
Dryandra squarrosa ssp					
Dryandra squarrosa ssp					
Dryandra squarrosa ssp					
Dryandra nivea ssp. uli					
Dryandra nivea ssp. uli					
Dryandra nivea ssp. uli					
Dryandra nivea ssp. uli					
Lambertia echinata ssp					
Lambertia echinata ssp					
Lambertia echinata ssp					
Lambertia echinata ssp					



CALM

A number of significant research projects are being conducted at the Busselton Ironstones to provide the necessary understanding of how the ecosystem functions and how it needs to be managed.

Who is conserving the Busselton Ironstones ?

Many people and organizations are involved. These include:

- The Recovery Team, including several community members;
- CALM staff from Region and District and specialist branches;
- Members of conservation groups, landholders and neighbours
- Busselton Shire – especially through the Abba Plains Project;
- Industry: utilities such as Western Power and Alinta, and mining companies including Cable Sands;
- Even an international group, Kew Gardens through the Millennium Seed Project.

TEC RECOVERY THROUGH AN ALL-OF-GOVERNMENT APPROACH (BUSH FOREVER).
David Mitchell (CALM Swan Region).

LEADING UP TO BUSH FOREVER
1993 – Ministry for Planning - Perth Environment Project.
1994 – CALM - TEC project commenced.
1994 – DEP - System 6 update.
1994 - Gibson et al report.
1996 – Perth Environment Project & System 6 merged – to form Perth's Bushplan.
1996 - CALM briefing Paper 1/96 (TECs).
1997 - English & Blyth report on TECs.
1998 - Perth's Bushplan released.
2000 - Bush Forever released.

REGIONALLY SIGNIFICANT BUSHLAND: CRITERIA FOR SELECTION:

- Representation of ecological communities;
- Diversity;
- Rarity;
- Maintaining ecological systems or natural processes;
- Scientific or evolutionary importance;
- General criteria for the protection of wetland, streamline, and estuarine fringing vegetation and coastal vegetation;
- Criteria not relevant to determination of regional significance, but which may be applied when evaluating areas having similar values.

MECHANISMS FOR PROTECTION INCLUDE:

- Existing management;
- Change of purpose of reserves (including Unallocated Crown Land);
- Acquisition;
- Negotiated Planning Solutions;
- Incentives and Encouragement;

WHO MANAGES BUSH FOREVER SITES?:
Of the areas identified in Bush Forever (51 220 ha):

- *CALM – currently managing 25 315 ha;*
- *35 different Local, State or Commonwealth agencies manage 16 000 - 20 000 ha;*
- *400 private land holders manage 4 600 ha plus;*
- *300 Friends Groups have input into Bush Forever sites, primarily areas included above. (there are also up to 200 additional groups looking after bushland not in BF sites, including the Hills and non-BF sites).*

- *In addition there are 29 235 ha of Bushland within the BF study area but not included/protected by BF, and very large areas of bushland outside the BF study area and under a variety of management.*

CALM already manages approximately 50% of the Bush Forever area, mostly as State Forest. The formal conservation reserve system (meeting IUCN Categories I to IV including Nature Reserves, National Parks and Conservation Parks but not including State Forest) may increase from currently 8 700 ha to 26 400 ha (of new areas not currently managed by CALM).

However, under Bush Forever up to 12 600 ha is not proposed for the formal conservation reserve system, and the intent is that these areas will remain under Local Government, other agency, or private control, but still be managed for conservation.

BUSHLAND MANAGEMENT ASSISTANCE IS AVAILABLE FROM:

- *Urban Nature - Ecoplan,*
- *Land for Wildlife, Voluntary Nature Conservation Covenants,*
- *local governments,*
- *other Agencies*
- *community groups.*

BUSH FOREVER 2000 INCLUDED:

- Statement of Regional policy and objectives for bushland conservation;
- Identification of sites for protection;
- Site specific recommendations;
- processes of information, liaison and involvement;
- Administration: structural and organizational arrangements.

THE POLICY FRAMEWORK IDENTIFIES THE IMPORTANCE OF:

- overall objectives for bushland conservation;
- ongoing implementation and administration;
- interim protection;
- coordination of environmental assessment and land use planning processes;
- management and management advice;
- incentives and assistance for off-reserve conservation;
- Locally Significant Bushland;
- public awareness.

BUSH FOREVER IMPLEMENTATION INCLUDES:

- MRS Amendment provides:
  - *protection as Special Control Areas (SCA) to <u>all</u> BF sites;*
  - *new P&R reservation for 21 000 ha of bushland.*
- BF Statement of Planning Policy provides:
  - *statutory standing to BF objectives*
  - *policy and implementation framework*
  - *standards and performance criteria*
  - *Special Control Areas (SCA) - control development, define processes*
- Locally Significant Bushland (Not BF sites)
  - *Support to Perth Biodiversity Project (WALGA)*
- Ongoing negotiation over protection of individual sites
- Reserve Management
- Off-reserve delivery
  - *encouragement, incentives, regulation*
  - *management advice*
  - *Urban Nature*

BEYOND BUSH FOREVER:

- the remaining 29 200 ha of bushland within the BF study area
  - *some regionally significant values within this 'unprotected' bushland (including TEC occurences and threatened species)*
  - *10 000 ha proposed for development over the next 5-10 yrs*
- proposals for a "Country Bush Forever" to cover the rest of the Swan Coastal Plain (BF only covers 1/3 of Swan Coastal Plain)

TECS IN THE SWAN COASTAL PLAIN

TECs not specifically covered by WA legislation

- *considered in Environmental Protection and Land Use Planning processes*
- *Some covered by EPBC Act*

CALM TEC project 1994 - 1997.

- *identified 33 TECs.*
- *19 of the 33 TECs are Floristic Community Types*
- *20 of the 33 TECs are in the Bush Forever study area.*

FLORISTIC COMMUNITY TYPES:

Identified in Gibson, N., Keighery, B., Keighery, G., Burbidge, A., Lyons, M. (1994). *A floristic survey of the southern Swan Coastal Plain.*

- *509 plots over Swan Coastal Plain*
- *analysis identified 4 super groups, and*
- *43 Floristic Community Types.*
- *This information used in TEC project.*

ADDITIONAL TEC DATA:

The DEP 1996 System 6 update program:

- *additional analysis of over 600 sites*
- *resulted in 23 new Floristic Community Types, Now 66 recognised.*
- *Extended range of some Floristic Community Types*

- *Located >60 additional occurrences of some TECs*
- *Located occurrence of Muchea Limestone – thought to be completely destroyed (extinct) in Gibson et al 1994 report.*

INCLUSION OF TECs IN BUSH FOREVER:

- *TEC occurrence used as a significant feature in identifying BF sites.*
- *majority of known occurrences of TECs included in BF sites*

Number of occurrences of TECs included within Bush Forever sites.

Threatened Ecological Community Name	**TEC Short Name**	**Rank**	**CALM land (incl. Regional Park)**	**BF - Some existing protection**	**BF – Newly identified**	**Not identified in BF.**
Aquatic root mat community number 1 of caves of the Swan Coastal Plain	cave root mat community	CR	6			1
Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)	Tumulus Springs	CR			2	
Eucalyptus calophylla - Kingia australis woodlands on heavy soils, Swan Coastal Plain (Gibson *et al*. 1994: type 3a)	FCT 3a	CR	1	2	6	1
Eucalyptus calophylla - Xanthorrhoea preisii woodlands and shrublands, Swan Coastal Plain (Gibson *et al.* 1994: type 3c)	FCT 3c	CR	3	1	8	
Sedgelands in Holocene dune swales of the southern Swan Coastal Plain (Gibson *et al*. 1994: type 19)	FCT 19	CR	25	3		20
Shrublands and Woodlands of the eastern side of the Swan Coastal Plain (Gibson *et al.* 1994: type 20c)	FCT 20c	CR		1	2	2
Shrublands and Woodlands on Muchea Limestone	Muchea Limestone	CR			2	
Stromatolite like community of coastal freshwater lakes (Lake Richmond)	Lake Richmond	CR		1		
Melaleuca huegelii – M. acerosa shrublands of limestone ridges (Gibson *et al*. 1994: type 26a)	FCT 26a	EN	10		1	1
Banksia attenuata and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain (Gibson *et al*. 1994: type 20b)	FCT 20b	EN	2	5	10	1
Banksia attenuata woodland over species rich shrublands (Gibson *et al*. 1994: type 20a)	FCT 20a	EN	2	9	8	1
Shrublands on dry clay flats (Gibson *et al*. 1994: type 10a)	FCT 10a	EN	1	3	4	
Southern wet shrublands (Gibson *et al*. 1994: type 2)	FCT 2	EN		1	2	
Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain (Gibson *et al*. 1994: type 15)	FCT 15	VU	1		2	
Eucalyptus calophylla - Eucalyptus marginata woodlands on sandy clay soils of the southern Swan Coastal Plain (Gibson *et al*. 1994: type 3b)	FCT 3b	VU		7	5	
Herb rich saline shrublands in clay pans (Gibson *et al*. 1994: type 7)	FCT 7	VU	1	2	4	1
Herb rich shrublands in clay pans (Gibson *et al*. 1994: type 8)	FCT 8	VU	1	4	6	
Dense shrublands on clay flat (Gibson *et al.* 1994: type 9)	FCT 9	VU		1	1	
Callitris preisii (or *Melaleuca lanceolata*) forests and woodlands Swan Coastal Plain (Gibson *et al.* 1994: type 30a)	FCT 30a	VU	1	2		1
Shrublands on calcareous silts of the Swan Coastal Plain (Gibson *et al*. 1994: community type 18)	FCT 18	VU		1	1	

FCT= Floristic Community Type **(Gibson *et al.* 1994)**

SUMMARY: OCCURRENCES OF TECs IN BF SITES.

- *Few TEC occurrences in CALM managed land 28% of total occurences*
- *Some have some other form of protection: 23% of total occurences*
- *BF identified for protection 64 new occurrences 34% of total occurences*
  [BF proposes to acquire 25 of these 64]
- *28 occurrences not protected by BF 15% of total occurrences*

Note:

- *FCT 19 – 20 of 48 occurrences not protected*
- *FCT 20c – 2 of 5 occurrences not protected*
- *FCT 26a –on CALM land but subject to mining leases*

WHAT HAS THE BUSH FOREVER PROCESS DELIVERED FOR TECS?

- *Improved knowledge of distribution and status of TECs.*
- *Located >60 additional occurrences of some TECs (DEP 1996 study)*
- *85% of known occurrences given additional protection.*
- *coordination of agency approaches to TEC protection.*
- *additional resources for management of TEC occurrences.*
- *reservation removes major threatening processes.*
- *secure reservation improves ability to manage TEC occurrences.*
- *identification as BF provides support to decisions for conservation.*

THREATENED ECOLOGICAL COMMUNITIES IN THE WHEATBELT

Rosemarie Rees
WA Threatened Species & Communities Unit

Background to Project

- 1994-1997: Val English, Original TEC project for SW Botanical Province
- 1998-2002: Sheila Hamilton-Brown, Natural Heritage Trust and State Salinity Strategy (SSS) funded Wheatbelt Project
- 2003-2005: Rosemarie Rees, continued SSS Wheatbelt (South-west Agricultural Area) Project

Background to Wheatbelt TECs

- Little detailed survey of the whole of the wheatbelt area to date
- SSS Wheatbelt Survey will address this as results become available in near future
- Beard Mapping, Griffin surveys, individual surveys
- Listing of TECs in the wheatbelt still at a preliminary stage.

Three examples of wheatbelt TECs

1. Perched wetlands of the Wheatbelt region with extensive stands of *Casuarina obesa* and *Melaleuca strobophylla*.

- Critically Endangered (reduced by >90%)
- Threatened by salinity,waterlogging, grazing, weeds
- 2 Occurrences: (421 ha & 13 ha= 434 ha)

- Toolibin: Ramsar wetland of international importance
  Full Recovery Plan and implementation by Recovery Team since 1994
- Occurrence 2 is on private property and found in 1998

Recovery Actions for Occurrence 2, with major involvement of landowner
- IRP written
- Fencing
- Hydrological investigation
- Installation of diversion barrier & revegetation for control of surface water flow
- Ongoing monitoring of through flow and ground water
- Monitoring of tree health

2. Heath community on chert hills of the Coomberdale Floristic Region

- 8 Occurrences (~630 ha)
- Described by Griffin & Beard
- Endangered
- Threatened by mining, clearing, grazing, frequent fire, weed invasion
- Most occurrences on private property

Recovery Actions
- IRP written
- Negotiation of land transfer from Westnet Rail
- Mining lease over best example relinquished voluntarily by Simcoa
- Fencing of private property remnants
- Possible land transfer of further area of bush
- Revegetation of degraded areas

3. Plant assemblages of the Inering System

- 27 occurrences – originally 4 hill systems (~650 ha)
- Described by Beard, contains DRF & Priority Flora
- Vulnerable (30% remaining)
- Threatened by grazing, clearing, weed invasion, frequent fire, fragmentation
- All occurrences on private property

Recovery Actions
- IRP written
- Lotterywest fencing project
- Landowners joined Land for Wildlife
- Ongoing monitoring
- Weed control
- Management of DRF

Summary
- The process of identifying and listing TECs in the wheatbelt is still occurring
- Range of community types, wetlands to hilltops, are TECs (many wetland problems in wheatbelt due to salinity issue)
- Range of threats: salinity, grazing, mining, clearing
- Range of scales: small wetland to Beard Systems
- All challenging and rely on input from community (especially landholders), industry and government to tackle the problems

Discussion and interactive summary

1. The lack of survey information for private land was discussed, along with the need to consider private land in classification systems, because some communities or variations may no longer occur on public land.

> The point was made that private land can only be surveyed with landholder permission, and that far more resources would be required for surveys, such as the Floristic Survey of the Southern Swan Coastal Plain, to include private lands. Nevertheless, Bush Forever did include survey on private land.

2. The difficulties experienced by some people with identifying some of the floristic communities identified in the 1994 report 'A Floristic Survey of the Southern Swan Coastal Plain' by Neil Gibson *et al*. was mentioned.

> It was suggested that people view the plot locations for TEC sites as listed in Gibson *et al*. (1994) on the ground and infer the community types by comparing new sites to these. Alternatively the methods used in the Swan Coastal Plain survey would ideally be repeated – putting plots in the new sites in spring, surveying them at least twice to pick up all species present, then running the analysis.
>
> The possibility of provision of information about reference TEC sites was discussed. In particular, it is necessary to have agreement on when an occurrence is to be considered totally destroyed. The comment was made that pristine areas that can be used as reference sites also need to be identified. It was noted that the location of TECs in good condition is included on the TEC database that is stored at Woodvale.
>
> However, there are problems with ensuring adequate variation in a single or very few sites used for reference purposes, and with concentrating visitor pressure on such selected sites.

3. A question was asked about the timing of release of the new Policy 9.

> It was noted that, following an extended public comment period, the new policy statement was now ready to go to the Corporate Executive, the Conservation Commission and then to the Minister for Environment and Heritage.

4. There was discussion about the need for classification systems for communities to be robust, and be flexible enough to include new elements of information.

> For example, classification systems need to be able to deal with different rates of dominance of their components. Dr Brown noted that because the classification system used in Tasmania was robust / flexible, new elements of information were able to be used and the system is still giving good results after 15 years.

5. The need for the National Vegetation Information System (NVIS) to be included in applications for NHT funding was questioned.

> It was noted that applicants probably only needed to relate the area they were working in to the particular NVIS unit that occurs in that area.

6. There were questions about the relationship between classifications that resulted in the identification of plant communities, and those that identified other biota such as bird communities.

It was stated that there were good relationships between some types of biota and plant communities, but not others, depending on various factors such as mobility, ecological history and so on. Consideration of the needs of various types of biota needed be considered on a case by case basis as has been done for the IBRA bioregionalisation at state level in Western Australia.

7. Questions arose about whether clearing of the catchment is having an effect on the hydrology of the Busselton Ironstone community.

It was stated that much of the catchment is already cleared, but there are not yet significant changes in flow. Potential changes in the salinity in the community are not well understood.

8. There was discussion about the need for peer review of classification systems, and of the level of risk to communities that are nominated for listing.

It was noted that the TEC Scientific Committee includes a number of people from outside CALM and that the methods used by CALM have been published in an international journal for peer review.

Classification systems should be reviewed internally first, prior to publication. In Tasmania and Victoria assessment of level of risk to TECs is done by the Scientific Committee, and is also required to be reviewed by people outside the committee.

9. It was noted that some of the ecological communities listed, such as the Inering Hills and other hill systems in the wheatbelt, are agglomerations of identifiable vegetation units, which, taken together are quite recognisable. Most of these, including the Inering Hills, were identified as discrete systems by John Beard.

10. There was discussion about communities being downlisted when the level of threat is perceived to have declined, such as when significant areas of land containing the community have been obtained for the conservation estate.

It was noted anyone can make nominations for downlisting, and that the TEC Scientific Committee seeks and evaluates nominations for downlisting as opportunities arise.

11. Dr Libby Mattiske, speaking as a member of the Commonwealth Threatened Species Scientific Committee, noted that issues raised today are not unique to Western Australia. The Commonwealth was heavily involved in the original development of methods for identifying and conserving TECs (and funded the original project in Western Australia). The WA procedures for identifying and assessing the level of threat to TECs had been submitted to the Commonwealth to allow comparison between States, and had been used in developing procedures under the EPBC Act. Dr Mattiske pointed out the urgency of establishing a streamlined system for data sharing between the States and the Commonwealth.

Gordon Wyre, Director of Nature Conservation in CALM said that the State process for identifying and classifying TECs needs to be accredited by the Commonwealth and that this should occur once the WA Biodiversity Conservation Act is in place. In particular, the new Act was likely to include the opportunity for public comment on species and ecological communities nominated as threatened. Mr. Wyre noted the importance of the passing of the new Act.

The cost of upkeep of the TEC database, including the expense of continued collection of scientific data, was also discussed.

12. The need for metadata statements to help in locating information about all survey work that has previously been done in an area was mentioned.

It was noted that the metadata statement for the TEC database is lodged with WALIS (WA Land Information Systems).

13. The possibility of considering large areas that are under threat from landscape scale processes, such as invasion by Ward's weed, as possible TECs, was mentioned.

It was noted that it may be more appropriate to deal with these large areas, some of which may not be a single identifiable ecological community, through listing Key Threatening Processes. That capacity is likely to be available under the Proposed State Biodiversity Conservation Act. This is already possible under the EPBC Act, but the effects of that on many KTPs in this State are still small.

CLOSING COMMENTS
Gordon Wyre
Acting Director Nature Conservation, CALM

- The TEC concept is sound and the new State Biodiversity Conservation legislation is likely to provide legislative protection for TECs.
- There needs to be accreditation from the Commonwealth for WA's listing and ranking processes.
- There needs to be a communications plan to get messages out about the significance of TECs and ways of conserving them.
- There needs to be rigorous science behind the identification and ranking of TECs, and there also needs to be feedback, peer review and continued modification.