Australian Government
Department of the Environment and Water Resources

Threatened Ecological Community Nomination Form - for listing, changing the status, or delisting an ecological community under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

Nominated Ecological Community - Summary of eligibility

6. *Name of Ecological Community*

Native Grassland on Basalt and Alluvium of the Brigalow Belt North Bioregion and the Claude River Downs

7. *Category for which the ecological community is nominated under the EPBC Act*

Current listing category	Proposed listing category
X Unlisted ☐ Critically Endangered ☐ Endangered ☐ Vulnerable	☐ Critically Endangered **X Endangered** ☐ Vulnerable ☐ Delisting

8. *Criteria that form the basis for this nomination*

X Criterion 1 – Decline in geographic distribution.
X Criterion 2 – Small geographic distribution coupled with demonstrable threat.
☐ Criterion 3 – Loss or decline of functionally important species.
☐ Criterion 4 – Reduction in community integrity.
☐ Criterion 5 – Rate of continuing detrimental change.
☐ Criterion 6 – Quantitative analysis showing probability of extinction.

Important notes for completing this form

- Complete the form as far as possible. It is important for the Threatened Species Scientific Committee to have comprehensive information and the best case on which to judge an ecological community's eligibility against the EPBC Act criteria for listing (Attachment A).
- Nominations that do not meet the EPBC Amendment Regulations 2007 will not proceed. Division 7.2 of the EPBC Amendment Regulations at http://www.environment.gov.au/epbc/about specifies the required information for a nomination. If after research you find the information is not available, please state this under the relevant questions (as described in subregulation 7.05(3) of the EPBC Act Regulations).
- To ensure you have the most up to date information, it is recommended that you contact the relevant Natural Resource Management authority. For details see: www.nrm.gov.au.
- Keep in mind that the purpose of the questions is to help identify why the ecological community is eligible for the conservation category for which it is nominated.
- The purpose of the form is to assist the Committee to gain an understanding of the ecological community. In that sense, it is important that you consider the full, national extent of an ecological community, not just its occurrence in specific areas or regions.
- The questions are separated into themes, which indirectly or directly relate to the criteria for listing. The Committee provides the following general description of what kind of information informs its judgements against the EPBC Act criteria for listing (Attachment A).
- For all facts and all information presented - identify your references and sources of information. Document the reasons and supportive data. Indicate the quality of facts/information and any uncertainty in the information. For example was it based on a peer-reviewed research publication or anecdote; or on observed data, an inference/extrapolation from the data, or a reasonable premise not yet supported by hard data?
- Personal communications - The opinion of appropriate scientific experts may also be cited (with their approval) in support of a nomination. If this is done the names of the experts, their qualifications and full contact details must also be provided at the end of this nomination.
- Confidential material – Identify any confidential material and explain the sensitivity.
- Tables – Can be included at the end of the form or prepared as separate electronic documents included as appendixes or attachments. Refer to tables in the relevant area of the text.
- Maps - If maps cannot be supplied electronically, please provide them in hardcopy.
- Cross-reference relevant areas of the nomination form where needed.

How to lodge your nomination

Completed nominations must be lodged either:
1. by email to: **epbc.nominations@environment.gov.au**

OR

2. by mail to: The Director
Ecological Communities Section
Department of The Environment and Water Resources
GPO Box 787
Canberra ACT 2601

Further information

The Threatened Species Scientific Committee has developed guidelines to assist nominators. The guidelines are attached to this form (Attachment A). They include the statutory criteria and guidelines for the 'critically endangered', 'endangered' and 'vulnerable' categories. The guidelines also include indicative thresholds, which may be used by the Committee to assess whether an ecological community is eligible for listing against the criteria prescribed by the EPBC Regulations. It should be noted that the Committee does not adhere strictly to these thresholds, but has regard to them when making judgements about ecological communities on a case-by-case basis.

More detailed information on all categories for threatened ecological communities can be found in Section 182 of the EPBC Act and the statutory criteria can be found in Division 7.1 of the EPBC Regulations 2000. These are available at: **www.environment.gov.au/epbc/about/index.html**

For questions regarding nominations contact:
The Director
Ecological Communities Section
Department of The Environment and Water Resources
GPO Box 787
Canberra ACT 2601
Telephone (02) 6274 2317
Fax (02) 6274 2214

Section 1 – Conservation Assessment

Information in this form is required for assessing ecological communities nominated as threatened under the EPBC Act. Provide answers in the space below each question. If no or insufficient information exists to answer a question, please indicate that no information is available, instead of leaving the space blank.

Conservation Theme

1. *How does this nomination qualify for assessment under the current Conservation Theme?* A Conservation Theme applies only if the Minister for the Environment and Water Resources announces a theme for the annual call for public nominations. See **www.environment.gov.au/biodiversity/threatened/nominations** for further details.

There is no conservation theme for nominations called for between 10 March – 10 May 2007.

Classification

By nominating a broader community, you will enable the Committee to consider the national extent and condition of the community and determine the limits of the listed ecological community.

2. *What is the name of the ecological community? Note any other names that have been used recently, including where different names apply to different jurisdictions.* For example, is it known by separate names in different States or regions?

The name of the ecological community is:

Native Grassland on Basalt and Alluvium of the Brigalow Belt North Bioregion and the Claude River Downs.

The nominated ecological community overlaps with the "Bluegrass (*Dichanthium* spp.) dominant grasslands of the Brigalow Belt Bioregion (North and South)", which was listed as endangered, under the *Environment Protection and Biodiversity Conservation Act 1999*, in April 2001 (Environment Australia 2001b).

The nominated ecological community is comprised of 6 regional ecosystems defined by the Queensland Environmental Protection Agency. In Queensland a Regional Ecosystem (RE) describes the vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil (Sattler and Williams 1999). Each is given a unique number that relates to the bioregion in which it occurs, the land zone and the vegetation. The grassland regional ecosystems that make up the nominated ecological community occur on basaltic, alluvial or similar substrates and are identified and described as follows (Qld EPA 2005a):

- RE 11.3.21 *Dichanthium sericeum* and/or *Astrebla* spp grassland on alluvial plains - Cracking clay soils;
- RE 11.3.31 *Ophiuros exaltatus*, *Dichanthium* spp grassland on alluvial plains;
- RE 11.4.4 *Dichanthium* spp, *Astrebla* spp grassland on Cainozoic clay plains;
- RE 11.4.11 *Dichanthium sericeum*, *Astrebla* spp and patchy *Acacia harpophylla*, *Eucalyptus coolabah* on Cainozoic clay plains;
- RE 11.8.11 *Dichanthium sericeum* grassland on Cainozoic igneous rocks; and
- RE 11.11.17 *Dichanthium sericeum* grassland on old sedimentary rocks with varying degrees of metamorphism and folding.

The inclusion of RE 11.11.17 in the nominated ecological community is still to be confirmed. This is because the principal substrate is metamorphic, but RE 11.11.17 occurs on gently undulating plains and rises formed on moderately to strongly deformed and metamorphosed sediments and interbedded volcanics (Qld EPA 2005a).

Certain grasslands that occur in the Brigalow Belt North bioregion are excluded from the nominated ecological community because their soil type is different. The excluded REs are:

- RE 11.8.10 *Themeda triandra* grassland on Cainozoic igneous rocks;
- RE 11.9.3 *Dichanthium* spp, *Astrebla* spp grassland on fine-grained sedimentary rocks; and
- RE 11.9.12 *Dichanthium sericeum* grassland with clumps of *Acacia harpophylla* on fine-grained sedimentary rocks.

3. *What authorities/surveys/studies support or use the name?*

The name of the nominated ecological community was proposed by an expert workshop, held by the then Department of the Environment and Heritage in November 2006, during a review of the national "Bluegrass (*Dichanthium* spp.) dominant grasslands of the Brigalow Belt Bioregion (North and South)" ecological community, which was listed in 2001 (DEH 2006a).

4. *How does the nominated ecological community relate to other communities that occur nearby or that may be similar to it? Does it intergrade with any other ecological communities and, if so, how wide are the intergradation zones? Please describe how you might distinguish the ecological community in areas where there is overlap.*

Grassland is vegetation in which the dominant stratum (the vegetation layer that contains more biomass than any other layer) is typically and primarily composed of grasses. Fensham (2003) defined grasslands as "vegetation where trees and shrubs are sparse and where grasses, mostly perennial, are dominant". Natural grasslands are widespread in Australia, particularly in arid and semi-arid areas.

Grasslands dominated by Bluegrass (*Dichanthium* spp) and species of Mitchell Grass (*Astrebla* spp) occur over a broad geographic region in Queensland including the Brigalow Belt, Mulga Lands, Mitchell Grass Downs, Desert Uplands and Gulf Plains IBRA bioregions. However, species composition is strongly influenced by soil and climatic variables (DEH 2006a) and there is, accordingly, a high degree of variation across their national distribution (Environment Australia 2001a). The grasslands in the Brigalow Belt also differ in their associated species and are considered to be ecologically distinct from ecological communities in bioregions further west and north (DEH 2006b).

The Bluegrass Ecological Community expert workshop acknowledged that the Brigalow Belt grasslands on alluvium and basalt are comprised of two distinct ecological communities, split on a north/south climatic divide. It recommended that the national ecological community "Bluegrass (*Dichanthium* spp) dominant grasslands of the Brigalow Belt Bioregions (North and South)" listed in 2001 be split accordingly:

- The northern grassland ecological community, nominated here, occurs in the Brigalow Belt North bioregion plus the Claude River Downs sub-region of the Brigalow Belt South bioregion. These native grasslands are typically composed of perennial grasses including one or more of the following indicator species: *Dichanthium sericeum; Dichanthium queenslandicum*; Panicum queenslandicum; Panicum decompositum; Eriochloa crebra; Digitaria divaricatissima; Astrebla elymoides; Astrebla lappacea; Astrebla squarrosa; Thellungia advena; Bothriochloa erianthoides; Aristida leptopoda*; and, Aristida latifolia*.*
- The southern ecological community occurs in the Brigalow Belt South bioregion (excluding the Claude River Downs sub-region) in Queensland and NSW plus the Nandewar, western New England Tablelands and northern Sydney Basin bioregions in New South Wales. These native grasslands are typically composed of perennial grasses containing one or more of the following indicator species: *Austrostipa aristiglumis*; Dichanthium sericeum; Themeda avenacea*; Themeda triandra*; Panicum queenslandicum; Panicum decompositum; Eriochloa crebra; Digitaria divaricatissima; Astrebla elymoides; Astrebla lappacea; Astrebla squarrosa; Thellungia advena; Bothriochloa biloba*; Bothriochloa erianthoides; and, Austrodanthonia bipartita*.*

(* Species used to identify only one of the nominated grassland ecological communities have been underlined in the two preceding paragraphs.)

Whilst there are floristic similarities between the northern and southern Brigalow grasslands, they contain distinctive floristic elements and are geographically separate (DEH 2006b).

Legal Status

5. *What is its current conservation status under Australian State/Territory Government legislation?*

The nominated ecological community overlaps with the "Bluegrass (*Dicanthium* spp.) dominant grasslands of the Brigalow Belt Bioregion (North and South)", which was listed as endangered under *the Environmental Protection and Biodiversity Conservation Act 1999* in 2001 (Environment Australia 2001b).

It also includes components that are recognised as threatened under the Queensland *Vegetation Management Act 1999*: RE 11.3.21 is designated as Endangered, and REs 11.8.11 and 11.11.17 are designated as Of concern. REs 11.3.31, 11.4.4 and 11.4.11 are designated as Not of concern (Qld EPA 2005a).

6. *Does the ecological community provide a habitat for any listed threatened species? If so, please note whether the species are listed on State/Territory and/or national lists and the nature of its dependence on the ecological community.*

Four plant and one animal species that are listed nationally, or listed in Queensland, are known to occur in the nominated ecological community. They include two nationally listed threatened plant species and one nationally listed threatened animal species (see tables 1 and 2 below).

Table 1. Threatened flora known to occur in the nominated ecological community (DEH 2005 & Butler 2007).

Scientific Name	Common Name	EPBC Status[1]	Qld Status[2]	RE[3] and Range
Cyperus clarus	Grassland Sedge	Not listed	Vulnerable	11.3.21 - From near Emerald to northern NSW
Dichanthium queenslandicum	King Blue-grass	Vulnerable	Vulnerable	11.3.21, 11.4.4 & 11.8.11 - Most frequent in BBN[4], very rare on Darling Downs
Digitaria porrecta	Finger Panic Grass	Endangered	Rare	11.3.21 – Emerald to Springsure, Darling Downs & NSW NW slopes and plains
Trioncinia retroflexa	Belyando Cobblers-peg	Not listed	Endangered	11.8.11 - Clermont to northern Darling Downs

Table 2. Threatened fauna known to occur in the nominated ecological community (DEH 2005 & Butler 2007).

Scientific Name	Common Name	EPBC Status[1]	Qld Status[2]	Range
Lerista allanae	Retro Slider	Endangered	Endangered	Known from Retro, Logan Downs & Clermont in BBN[4]

Table 2a. Threatened fauna that may occur, or have occurred, in the nominated ecological community (DEW 2007).

Scientific Name	Common Name	EPBC Status[1]	Qld Status[2]	Range / Former Range
Geophaps scripta scripta	Squatter Pigeon (southern)	Vulnerable	Vulnerable	From the Burdekin-Lynd divide, W to Charleville and Longreach, E to the coastline between Proserpine and Port Curtis and S to scattered sites throughout SE Qld
Lasiorhinus krefftii	Northern Hairy-nosed Wombat	Endangered	Endangered	Fossil records show this species was once widespread, living in Victoria, NSW & Qld (Qld EPA 2007)
Neochmia ruficauda ruficauda	Star Finch (eastern)	Endangered	Endangered	Formerly extended from Bowen Qld, S to the Namoi River & W to the Blackall Range
Onychogalea fraenata	Bridled Nail-tail Wallaby	Endangered	Endangered	Formerly extended from the Murray River region of NW Vic, through central NSW, N to Charters Towers Qld

Notes 1: *Environment Protection and Biodiversity Conservation Act 1999*. 2: Queensland *Nature Conservation Act 1992*.
3: From Qld EPA (2007) and [redacted] pers. comm. (2002). 4: BBN = Brigalow Belt North bioregion.

Description

7. *List the main features that distinguish this ecological community from all other ecological communities?* Characteristic features can be biological (e.g. species of plants and animals characteristic to the community; a type of vegetation structure), or associated non-biological landscape characteristics (e.g. soil type, habitat feature, hydrological feature). Please limit your answer to those features that are specific to the ecological community and can be used to distinguish it from other ecological communities.

The Bluegrass Ecological Community expert workshop identified the perennial native grass component as the primary indicator for the nominated ecological community, because of the prominence of perennial native grasses and their utility as indicators (DEH 2006b). The nominated ecological community is typically composed of perennial grasses including one or more of the following species: *Dichanthium sericeum; Dichanthium queenslandicum; Panicum queenslandicum; Panicum decompositum; Eriochloa crebra; Digitaria divaricatissima; Astrebla elymoides; Astrebla lappacea; Astrebla squarrosa; Thellungia advena; Bothriochloa erianthoides; Aristida leptopoda; and, Aristida latifolia* (DEH 2006a). The relative prominence of these species at any one time varies, and a wide range of other grass and non-grass (forb) species may also occur in the grassland (see Question 8 below).

Other characteristic features are the soil type and geographical distribution. The nominated ecological community occurs on cracking clay soils of basaltic and alluvial origins, and is limited to the Brigalow Belt North bioregion plus the Claude River Downs subregion of the Brigalow Belt South bioregion (DEH 2006a).

8. *Give a description of the biological components of the ecological community.* For instance, what species of plants and animals commonly occur in the community; what is the typical vegetation structure (if relevant).

The species that predominate in the grassland vegetation of the nominated ecological community vary with the underlying geology, landform and soil (i.e. they vary between regional ecosystems) although many species are common to two or more of the component regional ecosystems.

The Queensland EPA provides the following descriptions of the vegetation associated with the component regional ecosystems across their range (Qld EPA 2005a):

RE 11.3.21 - Grassland dominated by *Dichanthium sericeum* and/or *Astrebla spp* (*A. lappacea, A. elymoides* and *A. squarrosa*). A wide range of other grass and forb species is usually present and may be dominant, depending on seasonal conditions and management regimes. Frequently occurring species include the grasses *Aristida leptopoda, A. latifolia, Bothriochloa bladhii* var. *bladhii, Brachyachne convergens, Heteropogon contortus, Panicum decompositum, Eriochloa* spp, *Sporobolus mitchellii* and *Thellungia advena* and the forbs *Abelmoschus ficulneus, Corchorus trilocularis, Commelina ensifolia, Euphorbia coghlanii, Ipomoea lonchophylla, Neptunia gracilis, Phyllanthus maderaspatensis, Sida spinosa, S. trichopoda* and *Trichodesma zeylanicum* var. *latisepalum*. Scattered trees and shrubs may occur including *Eucalyptus coolabah, E. populnea, E. tereticornis* or *Acacia* spp.

RE 11.3.31 - *Ophiuros exaltatus* and *Dichanthium* spp grassland. The ground layer has a variable composition, with drier areas dominated by *Ophiuros exaltatus, Iseilema australe* or *Dichanthium* spp or *Brachyachne tenella*. Other common and sometimes dominant grasses include *Themeda triandra, Heteropogon contortus, Eulalia aurea, Imperata cylindrica, Eriochloa pseudoacrotricha, Bothriochloa* spp, *Panicum decompositum* and *Sporobolus* spp Other species include the grass *Aristida latifolia* and the forbs *Neptunia* spp, *Rhynchosia minima, Crotalaria spp, Euphorbia* spp, *Sida* spp and *Desmodium* spp. Trees such as *Eucalyptus platyphylla, Grevillea striata, Corymbia dallachiana* or *C. erythrophloia* may occur as emergent isolated trees or tall shrubs.

RE 11.4.4 - Tussock grassland dominated by *Dichanthium* spp ± *Astrebla* spp (mainly *A. lappacea and A. pectinata*). Other grasses frequently present include *Thellungia advena, Panicum* spp and *Aristida* spp Forbs and annual grasses may become common with seasonal rains. Occasional shrubs and trees may be present in places.

RE 11.4.11 - *Dichanthium sericeum* and *Astrebla* spp grassland with patches of low *Acacia harpophylla* or *Eucalyptus coolabah* trees. Grassland dominated by *Dichanthium sericeum* forms a mosaic with clumps of *Acacia harpophylla, Lysiphyllum hookeri* and *L. carronii* (usually 8±3m high). A wide range of other grass and forb species are usually present and may be dominant depending on seasonal conditions and management regime. Frequently occurring species include the grasses *Aristida leptopoda, A. latifolia, Astrebla lappacea, Bothriochloa erianthoides, Digitaria brownii, D. divaricatissima, Eriochloa crebra, Panicum decompositum, P. queenslandicum, Paspalidium globoideum* and the forbs *Abelmoschus ficulneus, Boerhavia dominii, Corchorus trilocularis, Cyperus bifax, Glycine latifolia, Hibiscus trionum, Ipomoea lonchophylla, Phyllanthus maderaspatensis, Malvastrum americanum, Tribulus micrococcus* and *Rhynchosia minima.*

RE 11.8.11 - Grassland dominated by *Dichanthium sericeum, Aristida* spp, *Astrebla* spp and *Panicum decompositum* with or without trees such as *Eucalyptus orgadophila, E. melanophloia, Corymbia erythrophloia* (tree height 11±3 m). However, dominance and cover may vary with seasonal and other environmental conditions. Frequently occurring and sometimes locally dominant species include the grasses *Aristida lazaridis, A. ramosa, Bothriochloa ewartiana, Dichanthium sericeum, Chrysopogon fallax, Heteropogon contortus, Enneapogon gracilis, Themeda triandra* and *Tragus australianus* and the herbs *Brunoniella australis, Evolvulus alsinoides, Sida spinosa, Galactia tenuiflora* and *Indigofera linnaei*. Isolated emergent trees (tree height 12±4 m - species including *Eucalyptus orgadophila, E. melanophloia* and *Corymbia erythrophloia*) or small areas of open-woodland may also be present.

RE 11.11.17 - *Dichanthium sericeum* grassland with *Eucalyptus melanophloia* and *E. orgadophila* scattered trees or low open-woodland on rises.

Management and climatic factors can cause large and seasonal fluctuations in species dominance and cover in grassland communities (Wilson *et al.* 2002). For example in Bluegrass communities, the extent of seedling recruitment of species of *Astrebla* (Mitchell grasses) and *Dichanthium sericeum* is affected by previous climatic conditions (Austin and Williams 1988). *Astrebla lappacea* requires a high rainfall event in spring (at least 100mm) followed by a similar rainfall in autumn and suitable rain the following winter to establish large numbers of seedlings. *Dichanthium sericeum* germinates and establishes in dense populations under warm-season rainfall and will out-compete *Astrebla lappacea* seedlings and attain dominance in the grasslands during favourable seasonal conditions. Because of these differing requirements, in some years plants of the shorter-lived perennial *Dichanthium sericeum* may be almost or totally absent from Bluegrass communities and the vegetation dominated by *Astrebla* spp Winter rainfall also results in the germination of a large suite of 'cool-season' plant species (mostly forb (non-grass) species) cf. summer rains which favour grass species such as *Iseilema membranaceum* (Small Flinders Grass) (Austin and Williams 1988). The total plant species composition of Bluegrass communities can thus also vary enormously with seasonal conditions.

9. *Give a description of the associated non-biological landscape characteristics or components of the ecological community.* For instance, what is the typical landscape in which the community occurs; is it associated with a particular soil type; what major climatic variables drive the distribution of the ecological community.

The grassland usually occurs on flat, or gently undulating Cainozoic alluvial plains (geologically young areas associated with rivers and creeks), including back-plains, terraces, low levees and back-swamps (Galloway *et al.* 1974; Gunn and Nix 1977; Gunn *et al.* 1967). The soils are usually cracking clays (Galloway *et al.* 1974), are often self mulching (Story *et al.* 1967), usually deep (>150 cm, Galloway *et al*. 1974) and range in colour from dark grey-brown to grey or black (Galloway *et al.* 1974; Vandersee 1975).

The Queensland EPA provides the following descriptions of the non-biological characteristics of the ecological community's component regional ecosystems.

11.3.21 - Occurs on Cainozoic alluvial plains that are near level (slope <1%), i.e. on flats associated with rivers and creeks, including back-plains, terraces, low levees and back-swamps. Associated soils are usually cracking clays that lack gilgai, are often self mulching, usually deep and range in colour from dark grey-brown to grey or black.

11.3.31 - Occurs on older floodplain complexes on Cainozoic alluvial plains. Black or dark grey earths or brown clays, in some areas with strong gilgai or debil debil microrelief (distinct hummocks and hollows). Often with a self-mulching surface and alkaline subsoil.

11.4.4 - Occurs on flat to gently undulating clay plains formed from Cainozoic or weathered basalt unconsolidated sediments. Soils are generally moderately deep to very deep, dark grey, self mulching cracking clays with linear gilgai. Gravel or stone may be present in some areas.

11.4.11 - Occurs in shallow open valleys and poorly drained Cainozoic clay plains with deep cracking clay soils.

11.8.11 - Occurs on Cainozoic igneous rocks, particularly fresh basalt, and is generally associated with undulating, to gently undulating rises. It usually occurs on the crests and middle and upper slopes (slopes 2–6%), although in places is occasionally present on lower slopes and flat areas (slopes 0–2%). Associated soils are moderately shallow to deep cracking clay soils, dark brown to reddish brown in colour, often self mulching, and with gravel, stone or linear gilgai sometimes present. Surface stone 10–15 cm diameter is present in the south-western remnants.

11.11.17 - Occurs on gently undulating plains and rises formed on moderately to strongly deformed and metamorphosed sediments and interbedded volcanics.

(Qld EPA 2005a)

10. *Provide information on the ecological processes by which the components interact (where known).*

Black soils swell and shrink as they successively become wet then dry. This process can kill tree seedlings (and other species dependent upon a non-regenerative tap root) by breaking their root systems. This intense soil movement probably contributes to the association of grasslands with heavy soils in the Brigalow Belt, although other factors such as fire, frost, drought and soil chemistry (particularly low sodicity) can also be important for tree exclusion (Fensham 2003).

The deep cracks of the clay soils are thought to be a key habitat characteristic for some of the more grassland dependent fauna in the Brigalow Belt, particularly reptiles (Hobson 2002). Deep soil cracks in Bluegrass grasslands are also believed to be habitat for small mammals such as the Narrow-nosed Planigale (*Planigale tenuirostris*), the Long-tailed Planigale (*Planigale ingrami*), the Pale Field-rat (*Rattus tunneyi*) and the Common Planigale (*Planigale maculata*) (Goodland 2003, Hobson 2002, Keith and Betts 2003).

The habitat quality of the grasslands for other fauna, including several grassland birds, is thought to be more dependent upon structural complexity in grassland vegetation than soil structure. Well-developed grass tussocks and inter-tussock spaces of varying size and character, as well as forbs, twining herbs, and decaying vegetation provide structural complexity in grasslands. Vegetation cover provides nesting material and protection from avian predators for granivorous birds like the Brown Quail (*Coturnix ypsilophora*), the Stubble Quail (*Coturnix pectoralis*), the Little Button-quail (*Turnix velox*) and the Red-chested Button-quail (*Turnix pyrrhothorax*); as well as insectivores like the Rufous Songlark (*Cincloramphus mathewsi*), the Brown Songlark (*Cincloramphus cruralis*) and the Golden-headed Cisticola (*Cisticola exilis*) (Goodland 2003, Hobson 2002, Keith and Betts 2003).

Bluegrass grasslands also support an array of raptors (at least 12 species) including widespread species such as the Brown Falcon (*Falco berigora*); as well as more grassland dependant species such as the Spotted Harrier (*Circus assimilis*) (Augusteyn and Melzer 2002, Hobson 2002).

(Butler 2007)

11. *Does the ecological community show any consistent regional or other variation across its extent, such as differences in species composition or structure? If so, please describe these.*

As described under Question 8, the plant species composition and structure of the ecological community can vary with a wide range of abiotic and climatic factors.

The floristic structure of RE 11.8.11 has also been found to vary with a north-south climatic gradient related to the seasonality of rainfall (Fensham *et al.* 1999). The most frequent perennial grass, *Aristida leptopoda*, was most abundant in the low impact end of the grazing disturbance gradient. This was thought to be due to the relatively poor performance of *Dichanthium sericeum* during a succession of dry years prior to the study, which thus favoured *A. leptopoda*. Although *D. sericium* was still considerably more abundant than the *Aristida*, this highlighted the importance of climate in affecting the abundance of species in these grasslands.

12. *Identify major studies on the ecological community.*

Previously listed components of the nominated ecological community have been included in five major regional studies and/or have been the subject of other ecological research. Studies known to apply to three of the component regional ecosystems (REs) are summarised in Table 3 overleaf. Similar data have not been assessed in relation to the other component ecosystems.

Table 3. Major regional and other studies relevant to each subregion in which previously listed components of the nominated ecological community (REs 11.3.21, 11.4.4 & 11.8.11) occur (DEH 2005).

IBRA Sub-region (Number and Name)	Major Regional Study[1]					Other Relevant Studies
	1	2	3	4	5	
2. Bogie River Hills	+		+			
4, Beucazon Hills						
6. Northern Bowen Basin	+	+	+		+	Fensham (1999); Fensham, Holman and Cox (1999).
7. Belyando Downs		*			*	
8. Upper Belyando Floodout		*			*	
9. Anakier Inlier		*			*	
10. Basalt Downs		+	+		*	Fensham (1999); Fensham, Holman and Cox (1999); Fensham, Fairfax and Holman (2002).
11. Isaac-Comet Downs		+	+	+	*	Fensham (1999); Fensham, Holman and Cox (1999).
12, Nebo-Connors Range						
13. South Drummond Basin		*			*	
15. Claude River Downs		*			*	

Notes

1a * = subregion located entirely within study region
+ = subregion partly located in study region

1b 1. = Townsville-Bowen Area (Christian *et al.* 1953)
2. = Nogoa-Belyando Area (Gunn *et al*. 1967)
3. = Isaac-Comet Area (Story *et al*. 1967)
4. = Dawson-Fitzroy Area (Speck *et al*. 1968)
5. = Fitzroy Region (Gunn and Nix 1977); this study synthesises studies 2, 3 and 4 above.

Distribution

13. *Describe the national distribution in Australia. If possible, include appropriate bioregions where the ecological community occurs and attach a map showing its distribution.*

The ecological community occurs entirely within Queensland and is considered to be limited to the Brigalow Belt North bioregion, plus the Claude River Downs subregion of the Brigalow Belt South bioregion (DEH 2006a). Its occurrences roughly extend from Townsville and Bowen in the north, to Castlevale and Rolleston in the south - and from Moray Downs and Surbiton in the west to Nebo and Junee in the east.

The nominated ecological community occurs in 13 IBRA subregions. The occurrence of the component regional ecosystems in individual IBRA subregions is shown in Table 4.

Table 4. IBRA subregions in which the regional ecosystem (RE) components of the nominated ecological community occurs, as determined by visual examination of mapping provided by Qld Herbarium (Qld EPA 2005b)

IBRA Sub-region (Number & Name)	**RE Components from the Previous Listing, Included in this Nomination**			**Additional REs Included in this Nomination**		
	11.3.21	**11.4.4**	**11.8.11**	**11.3.31**	**11.4.11**	**11.11.17**
1. Townsville Plains				X		
2. Bogie River Hills		X		X		
3. Cape River Hills	X					
4, Beucazon Hills	X					
5. Wyarra Hills		X			X	
6. Northern Bowen Basin	X	X	X		X	
7. Belyando Downs	X	X			X	
8. Upper Belyando Floodout	X		X			
9. Anakier Inlier						
10. Basalt Downs	X	X	X		X	
11. Isaac-Comet Downs	X	X	X			
12, Nebo-Connors Range	X					
13. South Drummond Basin	X	X	X			X
15. Claude River Downs	X	X	X			X

14. *What is the national distribution (in ha) for the ecological community? Identify whether any values represent extent of occurrence or area of occupancy (as described in Attachment B); explain how it was calculated and datasets used.*

a. *What is the current distribution (in ha)?*
b. *What is the pre-European extent (in ha)?*
c. *What is the estimated percentage decline of the ecological community?*
d. *What data are there to indicate future changes in distribution will occur?*

The mapped pre-European and current area of occupancy of the nominated ecological community's component regional ecosystems is summarised in Table 5.

Table 5. Pre-European and current extent (area of occupancy in ha) of the nominated ecological community (Accad *et al*. 2006).

Regional Ecosystem	Pre-European Extent	Remnant Extent 1997	Remnant Extent 1999	Remnant Extent 2000	Remnant Extent 2001	Remnant Extent 2003	Latest Extent	Decline
11.03.21	**66 460**	33 632	32 116	31 696	31 674	31 609	**31 609**	**52.4%**
11.03.31	**42 472**	18 361	18 075	18 029	17 992	17 960	**17 960**	**57.7%**
11.08.11	**547 510**	191 351	186 173	184 473	184 423	No data	**184 423**	**66.3%**
11.04.04	**64 974**	27 110	27 023	26 781	26 767	26 720	**26 720**	**58.9%**
11.04.11	**78 309**	29 308	27 633	27 446	27 422	27 100	**27 100**	**65.4%**
11.11.17	**1 443**	698	643	643	643	No data	**643**	**55.4%**
Total	**801 168**	300 460	291 663	289 068	288 921	-	**288 455**	**64.0%**

Table 5 shows that the nominated ecological community covered about 801 000 ha at the time of European settlement, and since that time, there has been an estimated 64% reduction in its area of occupancy. However, these estimates do not take the condition of grassland communities into consideration, particularly the degree to which exotic pasture species and weeds have invaded natural grasslands. Of the 36% of the nominated ecological community that remains now, it has been recognised that introduced pasture and weed species (in particular Parthenium Weed, *Parthenium hysterophorus*) are certain to have degraded significant areas of it [conservatively estimated at 50% for the Bluegrass ecological community listed in 2001 (Environment Australia 2001a)]. When the condition of sites is taken into account, the overall decline in area of occupancy of the nominated ecological community (i.e. the Highest Quality and the Good Quality grassland, see Question 21) is likely to be in the order of 70% to 80%.

Unless threat abatement actions are implemented across the nominated ecological community, the decline in the area of occupancy of the ecological community will continue. For example, cultivation for cropping will continue as intensification is ongoing and seed companies are still looking for species for their "black soil mixes" to market for pasture improvement on black soils. ([redacted] pers. comm. 2007).

15. *Is the ecological community considered to be naturally rare or restricted, based on its original (pre-European) distribution?* An ecological community is considered to be naturally restricted if it has a pre-European area of occupancy that is less than 10 000 ha or a pre-European extent of occurrence that is less than 100 000 ha (refer to attachment A).

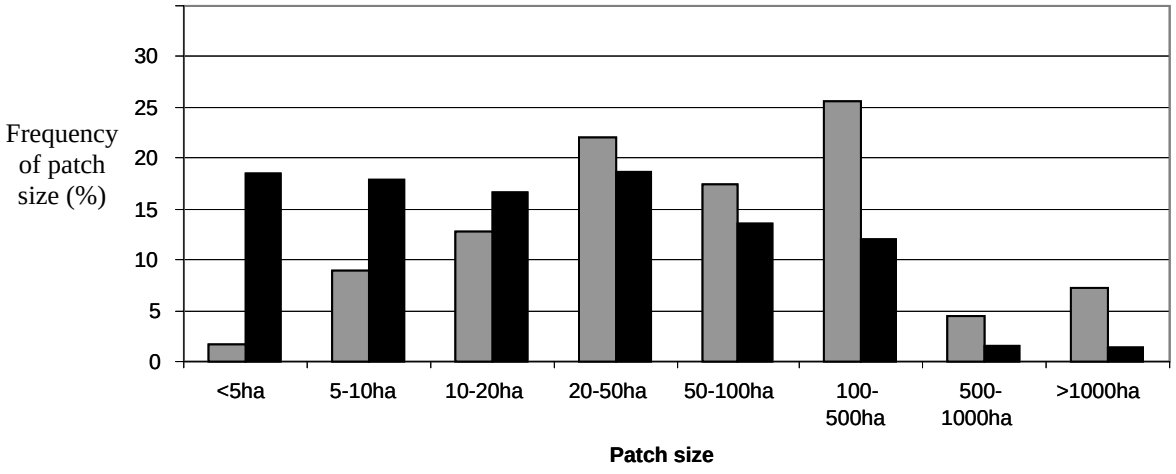
The nominated ecological community is not considered to be naturally rare or restricted, because prior to European settlement its estimated area of occupancy was over 800 000 ha (see Table 5, at Question 14 above).

16. *What is the typical size (in ha) for a patch of the ecological community (if known)?* Explain how it was calculated and the datasets that are used. Relevant data includes the average patch size, the proportion of patches that are below 10 ha or 100 ha in size.

Map data from the Qld Herbarium for the Brigalow Belt North bioregion allow a comparison of the size of patches of the Bluegrass community at the time of European settlement compared with patch sizes in 2001 (Butler 2007). The data are based on grassland polygons and relate to the national Bluegrass ecological community listed in 2001, which has a large degree of overlap with the nominated ecological community. Figure 1 shows the frequency of distribution of patch size classes, while Figure 2 shows the contribution of patch size classes to the total distribution of the community.

The data in Figure 1 indicate that at the time of European settlement, two-thirds of patches were 20–500 ha in size, about 8% of patches exceeded 1000 ha and only about 2% of patches were smaller than 5 ha. In 2001, less than half the patches were 20–500 ha in size, only about 2% were greater than 1000 ha, and about 18% were smaller than 5 ha. In 2001 only about 30% of patches were 50 ha or more in size, compared with about 55% of patches 50 ha or more in size at the time of European settlement. These data indicate that there has been a substantial change in the distribution of patch sizes, with an overall major trend towards larger numbers of smaller patches.

Figure 1. Frequency distribution of patch sizes for the national 'Bluegrass ecological community' in the Brigalow Belt North bioregion. Grey bars = Pre-clearing; black bars = 2001. (From Butler 2007)

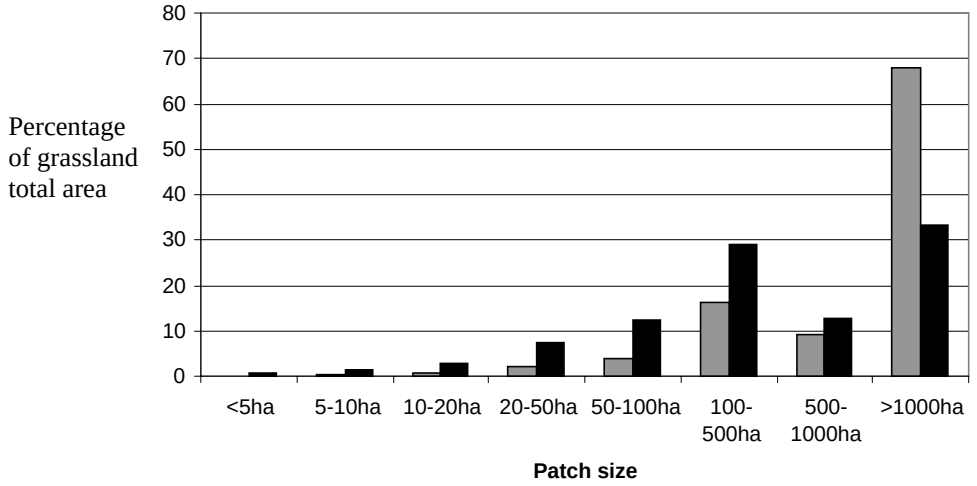


Continued in extra row (inserted overleaf)

In terms of the contribution of patch size classes to the total distribution of the community, at the time of European settlement, the 5% of patches greater than 1000 ha comprised almost 70% of the total distribution (see Figure 2 overleaf). In contrast, by 2001 grassland patches greater than 1000 ha comprised only about 32% of the total distribution, representing a more than 50%

reduction in the contribution of that patch class. In other words, in many grasslands, remnants that were formerly part of larger continuous grassland stands are now much reduced in size.

Figure 2. Percentage of the total extent of the national 'Bluegrass ecological community' in the Brigalow Belt North bioregion". Grey bars = Pre-clearing; black bars = 2001. (From Butler 2007)



17. *Quantify the percentage or area required for a patch to be considered viable.* This refers to the minimum size of a remnant that can remain viable without active management. What would you consider is the smallest area for which a patch of the ecological community can be considered viable? It may be determined through the requirements for dominant native species, level of species diversity, or the nature of invasive weeds.

The Bluegrass Ecological Community expert workshop defined the highest quality patches of the nominated ecological community as being at least 1 ha in size (DEH 2006a). This is slightly larger than the 0.5 ha minimum measurable size of a patch of Natural Temperate Grassland in south-eastern Australia (Carter *et al.* 2003) and the size of the smaller grassland reserves (down to 0.5 ha**)** considered to remain efficient for conserving plant species diversity (McCarthy *et al.* 2006).

The minimum measurable patch size recommended by Carter *et al.* (2003) was based on expert opinion and other factors relevant to grasslands, such as the need to distinguish between grassland and woodland or shrubland. In most patches of woodland or grassy shrubland, it is possible to find small patches that lack an upper stratum of trees or shrubs that could be defined as grassland. An area that has woodland, shrubland and grassland interspersed is problematic. If the grassland and non-grassland components are managed or considered separately, definition of the communities and management of the area becomes difficult.

It is recognised that many grassland remnants, formerly part of larger continuous grassland stands, are now less than 0.5 ha and would be overlooked by the minimum size used by Carter *et al.* (2003). However, a smaller minimum size would exponentially increase the number of sites of grassland and include many sites that would be better considered as naturally open spaces within grassy woodland or similar grassy communities.

Functionality

18. *Is the present distribution of the ecological community severely fragmented? If so, what are likely causes of fragmentation?* Severely fragmented refers to the situation in which increased extinction risk to the ecological community results from most remnants being found in small and relatively isolated patches. These small patches may go extinct, with a reduced probability of decolonisation.

Agricultural development has fragmented the native grasslands in the Brigalow Belt North bioregion. This is indicated by:

a. the greatly increased number of smaller grassland patches in the landscape, many of which formerly would have been part of larger continuous grassland patches (Butler 2007); and

b. the reduced proportion of grassland occurring as large patches

(See Question 16, including figures 1 and 2).

19. *Has there been a loss or decline of functionally important species? If yes, which species are affected? How are they functionally important and to what extent have they declined?* This refers to native species that are critically important in the processes that sustain or play a major role in the ecological community and whose removal has the potential to precipitate change in community structure or function sufficient to undermine the community's viability.

There has been a documented decline in some perennial grasses in Bluegrass grasslands, which is likely to have impacted upon ecosystem function. This decline is associated with persistent heavy grazing and has been most apparent for palatable perennial grasses such as King Bluegrass (*Dichanthium queenslandicum*) and Queensland Bluegrass (*D. sericeum*). The result can be a shift in dominance towards less palatable perennial grass species such as White Spear-grass (*Aristida leptopoda*). This loss of palatable perennial species is well documented because it affects domestic herbivores, but native herbivores are also likely to be affected. In more extreme cases all perennial grasses decline to such an extent that annual grasses and forbs become the dominant species. Such loss of perennial tussock-grass cover is likely to substantially alter grassland suitability as habitat for cover dependent fauna such as quail and reptiles. Although functionally important, the decline of perennial grasses is probably reversible over the medium term (perhaps a decade or so) but is likely to require substantial management change ([redacted] pers. comm. 2007).

20. *Reduction in community integrity. Please describe any processes that have resulted in a reduction in integrity and the consequences of these processes e.g. loss of understorey. Include any available information on the rate of these changes.* This recognises that an ecological community can be threatened with extinction through on-going modifications that do not necessarily lead to total destruction of all elements of the community. Changes in integrity can be measured by comparison with a benchmark state that reflects as closely as possible the natural condition of the community with respect to the composition and arrangement of its abiotic and biotic elements and the processes that sustain them. Please provide a description of the benchmark state where available. For further information please refer to the Guidelines (Attachment A).

Changes in condition and composition of Bluegrass grasslands can occur over short periods of time in response to both grazing pressure and environmental conditions.

High grazing pressure can remove vegetation cover from grasslands rapidly. Conversely, a good growing season can induce rapid recovery of a grassland from a state of low vegetation cover. The actual composition of Bluegrass grassland at the end of a good season depends on many factors, including grazing regime, fire history, weed invasion, composition of the soil seed bank and the seasonality of rainfall.

Pasture degradation associated with grazing in the Bluegrass grasslands of Queensland Central Highlands first attracted attention in 1915 (Bisset 1960). Substantial composition changes had reportedly occurred prior to this time as a result of both extreme climatic events and grazing. The degradation was mainly apparent through an increasing dominance of comparatively unpalatable native perennial tussock grasses, notably White Spear-grass (*Aristida leptopoda*) and Yabila Grass (*Panicum queenslandicum*) Everist (1939).

Parthenium weed (*Parthenium hysterophorus*) poses a serious threat to the biodiversity of native grasslands in central Queensland as its prolific and persistent soil seedbank, fast germination rate and other features make it well adapted to semi-arid environments (CRC Weed Management 2003). Parthenium also is highly toxic to stock, so that infestations significantly reduce pasture quality and makes conversion of grasslands to cropping a more attractive proposition for landholders (Fensham 1999).

Condition Classes

21. *The Committee recognises that ecological communities can exist in various condition states. In reaching its decision the Committee uses condition classes to determine the patches which are included or excluded from the listed ecological community (see www.environment.gov.au/epbc/publications/pubs/ecological-communities-listing-approach.pdf for details of the process of determining condition classes). What features do you consider to be most valuable for identifying a patch of the ecological community in good condition?* Variables for establishing the condition class may include patch size, connectivity, native plant species diversity, overstorey foliage cover, understorey composition and cover and recognised faunal values.

For the purposes of the Queensland *Vegetation Management Act 1999* grasslands are classified and mapped as remnants of native vegetation unless they have been cultivated within the last 15 years or are so degraded that they are unlikely to recover to a natural state within 15 years (Neldner *et al.* 2005).

The Bluegrass Ecological Community expert workshop indicated the nominated ecological community must contain no more than 10% projected foliage tree crown cover, and must meet the defined condition thresholds set out in Table 6 overleaf (DEH 2006a).

Continued in extra row (inserted overleaf)

Table 6. Proposed condition thresholds for the Native Grassland on Basalt and alluvium of the Brigalow Belt North IBRA Bioregion and the Claude River Downs (from DEH 2006a).

Patch Size	Ground Cover*	Woody Shrub Cover	Weeds	Tussock Density
Nominated – Highest Quality (may only be identifiable in a good season)				
At least 1ha **And**	*Dichanthium sericeum*, *Dichanthium queenslandicum*, and *Astrebla* spp are no less than 30% of the total perennial grass cover **And**	Woody shrubs (e.g. *Acacia farnesiana* and *A. salicina*) are less than 30% of the total canopy cover **And** Introduced woody shrubs (e.g. *Acacia nilotica* and *Leucaena leucocephala*) are less than 5% of the total canopy cover **And**	Perennial introduced species are less than 5% of the total cover of perennial species **And** *Parthenium hysterophorus* is less than 5% of the total cover of annual species	
Nominated – Good Quality				
At least 5ha **And**		Woody shrubs (e.g. *Acacia farnesiana* and *A. salicina*) are less than 70% of the total canopy cover **And** Introduced woody shrubs (e.g. *Acacia nilotica* and *Leucaena leucocephala*) are less than 20% of the total canopy cover **And**	Perennial introduced **grass** species are less than 50% of the total cover of perennial **grass** species **And** *Parthenium hysterophorus* is less than 70% of the total cover of annual species **And**	An average of at least 20 native grass tussocks per 100 m^2
Not nominated				
			Perennial introduced species are 50% or more of the total cover of perennial species **Or** *Parthenium hysterophorus* is 70% or more of the total cover of annual species **Or**	An average of less than 20 native grass tussocks per 100 m^2

Note *The quadrat size for assessing the presence/absence of indicator species is 0.1 ha (e.g. 50 m by 20 m).

If it can be demonstrated, beyond reasonable doubt, that the grassland was derived from woodland then it is not part of the ecological community nominated for listing

Survey and Monitoring

22. *Has the ecological community been reasonably well surveyed? Provide an overview of surveys to date and the likelihood of its current known distribution and/or patch size being its actual distribution and/or population size. Where possible, please indicate areas that haven't been surveyed but may add to the information required in determining the community's overall viability and quality. Is there an ongoing monitoring programme? If so, please describe the extent and length of the programme*

The ecological community has been reasonably well surveyed through the vegetation mapping programs of the Queensland Herbarium. The following technical detail comes from the Qld Herbarium (2007).

The Herbarium has produced high quality vegetation maps since the early 1970's. These maps have accurate spatial and point data on the distribution and species composition of vegetation communities and regional ecosystems. Survey data is compiled between scales of 1:50,000 and 1:250,000 and the mapping is prepared at a scale of 1:100,000. The survey and mapping includes a pre-clearing distribution, as well as remnant vegetation data for the years 1995, 1997, 1999, 2001 and 2003. Description of vegetation, ecology and statistics are also documented. Site data are available from the database CORVEG.

The survey and mapping program aims to provide a comprehensive 1:100,000 scale vegetation and regional ecosystem information base across Queensland.

Vegetation and regional ecosystem mapping now exists for more than 70% of the State. The maps are an essential component for the administration of the *Vegetation Management Act 1999* and are an important tool for land management, including conservation planning. The *Vegetation Management Act* status of these ecosystems has been determined from the Herbarium's regional ecosystem mapping.

The methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland is described by Neldner *et al*. (2005).

Threats

23. *Identify past, current and future threats to the ecological community indicating whether they are actual or potential. For each threat, describe:*

a. *how and where it impacts on this ecological community?*
b. *what its effect has been so far (indicate whether it is known or suspected; provide supporting information/research; does the threat only affect certain patches)?*
c. *what is its expected effect in the future (is there supporting research/information; is the threat only suspected; does the threat only affect certain patches)?*

For the purpose of the assessment of threats, the information from the draft recovery plan for the national Bluegrass ecological community listed in 2001 is equally applicable to this nomination of the "Native Grassland on Basalt and Alluvium of the Brigalow Belt North Bioregion and the Claude River Downs" ([redacted] pers. comm. 2007).

Threats do not necessarily operate in isolation but can interact so that one threat will often affect the likelihood or severity of other threats. For example, unsustainable grazing increases the risk of *Parthenium* invasion which, in turn may increase the risk of conversion to cultivation.
The main threats to the nominated ecological community are (from Butler 2007):

1. Expansion of exotic pastures and tree crops [actual current threat]
2. Expansion of mining activities [actual current threat]
3. Expansion of cultivation for cropping [actual current threat]
4. Persistent heavy grazing [actual current threat]
5. Invasive species [actual current threat]
6. Construction of roads and other infrastructure [actual current threat]
7. Lack of knowledge [potential current threat]

The order in which the threats are listed above is based on judgement about the area potentially affected and the severity of impact of each of the threats, and is intended to be indicative only. Not all populations will be equally threatened by these threatening processes. For example, the threat of road and infrastructure construction is more likely for the high priority grasslands in road and rail reserves, stock routes and travelling stock reserves.

1. Expansion of exotic pastures and tree crops replaces the native grassland with introduced species or alters the grassland structure by introducing a woody over-storey. Common cultivated pasture plants include Purple Pigeon Grass (*Setaria incrassata*), Butterfly Pea (*Clitoria ternatea*), Bambatsi Panic (*Panicum coloratum*), Rhodes Grass (*Chloris gayana*), Buffel Grass (*Cenchrus ciliaris*), Creeping Bluegrass (*Bothriochloa insculpta*) and Indian Bluegrass (*Bothriochloa pertusa*). The only common tree crop is the fodder tree, Leucaena (*Leucaena leucocephala*). Some seed companies have begun offering "black soil mixes" which include selections of the grasses listed above as well as other legumes.

Pasture development can involve various techniques from simply broadcasting seed (e.g. some legumes), delivering seeds into fairly intact grassland soil using machinery such as "crocodile" or band seeders, through to intensive seed bed preparation by cultivation and planting. The more intensive the seedbed preparation the more native biota will be impacted. Only intensive seedbed preparation involving "ploughing" should be considered to be cultivation in terms of the remnant definition for grasslands (i.e. not cultivated within last 15 years).

Less intense forms of pasture development render grasslands non-remnant only if they make the grassland "unrecoverable" to its original condition within the medium term, which would probably be the case if exotic perennial grasses become dominant. As well as direct pasture development, introduced pasture species, such as Buffel Grass, can invade nearby native grasslands and continue to spread. Some forms of pasture development and exotic species invasion are difficult to detect using satellite imagery or aerial photography, which means that the mapped remnant area of the Bluegrass ecological community may over-estimate the actual area remaining.

Areas subject to pasture development can maintain some habitat value for Bluegrass grassland flora and fauna, unlike areas converted to regular cropping. For example, although development of Butterfly Pea pastures generally involves intense seedbed preparation, the fairly open pastures often also feature native annual grasses such as Flinders Grass (*Iseilema* spp), as well as colonising vines such as Caltrop (*Tribulus* spp) and Cow Vine (*Ipomea lonchophylla*).

Conversion of grasslands into Leucaena (*Leucaena leucocephala*) plantations can sometimes briefly improve the condition of uncultivated areas of Bluegrass grassland in the same paddock, because grazing must be tightly controlled while the Leucaena is establishing. However over the longer term, unless Leucaena is planted in very wide rows (e.g. 20 m spacing), its establishment will substantially alter the grassland between the rows, and areas planted to dense Leucaena will not be recognised as remnant grassland.

2. Expansion of mining activities threatens the Bluegrass ecological community because it can result in the physical destruction of the vegetation. The Brigalow Belt in Queensland is a centre for coal production, and mining activity, including exploration, in the Central Highlands is expanding. Long wall mining has the potential to affect substantial areas of the Bluegrass ecological community. Construction of other infrastructure associated with mining activities such as roads, conveyors and spoil heaps can also be important factors in the overall impact of expanding mining activities.

3. Expansion of cultivation for cropping remains an ongoing and immediate threat to the extent of Bluegrass grasslands. Conversion of grassland to cropping removes many of the environmental values of the grassland, although cultivation paddocks may have residual value for some fauna and ruderal plants. A range of very valuable grain, pulse and forage crops are grown on the black vertosols derived from Bluegrass grasslands, including grain sorghum, sunflowers, mung beans and wheat as well as forage sorghum and oats. It is difficult to judge how much cropping will expand further into the nominated ecological community as it is possible that much of the land suitable for cropping has already been converted.

4. Persistent heavy grazing is an ongoing threat to the Bluegrass ecological community because grazing is the predominant land use to which remnant grasslands are subject. Persistent heavy grazing can degrade grasslands and greatly increases the risk of weed invasion. Also, certain grassland plants and animals are not favoured by heavy grazing regimes, including species recognised to be threatened. As a general rule extreme grazing duration, frequency and/or intensity, decreases the dominance of perennial plants and increases the prominence of annual grasses and herbs (Tremont 1994, Fensham *et al.*1999, Dorrough *et al.* 2004).

Pasture degradation associated with grazing in the Bluegrass grasslands of Queensland's Central Highlands attracted attention soon after settlement (Bisset 1960). Substantial compositional changes had reportedly occurred prior to 1915 as a result of both extreme climatic events and grazing. The degradation was mainly increasing dominance of comparatively unpalatable native perennial tussock grasses, most frequently White Spear-grass (*Aristida leptopoda*) and Yabila grass (*Panicum queenslandicum*) (Everist 1939). Signs of more severe degradation in Bluegrass/Mitchell grass grasslands include dominance by annual grasses or forbs, or dominance by herbaceous or woody weeds (McArthur *et al.* 1994).

The apparent grazing sensitivity of threatened grassland flora means that infrequently grazed grasslands such as those that occur in stock routes, travelling stock reserves and railway corridors are now essential habitat for several threatened plants including King Bluegrass (*Dichanthium queenslandicum*), Hawkweed (*Picris evae*), Austral Cornflower (*Stemmacantha australis*), Austral Toadflax (*Thesium australe*) and Belyando Cobblers-peg (*Trioncinia retroflexa*) (Fensham 1998).

Corresponding evidence for strong sensitivity to grazing has not been provided for grassland fauna, however studies are limited to date (Augusteyn and Melzer 2003). Grassland fauna are potentially threatened by grazing if it causes soil compaction or removes ground cover (Hobson 2002). Some grassland specialist fauna such as the Pale Field-rat (*Rattus tunneyi*) and several bird species (Stubble Quail, Brown Quail, Little Button-quail, Red-chested Button-quail and Singing Bushlark) prefer habitats with high levels of vegetation cover and complexity, and are therefore likely to be threatened by management that reduces grass height and density such as persistent heavy grazing or persistent slashing.

5. Invasive species threaten both the environmental and pastoral values of Bluegrass grasslands. Invasive animals that use Bluegrass grasslands include rabbits, pigs, cats, foxes, and dogs, as well as birds such as common starlings and indian mynas. The most abundant animal pest found in grasslands is the House Mouse (*Mus musculus*). The House Mouse potentially competes with native small mammals, reptiles and birds such as quail, and may impact upon seed production and recruitment by some plants.

The House Mouse is also an important food resource for grassland specialist predators such as the Black-shouldered Kite (*Elanus axillaris*), the Australian Kestrel (*Falco cenchroides*), the Barn Owl (*Tyto alba*) and the Spotted Black Snake (*Pseudechus guttatus*), as well as predators with more generalist habitat preferences such as the Eastern Brown Snake (*Pseudonaja textilis*) (Hobson 2002). There is very little information available on the impact of pest animals on Bluegrass grassland's environmental or pastoral values.

Most invasive plants require some form of disturbance to invade healthy Bluegrass grasslands. Disturbances may be natural (e.g. drought, wildfire, activities of native animals) or human-induced (e.g. managed grazing regimes). Many weed species typically occur as scattered plants and rarely become seriously invasive unless triggered to do so by a particular set of environmental and disturbance events (e.g. the Mexican Poppy (*Argemone ochroleuca)*). Some weeds, such as certain exotic grasses (see 6 'Construction of roads and other infrastructure' below) are primarily disturbance dependent for establishment in Bluegrass grasslands, but hold onto sites very tenaciously following invasion.

Recent experience in the Central Highlands suggests that Buffel Grass is establishing on heavy black clay soils to which it had previously appeared unsuited. Buffel Grass now dominates the ground stratum in many areas of Mountain Coolibah (*Eucalyptus orgadophila*) woodland, which often form a landscape mosaic with Bluegrass grasslands. The invasion of these woodlands, which grow on slightly lighter and redder clay soils higher in the landscape, has implications for the biota of the Bluegrass grasslands because the Mountain Coolibah woodlands used to provide additional habitat for many plants of Bluegrass grasslands. In other words, invasion of woodlands by weedy grasses increases the overall pressure on many threatened grassland species.

Three weeds identified as Weeds of National Significance are known to invade and threaten the Bluegrass ecological community. These are Parthenium (*Parthenium hysterophorus*), Parkinsonia (*Parkinsonia aculeata*) and Prickly Acacia (*Acacia nilotica* subsp. *indica*). Parkinsonia and Prickly Acacia are prickly leguminous shrubs. Parkinsonia is primarily a floodplain weed that threatens mainly the northern alluvial component of the Bluegrass ecological community (RE 11.3.21). Prickly Acacia currently occurs in the Central Highlands, around Clermont, and is climatically suited to clay soils over large areas of the Brigalow Belt bioregion (Spies and March 2004).

Parthenium is an annual herb that invades after disturbances such as persistent heavy grazing, inappropriate fires and mechanical disturbance. Disturbance facilitates Parthenium invasion by increasing the open space available to the invasive species. Reduction in pasture cover associated

with Parthenium invasion can also make cultivation a more attractive proposition to landholders, increasing the weed's threat to the Bluegrass ecological community (Fensham 1999). However, sustainable grazing management can provide effective Parthenium management in many cases (Chamberlain and Gittens 2004).

Some native woody weeds can also threaten the integrity of Bluegrass grasslands. Such plants are often a natural part of Bluegrass grasslands and intervention is only warranted where they present a clear threat to grassland integrity. Sally Wattle (*Acacia salicina*) appears to be a particularly problematic species in the Central Highlands but Mimosa (*Acacia farnesiana*) can also form dense thickets. Increasing density of wattles and other woody plants can be a result of fire exclusion.

6. Construction of roads and other infrastructure is a very significant threat to grasslands because Bluegrass grasslands in road reserves and rail corridors provide essential habitat for grazing intolerant flora and fauna. Bluegrass grasslands on road and rail reserves are frequently of the highest conservation value because, given the absent to low levels of grazing, they provide refugia for highly grazing-sensitive species such as *Trioncinia retroflexa.*

Road widening and associated construction of culverts, drainage lines, stock-piles, site offices and turning circles destroy grassland cover, and therefore directly damage the ecosystem and also increase the likelihood of weed invasion and soil erosion. Importation of rock and soil and mechanical disturbance associated with road work frequently enables invasion by exotic grasses such as Columbus Grass (*Sorghum* x *almum*), Johnson's Grass (*Sorghum halepense*), African Lovegrass (*Eragrostis curvula*), Rhodes Grass (*Chloris gayana*), Buffel Grass (*Cenchrus ciliaris*), Green Panic *(Megathyrsus maximus*), Paspalum (*Paspalum dilatatum*) and Rat's Tail Grasses (*Sporobolus natalensis* and *S. pyramidalis*). Slashing and movement of stock helps to spread these grasses and they are very difficult to eradicate once established.

7. Lack of knowledge about complex issues such as climate change, the detailed ecology of threatened species, weed invasion and fire regimes means that we could be overlooking some threats to the Bluegrass grasslands in the Brigalow Belt.

24. *Catastrophic threats (if not included above) i.e. threats with a low predictability that are likely to severely affect the ecological community. Identify the threat, explain its likely impact and indicate the likelihood of it occurring (e.g. a drought/cyclone in the area every 100 years)*

N/A

25. *Identify and explain any additional biological characteristics particular to the community or species within that are threatening to its survival (e.g. Low genetic diversity)? Identify and explain any models addressing survival or particular features.*
a. How does it respond to disturbance?
b. How long does it take to regenerate and/or recover?

N/A

26. *Relative status of remnants within the community?*
How much of the community would you describe as in good condition, (i.e. Likely to persist into the long-term with minimal management?) Please describe how you would identify areas in good condition using one or a combination of indicators such as species richness, structure, remnant size, weed invasion etc.
How much of the community would you describe as in medium condition (i.e. Likely to persist into the long-term future with management?) Please describe how you would identify areas in medium condition using one or a combination of indicator such as species diversity, structure, remnant size, weed invasion etc.
How much of the community would you describe as in poor condition, (i.e. Unlikely to be recoverable with active management?) Please describe how you would identify area in poor condition using one or a combination of indicators such as species diversity, structure, remnant size, weed invasion etc.

Proposed criteria are set out in Q21 (Condition classes) that identify areas that are of highest quality, good quality and recoverable condition.

Introduced pasture and weed species (in particular, *Parthenium hysterophorus*), are conservatively estimated to have degraded at least 50% of the Bluegrass ecological community listed in 2001 (Environment Australia 2001a). This figure alone, applied to the nominated ecological community, would mean that 50% of the ecological community was in highest or good quality condition and 50% in recoverable and irrecoverable condition.

Threat Abatement and Recovery

27. *Identify key management documentation available for the ecological community, e.g. recovery plans, conservation plans, threat abatement plans.*

Butler D.W. (2007). *Recovery plan for the "Bluegrass (Dichanthium spp.) dominant grasslands in the Brigalow Belt Bioregions (north and south)" endangered ecological community 2007–2011*. Report to Department of the Environment and Heritage, Canberra. Queensland Parks and Wildlife Service, Brisbane.

28. *Give an overview of how threats are being abated/could be abated and other recovery actions underway/proposed. Identify who is undertaking these activities and how successful the activities have been to date.*

For the purpose of the abatement of threats, the draft recovery plan for the Bluegrass ecological community listed in 2001 is equally applicable to the nominated Brigalow Belt North native grassland ecological community ([redacted] pers. comm. 2007).

The key to retention of the endangered native grasslands in the Brigalow Belt is to halt and reverse decline in their area and condition. The approach recommended is to encourage managers of significant areas of the native grassland to undertake activities that will not adversely impact on them and to facilitate improvements in grassland condition through education and support. In some situations this may impact upon plans to intensify use and may have an economic impact. The principle activities likely to be impacted are expansion of mining, and expansion of exotic pastures or crops (Butler 2007).

Successful implementation of recovery actions that encourage improvement in the condition and sustainable utilisation of grasslands, including financial assistance and incentives, are anticipated to produce social and economic benefits as well as environmental benefits. Native grasslands can be productive pastures and their diversity and productivity are important to the long-term resilience and sustainability of pastoralism in the Brigalow Belt (Bisset 1960, Barrett and Bishop 2000). Sustainable grazing management and resulting improvements in pasture structure should reduce the cost of weed management (Butler 2007).

Continued in extra row (inserted overleaf)

Table 7 summarises the types of threats facing native grassland in the Brigalow belt, along with current and future actions that will reduce the threats.

Table 7. Threat abatement actions (Butler 2007).

Type of threat	Current actions to reduce threats	Future actions to reduce threats
Expansion of exotic pastures and tree crops	Legislative protection. Protection under nature-refuge agreements and other reserves. Sustainable grazing management.	Encourage sustainable grazing management of native species. Ensure relevant proposed future land management actions are referred under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
Expansion of mining activities	Legislative protection. Protection under nature-refuge agreements.	Ensure relevant proposed future land management actions are referred under the EPBC Act. Negotiated conservation agreements. Purchase land for addition to protected area estate.
Expansion of cultivation for cropping	Legislative protection. Protection under nature-refuge agreements and other reserves.	Ensure relevant proposed future land management actions are referred under the EPBC Act. Negotiated conservation agreements. Purchase land for addition to protected area estate.
Persistent heavy grazing	Extension work by the Queensland Department of Primary Industries and Fisheries (DPI&F) and others to encourage and empower landholders to adopt sustainable grazing practices.	Financial support or incentives for best practice grazing management and more resources for extension by DPI&F.
Invasive species	Considerable effort is already made to control weeds and feral animals by landholders and government and non-government agencies. DPI&F extension often identifies prevention of weed invasion as a major benefit from sustainable grazing practices.	Avoid propagation or promotion of invasive exotic species. More resources to encourage sustainable grazing practices. Control slashing where appropriate. Research into problematic pest animals and weeds (including natives), and their control.
Construction of roads and other infrastructure	Mining companies, Shire Councils, Main Roads and Queensland Transport have environment officers and protocols in place to minimise impact on endangered vegetation.	Reinforce importance of roadside grasslands to relevant agencies. Periodic survey of roadsides to provide up-to-date information on the distribution of high value grasslands to relevant agencies.
Lack of knowledge	Considerable previous research as well as informal monitoring by landholders and biologists.	Further research into detailed ecology of key ecosystem components and threatened species, including fire ecology, recruitment and mortality. Establish strategic monitoring of relevant common and threatened species. **[Plus -** Disseminate research results and best practice management strategies to landholders, e.g. through extension officers.]

Further Details

Expansion of exotic pastures and tree crops - The use of native grasses and legumes to restore Bluegrass grasslands is preferable to establishing exotic pastures. It is likely that some landholders would use native seeds (particularly of Bluegrasses and Mitchell grasses) if a ready supply were available at competitive prices.

Expansion of mining activities - The high value of the resource developed by mining means that mines are well placed to mitigate against impacts their activities have on remnant grasslands by rehabilitating greater areas of degraded but otherwise comparable habitat. Care should be taken when evaluating such arrangements to ensure that the promised offset is delivered prior to the destruction of the pre-existing high-value habitat. If mine sites include grasslands that are out of the mine's direct path, mining companies are well placed to manage such grasslands for environmental benefit and should be encouraged to do so. Nature refuge agreements or similar arrangements may be useful in such instances.

Persistent heavy grazing – Maintaining a good cover of perennial grasses and spelling the grasslands from grazing are reliable methods of managing the risk of weed invasion (Chamberlain and Gittens 2004). With regard to grazing dynamics, research highlights the complexity of the interactions involved and suggests that accurately predicting the response of many species to a given grazing regime is inherently problematic. Factors such as rainfall, temperature, other disturbances, and the presence or absence of other species can all influence how a given species responds to grazing.

Grazing can be compatible with environmental values in remnant grasslands, provided it is managed to maintain palatable native perennial grasses and legumes, as well as to prevent erosion. Grazing can also be managed to foster the survival of some grazing sensitive plants, for example through cell grazing and proper timing to avoid growing or breeding seasons (Fensham *et al.* 2002).

Maintaining a good component of perennial grasses is the most reliable method of managing the risk of Parthenium invasion and should also maximise resistance to other weed species. Strategic resting (spelling) of grassland from grazing is an essential part of best practice management of Parthenium infested pastures (Chamberlain and Gittens 2004). Spelling pastures for at least six to eight weeks early in the growing season, following rain or fire, is strongly recommended to allow grassland plants to set seed, establish seedlings and replenish plant reserves. Allowing grassland species to regularly set seed is essential to the maintenance of a healthy soil seed bank and will therefore affect the long-term stability of the ecosystem.

Many plants are likely to be most palatable and grazing sensitive as seedlings, which means that spelling grassland from grazing when seedlings are prevalent, as after rain, can potentially increase recruitment. Consistent failure to spell grasslands following rain can result in deteriorating in pasture condition, including dominance by relatively unpalatable species. Once a pasture is dominated by relatively unpalatable species, or otherwise degraded, re-establishing desirable native perennial grasses can be a difficult process (Bishop *et al.* 1999). Even relatively low grazing pressure appears to significantly retard recovery and perpetuate the degradation process. Summer is the most important period for successful germination and establishment of warm season perennial grasses, including Bluegrasses (Lodge 1981), which suggests that spelling grasslands is particularly important following summer rainfall.

Grazing management should focus on maintaining the most palatable species (such as King Bluegrass) and carrying vegetation cover through the driest years. This generally means reducing cattle stocking rates from a typical year-round average of about 1 cattle equivalent to 4.5 ha (Barrett and Bishop 2000) to about 8 ha per head, on top of spelling grasslands during the summer growing season. Stock route management should also follow the practice of minimising grazing pressure on Bluegrass grasslands during the summer growing season. It is essential that the grazing of endangered Bluegrass grasslands in stockroutes be well managed and closely monitored.

Degraded paddocks appear to be particularly sensitive to grazing pressure, and even very low grazing pressure is sufficient to perpetuate degradation in grassland. Complete de-stocking is recommended in degraded areas, especially following summer rain, at least until key palatable perennial grasses are re-established. Marsupial grazing pressure, and its appropriate management, can be a serious issue for some landholders attempting to spell paddocks (Chamberlain and Gittens 2004).

When Bluegrass grasslands are a small part of a paddock containing a mixture of land types, fencing according to land type is strongly recommended to improve the management and condition of grasslands. For this reason, incentive schemes to help landholders with the cost of fencing Bluegrass grasslands out of mixed country paddocks would be useful.

Invasive species - Minimising disturbance, maintaining high grass cover, and allowing regular opportunities for native seed bank and plant reserve replenishment, offer the best chance for sites to resist weed invasion. Where weeds have established, their long-term management should follow the principles of Integrated Pest Management. Best practice management guides have been prepared for weeds of national significance that invade the grassland, such as Parkinsonia, Parthenium Weed and Prickly Acacia (refer to the Australian Government's Weeds website http://www.weeds.gov.au/publications/guidelines/index.html) It is also essential to ensure that regular monitoring and early intervention of invasive species are well established, since they are the most cost effective strategies in weed management.

Lack of knowledge - A strategic approach to the development of knowledge about the grasslands should involve detailed studies of the ecology of the relevant common and threatened species, as well as formalised and appropriately funded monitoring programs and management research to assess trends in condition and function.

The ecology of Queensland Bluegrass and King Bluegrass should certainly be more closely examined, particularly since their palatability may make them useful as indicators for sustainable grazing management. Survey and ecological work is also clearly needed on other rare and poorly known species that are not currently listed.

Although rare species deserve research attention, documented understanding of key grassland components, including common species such as *Dichanthium sericeum* and other dominant perennial grasses and key legumes, is also inadequate. Detailed work on key grassland species and community level studies will increase and test our knowledge of the ecosystem as a whole.

(Butler 2007)

29. *What portion of the current extent of the ecological community is protected in a reserve system? Which of these are actively managed? Give details including the name of the reserves, and the extent the ecological community is protected within these reserves.*

Very little of the ecological community is protected in reserves at present, see Table 8 below.

Table 8. Area of occupancy of component Queensland Regional Ecosystems in State Forests and Conservation Reserves as at 2003 (Butler 2007 and Accad *et al.* 2006[#]).

Reserve	Area (ha)
RE 11.8.11	
Albinia Downs National Park	5 277
Peak Range National Park	521
Mount Hope State Forest	124
Fairbairn State Forest	27
Blair Athol State Forest	17
Minerva Hills National Park	14
Total RE 11.8.11	5 980
% of current area of occupancy	3.2 %
RE 11.3.21	
Junee State Forest	165
% of current area of occupancy	0.5 %
REs 11.3.31, 11.4.4, 11.4.11 & 11.11.17	
N/A	0
Total for all REs	**6 145**
% of total current area of occupancy	**2.1 %**

Note [#] Figures for current extent (area of occupancy in ha) are reproduced in Table 5 at Question 14

Section 2 - Justification for this nomination

30. *Provide data that demonstrates why the ecological community meets at least one of the following criteria for the nominated category of threat.*
This data may already have been provided in previous sections. Please refer to the data again and demonstrate how it specifically meets at least one of the following criteria.

Criterion 1: Decline in geographic distribution.

Using Accad *et al.* (2006) (Table 5; at Question 14) the estimate for pre-clearing area of occupancy of the 6 Queensland REs, that are closest in definition to the nominated ecological community, is about 800 000 hectares. Their current area of occupancy is estimated to be about 290 000 ha. This represents a 64% decline in area of occupancy.

If the condition of sites is taken into account, based on an estimate that at least 50% of the remaining sites (36%) are degraded (Environment Australia 2001a), a further 18% decline overall, should be factored in (i.e. half of 36%).

These two estimates together indicate a decline in area of occupancy of the nominated ecological community that exceeds 70% , and is likely to be in the order of 80% of the pre-European extent (i.e. 64% + 18% = 82%). This substantial decline indicates that the nominated ecological community is eligible for listing as **Vulnerable**.

Criterion 2: Small geographic distribution coupled with demonstrable threat.

Figure 1 (at Question 16) indicates that only about 30% of patches of the Bluegrass ecological community listed in 2001, in the Brigalow Belt North bioregion, were 50 ha or more in size in 2001. This reduction of patch sizes, to generally less than 100 ha in size, indicates a restricted geographic distribution (in terms of the guidelines for this criterion). Since this portion of the listed ecological community has a large degree of overlap with the nominated ecological community it is reasonable to infer a restricted geographic distribution for the nominated ecological community.

Six major, demonstrable threats to the ecological community are described at Question 23. They are: cultivation for cropping; pasture development; unsustainable grazing; pest invasion; construction of roads and other infrastructure; and, mine expansion. Unless threat abatement actions are implemented across the ecological community, the decline in its extent will continue ([redacted] pers. comm. 2007).

The restricted geographic distribution, coupled with demonstrable threat, indicates that the nominated ecological community is eligible for listing as **Endangered**.

Criterion 3: Loss or decline of functionally important species.

There has been a documented decline in some perennial grasses, which is likely to have impacted upon ecosystem function. This decline is associated with persistent heavy grazing and has been most apparent for palatable perennial grasses such as King Bluegrass and Queensland Bluegrass. The result can be a shift to dominance by less palatable perennial grass species such as White Spear-grass. This loss of palatable perennial species is well documented because it affects domestic herbivores but native herbivores are also likely to be affected. In more extreme cases all perennial grasses decline to such an extent that annual grasses and forbs become dominant species. Such loss of perennial tussock-grass cover is likely to substantially alter grassland suitability as habitat for cover dependent fauna such as quail and reptiles. Although functionally important, the decline of perennial grasses is probably reversible over the medium term (possibly within a decade) but is likely to require a substantial management commitment ([redacted] pers. comm. 2007).

The loss of perennial grass cover may be approximated by estimates of the loss of extant patches of the 6 Queensland regional ecosystems. The decline in area of occupancy may thus be estimated to be about 4% over six years (from 300 000 ha in 1997 to 288 000 ha in 2003) (Accad *et al*. 2006). As this is below the minimum threshold of at least a 20% decline in functionally important species, the ecological community is not eligible for listing under this criterion.

Criterion 4: Reduction in community integrity.

There are insufficient data to demonstrate eligibility under this criterion.

Criterion 5: Rate of continuing detrimental change.

The recent decline in area of occupancy (of the 6 Queensland regional ecosystems) is estimated to be about 4% over six years (from 300 000 ha in 1997 to 288 000 ha in 2003) (Accad *et al*. 2006). As this is below the minimum threshold of at least a 30% decline over the immediate past, the ecological community is not eligible for listing under this criterion.

Criterion 6: Quantitative analysis showing probability of extinction.

It has not been possible to demonstrate eligibility under this criterion.

Section 3 – Recovery, Conservation, Protection

Additional information on legal status

31. *Does the ecological community have legal protection under other legislation or political agreements, i.e. State or Territory legislation?*

The nominated ecological community includes components that are recognised as threatened under the Queensland *Vegetation Management Act 1999* (VMA)*:* RE 11.3.21 is designated as Endangered; and RE 11.8.11 and 11.11.17 are designated as Of concern. REs 11.3.31, 11.4.4 and 11.4.11 are designated as Not of concern (Qld EPA 2005a).

However, the VMA focuses on woody plants, and "vegetation" under the VMA excludes grass. As a result the VMA does not protect most remnant Bluegrass grasslands in Queensland, other than natural woody components that occur in some grassland Regional Ecosystems (including 11.9.12 and 11.8.11). Two of the regional ecosystems are exempt from requirements to apply for a permit to clear native vegetation under the VMA (11.3.21 and 11.4.4). Cultivation is not controlled under the VMA unless it involves clearing woody plants (Butler 2007).

Additional information on distribution

32. *Give locations of sites for proposed management, preferably that have been identified in recovery plans. Are the sites considered to demonstrate those remnants of highest quality/most needing management/most under threat?*

Action 2.2, in the draft Bluegrass Recovery Plan (Butler 2007), identifies particular priority stock route grassland sites for proposed management. The sites, relevant to this nomination, are set out in Table 9 below.

The overall action, relating to the nominated ecological community, is for:

"Officers to monitor and improve the condition of priority grasslands in stock routes in the Central Highlands.… Grasslands in stock routes and travelling stock reserves are important parts of the Bluegrass grassland endangered ecological community because of their association with infrequent grazing, but they are linear strips with large edge to interior ratios and may be particularly prone to weed invasion and disturbance."

For the Central Highlands, Keith's (2002) survey of stock route grasslands provided a basis for ongoing monitoring and targeted management. It is recommended that at least the priority grassland areas identified in Table 9 (below) are revisited regularly and permanent monitoring plots installed. In the process, weed issues in each area should be identified and then systematically addressed. Where signage has not been installed to identify these areas this should be addressed with signs installed at each end of the grassland area. Neighbouring landholders, stock route supervisors and fire wardens should be consulted regarding land management history and constraints, and where appropriate fire should be applied to portions of the areas and the results monitored. Where low quality areas occur within high quality sections of grassland in a stock route, for instance localised infestations of Columbus grass or Johnson's grass, they should be targeted for restoration.

Table 9. Priority stock route grassland sites in the Central Highlands (from Keith 2002).

Shire	Road
Belyando Shire	1. Peak Downs highway from the Charters Towers Road turn-off to Wolfang Peak
	2. Kilcummin-Diamond Downs Road
	3. Clermont-Dysart Road
Peak Downs Shire	1. Gregory Highway at Lilyvale between Freshfields and Lucknow
	2. Gregory Highway at Retro Creek
Emerald Shire	1. Gregory Highway at Fernlees
	2. Cullin-La-Ringo Road
Bauhinia Shire	1. Gregory Highway between the Emerald shire boundary and Minerva Creek
	2. Dawson Highway between Staircase Range and Orion 10 Chain Road
	3. Orion 10 Chain Road between Dawson Highway and Orion State School
	4. Dawson Highway between Bottle Tree Downs Road and Rolleston
	5. Wealwandangie Road

Conservation Advice

33. *Give details of recovery actions that are or could be carried out at the local and regional level. e.g. develop and implement management plan for the control of specific weed species (regional), undertake weeding of known sites (local).*

In terms of recovery actions, the draft recovery plan for the Bluegrass ecological community listed in 2001 is equally applicable to the nominated northern native grassland ecological community ([redacted] pers. comm. 2007).

Action 1.1 Promote landholder awareness of sustainable management practices.

Field days aimed at people with an interest in native grasslands, including landholders and government officers, should be conducted to demonstrate well managed grasslands in good condition and provide a forum for extension of best practice grassland management. Some landcare groups are already conducting such field days.

Field days would ideally include the experience of extension and research officers of the Queensland Department of Primary Industries and Fisheries (DPI&F). Field days will also progress some of the other proposed actions including encouragement toward nature refuge agreements and discussion of sustainable grazing management. The DPI&F's "Stocktake Grazing Land Management" package (Aisthorpe and Paton 2004, Open Downs land type) provides a useful framework within which to promote best practice grazing management of Bluegrass grasslands.

Action 1.2. Encourage landholders to enter into conservation agreements.

Negotiation of voluntary conservation agreements, such as Nature Refuges, which attach to the title and cover all or part of a parcel of land, can be mutually beneficial for landholders and biodiversity. Landholders with Nature Refuges are eligible for the Queensland Environmental Protection Agencies' NatureAssist program. NatureAssist provides a number of incentives, including funding for management assistance, such as fencing and eradication of weeds and pests. In addition, landholders may be entitled to benefits such as reimbursement of Stamp Duty and Land Tax, and may be advantaged in seeking grants for conservation works (e.g. fencing, watering points) through Natural Resource Management (NRM) Regional Bodies.

Action 2.1.1 Assist graziers to fence Bluegrass grasslands out from other land types and to subdivide Bluegrass grasslands to facilitate sound grazing management, including spelling from grazing during critical periods in the summer growing season.

Sustainable grazing management of Bluegrass grasslands has mainly been developed and communicated by pasture scientists and extension officers from the DPI&F. Extension officers possess knowledge relevant to a very wide range of problems landholders face, including weed management, pasture decline and soil loss. Additional support for these officers in the form of assistance to run field days, production of extension material and information sheets, and most importantly, extra staff to increase the availability of their services, would all benefit grazing management of the Bluegrass grasslands. Field days should be organised to discuss and demonstrate sustainable grazing management of Bluegrass grassland, involving graziers, mining environmental officers and other managers of Bluegrass grasslands, as well as representatives of regional NRM bodies and government.

Bluegrass grasslands in paddocks mainly of other land-types can be preferentially grazed. The threat of overgrazing can be managed by fencing so that grasslands are major components of the paddocks within which they occur. This will not always be practical but should be encouraged.

Persistent heavy grazing is well understood as a major cause of pasture decline and dominance by unpalatable perennial grasses or weeds. Grassland managers should be encouraged and assisted to strategically spell paddocks during phases of very active growth during and following wet warm weather. This might require additional watering points, fences or other infrastructure.

Financial support for this action may already be available under initiatives such as the Biodiversity Incentives Tender (administered by Queensland Environmental Protection Agency), or the Australian Government Envirofund (Natural Heritage Trust). NRM Regional Bodies may also have opportunities to help landholders better manage grasslands by these means. Fencing by land type and summer spelling should also be common components of Nature Refuge Agreements or other conservation agreements.

Action 2.1.2 Research and develop the use of Bluegrass grassland species for pasture renovation and land rehabilitation, and encourage mines, main roads and others to use native species in plantings, by establishing a seed bank from which seed may be purchased at competitive prices.

Though desirable, the uses to which native pasture species are currently put are limited by the availability and cost of seed and technological know-how regarding its use. Significant progress has been made toward establishing native grass industries in southern Australia but relatively little progress has been made in Queensland.

NRM Regional Bodies could help this industry to develop by seeking and funding appropriate proposals. For example, a first step might trial the use of material from healthy Bluegrass grasslands to renovate or recover degraded pastures, perhaps by cutting and bailing hay from a healthy Bluegrass grassland late in summer (when the grasses are carrying seed) and then spreading the hay over a degraded pasture. Similar trials may be appropriate to restore grasslands subject to physical disturbance such as road works. Other techniques such as seed harvesting and sowing perennial grasses such as Queensland Bluegrass also need trialling. The use of native species should be encouraged. The ecology of Queensland Bluegrass and other grassland plants certainly suggests they have potential as utility species.

Techniques using native grassland species for restoration or reclamation will develop faster if their use is required by policy and government action. At present exotic grasses such as buffel grass and Rhodes grass tend to be species of choice for reclamation of disturbed areas. This is primarily because the seed of such species is readily available whereas native species are not. Investment is required to address this discrepancy. Establishing a seed bank of key species such as Queensland Bluegrass would enable parties with an interest in using natives to purchase seed. Whether potential users will buy seed will often depend upon a reasonably competitive price. Mining companies and other potentially large-scale users of seed may find it in their interest to establish seed reserves themselves and should be encouraged to do so.

Action 2.2 Officers to monitor and improve the condition of priority grasslands in stock routes.

More details on this action are given in answer to Question 32 on sites for proposed management.

Action 3.1 Monitor selected populations of Belyando Cobblers-peg (*Trioncinia retroflexa*), Finger Panic Grass (*Digitaria porrecta*) and King Bluegrass (*Dichanthium queenslandicum)* across the ecological community and continue efforts to locate the Retro Slider (*Lerista allanae*).

Sites containing threatened flora and fauna should be identified and subject to ongoing monitoring. Monitoring should be attentive to recovery from fire, grazing or other management interventions and should be set up in collaboration with local stock route supervisors, extension officers and landholders. Specific monitoring for selected threatened species may be necessary, for instance, the Retro Slider.

(Butler 2007)

Community Networks

34. *Is there an existing support network for the ecological community that facilitates recovery? e.g. an active landcare group, Conservation Management Network or funding.*

All levels of government, along with regional NRMs, are working to facilitate the recovery of the "Bluegrass (*Dichanthium* spp.) dominant grasslands of the Brigalow Belt Bioregions (North and South)".

Survey Methods

35. *Describe methods for identifying the ecological community including when to conduct surveys (e.g. season, time of day, weather conditions); length, intensity and pattern of search effort; and limitations and expert acceptance; recommended methods; survey-effort guide.*

Appropriate survey methods are detailed in: Neldner V.J., Wilson B.A., Thompson E.J. and Dillewaard H.A. (2005). *Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland*. Version 3.0. Queensland Herbarium, Queensland Environmental Protection Agency, Brisbane.

The ecological community is dominated by summer growing species and so is best surveyed following a good growth period. The highest quality patches of the nominated ecological community may only be identifiable in a 'good season' (DEH 2006a).

The quadrat size for presence/absence of indicator species is 0.1 ha (e.g. 50 m by 20 m).

36. *Give details of the distinctiveness and detectability of the ecological community.*

No further details at this time.

Other

37. *Are there other aspects relating to the survival of this ecological community that you would like to address?*

Not at this time

Section 4 – References

Notes:

- The opinion of appropriate scientific experts may be cited (with their approval) in support of a nomination. If this is done the names of the experts, their qualifications and full contact details must also be provided in the reference list below.
- Please provide copies of key documentation/references used in the nomination

38. *Reference list*

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DEH (2005). Bluegrass (*Dichanthium* spp.) dominant grasslands of the Brigalow Belt Bioregions (North and South). Species Profile and Threats Database. Unpublished Draft Information on Intranet. Australian Government Department of the Environment and Heritage, Canberra.

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DEH (2006b). Workshop to review the Bluegrass (*Dichanthium* spp) dominant grasslands of the Brigalow Belt Bioregions (North and South). Unpublished proceedings. Held by the Australian Government Department of the Environment and Heritage, Canberra.

DEW (2007). (Species of National Environmental Significance Database &) the Species Profile and Threats Database. Australian Government Department of the Environment and Water Resources, Canberra. At: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl [Accessed 3 October 2007]

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Appendix 1. Glossary of Plant Scientific Names and Common Names

Scientific Name (* Denotes Introduced Species)	Common Name
*Abelmoschus ficulneus**	Native Rosella
Acacia farnesiana	Prickly Mimosa, Prickly Moses, Scented Wattle, Sweet Wattle, Mimosa Bush
Acacia salicina	Cooba, Coobar, Willow Wattle, Doolan, Broughton Willow, Native Wattle, Sally Wattle
Acacia harpophylla	Brigalow, Brigalow Spearwood, Orkor
*Acacia nilotica**	Prickly Acacia
Acacia nilotica subsp. *indica**	Prickly Acacia, Babul
*Argemone ochroleuca**	Mexican Poppy
Aristida latifolia	Feather-top Wire-grass
Aristida lazaridis	
Aristida leptopoda	White Spear-grass
Aristida ramosa	Purple Wire-grass
Astrebla elymoides	Hoop Mitchell-grass
Astrebla lappacea	Curly Mitchell-grass
Astrebla pectinata	Barley Mitchell-grass
Astrebla squarrosa	Bull Mitchell-grass
Austrodanthonia bipartita	Bandicoot Grass, Wallaby Grass
Austrostipa aristiglumis	Plains Grass
Boerhavia dominii	Tar-vine
Bothriochloa biloba	Lobed Blue-grass
B*othriochloa bladhii* var. *bladhii*	Forest Blue-grass
Bothriochloa erianthoides	Satin-top Grass
Bothriochloa ewartiana	Desert Blue-grass
*Bothriochloa insculpta**	Creeping Blue-grass, Blue-grass
*Bothriochloa pertusa**	Indian Blue-grass
Brachyachne convergens	Spider-grass, Common Native-couch
Brachyachne tenella	Slender Native-couch
Brunoniella australis	Blue Trumpet
*Cenchrus ciliaris**	Buffel-grass, Black Buffel-grass (Slender Buffel-grass)
*Chloris gayana**	Rhodes Grass
Chrysopogon fallax	Golden Beard-grass

Scientific Name (* Denotes Introduced Species)	Common Name
*Clitoria ternatea**	Butterfly Pea
Commelina ensifolia	Scurvy Grass
Corchorus trilocularis	Native Jute
Corymbia dallachiana	Ghost Gum
Corymbia erythrophloia	Gum-topped Bloodwood, Variable-barked Bloodwood, Red-barked Bloodwood
Cyperus bifax	
Cyperus clarus	Grassland sedge
Dichanthium queenslandicum	King Blue-grass
Dichanthium sericeum	Queensland Blue-grass
Digitaria brownii	Cotton Panic-grass
Digitaria divaricatissima	Umbrella Grass
Digitaria porrecta	Finger Panic-grass
Enneapogon gracilis	Slender Nine-awn
*Eragrostis curvula**	African Love-grass
Eriochloa crebra	Cup Grass
Eriochloa pseudoacrotricha	Perennial Cup-grass, Early Spring-grass
Eucalyptus coolabah	Coolibah, Coolabah
Eucalyptus melanophloia	Silver-leaved Ironbark, Silver Ironbark
Eucalyptus orgadophila	Mountain Coolabah, Gum-topped Box
Eucalyptus platyphylla	Poplar Gum
Eucalyptus populnea	Bimble Box, Poplar Box
Eucalyptus tereticornis	Forest Red Gum, Blue Gum, Red Iron Gum
Eulalia aurea	Silky Browntop
Euphorbia coghlanii	
Evolvulus alsinoides	Baby Blue-eyes, Tropical Speedwell
Galactia tenuiflora	Snail Flower
Glycine latifolia	
Grevillea striata	Beefwood, Silver Honeysuckle
Heteropogon contortus	Bunch Spear-grass, Black Spear-grass
Hibiscus trionum	Bladder Ketmia
Imperata cylindrica	Blady Grass
Indigofera linnaei	Nine-leaved Indigo, Birdsville Indigo
Ipomoea lonchophylla	Cow Vine

Scientific Name (* Denotes Introduced Species)	Common Name
Iseilema australe	Flinders Grass
Iseilema membranaceum	Small Flinders Grass
*Leucaena leucocephala**	Leucaena
Lysiphyllum carronii	Ebony Tree, Bauhinia, Red Bauhinia, Northern Beantree, Bean Tree, Carrons Bauhinia, Pergunny, Queensland Ebony, Thalmera
Lysiphyllum hookeri	Queensland Ebony, Hooker's Bauhinia, Pegunny
Malvastrum americanum	Spiked Malvastrum, Prickly Malvastrum
*Megathyrsus maximus**	Green Panic
Neptunia gracilis	Native Sensitive Plant
Ophiuros exaltatus	Cane Grass
*Panicum coloratum**	Bambatsi Panic
Panicum decompositum	Native Millet
Panicum queenslandicum	Yabilla Grass
*Parkinsonia aculeata**	Parkinsonia
*Parthenium hysterophorus**	Parthenium
Paspalidium globoideum	Shot Grass
*Paspalum dilatatum**	Paspalum
Phyllanthus maderaspatensis	
Picris evae	Hawkweed
Rhynchosia minima	Rhyncho, Rhynchosia
*Setaria incrassata**	Purple Pigeon Grass
Sida spinosa	Spiny Sida
Sida Trichopoda	High Sida
*Sorghum halepense**	Johnson’s Grass
*Sorghum x almum**	Columbus Grass
Sporobolus mitchellii	Rat's-tail Couch, Swamp Rat's-tail Grass
*Sporobolus natalensis** and *Sporobolus pyramidalis**	Giant Rat’s-tail Grass
Stemmacantha australis	Austral Cornflower
Thellungia advena	Coolibah Grass
Themeda avenacea	Native Oat-grass
Themeda triandra	Kangaroo Grass
Thesium australe	Austral Toadflax

Scientific Name (* Denotes Introduced Species)	Common Name
Tragus australianus	Small Burr-grass
Tribulus micrococcus	Yellow Vine, Spineless Caltrop
Trichodesma zeylanicum var. *latisepalum*	Cattlebush
Trioncinia retroflexa	Belyando Cobblers-peg

Appendix 2. Glossary of Animal Scientific Names and Common Names

Scientific Name (*Denotes Introduced Species)	Common Name
Mirafra javanica	Singing Bushlark
*Acridotheres tristis**	Indian Myna
*Canis familiaris**	Dog
Cincloramphus cruralis	Brown Songlark
Cincloramphus mathewsi	Rufous Songlark
Circus assimilis	Spotted Harrier
Cisticola exilis	Golden-headed Cisticola
Coturnix pectoralis	Stubble Quail
Coturnix ypsilophora	Brown Quail
Elanus axillaris	Black-shouldered Kite
Geophaps scripta scripta	Squatter Pigeon (southern)
Falco berigora	Brown Falcon
Falco cenchroides	Australian kestrel
*Felis catus**	Cat
Lasiorhinus krefftii	Northern Hairy-nosed Wombat
Lerista allanae	Retro Slider
*Mus musculus**	House Mouse
Neochmia ruficauda ruficauda	Star Finch (eastern)
Onychogalea fraenata	Bridled Nail-tail Wallaby
*Oryctolagus cuniculus**	Rabbit
Planigale ingrami	Long-tailed Planigale
Planigale maculata	Common Planigale
Planigale tenuirostris	Narrow-nosed Planigale
Pseudechis guttatus	Spotted Black-snake
Pseudonaja textiles	Eastern Brown Snake
Rattus tunneyi	Pale Field-rat
*Sturnus vulgaris**	Common Starling
*Sus scrofa**	Pig
Turnix pyrrhothorax	Red-chested Button-quail
Turnix velox	Little Button-quail
Tyto alba	Barn Owl
*Vulpes vulpes**	Fox