DEVELOPMENT OF CONSERVATION CRITERIA FOR BRIGALOW BELT SOUTH BIOREGION

NSW WESTERN REGIONAL ASSESSMENTS

FINAL SEPTEMBER, 2002

Brigalow Belt South

Stage 2

This blank page has been inserted here so the title page appears on the right hand side in double-sided printing.

Development of conservation criteria for Brigalow Belt South bioregion

Resource and Conservation Division,
Planning New South Wales

Project WRA-36 undertaken for the Western Regional Assessment
within the New South Wales part of the Brigalow Belt South bioregion.

Disclaimer

This project is a working document. It is the result of workshops, research and expert review over a relatively short period. The conservation criteria presented in this report are not the final word, but rather serve as a starting point for further development and application in the western regional assessments.

While every reasonable effort has been made to ensure that this document is correct at the time of printing, the State of New South Wales, its agents and employees, do not assume any responsibility and shall have no liability, consequential or otherwise, of any kind, arising from the use of or reliance on any of the information contained in this document.

CONTENTS

Appendices

Tables

Charts

Maps

SUMMARY

The biophysical circumstances in the Brigalow Belt South Bioregion (BBSB) are such that real conservation gains depend heavily on a landscape approach, restoring the condition and expanding the extent of native ecosystems, and rehabilitating landscape function.

The magnitude of this challenge would require many years to address. The relatively small proportion of public land further limits the ability to generate a comprehensive, adequate and representative reserve system from the Crown-managed land, and the contribution it could make to improving conservation outcomes.

Project Objectives

This project sought to develop criteria and measuring/reporting that could be used to provide for conservation of natural values across the landscape through land management decision-making over time, and more immediately, for consideration of management options for public lands.

The project was largely based on expert opinion and responses on proposals from stakeholder technical representatives and agency personnel. However, the time available was short, and the depth of consultation and debate was constrained.

Key results and Products

The project provided geomorphic units, management priority classification, tenure grouping, a broad taxonomic classification, and certainty of conservation management classification.

Twenty six criteria under ten primary/sub-primary values were proposed. Of these, fourteen were implemented for options and recommendations deliberations. The criteria implemented covered six of the proposed ten conservation values.

The table on the next page summarises the status of the criteria proposed by this project. Each criterion is presented separately, and each primary value is presented separately. No lumping of criteria occurs, and no weightings are applied.

The reporting has been specified. The criteria are measurable parameters that quantify key elements of the primary values they fall under. They are not additive, nor comprehensive. They simply provide a quantified and objective relative measure. The data for each criterion is consolidated to encapsulate the criterion outcome at landscape or bioregional scale, and is reported for the value it falls under.

Recommendations in this report include the need to task competent processes and institutional arrangements to apply the criteria over time, to refine them, and to undertake monitoring. Monitoring is fundamental to the effective use of these criteria for contributing to improved conservation of biodiversity and cultural heritage in the bioregion.

With coverage limited to the Crown-managed land for many implemented criteria, incomplete data sets, and much of the data being coarse or strategic reliability, the implemented criteria are likely to understate results. The report considers that the criteria implemented all appear unsuitable as a basis for setting and pursuing firm landscape-scale or bioregion-wide targets. The criteria implemented do appear suitable for strategic application such as indicative or contextual use in guiding deliberations, as was the aim of this project. This conclusion is based on subjective consideration of the degree to which the coverage and reliability relate to the intended usage in the deliberations.

The concept and methodology appear sound and are appropriate for further development.

Table Sa Status of criteria proposed by this project

Value code	Criterion code	Short name	Coverage	Character	Use	Available but culturally sensitive	Available but not priority for agency	Lacks data, needs development
		Criteria				**Implemented**		**Not implemented**
A	a	Native veg extent	Bioregion	Strategic	Context			
	b	Native veg condition						#
	c	Native veg distinctiveness						#
B	a	Aboriginal responsibility (broad)	Crown areas	Reliable	Context			
	b	Aboriginal influence (broad)	Crown areas	Reliable	Context			
	c	Cultural plants				#		
C1	a	River health						#
	b	Surface water						#
	c	Groundwater					#	
	d	Energy / nutrient						#
C2	a	Connectivity / patches	Bioregion	Strategic	Context			
	b	Successional change						#
C3	a	Management priority	Bioregion	Surrogate	Context			
C4	a	Veg groups (general)	Crown areas	Strategic	C-plan I			
	b	Veg groups (vulnerable)	Crown areas	Strategic	C-plan I			
	c	Veg groups (rare & endangered)	Crown areas	Strategic	C-plan I			
	d	Habitat of particular quality	Crown areas	Coarse	C-plan G			
	e	Late mature						#
	f	Wilderness	Crown areas	Reliable **	C-plan I			
	g	Cultural heritage sites	Crown areas	Reliable ** [1]	Context			
C5	a	Exotics						#
D	a	Aboriginal responsibility (places)	Crown areas	Reliable	Context			
	b	Aboriginal influence (places)	Crown areas	Reliable	Context			
	c	Geomorphic mapping	Pilliga/Goonoo	Reliable [2]	Context			
F	a	State of knowledge					#	
F	a	Ecosystem vulnerability						#
10		26		14		1	2	9

** data sets are incomplete, and reliability applies only to the data available.

[1] Aboriginal sites were excluded due to potential cultural sensitivity.

[2] Nature / use of the data will not be known until presentation of the Aboriginal Cultural Heritage project report.

Character: subjective evaluation based on input data sets.

Reliable: relatively reliable for the stated coverage.

Context: informs the participants in the deliberations, but does not drive any software outputs.

C-plan G: has a broad guideline (maximise) that could be used in C-plan to derive the irreplacability index.

C-plan I: has a numeric indicator that is used in C-plan to derive the irreplacability index.

1. INTRODUCTION

1.1   AIM

This project was established under the Western Regional Assessment covering the NSW part of the Brigalow Belt South bioregion. A key outcome from previous Comprehensive Regional Assessments in NSW has been a "decision" about management of "Crown-managed land" (being a number of Crown tenures, excluding lands managed under trust or under continuing lease). One of the key drivers was delivery of a reserve system, guided by targets for a range of "conservation criteria" (see definitions).

The biophysical circumstances in the Brigalow Belt South bioregion are such that real conservation gains depend heavily on a landscape approach, restoring the condition and expanding the extent of native ecosystems, and rehabilitating landscape function. The magnitude of this challenge will require many years to address. The relatively small proportion of public land further limits the ability to generate a comprehensive, adequate and representative reserve system from the Crown-managed land, and the contribution it could make to improving conservation outcomes.

Rather than delivering a conservation solution, an early decision regarding the management Crown-managed land in this bioregion can only set a platform. From this, other processes might pursue conservation objectives across the landscape over time, particularly with voluntary options for private land that integrate with the management of the Crown-managed land.

Conservation goals that can be achieved over time, using innovative approaches to conservation management on public and private land, are needed for the New South Wales part of the bioregion. These will only be effective if underpinned with a sound structure for monitoring and reporting progress over time.

This project aims to develop criteria and measuring/reporting that can be used to provide for conservation of natural values across the landscape through land management decision-making. One of the more immediate uses of the outputs will be the impending consideration of management options for the lands directly managed by government agencies, such as National Park and State forest.

1.2   OBJECTIVES

The broad objectives defined for the project were:

1. establish conservation criteria which determine the relative conservation value of, and/or conditions which allow the persistence of, biodiversity, natural and cultural heritage values across the landscape in perpetuity;

2. determine how these should be applied in the bioregion, with goals as appropriate to protect the conservation values

3. provide data on criteria and goals as inputs to integration software for the deliberations.

To guide pursuit of these objectives, the project approval specified the following approach:

i) identify those conservation values which are important for protection in the bioregion;

ii) identify the desired objectives with respect to those values;

iii) develop indicators for those objectives;

iv) develop a strategy for protecting those values in the bioregion over time, which will include innovative approaches to conservation management on public and private land;

v) develop a monitoring program with appropriate indicators showing the improvement in management and protection of conservation values over time; and

vi) structure the analysis of conservation values for ready comparison with economic and social values.

1.3   BACKGROUND

Conservation is the process of maintaining environmental quality and resources (see definitions). Conservation value is the measure of the role the land plays in ensuring persistence of biodiversity, natural and cultural heritage. Social and economic considerations will be provided by other projects.

1.3.1   Societal Goal

Humans are part of the environment, and must use the natural resources to survive. Society seeks to use and manage the resources so that future generations will have the same range of resources. The Australian natural heritage charter also recognises that all living organisms, earth processes and ecosystems may have value beyond the social, economic or cultural values held by humans. The present generation should therefore ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations (Australian Committee for IUCN, 1996).

1.3.2   Context

The New South Wales part of the Brigalow Belt South bioregion is highly affected by past land clearing and current land management regimes. The extent and condition of the remaining native vegetation appears well below that required to sustain much of the inherent biodiversity, such that prompt broad-scale action is called for to limit further biodiversity decline (Smith and Sivertsen, *in prep*). There are several considerations flowing from this that are crucial for meaningful conservation outcomes:

1. To support persistence of biodiversity within the bioregion, production and conservation must co-exist over substantial areas across the landscape. The majority of the landscape is and will continue to be used for agricultural production. Even putting all extant native vegetation under conservation management and into reserves will not ensure long-term persistence in the landscape. The "reserve system" must be complemented by substantial off-reserve management that together supports conservation of ecosystems and ecological processes (terrestrial and aquatic) at landscape scale. [Archer, 2000; Bennett, 1999; McIntyre et al, 1992; Pressey and Logan, 1992]

2. Aboriginal cultural identity and heritage is intrinsically linked with the natural environment. The land itself is deeply significant, and impacts to it disturb the cultural relationship to the land. Natural resources are important to Aboriginal people, and derive from the land. Persistence and utilisation of the natural resources left in the bioregion are important to Aboriginal people trying to maintain cultural identity. Sensitive incorporation of values and criteria for cultural heritage as it relates to the natural environment, including culturally significant natural resources (eg fauna for hunting, plants for bush medicine / bush tucker, ceremonial elements), and archaeological / historical places needs particular attention.

3. Some large-scale changes with major implications for ecosystems and ecological processes, postulated (eg climate change) and demonstrated (eg salinity), have potential to significantly affect this landscape. Conservation strategies must engender a landscape with scope for species to respond (to the extent they can) to such potential changes, through a framework for landscape rehabilitation to slow those changes and, ideally, their reversal.

1.3.3   Community and agency expectations

Many stakeholders participating in this regional assessment expect this and other projects will empower them to effectively pursue their aspirations (environmental, social and economic). One specific application of this will be equitable recognition of the values they or other interests hold during the impending deliberations regarding management options for land managed by the Crown. The quantification of values and criteria must be objective and relevant to this need.

Equally there appears a desire amongst many stakeholders that the project define parameters to guide prioritisation of conservation initiatives, and initiate monitoring and reporting of progress with those initiatives through time. The deliberations and ensuing government decisions over land managed by the Crown only set a platform to work from, with substantial further conservation initiatives across the landscape required over many years. The criteria ideally should be independent of tenure and time, covering the landscape and encompassing all ecosystems.

1.3.4   Strategy for improving conservation through this regional assessment

Actual strategic planning in pursuit of landscape-scale conservation objectives is beyond the scope of the current regional assessment. The assessment seeks to provide subsequent processes (such as Catchment Management Boards, Native Vegetation Management Committees, or others as may be instituted) with things that help them to do this. This project aims to contribute to this through providing a range of criteria that can be measured and which allow objective evaluation of relevant environmental values nominated for conservation. This has three primary purposes[1]:

- To expose the effect on the conservation values under various management options, in simple terms. This will be particularly helpful during the impending deliberations regarding management of land managed by the Crown.

- To stimulate monitoring and reporting of the change over time for each value in a repeatable, cost-effective way. This will help the community assess the effectiveness of conservation initiatives.

- To enable ready comparison of outcomes for environmental, economic and social values. This will provide scope for equitable, transparent deliberations and for balanced discussion and decisions.

The strategy assumed by this project for achieving these purposes is:

1. <u>Nominate values and criteria</u>

– Nominate the primary conservation values and objectives for the natural environment and related cultural heritage.

– Consider criteria that will underpin these values and objectives. Of particular interest as a starting point are criteria from pertinent current policy statements, and that are relevant to this bioregion's biophysical and social circumstances.

– Recognise the relevant data that is anticipated to be available for the proposed deliberations about Crown-managed land, in a state suitable for input into C-plan (which has been agreed as the analysis system for the deliberations). [C-plan is explained in the definitions]

2. <u>Measuring and reporting criteria</u>

– Define how to measure and report each criteria and how to appraise and report each value.

– Limit development effort within the broad set of criteria to those that can be implemented for the deliberations.

– C-plan use numeric indicators to calculate an index of importance ("irreplacability") of each "planning unit" for satisfying a set of criteria. Define the index or indexes to be calculated. Choose the set of criteria for each index, then recommend a numeric indicator for each of those

---

[1] Derived from the changed emphasis (of the project) submission approved by RACAC

criteria, being a nominal representation of what might be useful to optimise conservation through the deliberations. For each other criteria, recommend an objective (eg "maximise", "minimise") and how to enable it to pursue conservation improvement during the deliberations.

3. <u>Use this to assist participants during the deliberations</u>

– Run each option tabled during the deliberations through C-plan. Report the effects on each broad value, and underpin this with data for each criterion. Participants can use this information to optimise environmental, social and economic outcomes in arriving at a recommendation.

– Non-GIS data could be used in tandem with the criteria/values reporting outputs during the deliberations for context and subjective considerations.

4. <u>Report the outcomes of the deliberations and government decisions</u>

– Run the outcomes from the recommendations to government delivered by the deliberations. Report (table and map) outcomes they deliver for conservation values.

– Run the outcomes from the package of decisions made by government. Report (table and map) the implications that it delivers for conservation values.

5. <u>Implementation</u>

The Assessment to make appropriate recommendations to government. Indicative examples are

– Adopt the approach herein to aid prioritisation of effort and funding for initiatives, as it provides an objective relative valuation of improvement in conservation outcomes per dollar of funding for different options. [this is useful provided that the options focus on sites that are responsive to management and are vulnerable if not addressed].

– Task (with adequate powers and resourcing) competent processes to develop and implement business and management strategies to promulgate stakeholder/landowner participation in their conservation strategies, in partnership with government seed funding and support as is available.

6. <u>Monitor, report, review, refine</u>

The Assessment to make appropriate recommendations to government. Indicative examples are

– Task competent processes with coordinating:

➢ Monitoring and research to define ecological thresholds and improve the capacity to manage ecosystems to improve ability to deliver specified conservation outcomes.

➢ 5-yearly revisions of the data and running analyses to produce a report for government and the community that assesses improvement in the conservation values and feeds into refinement of the conservation strategies.

– That geo-spatial criteria are advantageous because they are amenable to analysis using any boundaries and so meet the needs of a variety of diverse users. Data archived now can subsequently be processed to generate historical comparisons. Output from bioregional assessment (lacking institutional structures) can be taken up through institutional frameworks (eg catchments, local government).

1.4   METHOD AND RESULTS

The project commenced during April, with release of draft criteria set for early June and the final report due by 31st July. The depth of investigation and level of consultation possible related to this timeframe. The central requirement was to develop a sound framework for conservation at landscape scale, with key aspects to be refined as much as possible within the available time.

A discussion paper was prepared and circulated to a range of experts and to the stakeholder technical representatives for comment. Responses were collated. See appendix 1.1 for the briefing

notes and the responses report. Most suggestions of a minor nature and were incorporated in a revision of the discussion paper. The revised paper and the remaining comments were considered at an expert workshop. See appendix 1.2 for the briefing notes and workshop report. Draft criteria based on the expert workshop were circulated to experts and stakeholder technical representatives for comment. A draft report was prepared developing the draft criteria in light of the responses and the available data. The draft was released in time for consideration leading up to the deliberations. This final report incorporated data obtained after the draft and response to it.

A key consideration for the workshop was the short time frame. The workshop developed a framework for the criteria, and focussed on criteria that could potentially be implemented in the subsequent few months. Chapter 2 presents an overview of the primary conservation values, conservation objectives and conservation criteria that emerged. Chapter 3 presents a discussion of each criterion. Many criteria could not be implemented for immediate use during the deliberations for the options development and recommendations phase of the regional assessment. Each criterion was considered and only those that were likely to be enabled in time were pursued. Some that were explored had to be abandoned as time ran out. The base data sets that were employed or developed are discussed in chapter 4. The criteria that were implemented are discussed in chapter 5. The proposed reporting is detailed in chapter 6.

Of the 26 criteria proposed by the expert workshop, 14 have been implemented, though some are coarse and many are limited to Crown-managed land. Of the 12 not implemented for the impending deliberations, 1 had data available but was regarded as culturally sensitive, 2 probably had data available but agency resources were not available to extract and process the data they held, and the remaining 9 need further development.

Considerations relating to Aboriginal environmental values were pursued through liaison with Aboriginal community representatives, Western Regional Assessment Cultural Heritage project manager and Aboriginal consultation staff, and relevant agency staff, including the New South Wales Heritage Office. [Note – material herein relating to Aboriginal community interests is at a preliminary stage needing further consultation and development. It is presented herein as indicative only, so the sense of the overall framework can be demonstrated.]

Whilst prepared for broad consumption, this report is partly a technical document. It attempts to draw a balance between these two roles. It covers a range of technical matters and in places uses terms that, though common among practitioners, may not be as well understood within the community at large. The report also uses terms that, whilst in fairly common usage, may mean different things to different people, or be imprecisely understood, or have a range of usage and interpretation. It may benefit the reader to peruse the Definitions (chapter 8) prior to embarking on study of the report.

This blank page has been inserted here so the next section
appears on the right hand side in double-sided printing.

2. IDENTIFYING VALUES, OBJECTIVES, CRITERIA

2.1   PRIMARY CONSERVATION VALUES

The primary components of the environment are air, soil, rock, water and biota. A fundamental community aspiration is long-term maintenance of the quality of the physical elements, and the diversity of the biological elements – the biodiversity. Considerations directed at conserving biodiversity seem to naturally group into categories with their own particular focus and indications. These categories are viewed as an expression of underlying primary conservation values, and provide a mechanism for grouping, evaluating, and reporting on, the breadth of individual conservation values and issues within the community.

Experts engaged to develop conservation criteria devised the following categories as the "primary conservation values".

A. The extent, condition and distinctiveness of native vegetation.

B. Natural cultural heritage - cultural heritage as it relates to the natural environment, including natural resources culturally significant to Aboriginal communities (eg fauna for hunting, plants for bush medicine / bush tucker, ceremonial elements).

C. Landscape function and sustainability

- Landscape process

- Landscape pattern

- Management practices

- Certainty that conservation management will apply and persist

- Impact of exotic species

D. Historical / archaeological places that are within "natural" environments and that are subject to degradation through natural processes or whose character is tied to the surrounding land.

E. The security of species, particularly those known to be facing extinction.

F. Vulnerability of ecosystems.

Under this approach, conservation issues arise as particular circumstances interact with the primary values. Thus woodland birds are an issue because they are facing extinction (the community doesn't wish any species to go extinct) and their fate indicates a breakdown in landscape function (the community appears concerned that the landscape cannot sustain existing organisms).

2.2   CONSERVATION OBJECTIVES

The project vision is "*the persistence of biodiversity, natural and cultural heritage values across the landscape*". A broad goal might then be to support ecosystem processes and landscape functionality. The following are nominated as appropriate objectives directed at that vision. These provide context for devising criteria under each primary value.

1. To manage areas of predominantly native vegetation in an ecologically sustainable manner, restoring and maintaining key ecological processes and cultural components.

2. To improve habitat quality of areas of predominantly native vegetation at patch scale (eg improve the condition of degraded areas, expand the size of small areas).

3. To restore healthy landscape function through a mosaic of habitat opportunities (at appropriate physical and time scales), functional linkages across the landscape, and reinvigorate disrupted landscape processes (fire, flooding, major watertable change, water quality, and river flows).

4. To promulgate specific management regimes over areas of particular conservation significance:

   - Places of cultural/historical significance

   - Areas critical for species/communities/systems at risk of extinction

   - Areas important to the landscape conservation framework[2].

5. To develop and secure the persistence of management regimes that sustain the conservation values, particularly over areas that make a key contribution to delivering those values.

6. To pursue specific strategies to address broad scale threats posed by a range of changing environmental conditions. The most significant of these are rising groundwater leading to salinisation of soils and shallow aquifers, competition and predation from introduced species.

7. To maintain a process of monitoring and reporting, review and refinement to underpin achieving these objectives.

2.3 CONSERVATION CRITERIA

Within the primary conservation values framework, the following criteria were recommended [through an expert workshop and (for B. and D.) Aboriginal representatives] for determining the relative conservation value and/or conditions which allow the persistence of biodiversity, natural and cultural heritage values across the landscape in this bioregion. They are discussed in more detail in chapter 3 of this report.

A. <u>Extent, condition and distinctiveness of native vegetation</u>

(a) Extent: The amount of existing native vegetation in relation to its predicted potential distribution, by vegetation grouping and geomorphic/environmental unit.

(b) Condition: The amount of existing native vegetation, in condition class by vegetation grouping and geomorphic/environmental unit. (base classes on ecological benchmarks (floristics, structure) and restorability classification

(c) Distinctiveness: The amount of existing native vegetation in each distinctiveness class, by geomorphic/environmental unit.

B. <u>Natural cultural heritage</u> *(indicative only)*

(a) The Aboriginal community having direct responsibility (sole, or through formal cooperative agreement) for management and maintenance of the features of cultural significance within cultural landscape areas.

(b) The Aboriginal community having direct influence (sole responsibility, or by formal cooperative arrangement) over management of the culturally significant elements of the natural environment, and access to use these natural resources only in their community.

(c) The number of culturally significant plant species in the region, and the area covered by predictive models for each species or group of similar species

C. <u>Landscape function and sustainability</u>

– *C 1 Landscape process*

---

[2] The Bioregional Landscape Conservation Framework project will evaluate broad level of importance for each planning unit, and may present this as a "grey-scale" map.

(a) River Health: Proportion of rivers and streams in good condition and free from artificial barriers

(b) Surface Water: criteria to evaluate implications relating to surface water and related soil loss/gain are needed. Lack of relevant data precludes giving specific criteria here.

(c) Groundwater change: areas with high probability of becoming saline, by geomorphic / environmental unit and vegetation grouping

(d) Energy and nutrient flows: criteria for measuring energy and nutrient flows in the landscape are critical. Lack of data precludes giving specific criteria here.

– *C 2 Landscape pattern*

(a) Connectivity and patch characteristics (size, patchiness)

(b) Successional stages (spatial/temporal matrix): Evaluation of implications regarding successional process and related spatial/temporal matrix is needed. Lack of data precludes defining specific criteria here.

– *C 3 Management practices*

(a) Management priority: land management priorities across the bioregion provide a balanced focus for production and conservation

– *C 4 Certainty that conservation management will apply and persist*

  ▪ General cross-section of ecosystems

(a) Vegetation groupings: area of each in secure conservation management, other than the veg groupings in Rare and endangered or Vulnerable below.

  ▪ Especially rare elements

(b) Vulnerable vegetation groupings: area in secure conservation management, other than the veg groupings in Rare and endangered below.

(c) Rare and endangered vegetation groupings: area in secure conservation management

(d) Habitat of particular quality (being natural refugia, centres of endemism or offering a particularly beneficial range of key habitat resources) for "at risk" species with special needs[3]: area of each in secure conservation management.

  ▪ Especially sensitive elements

(e) Late mature growth stage: area in secure conservation management

(f) Wilderness: area of areas each at least 8000ha of National Wilderness Inventory index (NWI – see Lesslie and Maslen 1995) 12 or more in secure conservation management

  ▪ Cultural Heritage

(g) Number of cultural heritage sites within areas under conservation management

– *C 5 Impact of exotic species*

(a) Impact of exotics: criteria to evaluate implications relating to impact of exotics =needed. Lack of relevant data precludes defining specific criteria here.

D. Cultural historical places *(indicative only)*

(a) Area within which the Aboriginal community has responsibility (sole, or through formal cooperative agreement) for management of the Aboriginal culturally significant places therein.

(b) Area within which community interest groups have direct influence over management of places they hold as culturally significant.

---

[3] Rare/endangered species, groups of organisms with complex habitat requirements, migratory or mobile species, species with requirements not well correlated with vegetation groupings

(c) Area covered by geomorphological mapping

E.   <u>The security of species, particular those known to be facing extinction</u>

(a) The state of knowledge regarding the security of individual species

F.   <u>Vulnerability of ecosystems</u>

   (a) Vulnerability of ecosystems to further degradation

2.4   DISCUSSION

This set of primary conservation values and criteria may at first glance seem in some ways a little complex and in other ways a little general, depending on the scale under consideration. To engender conservation management over priority areas a suite of business opportunities and management options that would appeal to land managers is needed. To achieve on-ground improvement in biodiversity conservation, a mechanism to define and prioritise strategic action within individual landscapes is needed (a local scale). However this would need to be supported at a regional scale to enhance attraction of significant funding, engender co-ordination, and achieve sufficient momentum to keep going for the long term. The values and criteria have been structured to provide a comprehensive framework to allow those targeted approaches to operate within, and to facilitate consistent reporting of progress that is relevant at landscape scale and can be consolidated to regional and State scale. They go beyond reserve considerations so as to cover the range of conservation values and objectives. They provide context to aid prioritisation of funding and action, and coverage to report conservation outcomes appropriate for the range of conservation interest within the community.

The criteria are not intended to measure every facet of conservation policy, strategy or action. They are simply indicators to provide a relative measure of each primary/sub-primary conservation value, in the context of the broad conservation objectives. They are not comprehensive, and simply feed the monitoring and reporting of the values.

One consideration that is not incorporated for the immediate application of the criteria is reporting the rate of change. Rate of change is a very important consideration for reporting and for targeting actions and funding. However there is no baseline yet, and for the initial implementation the reporting can only cover the immediate outcomes.

To reap the benefits of the proposed framework, its application should be consistent with institutional arrangements. For example, there would be improved synergy if applying the criteria across the area covered by say a Catchment Management Committee or a Native Vegetation Management Committee. Current application across only the bioregion aligns with no institutional structures.

The first application will be the impending deliberations over management of Crown-managed land.

3. CONSERVATION CRITERIA

A summary of the following details for each criterion is presented in Appendix 3.2

3.1   VALUE A. EXTENT, CONDITION AND DISTINCTIVENESS OF NATIVE VEGETATION

Discussion

Much of the biota remains undescribed. The interaction of organisms in supporting ecosystem function is poorly understood. Thus little is known about biodiversity. It follows that conserving biodiversity is not clearly defined and active adaptive management appears the most appropriate response (Walker, 1998).

Vegetation is an indication of biophysical circumstances, a reflection of management, and a clue to the capacity of an area to support species (including those that are mobile, cryptic, or very small), at least to the extent of our knowledge. Hence vegetation is a key issue, and is seen as a surrogate for maintaining biodiversity. It provides many of the habitat components for vertebrate fauna and wildlife management is strongly linked with the ecosystem and therefore the vegetation. Vegetation is also suited to monitoring through remote sensing.

The distribution of native vegetation in the landscape should be based on more than simply the geographic extent. Ideally it would be identified by landscape units based on geomorphology or other environmental domains so as to get an indication of the relationship between groups in the landscape. This also captures genetic variability of the flora, as well as the likely differences in other species such as invertebrates, micro-organisms and cryptogams. It would for example inform efforts to limit "trade-offs between hilltops and valley floors" (from expert workshop).

3.1.1   Criterion (a) Extent: The amount of existing native vegetation in relation to its predicted potential distribution, by vegetation grouping and geomorphic/environmental unit.

Considerations

Given the extent of clearing evident in the bioregion, consideration of criteria under this primary value is best done in light of a starting point for comparison.

- Simply measuring change in extent of the current vegetation groupings from now in isolation was rejected because clearing has been highly biased to particular vegetation groupings, and also that the value of currently extensive vegetation groupings may be underrated.

- Using a map "pre-1750" extent of native vegetation is rejected because it implies knowledge which does not exist, and the inferred comparison between pre European settlement and present is not appropriate for current management of biodiversity conservation.

- Comparison with a map of potential vegetation predicted from relationships between existing vegetation and soil and other physical environmental variables is helpful, and seems essential for adequate assessment of existing vegetation.

It has been proposed that at regional scale, there appears to be thresholds of biodiversity decline when 10%, 30% and 70% of the landscape is cleared.

Goals

The persistence of each vegetation grouping is sought. Within this bioregion any proposed further loss or degradation of native vegetation should be carefully considered before it is undertaken. Particular care should be extended to vegetation groupings that are very limited in extent, or limited in extent and subject to threatening processes, or subject to significant threatening processes likely to reduce the extent to being very limited. Application of this general aim must have regard for specific circumstances. For the purposes of the impending deliberations, some specific goals are nominated under the certainty of conservation management.

Data

- Existing native vegetation (by grouping). Source: this is being derived by the vegetation mapping project.

- Predicted potential distribution of native vegetation (by grouping). This is being derived by the vegetation mapping project.

- Geomorphic / environmental units. Source: a geomorphic units layer has been generated.

Measuring and reporting

Measuring will be:

- Existing vegetation: area by vegetation group and geomorphic unit.

- Predicted vegetation: area by vegetation group and geomorphic unit.

Reporting will be:

- Existing vegetation: area, and areal % of predicted, by vegetation group and geomorphic unit

- Existing vegetation: areal % by coverage class and geomorphic unit. For coverage class use say 0 to <10%, 10 to <30%, 30 to <70%, 70 to 100%.

Use in deliberations

The extent and potential extent of vegetation communities is a fundamental element for the deliberations. Spatial layers will be loaded into the integration software for it to use when processing the options.

Interaction with the bioregional landscape framework project

The data may help identify areas for potential restoration for each vegetation group.

Further development

The main aspect needing further development is derivation of geomorphic units at a suitable scale, unless the newly derived layer proves suitable for longer-term use. One refinement that warrants exploration is the incorporation of salient geomorphic features as a further level of detail using geomorphological process data. For example, this would aid differentiation between a level plain that is also a swamp, and a level plain of stagnant alluvium. However, development must be mindful of the use of the reporting and should adopt appropriate scales.

3.1.2 Criterion (b) Condition: The amount of existing native vegetation in condition class by veg grouping and geomorphic /environmental unit.

Considerations

The extent of types of vegetation on its own is inadequate for developing strategic conservation actions, prioritising funding or reporting conservation outcomes. The condition of the vegetation and its spatial distribution is a crucial consideration. However there is no current or proposed data set that assesses condition.

Condition is a concept incorporating structure and composition, and how these relate to the functioning of the particular vegetation type. Condition has strong implications for the capacity for the area to be "restored". Each vegetation type is potentially different, and ecological benchmarks are needed for each to provide something to compare current condition to. The benchmarks should be based on structure and floristics, with a restorability classification embedded.

Tenure may be a surrogate giving a coarse indication of condition. However, not all management intervention or resource utilisation necessarily leads to degradation of condition. Condition may be highly variable in any tenure, and thus tenure alone would be misleading.

Goals

No goals are proposed here. These would be explored as part of the further development.

Data

- Existing native vegetation (by grouping). Source: this is being derived by the vegetation mapping project

- Ecological benchmarks, restorability classification, condition assessment. Unavailable.

- Geomorphic units. Source: A geomorphic units layer has been generated.

Measuring and reporting

Measuring will be:

- Existing vegetation: area in condition classes by vegetation group and geomorphic unit.

Reporting will be:

- Existing vegetation: area, and areal % of existing, in condition classes by vegetation group and geomorphic unit.

Use in deliberations

Will not be available for use during the deliberations. The tenure layer would provide little benefit to the deliberations as a surrogate for condition because it would provide little differentiation for the Crown-managed lands.

Interaction with the bioregional landscape framework project

Will not be available for that project.

Further development

It is critical that ecological benchmarks, restorability classification, condition assessment be developed as soon as possible, for further regional assessments and continuing conservation efforts. This would require having experts specify benchmarks and restorability classification for each vegetation group, and collection and analysis of appropriate data.

3.1.3   Criterion (c) Distinctiveness: The amount of existing native vegetation in each distinctiveness class, by geomorphic/environmental unit.

Considerations

The distinctiveness of native vegetation groupings is an expression of the dissimilarity of each vegetation grouping. A less distinctive vegetation grouping is less likely to have special habitat features, or to reflect special conditions, than one that is more distinctive, because other vegetation groupings are more similar to the less distinctive grouping. It is an important consideration because it allows weighting of each vegetation community in terms of its potential inherent conservation importance.

Goals

This is simply a rating of the vegetation groupings, so a goal is not appropriate.

Data

- Existing native vegetation (by grouping). Source: this is being derived by the vegetation mapping project

- Geomorphic units. Source: A geomorphic units layer has been generated.

- Vegetation grouping distinctiveness index. This is unavailable. An index could be derived from the vegetation groupings and related floristics data from the regional assessment projects, but its veracity would be subject to the limitations of that data.

Measuring and reporting

Measuring will be:

- Distinctiveness rating for each vegetation grouping

Reporting will be:

- Distinctiveness rating for each vegetation grouping

- Existing vegetation: Area in distinctiveness class by geomorphic unit

Use in deliberations

Finalisation of a distinctiveness index and subsequent weightings for each vegetation grouping could not be achieved in time for incorporation into the integration software, and was not pursued. This criterion will not be used for the deliberations.

Interaction with the bioregional landscape framework project

Will not be available for that project.

Further development

It is critical that a distinctiveness index and classes, and subsequent weightings for each vegetation grouping be developed as soon as possible, for further regional assessments and continuing conservation efforts. This could be done through expert discussion and analysis.

3.2   VALUE B. NATURAL CULTURAL HERITAGE

Discussion

Cultural heritage as it relates to the natural environment applies potentially to all cultures. For example, Parramatta Park in Sydney is recognised as a cultural landscape of national significance (NSW National Parks and Wildlife Service, 2000(1)).

Aboriginal cultural identity and heritage is intrinsically linked with the natural environment. The land itself is deeply significant. Persistence and utilisation of the natural resources in the bioregion are important to Aboriginal people trying to maintain cultural identity. The value is not in simply knowing that the resources are being conserved, it is in integrating that conservation with their cultural pursuits. Aboriginal people also have a cultural knowledge about managing and conserving those resources. The following criteria attempt to measure that involvement. Non-Aboriginal natural cultural heritage was not incorporated for this value, and should be explored with experts.

The following report areas under responsibility or influence. Reporting of areas of interest but where responsibility or influence does not yet exist might be useful, however this could be very sensitive information, and would only be proposed if the Aboriginal community sought it.

3.2.1   Criterion (a) The Aboriginal community having direct responsibility (sole, or through formal co-operative agreement) for management and maintenance of the features of cultural significance within cultural landscape areas.

Considerations

This is criterion is presented as indicative for further consultation with Aboriginal people. This criterion embodies, within the concept of responsibility to manage, access for the Aboriginal community to use the resources being managed, though only in their community. Legal obligations, such as licencing and approvals, pertaining to such use would remain in place.

Goals

(Indicative for further consultation)

Data

- Area covered by sole management by the Aboriginal community or by relevant formal co-operative agreements.

Measuring and reporting

Measuring will be:

- Area covered by sole management by the Aboriginal community or by relevant formal co-operative agreements. (Indicative for further consultation)

Reporting will be:

- Area covered by sole management by the Aboriginal community or by relevant formal co-operative agreements. (Indicative for further consultation)

Use in deliberations

This is criterion is presented as indicative for further consultation with Aboriginal people. As it stands it could be used to inform Aboriginal people during the deliberations.

Interaction with the bioregional landscape framework project

For discussion with Aboriginal people.

Further development

For discussion with Aboriginal people.

3.2.2   Criterion (b) The Aboriginal community having direct influence (sole responsibility, or by formal co-operative arrangement) over management of the culturally significant elements of the natural environment, and access to use these natural resources only in their community.

Considerations

This is criterion is presented as indicative for further consultation with Aboriginal people.

Goals

(Indicative for further consultation)

Data

- Area covered by sole responsibility by the Aboriginal community or by relevant formal co-operative agreements.

Measuring and reporting

Measuring will be:

- Area covered by sole responsibility by the Aboriginal community or by relevant formal co-operative agreements. (Indicative for further consultation)

Reporting will be:

- Area covered by sole responsibility by the Aboriginal community or by relevant formal co-operative agreements. (Indicative for further consultation)

Use in deliberations

This is criterion is presented as indicative for further consultation with Aboriginal people. As it stands it could be used to inform Aboriginal people during the deliberations.

Interaction with the bioregional landscape framework project

For discussion with Aboriginal people.

Further development

For discussion with Aboriginal people.

3.2.3   Criterion(c) The number of culturally significant plant species in the region, and the area covered by predictive models for each species or group of similar species

Considerations

This is criterion is presented as indicative for further consultation with Aboriginal people. It is assumed that any cultural sensitivity will relate to the cultural use of the plants. The botanical and common names of the species may be sensitive to the extent that it may draw attention to their cultural association. This may lead people outside the Aboriginal community dealing with those species in ways regarded as inappropriate by the Aboriginal community. However, the number of such species is unlikely to be held as sensitive.

Goals

(Indicative for further consultation)

Data

- The number of culturally significant plants in the region. It is anticipated that this list will be possible through the Aboriginal Cultural Heritage project.

- The area covered by predictive models for each species or group of similar species. Relevant models are not anticipated in the immediate future.

Measuring and reporting

Measuring will be:

- The number of culturally significant plants in the region. (Indicative for further consultation)

- The area covered by predictive models for each species or group of similar species. (Indicative for further consultation)

Reporting will be:

- The number of culturally significant plants in the region. (Indicative for further consultation)

- The area covered by predictive models for each species or group of similar species. (Indicative for further consultation)

Use in deliberations

Consultation regarding the criteria relating to Aboriginal cultural heritage was insufficiently advanced to countenance inclusion of this criterion for the deliberations, even as indicative only. This is because the issue is potentially culturally sensitive, and should only be pursued after full consultation.

Interaction with the bioregional landscape framework project

Not available for that project.

Further development

For discussion with Aboriginal people.

3.3   VALUE C. LANDSCAPE FUNCTION AND SUSTAINABILITY

Discussion

Ecosystems are dynamic. For example, Kellas et al (1988) reports a change in species associated with high overwood densities following the establishment and development of the more shade-tolerant canopy species. It is the arrangement in space and time of the individual elements, such as vegetation structure and water flows, and the processes that support it, that afford the opportunity for long-term persistence of biodiversity. The capacity for genetic migration, propagule dispersal, species response to change are landscape issues. How the landscape functions now and into the future is fundamental to maintaining biodiversity.

Climatic features can be classed at three scales: global, regional, and microclimate. The regional scale includes albedo / energy, wind flux, rainfall regime, and temperature regime. The climatic features provide the overarching context, driving the hydrological/geomorphological, and photosynthesis/carbon cycle processes. These processes provide the reference and measurement for landscape scale processes, patterns in the landscape, management regimes and the impact of exotics.

3.3 (C1) Landscape process

3.3.1   Criterion (a) River Health: Proportion of rivers and streams in good condition and free from artificial barriers

Considerations

Aquatic systems are a significant component of biodiversity. The condition of rivers and streams is a broad reflection of how well they are functioning ecologically.

Goals

To be considered during development of this criterion.

Data

- River/stream condition. Availability uncertain. Likely sources of possible coarse level data include Wild Rivers and Stressed Rivers reports, NSW Fisheries work.

- Artificial barriers data. Availability not known. NSW Fisheries might hold data.

Measuring and reporting

Measuring will be:

- Length and proportion in each condition class and barrier class

Reporting will be:

- Length and proportion in each condition class and barrier class

Use in deliberations

Use in deliberations was not explored due to data uncertainties.

Interaction with the bioregional landscape framework project

Will not be available for that project.

Further development

Existing data might not be fully appropriate. Work with river, stream, and freshwater aquatic/wetland system experts and agencies (including NSW Fisheries) is suggested.

3.3.2   Criterion (b) Surface Water: criteria to evaluate implications relating to surface water and related soil loss/gain are needed.

Considerations

Surface water, run-off and infiltration are basic processes, and land management has the capacity to alter these at local and landscape scale. Criteria for evaluating this are vital to help sound management for conservation outcomes.

Goals

To be considered during development of this criterion.

Data

* Unknown. Coarse surrogates might include erosion hazard mapping, land capability (implied soil erosion potential), NSW groundwater-dependant ecosystems (draft) policy paper, sedimentation levels in rivers.

Measuring and reporting

Measuring will be considered during development of this criterion.

Reporting will be considered during development of this criterion.

Use in deliberations

Will not be available for use during the deliberations.

Interaction with the bioregional landscape framework project

Will not be available for that project.

Further development

This needs to be developed. Interactions between soil and its biota, water and vegetation should be explored to arrive at criteria that encapsulate this, with particular regard for reflecting land management implications and ecological ramifications. There is much data in the database supplied by the Soil Landscapes Reconnaissance Mapping project.

3.3.3   Criterion (c) Groundwater change: areas with high probability of becoming saline, by geomorphic / environmental unit and vegetation grouping

Considerations

Groundwater changes resulting from land management, including salinisation and waterlogging due to rising water tables, are recognised as serious issues at regional and landscape scale. Less publicised are implications for groundwater dependant ecosystems and recharge for the Great Artesian Basin and other aquifers. This criterion relates only to one specific aspect of groundwater change, however it has implications for the other aspects and seems to cover groundwater change.

Goals

Ideally, minimise the area of high risk of salinisation,

Data

- Existing native vegetation (by grouping). Source: this is being derived by the vegetation mapping project

- Geomorphic units. Source: A geomorphic units layer has been generated.

- Salinity risk mapping. A very coarse level mapping is available. Refined mapping is being explored by Department of Land and Water Conservation.

Measuring and reporting

Measuring will be:

- Areas of salinity risk by vegetation grouping and geomorphic unit

Reporting will be:

- Areas of salinity risk by vegetation grouping and geomorphic unit

Use in deliberations

Use for deliberations is not implemented. The data that is available is reported as being very coarse, and appears unsuitable for defining risk at sufficient scale to contribute to the impending deliberations. Its suitability for very coarse reporting was not investigated due to indications that Dept. Land and Water Conservation would provide a much better quality product for the bioregion before the end of July. Unfortunately other priorities overtook that work just prior to its finalisation, and there is no time left to implement an alternative.

Interaction with the bioregional landscape framework project

As a spatial layer it might contribute to identifying risk to areas of potential or existing vegetation, particularly useful for prioritising areas for revegetation or rehabilitation.

Further development

The emerging DLWC data should be assessed to see if it is adequate scale and sensitivity. A process for on-going updating would be needed to ensure currency.

3.3.4 Criterion (d) Energy and nutrient flows: criteria for measuring energy and nutrient flows in the landscape is critical.

Considerations

Energy and nutrient flows are basic processes, and land management has the capacity to alter these at local and landscape scale (see Ludwig et al, 1997). Criteria for evaluating this are vital to help sound management for conservation outcomes. Our understanding about relevant ecological processes is very preliminary.

Goals

To be considered during development of this criterion.

Data

- Unknown. Coarse surrogates might include erosion hazard mapping, land capability (implied soil erosion potential), NSW groundwater-dependant ecosystems (draft) policy paper, sedimentation levels in rivers.

Measuring and reporting

Measuring will be considered during development of this criterion.

Reporting will be considered during development of this criterion.

Use in deliberations

Will not be available for use during the deliberations.

Interaction with the bioregional landscape framework project

Will not be available for that project.

Further development

The lack of data, and preliminary nature of our understanding about relevant ecological processes, need to be addressed. Landscape assessment methods are in use and should be considered for adoption in conservation criteria implementation (Ludwig et al, 1997).

3.3 (C2) Landscape pattern

3.3.5   Criterion (a) Connectivity and patch characteristics (size, patchiness)

Considerations

The size and placement of vegetation across the landscape determines the capacity of species to survive, through influences on foraging, dispersal, ability to withstand change (transitory and permanent), ability to withstand competition and predation, genetic movement. Implications for biodiversity may take decades to emerge, as is the case with woodland birds. There appears to be a relationship between the level of clearing and the level of terrestrial biodiversity, with significant change in biodiversity when clearing exceeds 10%, 30% and 70% of the landscape (Smith and Sivertsen, *in prep*). These are linked with levels of connectivity and patch size, and implications of further clearing and priorities for rehabilitation should be strongly related to connectivity and patch characteristics. Walker (1998) observes that the animals in the thousands of remnant patches in the Western Australian wheat belt constitute meta-populations , few of which are likely to be in equilibrium. Optimising landscapes is a challenge because different species have different optima, requiring a practical approach in fragmented landscapes.

Goals

Goals might be possible at present for woodland birds. However there are many other functional groups of organisms the may have very different needs, and meaningful goals are not possible now.

Data

- Existing native vegetation (by grouping). Source: this is being derived by the vegetation mapping project

- Geomorphic units. Source: A geomorphic units layer has been generated.

- Relative habitat value (effective habitat area and projected species richness index) from the bioregional landscape framework project.

Measuring and reporting

Measuring will be:

- Patch size distribution by vegetation grouping and geomorphic unit

Reporting will be:

- Relative habitat value for the bioregion, by major functional groupings (and for each vegetation grouping if meaningful).

- Patch size distribution by vegetation grouping and geomorphic unit

Use in deliberations

Should be available for the deliberations. Patch size analysis should be possible and will be attempted for the deliberations. A coarse relative habitat value index should be available.

Interaction with the bioregional landscape framework project

That project will supply the relative habitat value index. The landscape framework project will be re-run from time to time during the deliberations to report on various options and developments.

Further development

Further development of this criterion is not warranted as this is simply a measure. However, the bioregional landscape framework project needs further refinement, in line with efforts to improve the understanding of the requirements for all functional groups of organisms.

3.3.6   Criterion (b) Successional stages (matrix in space and time): Evaluation of implications regarding successional process and related matrix over space and time is needed.

Considerations

The landscape should provide the full range of successional stages to provide a diverse range of habitat, and to ensure sustainability. Attiwill (1994A) argues this and concludes:

Forests often represent a tranquillity associated with the apparent changelessness of large trees. Ironically, this tranquillity is largely a product of the human perception of time. Forest ecosystems are dynamic and may not be static in space or time. Many of our concepts of ecosystem management are based on the hope that if a forest is left alone it will gradually return to its natural state. There is great variation in time and space in the forces that influence the development of the structure, composition and functioning of plant communities. Some disturbances such as fire have had such a profound evolutionary influence on the survival and regeneration of plant communities that periodic disturbance is essential if diversity is to be maintained, and a delay in the recurrence of disturbance leads to a reduction in diversity.

The development of most forests of the world is moulded by natural disturbances. That their sustainability depends on disturbance seems incontrovertible. Management of natural forests should be based on an ecological understanding of natural disturbance processes. The present "equilibrium" vegetation in Australia has descended from late Pleistocene vegetation through an unbroken sequence of autogenic and allogenic successional responses to human-generated disturbance and other natural agents of landscape change.

Maximum diversity and productivity of ecosystems are maintained by random periodic disturbance. Systems without an autogenically derived steady state depend entirely on exogenous catastrophic disturbance, which is fundamental to stability of the ecosystem. An example is the coastal heath lands of south east Australia, where diversity is highest immediately after fire. Excluding fire leads to reduced plant and animal diversity, and dominance by a few species, and eventually to reduced capacity to respond to fire when it does occur.

Goals

To be considered during development of this criterion.

Data

- Existing native vegetation (by grouping). Source: this is being derived by the vegetation mapping project
- Geomorphic units. Source: A geomorphic units layer has been generated.
- Successional stages spatial layer
- Fire and disturbance history mapping

Measuring and reporting

Measuring will be considered during development of this criterion.

Reporting will be:

- Successional matrix value index for major functional groups by vegetation group and geomorphic unit
- Successional distribution / class by vegetation group and geomorphic unit

Use in deliberations

Unavailable.

Interaction with the bioregional landscape framework project

Will not be available for that project, but would provide crucial data for that project.

Further development

How to develop this is not clear at present, and needs resolution before development commences.

3.3 (C3) Management practices

3.3.7   Criterion (a) Management priority: the extent to which conservation management is applied across the landscape

Considerations

Pattern and process indicate the current situation. A measure of management focus and priority is needed to consider potential implications over time. Disturbance of itself is not antagonistic to conservation, and some disturbances are ecologically appropriate. It is difficult to report management focus and priority precisely, and surrogates may be helpful at this stage. Management priority classification should recognise that conservation and production are not exclusive and can be integrated. Actual conservation outcomes emerge from the mix of land management actions at landscape scale. Classes could be based on the focus for removal of ecological resources.

Goals

To be considered further during development of this criterion.

Data

- Management focus/priority layer. Unavailable – coarse surrogates might include tenure, current land use (unreliable), land capability. These surrogates are poor. For example, tenure – some private land may be managed very well for conservation while some Crown land might not, and there is not reliable way of evaluating this from current data.

Measuring and reporting

Measuring will be:

-     Area within management priority classes, by vegetation group and geomorphic unit

Reporting will be:

-     Area within management priority classes (see table 4.c), by vegetation group and geomorphic unit

Use in deliberations

It is possible to report this at a coarse level for the landscape, with more precision for the Crown managed land, and has been attempted. A spatial layer will be applied to the integration software to inform participants. It might be useful applied as a weighting of vegetation grouping priority for conservation initiatives, and this will be discussed with integration software support.

Interaction with the bioregional landscape framework project

This criterion might be useful in the landscape framework project.

Further development

It is critical to further develop capacity to report this criterion to pursue biodiversity outcomes at landscape level. How to develop this is not clear at present, and needs resolution before development commences.

3.3 (C4) Certainty that conservation management will apply and persist

Discussion

A measure of certainty that conservation management will apply and persist is important to the integrity of maintaining biodiversity, and for supporting funding initiatives. Also, following the impending deliberations the government will make decisions on the future tenure and management of public land in the bioregion. One of the considerations in these decisions will be the desire to develop a reserve system. However, the reserve system is only one component of the certainty value. The nationally agreed criteria for forest ecosystems, as presented in JANIS (1997), have been used in previous regional assessments over regions having substantial proportions of existing forested vegetation under Crown management.

This bioregion is highly altered, with non-forest vegetation predominating, and having a low proportion under Crown management. Some stakeholders sought reserve design criteria more stringent than the nationally agreed standard, to underpin urgent expansion of the reserve system. Others argued that a more appropriate response is to reconsider how to optimise reserve system configuration where the Crown-managed land is a small proportion of the bioregion, is unevenly distributed in environmental space, and its reservation does not address the conservation issues, as in this bioregion. Seeking the JANIS targets now, based on the landscape but in the first instance from Crown-managed land so far as possible risks a sub-optimal outcome. To optimise a comprehensive, adequate and representative reserve system in this bioregion, its development should adopt a landscape scale process over time. Knowing how reserves are placed in the landscape is a precondition to being able to measure the security afforded to biodiversity.

The expert workshop recognised this, and considered that for this bioregion there is a need to move away from focusing on only the dedicated reserve component, which tends to segregate the landscape into reserve/non-reserve, and to recognise the contribution of a broad range of levels of certainty across all tenures. However, the group acknowledged that it was not in a position to devise a competent alternative set of criteria in time for consultation and approval prior to the deliberations. Nix and Mackey (1999) have suggested modifications for some of the targets. However, a broader review was called for to define the landscape approach, particularly in view of the opportunities provided by the landscape framework project and other criteria herein.

In the absence of a recognised alternative, the JANIS criteria will be used to guide selection of a public land reserve system during the pending deliberations, whilst recognising the need for a landscape approach for conservation issues across the bioregion. The full range of reserve types will be considered, JANIS targets will be adopted as indicators to assist the deliberations rather than firm targets to pursue. The JANIS reserve design principles will be used as guidelines for the deliberations, and are consolidated in appendix 3.1.

Table 4c provides a certainty classification based on the JANIS reserve classes and broadened to acknowledge off-reserve conservation efforts and the contribution from private lands towards conservation management. The highest level of certainty recognised is where Parliamentary action is required to change the boundary. Ministerial (no-term) areas are accountable to government and not limited in term. These comprise the JANIS reserve categories. Conservation management not qualifying in these categories is recognised in categories Term/sub-Ministerial and Other.

For criteria (a) to (f) hereunder, the goal and further development are the same and are not given under each criteria. *Further development* recommended is that an alternative approach should be explored for future conservation and land use planning in landscapes that are highly disturbed and largely private tenure. Hence these criteria are specified for the deliberations only, and a *goal* is not appropriate. *Indicators* are nominated only for the security classes that qualify as "reserves" under the JANIS guidelines. Indicators for the other classes would need to recognise the variation across the bioregion and should be done on an ecological basis in conjunction with the processes and mechanisms that will oversee them. This is not feasible for the impending deliberations. Interaction with the *bioregional landscape framework project* is that management decisions for Crown-managed land provide context for considering options for private land management.

3.3.8   Criterion (a) Vegetation groupings: area of each in secure conservation management, other than the veg groupings in Rare and endangered or Vulnerable below.

Considerations

To maintain biodiversity it is desirable to seek to ensure some of each ecosystem type is under secure conservation management. Vegetation groupings are recognised as the most appropriate surrogates for terrestrial ecosystems.

Data

- Existing native vegetation (by grouping). Source: this is being derived by the vegetation mapping project

- Geomorphic units. Source: this is being derived by the vegetation mapping project

- Tenure and planning unit layers. This is to be provided by other Western Regional Assessment projects.

- Conservation management layer. Source: A classification for tenures of State Forests of New South Wales and New South Wales National Parks and Wildlife Service has been derived.

Measuring and reporting

Measuring will be:

- For each area under conservation management, classify the strength of certainty that that management will apply and persist, by vegetation grouping.

Reporting will be:

- Area in Parliamentary or Ministerial (no term) classes [vis table 4c] by vegetation grouping

- Area in Term/sub-Ministerial or Other classes [vis table 4c] by vegetation grouping

Use in deliberations

To help guide reserve selection. Numeric indicator: broad guideline to assist in developing conservation options = 15% of potential distribution for each vegetation grouping in Parliamentary or Ministerial (no term) classes.

3.3.9   Criterion (b) Vulnerable vegetation groupings: area in secure conservation management, other than the veg groupings in Rare and endangered below.

Considerations

Where there appears a real risk of the extent of a vegetation community getting particularly low, that vegetation grouping warrants a higher proportion of what is left being under conservation management.

Data

- Existing native vegetation (by grouping). Source: This is being derived by the vegetation mapping project.

- Geomorphic units. Source: A geomorphic units layer has been generated.

- Tenure and planning unit layers. This is to be provided by other Western Regional Assessment projects.

- Conservation management layer. Source: A classification for tenures of State Forests of New South Wales and New South Wales National Parks and Wildlife Service has been derived.

Measuring and reporting

Measuring will be:

- For each area under conservation management, classify the strength of certainty that that management will apply and persist, by vegetation grouping.

Reporting will be:

- Area in Parliamentary or Ministerial (no term) classes [vis table 4c] by vegetation grouping

- Area in Term/sub-Ministerial or Other classes [vis table 4c] by vegetation grouping

Use in deliberations

To help guide reserve selection. Numeric indicator: broad guideline to assist in developing conservation options = 60% of existing extent of each vulnerable vegetation grouping in Parliamentary or Ministerial (no term) classes. A task is to evaluate each vegetation grouping once these are finalised by the vegetation mapping project to list those that are "vulnerable" as defined. This would be used in the integration software.

3.3.10 Criterion (c) Rare and endangered vegetation groupings: area in secure conservation management

Considerations

Where there appears a real risk to the persistence of a vegetation community, that vegetation grouping warrants effort to have what is left being under conservation management.

Data

- Existing native vegetation (by grouping). Source: This is being derived by the vegetation mapping project.

- Geomorphic units. Source: A geomorphic units layer has been generated.

- Tenure and planning unit layers. This is to be provided by other Western Regional Assessment projects.

- Conservation management layer. Source: A classification for tenures of State Forests of New South Wales and New South Wales National Parks and Wildlife Service has been derived.

Measuring and reporting

Measuring will be:

- For each area under conservation management, classify the strength of certainty that that management will apply and persist, by vegetation grouping.

Reporting will be:

- Area in Parliamentary or Ministerial (no term) classes [vis table 4c] by vegetation grouping

- Area in Term/sub-Ministerial or Other classes [vis table 4c] by vegetation grouping

Use in deliberations

To help guide reserve selection. Numeric indicator: broad guideline to assist in developing conservation options = 100% of existing extent of each rare and endangered vegetation grouping in Parliamentary or Ministerial (no term) classes. A task is to evaluate each vegetation grouping once these are finalised by the vegetation mapping project to list those that are "rare" and "endangered" as defined. This would be used in the integration software.

3.3.11 Criterion (d) Habitat of particular quality (being natural refugia centres of endemism or offering a particularly beneficial range of key habitat resources) for "at risk" species with special needs[4]: area of each in secure conservation management

Considerations

Some species that are now at risk of extinction or have specific habitat requirements may not be provided for in the forgoing criteria. It is desirable that specific areas be managed for conservation for these species, to the extent that we can define them and identify them.

Data

- Distribution of habitats of particular quality for species with special needs. This might be possible for a limited number of assemblages, being reliant on the response to disturbance and fauna projects. This will need to be explored. Data needed would be "at risk" species with special needs, defined habitats being natural refugia or possessing critical habitat features of those species, and existing distribution of those habitats.

- Tenure and planning unit layers. This is to be provided by other Western Regional Assessment projects.

- Conservation management layer. Source: A classification for tenures of State Forests of New South Wales and New South Wales National Parks and Wildlife Service has been derived.

Measuring and reporting

Measuring will be:

- Classify the strength of certainty that conservation management will apply and persist, for each area of identified habitat.

Reporting will be:

- Area in Parliamentary or Ministerial (no term) classes [vis table 4c]

- Area in Term/sub-Ministerial or Other classes [vis table 4c]

Use in deliberations

To the extent this is possible, a broad guideline to assist developing options is to maximise areas of this habitat in Parliamentary or Ministerial (no term) classes. What is possible depends on what comes out of the response to disturbance, fauna and flora projects, and the capacity to evaluate and apply them through this project.

---

[4] Rare/endangered species, groups of organisms with complex habitat requirements, migratory or mobile species, species with requirements not well correlated with vegetation groupings

3.3.12 Criterion (e) Late mature growth stage: area in secure conservation management

Considerations

Ecologically, "late mature growth stage" (definition required) is more relevant to this bioregion than the concept of "old growth", and is used here as a substitute for that JANIS criteria. The community places a value on patches of large old trees and ecologists also recognise their value.

Data

- Existing late mature growth stage spatial layer. Unavailable.

- Tenure and planning unit layers. This is to be provided by other Western Regional Assessment projects.

- Conservation management layer. Source: A classification for tenures of State Forests of New South Wales and New South Wales National Parks and Wildlife Service has been derived.

Measuring and reporting

Measuring will be:

- Classify the strength of certainty that conservation management will apply and persist, for each area of late mature growth stage

Reporting will be:

- Area in Parliamentary or Ministerial (no term) classes [vis table 4c]
- Area in Term/sub-Ministerial or Other classes [vis table 4c]

Use in deliberations

Unavailable

3.3.13 Criterion (f) Wilderness: area of areas each of at least 8000ha of National Wilderness Inventory index 12 or more in secure conservation management

Considerations

Wilderness is primarily a cultural value. Reservation of wilderness will have some benefits for conserving biodiversity. However, in some circumstances declared wilderness status may limit (for example, through inability to manage for biodiversity) achievement of biodiversity conservation outcomes. This is a particular issue in fragmented landscapes such as exist in this bioregion.

NWI refers to the National Wilderness Inventory (see Lesslie and Maslen 1995).

Data

- Spatial layer of areas each 8000ha or more of NWI rating 12 or more

- Tenure and planning unit layers. This is to be provided by other Western Regional Assessment projects.

- Conservation management layer. Source: A classification for tenures of State Forests of New South Wales and New South Wales National Parks and Wildlife Service has been derived.

Measuring and reporting

Measuring will be:

- Classify strength of certainty that conservation management will apply and persist, for areas of at least 8000ha of NWI of 12 or more.

Reporting will be:

- Area of areas of at least 8000ha of NWI of 12 or more in Parliamentary or Ministerial (no term) classes [vis table 4c]

- Area of areas of at least 8000ha of NWI of 12 or more in Term/sub-Ministerial or Other classes [vis table 4c]

Use in deliberations

Wilderness is a cultural concept (JANIS, 1997) and will need to be balanced with biodiversity criteria in fragmented landscapes during reserve selection. Numeric indicator: broad guideline to assist developing conservation options = 90% in Parliamentary or Ministerial (no term) classes. Source the spatial layer of qualifying wilderness and supply it to the integration software.

3.3.14 Criterion (g) Number of cultural heritage sites within areas under conservation management

Considerations

This is criterion is presented as indicative for further consultation with Aboriginal people, in relation to Aboriginal cultural heritage sites. It is assumed that the site location data will be culturally sensitive, and its use will need to be dealt with appropriately. To limit the sensitivity, the type of site need not be used, simply the location of it.

Goals

(Indicative for further consultation)

Data

- Existing native vegetation (by grouping). Source: This is being derived by the vegetation mapping project.

- Geomorphic units. Source: A geomorphic units layer has been generated.

- Tenure and planning unit layers. This is to be provided by other Western Regional Assessment projects.

- Conservation management layer. Source: A classification for tenures of State Forests of New South Wales and New South Wales National Parks and Wildlife Service has been derived.

- Site location data

Measuring and reporting

Measuring will be:

- The number of cultural heritage sites within areas under conservation management, by certainty class, tenure and geomorphic/environmental unit

Reporting will be:

- The number of cultural heritage sites within areas under conservation management, by certainty class [vis table 4c], tenure and geomorphic unit

Use in deliberations

Consultation regarding the criteria relating to Aboriginal cultural heritage was insufficiently advanced to countenance inclusion of this criterion for the deliberations, even as indicative only. This is because the issue is potentially culturally sensitive, and should only be pursued after full consultation. Thus, only data for non-Aboriginal cultural heritage sites has been implemented.

Interaction with the bioregional landscape framework project

Not envisaged.

Further development

For discussion with Aboriginal people in relation to Aboriginal cultural sites.

3.3 (C5) Impact of exotic species

3.3.15 Criterion (a) Impact of exotic species: criteria to evaluate implications relating to impact of exotics are needed.

Considerations

Exotic species present significant implications for maintaining biodiversity and warrant criteria.

Goals

This needs exploration during development of this criterion.

Data

- Existing native vegetation (by grouping). Source: This is being derived by the vegetation mapping project.

- Geomorphic units. Source: A geomorphic units layer has been generated.

- Exotic species posing significant threat – distribution and abundance. Unknown, though data for exotic plants might be possible through the vegetation mapping project.

- Rate of spread of each exotic

- Rate of new naturalisations

Measuring and reporting

Measuring will be considered during development of this criterion.

Reporting will be considered during development of this criterion. A coarse indication that could be done quickly is relative cover and abundance of exotic plants by vegetation grouping and geomorphic/environmental unit.

Use in deliberations

Unlikely to be available for the deliberations.

Interaction with the bioregional landscape framework project

This criterion might be useful in the landscape framework project through contributing to it dealing with threats and vulnerability. However it is unlikely to be available for the deliberations

Further development

It is critical that this be developed.

3.4   VALUE D. CULTURAL HISTORICAL PLACES

Places of significance to non-Aboriginal people have not been pursued here, but warrant development, particularly with reference to Australia ICOMOS (2000) and Australian Committee for IUCN (1996) and (1998).

The following report areas under responsibility or influence. Reporting of areas of interest but where responsibility or influence does not yet exist might be useful, however this could be very sensitive information, and would only be proposed if the Aboriginal community sought it.

3.4.1   Criterion (a) Area within which the Aboriginal community has responsibility (sole, or through formal co-operative agreement) for management of the Aboriginal culturally significant places therein.

Considerations

This is criterion is presented as indicative for further consultation with Aboriginal people.

Goals

(Indicative for further consultation)

Data

- Area within which the criterion applies. (Indicative for further consultation)

Measuring and reporting

Measuring will be:

- Area within which the criterion applies. (Indicative for further consultation)

Reporting will be:

- Area within which the criterion applies. (Indicative for further consultation)

Use in deliberations

This is criterion is presented as indicative for further consultation with Aboriginal people. As it stands it could be used to inform Aboriginal people during the deliberations.

Interaction with the bioregional landscape framework project

For discussion with Aboriginal people.

Further development

For discussion with Aboriginal people.

3.4.2   Criterion (b) Area within which community interest groups have direct influence over management of places they hold as culturally significant.

Considerations

This is criterion is presented as indicative for further consultation with Aboriginal people.

Goals

(Indicative for further consultation)

Data

- Area within which the criterion applies. (Indicative for further consultation)

Measuring and reporting

Measuring will be:

- Area within which the criterion applies. (Indicative for further consultation)

Reporting will be:

- Area within which the criterion applies. (Indicative for further consultation)

Use in deliberations

This is criterion is presented as indicative for further consultation with Aboriginal people. As it stands it could be used to inform Aboriginal people during the deliberations.

Interaction with the bioregional landscape framework project

For discussion with Aboriginal people.

Further development

For discussion with Aboriginal people.

3.4.3   Criterion (c) Area covered by geomorphological mapping

Considerations

This is criterion is presented as indicative for further consultation with Aboriginal people. It is assumed that this information is not culturally sensitive.

Goals

(Indicative for further consultation)

Data

- Area within which the criterion applies. (Indicative for further consultation)

Measuring and reporting

Measuring will be:

- Area within which the criterion applies. (Indicative for further consultation)

Reporting will be:

- Area within which the criterion applies. (Indicative for further consultation)

Use in deliberations

This is criterion is presented as indicative for further consultation with Aboriginal people. As it stands it could be used to inform Aboriginal people during the deliberations.

Interaction with the bioregional landscape framework project

For discussion with Aboriginal people.

Further development

For discussion with Aboriginal people.

3.5 VALUE E. THE SECURITY OF SPECIES, PARTICULARLY THOSE KNOWN TO BE FACING EXTINCTION

3.5.1 Criterion (a) The state of knowledge regarding the security of individual species

Considerations

Given the conservation challenges in this bioregion, and the scarcity of resource to address them, a key strategy is to look after the vegetation in the landscape and landscape function. Vegetation is thus the surrogate for managing biodiversity. In focusing on individual species there is a risk of sub-optimal use of resources because:

- There is little data for any groups other than vertebrate fauna and vascular plants, and focusing effort on species known to be at risk is a biased approach. There are many functional groups of species in the landscape and prioritisation of effort should recognise the importance of each.

- Species are in part nominated as at risk due to their rarity. Some such species may be intrinsically rare, and attempts to encourage their "recovery" may be misplaced.

- Some species may not be amenable to long term survival through human intervention.

Nevertheless some species at risk may have requirements not addressed adequately through the broad strategies, and that are amenable to assistance through human design. There are legislative responsibilities in NSW relating to the conservation of threatened species, and thus an expectation by the community that the protection of such species be explicitly considered.

An ecological basis for setting criteria for this value is desirable, but adequate data to do this realistically is lacking for most and probably all species in the bioregion. We have little knowledge about the functional significance of each species. An example showing emerging information regarding such functional significance is the "buzz pollination" needs of some flowers which requires suitable native insects to achieve pollination and hence propagation (John, 2002).

This criterion therefore seeks to report the state of knowledge and level of recovery planning regarding species at risk, in the context for all species on the basis of taxonomic/functional groupings and geographic subdivisions. This allows broad potential data gaps and biases in existing knowledge to be considered and effort apportioned accordingly. The amount of survey is adopted as a surrogate for a relative level of knowledge.

Ideally the analysis would be at a finer scale, such as by vegetation group. However this would increase the workload and the complexity of the data. Use of geomorphic units should provide sufficient resolution to give an indicative result, and is recommended as a start.

Goals

This criterion simply reports data, and a quantitative goal is inappropriate. The goal is to give a relative indication of the survey effort across broad taxonomic/functional species groups and broad landscape or geomorphic units.

Data

- By broad taxonomic group: survey effort, number of species found, number of Threatened species found, all spatially identified, and the number of those Threatened species with recovery plans (record budget). This should be available from the flora and fauna projects, and miscellaneous other sources.

- Geomorphic units. Source: A geomorphic units layer has been generated.

Measuring and reporting

Measuring will be:

- By broad taxonomic group: survey effort, number of species found, number of Threatened species found, all by geomorphic unit, and for the bioregion the number of those Threatened species with recovery plans (record budget)

Reporting will be:

- By broad taxonomic group: survey effort, number of species found, number of Threatened species found, all by geomorphic unit, and for the bioregion the number of those Threatened species with recovery plans (with budget for the relevant plans). This reporting is more detailed than indicated in the summary table for this criterion in the expert workshop report (appendix 1.2) however it is discussed in the text underpinning that table, and has been confirmed with the experts.

Use in deliberations

Staff from the flora and fauna projects were unavailable to help extract details from their reports, and implementation of this criterion, even in a simplified form, eventually lapsed due to lack of time. However the broad taxonomic groups were derived, and are presented in appendix 3.3, which seeks to maximise differentiation of the groupings relative to survey method and effort.

Interaction with the bioregional landscape framework project

No direct interaction is envisaged.

Further development

None required.

3.6   VALUE F. VULNERABILITY OF ECOSYSTEMS

3.6.1   Criterion (a) Vulnerability of ecosystems to further degradation

Considerations

Vulnerability of ecosystems to further degradation through a number of threats, both now and in the future, is a key issue and warrants conservation criteria. Some ecosystems are more at risk where a number of threats interact and some are more at risk than others.

Goals

This will be explored during development of this criterion.

Data

- Key threats. Unavailable. Some threats such as clearing and proximity to development are embedded in the landscape framework project.

- Implications for ecosystem resilience

Measuring and reporting

Measuring will be:

- Local / regional threats and implications for ecosystem resilience, by ecosystem and geomorphic/environmental unit

Reporting will be:

- Local / bioregional threats and implications for ecosystem resilience, by ecosystem and geomorphic / environmental unit

- Perhaps generate a vulnerability index.

Use in deliberations

Unavailable.

Interaction with the bioregional landscape framework project

Some threats (clearing and proximity to development are incorporated into the landscape framework project). No specific interaction is proposed at this stage due to lack of knowledge.

Further development

A key for persistence of biodiversity and cultural heritage, this needs development. A ranking of disturbance from those threats could be used to generate separate spatial layers showing the threats for each ecosystem, possible broken down to geomorphic / environmental units. This needs to be restricted to those threats that we can get some kind of measure on (including the effect between threats – multiplying / additive / exponential), otherwise they could be ranked as a simple high, medium or low. Threats that could be ameliorated through appropriate management on each effected area should be separated from those which could not (e.g. rising groundwater). Local threats should be separated from bioregional threats.

This blank page has been inserted here so the next section
appears on the right hand side in double-sided printing.

4. BASE DATA SETS USED FOR THE CURRENT IMPLEMENTATION

This chapter discusses the base data sets used in the implementation of the criteria for the impending deliberations. Some were adopted from existing sources or regional assessment projects. Some were derived from existing sources. Some were prepared from newly collated information.

As well as the specific data sets described hereunder, particular reference was made to the following regional assessment reports (RACD, unpublished at this point in time):

- Preliminary Crown land identification: stage 1-areas exceeding 100 ha (draft, 24 June 2002)
- Summary of scoping of wilderness values (draft, 26 June 2002)
- Soil landscape reconnaissance mapping (final, February 2002)
- Non-indigenous cultural heritage study (draft, June 2002)
- Targeted flora survey and mapping (draft, June 2002)
- Community data search & biodiversity survey (draft, 6 June 2002)
- Vertebrate fauna survey, analysis and modelling (draft, 25 June 2002)
- Response to disturbance and land management (draft, June 2002)
- An investigation into the ecology of the eastern pygmy possum (*Cercartetus nanus*) (final draft, 29 July 2002)
- An investigation of glossy black cockatoo ecology in western New South Wales (final draft, 29 July 2002)
- An investigation into the ecology of the pale-headed snake (*Holocephalus bitorquata*) (final draft, 29 July 2002).

A number of anticipated pertinent reports were unavailable at the time of preparing this report:

- Vegetation mapping
- Aboriginal cultural heritage assessment and community consultation
- Tenure
- Autecology of the squirrel glider

4.1   NATIVE VEGETATION

This data is provided by the Joint Vegetation Mapping project, and a full explanation should be available in the report for that project. Three data sets were available:

Vegetation probability surfaces

For each of the 115 existing native vegetation groupings identified, a "surface" was developed. For each surface the bioregion was divided into 100m x 100m "cells", and the probability of that vegetation grouping occurring there determined by modelling. The sum of all probabilities for each cell for all groups combined is unity (ie 100%). The area of each vegetation group in any physical area is the sum of the probabilities for that vegetation group across all cells in the physical area, times the size of the physical area divided by the size of a cell.

1) Predicted potential distribution of native vegetation probability surface

The extant vegetation groupings were projected across the landscape to estimate where each might proliferate, in the absence of management intervention that limits it but with management intervention that sustains it, on the basis of similar abiotic attributes.

2) Predicted extant distribution of native vegetation probability surface

The potential distribution of each vegetation group was limited to "masks". The "woody" mask represents a minimum extent, the "woody plus grassy woodland/grassland" mask represents the maximum.

3) Consolidated extant native vegetation

In order to depict extant vegetation to help people visualise the mapping, the extant probability surface was used to allocate the more likely vegetation group for each cell. The adjacent cells of like vegetation group were amalgamated into patches of each vegetation group. This is only an approximation of the exact occurrence of each vegetation group, and the calculation of patch sizes, being based on this data set, embodies this limitation. The opinion of the joint vegetation mapping technical working group is that this will provide a reasonable indication suitable for the proposed uses in these criteria.

Caveats and limitations

Sampling bias for some parts of the vegetation project have been confirmed. The steps explored to reduce the impact of the bias caused further problems with the modelled output, and were abandoned. As a result there are a number of issues that remain unresolved and will impact upon the end result vegetation mapping and other processes which will rely on that vegetation mapping.

The main issues revolve around the level of sampling bias in the data set:

• Initially woody vegetation was applied as a mask to restrict the first samples to areas that would provide the most value on a dollar for dollar basis. This has resulted in areas that have been extensively cleared being poorly sampled. There is also a strong sampling bias towards public land due to decisions made by operational staff without reference to the Technical Working Group, and was not evident until late in the process. Further sampling sought for privately managed lands did not take place due apparently to logistic reasons.

• The sampling intensity in some areas was so low that significant communities are being masked in the floristic analysis and that the environmental differences that are evident between some State Forests and the surrounding landscape are not being adequately represented in the variables which are being used for modelling. Effectively this means that the models themselves may be deficient in this respect even with sufficient samples.

Essentially the vegetation map in its current form appears inadequate as a basis for hard targets via C-plan but appears suitable as an information tool to guide the broader strategic processes involved in the deliberations and negotiations (advice from the Joint Vegetation Mapping project).

Additionally it will impact upon the way the bioregional framework tool operates as well as impacting upon the figures to be reported for the conservation criteria.

4.2   GEOMORPHIC UNITS

Details of the derivation of this data set are presented in appendix 4.1

In order to develop a geomorphic layer it is necessary to take account of the purpose the expert workshop had in mind for its use – to allow consideration of the distribution of aspects of interest across the bioregion, being a combination of geographic spread and landscape position. The most suitable parameters readily available are *Province* and *Landform relief modal slope*, both sourced from the comprehensive database provided by the soil landscape reconnaissance mapping project.

The provinces were identified by their dominant geomorphological patterns. The significant kinds of landform pattern in Australia can be described and differentiated from local relief, modal slope, stream channel occurrence, geomorphological mode/agent/status, and component landform elements. The scale of reporting sought for the geomorphic units is broad, and the most appropriate parameters to use are the simple types of erosional landform pattern characterised by relief and modal slope (from McDonald et al, 1990). The range of classes was condensed (using a simple rule set resulting in 33 units) to enhance usefulness of the output for reporting outcomes.

This was devised in consultation with the team from the Soil Landscape Reconnaissance Mapping project. As with the vegetation data, the data used from the soil landscapes database is also a derived set, and the geomorphic unit layer embodies the limitations as described in that project report in-so-far as it relates to the data items utilised. This does not appear to detract from the geomorphic unit data set because the scale it operates at is sufficiently broad.

Map 1 depicts the geomorphic units.

4.3   TENURE GROUPING

Details of the derivation of this data set are presented in appendix 4.2

For reporting in the immediate deliberations, the experts sought sub-totals in the criteria reporting for "Crown" estate and all other estate. The Crown tenure data supplied for the deliberations was largely un-validated, and only validated lands are accepted for negotiation at this time. Lands recorded as tenure that would be negotiable but that are un-validated might be contemplated for further consideration in the deliberations but would not be subject to negotiation at this time. There is then a need in the immediate deliberations to highlight three tenure groupings:

Negotiable   all Crown-managed land that has been validated

Potentially negotiable   all Crown-managed land that is un-validated

Non-negotiable   all other land

These have been derived, using the Planning Unit layer and the CLID data in the Tenure layer. The negotiable class is reliable, the other classes are indicative but not reliable.

4.4   MANAGEMENT PRIORITY

Details of the derivation of this data set are presented in appendix 4.3

The concept of management priority is an attempt to compare the degree of conservation focus with the degree of production focus in land management. Conservation management and production management are not exclusive and can be integrated. Conservation and production outcomes can and must co-exist (Archer, 2000). At present there is no direct measure for management priority, and the focus on removal of ecological resources is adopted as being indicative.

Whilst there is no direct measure of the focus of management on removal of ecological resources, surrogates are available to provide a coarse spatial layer for management priority using nominal approximations of focus on removal of ecological resources as the defining parameter.

For the private and CLID tenures, the Landcover and Land capability classes were assigned nominal priority classes to reflect perceived likely general circumstances. This is very gross, and does not encompass the potential for the management focus of some areas to be quite different from the nominated class. Spatial data was not readily available for a range of circumstances where management priority might be more precisely estimated, such as wildlife refuge, voluntary conservation agreement, fencing initiative program. For the agency managed lands, having little Land capability data, approximations were made for spatially defined components on the basis of anticipated management focus by anticipated tenure categories.

The management priority classes adopted are shown in the table below. They relate to <u>current</u> focus of management regarding removal of ecological resources, and should not be taken to infer any correlation (or inverse correlation) between "production" and "conservation" or that "artificial systems" have little contribution to conservation outcomes at landscape scale.

Table 4a Management priority classes

umbrella	Focussed primarily on conservation		Joint conservation and production focus	Focussed primarily on production	
category	Conservation A	Conservation B	Integrated	Production A	Production B
code	CA	CB	I	PA	PB
Removal of ecological resources	None permitted	To the extent consistent with the explicit conservation objectives, and only resources generated through – Specific conservation works – Natural events (such as wildfire)	Sustainable use of ecological resources from native ecosystems	Relies on or generates simplified native ecosystems (such as rangelands with simplified vegetative structure and low native species diversity/abundance)	Relies on or generates artificial or created systems (such as cropping, irrigation, highly improved pasture)

This is obviously extremely coarse and broad.

Whilst the input layers are of variable reliability, and the assumptions fairly gross for non-agency lands, the outcome should be indicative at a coarse scale, and appears adequate for contextual reporting and providing a relative indication of outcomes for the impending deliberations.

At the time of preparing this report the State Forest Forest Management Zone data (see State Forests of NSW, 1999) was not available, and the management priority layer has not been prepared.

4.5 CERTAINTY THAT CONSERVATION MANAGEMENT WILL APPLY AND PERSIST

The derivation of this layer is described in Appendix 4.4

The result is shown in table 4b. The classification assumes Ecologically Sustainable Forest Management Plans will enable and underpin management of the nominated lands.

Table 4b Classification of certainty that conservation management will apply and persist

Tenure / Management Category		Planning Unit code	Certainty category	Certainty class
National Park, Nature Reserve, Declared Wilderness		NP	Dedicated reserve	Parliamentary
State/National Forest	FMZ 1	SFN	Dedicated reserve	Parliamentary
	FMZ 2		Informal reserve	Ministerial (no term)
	FMZ 3		Informal reserve	Ministerial (no term)
	FMZ 4 (prescription)		Prescription	Ministerial (no term)
	FMZ 4 (other)		Conservation area (agency)	Term / sub-Ministerial

The minimum requirements for classes of strength of certainty that conservation management will apply and persist are given in table 4c. Evaluation of the appropriateness and achievability of the conservation objectives in the management plan/code, and the commitment and capacity of the manager to achieve them lies with the person accountable for management plan approval.

The minimum requirements in table 4c structure in a consistent way the requirements embodied in the JANIS (1997) guidelines, and extends them by:

1. nominating accountability for the management regime, so as to support the boundary certainty,

2. setting requirements for levels of certainty not qualifying as reserve, in order to recognise all forms of conservation management.

Initiatives outside State Forests of NSW or New South Wales National Parks and Wildlife Service estate were not available to this project in suitable format. Thus, details for State Park, Regional Park, Aboriginal Area, Historic sites and Karst reserves were not achieved for this project. Some of these are embodied within like-certainty tenures such as National Park.

The impending deliberations will focus on Crown-managed land, this will not preclude implementation for those deliberations. However the reporting may understate the area in the various certainty classes, particularly the contribution of State Parks, Regional Parks, voluntary conservation agreements, and the like. This limited certainty data should be adequate for negotiating outcomes over Crown-managed land for those deliberations, but is unsuitable for contextual reporting and providing a relative indication of outcomes at a regional scale.

- State Conservation areas have yet to be implemented, and cannot be classified until more is known about their parameters. If any are proposed in the impending deliberations, the mechanism of accounting for their contribution to the certainty reporting should be addressed.

- Areas qualifying management by prescription have not been spatially identified. This will be an issue regarding State Forest FMZ 4 (prescription) in particular. The mechanism of accounting for their contribution to the certainty reporting will need to be addressed.

- The management requirement has not been formally agreed by any parties. There has been no formal agreement to this classification, or the minimum requirement for approval of management plans/codes, by any parties, government or non-government [this was not pursued due to the need to get this draft report out].

Table 4c Minimum requirements for classes of strength of certainty that conservation management will apply and persist.

Certainty class	Category	Management intent				Accountability (set-up of and changes to:)						Control		Term
		Identified area* OR Prescription based			Established in	Management plan or Code of Practice			Boundaries					
		Area set aside & managed specifically# for explicit conservation outcomes	Area managed for explicit conservation outcomes	Managed specifically for explicit conservation outcomes by prescription ##	Managed in accord with a formal management plan**	Opportunity for public comment prior to finalising	Advised by government agency prior to finalising	Plan / Code approved by	Opportunity for public comment prior to finalising	Advised by government agency prior to finalising	Boundaries approved by	By or in co-operation with a government agency	Supported or advised by government agency	
Parliamentary	Dedicated reserve ***	✔			✔	✔		Minister of the Crown			Parliamentary action	✔		Not limited
Ministerial (no term)	Informal reserve, Private conservation	✔			✔	✔		General Manager of gov't agency	✔		Minister of the Crown 4	✔		Not limited
	Reserve by prescription, Private conservation			✔	✔ or COP²	✔		General Manager of gov't agency	✔		Minister of the Crown 4	✔		
	Other reserve, Private conservation	✔			✔		✔	General Manager of gov't agency		✔	Minister of the Crown 4		✔	
Term / sub-Ministerial	Conservation area (Ministerial)		✔ or ✔		✔ or COP²		✔	General Manager of gov't agency		✔	Minister of the Crown 4		✔	If limited, min=10 yrs
	Conservation area (Institution / Agency)		✔ or ✔		✔ or COP²		✔ ²	Senior manager³ of gov't agency or body accountable to gov't		✔ ²	General Manager of gov't agency or body accountable to gov't		✔ ²	
Other	Other		✔ or ✔		✔ / COP²									

"Set aside" means set apart from routine (not necessarily all) production of natural resources.   ## Where separation of an area is not practical (for example: fragmented distribution, linear form)
¹ COP is a formal Code Of Practice.   ² or non-government institution competent in landscape conservation.   ³ Eg Regional Manager, Regional Director.
    ⁴ Where the land is not Crown land, the boundaries must be equivalent to binding successors in title.
* The area can be accurately identified on maps, and is sufficient size and design to maintain the natural values specified to be protected. Except for formal reserves boundaries may be flexible over time to reflect ecosystem dynamics and climate change, consistent with ** and ***.
** The management prescriptions in the plan or code are competent and appropriate to maintain the natural value(s) nominated for the area.
*** Generally reserved for areas of outstanding/unique natural values in a largely "undisturbed" state (equivalent to IUCN protected areas I to IV). Active intervention is permitted where required to optimise habitat conditions, conduct research, and (where consistent with these) benefit resident population.

4.6   LAND COVER

The existing Department of Land and Water Conservation indicative landcover data set was used. This is a broad classification of land into 6 categories on the basis of interpretation of satellite imagery for 1999-2000:

1. timber (generally at least 15% canopy cover),

2. waterbody,

3. cropping (cultivated in the previous 5 years),

4. wetlands,

5. urban, and

6. grassland/open woodland.

There were no field checks or verification with other data sets, and the landcover data is imperfect. However, it does provide a coarse data set for broad scale application.

4.7   LAND CAPABILITY

This provides an eight-class classification of potential for agricultural or pastoral use, based on an assessment of biophysical characteristics of the land. This data was initially drawn on hard-copy maps by the then Soil Conservation Service of NSW, and subsequently scanned/digitised on a 1:100000 mapsheet basis. A minimum mapping unit size of 100hectares was set as the standard of reliability. Field checking was done, and the data is considered reasonably good. The codes are:

Table 4d Land capability classes

Suitable for	Class	Conservation works or practices
Regular cultivation	1	No special conservation works or practices
	2	Soil conservation practices such as strip cropping, conservation tillage and adequate crop rotation
	3	Structural soil conservation works such as graded banks, waterways and diversion banks, together with soil conservation practices such as conservation tillage and adequate crop rotation
Grazing with or without occasional cultivation	4	Soil conservation practices such as pasture improvement, stock control, application of fertiliser and minimal cultivation for the establishment or re-establishment of permanent pasture
	5	Structural soil conservation works such as absorption banks, diversion banks and contour ripping, together with the practices as in Class IV
Grazing only	6	Land best protected by green timber. Generally stock should be excluded
Best suited to timber (steep or rocky land)	7	Soil conservation practices including limitation of stock, broadcasting of seed and fertiliser, prevention of fire and destruction of vermin. May include some isolated structural works
Other	8	Cliffs, lakes, swamps and other lands incapable of sustaining agricultural or pastoral production
	U	Urban areas
	M	Mining areas

4.8   ABORIGINAL MANAGEMENT RESPONSIBILITY AND INFLUENCE

Data for land controlled by Aboriginal community interests is not available digitally, being stored in hard copy in various agency offices across New South Wales. It seems there are no declared Aboriginal Places in the bioregion. The only known occurrences of areas that meet the criteria for Aboriginal management responsibility or influence within Crown-managed land are the areas covered by the Pilliga and Goonoo Goonoo Aboriginal forest management committees. These are provided in digital spatial form. Thus the data only covers the Crown-managed land, but in so doing is valid for reporting options and outcomes from the immediate deliberations.

Maps 2a and 2b depict the data in this layer.

4.9   GEOMORPHOLOGICAL MAPPING

The Aboriginal Cultural Heritage project undertook geomorphological mapping for substantial areas of Crown-managed land in the Pilliga and Goonoo areas. This layer will be discussed in that project report, and further explanation here is unwarranted. It is assumed this data will be supplied to the deliberation process.

4.10   NON-ABORIGINAL CULTURAL HERITAGE SITES

The Non-Aboriginal Cultural Heritage project supplied site locations and significance classification for the sites it unearthed. This survey that project undertook was relatively cursory in places, and was incomplete in coverage. Thus the data is what is known, but would probably expand substantially with more investigation. The layer is used as is.

5. CRITERIA IMPLEMENTED FOR IMMEDIATE USE

This chapter discusses the criteria that have been implemented for use in the immediate deliberations. In some cases they are only indicative due to the adoption of coarse surrogates because of a lack of pertinent data. The caveats provided for each criterion should be noted when considering the outputs of its application. Reporting is discussed in chapter 6, with the proposed format for the reporting tables given in appendix 5.1.

See chapter 3 for a discussion of the background for each of these criteria. The following presents the only the information relevant to implementation of each criterion for the impending deliberations.

5.1   VALUE A. EXTENT, CONDITION AND DISTINCTIVENESS OF NATIVE VEGETATION

5.1.1   Criterion (a) Extent

Data Used: - native vegetation (extant and projected probability surfaces and consolidated patches)

- geomorphic units

- tenure grouping

Base reporting: - For each vegetation group, the area in each geomorphic unit, with tenure group sub-totals.

- For each geomorphic unit, the percentage covered by native vegetation (extent and projected), with sub-totals for extant cover class.

Consolidation reporting: areal extent of native vegetation as a percentage of the bioregion area.

Discussion: see 4.1 for a discussion of the limitations of the vegetation data.

Caveats and limitations: see 4.1. The data appears suitable at strategic scale. The desired reporting is also strategic scale, so the data appears quite suitable for the criterion.

5.2   VALUE B. NATURAL CULTURAL HERITAGE

The criteria hereunder for Aboriginal cultural considerations have emerged from preliminary consultation only, and are implemented as indicative only. They are presented on the assumption that they do not deal in culturally sensitive information.

5.2.1   Criterion (a) The Aboriginal community having direct responsibility for management and maintenance of the features of cultural significance within cultural landscape areas

Data Used: - Aboriginal management responsibility and influence.

                                      - tenure grouping

Base reporting: - area by tenure group

Consolidation reporting: area as a percent of the bioregion

Caveats and limitations: the data at this time covers only the Crown-managed land.

5.2.2   Criterion (b) The Aboriginal community having direct influence over management of the culturally significant elements of the natural environment, and access to use these natural resources only within their community

Data Used: - Aboriginal management responsibility and influence.

                                      - tenure grouping

Base reporting: - area by tenure group

Consolidation reporting: area as a percent of the bioregion

Caveats and limitations: the data at this time covers only the Crown-managed land.

5.3   VALUE C. LANDSCAPE FUNCTION AND SUSTAINABILITY

5.3.1   Landscape pattern Criterion (a) Connectivity and patch characteristics

Data Used: - consolidated extant vegetation

                                      - geomorphic units

                                      - landcover

Base reporting: mean, standard deviation for native vegetation in areas classed as TIMBER within the Landcover data layer is all that is possible (see discussion).

Consolidation reporting: mean, standard deviation and distribution chart for native vegetation in areas classed as TIMBER within the Landcover data layer.

Discussion: see 4.1. The "patches" in the consolidated vegetation data appear unrealistic (with many isolated 1 hectare units), being artefacts of developing the modelled computerised data layer. Attempting an analysis of patch sizes using these layers would give an illusion of rigor that is not really there. Given the apparent unsuitability of the vegetation data for realistic analysis of patch size, quantitative analysis is not possible by vegetation group.

The Bioregional Landscape Framework project takes extant vegetation and models implications over time from threats, vulnerability, and management decisions. It then produces an effective habitat area and projected species richness index for each vegetation grouping, then aggregates (in a non-linear fashion) the index for a landscape scale index for the bioregion. The data inputs to the landscape framework project are quite coarse at this stage, and the output is effectively indicative for generalised vertebrate fauna. Different

functional groups of fauna have widely differing ecological parameters, and a landscape that is attractive for one might be inhospitable for another. With further refinement and improved data, the project could provide indices for a range of functional biotic groupings. It is not meaningful to split the index spatially (such as by tenure grouping or geomorphic unit because it is the landscape scale outcome that drives the index, and it is not simply the sum of any spatial unit scores. The prototype of the relative habitat index software has not reached the stage of providing data suitable for comparing options meaningfully for the deliberations.

Caveats and limitations: see 4.1 The Landcover data appears to be coarse only. The output of this criterion as enabled will have the same qualities.

5.3.2 Management practices Criterion (a) Management priority: the extent to which conservation management is applied across the landscape

Data Used: - extant vegetation probability surface

- geomorphic units

- tenure grouping

- management priority class

Base reporting: for each management priority class, area in each vegetation grouping and in each geomorphic unit, with tenure grouping sub-totals.

Consolidation reporting: percentage of the bioregion in each management priority class.

Discussion: the results for this criterion need to be interpreted carefully, as the link with conservation outcomes is not particularly direct or linear.

Caveats and limitations: this reporting uses coarse surrogates, and is useful only as an indicative relative measure.

5.3.3 Certainty Criteria (a) – (c) Vegetation groupings

Data Used: - extant vegetation probability surface and projected vegetation probability surface

- certainty layer

- tenure group layer

- list of vegetation groups qualifying as rare and endangered, vulnerable, other

Base reporting: the area of each vegetation group category (rare and endangered, vulnerable, other) in each certainty group (Parliamentary or Minister (no term), Minister (term) or non-Minister, Other), with tenure group split.

Consolidation reporting: net area in each certainty group for all certainty criteria combined

Discussion: These criteria require identification of Rare, Endangered, and Vulnerable vegetation under the JANIS (1997) criteria. This requires analysis of patch sizes and identification of which vegetation groups face continuing threatening processes that present significant risk of their going extinct and which vegetation groups are subject to threatening processes likely reduce the extent enough to put them at significant risk of going extinct within 25 years. See Table A5.1n and appendix 5.2.

Caveats and limitations: The criteria output should be taken as indicative rather than precise. Whilst the process of ascribing threats to the vegetation groups was not rigorous or repeatable, the expert opinion appears to be reasonable basis for ascribing vegetation groups to the relevant categories. Given the limitations of the vegetation mapping data, further refinement in this categorisation of the vegetation groups is unwarranted. The

certainty layer so far is limited to the State Forests of NSW and NSW National Parks and Wildlife estate, and may understate even the Crown-managed lands.

5.3.4 Certainty Criterion (d) Habitat of particular quality (being natural refugia centres of endemism or offering a particularly beneficial range of key habitat resources) for "at risk" species with special needs[5]: area of each in secure conservation management.

Data Used: - the Brigalow Belt South bioregion assessment reports available at the time, for the *Response To Disturbance And Land Management Practices* project, *Fauna Survey And Modelling* project, *Targeted Flora Survey And Modelling* project, *An investigation into the ecology of the eastern pygmy possum* (*Cercartetus nanus*) project, *An investigation of glossy black cockatoo ecology in western New South Wales* project, and *An investigation into the ecology of the pale-headed snake* (*Holocephalus bitorquata*) project.

- Smith and van der Lee (1992)

Base reporting: area of identified habitat of particular quality in each certainty group, with tenure grouping split.

Consolidation reporting: net area in each certainty group for all certainty criteria combined

Discussion: A preliminary analysis of the data was undertaken, and referred to the experts on the technical working groups for the vegetation, flora and fauna survey and mapping projects. The responses all concurred that the data available does not permit the spatially explicit identification of areas of habitat of particular quality for species where reservation would be meaningful. Therefore the result for this criterion at this point in time is NIL.

This is discussed in appendix 5.3. In many instances the habitat resources of particular interest for threatened species operate at a fine scale, and are not necessarily related to particular vegetation groupings or to other spatial data available. Such species may be more readily conserved managing in time and space across the landscape those habitat resources that satisfy their ecological requirements. It appears that reserving areas with particular vegetation of itself may provide no real improvement for conservation of such species.

For example, Bennett (1993) urges a landscape approach to complement traditional approaches of survey and individual species. A landscape perspective emphasises the integration of natural resource management across the whole landscape, rather than being focused on selected areas (eg conservation reserves on public land) to the exclusion of all others. This is especially relevant to fragmented landscapes.

Caveats and limitations: There might be areas that would qualify, however these were not identified by the relevant projects, and cannot be extrapolated from them. The certainty layer so far is limited to the State Forests of NSW and NSW National Parks and Wildlife estate, and may understate even the Crown-managed lands.

---

[5] Rare/endangered species, groups of organisms with complex habitat requirements, migratory or mobile species, species with requirements not well correlated with vegetation groupings

5.3.5   Certainty Criterion (f) Wilderness

Data Used: - wilderness spatial layer supplied by National Parks and Wildlife Service, and the associated project report Summary Of Scoping Of Wilderness Values

- certainty layer

Base reporting: area in areas of at least 8000ha of National Wilderness Inventory index 12 or more, in each certainty group, with tenure grouping split.

Consolidation reporting: net area in each certainty group for all certainty criteria combined

Discussion: the data supplied by the Summary Of Scoping Of Wilderness Values (draft) regional assessment report (26 June 2002) indicates there is no qualifying wilderness outside the "provisionally identified wilderness" areas around Kaputar, Pilliga and Bebo nominated in that report. No qualifying areas are identified within the "provisionally identified wilderness" areas around Kaputar, Pilliga and Bebo. Therefore the result for this criterion at this point in time is NIL.

Caveats and limitations: Within the provisionally identified wilderness there might be areas that would qualify, however these were not considered by the scoping project. A report discussing the provisionally identified wilderness areas is not available from the relevant agency. The certainty layer so far is limited to the State Forests of NSW and NSW National Parks and Wildlife estate, and may understate even the Crown-managed lands.

5.3.6   Certainty Criterion (g) Number of cultural heritage sites within areas under conservation management

Data Used: - certainty layer

- location of non-Aboriginal cultural heritage sites by significance class

Base reporting: the number of sites in each certainty group, with tenure grouping split, by significance class

Consolidation reporting: the number of sites in each certainty group

Discussion: See chapter 3 for a discussion of why the Aboriginal cultural heritage sites are not implemented. As only the non-Aboriginal data is presented here, the value of reporting by vegetation grouping and geomorphic unit is diminished. Hence only this basic reporting is implemented, in contrast to that proposed in section 3.3.14.

Caveats and limitations: see 3.3.14. Data appears suitable as an indication of the state of knowledge. The certainty layer so far is limited to the State Forests of NSW and NSW National Parks and Wildlife estate, and may understate even the Crown-managed lands.

5.4   VALUE D. CULTURAL HISTORICAL PLACES

5.4.1   Criterion (a) Area within which the Aboriginal community has responsibility for management of the culturally significant places therein

Data Used: - Aboriginal management responsibility and influence.

                   - tenure grouping

Base reporting: - area by tenure group

Consolidation reporting: area as a percent of the bioregion

Caveats and limitations: the data at present covers only the Crown-managed land.

5.4.2   Criterion (b) Area within which the community interest groups have direct influence over management of places they hold as culturally significant

Data Used: - Aboriginal management responsibility and influence.

                   - tenure grouping

Base reporting: - area by tenure group

Consolidation reporting: area as a percent of the bioregion

Caveats and limitations: the data at this time covers only the Crown-managed land.

5.4.3   Criterion (c) Area covered by geomorphological mapping

Data Used: - tenure grouping

                   - geomorphological mapping

Base reporting: - area by tenure group

Consolidation reporting: area as a percent of the bioregion

Discussion: At the time of writing this report the Aboriginal Cultural Heritage project report was not available, and the geomorphological mapping has not been evaluated.

Caveats and limitations: It is assumed that this information is not culturally sensitive.

6. MONITORING AND REPORTING

The monitoring and reporting specified in chapter 5 and appendix 5.1 is the initial application of the proposed criteria. It is intended for use in the impending deliberations, and to report the recommendations that emanate from them, and the eventual government decision regarding management of the Crown-managed lands in the New South Wales part of the Brigalow Belt South bioregion. This should be relatively straight forward, and software support staff foresee no difficulties (see 6.2.2). Thereafter monitoring may initially be confounded by changes to the criteria and methodology as they are developed, and to the data (coverage, precision, refinement). These should be addressed as part of the development process. It is not intended as a final product, and should be afforded a process of refinement as experience is obtained in its use.

6.1   MONITORING

Monitoring is the detection and interpretation of change. It is fundamental to the effective use of these criteria for contributing to improved conservation of biodiversity and cultural heritage in the New South Wales part of the bioregion.

The criteria must be simple to monitor. This is strongly influenced by the data needs of the criteria. Thus, refinement of the criteria must include critical review of the monitoring efficiency and efficacy. Compromises in the level of detail gathered and reported may be necessary in the context of resourcing and institutional arrangements.

Should include comparison over time, and rates of change. Consistency and reliability of data sets will need to be addressed as these are likely to be dynamic over time.

6.2   REPORTING

6.2.1   Reporting concept

The criteria are measurable parameters that quantify key elements of the primary values they fall under. They are not additive, and are not comprehensive. They simply provide a quantified and objective relative measure. To effectively report relative outcomes for the primary values, the data for each criterion needs to be consolidated and reported for the value it falls under. Hence each value would have for each criterion under it, a consolidated result of that criterion that encapsulates the criterion outcome at landscape or bioregional scale. Each criterion is presented separately, and each primary value is presented separately. No lumping of criteria occurs, and no weightings are applied.

The detailed data allows interested parties to explore the components of the criteria. The consolidated reporting facilitates highlighting key outcomes for ready comparison of values. The reporting format needs to be clear and concise to allow interested parties to easily interpret the data.

The expert workshop split the primary value C, Landscape function and sustainability, into five sub-values: landscape process, landscape pattern, management practices, certainty that conservation management will apply and persist, and impact of exotic species. The criteria for each of these should be reported under these headings for the consolidation report.

6.2.2 Reporting for the immediate deliberations

The criteria that have been implemented for immediate use are described in chapter 5, including details of the data proposed for reporting. Reporting for each criterion will be provided in a set of tables, the format being shown in Appendix 5.1. In order to distil the essence of that detail, a one-page consolidation report is proposed, also shown in appendix 5.1.

For the deliberations, some of the criteria outcomes are unlikely to be influenced by decisions relating to the management of the Crown-managed land:

- Extent of native vegetation
- Cover of native vegetation
- Native vegetation patch sizes

These outcomes need only be calculated once, with the data repeated in successive reports as required for completeness.

The outcomes for the other criteria are likely to be influenced by the decisions, and the data integration and support system must be able to recalculate and report the outcomes from time to time so that options can be evaluated essentially in real time. Thus, the decisions must be readily translated into changes for the relevant data sets used to calculate the criteria outcomes:

- Certainty classification layer
- Management priority classification layer
- Aboriginal management responsibility and influence layer
- Tenure grouping layer

Discussions with operating staff (NSW National Parks and Wildlife Service, Armidale) indicated that the proposed reporting could be supported and that no difficulties were apparent, notwithstanding that many of the data layers were yet to be supplied.

6.2.3 Reporting for future use

This report is not in a position to specify precise guidelines. Several requirements seem obvious:

1. Report on all the criteria, including:
   - For those that are not developed, report nominated time frames for development where available
   - For those that are partially developed, report nominated time frames for finalisation where available, and report using the data that is at hand
2. Report rate of change, and progress toward any defined goals.
3. Ensure the reporting differentiated between changes due to new methods or data, and changes in real outcomes for the criteria and values.

7. DISCUSSION

7.1   LIMITATIONS

The expertise of the expert workshop was limited principally to terrestrial ecology and related fields, primarily a result of the mix of individual people who were able to attend at short notice. The criteria that were developed therefore might not adequately cover elements related to other fields such as aquatic or subterranean systems, natural cultural heritage, or the usefulness of soils, invertebrates and other biota for conservation criteria. Equally, the workshop did not tap into the conservation and land management knowledge held by Aboriginal communities, which is born of long experience rather than classical scientific inquiry. The criteria are also of necessity proposed in the context of perceived potential for data to be realistically captured and available. Therefore the criteria are not the final word, but rather are a starting point for further development.

The project was constrained by the limited capacity of individuals and organisations to respond in short time to requests for review and guidance, and to provide data that was potentially available. This appears to have been exacerbated by the rush at this pointy end of the assessment progress, the overlap with other regional assessments, the level of other high priority work (limiting staff time to do the work, and limiting access to resources such as GIS capacity that became a bottleneck).

For immediate application the criteria are substantially limited by availability of adequate data, with some not implemented at all, and others restricted to coarse data or surrogates. Unfortunately most of the assessment projects commenced well before the conservation criteria were specified, and were unable to respond to tailor their outputs to suit the criteria.

This is not to say that the data gathered is not useful nor that the effort collecting it was wasted. The criteria are simply a reflection of outcomes for conservation values, and may be used as guidelines to further conservation outcomes. Conservation itself is delivered by the management applied to all lands across the landscape. Better data, such as that produced by the cultural heritage projects and fauna studies, will contribute to decisions about improved management for conservation outcomes, and should contribute to decisions about management of Crown-managed lands in the impending deliberations. The data will be particularly useful in pursuing the "active adaptive management" urged by Walker (1998) in the Crown forests and woodlands. There appears broad support in the literature for this, and a cursory discussion is presented in appendix 7.1. These criteria are but one element of a broader conservation effort.

Notwithstanding the foregoing, for six of the ten conservation values (primary/sub-primary), they appear to provide a relative measure of conservation values suitable for application in the coming deliberations.

7.2 INTERACTION WITH DATA INTEGRATION SOFTWARE FOR THE IMMEDIATE DELIBERATIONS

7.2.1 Bioregional landscape framework project

That project's report was not available at the time of preparing this report. However its principle development officer has indicated the reporting is straight forward, and would be produced each time the framework tool is run. Other than this reporting there is no interaction proposed.

7.2.2 C-plan

The details herein were nominated for C-plan can readily be incorporated into it. Most of the reporting can be generated through C-plan (the C-plan operations staff consulted saw no difficulties in generating the data).

7.3 CULTURAL SIGNIFICANCE

Heritage is the story of our past and the evidence of our history. Places, buildings, artefacts, landscapes, objects and memories all tell a story and help us understand our past (Refshauge, 2000). Heritage consists of those things we want to keep that give us a special sense of the past and of our cultural identity. It is the things we want to keep and pass on to future generations so they too will understand what came before them (NSW Heritage Office, 1999).

Heritage is therefore a major issue. Natural heritage incorporates a spectrum of values ranging from existence value at one end through to socially-based values at the other. The fundamental concept of natural heritage which most clearly differentiates it from cultural heritage is that of dynamic ecological processes, on-going natural evolution, and the ability of ecosystems to be self-perpetuating. At the cultural end of the spectrum, clear separation of natural and cultural values can be difficult. (Australian Committee for IUCN, 1996).

The following useful discussion is taken from Australian ICOMOS (2000). Places of cultural significance enrich people's lives, often providing a deep and inspirational sense of connection to community and landscape, to the past and to lived experiences. They are historical records, that are important as tangible expressions of Australian identity and experience. Places of cultural significance reflect the diversity of our communities, telling us about who we are and the past that has formed us and the Australian landscape. They are irreplaceable and precious.

Conservation, interpretation and management of a place should provide for the participation of people for whom the place has special associations and meanings, or who have social, spiritual or other cultural responsibilities for the place. Conservation of a place should identify and take into consideration all aspects of cultural and natural significance without unwarranted emphasis on any one value at the expense of others. The policy for managing a place must be based on an understanding of its cultural significance. Where a use of a place is of cultural significance it should be retained. Conservation may, according to circumstance, include the processes of: retention or reintroduction of a use, retention of associations and meanings, maintenance, preservation, restoration, reconstruction, adaptation and interpretation; and will commonly include a combination of more than one of these (Australian ICOMOS, 2000).

Therefore a clear separation of cultural and natural significance is not possible. This project has attempted a separation based on perceived relationship of cultural heritage elements to the natural environment.

7.4 MONITORING

Monitoring and reporting are discussed in chapter 6. Monitoring is not obligatory during the deliberations (other than reporting on the implications of the various scenarios / options), but should be embedded into the decisions flowing from it.

7.5   EFFICACY OF THE CRITERIA

7.5.1   Efficacy for the pending deliberations

It is evident throughout this report that some criteria have not been implemented, some are only based on coarse surrogates, and the remainder are limited in coverage or reliability, What does this mean for the deliberations?

Of the ten primary/sub-primary values, six have at least one criterion implemented, which appears to be five more than implemented in previous regional assessments' deliberations.

Of the twenty six criteria, nineteen have not been countenanced in previous regional assessments' deliberations. Of these nineteen, eight have been implemented, providing broader contextual criteria than available to those deliberations. All of these eight (except the geomorphological mapping) have coverage over the Crown-managed land (the vast bulk of the negotiable land). All of these eight (except management priority) have reliability at strategic level or better, and management priority within the Crown-managed land would achieve strategic reliability. Thus these eight criteria should be suitable as contextual inputs at strategic level of reliability for the Crown-managed land.

Of the twenty six criteria, seven have been used in previous regional assessments' deliberations. Of these seven, six have been implemented, all having coverage over the Crown-managed land only. Of these six, three have reliability at strategic level, two appear reliable though with incomplete data, and one has coarse reliability.

For the criteria with coverage limited to the Crown-managed land, and also those with incomplete data sets, there is a likelihood of understating of areas meeting the criteria. This, coupled with much of the data being coarse or strategic reliability, suggests the criteria as implemented all appear unsuitable as a basis for setting and pursuing firm landscape-scale or bioregion-wide targets. The criteria as implemented do appear suitable for strategic application such as indicative or contextual use in guiding deliberations, as was the aim of this project.

This conclusion is based on subjective consideration of the degree to which the coverage and reliability relate to the intended usage in the deliberations.

7.5.2   Efficacy for further application

The concept and methodology appear sound for further development. The limitations in the implemented criteria, and indeed in all the nominated criteria, need to be addressed. The following points highlight the key considerations:

1. Explore how well the criteria encapsulate the primary/sub-primary values

2. Broaden the consultation to encompass expertise in aquatic and subterranean systems, soils, invertebrates and other biota, Aboriginal conservation and land management knowledge, Aboriginal and non-Aboriginal cultural heritage.

3. Refine the derivation of input parameters through broader consultation and more expert input.

4. Pursue better data (coverage, completeness and reliability) that can be used to address the criteria.

5. The certainty criteria need thorough review in terms of what is sought from them in further application, and how to get value for money from the data needs they generate. One key issue is the need to look at parameters that link to the whole landscape and function over time.

6. The focus of the criteria should be outcome focussed rather than input driven.

7.6   ACHIEVEMENTS

The project provides criteria that meet the need and character of the proposed deliberations, and has met the aim and objectives except the monitoring and reporting has been not been able to be given

thorough attention. The following table compares achievements with the key objectives and approach specified for the project.

Table 7a Comparison of achievements with key project specifications

KEY PROJECT SPECIFICATION	ACHIEVEMENT
Objectives	
1. Establish conservation criteria which determine the relative conservation value of, and/or conditions which allow the persistence of, biodiversity, natural and cultural heritage values across the landscape in perpetuity	Achieved to the extent possible, though further work is recommended. 26 criteria have been established covering 10 primary/sub-primary conservation values, through consultation with experts, community interests and agencies.
2. Determine how these should be applied in the bioregion, with goals as appropriate to protect the conservation values	14 of these criteria have been implemented for the deliberations, covering 6 of the values
3. Provide data on criteria and goals as inputs to integration software for the deliberations	Data layers have been provided to the extent of available data. The criteria are herein.
Approach	
i) Identify those conservation values which are important for protection in the bioregion	10 primary/sub-primary values have been identified to embody landscape-scale issues
ii) Identify the desired objectives with respect to those values	Specified in this report, both as seven broad objectives, and a discussion for each criterion
iii) Develop indicators for those objectives	Indicators provided where meaningful
iv) Develop a strategy for protecting those values in the bioregion over time, which will include innovative approaches to conservation management on public and private land	A detailed strategy is outside the purview of this project, particularly with so many criteria needing further development, and the strategy adopted is rather general beyond this assessment process
v) Develop a monitoring program with appropriate indicators showing the improvement in management and protection of conservation values over time	A detailed program is outside the purview of this project, as it will be influenced by the criteria review, the institutional arrangements adopted, and the technology / data needs. A conceptual position is provided.
vi) Structure the analysis of conservation values for ready comparison with economic and social values	The analysis and reporting should provide for ready comparison, however it is unclear how the social and economic values will be presented

As well as this, the project has provided:

- A broad taxonomic classification

- A certainty of conservation management classification

- A management priority classification

- Data layers, current at the time this report was prepared, for:

    - Geomorphic units

    - Aboriginal management responsibility and influence

    - Management priority

    - Tenure grouping

    - Management certainty

These outputs can help effective comparison of a range of values for the impending deliberations, and are available to help people participate in the deliberations.

This blank page has been inserted here so the next section
appears on the right hand side in double-sided printing.

8. RECOMMENDATIONS

1.   That the implemented criteria (presented in chapter 4) be adopted for the impending deliberations:

   -   To guide pursuit of conservation outcomes

   -   To assist representatives to participate through availability of reporting of the range of conservation values

   -   To characterise the conservation value of options in the recommendations and the subsequent government decision

2.   That work required to finalise the outstanding criteria, as described in section 7.7, be pursued promptly as the required data is received.

3.   That the assessment recommend to government:

   -   That the approach presented herein for defining criteria for each primary/sub-primary value should be implemented to assist conservation initiatives into the future, at least for highly disturbed landscapes, and potentially across New South Wales.

   -   That the government task (with adequate powers and resourcing) competent processes and institutional arrangements to undertake this. Existing arrangements, such as Catchment Management Boards, may conceptually appear well placed, however they are regarded by some as ineffective, too strongly influenced by the support agency and therefore by government, and that they make decisions by political compromise rather than technical merit. Tasking should have particular reference to the needs for:

       ➢   Refining the criteria, co-ordinating the monitoring, undertaking consolidation reporting.

       ➢   5-yearly revisions of the data and running analyses to produce a report for government and the community that assesses improvement in the conservation values and feeds into refinement of the conservation strategies.

       ➢   Monitoring and research to define ecological thresholds and improve the capacity to manage ecosystems to improve ability to deliver specified conservation outcomes.

   -   Such institutional arrangements should align with other administrative boundaries to facilitate efficiency.

   -   That the government adopt the approach herein to aid prioritisation of effort and funding for initiatives, as it provides an objective relative valuation of improvement in conservation outcomes per dollar of funding for different options.

   -   That the government task (with adequate powers and resourcing) competent processes to develop and implement business and management strategies to promulgate stakeholder/landowner participation in their conservation strategies, in partnership with government seed funding and support as is available.

4.   That review of the criteria should be based on experience gained through their initial use in the deliberations, and should encompass:

   -   Explore how well the criteria encapsulate the primary/sub-primary values.

   -   Broaden the consultation to encompass expertise in aquatic and subterranean systems, soils, invertebrates and other biota, Aboriginal conservation and land management knowledge, Aboriginal and non-Aboriginal cultural heritage.

- Broaden the debate by consulting widely and with sufficient time to explore the issues.

- Pursue better data quality (coverage, completeness, reliability) to address the criteria, and refine the derivation of input parameters, with broader consultation and more expert input. Design the criteria to be efficient and effective in the context of the capacity to collect, analyse and monitor the data over time.

- The certainty criteria need thorough review in terms of what is sought from them in further application, and how to get value for money from the data needs they generate. One key issue is the need to look at parameters that link to the whole landscape over time.

- Suggestions for further development of each criterion are presented in chapter 3 under the heading for each criterion "*Further development*". In the end, the focus of the criteria should be outcome focussed rather than input driven.

- That the criteria be recognised as only a part of the broader conservation strategy. Management of the landscape is what delivers conservation. Incorporation of "active adaptive management" into the criteria warrants consideration in the review.

5. That geo-spatial criteria are advantageous because they are amenable to analysis using any boundaries and so meet the needs of a variety of diverse users. Data archived now can subsequently be processed to generate historical comparisons. Output from bioregional assessment (lacking institutional structures) can be taken up through institutional frameworks (eg catchments, local government).

6. That the criteria be designed to operate across the whole landscape. This will allow consideration of the role all tenures play in generating conservation outcomes.

9. DEFINITIONS

Aboriginal cultural landscape – A culturally significant place (or group of related culturally significant places) with associated natural resources in close proximity that would have sustained the people while at that place (or places), as identified by the Aboriginal community, and containing at least one resource from each of the following four categories: cultural plants (food or medicine), cultural animal, water, culturally important raw materials. *See also Cultural landscape.*

Adaptation – Modifying a place to suit the existing use or a proposed use. (Australia ICOMOS, 2000)

Allogenic – Produced through cross-fertilisation, interaction with other factors/agents (deduced from Delbridge, 1991).

Association – The special connections that exist between people and a place. (Australia ICOMOS, 2000)

Association (*ecol.*) – A group of plants living together under uniform environmental conditions and having a uniform and particular appearance (Blair, 1982).

Autogenic – Self-produced, self-generated (Delbridge, 1991).

Biodiversity – The variety of all life forms – the different plants, animals and micro-organisms, the genes they contain, and the ecosystems of which they form a part. It is usually considered at three levels: genetic diversity, species diversity and ecosystem diversity." (Comm. of Aust. 1996).

Bioregion (biogeographic region) – A region in which the boundaries are determined by vegetation cover, and the earth's physical features and climate (JANIS, 1997). An interim bioregionalisation of Australia has been presented by Thackway and Creswell, 1995.

Bioregional landscape framework project – A Western Regional Assessment project is developing a computer-based package that seeks to evaluate habitat value from landscape vegetative pattern in relation to land use, threats and current condition of vegetation, and modelled future condition of vegetation. *See Integration software.*

CLID – Crown Land Information Database, managed by Department of Land and Water Conservation.

Community – A group of organisms, both plant and animal, living together in an ecologically related fashion in a particular region (Blair, 1982). All living things in a particular area (Burgmann and Lindenmayer, 1998). *See Ecological community*

Conservation (1) – The maintenance of environmental quality and resources (physical, biological, cultural) sound biosphere management within given social and economic constraints, producing goods or services for humans without depleting natural ecosystem diversity, and acknowledging the naturally dynamic character of biological systems (Allaby, 1994).

(2) – All the processes and actions of looking after a place so as to retain its natural and cultural significance and always includes protection, maintenance and monitoring. (Australian Committee for IUCN, 1996 and Australia ICOMOS, 2000)

Conservation criteria (*singular* criterion) **[1]** – Rules or principles for testing the capacity of biosphere management to maintain environmental quality and resources (physical, biological and cultural) (derived from Allaby, 1994)

[2] – Principles used to determine the relative conservation value and/or the conditions which allow the persistence of biodiversity, natural and cultural heritage values across the landscape in perpetuity (project specification - Attachment 1).

Conservation management (management for conservation) – A formally defined management regime with clearly articulated conservation objectives and that establishes or maintains basic ecological function within existing native ecosystems [functional or targeted for rehabilitation] or areas that can be re-established for landscape functionality. Flexibility allowing response to dynamic business circumstances and scientific knowledge to the extent consistent with the specified conservation outcomes is appropriate. "Certainty" refers to institutional provisions, not physical security.

C-plan – A computer-based package, operating as a reporting and analysis tool. It requires data that is in geo-spatial format or that is linked to existing spatial data. The data is analysed in sets called "layers" that operate essentially as overlays when producing a map. Areas generated by the intersection of specified layers can be calculated. These areas can be reported, and compared to defined parameters. It can calculate an index of importance ("irreplacability") of each predefined section of land ("planning unit") for satisfying a set of criteria. To do this it needs a numeric indicator for each criterion chosen to contribute to this index. *See Integration software.*

Cultural group – A group of people holding common values, expressed through the sharing of beliefs, traditions, customs and/or practice. (Australia ICOMOS, 2000)

Cultural landscape – A broad area demonstrating or embodying the relationship or interaction between the natural environment and a culture. For example, Parramatta Park is a cultural landscape of national significance (NSW National Parks and Wildlife Service, 2000 (1)). *See also Aboriginal cultural landscape.*

Culturally significant place - Archaeological/historical sites are sites exhibiting evidence of historical occupation. Those that were used repeatedly, and burial sites, are of highest cultural significance. Culturally significant places are those significant sites identified by the community.

Cultural significance – Aesthetic, historic, scientific, social or spiritual value for past, present or future generations. (Australia ICOMOS, 2000)

Deliberations – One output of the current regional assessment process in Brigalow Belt South bioregion will be recommendations to the NSW government regarding management of the Crown-managed lands in the bioregion. These recommendations will derive from an agency-community collaboration proposed for August/September 2002, based on the data proved by the assessment projects, referred to as the "deliberations".

Earth processes – The interactions, changes and evolutionary development of geodiversity over time. (Australian Committee for IUCN, 1996)

Ecological community – An assemblage of interdependent populations of different species (plants and animals) interacting with one another, living in a particular area. (Burgmann and Lindenmayer, 1998). *See Community*

Ecological processes – All those processes that occur between organisms, and within and between populations and communities, including interactions with the non-living environment, that result in existing ecosystems and bring about changes in ecosystems over time. (Australian Committee for IUCN, 1996)

Ecological resources – A subset of natural resources, this refers to the resources produced by the ecosystem, being living things and their products, or that support the ecological processes of the area, being soil, water and air.

Ecosystem (ecological system) – A discrete unit that consists of living and non-living parts, interacting to form a stable system. Fundamental concepts include the flow of energy via food chains and webs, and the cycling of nutrients bio-chemically. Ecosystem principles can be applied at all scales (Allaby, 1994).

Ecosystem function – How an ecosystem works to maintain a stable system. A functional or fully functional ecosystem is working well or very well at supporting the range of ecological processes natural to (or expected of) that type of ecosystem. A dysfunctional or partially dysfunctional ecosystem is working poorly at supporting the range of ecological processes natural to (or expected of) that type of ecosystem (for example, lack of critical food source for a fauna species, or disruption to propagule dispersal mechanism for a plant).

Endangered vegetation grouping – A vegetation grouping where the existing area is 10% or less of potential distribution in the bioregion and subject to threatening processes, OR where 90% of its area is in small patches subject to threatening processes and unlikely to persist. [*This relates to the specific criterion in JANIS (1997)*]

Endemism – Species that have evolved in, and are restricted to, a particular area (Cox, 1997).

Evolutionary processes – Genetically-based processes by which life forms change and develop over generations. (Australian Committee for IUCN, 1996)

Existence value – Living organisms, earth processes and ecosystems may have value beyond the social, economic or cultural values held by humans. (Australian Committee for IUCN, 1996)

Exogenous – Having its origin external, derived externally (Delbridge, 1991)

Exotic species (exotics) - Terrestrial and aquatic species introduced from outside Australia, and species natural to Australia but outside their "normal" range.

Extant – Still in existence, not destroyed or lost (Blair, 1982).

Fabric – All the physical material of the place, including components, fixtures, contents and objects. (Australia ICOMOS, 2000)

FMZ – Forest Management Zone (see State Forests of NSW, 1999).

Geomorphic – Relating to the figure of the earth, or the forms of its structure (Blair, 1982).

Geomorphology – The study of the characteristics, origin, and development of landforms (Blair, 1982).

Geodiversity – The range of earth features including geological, geomorphological, palaeontological, soil, hydrological and atmospheric features, systems and earth processes. (Australian Committee for IUCN, 1996)

Geo-spatial – Of or relating to space as applies to the earth's surface. [From *geo-* (the earth) and *spatial* (of or relating to space)]. (Blair, 1982).

GIS – Geographic Information System, a computer based system for storing and processing spatial data, akin to electronic maps and map overlays.

Habitat – The sum of the environmental conditions where an organism, population , or community lives; the place where an organism normally lives; the environment in which the life needs of an organism are supplied (Stiling, 1996). The structural environments where an organism lives for all or part of its life. (Australian Committee for IUCN, 1996)

Integration software – A variety data (existing and being delivered by current projects) will be available for the deliberations and future use. These need to be brought together so they can operate as a consistent integrated data set. Physical maps are too cumbersome, and computer-based software packages using geo-spatial functions are used. The software that will be used for the deliberations is C-plan supported by the Bioregional landscape framework package. C-plan will be run as required in the deliberations to accommodate and report the implications of the decisions made and options being explored. The bioregional landscape framework package is anticipated to be run from time to time during the deliberations to update the landscape habitat value score based on appropriate stages in C-plan runs. The score will feed back into the deliberations and subsequent C-plan runs. *See C-plan and Bioregional Landscape Framework*

Interpretation – All the ways of presenting the cultural significance of a place. The cultural significance of many places is not readily apparent, and should be explained by interpretation. Interpretation should enhance understanding and enjoyment, and be culturally appropriate. (Australia ICOMOS, 2000)

Landscape framework – the structure of the landscape that provides capacity for persistence of biodiversity. A primary focus is the character, patch size and placement of vegetation across the landscape because it determines the capacity of species to survive, through foraging, dispersal, ability to withstand change (transitory and permanent), ability to withstand competition and predation, genetic movement. *See Bioregional landscape framework project*

Landscape function – How a landscape works to capture, retain and use the valuable natural resources within the local system. A functional or fully functional landscape is working well or very well at capturing and retaining resources. A dysfunctional or partially dysfunctional landscape is working poorly at capturing and retaining resources (for example, conserving water and nutrients) (Ludwig, et. al., 1997)

Layer – Geospatial data sets used in GIS systems, operating essentially as map overlays.

JANIS – Refers to the document: JANIS, 1997, *Nationally agreed criteria for the establishment of a comprehensive, adequate and representative reserve system for forests in Australia*. A report by the ANZECC/MCFFA national forest policy statement implementation sub-committee. May be use to refer to the reserve criteria contained in that document.

Maintenance – The continuous protective care of the fabric and setting, or the biological diversity and geodiversity of a place and is to be distinguished from repair. Repair involves restoration and reinstatement or reconstruction. Maintenance is fundamental to conservation, and should be consistent with the conservation process(es) adopted for a place and should not detract from its natural or cultural significance. (Australian Committee for IUCN, 1996 and Australia ICOMOS, 2000)

Meanings – Denote what a place signifies, indicates, evokes or expresses. (Australia ICOMOS, 2000)

Natural heritage – This incorporates a spectrum of values ranging from existence value at one end through to socially-based values at the other. The fundamental concept of natural heritage which most clearly differentiates it from cultural heritage is that of dynamic ecological processes, on-going natural evolution, and the ability of ecosystems to be self-perpetuating. At the cultural end of the spectrum, clear separation of natural and cultural values can be difficult. (Australian Committee for IUCN, 1996)

Natural resources – This can be thought of as living things (plants, animals, and other biota) and their products, substrate (soil and geological components), and supply systems (air, water). The geological components include rock, gravel, minerals and petroleum resources.

Natural significance – The importance of ecosystems, biological diversity and geodiversity for their existence value, or for present or future generations in terms of their scientific, social, aesthetic and life-support value. (Australia ICOMOS, 2000)

NWI – An environmental database and set of modelling procedures designed to assist in the planning and management of remote and natural lands in Australia. (JANIS, 1997). This is used to derive an index for rating "quality" of wilderness (as adopted by the National Wilderness Inventory – see Lesslie and Maslen 1995) using four variables: remoteness from settlement, remoteness from access, apparent naturalness (degree of freedom from permanent structures associated with modern technological society), biophysical naturalness (degree of freedom from biophysical disturbance caused by the influence of modern technological society).

Organism – Any living being. (Australian Committee for IUCN, 1996)

Place – A site or area with associated ecosystems, which are the sum of its geodiversity, biological diversity and natural processes. (Australian Committee for IUCN, 1996)

Preservation – Maintaining the fabric in its existing state or the biodiversity and/or an ecosystem of a place at the existing stage of succession, or maintaining existing biodiversity. Preservation is appropriate where the natural significance of a place is its existing state, stage of natural succession or the existing state of its geodiversity. Preservation should be limited to the minimum intervention, or the change of maintenance actions, needed to suspend the natural earth processes or processes of succession and where that intervention or change will not adversely affect surrounding ecosystems. (Australian Committee for IUCN, 1996 and Australia ICOMOS, 2000)

Protection – Taking care of a place by maintenance and by managing impacts to ensure that natural significance is retained. (Australian Committee for IUCN, 1996)

Rare vegetation grouping – A vegetation grouping where the geographic distribution is less than 10,000ha, or total area is less than 1,000ha or patch sizes are generally under 100ha where such patches do not aggregate into larger areas. [*This relates to the specific criterion in JANIS (1997)*].

Reconstruction – Returning a place to a known earlier state by the introduction of new material into the fabric. (Australia ICOMOS, 2000)

Refugium (*plural* refugia) – A biological community or geographic entity, which, because of its moderating structural characteristics and/or physical isolation, provides a sanctuary to which species or groups of species have retreated or been confined in response to threatening processes. (JANIS, 1997)

Reinstatement – Introducing to a place one or more species or elements of habitat or geodiversity that are known to have existed there naturally at a previous time but that can no longer be found at that place. Reinstatement is only appropriate if there is evidence that the species or habitat elements or earth features which are to be introduced, have existed there naturally at a previous time, and if returning them to the place contributes to the restoration of the natural significance of that place, and if the processes threatening to their continued existence at that place have been discontinued. (Australian Committee for IUCN, 1996)

Restoration – Returning existing fabrics or habitats to a known past state or an approximation of the natural condition by repairing degradation, by removing accretions or introduced species, or by reinstatement, or by reassembling existing components. Restoration is appropriate only if there is sufficient evidence of an earlier state to guide the conservation process and if returning the place or ecosystem to that state reveals the natural or cultural significance of that place. (Australian Committee for IUCN, 1996 and Australia ICOMOS, 2000)

Setting – The area around a place, and may include the visual catchment. (Australia ICOMOS, 2000)

Spatial – Of or relating to space (Blair, 1982).

Temporal – Of or relating to time (Blair, 1982).

Threatening process – A process that threatens, or may threaten, the survival, abundance or evolutionary development of a native species or ecological community (JANIS, 1997).

Use – The functions of a place as well as the activities and practices that may occur at the place. (Australia ICOMOS, 2000)

Values – Those beliefs which have significance for a cultural group – often including but not limited to political, religious and spiritual, and moral beliefs. (Australia ICOMOS, 2000)

Vegetation grouping (vegetation group) – The base unit available from the vegetation mapping project. The term "group" is used rather than "association" or "community" to avoid being pre-emptive, because the level of detail that is meaningful or that will be available might be broader than these terms might imply.

Vulnerable vegetation grouping – A vegetation grouping where the existing area is 30% or less of potential distribution in the bioregion and subject to threatening processes, OR is subject to continuing significant threatening processes likely to reduce its extent. [*This relates to the specific criterion in JANIS (1997)*].

Wilderness – Whilst a range of definitions and perceptions exist, the one relevant to the Brigalow Belt South assessment is that contained in the NSW Wilderness Act, 1987 section 6:

> "An area of land shall not be identified as wilderness by the Director-General unless the Director-General is of the opinion that:
>
> (a) the area is, together with its plant and animal communities, in a state that has not been substantially modified by humans and their works or is capable of being restored to such a state;
>
> (b) the area is of sufficient size to make its maintenance in such a state feasible; and
>
> (c) the area is capable of providing opportunities for solitude and appropriate self-reliant recreation."

10. READING LIST

The project report has been formed from material in the following sources. The report has not been fully referenced, and the following are therefore presented as a list of sources and references worth reading to further explore relevant issues.

Allaby, M. (Ed.), 1994, The *Concise Oxford dictionary of ecology*. Oxford Uni Press, Oxford, UK.

Archer, M. 2000, Endangered continent, *Sydney Morning Herald*, 13th Jan 2000, p11.

Attiwill, P.M., 1994A, The disturbance of forest ecosystems: the ecological basis for conservative management. *Forest Ecology and Management*, 63: 247-300.

Attiwill, P.M., 1994B, Ecological disturbance and the conservative management of eucalypt forests in Australia. *Forest Ecology and Management*, 63: 301-346.

Australia ICOMOS, 2000, TheBurra *Charter: the Australia ICOMOS Charter for places of cultural significance 1999.* Australia ICOMOS (the Australian national committee of the International Council on Monuments and Sites), Deakin Uni., Burwood, Victoria. 23pp.

Australian Committee for IUCN, (1996), *Australian natural heritage charter: standards and principles for the conservation of places of natural significance.* [Project consultant Cairnes, L.] Australian Heritage Commission. Sydney. 56pp.

Australian Committee for IUCN, (1998), *Natural heritage places handbook: applying the natural heritage charter to conserve places of natural significance.* [Project consultant Cairnes, L.] Australian Heritage Commission. Sydney. 56pp.

Beattie, A.J. and Dangerfield, M., 2000, *RACAC expert workshop on western regional assessment*, Report to the resource and conservation assessment council, 23pp.

Bennett, A.F., 1993, Fauna conservation in box and ironbark forests: a landscape approach. *Victorian Nat*. 110(1):15-23.

Bennett, A.F. 1999, *Linkages in the landscape: the role of corridors and connectivity in wildlife conservation*. IUCN Gland Switzerland & Cambridge UK.

Blair, D. (gen. Ed.), 1982, *The pocket Macquarie dictionary*. The Jacaranda Press. 1070pp.

Burgmann, M. A. and Lindenmayer, D. B., 1998, Conservation Biology for the Australian environment. Surrey Beattie & Sons, Chipping Norton NSW.

Bushby, V., 2001, Soil biology. *STIPA Newsletter* 18:6-9.

Commonwealth of Australia, 1992, 1995, *National Forest Policy Statement*, 32pp.

Commonwealth of Australia, 1996, *National Strategy for the Conservation of Australia's Biological Diversity.* Commonwealth of Australia, Canberra.

Commonwealth of Australia, 1997, *Nationally Agreed Criteria for the Establishment of a CAR reserve system for Forests of Australia*, Commonwealth of Australia, Canberra. 24pp.

Cox, G.W., 1997, *Conservation biology (2nd edition)*. WM C Brown Publishers, Dubuque, USA.

Delbridge, A. (editor in chief), 1999, *The Macquarie Dictionary*, Second Edition. The Macquarie Library, Sydney.

Dexter, N., 1999, Guidelines for prioritising threatening processes causing biodiversity loss, Tas. IMCRA Threatening Processes Workshop, Nov. 1999.

Environment Australia, 2001, *National Objectives and Targets for Biodiversity Conservation 2001 –2005,* Environment Australia, Canberra.

Freudenberger, D., Noble, J. and Morton, S., 1997, *A comprehensive, adequate and representative reserve system for the southern mallee of NSW: principles and benchmarks*, Report to Dept. Land and Water Cons. NSW 19pp.

Freudenberger, D. and Drew, A., 2001, *Bird surveys in travelling stock routes and reserves on the northwest slopes and plains: perspectives on the conservation value of TSRs*. CSIRO Sustainable Ecosystems. 38 pp plus site lists 72pp.

Greenberg, C.H., 2001, Response of reptile and amphibian communities to canopy gaps created by wind disturbance in the southern Appalacians. *For. Ecol. And Management* 148:135-144.

Hale P. & Lamb D. (*Eds*), 1997, *Conservation outside nature reserves*. Centre for Cons Biol, Uni. Qld. 1997, 534 pp.

IUCN, 1994, *Guidelines for protected area management categories*. IUCN commission on national parks and protected areas with the assistance of the world conservation monitoring centre.

James, C.D. and Saunders, D.A., 2001, *A Framework for Terrestrial Biodiversity Targets in the Murray Darling Basin.* CSIRO Sustainable Ecosystems *and* Murray-Darling Basin Commission, Canberra.

JANIS, 1997, *Nationally agreed criteria for the establishment of a comprehensive, adequate and representative reserve system for forests in Australia*. A report by the ANZECC/MCFFA national forest policy statement implementation sub-committee.

John, C., 2002, Research shows need for large native plant reserves. *ANU Reporter* 33(3):7.

Jurskis, V., 2000, Vegetation changes since European settlement of Australia: an attempt to clear up some burning issues. *Aust. For*. 63(3):166-173.

Kellas, J.D., Jarrett, R.G. and Morgan, B.J.T., 1988, Changes in species composition following recent shelterwood cutting in mixed eucalypt stands in the Wombat forest of Victoria. *Aust. For*. 51(2):112-118.

Lesslie, R. and Maslen, M., 1995. *National Wilderness Inventory – Handbook of procedures, content and usage, 2nd edition.* Aust. Heritage Commission, Canberra.

Lindenmayer, D.B., Margules, C.R. and Botkin, D.B., 2000, Indicators of biodiversity for ecologically sustainable forest management, *Cons. Biol*. 14(4):941-950.

Lindenmayer, D.B., Cunningham, R.B., Donnelly, C.F., Incoll, R.D., Pope, M.L., Tribolet, C.R., Viggers, K.L. and Webb, A.H., 2001, How effective is spotlighting for detecting the greater glider (Petauroides volans)? *Wildlife Research* 28:105-109.

Ludwig, J., Tongway, D., Freudenberger, D., Noble, J. and Hodgkinson, K., 1997, *Landscape ecology, function and management: principles from Australia's rangelands*. CSIRO publishing, Collingwood, Vic. 158pp.

McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, J.and Hopkins, M.S., 1990, *Australian soil and land survey: field handbook (second edition).* Inkata Press. Melbourne and Sydney. 198pp.

McIntyre, S., Barrett, G.W., Kitching, R.L., Recher, H.F., 1992, Species triage – seeing beyond the wounded rhinos. *Cons. Biol*. 6(4):604-606.

MacNally, R., Soderquist, T.R. and Tzaros, C., 2000, The conservation value of mesic gullies in dry forest landscapes: avian assemblages in the box-ironbark ecosystem of southern Australia. *Biol. Cons*. 93:293-300.

Mix, M.C., Farber, P. and King, K.I., (1992), Biology: the network of life. Harper Collins Publishers Inc. New York.

Morgan, G. and Terrey, J., 1992, *Nature conservation in western New South Wales*, National Parks Association of NSW Inc. Sydney.

Murray Darling Basin Ministerial Council, 2001, *Integrated Catchment Management in the Murray Darling Basin 2001 - 2010 - Delivering a sustainable future.* Murray Darling Basin Ministerial Council, Canberra.

Native Vegetation Advisory Council NSW, 2000, (*Draft*) *NSW Native Vegetation Conservation Strategy*, 40pp.

Nix, H.A. and Mackey, B.G., (1999), *Conservation principles and criteria for the Brigalow Belt South bioregion in NSW*. Unpublished report to NSW National Parks and Wildlife Service. Sydney. 42pp. ["confidential", not available for distribution]

Norton, D.A. & Miller, C.J., 2000, Some issues and options for the conservation of native biodiversity in rural New Zealand. *Ecol. Management & Restoration* 1(1):26-34

NSW Government, 2001, *Action for the Environment - NSW Government Environment Statement,* NSW Government, Sydney.

NSW Heritage Council, 2000, *Review of Historical Archaeology Planning Systems and Practice in NSW,* NSW Heritage Council.

NSW Heritage Office, 1999, *A guide to the heritage system*. NSW Heritage Office. 11pp.

NSW National Parks & Wildlife Service, 1997, *Aboriginal Cultural Heritage Standards and Guidelines Kit*, NSW National Parks & Wildlife Service, Hurstville.

NSW National Parks & Wildlife Service, 1999, *NSW biodiversity strategy,* NSW National Parks and Wildlife Service, Hurstville, NSW 74pp.

NSW National Parks & Wildlife Service, 2000 (1), *Visitor guide Parramatta Park*, NSW National Parks & Wildlife Service, Hurstville.

NSW National Parks & Wildlife Service, 2000 (2), *Cultural Heritage Policy*, NSW National Parks & Wildlife Service, Hurstville.

Pressey, R.L., 1994, ad hoc reservations: Forward or backward steps in developing representative reserve systems. *Cons. Biol*. 8(3):662-668

Pressey, R.L. and Logan, V.S., 1998, Inside looking out: findings of research on reserve selection relevant to "off-reserve" nature conservation. pp 407-418 In *Conservation outside nature reserves*, Ed. by P. Hale and D. Lamb. C. for Cons. Biol., Uni of Qld. 1997.

Quicke, D.J.L., (1993), *Principles and techniques of contemporary taxonomy*. Blackie Academic and Professional, Chapman and Hall, Glasgow. 311pp.

Refshauge, A., 2000, *Heritage week directions statement April 2000*. NSW Government. 4pp.

Resource and Conservation Division, 2000, *Aboriginal Cultural Heritage Assessment - Preliminary Report (Stage 1)*, NSW Western Regional Assessments RACD Dept Urban Affairs and Planning, Sydney.

Resource and Conservation Division, 2001, Strategic Framework Stage 2 – Brigalow Belt South (endorsed 3rd Sept, 2001), Sydney.

Robertson, M., Nichols, P., Horwitz, P., Bradby, K. and MacKintosh, D., 2000, Environmental narratives and the need for multiple perspectives to restore degraded landscapes in Australia. *Ecosystem Health* 6(2):119-133.

Sivertsen, D. and Smith, P.L., (in prep) *Part B – setting goals and targets*. Centre for Nat. Res., Dept Land and Water Cons. Sydney. 6pp.

Smith, A.P. and van der Lee, G., 1992, *Guidelines for assessing the significance of logging and clearing on endangered forest fauna on protected land in NSW*. Dept. Conservation and Land Management, Sydney. 167pp.

Smith, P.L. and Sivertsen, D., (*in prep*) *Part A – landscape composition for the maintenance of biodiversity values in production-oriented landscapes*. Centre for Nat. Res., Dept Land and Water Cons. Sydney. 11pp.

Soderquist, T.R. and MacNally, R., 2000, The conservation value of mesic gullies in dry forest landscapes: mammal assemblages in the box-ironbark ecosystem of southern Australia. *Biol. Cons*. 93:281-291.

State Forests of NSW, 1999, *Managing our forests sustainably: forest management zoning in NSW State forests*. Operational circular 99/10, State Forests of NSW, Sydney, NSW 32pp.

Stiling, P.D., 1996, *Ecology: theories and applications* (second addition). Prentice Hall International Inc., Sydney.

Thackway, R., and Creswell, I.D. (eds), 1995, An interim biogeographic regionalisation for Australia: a framework for establishing the national system of reserves, version 4.0. Australian Nature Conservation Agency, Canberra.

Thiele, K.R. and Prober, S.M., 2000, Reserve concepts and conceptual reserves: options for the protection of fragmented ecosystems. Pp 351-358 Chapter 20 In *Temperate eucalypt woodlands in Australia: biology, conservation, management and restoration*, Ed. by Hobbs, R.J. and Yates, C.J. Surrey Beatty & Sons P/L, Chipping Norton (NSW) 1999.

Walker, B., 1998, The art and science of wildlife management. *Wildlife Research* 25:1-9.

York, A., 1999, Ecologically sustainable management: the utility of habitat surrogates for assessing terrestrial invertebrate diversity in temperate forests. In *The other 99%. The conservation and biodiversity of invertebrates*. Ed by Winston, P. and Lunney, D., Transactions of the Royal Zoological Society of NSW, Mosman. Pp34-39.