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A Review of Vegetation Types in the PVP-Developer

for the Border Rivers/Gwydir, Central West, Lachlan, Lower Murray Darling, Namoi and Northern Rivers Catchment Management Authority Areas

(Project No. 21-09)

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Executive Summary

Vegetation types and percentage cleared estimates stored in the *BioMetric* Vegetation Types Database for Border Rivers/Gwydir, Central West, Lachlan, Lower Murray Darling, Namoi and Northern Rivers Catchment Management Authority areas were reviewed using a combination of expert consultancy analysis and expert workshop review. The original approach used in 2004 by the Department of Environment and Conservation to populate the *BioMetric* Vegetation Types Database was completed within a very limited timeframe, and the potential for inconsistencies and other problems resulted in the commissioning of this review. The review has found that vegetation types varied markedly between CMAs, to the extent that the vegetation classification was observed to be inconsistent in terms of number of types, sources from which types were drawn, nomenclature, sharing of types between CMAs, and amount of duplication within CMAs. As such, a process was developed in which one of three actions was recommended for each vegetation type currently used in *BioMetric*; retain, delete or add.

On completion of the expert and workshop review, it was recommended that 500 vegetation types across the six CMAs be retained, 387 be deleted, and 291 be added. This represented an overall reduction of 96 types, from 887 to 791, largely as a result of deletion of duplicate types sourced from different classifications, or deletion of types considered not to occupy the CMAs. Of the 500 vegetation types recommended for retention, %cleared estimates and Keith classes were revised for 114 (23%) types and 71 (14%) types, respectively. The total number of unique types across the six CMAs was reduced from 660 to 471, while the proportion of vegetation types shared by two or more CMAs increased from 27% to 47%. The consistency between and within CMAs was improved, and the diversity in vegetation types increased through addition of types not originally included in the Database.

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List of Acronyms

BBS	Brigalow Belt South
BRG	Border Rivers/Gwydir (CMA)
CMA	Catchment Management Authority
CW	Central West (CMA)
DEC	Department of Environment and Conservation (formerly NPWS)
DNR	Department of Natural Resources
ELA	Eco Logical Australia
FCNSW	Forestry Commission of New South Wales
FE	Forest Ecosystem
L	Lachlan (CMA)
LMD	Lower Murray Darling (CMA)
N	Namoi (CMA)
Nd	Nandewar
NPWS	National Parks and Wildlife Service (now DEC)
NR	Northern Rivers (CMA)
NRAC	Natural Resources Audit Council
NRC	Natural Resources Commission
NSWVCA	New South Wales Vegetation Classification and Assessment
PVP	Property Vegetation Plan
RN17	Research Note 17
TS	Threatened Species
VTDB	Vegetation Types Database

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1. Introduction

Recent legislation developed to support native vegetation reform in NSW (*Native Vegetation Act 2003*, *Catchment Management Authorities Act 2003*, *Natural Resources Commission Act 2003*) underpins a commitment by the NSW Government to end broadscale clearing of native vegetation in NSW, and to deliver investment security, increased flexibility, and land remediation support for landholders across the state. The new system is based on voluntary agreements established between landholders and Catchment Management Authorities (CMAs), called Property Vegetation Plans (PVPs). These plans are partly informed by a computer modelling program called the PVP-Developer, which supports on-site assessment of salinity, soil, water and biodiversity and threatened species.

The PVP-Developer is designed to help CMAs and farmers to prioritise incentive payments for improving the condition of native vegetation on rural properties, and to assess whether clearing applications provide a 'maintained or improved' environmental outcome, through provision of offsets, if necessary, or by management of invasive native scrub. *BioMetric* and the *Threatened Species Tool* (*TS Tool*) represent the biodiversity and threatened species components of the PVP-Developer, and each is underpinned by a Vegetation Types Database (VTDB). This lists all native vegetation types known to occur in each CMA, accompanied by an estimated %cleared for each type. Vegetation types and %cleared estimates were assembled for each CMA by regional staff of the Department of Environment and Conservation (DEC) using the best available data, sourced from various classifications for which clearing percentages were available.

The vegetation types in *BioMetric* are integral to assessing clearing and incentive proposals under the *Native Vegetation Act 2003*. For example, proposed zones for assessment on private land are delineated according to vegetation type and condition, vegetation condition is assessed against established benchmarks for broad vegetation classes, priority is given to incentive proposals within vegetation types which are more highly cleared, and vegetation clearing is prohibited in types exhibiting a %cleared estimate greater than 70%. Given the influence that vegetation types impose on PVP outcomes, it is well recognised that the rigour and comprehensiveness of the classification in the PVP-Developer be regularly reassessed and improved, particularly as new data become available.

2. Scope

Eco Logical Australia was commissioned by DEC in April 2006 to conduct a review of the current vegetation types in *BioMetric* for six priority CMAs, namely Border Rivers/Gwydir, Central West, Lachlan, Lower Murray Darling, Namoi and Northern Rivers. The review was undertaken to improve consistency in the vegetation classification within and between CMAs, to address missing, and duplicate and overlapping vegetation types, to revise %cleared estimates provided for each vegetation type, and to check broad vegetation classes (Keith 2004) to which types are linked. Incorporation of any new mapping/classification data was sought to assist the vegetation types and %cleared review. On completion of this review, Eco Logical was to provide an updated spreadsheet, comprising several key fields, for official update to the *BioMetric* VTDB for the six priority CMAs.

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3. Methods

3.1 Broad Approach

The major output required of Eco Logical for this contract was a review and update of the vegetation types within the *BioMetric* tool (part of the PVP-Developer) for six priority CMAs (Figure 3.1). The review was undertaken for 3 groups.

Group 1: Border Rivers/Gwydir, Namoi and Northern Rivers
Group 2: Central West and Lachlan
Group 3: Lower Murray Darling

Figure 3.1. Location of CMAs considered in the Vegetation Types review

A full list of vegetation types for each group was exported from the *BioMetric* VTDB into Microsoft EXCEL, thence reviewed against analyses of floristic equivalence and spatial overlap. An initial position was consequently reached about which units to retain, add and delete. This position was taken to three specially convened expert CMA workshops for external review, from which a final set of updated vegetation types and clearing estimates was agreed. Workshop details are provided in Appendix I.

For each CMA, the final recommended set of vegetation types and %cleared estimates will be listed in new updated table for incorporation into the *BioMetric* VTDB. Upon signoff by the Natural Resources Commission (NRC), this new table will be formally integrated into *BioMetric* and the *TS Tool* for ongoing use by CMAs.

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3.2 Initial revision

i. Selection of a standard classification

The main objective of this review was to refine the vegetation types list in *BioMetric* to achieve a more logical and consistent classification within and between six priority CMAs, and to update the *BioMetric* VTDB accordingly. For each of the three groups of CMAs (section 2.1), commencing with Border Rivers/Gwydir, Namoi and Northern Rivers (group 1), all vegetation types were exported from the Database and listed/sorted in excel. A preliminary comparison of the set of units for Border Rivers/Gwydir, Namoi and Northern Rivers revealed various inconsistencies requiring refinement by Eco Logical staff prior to expert workshop review. These were:

1. inconsistent inclusion of source data between CMAs;
2. inconsistent approach to deleting and merging types between CMAs;
3. inter-classification duplication of some types between and within CMAs; and
4. inconsistent nomenclature.

Vegetation types used in *BioMetric* were sourced from various regional vegetation mapping/classification projects. These included northern Forest Ecosystems (NPWS 1999) for Northern Rivers, Border Rivers/Gwydir and Namoi CMAs, Nandewar WRA units (Wall 2004) for Border Rivers/Gwydir and Namoi CMAs, Brigalow Belt South WRA units (planningNSW 2003) for Border Rivers/Gwydir, Namoi and Central West CMAs, southern Forest Ecosystems (Thomas *et al.* 2000) for Lachlan CMA, and broad map units for Lower Murray Darling CMA (Val 1998). Each of these projects had different purposes, timeframes, geographic extents, and used different techniques.

An additional source of vegetation units, currently incorporated into *BioMetric* for several CMAs, is the NSW Vegetation Classification and Assessment (NSWVCA), an ongoing program being undertaken by the Sydney Royal Botanic Gardens (Benson 2006). It aims to classify the native vegetation of NSW into an estimated 800–1200 unique units using available vegetation map descriptions, floristic groups derived from existing plot data, expert advice, and extensive field checking. Plant communities are classified within 5 hierarchical levels, and are recorded in a database containing 90 fields, including common name, diagnostic species in each stratum, proportion within different CMAs, description of threatening processes, estimates of pre-European and current extent (including confidence levels), equivalence to broader classifications such as those described in Keith (2004), and an exhaustive list of references (Benson 2006). To date, about 270 units have been described, covering about 60% of the state (all of the Western Division and part of the Central Division). Of these, 213 communities which occur in the arid and semi-arid NSW Western Plains, have recently been published (Benson *et al.* 2006). Following this publication, the NSWVCA is continuing to progress eastwards to the western slopes, tablelands, and finally the coastal and escarpment regions of eastern NSW. Three further publications are anticipated over coming years.

The NSWVCA represents the only native vegetation classification of a resolution and consistency suitable for direct incorporation into *BioMetric* as a single statewide standard. An alternative vegetation classification on which benchmarks in *BioMetric* are currently based (Keith 2004), provides an excellent overview of broad vegetation

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types in NSW. However, it is arguably too broad to be used as a baseline vegetation classification in *BioMetric*, as it does not generally differentiate finer vegetation types, based on canopy-midstorey-understorey floristics, within specific landscapes. There are over 1000 unique types in the *BioMetric* VTDB at present, compared with 99 described Keith classes.

It was decided at an early stage in this review to adopt NSWVCA units as the single standard for *BioMetric*. The work is comprehensive and well researched, is peer reviewed, includes %cleared estimates (albeit across the entire range of each unit), includes direct equivalence to Keith classes (necessary for benchmarking), and to date covers 60% of the state, including 2 whole CMAs (Lower Murray Darling and Western). It is currently stored in a Microsoft ACCESS database from which various informative and contextual reports can be generated for different areas and/or vegetation units, and it includes a comprehensive photograph library of all described units. The Federal Department of Environment and Heritage (DEH) has funded this work through NHT on the premise that equivalence be provided against cross border classifications such as the Victorian EVC (ecological vegetation classification) system.

Having decided to adopt NSWVCA units as the standard for the vegetation types review process, the next step was to ensure that all published units (Benson *et al.* 2006), and all available unpublished units (Benson 2006 *unpubl. data*) were included in the *BioMetric* upgrade for the six CMAs under review. Table 3.1 compares the number of NSWVCA units currently in *BioMetric* and the *TS Tool* with the total number released to date. Fewer NSWVCA units were incorporated as presently exist, although the full set of NSWVCA units was not available at the time the original database was populated. Notwithstanding, the Border Rivers/Gwydir CMA vegetation classification is not currently populated with NSWVCA units, in contrast to that of Namoi CMA, which contains 49. This represented one of the main inter-CMA inconsistencies resulting from the review, particularly given that many NSWVCA units described by 2004 were common to both CMAs. A similar inconsistency was observed between Lower Murray Darling CMA, which is currently populated with 8 from a total of 58 NSWVCA units described for that CMA (Benson *et al.* 2006), and Lachlan and Central West CMAs, which contain close to the full set of NSWVCA units described for those CMAs.

Table 3.1. NSWVCA units in the current *BioMetric (version 1.8)*, and the total number currently available for inclusion.

	NSWVCA units	
CMA	**Total included (2004)**	**Total Available (2006)**
Border Rivers/Gwydir	0	54
Central West	92	92
Lachlan	81	100
Lower Murray Darling	8	58
Namoi	49	53
Northern Rivers	0	1

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ii. Equivalence tables

Having selected NSWVCA units as the standard, the next step was to test their floristic equivalence against other types in *BioMetric*. Where a non-NSWVCA vegetation type present in the *BioMetric* VTDB (eg. those derived for Nandewar and BBS WRAs) exhibited the same or very similar dominant species floristics to a NSWVCA unit, it was eliminated, under the assumption that it was the same community. A record of all equivalent types was logged in equivalence tables developed in Microsoft EXCEL for this project. Table 3.2 shows an example of community equivalence. Those units in green font were eliminated.

A subsequent round of equivalence testing was required for all other non-NSWVCA types in *BioMetric* in view of the substantial spatial overlap of some classifications. For example, the Nandewar and BBS classifications were each informed by a subset of shared floristic sites, with the result that different names are used to describe the same community. There is also considerable overlap between forest ecosystems and Nandewar units. Table 3.3 shows a further example of community equivalence.

Table 3.2. Part of an equivalence table for NR-BRG-N review, showing equivalence of NSWVCA units with BBS and Nandewar units

NSWVCA unit	BBS Unit	Nandewar Unit
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	Kaputar riparian woodland - *Casuarina cunninghamiana/ Stephania japonica* (BBS 2)	River Oak Riparian Open Forest; widespread (Nd 109)
River Red Gum open forest and woodland mainly of the Darling Riverine Plains Bioregion (Benson 36)	Northern floodplain woodland - *E. camaldulensis/Leptochloa digitata/Cynodon dactylon* (BBS 158)	
River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78)	Southern floodplain woodland - *E. camaldulensis/Cynodon dactylon/ Paspalum distichum* (BBS 161)	River Red Gum Riparian Open Forest/Woodland; widespread (Nd 110)
Semi-evergreen vine thicket of basalt hills of the NSW north western slopes (Benson 147)	Vine thicket - *Cassine australis/Carissa ovata* (BBS 192)	Semi Evergreen Vine Thicket; scattered (Nd 114)

Table 3.3. Part of an equivalence table for NR-BRG-N review, showing equivalence of Forest Ecosystem, BBS, and Nandewar units

BBS Unit	Nandewar Unit	FE	New Type
Kaputar grassy woodland - *E. dalrympleana/Poa sieberiana/Coprosma hirtella* (BBS 15)	Mountain Gum/Snow Gum Grassy Open Forest; Kaputar high elevation (Nd 76)		
Riparian red gum woodland - *E. blakelyi/Leptospermum polygalifolium* (BBS 143)	Blakely's Red Gum/White Pine/Rough-barked Apple Grassy Open Forest; northern drainage lines (Nd 56)	Red Gum - Apple (FE 183)	
	Blakely's Red Gum/Rough-barked Apple/Red Stringybark Grassy Open Forest; tableland edge (Nd 55)	Red Gum - Stringybark (FE 116)	Blakely's Red Gum/Rough-barked Apple/Red Stringybark Grassy Open Forest; tableland edge
	Rough-barked Apple/Blakely's Red Gum Grassy Open Forest; central tableland edge (Nd 15)		

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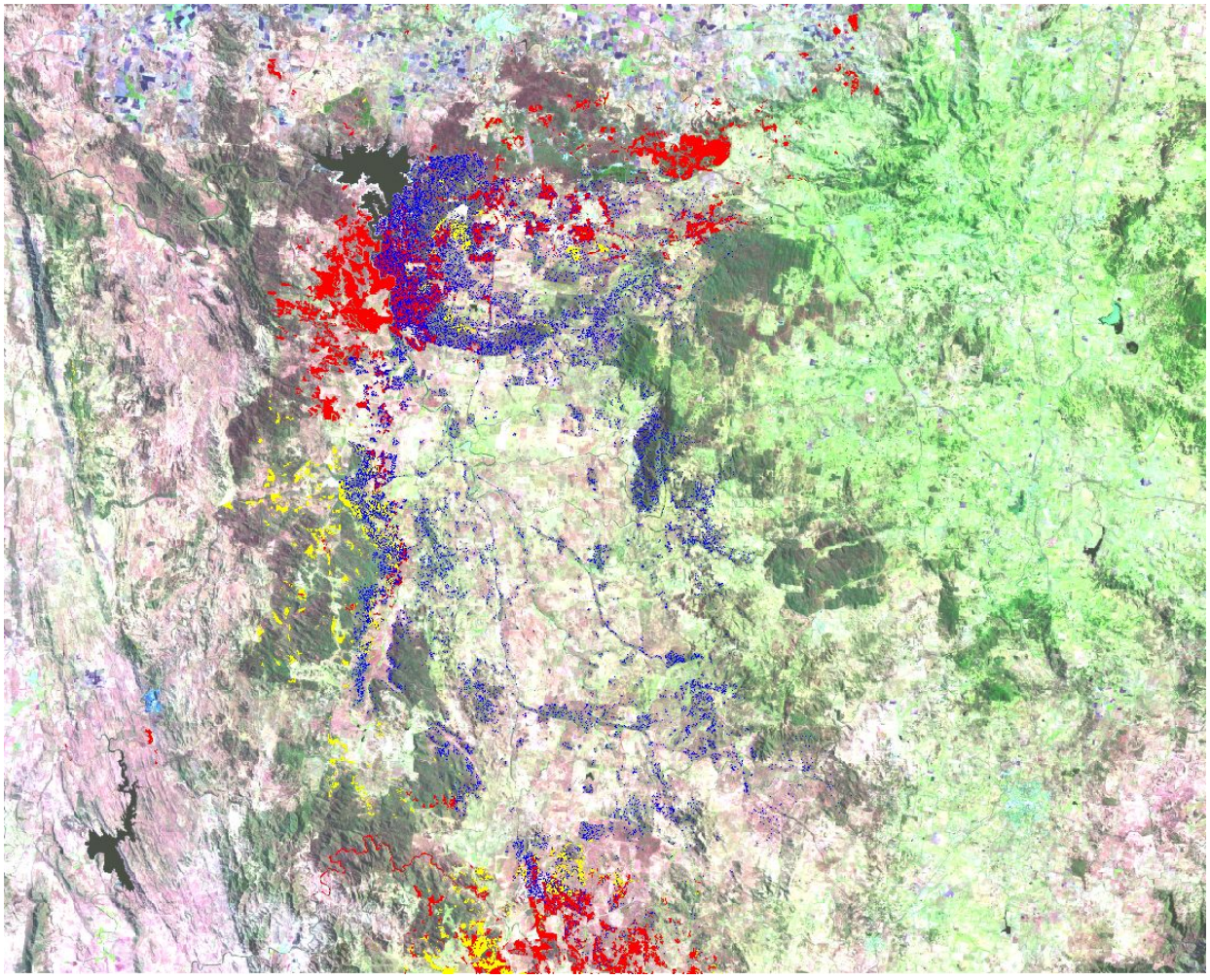
Given that all non-NSWVCA types were available as spatial maps/models in GIS, construction of the second phase of equivalence (Table 3.3) was facilitated by visual assessment of geographic overlap as well as diagnostic species comparison. This is demonstrated in Figure 3.2 below, which shows the distribution of three floristically similar types on the north-west slopes of NSW. Note that in this case, two closely related types from the one classification (Nandewar units 15 and 55) were merged with Forest Ecosystem 116, based on similar floristics and spatial overlap, to form a new vegetation type in the current upgrade process.



Nandewar Unit	FE	New Type
Blakely's Red Gum/Rough-barked Apple/Red Stringybark Grassy Open Forest; tableland edge (Nd 55)	Red Gum - Stringybark (FE 116)	Blakely's Red Gum/Rough-barked Apple/Red Stringybark Grassy Open Forest; tableland edge
Rough-barked Apple/Blakely's Red Gum Grassy Open Forest; central tableland edge (Nd 15)		

Figure 3.2. Spatial distribution of Nandewar Unit 15 (red), Nandewar Unit 55 (yellow) and Forest Ecosystem 116 (blue).

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Equivalence tables generated for this project provide a record of floristically equivalent types which, as part of the review, helped to inform decisions about individual types in *BioMetric*. However, not all decisions were based on equivalence. Some initial expert decisions were made with respect to adding types not currently included, or deleting types considered not to occur in the CMA. Some types described in Namoi were also imported to Border Rivers/Gwydir and Central West to increase consistency between these CMAs. In summary, one of three major decisions was made to each vegetation type in *BioMetric*, for each CMA, in this review – **retain**, **delete** or **add**.

A type was **retained** if:
- it was known to exist in the CMA, and
- it was not equivalent to any other type, or
- it was equivalent to one or more other types over which it took precedence (eg. NSWVCA units).

A type was **deleted** if:
- it was known not to exist in the CMA, or
- it was replaced by an equivalent type.

A type was **added** if:
- it was known to exist in the CMA but was not currently in the *BioMetric* VTDB, or
- it was a new name for an combination of 2 or more equivalent types, or
- it was carried as a consistent type between adjoining CMAs.

Maintenance of the decision path for all vegetation types in *BioMetric* is a requirement of the current legislation. As such, all changes to *BioMetric* vegetation types had to be tracked and justified. To do this, a separate Microsoft EXCEL file was developed, within which a link between current **Vegtype_ID** field (unique ID for each existing type in *BioMetric*) and a **new VegtypeID** field was established. Appendix II shows an example of this file.

3.3 Workshop revision

On completion of the initial review of vegetation types (section 3.2), three expert workshops were convened to discuss the revised types and the decision process in general, and to make necessary changes and recommendations to the vegetation classification for the six priority CMAs. Details of the expert workshops are provided in Appendix I. An overview of the NSWVCA program was presented by John Benson at the first and second workshops, providing CMA staff and other participants with an insight into the utility and application of that classification. The initial methodology employed by Eco Logical to conduct the vegetation revision was also presented, and results summarised. A staff member from each CMA presented an overview of issues associated with interpreting and using the current vegetation classification, in the context of undertaking development and incentive PVPs. This provided a very important context, and assisted in formulating some recommendations in this report. All revisions made to vegetation types and %cleared estimates in *BioMetric* were scrutinised by workshop participants, and further expert changes made, where appropriate, using an agreed and transparent process. Workshop recommendations were logged by Eco Logical in a Microsoft EXCEL file for future reference and tracking. A part of this file is provided for reference in Appendix II.

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3.4 Database update

On completion of the workshops, all decisions and comments were transferred into a Microsoft EXCEL spreadsheet entitled 'Veg_Types_Updates_Contractor_Version1.xls' , developed by DEC in July 2006 for integration into *BioMetric*. For each retained, deleted and added unit, this spreadsheet required insertion of a New_VegType_ID against the original VegType_ID field, and insertion of one of nine specific actions in an 'Action_ID' field, including:

	Retained types
no change	no changes required to the vegetation type in *BioMetric* (VegType_ID = New_VegType_ID) – *represented by a single row in the spreadsheet.*
retain - changed	one or more changes required to the vegetation type in *BioMetric*, such as vegetation type name, %cleared estimate, and diagnostic species (VegType_ID = New_VegType_ID)) – *represented by a single row in the spreadsheet.*
	Added types
new	new vegetation type introduced to *BioMetric* (VegTypeID = null) – *represented by a single row in the spreadsheet.*
	Deleted types
delete	vegetation type not considered to occur in the CMA and is thus not equivalent to any current or new type (NewVegType_ID = null)) – *represented by a single row in the spreadsheet.*
merge - existing	vegetation type (Vegtype_ID) is merged into an existing type (New_VegType_ID) – *represented by a single row in the spreadsheet.*
merge - new	vegetation type (Vegtype_ID) is merged into a new type (New_VegType_ID) – *represented by a single row in the spreadsheet.*
split - merge	vegetation type (Vegtype_ID) is replaced by two or more retained types (New_VegType_IDs) – *represented by two or more rows in the spreadsheet.*
split - new	vegetation type (Vegtype_ID) is replaced by two or more new types (New_VegType_IDs) – *represented by two or more rows in the spreadsheet.*
split – merge - new	vegetation type (Vegtype_ID) is replaced by two or more new types (New_VegType_IDs), at least one of which represents a merge of two or more deleted types – *represented by two or more rows in the spreadsheet.*

The 'VegTypeName' and 'ClearedEstimate' fields were reviewed and, if necessary, revised for all retained and added types in *BioMetric*. The other key fields in *BioMetric*, namely 'Statecode' (ie. Keith class), 'DomCanopySpp', 'MainAssocdSpp', 'CharMidStoreySpp', 'CharGndcoverSpp', 'LandscapePosn', 'OtherDiagnostic Feature's, 'ProfileSource' and 'FullRefDetails', were updated for all new VegTypes added in this review, and for retained types into which other types were merged. Appendix III provides an example of part of this file. On completion of data input, all records were sorted by 'Statecode', and changes made in all cases in which the Keith class was considered inappropriate for its vegetation type.

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4. Results

4.1 Vegetation type revision

The number of vegetation types retained, added and deleted for each of the six CMAs, prior to and during the expert workshops, is summarised in Table 4.1. The total number of types was revised down by almost 100, from 887 to 791 (11%). Four of the six CMAs (Border Rivers/Gwydir, Central West, Namoi and Northern Rivers) exhibited a reduction in types, while Lachlan and Lower Murray Darling were revised upwards, largely as a result of incorporation of NSWVCA units. The most significant downward revision of types took place in Border Rivers/Gwydir, where duplication was most prevalent as a result of retention of equivalent types from different sources. Reduction in the number of types in Namoi and Northern Rivers CMAs resulted largely from deletion of duplicate forest ecosystems and Nandewar units in the former, and deletion of inappropriately included western forest ecosystems in the latter.

Table 4.1. Proposed number of changes in the *BioMetric* VTDB resulting from the vegetation types review for six priority CMAs

	Catchment Management Authority						
	Border Rivers/ Gwydir	**Central West**	**Lachlan**	**Lower Murray Darling**	**Namoi**	**Northern Rivers**	**ALL**
Current types [A]	**249**	**131**	**114**	**26**	**165**	**202**	**887**
Eco Logical Review							
Retain	*64*	*88*	*89*	*10*	*107*	*159*	*517*
Delete	*185*	*43*	*25*	*16*	*58*	*44*	*371*
Add	*91*	*33*	*26*	*50*	*34*	*22*	*256*
Interim proposed types	155	121	115	60	141	181	773
+ Workshop Review							
Retain	*-2*	*-6*	*-2*	*-1*	*-6*	*-*	*-17*
Delete	*2*	*6*	*2*	*1*	*6*	*-1*	*16*
Add [B]	*3*	*12*	*13*	*1*	*4*	*2*	*35*
Resultant proposed types	**156**	**127**	**126**	**60**	**139**	**183**	**791**
change	-93	-4	12	34	-26	-19	-96
% change	*-38%*	*-3%*	*11%*	*131%*	*-16%*	*-10%*	*-11%*

A. includes duplicate types in *BioMetric*, each comprising a unique 'Keith class'
B. new types not previously included in *Biometric*

4.2 Updating the *BioMetric* Vegetation Types Database

The recommendation statement provided for each vegetation type (ie. retain, delete, or add) was refined into one of nine actions (section 3.4) as part of the transfer of review data for the six CMAs into the new input table developed by DEC to support the proposed upgrade to the *BioMetric* VTDB. The action content of this table is shown in Table 4.2.

In summary, 500 vegetation types were retained, including 46 as 'no change' and 454 as 'retain - change'. Of the 'retain - change' types, %cleared estimates were revised for 112 (22%), while Keith classes were revised for 72 (14%). Others required a simple name change in which a classification tag, such as (FE 24) or (Benson 55), was appended to the vegetation type name to identify its source. More substantial name changes were made to a few types, while about 30 types had their diagnostic species lists updated to account for merging of other units.

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A total of 291 types were added, including 100 'new' types (those exhibited no equivalence to existing types), and 191 types instated as merges or splits of 226 deleted types. Of all new types, 147 were sourced from the NSWVCA (Benson *et al.* 2006; Benson *unpubl. data*), mostly in Border Rivers/Gwydir and Lower Murray Darling. These replaced a total of 80 merged or split types, mostly in Border Rivers/Gwydir. The total number of deleted types was 387, including 119 not considered to occupy their respective CMAs, 226 which were equivalent to new types, and 42 which were equivalent to existing types.

Table 4.2. Number of actions imposed on the vegetation types classification in *BioMetric* for six priority CMAs

	Catchment Management Authority						
	Border Rivers/Gwydir	Central West	Lachlan	Lower Murray Darling	Namoi	Northern Rivers	ALL
Current types [A]	**249**	**131**	**114**	**26**	**165**	**202**	**887**
Retained							
No changes	4	2	2	0	31	7	**46**
Name change [B]	34	54	56	2	35	90	**271**
%cleared change [B]	6	23	24	6	20	33	**112**
Keith class change [B]	18	3	5	1	15	29	**71**
Total retained	62	82	87	9	101	159	**500**
Added							
New	24	30	19	2	12	13	**100**
NSWVCA units	*16*	*17*	*12*	*1*	*2*	*1*	***49***
Non-NSWVCA units	*8*	*13*	*7*	*1*	*10*	*12*	***51***
Merge - new [D]	54	15	16	6	15	9	**115**
NSWVCA units	*24*	*0*	*5*	*6*	*1*	*0*	***36***
Non-NSWVCA units	*30*	*15*	*11*	*0*	*14*	*9*	***79***
Split - new	16	0	4	43	11	2	**76**
NSWVCA units	*14*	*0*	*2*	*43*	*3*	*0*	***62***
Non-NSWVCA units	*2*	*0*	*2*	*0*	*8*	*2*	***14***
Total added	94	45	39	51	38	24	**291**
Deleted							
Delete [C]	42	23	8	1	25	20	**119**
Merge - existing	12	5	0	0	9	4	**30**
NSWVCA units	*0*	*4*	*0*	*0*	*3*	*0*	***7***
Non-NSWVCA units	*12*	*1*	*0*	*0*	*6*	*4*	***23***
Merge - new	123	20	17	6	23	10	**199**
NSWVCA units	*41*	*0*	*5*	*6*	*1*	*0*	***53***
Non-NSWVCA units	*82*	*20*	*12*	*0*	*22*	*10*	***146***
Split - merge	1	1	0	0	2	8	**12**
NSWVCA units	*0*	*1*	*0*	*0*	*0*	*0*	***1***
Non-NSWVCA units	*1*	*0*	*0*	*0*	*2*	*8*	***11***
Split - new [D]	9	0	2	10	5	1	**27**
NSWVCA units	*7*	*0*	*1*	*10*	*1*	*0*	***19***
Non-NSWVCA units	*2*	*0*	*1*	*0*	*4*	*1*	***8***
Total deleted	187	49	27	17	64	43	**387**
Final proposed types	**156**	**127**	**126**	**60**	**139**	**183**	**791**
change	-93	-4	12	34	-26	-19	-96
% change	*-38%*	*-3%*	*11%*	*131%*	*-16%*	*-10%*	*-11%*

A. includes duplicate types in *BioMetric*, each comprising a unique 'Keith class'
B. may include name and/or diagnostic species changes
C. deleted from CMAs (no equivalence)
D. includes 'split - merge - new' types

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Figure 4.1 shows the change in the total number of vegetation types for each CMA following the review, and the actions contributing to those changes. Green/mauve bars represent retained types, red/orange/yellow bars represent deleted types, and blue bars signify new types. The revised number of types occupying each CMA, following retention, merging, splitting and adding, decreased from north-east to south-west, from the highest biodiversity Northern Rivers (186 types), to the least diverse Lower Murray Darling (60 types). Border Rivers/Gwydir CMA was subject to the greatest change. Over 75% of the original types were deleted (187 in total), representing almost half the number of types deleted across all CMAs. A total of 94 new types were introduced in Border Rivers/Gwydir CMA, about a third of the number of units added across all CMAs.

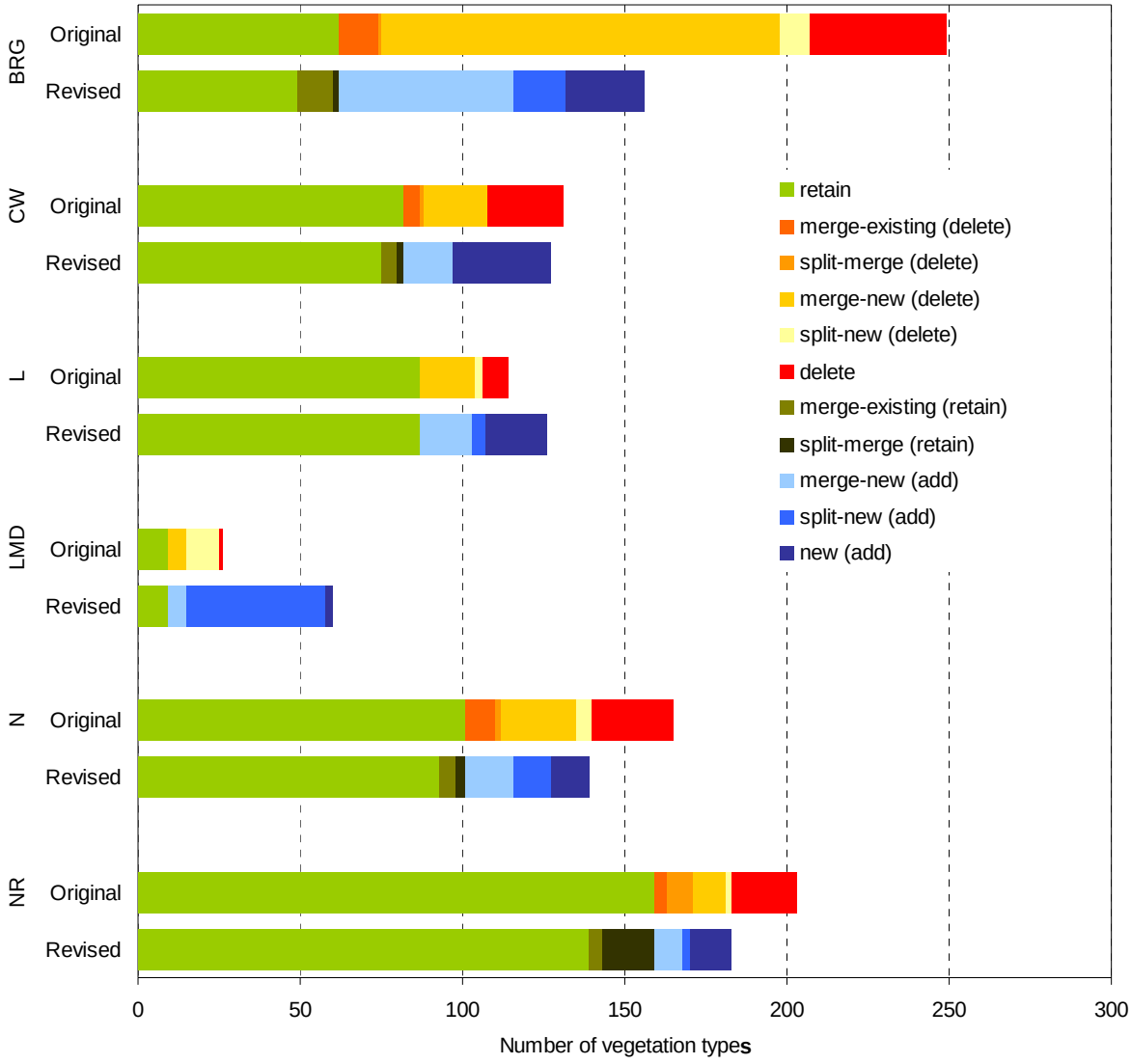

Figure 4.1. Chart of original and revised number of vegetation types in *BioMetric* for six priority CMAs, and recommended actions for *BioMetric* vegetation types upgrade.

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In terms of the proportion of types deleted and added, the least number of changes occurred in Northern Rivers CMA. In total, just 43 types were deleted (21%) while 23 types were added (13% of the total revised types). This is due partly to the unavailability of the NSWVCA units in Northern Rivers CMA, but also reflects the thoroughness and quality of the initial compilation undertaken by DEC.

In addition to revised actions, floristic and other relevant data (section 3.4) were established for types added to *BioMetric* as part of this review. However, resourcing did not permit major nomenclatural change or comprehensive review of descriptive and diagnostic species data of any retained vegetation types. As such, relevant information for retained types will default to those listed in the current *BioMetric* tables, linked through the VegType_ID field.

4.3 Statewide comparisons

As previously stated, the number of individual vegetation types listed in the *BioMetric* VTDB for the six CMAs is 887, revised to 791 following this review. In contrast, the number of *unique* types within the six CMAs is 660, including 181 types occurring in at least two CMAs. Figures 4.2 and 4.3 compare the distribution of types across the six CMAs before and after the review.

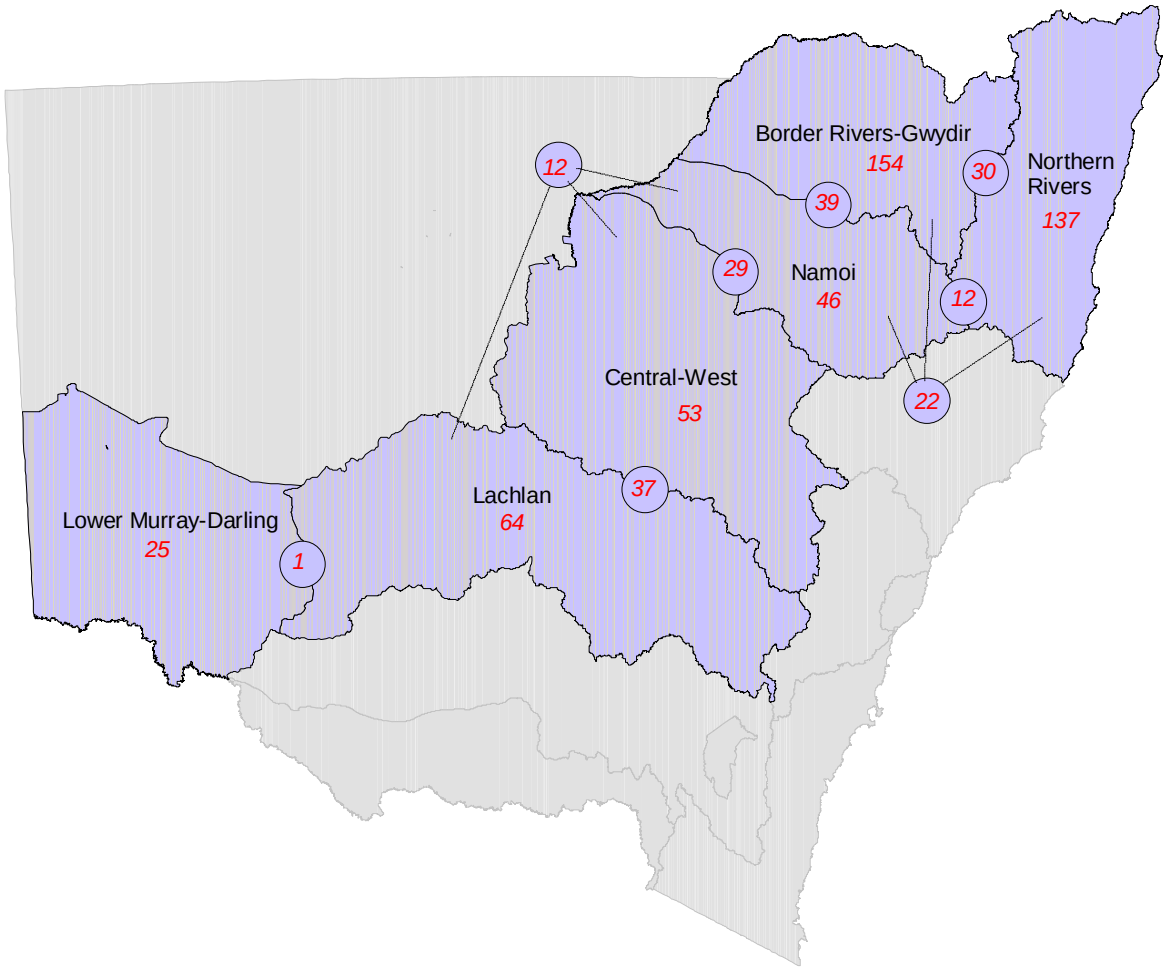

Figure 4.2. Current distribution of *BioMetric* vegetation types within six CMAs in NSW (number of shared types shown within circles)

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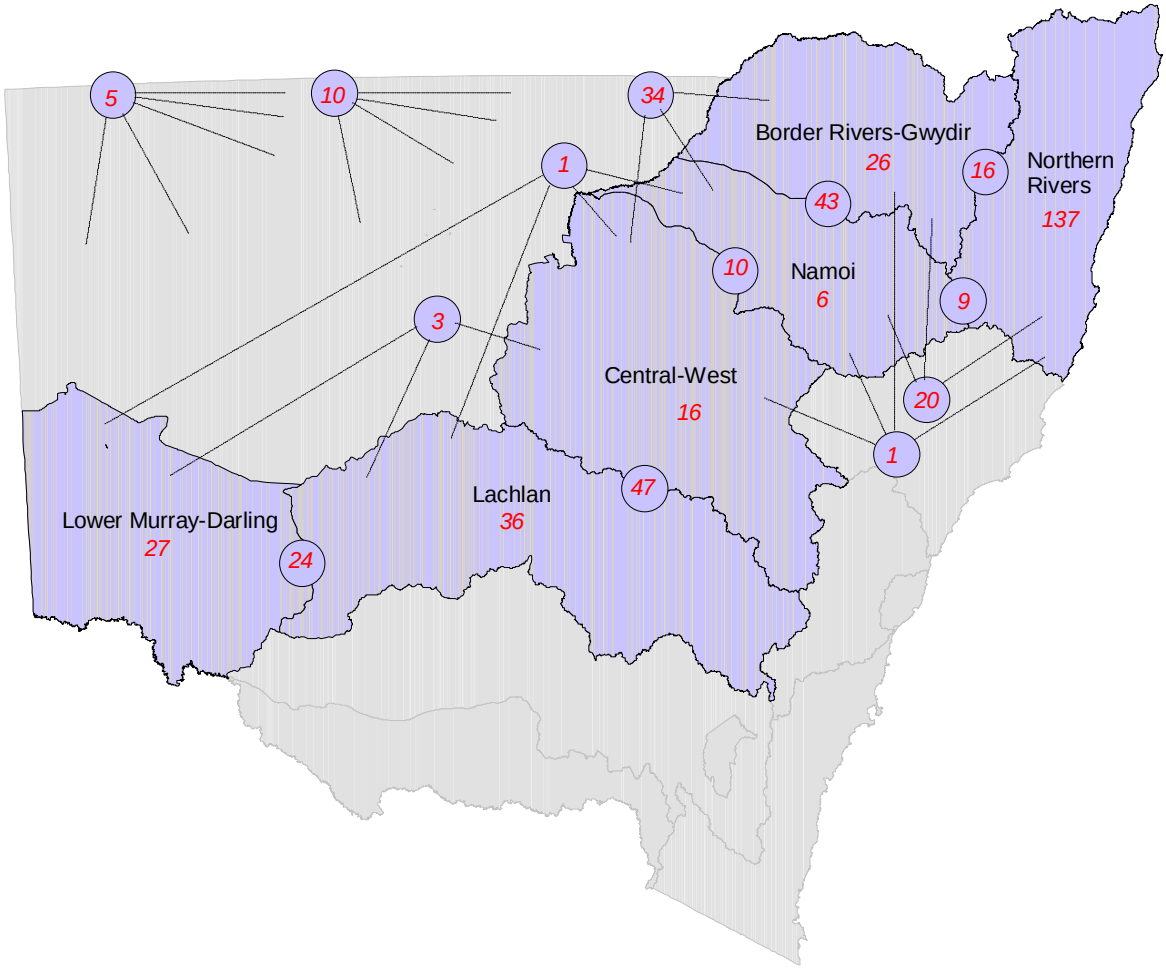

Figure 4.3. Proposed distribution of *BioMetric* vegetation types within six CMAs in NSW

As evident by comparing Figures 4.2 and 4.3, a key finding of this review was the inconsistency in the vegetation types classification between Namoi and Border Rivers/Gwydir CMAs. Prior to review, a total of 190 types were unique to either Border Rivers/Gwydir or Namoi CMAs, while they shared only 42 types. The disparity was largely the result of different processes employed by two branches of DEC in populating the original tables in 2004, at the time of major restructure of the department, including substantial boundary changes. The time available for DEC staff to carry out the task was very limited. In summary, Namoi database was populated by listing all candidate vegetation units from NSWVCA, BBS WRA, Nandewar WRA, and Forest Ecosystems, then undertaking an equivalence assessment and some expert amalgamation of types. In contrast, Border Rivers/Gwydir database was populated with all available units from BBS WRA, Nandewar WRA, and Forest Ecosystems, with minimum consideration of equivalence. The result is that Border Rivers/Gwydir comprised over 50% more types than Namoi, despite NSWVCA units not having been included. Broad units described by White (2002) were used instead of NSWVCA units in Border Rivers/Gwydir CMA.

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A similar inconsistency was evident between Lachlan and Lower Murray Darling CMAs, which shared just one vegetation type (Figure 4.2). All available NSWVCA units were used for Lachlan CMA, while broader vegetation classes (Val 1998) were preferred in Lower Murray Darling given their application to previous assessments under the defunct *Native Vegetation Conservation Act 1997*, and availability of an associated vegetation map. A handful of NSWVCA units were included to fill obvious gaps in that classification.

The process used to populate the *BioMetric* VTDB for Namoi, Central West and Lachlan CMAs was reasonably consistent. It was based on primary use of NSWVCA units, augmented with units from other classifications on the slopes and tablelands. There was a strong level of sharing between these CMAs (a total of 240 types (60%) shared, including 12 types common to all three), and the overall number of types was sensible (Namoi = 160, Central West = 130, Lachlan = 113). The process used to develop the Northern Rivers CMA *BioMetric* classification was also well thought out. It was based on forest ecosystems (NPWS 1999), and given the broadness of this classification on private land, involved expert splitting of ecosystems with input from other classifications reported in Benson and Ashby (2000), Floyd (1990), Griffith (2002) and NRAC (1995). Of all primary sources used to support *BioMetric*, it is the view of Eco Logical that the forest ecosystem classification is the least appropriate and in most need of replacement by the NSWVCA in future upgrades (Appendix IV).

On completion of this review, the total number of unique types for the six CMAs was revised from 660 to 471 following the Eco Logical and workshop reviews (Figures 4.2, 4.3), a reduction of 189 types, or 28%. The number of types unique to a single CMA was revised from 479 to 248, a reduction of 48%. The number of types shared by two or more CMAs was revised from 181 to 223, an increase of 23% despite the overall reduction in types. As a proportion of the total number of unique types, the number of types shared by two or more CMAs increased from 27% to 47%.

The number of types unique to Northern Rivers CMA remained the same pre- and post-review, while the number of types shared between Northern Rivers and adjacent CMAs was reduced from 64 to 45. In contrast, the number of types unique to one of the five western CMAs, into which available NSWVCA units were incorporated, was reduced from 342 to 111, while the number of types shared between two or more of these CMAs increased from 140 to 198. This apparent improvement in inter-CMA consistency is supported further by the fact that 34 types were common to at least three CMAs pre-review, compared with 74 post-review, mostly NSWVCA units.

4.4 Review of %cleared estimates

The intent of including %cleared estimates in *BioMetric* is to provide the best estimate of the proportion of a vegetation type remaining in relation to its likely pre-European extent, based on best available information and expert opinion. It is used as a surrogate for regional conservation significance in *BioMetric*, and is thus critical to development and incentive assessment outcomes of the PVP-Developer. Part of the expert workshop review of vegetation types included checking %cleared estimates for each vegetation type, and determining %cleared estimates for new types.

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Many of the %cleared estimates reported for NSWVCA units (Benson *et al.* 2006) included in Border River/Gwydir, Namoi, Central West and Lachlan CMAs were increased, given that clearing in the Central Division has been more extensive than in the Western Division (NSWVCA units provide a statewide estimate only). Conversely, many of the NSWVCA units introduced to Lower Murray Darling CMA were assigned lower %cleared estimates than their respective statewide estimates.

For non-NSWVCA units added to the *BioMetric* VTDB, the best available information was used. For example, a number of the %cleared estimates instated for new Central West and Lachlan CMA vegetation types were supported by new information provided by a recently finalised broad vegetation map (DEC 2006a,b), although with some precaution given the various limitations associated with attempting to directly map pre-European extent. The review of %cleared estimates for some new types in Northern Rivers CMA was similarly supported by results of a remapping project undertaken for that CMA (Eco Logical 2005). Several %cleared estimates were increased or reduced during workshops on the basis of expert knowledge and agreement, while the %cleared estimates for all derived native communities were set to zero, given the likely extent of derived communities has expanded rather than contracted since European settlement. Clearing estimates associated with deleted types were used to inform those for new types where an equivalence was established.

Broad results of the %cleared revision for retained types is presented in Table 4.3. All decisions were based on expert workshop review, and the reasons for changes were logged as part of the proposed integration of new data into the *BioMetric* VTDB. The %cleared estimates for about 77% of all retained vegetation types were unchanged following the review, while 19% were increased or reduced by up to 30%. A total of 21 vegetation types (4%) had their %cleared estimates revised by more than 30%. These are listed in Table 4.4.

Table 4.3. Results of the %cleared review for vegetation types identified for retention in the *BioMetric* Vegetation Types Database for six priority CMAs

	Catchment Management Authority						
Revision of %cleared estimate	**BRG**	**CW**	**L**	**LMD**	**N**	**NR**	**ALL**
> 70%	0	0	1	0	0	0	***1***
31-70%	0	2	2	1	2	2	***9***
11-30%	1	7	9	0	7	8	***32***
1-10%	4	3	8	0	5	19	***39***
unchanged	56	58	63	3	80	126	***386***
< (1 – 10)%	0	3	2	1	1	0	***7***
< (11-30)%	0	4	1	3	4	3	***15***
< (31-70)%	1	5	1	0	1	1	***9***
< 70%	0	0	0	1	1	0	***2***
	62	***82***	***87***	***9***	***101***	***159***	***500***

The average %cleared estimate for those deleted types linked to new types was 51.6%, while the average %cleared estimate for the new types was 52.6%. In summary, %cleared estimates were increased an average of 1% as a result of replacement of deleted types with new types through merge or split actions.

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Table 4.4. List of retained vegetation types for which %cleared estimates were revised by more than 30%

CMA	Vegetation Name	%cleared estimates Old	%cleared estimates New	Reason for recommended change to %cleared estimate
LMD	Sandplain Mulga tall open shrubland of the semi-arid and arid climate zones (Benson 119)	40	75	revised from 40% to 75% (expert workshop/ Benson *pers comm.*); grazed out in LMD (very restricted).
	Smooth-barked Coolibah - Mulga open woodland on gravelly ridges of the Cobar Peneplain Bioregion (Benson 108)	100	12	Benson database (Benson *et al*. 2006).
CW	*Acacia cheelii* woodlands on sandstones of the Brigalow Belt South Bioregion	89.9	50	revised from 90% to 50% based on expert opinion (workshop 02).
	Belah/Black Oak - Western Rosewood - Wilga woodland of central NSW including Cobar Peneplain Bioregion (Benson 57)	33	67	revised from 33% to 67% (DEC CW/L map/report 2006, workshop 02)
	River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	96.6	43	revised from 97% to 43% (DEC CW/L map/report 2006, workshop 02)
	Scribbly Gum - Brown Bloodwood woodland on volcanic slopes	1	40	revised from 1% to 40% (DEC CW/L map/report 2006, workshop 02)
	Slender-fruit Saltbush - Black Roly Poly low open shrubland of the Darling Riverine Plain (Benson 211)	62	0	derived community; set to 0%.
	Tumbledown Red Gum - Black Cypress Pine - Currawang woodland of ridges and rocky hills in the Central West	75	35	revised from 75% to 35% (DEC CW/L map/report 2006, workshop 02)
	White Cypress Pine woodland on sandy loam soils on the plains of central NSW (wheatbelt) (Benson 70)	98	60	revised from 98% to 60% (workshop 02)
L	Belah/Black Oak - Western Rosewood - Wilga woodland of central NSW including Cobar Peneplain Bioregion (Benson 57)	33	95	revised from 33% to 95% (DEC CW/L map/report 2006, workshop 02)
	Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion (Benson 180)	6	40	revised from 6% to 40% (DEC CW/L map/report 2006, workshop 02)
	Mugga Ironbark - White Cypress Pine woodland on sedimentary or metamorphic low rises in the temperate (hot summer) climate zone (Benson 243)	86	35	revised from 86% to 35% based on expert opinion (workshop 02)
	Red Stringybark - White Box grassy open forest of the western slopes	1.1	80	Average of SVT 120 (84%) and SVT 122 (76%) from Gellie (2006)
NR	Broad-leaved Stringybark (FE 197)	90	50	revised from 90% to 50% based on expert opinion (workshop 01)
	Eastern red gums (FE 46b) - *Eucalyptus bancroftii*	40	75	revised from 40% to 75% based on expert opinion (workshop 01)
	Snow Gum (FE 131)	40	75	revised from 40% to 75% based on expert opinion (workshop 01)
BRG	Northern clay plain grassland - *Bothrichloa decipiens - Asperula conferta* (BBS 190)	70	0	derived community; set to 0%
N	Green Mallee scrub on sandstone rises in the Brigalow Belt South Bioregion (Benson 179)	74	17	
	Leopardwood woodland of alluvial plains (Benson 144)	43	75	revised from 46% to 75% Central Division context (expert workshop)
	Northern clay plain grassland - *Bothrichloa decipiens - Asperula conferta* (BBS 190)	89	0	derived community; set to 0%
	Rat's Tail Couch sod grassland of inland floodplains (Benson 242)	40	75	revised from 40% to 75% Central Division context (expert workshop)

Note: large discrepancy between pre- and post-review %clearing estimates of derived communities results from the pre-review estimate being based on %-cleared of its natural extent, not its derived extent.

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4.5 Review of Keith classes

Following an expert review of Keith class allocation by Eco Logical staff, 71 of the 500 vegetation types recommended for retention were considered to possess an inappropriate Keith class. These included 10 NSWVCA units, most of which were changed according to Benson *et al.* (2006), and several forest ecosystems in Northern Rivers. All but eight of the changes were in Border Rivers/Gwydir, Namoi and Northern Rivers CMAs. Table 4.5 lists examples of vegetation types for which changes to Keith classes were made in the update file.

Table 4.5. Examples of retained vegetation types for which Keith classes were revised

		Keith Class		
CMA	**Vegetation Name**	**Old**	**New**	**Reason for recommended change to Keith class**
LMD	Smooth-barked Coolibah - Mulga open woodland on gravelly ridges of the Cobar Peneplain Bioregion (Benson 108)	52	44	Change to 44 (Western Peneplains Woodlands) as per Benson *et al*. (2006).
CW N	River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	113 113	51	Change to 51 (Eastern Riverine Forests) – more suitable than 113 (North-west Slopes Dry Sclerophyll Woodlands).
L	Belah woodland on alluvial plains in central-north NSW (Benson 55)	109	101	Change to 101 (Brigalow Clay Plain Woodlands) as per Benson *et al*. (2006), and consistent with Benson 55 in other CMAs.
NR	Yellow Box - Broad-leaved Stringybark (FE 179)	27	41	Change to 41 (New England Grassy Woodlands), consistent with FE 179 in BRG. Class 27 (Northern Tableland Dry Sclerophyll Forests) is more typically associated with black pine, western New England blackbutt, tumbledown gum types on the harder western granite country.
N NR	Brown Barrel - Gum (FE 15)	9 9	8	Change to 8 (Northern Escarpment Wet Sclerophyll Forests). Class 9 (Southern Escarpment Wet Sclerophyll Forests) is confined to southern NSW.
BRG N NR	Messmate (FE 81)	9 9 9	8	Change to 8 (Northern Escarpment Wet Sclerophyll Forests). Class 9 (Southern Escarpment Wet Sclerophyll Forests) is confined to southern NSW.
NR	Coast Cypress Pine (FE 22)	70	19	Change to 19 (Coastal Dune Dry Sclerophyll Forests) – more suitable than 70 (Coastal Headland Heaths) which represents an inappropriate structural formation.
BRG N	Snow Gum - New England Peppermint grassy open forest; tableland edge (Nd 78)	21 10	40	Change to 40 (Tableland Clay Grassy Woodlands). Classes 10 (Northern Tableland Wet Sclerophyll Forests) and 21 (Northern Hinterland Wet Sclerophyll Forests) are wet sclerophyll forest classes, and Nd 78 is clearly not.
	Silvertop Stringybark - Manna Gum ferny open forest; Kaputar (Nd 77)	21	10	Change to 10 (Northern Tableland Wet Sclerophyll Forests). Class 21 (Northern Hinterland Wet Sclerophyll Forests) occurs well to the east of Mount Kaputar.

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4.6 Overview of results

In summary, the vegetation review process will deliver the following improvements to the *BioMetric* VTDB if adopted:

1. reduced number of vegetation types;
2. reduced number of unique vegetation types;
3. reduced number of vegetation types unique to one CMA;
4. increased number of vegetation types common to more than one CMA;
5. reduced number of source classifications;
6. elimination of duplicate vegetation types through analysis of floristic equivalence;
7. elimination of vegetation types not deemed to occur in CMAs;
8. introduction of vegetation types not previously included in CMAs, thus increased diversity within and between CMAs;
9. revision of vegetation type naming;
10. revision of %cleared estimates; and
11. revision of Keith class assignment.

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Appendix I

Workshop Details

Workshop 01
Border Rivers/Gwydir, Namoi, Northern Rivers CMAs
06-07 June 2006, University of New England, Armidale

Attendees
Tim Elder (NR CMA)
John Nagle (NR CMA)
Alan Ede (BRG CMA), Catchment Co-ordinator PVP
Greg Steenbeeke (BRG CMA), Catchment Officer (Technical Advice)
Dennis Boschma (Namoi CMA), Catchment Coordinator – native Vegetation
Danielle Ayers (DEC), Project Officer - Biodiversity Assessment, Woodland Ecology Unit, Biodiversity Conservation Science Section, CSIRO Canberra
John Benson (DEC), Senior Plant Ecologist, Plant Sciences, Botanic Gardens Trust Sydney
Miranda Kerr (DEC), Botanist - North West Branch
Vanessa Pelly (DEC), Project Officer, Policy and Science Division
Dominic Sivertsen (DNR), Senior Natural Resources Project Leader, Water and Landscape Sciences, Science and Information Division
Ross Peacock (DNR), Water and Landscape Sciences, Science and Information Division
Chris Nadolny (DNR), Threatened Species Coordinator
Wendy Hawes (DNR), Terrestrial Ecologist, Science and Information Unit, Barwon
Doug Binns, Flora Ecologist, Native Forests Operations Branch, Forests NSW - Dept of Primary Industries
Julian Wall (Eco Logical), Senior Environmental Scientist
Phil Gilmour (Eco Logical), Senior Botanist
Peter Richards (Eco Logical), Senior Ecologist

Workshop 02
Central West, Lachlan CMAs
15 June 2006, CWCMA, Dubbo

Attendees
Sarah Munro (CW CMA), Catchment Coordinator - PVP
Silvana Keating (Lachlan CMA), Catchment Coordinator, PVP
Danielle Ayers (DEC), Project Officer - Biodiversity Assessment, Woodland Ecology Unit, Biodiversity Conservation Science Section, CSIRO Canberra
John Benson (DEC), Senior Plant Ecologist, Plant Sciences, Botanic Gardens Trust Sydney
Peter Christie (DEC), Head, Biodiversity Conservation Unit, North-West Branch
Miranda Kerr (DEC), Botanist - North West Branch
Darren Shelly (DNR), Regional Ecologist, Terrestrial Team, Central West Region
Dominic Sivertsen (DNR), Senior Natural Resources Project Leader, Water and Landscape Sciences, Science and Information Division
Julian Wall (Eco Logical), Senior Environmental Scientist
Phil Gilmour (Eco Logical), Senior Botanist

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Workshop 03
Lower Murray Darling CMA
21 June 2006, LMDCMA, Buronga

Attendees
Jacinta Cain (LMD CMA), PVP officer
Noel Haywood (LMD CMA), Team Leader, PVP & Projects
Claire Wilkinson (LMD CMA), PVP officer
Danielle Ayers (DEC), Project Officer - Biodiversity Assessment, Woodland Ecology Unit, Biodiversity Conservation Science Section, CSIRO Canberra
Peter Ewin (DEC), Regional Biodiversity Conservation Officer, South West Region.
Else Foster (DEC), Conservation Assessment Officer, North West Branch
James Val (DNR), Regional Terrestrial Ecologist, Science and Information Branch
Julian Wall (Eco Logical), Senior Environmental Scientist
Phil Gilmour (Eco Logical), Senior Botanist

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Appendix II

Example of the EXCEL tracking file developed by ELA

Vegtype_ ID	NewVeg type_ID	CMA	VegTypeName	Cleared Estimate	Action	Comments
1	1	BRG	*Alectryon*/Rusty Fig/Mock Olive Dry Rainforest; scattered (Nd 93)	55	delete	unit equivalent to 10056 (new unit) based on similar floristics and distributional overlap
1	10056	BRG	Fig - *Alectryon* - *Nolelaea* Dry Rainforest	15	add	new unit, comprising a combination of 1 (Nd 93, 25% cleared) and 185 (Nd 92, 8% cleared). Average clearing rate of 15% adopted
3	3	BRG	Apple - Manna Gum woodland (FE 195)	80	retain	
11	11	BRG	Belah wilga woodland - *C. cristata/Geijera parviflora/Rhagodia spinescens* (BBS 197)	95	delete	unit equivalent to 10001 (Benson 55) based on similar floristics and distributional overlap
11	10001	BRG	Belah woodland on alluvial plains in central-north NSW (Benson 55)	85	add	Benson unit included in BRG
12	12	BRG	Belah Woodland / Shrubland on Plains and Rolling Downs (BVT 8)	60	delete	unit equivalent to 10001 (Benson 55) based on similar floristics and distributional overlap
12	10001	BRG	Belah woodland on alluvial plains in central-north NSW (Benson 55)	85	add	Benson unit included in BRG
15	15	BRG	Bimble Box Woodlands on Alluvial Plain (BVT 3)	50	delete	unit equivalent to 10028 (Benson 87), 10029 (Benson 98) and 10004 (Benson 244) based on similar floristics and distributional overlap
15	10028	BRG	Poplar Box - Coolibah floodplain woodland on light clay soil mainly in the Darling Riverine Plain Bioregion (Benson 87)	75	add	Benson unit included in BRG; clearing rate revised from 60% to 75%, central division context (expert workshop)
15	10029	BRG	Poplar Box - White Cypress Pine shrubby woodland on red sandy loam soils mainly on stagnant alluvial plains (Benson 98)	44	add	Benson unit included in BRG; adopt same clearing rate as Benson 98 unit in Namoi
15	10004	BRG	Poplar Box grassy/shrubby woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) (Benson 244)	73	add	Benson unit included in BRG; adopt same clearing rate as Benson 244 unit in Namoi
40	40	BRG	Carbeen Woodland (Nd 116)	70	delete	unit equivalent to 10006 (Benson 71) based on similar floristics and distributional overlap
40	10006	BRG	Carbeen woodland on alluvial soils (Benson 71)	78	add	Benson unit included in BRG; adopt same clearing rate for Benson 71 unit in Namoi
41	41	BRG	Clay plain grassland - *Enteropogon acicularis/Paspalidium constrictum* (BBS 174)	95	delete	does not occur in BRG CMA
43	43	BRG	Coolah Tops grass/herb forest - *E. laevopinea/Hydrocotyle laxiflora* (BBS 21)	80	delete	does not occur in BRG CMA
96	96	BRG	Messmate (FE 81)	55	retain	
101	36	BRG	Broad-leaved Stringybark - Manna Gum (FE 200)	65	retain	
101	101	BRG	Mixed Tableland Stringybark-Gum Open Forest (FE 87)	30	delete	unit equivalent to 36 (FE 200) or 105 (FE 92) based on similar floristics and distributional overlap
101	105	BRG	Moist shrubby stringybark - gum (FE 92)	70	retain	
131	23	BRG	Black Pine-Rough-barked Apple -Stringybark shrubby open forest; tableland edge (Nd 13)	45	retain	
131	131	BRG	Orange Gum - Tumbledown Gum - Apple (FE 174)	50	delete	unit equivalent to 23 (Nd 13) based on similar floristics and distributional overlap

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Appendix III

Example of part of the EXCEL tracking file developed by ELA

(same vegetation types as Appendix II)

Vegtype_ ID	NewVeg type_ID	CMA ID	VegTypeName	Cleared Estimate	Action	Comments
1	10056	6	Fig - *Alectryon - Nolelaea* Dry Rainforest	15	merge - new	Original VegType equivalent to 10056 (new type) based on similar floristics and distributional overlap; New type represents a combination of 1 (Nd 93, 25% cleared) and 185 (Nd 92, 8% cleared). Average clearing rate of 15% adopted.
3	3	6	Apple - Manna Gum woodland (FE 195)	80	retain - changed	Diagnostic species changes
11	10001	6	Belah woodland on alluvial plains in central-north NSW (Benson 55)	85	merge - new	Original VegType equivalent to 10001 (Benson 55) based on similar floristics and distributional overlap, Benson type added to BRG.
12	10001	6	Belah woodland on alluvial plains in central-north NSW (Benson 55)	85	merge - new	Original VegType equivalent to 10001 (Benson 55) based on similar floristics and distributional overlap, Benson type added to BRG.
15	10028	6	Poplar Box - Coolibah floodplain woodland on light clay soil mainly in the Darling Riverine Plain Bioregion (Benson 87)	75	split - new	Original VegType equivalent to 10028 (Benson 87), 10029 (Benson 98) and 10004 (Benson 244) based on similar floristics and distributional overlap; Benson 244 included in BRG; adopt same clearing rate as Benson 244 unit in Namoi
15	10029	6	Poplar Box - White Cypress Pine shrubby woodland on red sandy loam soils mainly on stagnant alluvial plains (Benson 98)	44	split - new	Original VegType equivalent to 10028 (Benson 87), 10029 (Benson 98) and 10004 (Benson 244) based on similar floristics and distributional overlap; Benson 87 included in BRG; clearing rate revised from 60% to 75%, central division context (expert workshop)
15	10004	6	Poplar Box grassy/shrubby woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) (Benson 244)	73	split - new	Original VegType equivalent to 10028 (Benson 87), 10029 (Benson 98) and 10004 (Benson 244) based on similar floristics and distributional overlap; Benson 98 included in BRG; adopt same clearing rate as Benson 98 unit in Namoi
40	10006	6	Carbeen woodland on alluvial soils (Benson 71)	78	merge - new	Original VegType equivalent to 10006 (Benson 71) based on similar floristics and distributional overlap; Benson 71 included in BRG; adopt same clearing rate as for Benson 71 unit in Namoi
41		6	Clay plain grassland - *Enteropogon acicularis/Paspalidium constrictum* (BBS 174)	95	delete	does not occur in BRG CMA
43		6	Coolah Tops grass/herb forest - *E. laevopinea/Hydrocotyle laxiflora* (BBS 21)	80	delete	does not occur in BRG CMA
96	96	6	Messmate (FE 81)	35	no change	
46	46	6	Diehard Stringybark - New England Blackbutt (FE 30)	20	delete	does not occur in BRG
101	36	6	Broad-leaved Stringybark - Manna Gum (FE 200)	65	split - merge	Original VegType equivalent to 36 (FE 200) or 105 (FE 92) based on similar floristics and distributional overlap
101	105	6	Moist shrubby stringybark - gum (FE 92)	70	split - merge	Original VegType equivalent to 36 (FE 200) or 105 (FE 92) based on similar floristics and distributional overlap
131	23	6	Black Cypress Pine-Rough-barked Apple - stringybark shrubby open forest; tableland edge (Nd 13)	45	merge - existing	Original VegType equivalent to 23 (Nd 13) based on similar floristics and distributional overlap

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Appendix IV

Limitations of the Forest Ecosystem Classification

Forest ecosystems were derived for the Comprehensive Regional Assessment (CRA) which had a clear public land (state forest) focus and, at the time, was not intended to support private land vegetation planning and management. Forests ecosystems were derived using a complicated process of splitting and amalgamating existing state forest types based on analysis of variation between field survey plots and underlying environmental variables. A total of 157 forest ecosystems were classified (and mapped/modelled) in the CRA region, including 141 dominated by eucalypts, and 16 dominated by non-eucalypt vegetation. A total of 98 of the eucalypt dominated ecosystems were derived from splitting and amalgamation of forest types and descriptions of each of these ecosystems is provided in the final report (NPWS 1999). The remaining 43 ecosystems comprised SFNSW forest types on which no splitting or amalgamation was conducted. Descriptions of these ecosystems are available in Research Note 17 (RN17; FCNSW 1989).

The main issue with the forest ecosystem classification, as quoted in the final report, was that "the basic aim ... was to use floristic survey data to guide decisions on splitting or amalgamating existing SFNSW forest types to yield a forest ecosystem classification suitable for use in CRA/RFA assessments" (NPWS 1999). Flora plots located within RN17 forest types had a major influence on the final forest ecosystem classification, while a substantial number of plots located outside the extent of forest typing (and some within non-commercial state forest) were not included. The result is a classification which is robust and of fine resolution for commercial forest types, yet which appears overly broad in non-commercial forest types and non-forest types. For example, the classification includes 15 ecosystems dominated by tallowwood (*E. microcorys*), 13 dominated by coastal blackbutt (*E. pilularis*), 12 dominated by spotted gum (*Corymbia maculata*), and 11 dominated by New England blackbutt (*E. campanulata*). In contrast, non-eucalypt communities such as rainforest, banksia, heathland, paperbark and swamp were each represented by a single ecosystem. Non-commercial forest ecosystems such FE 35 (dry grassy stringybark), FE 46 (eastern red gums) and FE 77 (mangrove) also include several communities.

In the context of private land vegetation management and planning, and PVP assessments, it is the expert view of Eco Logical that the forest ecosystem classification is too fine for production forests of the coast and escarpment, is too broad elsewhere, and given that no sites informed the original classification, it is probable that various vegetation types are not represented outside the area of commercial forests.

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