A Biodiversity Planning Assessment for the Northwest Highlands Bioregion

Version 1.1

Summary Report

Queensland Government

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Cover image: Smiths Range, near Riversleigh - photo taken and provided by Dan Kelman, Department of Environment and Science.

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Note. This report should be read in conjunction with the accompanying Expert Panel Report - A Biodiversity Planning Assessment for the Northwest Highlands Bioregion: Expert Panel. Version 1.1 (DES, 2020).

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1 Introduction

The Northwest Highlands Bioregion is characterised by a spectacular exposure of ancient rock and supports some of the most unique habitats and native species in the state (Neldner et al. 2019). The bioregion contains the globally important Riversleigh fossil mammal world heritage area and two ecologically unique national parks, Boodjamulla (Lawn Hill) and Camooweal Caves. There are also a number of wetlands of national importance, including the Gregory River, one of the most pristine river ecosystems in the country and the Thorntonia Aggregation which supports the unique limestone karst springs ecosystems around Lawn Hill and Riversleigh. While less biodiverse than many other Queensland bioregions, the Northwest Highlands is one of the most intact regions in the state, with less than one percent clearing across the bioregion (see Table 1).

This report summarises the results of a Biodiversity Planning Assessment (BPA) for the Northwest Highlands bioregion. BPAs provide a consistent approach for assessing biodiversity values at the landscape scale. Specifically, this BPA will be an important information layer to support future conservation planning in the region.

This project was led by the Department of Environment and Science with significant contributions from regional stakeholders and experts. This report should be read in conjunction with the accompanying Expert Panel Report (DES, 2020). For convenience, the Northwest Highlands bioregion is hereafter referred to as NWH. Appendix 1 provides details of other abbreviations included in this report.

1.1 Biodiversity Planning Assessments

The Biodiversity Assessment and Mapping Methodology (BAMM, version 2.2) (EHP, 2014) was developed to provide a consistent approach for assessing biodiversity values at the landscape scale using vegetation mapping data generated or approved by the Queensland Herbarium. The BAMM is being used by the Department of Environment and Science (DES) to generate BPAs for all bioregions across Queensland. The BAMM is continually being refined and is published on the DES website at https://www.qld.gov.au/environment/plants-animals/biodiversity/planning/. The methodology was modified from an approach initially developed by (EPLA, 2000) and the results can be used by DES staff, other government departments, local governments or members of the community to advise on a range of decision-making processes.

The methodology is applied in two stages. The first stage uses existing data to assess seven diagnostic criteria. These account for ecological concepts including rarity, diversity, fragmentation, habitat condition, resilience, threats and ecosystem processes. They are diagnostic in that they are used to filter available data and provide a 'first-cut' determination of significance. This initial assessment is generated on a geographic information system (GIS) and is then refined using a second group of expert panel criteria. These criteria rely more upon expert opinion than on quantitative data and focus on information that may not be available uniformly across the bioregion.

BPAs have now been completed for all thirteen bioregions within Queensland. They provide a comprehensive source of baseline conservation and ecological information to support natural resource management and planning processes. They can be used as an independent product or as an important foundation for adding and considering a variety of additional environmental and socio-economic elements (i.e. an early input to broader ‘triple-bottom-line’ decision-making processes). BPAs are periodically updated as new information becomes available, underlying data layers change and resources permit.

BPAs provide a powerful decision support tool that can be interrogated through a GIS platform to support a range of decision-making processes. For example, to date BPA results have been used to inform a wide range of assessment, planning and referral activities including:

- regional plans and local government planning schemes
- Queensland Parks and Wildlife Service park management plans
- government advice under the *Sustainable Planning Act 2009* (Qld)
- State government tenure dealings including identification of new protected areas
- habitat mapping for threatened species.

BPA results have also been used by environmental consultants, environmental non-government organisations and natural resource management groups to:

- identify priorities for protection, regulation or rehabilitation of ecosystems
- contribute to impact assessment of large-scale development
- provide input to socio-economic evaluation and prioritisation processes
- inform natural resource management plans.

While the BAMM methodology does include aquatic biodiversity values, the Department of Environment and

Science undertakes more detailed Aquatic Conservation Assessments (ACA) using the Aquatic Biodiversity Assessment and Mapping Methodology (AquaBAMM) (Clayton et al. 2006).

1.2 Northwest Highlands study area

Covering 7.3 million hectares, the NWH is the eighth largest bioregion in Queensland, bounded in the west by the NT border, the north and east by the Gulf Uplands bioregion and the south by the Mitchell Grass Downs bioregion. The bioregion is comprised of four subregions (refer to Table 1 and Figure 1).

Table 1. Subregions of the NWH

Subregion	Pre-clearing area (ha)	Remnant area (ha) as of 2017	Remnant area (% remaining) as of 2017
Southwestern Plateaus and Floodouts	1,333,522	1,326,100	99.44%
Thorntonia	777,564	777,328	99.97%
Mount Isa Inlier	4,641,855	4,617,827	99.48%
McArthur	580,980	580,814	99.97%
Total	7,333,921	7,302,069	99.57%

The Northwest Highlands is a complex landscape, dominated by dissected metamorphic and volcanic rocky hills, eroded sandstone platforms and limestone karst systems. River systems in the bioregion either flow north to the Gulf of Carpentaria, inland to the Barkly Tableland, or south to the Eyre Basin. Soils are mostly shallow to skeletal and are derived from a range of parent materials such as volcanic and calcareous rocks to granitoid rocks and sandstones (Christian et al. 1954; Perry et al. 1964). The climate in the region ranges from semi-arid in the south to dry monsoonal in the north, with temperatures ranging from 21^{o} C to 27^{o} C (Geoscience Australia). The hot summers occasionally experience tropical cyclones that can result in significant rainfall events and flooding across the region.

The Northwest Highlands is difficult to summarise from a geological perspective, because it is a mix of subregions with vastly different and complex geological histories. The eastern half of the bioregion, the Mount Isa Inlier, is a highly weathered and eroded mix of volcanic and granitoid rocks that have at times been covered by sea and had most of their covering sediment stripped off during the Tertiary. The western half of the bioregion, made up of three subregions, is a mix of limestone karst systems and formerly swampy plains that have received part of the sediment load from the Mount Isa Inlier periods of erosion. This area sits on the north-eastern edge of the Great Artesian Basin and many of the springs in the region have this aquifer as their origin. The limestone karst systems house extensive fossil and near-fossil remains and are particularly well known for their mammal fossils from the Riversleigh area.

The complex geological history has given rise to a complex ecological history to the bioregion. While overall biodiversity is low due to the semi-arid nature of much of the region, the northern parts are better described as dry monsoonal. Rain in this region comes mainly from the north, and annual rainfall averages change on a north-south gradient, with the southern parts averaging 300-400mm and the northern parts as high as 600-900mm (Geoscience Australia). This rainfall is highly seasonal, with the majority falling over a three-month period in summer.

Land use in the NWH is primarily agriculture, especially pastoral grazing and extractive industry. The major population centres are Mt Isa and Cloncurry. Approximately eight percent of the bioregion has protected area estate or nature refuge status.

Key threats to biodiversity values within the bioregion include:

- changed fire regimes, particularly through invasion of exotic pasture grasses leading to increases in fire frequency and intensity
- direct habitat loss through extractive industry and indirect habitat loss through intensive grazing leading to loss of habitat condition
- climate change
- invasion by exotic and non-local native plants and animals, both terrestrial and freshwater
- stochastic events, e.g. cyclones

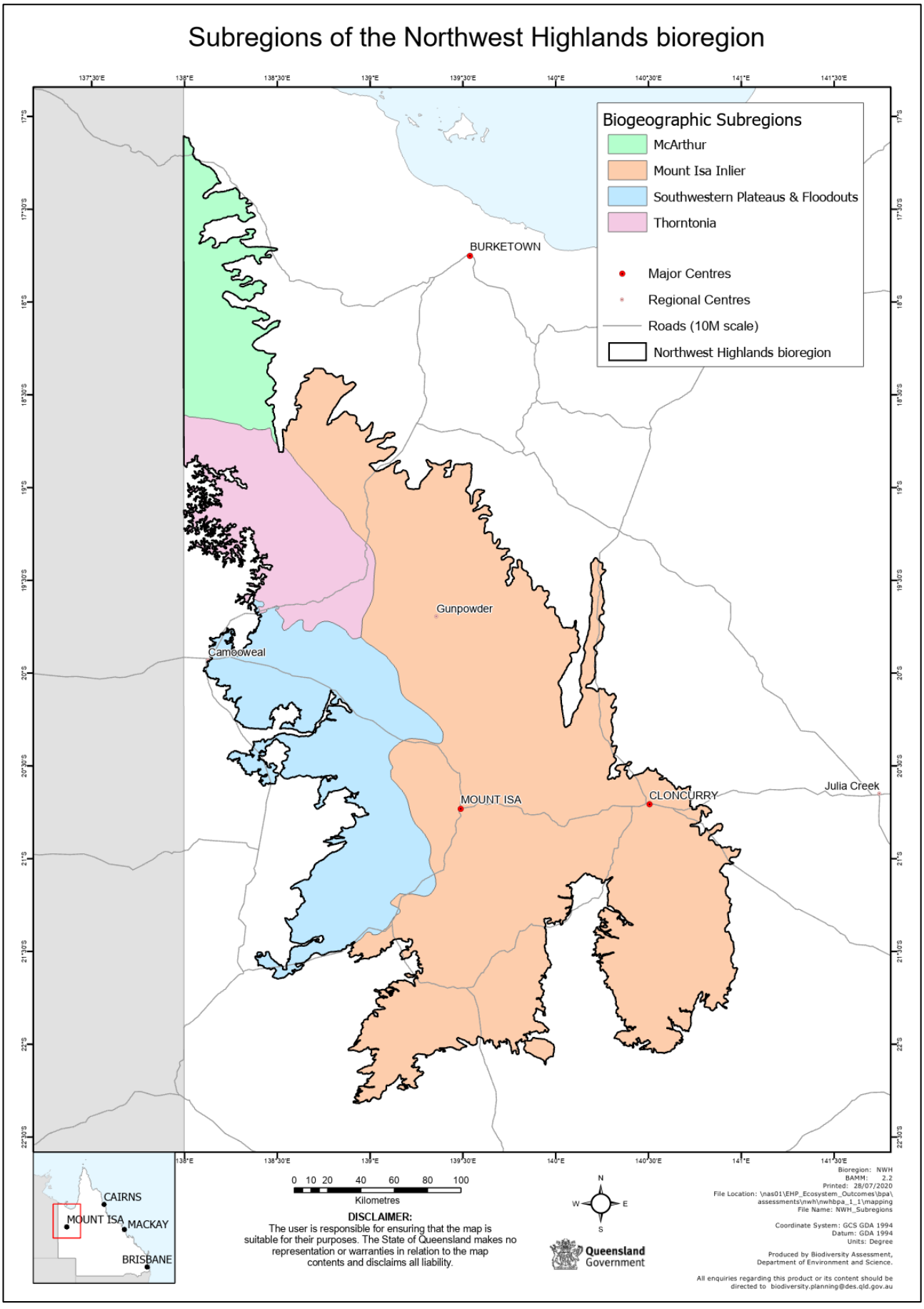

Figure 1. Subregions of the NWH

2 Methods and implementation

2.1 BAMM

The NWH BPA was undertaken using BAMM version 2.2 (EHP, 2014). Many factors contribute to the assessment of biodiversity values. The methodology focuses on consistent and reliable criteria that are transparent, objective and scientifically defensible. The criteria are in two groups (Table 2). The first group is based on existing data with bioregional coverage. These diagnostic criteria are used to filter available data and provide an initial determination of significance. This assessment is then refined using a second group of expert panel criteria to produce the final BPA product (Figure 2).

Table 2. BAMM criteria

Diagnostic criteria	**Expert panel criteria**
For analysis of uniformly available data	Assessed by expert panel using non-uniform data
A: Habitat for EVNT taxa **B**: Ecosystem value: at two scales: B1: State B2: Regional **C**: Tract size **D**: Relative size of regional ecosystem: at two scales: D1: State D2: Regional **E**: Condition **F**: Ecosystem diversity **G**: Context and connection (relationship to water, endangered ecosystems and physical connection between contiguous remnant units)	**H**: Habitat for priority taxa **I**: Special biodiversity values **J**: Corridors **K**: Threatening process (condition)

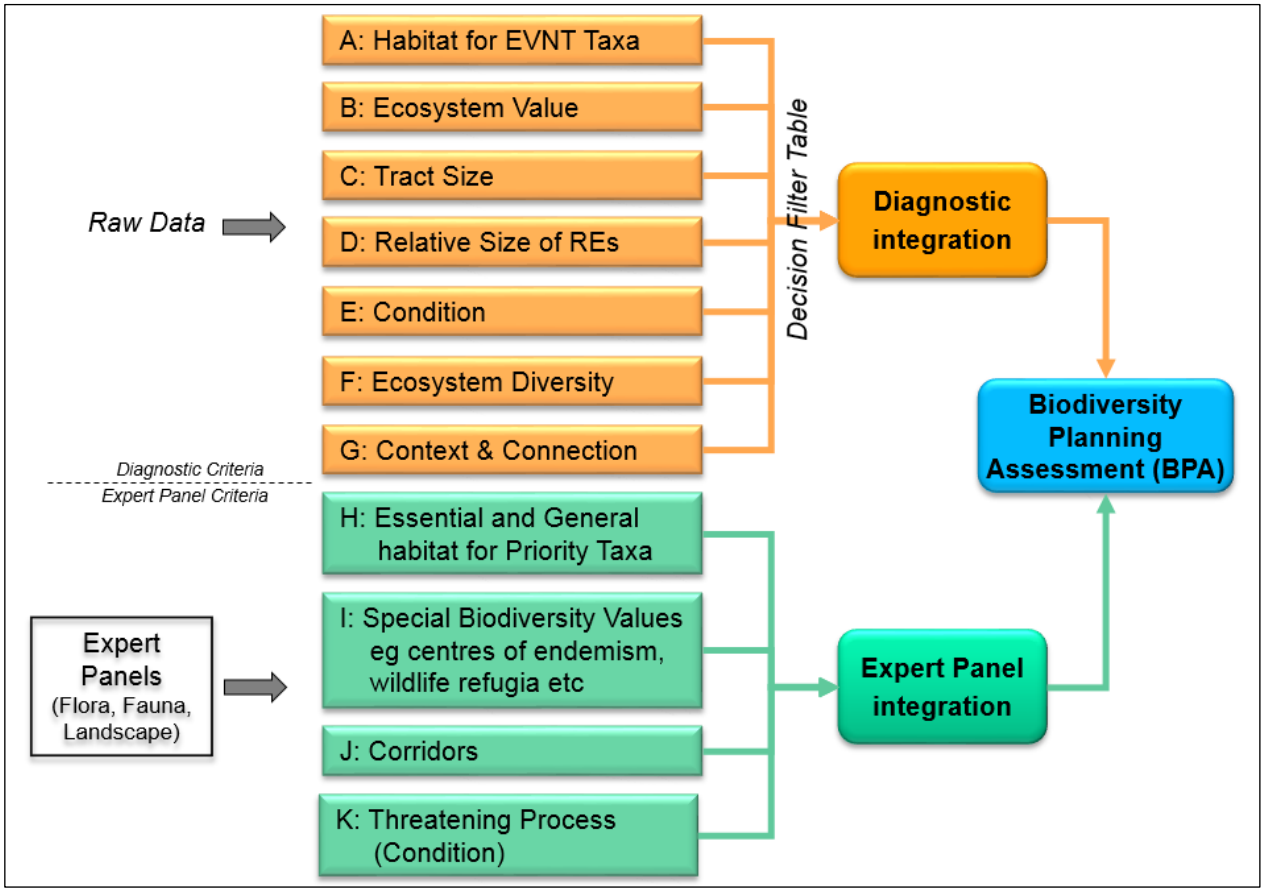

Figure 2. Biodiversity Assessment and Mapping Methodology (BAMM) process

The seven diagnostic criteria in Table 2 use largely uniformly available information that can be queried to automatically generate significance classes based on individual or combinations of biodiversity values. While species data are included in the diagnostic criteria, it is acknowledged that fauna and flora surveys are far from complete in Queensland and that existing data do not provide a uniform coverage across any bioregion.

A filtering process is used to assess remnant units using criteria A to G (refer to Appendix 2). It can also be used as a series of questions applied to a particular site in the absence of a completed BPA. Although the various data layers are integrated in a BPA, each layer can be interrogated separately to ensure transparency and allow for any combination of criteria to be used in isolation from others in decision making.

Data for the expert panel criteria (H to K, Table 2) are primarily derived through elicitation of accumulated knowledge held by persons considered familiar with the biodiversity values of the bioregion. Such information may not be quantitative in nature nor widely available, e.g. in published reports. The expert's role is to propose additional features not identified through the diagnostic criteria. For inclusion in the BPA, the experts must describe the values, significance and spatial extent of the proposed features.

2.2 Datasets

Typically, a BPA draws on a wide range of datasets with a wide range of formats. This will generally include published scientific documents, unpublished data (grey literature) and officially collated data from various Queensland Government sources including data from the Queensland Museum, Queensland Herbarium and WildNet. A list of datasets used in the NWH BPA is included in Appendix 3.

2.3 Expert panels

Three expert panels were held in Brisbane May 20-22, 2019 to address flora, fauna and landscape ecological values. The findings from the NWH BPA expert panel process are reported in the accompanying expert panel report (DES, 2020).

2.4 Implementation

The BAMM version 2.2 (EHP, 2014) was followed in this assessment. Custom python scripts and ArcGIS ModelBuilder toolboxes were used to apply BAMM and create the BPA. Previous methodological updates applied during the review of the Brigalow Belt (BRB) BPA version 2.1 and Southeast Queensland (SEQ) BPA version 4.1 were also implemented in the NWH BPA and will form the basis for updating BAMM to version 3. The methodological changes are summarised below in Table 3.

Table 3. BAMM method changes implemented in the NWH BPA version 1.1

Criterion	Change in NWH Version1.1 / WET Version 1.1 / BRB BPA Version 2.1 / SEQ Version 4.1
A	Inclusion of non 1-to-1 habitat models - i.e. the inclusion of habitat models that do not necessarily spatially align/coincide with the boundary of remnant units
B	1. For the purpose of depicting B1 "Very High" significant wetlands, the base spatial unit was derived from the Queensland Wetland Program mapping product. "Significant wetlands" included those relatively natural wetlands which overlapped with Ramsar, Directory of Important Wetlands, Fish Habitat Areas and/or State Marine Parks (exclusive of General Use zones) 2. EPBC listed threatened ecological communities were incorporated in Criterion B1 and assigned a significance rating of "Very high" (*n.b. no EPBC communities were mapped as present in the NWH*)
C	The method of tract delineation was reviewed and altered to account for pinch-points, edge effects and small gaps in tracts. Thresholds used to assign "Low", "Medium", "High" and "Very high" Criterion C significant ratings were calculated at the subregion level
H	1. Revised the justifications for nomination of priority species. 2. New category was incorporated - "Taxa particularly vulnerable to climate change" 3. Altered the spatial implementation to be more consistent with Criterion A and reduced the disproportionate impact of priority species records on the overall biodiversity significance value
I	Addition of a new Sub-criterion, Ik: Climate change refugia

2.5 Assessment parameters

The tools used to produce a BPA calculate a number of criteria parameters based on the size distribution of remnant vegetation polygons. As a result, these will vary between bioregions/subregions and versions of a BPA. Refer to the BAMM version 2.2 (EHP, 2014) for further information with respect to specific criteria, methods and associated assessment parameters.

See Appendix 4 for the Criterion C subregion thresholds implemented in NWH BPA.

For Criterion F (ecosystem diversity), the calculated buffer distance was 413.4 metres.

2.6 Transparency of results

After running the BAMM tool, BPA results are available at a range of levels, despite its initial presentation as a single score of biodiversity significance. The results are also available through application of user-defined queries that may interrogate one or more levels within the assessment in any number of possible combinations. This transparency provides the BPA end user (e.g. scientists, resource managers and conservation organisations) with a unique level of flexibility for BPA interrogation, interpretation and presentation. Links between the BPA results and a GIS environment facilitate this interrogation and provide a means of visualising the BPA results (Figure 3).

This data access and interrogation flexibility enables investigation of how different data contribute to the overall conservation value, investigation of missing data and an ability to tailor the BPA output for a particular purpose.

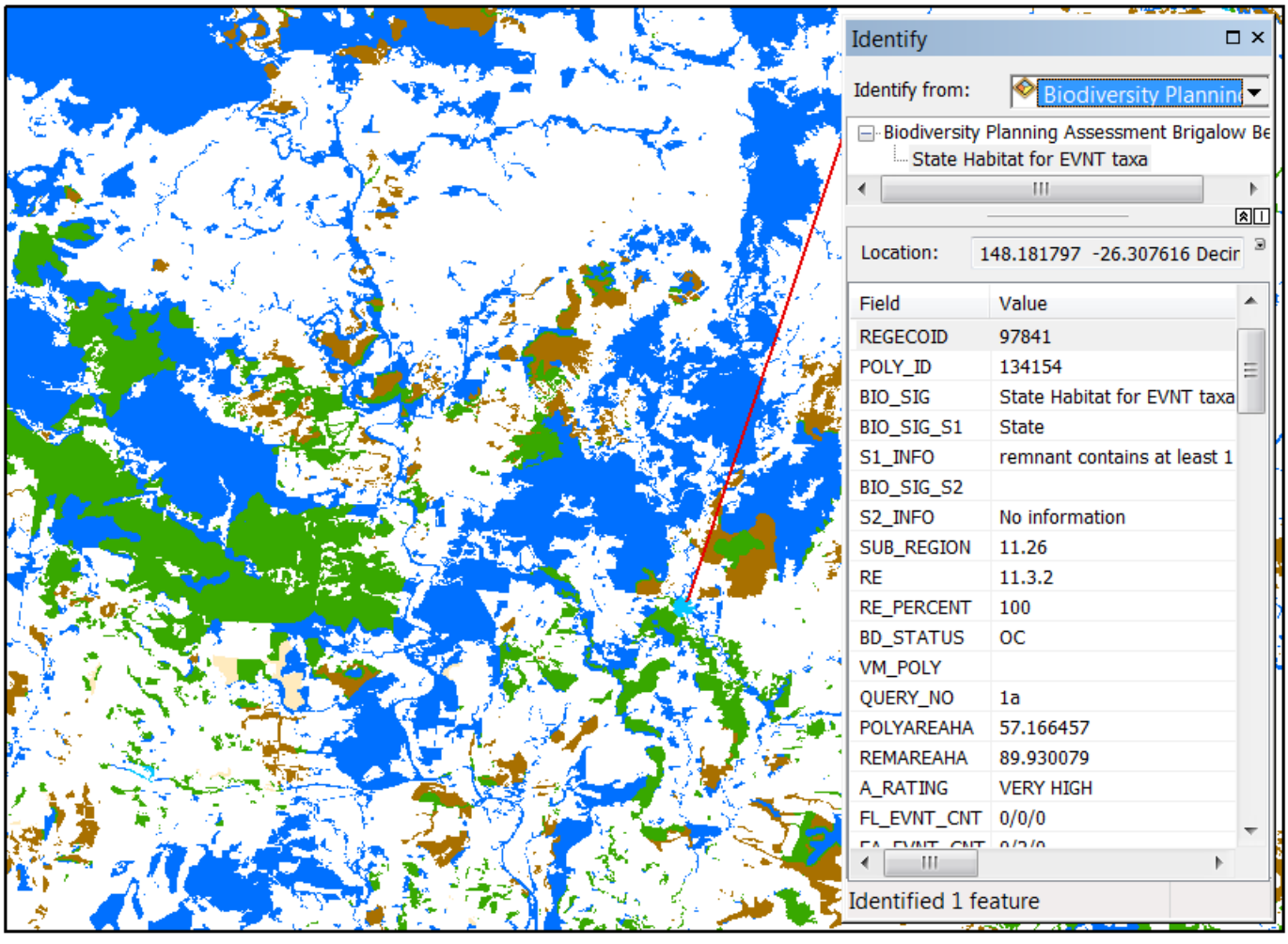

Figure 3. Interrogating the BPA results for a spatial unit in the GIS environment

2.7 Filter table

A single diagnostic biodiversity significance score is derived for each assessment unit by combining all of the diagnostic criteria ratings. This diagnostic significance is then combined with the expert panel significance and the maximum value assigned as the overall biodiversity significance score. This significance will be one of three options: State, Regional, or Local.

To calculate the diagnostic biodiversity significance, BAMM uses a combination rating table (or filtering decision table), that provides an ordered series of decisions that are tested against the final diagnostic criteria ratings for each spatial unit. Each decision is a unique combination of criteria ratings that is associated with a final conservation significance category. The decisions are effectively a number of ‘if-then’ statements and are tested in sequence for each spatial unit. A score is assigned immediately when a match is achieved between the criteria rating combination of the decision and that of the assessment unit.

The filter table used to evaluate the diagnostic criteria and assign a biodiversity significance is contained in Appendix 2.

3 Results

3.1 Conservation value categories

The conservation value results are relative within each bioregion, but each value category has characteristics in common. The BAMM uses combinations of criteria level scores to determine the final biodiversity significance. Based on these combinations, the following descriptions can be used to provide context for each level of biodiversity significance.

State significance—Areas assessed as being significant for biodiversity at the bioregional or state scales. They also include areas assessed as being significant at national or international scales.

Regional significance—Areas assessed as being significant for biodiversity at the sub-bioregional scale. These areas have lower significance for biodiversity than areas assessed as being of State significance.

Local significance and or other values—Areas assessed as not being significant for biodiversity at State or Regional scales.

Non bioregional ecosystem—A regional ecosystem outlier from an adjacent bioregion.

3.2 Positional accuracy

The positional accuracy of the BPA results is dependent on the accuracy of the input data and primarily the Herbarium's regional ecosystem (RE) mapping version 11.0, which is primarily at a scale of 1:100,000 for the Northwest Highlands. The precision of polygon boundaries or positional accuracy of line-work is 100 metres.

Positional accuracies of other datasets are unknown, but at 1:100,000 scale, at least 100 metres should be assumed.

3.3 NWH overall results

A summary of the NWH BPA results is provided below. Overall, 55 per cent[1] (4.1 million ha) of remnant vegetation in the NWH was found to have biodiversity values of State significance of which 12 per cent (918,808 ha) is State Habitat for EVNT taxa. Regional significance was attributed to 9 per cent (654,284 ha), with the remaining 36 per cent of remnant vegetation being assigned Local or Other Values (Figure 4 and Figure 5).

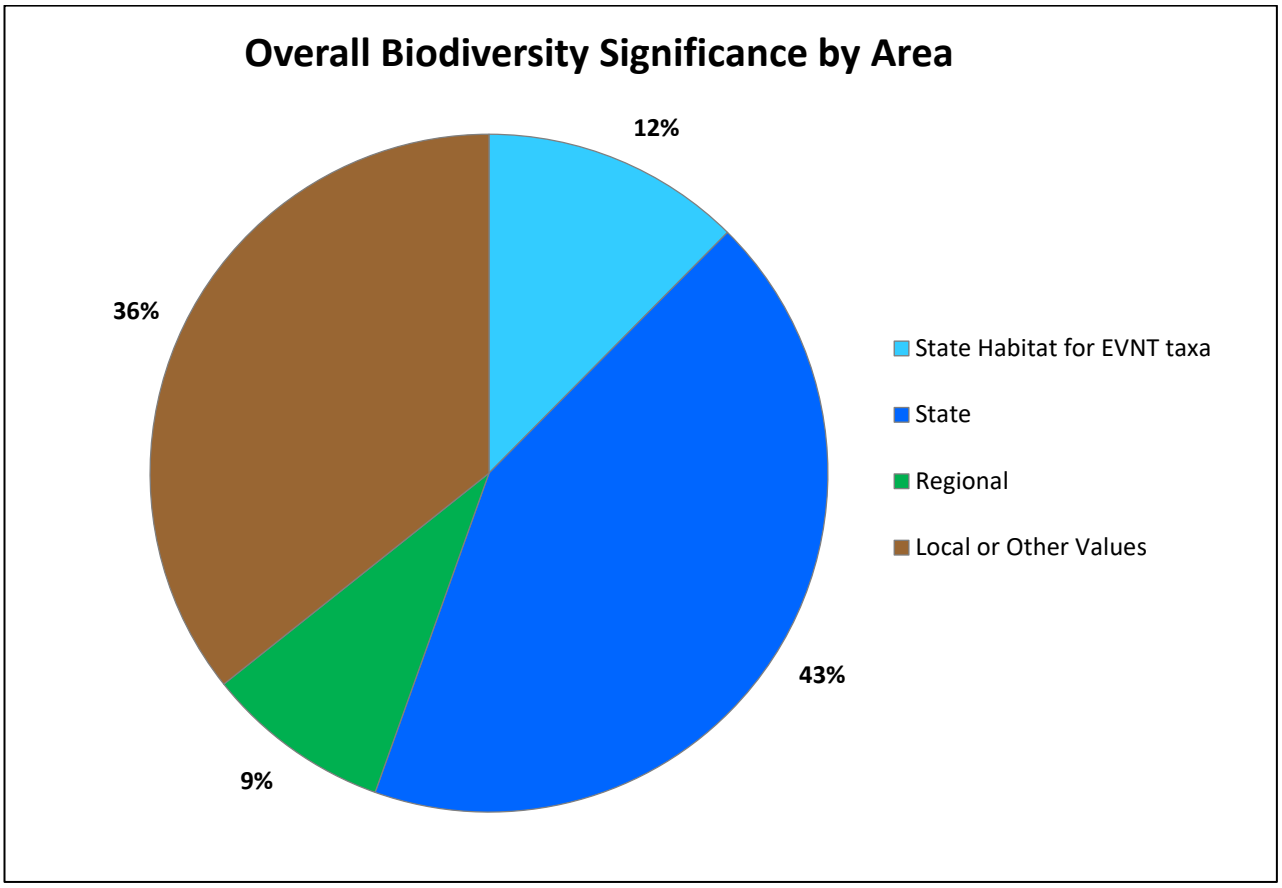

Figure 4. Summary of overall biodiversity significance as a proportion of NWH remnant vegetation

[1] Note that percentage area and area calculations mentioned throughout this report relate only to areas of NWH remnant vegetation. Non-remnant areas (e.g. some significant wetlands types, threatened species habitat, panel identified special areas etc.) have been excluded for the purposes of the report.

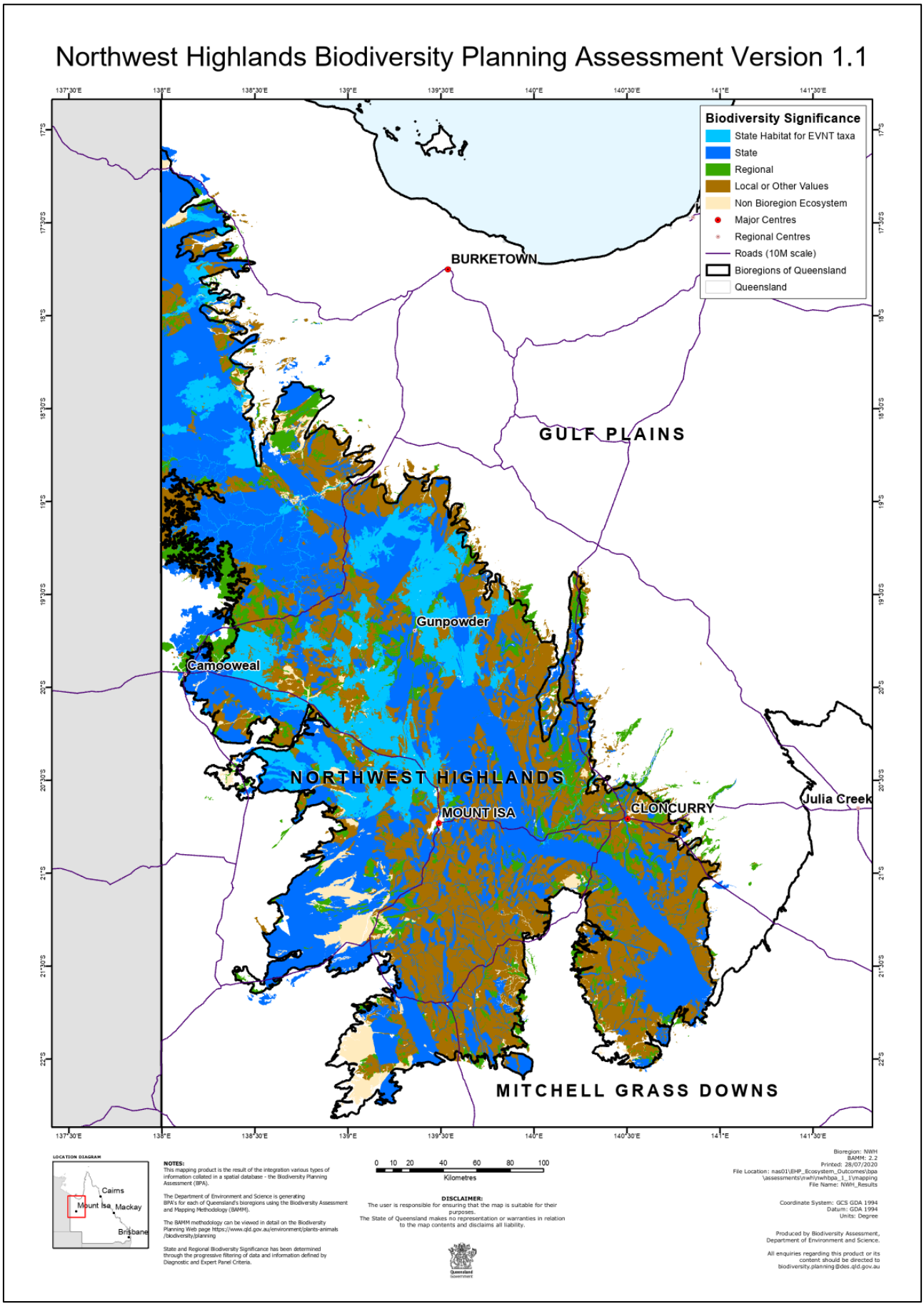

Figure 5. Overall biodiversity significance

As outlined in Table 2, the overall biodiversity significance is the result of a number of criteria that are assessed individually. Criteria A - G ratings are combined, via a filter table, to provide a diagnostic biodiversity significance, whilst Criteria H - K ratings, are combined to provide the expert panel biodiversity significance. Figure 6 shows the results for both the individual diagnostic and expert panel criteria.

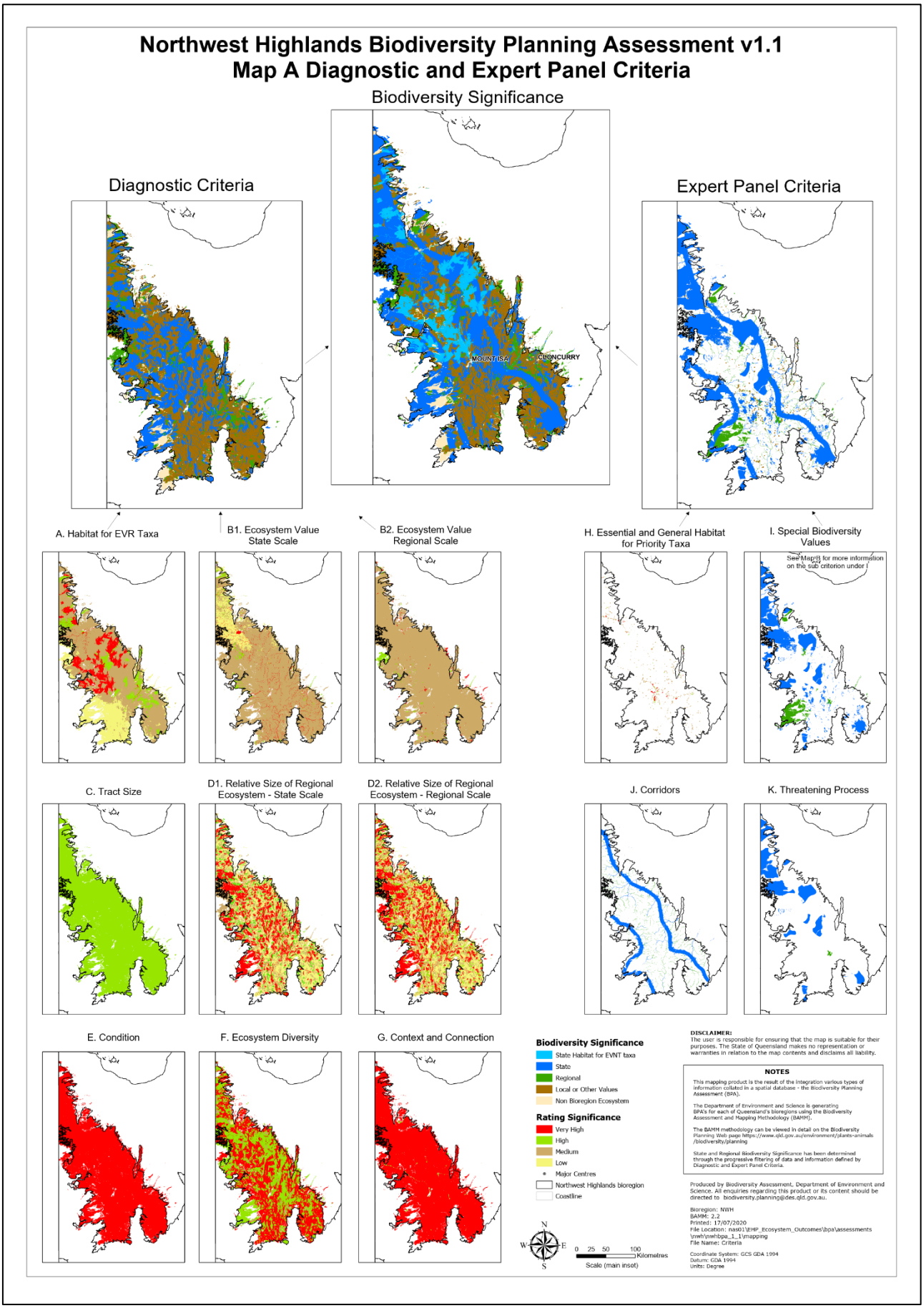

Figure 6. Diagnostic and expert panel criteria results.

3.4 Diagnostic results

3.4.1 Overall diagnostic criteria results

From the diagnostic criteria, 2.8 million ha or 38 per cent of NWH remnant vegetation was assessed as being of State significant biodiversity value. Regional significance was attributed to 11 per cent (832,358 ha), and Local or Other Values 51 per cent (3.8 million ha) of NWH remnant vegetation (Figure 7 and Figure 8).

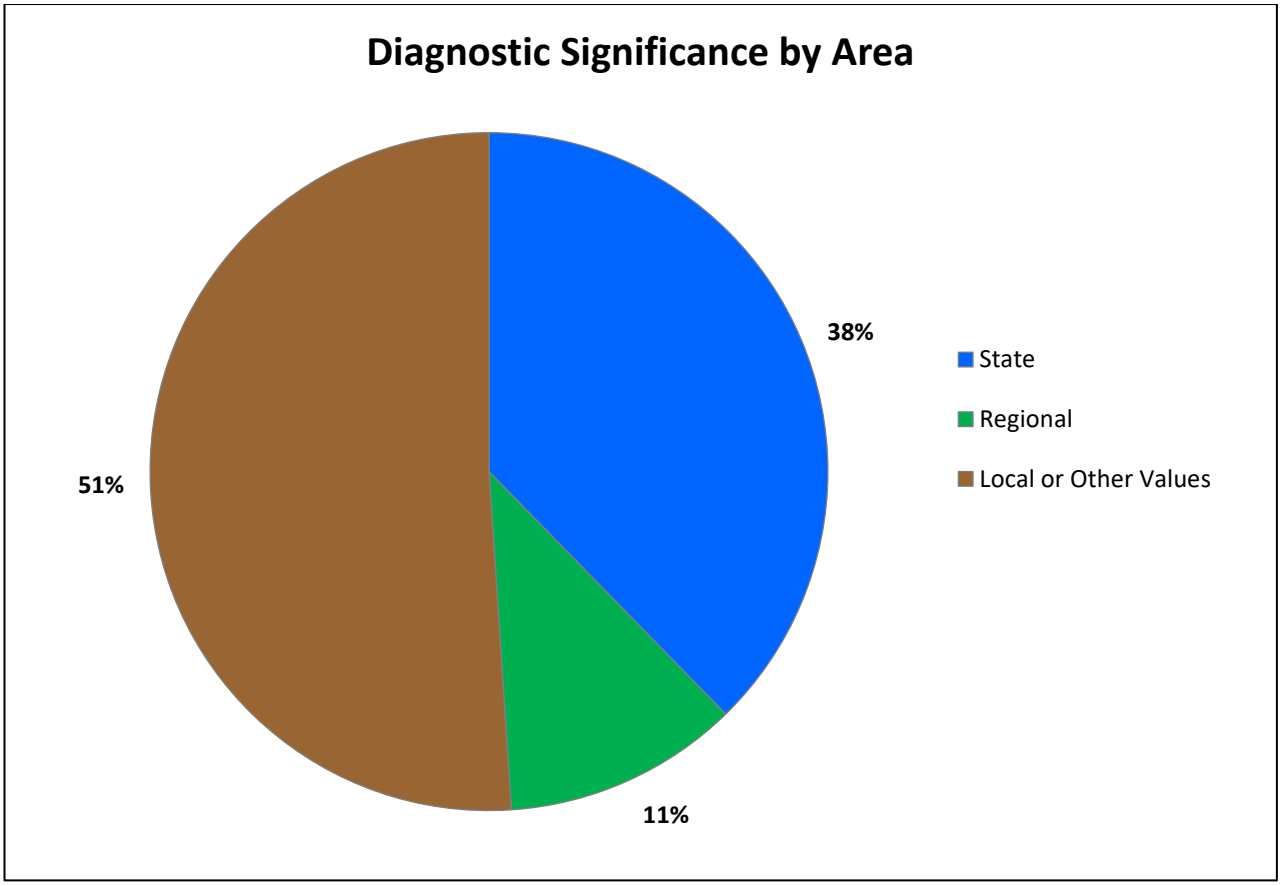

Figure 7. Summary of biodiversity assessment diagnostic criteria results as a proportion of remnant vegetation

The contribution of each diagnostic criterion to the diagnostic significance rating is summarised in Table 4 below.

Table 4. Diagnostic criteria ratings (expressed as percentage of remnant vegetation cover).

Diagnostic criterion	Very High	High	Medium	Low
A: Habitat for EVNT taxa	12.4%	7.9%	56.9%	22.7%
B1: Ecosystem value (Bioregion)	3.2%	2.2%	84.2%	10.4%
B2: Ecosystem Value (Subregion)	1.5%	2.2%	96.4%	< 0.01%
C: Tract	-	99.99%	-	0.01%
D1: Relative RE Size (Bioregion)	28.5%	8.6%	21.6%	41.3%

Diagnostic criterion	Very High	High	Medium	Low
D2: Relative RE Size (Subregion)	34.1%	9.8%	19.1%	37.0%
F: Ecosystem Diversity	53.6%	43.3%	2.9%	0.2%
G: Context and Connection	99.3%	0.6%	0.1%	< 0.01%

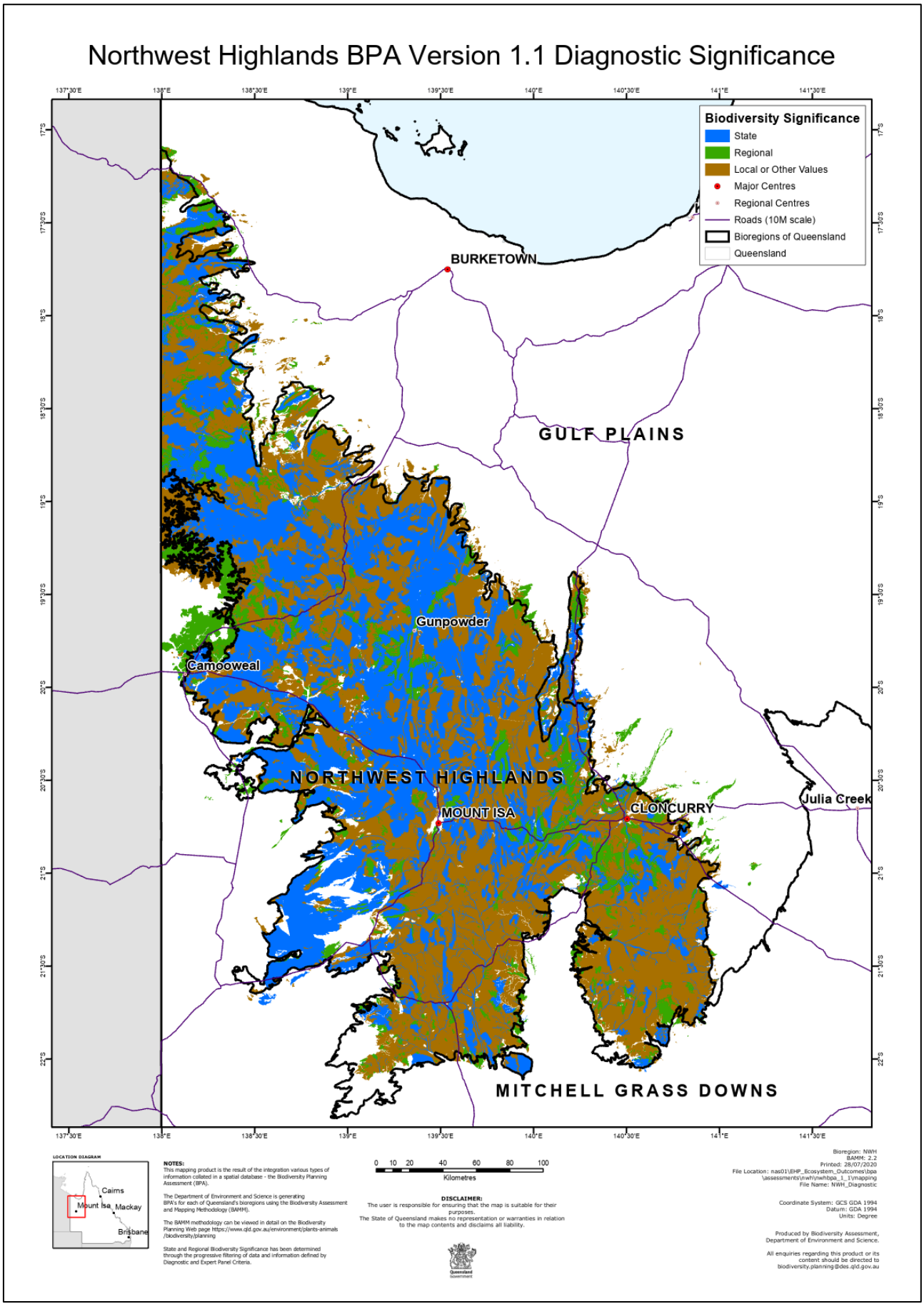

Figure 8. Diagnostic criteria biodiversity significance

3.4.2 Hit analysis

A 'hit analysis' was performed to assess the influence of each diagnostic criterion to the assignment of State or Regional biodiversity significance. For this analysis, hits equate to a polygon assigned significance due to individual or combinations of criteria as defined in the queries table (see Appendix 2). The results of the hit analysis for the diagnostic criteria are presented in Table 5 below.

Table 5. Diagnostic criteria hit analysis results. (Query number as per Appendix 2)

Query No.[1]	Significance	Remnant area (ha)	Remnant area (%) of total	Query no. frequency (% of polygons triggered)
1a	State	918,808	12.4%	12.4%
1b	State	187,565	2.5%	5.8%
2a	State	21,842	0.3%	0.2%
3a	State	6,923	<0.1%	<0.1%
3b	State	2,312	<0.1%	<0.1%
5a	State	450,561	6.1%	2.1%
5b	State	1,198,390	16.2%	5.3%
6a	Regional	319,581	4.3%	6.4%
6b	Regional	101,718	1.4%	2.2%
7a	Regional	87,520	1.2%	0.8%
8b	Regional	85,537	1.2%	0.3%
11b	Regional	234	<0.1%	<0.1%
11f	Regional	1,278	<0.1%	<0.1%
11g	Regional	57,747	0.8%	0.6%
12d	Regional	178,743	2.4%	0.9%
Default	Local or Other Values	3,774,101	51.1%	63.0%

[1] The variations (a - i) of the queries refer to specific combinations of the criteria within the query (refer to Appendix 2).

The results of the hit analysis reveal that the most widespread (by area) combination to trigger 'State significance' is query 5b (16.2 per cent of remnant vegetation). This query reflects remnant units which represent one of the larger examples of a regional ecosystem type within the bioregion (Criterion D1), whilst also exhibiting very high levels of ecosystem diversity (Criterion F) and context and connection (Criterion G) with adjoining ecosystems.

The most widespread (by area) combination to trigger Regional biodiversity significance is query 6a, with 4.3 per cent of remnant vegetation triggered. This query is due to a High rating under Criterion A, which reflects the presence of threatened species habitat.

3.5 Expert panel results

3.5.1 Overall expert panel results

Overall, 40 per cent of the NWH remnant vegetation was assigned a significance rating by the expert panel. The expert panel attributed 34 per cent (2.5 million ha) of the NWH with biodiversity values of State significance. Regional significance was attributed to 5 per cent (361,664 ha) (Figure 9 and Figure 10) and 1 per cent as Local

significance, as a result of priority taxa (Criterion H). While there is a reasonable level of confidence that known important areas of the NWH were identified by consulting experts and the use of existing data, it is likely that not all areas were identified.

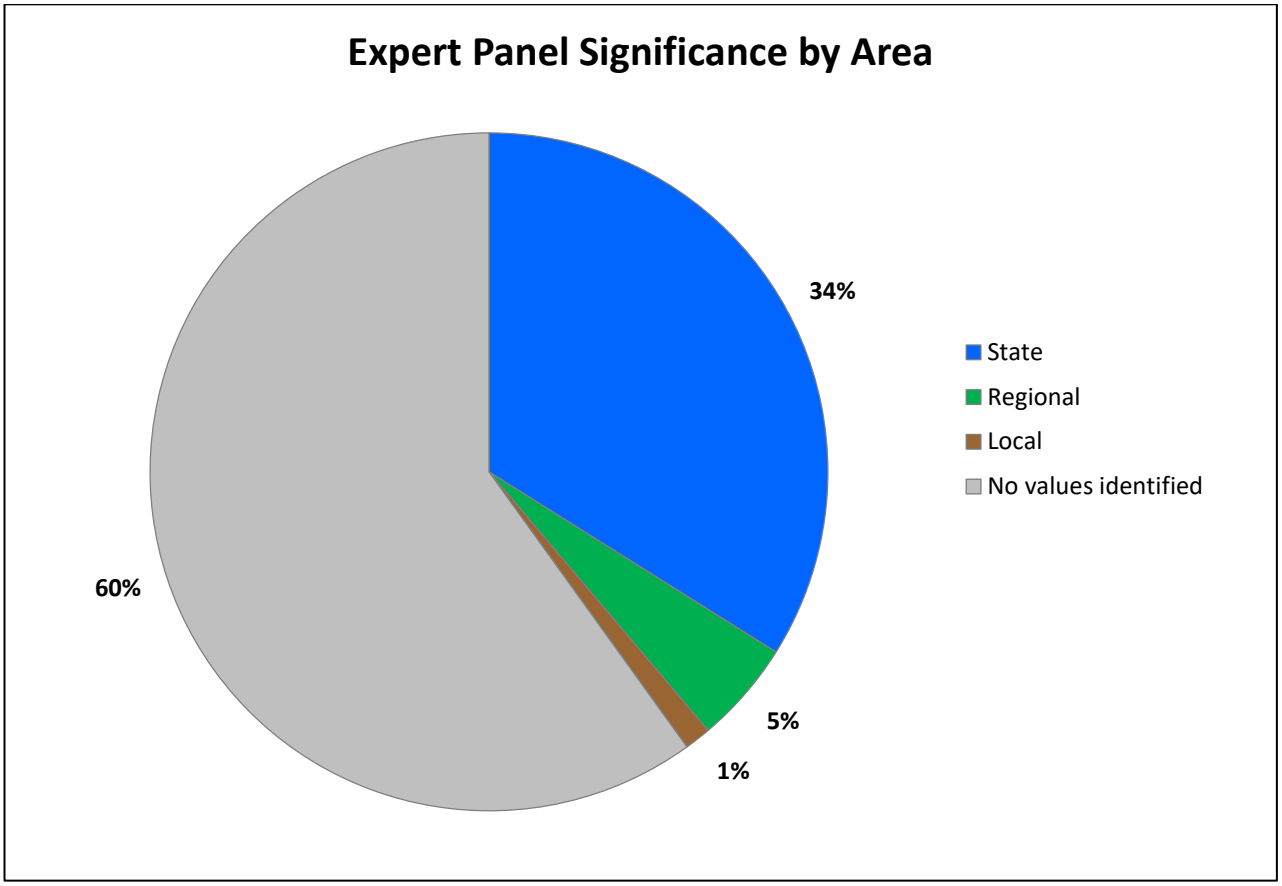

Figure 9. Summary of biodiversity assessment expert panel criteria results.

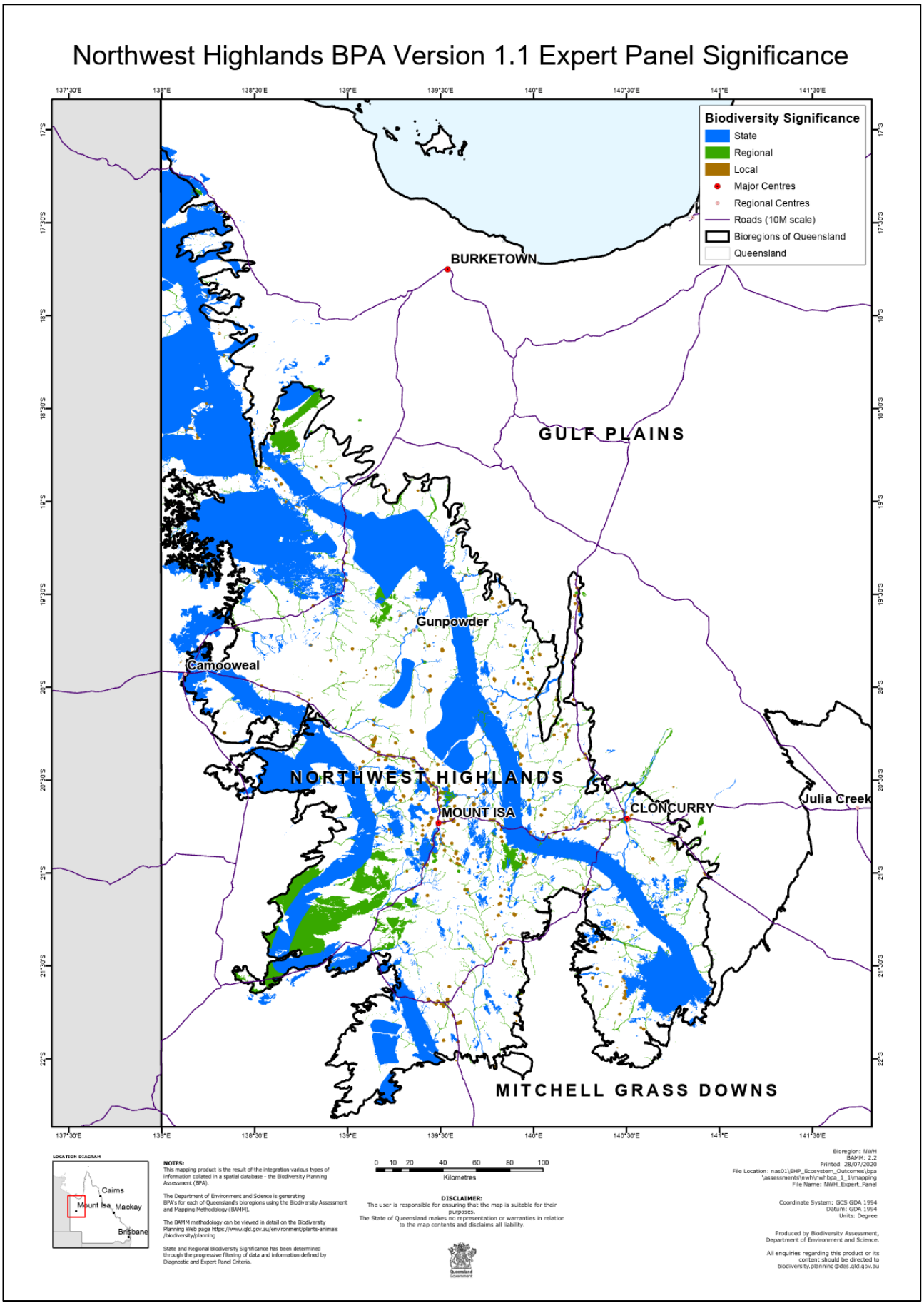

Figure 10. Expert panel criteria biodiversity significance.

3.5.2 Criterion H (priority taxa habitat) results

Priority species are those not listed as endangered, vulnerable or near threatened, however, are considered to be of particular conservation significance by the flora and fauna expert panels (DES 2019). There were 71 priority species identified in the NWH (30 flora, 41 fauna), and 2,020 records for these species. Survey effort across the bioregion is minimal, primarily due to difficulty of access and remoteness of much of the region. Approximately, 0.2 per cent of NWH (17,300 ha) achieved a value of Very High for Criterion H and 0.1% (9,778 ha) High (Table 6).

Table 6. Criterion H (Priority taxa habitat) results as percentage of remnant vegetation.

Criterion rating	Very High	High	Medium	No information/Low
H rating (Priority taxa habitat)	0.2%	0.1%	2%	97.7%

3.5.3 Other expert panel criteria

Criterion I (special areas), Criterion J (corridors), Criterion K (intact landscapes and ecosystems) were identified by expert panel members. Approximately 27 per cent of the total remnant vegetation area has been identified as having Criterion I special biodiversity values (State or Regional). Figure 11 illustrates the special areas and their biodiversity rating.

Landscape scale corridors have been defined and mapped at a statewide level for most of the state. The network is being expanded as BPAs are completed for additional bioregions. Their broad purpose is to provide for ecological and evolutionary processes at a landscape scale. Corridors considered of the greatest importance at the bioregional scale or above were assigned State significance. This mapped network (State and Regional terrestrial and riparian corridors) comprises almost 17 per cent of the NWH remnant vegetation (Table 7).

Approximately 15% of the NWH remnant extent, was identified as likely being in excellent natural condition with minimal existing pressures.

Table 7. Criteria I, J, K biodiversity significance results as percentage of remnant vegetation.

Criterion rating	State	Regional
I rating (Special Areas)	22.6%	4.6%
J rating (Corridors)	14.3%	2.3%
K rating (Threatening Process)	14.8%	0.2%

3.5.4 Criterion I sub-criteria results

Areas exhibiting special biodiversity values are identified by flora, fauna and landscape expert panel members based on their own knowledge and experience. Expert panel members were tasked with identifying what they considered to be the most important areas in the bioregion. For the most part, only Very High and High category values were identified. These identified areas are determined by selection and assignment of specific sub-criteria I values as defined in Table 8. Approximately 23 per cent of remnant vegetation (1,673,613 ha) was identified by the expert panel as exhibiting very high sub-criteria values for special features (Criteria I). The expert panel report (DES 2020) has detailed information relating to these areas. Most areas exhibited more than one sub-criteria value, with many exhibiting up to five sub-criteria values. Each of the sub-criteria were assessed and valued separately by the expert panel and the results are shown in Table 8 and Figure 11.

Areas identified as important for wildlife refugia (Ib rating of Very High or High) accounted for 22 per cent (1.66 million ha) of remnant vegetation. Areas identified as exhibiting Very High or High species richness (Ie rating), accounted for approximately 13 per cent (937,949 ha) of remnant vegetation. Areas identified as exhibiting Very High or High levels of species endemism (Ia rating) accounted for approximately 9 per cent of remnant vegetation (632,080 ha) of remnant vegetation.

Table 8. Criterion I sub-criteria results as percentage of remnant vegetation.

Criterion I sub-rating	Very High	High
Ia rating (centre of endemism)	7.5%	1.1%
Ib rating (wildlife refugia)	21.6%	0.8%
Ic rating (disjunct populations)	5.4%	4.3%
Id rating (species at geographic range limit)	3.2%	7.6%
Ie rating (high species richness)	4.0%	8.7%
If rating (areas with concentrations of relictual populations - ancient and primitive taxa)	1.8%	-
Ig rating (REs show distinct variation in species composition)	2.3%	6.7%
Ih rating (artificial waterbody or managed/manipulated wetland of ecological significance)	-	< 0.01%
Ii rating (high density of hollow-bearing habitat trees)	0.96%	2.6%
Ij rating (significant breeding or roosting sites)	3.3%	4.9%
Ik rating (climate change refugia)	1.6%	0.2%

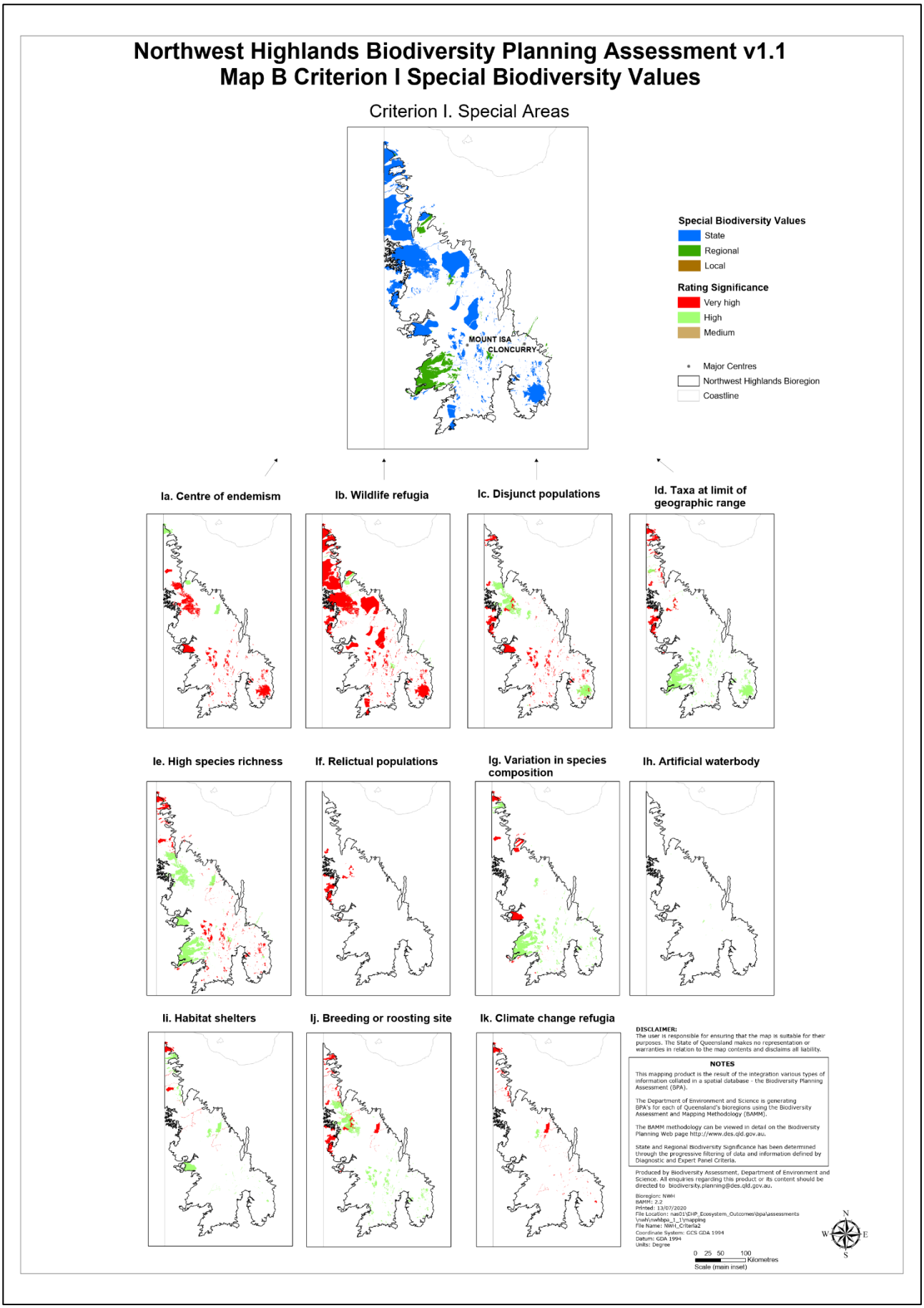

Figure 11. Criterion I special biodiversity values

3.6 Assessment caveats and limitations

It must be emphasised that the overall biodiversity significance rating attributed to each spatial unit should only be used as an initial flag to identify known/perceived areas of high biodiversity value. In addition, individual criterion ratings should be used to address specific questions depending upon the exercise at hand. End users should also be aware that within a BPA, whilst some criteria ratings are calculated in a deterministic manner (for example high confidence of the presence of an endangered species results in a locality being assigned as Very High under Criterion A), the majority of criteria ratings are calculated relevant to the values present in a bioregion. As such, whilst providing representation at a bioregion scale, direct comparison of criterion results across bioregions is not appropriate. For example, areas containing 30 vertebrate species can be given a species richness (Ie rating) rating of Very High in one bioregion and Medium in another.

The accuracy and representativeness of the BAMM criteria is also largely reliant upon available information. Even within bioregions with comparatively high levels of survey effort, significant knowledge gaps can be present resulting in data layers that are not spatially uniform across the bioregion. For example, areas close to populated centres, roads and accessible areas of public land (i.e. national parks) are generally subject to greater levels of species survey effort, whilst ranges, escarpments, vegetated tracts on private land and the interior parts of major floodplain wetland systems are often under-represented. The BAMM expert panel process is used, in part, to moderate and fill such knowledge gaps, however the outcomes from the expert panel process are only as comprehensive as the range of experts who attend and the extent of their knowledge of the bioregion. The increasing availability of predictive habitat suitability models will reduce reliance on sightings records for identifying conservation significant habitat and taxa hot spots.

Lastly, whenever lines are drawn on a map, e.g. from the expert panels or extracted from datasets produced as part of other assessments (e.g. Blackman 2001), there is a risk that the boundary may be approximate at the scale of the individual spatial unit. For such decisions, the boundary should always be considered at the appropriate scale. For the majority of diagnostic criteria, and many of the special areas identified by the expert panel, the fundamental spatial input is the Queensland regional ecosystem mapping. The NWH remnant vegetation cover mapping is at 1:100 000 scale and delineates a minimum area for remnant vegetation of 5 ha with a 100 m width limit for linear features.

4 Summary

Approximately 55 per cent of the remnant vegetation of the NWH was assessed as being of State biodiversity significance. The diagnostic criteria (Criteria A to G) accounted for 38 per cent of the remnant vegetation mapped as being designated of State biodiversity significance. A contributing factor for the comparatively high overall assignment of areas of Local significance (comparative to other bioregions), is due to the relative intactness of the landscape. Nearly all remnant vegetation (99%) rated 'Very High' in terms of context and connectivity (Criterion G), whilst 54% exhibited high ecosystem diversity with adjoining intact ecosystems. Comparative to other Queensland bioregions subject to greater levels of threats and disturbance, Criteria A and B (threatened species habitat and ecosystem value) contributed less to the overall biodiversity designation of State or Regional significance.

The expert panel criteria assigned 39 per cent of remnant vegetation within the NWH as having biodiversity values of State or Regional significance. This was largely due to Criterion I special areas values which accounted for approximately 23 per cent of the bioregion. Please refer to the accompanying expert panel report for more detailed information on the special features identified during the BPA expert panel process.

The results of a BPA can be used in a number of ways and for a number of purposes. For example, well-founded ecological or conservation values assessments are a useful input to natural resource management decision making processes, regional planning, development assessment, tenure negotiations or protected area estate review. The criterion and sub-criterion ratings from each assessment can be used for management and planning purposes. An example of this is the spatial prioritising of natural resource management actions within a bioregion including ecological surveys, changes in land management practices, rehabilitation and weed eradication.

5 References

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Appendices

Appendix 1: Acronyms and abbreviations

ACA	Aquatic Conservation Assessment
ALA	Atlas of Living Australia
BAMM	Biodiversity Assessment and Mapping Methodology
BPA	Biodiversity Planning Assessment
BRB	Brigalow Belt Bioregion
CORVEG	The site survey database maintained by the Queensland Herbarium
DES	Department of Environment and Science
EHP	Department of Environment and Heritage Protection
EVNT	Endangered, vulnerable or near threatened under the Queensland *Nature Conservation Act 1992* and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*
EPBC	*Environment Protection and Biodiversity Conservation Act 1999*
GIS	Geographic information system
Herbrecs	Specimen based register of plants held by Queensland Herbarium
QPWS	Queensland Parks and Wildlife Service
RE	Regional ecosystem
NWH	Northwest Highlands Bioregion
WildNet	Department of Environment and Science corporate wildlife application containing records and other information on Queensland flora and fauna
WTMA	Wet Tropics Management Authority

Appendix 2: Filter table used to evaluate the diagnostic criteria and assign a "BIO_SIG_1" significance

Biodiversity significance of remnant units	**Query No.**	**A: Essential habitat for EVNT spp.**		**B: Ecosystem value**		**C: Tract size**		**D: Relative size of ecosystem**		**E: Condition**		**F: Ecosystem diversity**		**G: Context & connection**
S: State	**1**	A: very high	or	B1: very high		n/r		n/r		n/r		n/r		n/r
Or	**2**	n/r		B1: high		n/r	&	D1: very high		n/r		n/r		n/r
Or	**3**	n/r		B1: high	&	C: high	&	D1: high	&	E: very high[1]	or	F: very high[1]	or	G: very high[1]
Or	**4**	n/r		n/r		C: very high	&	D1: very high	&	E: very high		n/r		n/r
Or	**5**	n/r		n/r		n/r		D1: very high	&	E: very high[1]	or	F: very high[1]	or	G: very high[1]
R: Regional	**6**	A: high	or	B1: high		n/r		n/r		n/r		n/r		n/r
Or	**7**	n/r		B2: very high		n/r		n/r		n/r		n/r		n/r
Or	**8**	n/r		B2: high	&	C: very high	or	D2: very high		n/r		n/r		n/r
Or	**9**	n/r		n/r		C: very high	&	D2: very high	&	E: very high		n/r		n/r
Or	**10**	n/r		n/r		C: very high		n/r	&	E: very high	&	F: very high	or	G: very high
Or	**11**	n/r		B2: high	&	C: high	&	D2: high[2]	or	E: very high or high[2]	or	F: very high or high[2]	or	G: very high or high[2]
Or	**12**	n/r		n/r		n/r		D2: very high	&	E: very high or high[2]	or	F: very high or high[2]	or	G: very high or high[2]

Biodiversity significance of remnant units	**Query No.**	**A: Essential habitat for EVNT spp.**		**B: Ecosystem value**		**C: Tract size**		**D: Relative size of ecosystem**		**E: Condition**		**F: Ecosystem diversity**		**G: Context & connection**
L: Local	**13**	n/r		B2: high		n/r		n/r		n/r		n/r		n/r
Or	**14**	n/r		B3: very high		n/r		n/r		n/r		n/r		n/r
Or	**15**	n/r		B3: high	&	C: very high	or	D3: very high		n/r		n/r		n/r
Or	**16**	n/r		n/r		C: very high	&	D3: very high	&	E: very high		n/r		n/r
Or	**17**	n/r		n/r		C: very high		n/r	&	E: very high or high[2]	or	F: very high or high[2]	or	G: very high or high[2]
Or	**18**	A: medium	or	B3: high	or	C: high	&	D3: high[2]	or	E: very high or high[2]	or	F: very high or high[2]	or	G: very high or high[2]
Or	**19**	n/r		n/r		n/r		D3: very high	&	E: very high or high[2]	or	F: very high or high[2]	or	G: very high or high[2]

Notes:

The assessment is progressive, i.e. a query is 'triggered' only if the preceding set has not been satisfied.

Criteria B & D vary according to the scale (State, Regional, Local)—all other criteria are independent of scale.

N/R: Not relevant.

VH: Very high

Very High[1]: A single 'Very High' score is not sufficient—at least two of the criteria marked as Very High[1] must be rated as Very High to qualify as significant.

High[2]: A single 'High' score is not sufficient— at least two of the criteria marked as High[2] must be rated as 'High' to qualify as significant.

'or': Options which apply only to the query immediately preceding the 'or' (i.e. A & B or C or D means A+B or A+C or A+D; A or B & C means A+C or B+C; A or B & C or D means A+C or A+D or B+C or B+D)

Appendix 3: List of datasets used in NWH BPA v1.1

Dataset	Version	Release date	Custodian
Directory of important wetlands		Published 01/01/2005	Wetlands, DES
Nature refuges - Queensland		Published 27/04/2018	QPWS,DES
Protected areas of Queensland		Published 02/07/2018	Queensland Herbarium, DES
Queensland wetland data – wetland areas	Version 5.0	Published 31/05/2019	Wetlands, DES
Remnant and pre-clearing regional ecosystem mapping	Version 11.0	Published 14/12/2018	Queensland Herbarium, DES
Species records - ALA		EVNT fauna extracted 05/11/2019 ; Priority fauna taxa extracted 18/12/2019	ALA
Species records – Chris Sanderson (expert)		Priority fauna taxa extract 18/12/2019	Individual
Species records - CORVEG		EVNT flora extracted 01/11/2019; Priority flora taxa extracted 18/06/2019	Queensland Herbarium, DES
Species records - Herbrecs		EVNT flora extracted 17/01/2020; Priority flora taxa extracted 19/07/2020	Queensland Herbarium, DES
Species records - QBERD		EVNT fauna extracted 22/11/2018	Queensland Herbarium, DES
Species records - Queensland historical fauna database (QHFD)		EVNT fauna extracted 17/11/2018; Priority fauna taxa extracted 18/12/2019	Biodiversity Assessment, DES
Species records - WildNet		EVNT flora extracted 27/11/2019; EVNT fauna extracted 03/02/2020; Priority taxa extracted 25/07/2020	WildNet, DES
World Heritage Areas		Published 23/03/2017	Australian Government

Appendix 4: Criterion C subregion thresholds implemented in NWH BPA v1.1

Subregion	Low	Medium	High	Very High
1.1 Southwestern Plateaus and Floodouts	< 165872	< 331744	< 1326966	NA
1.2 Thorntonia	< 194373	< 388746	< 777491	NA
1.3 Mount Isa Inlier	< 519	< 1306	< 4617480	NA
1.4 McArthur	NA	NA	< 580862	NA