

4.2.3 POTENTIAL IMPACTS TO CUMBERLAND PLAIN SHALE WOODLANDS AND SHALE GRAVEL TRANSITION FOREST AS A RESULT OF DEVELOPMENT WITHIN THE GROWTH CENTRES

For the purposes of this assessment, all areas within the Growth Centres that fall within the lands certified under the Growth Centres Biodiversity Certification are being assessed as though they will be entirely cleared as a result of development. This is a conservative assumption that is being applied, as additional retention of vegetation is likely to be achieved through the detailed precinct planning process and the assessment of individual development applications.

Development within the certified lands of the Growth Centres will lead to the loss of approximately 1,187 ha of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest. This loss comprises approximately 478 ha of EPBC condition A, 580 ha of EPBC condition B and 129 ha of EPBC condition C and represents approximately 11% of the total distribution of the community.

All together, 614 ha of the listed community will be lost within the North West Growth Centre and 574 ha will be lost within the South West Growth Centre (see Table 9: Amount (ha) of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest to be lost within the certified lands of the Growth Centres).

Table 9: Amount (ha) of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest to be lost within the certified lands of the Growth Centres

Area	EPBC Condition Threshold			Total
	A (ha)	B (ha)	C (ha)	
NW Growth Centre	350	210	55	614
SW Growth Centre	129	371	74	574
	478	580	129	1,187

Impacts to Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest with HMV have been avoided wherever possible. Of the 390 ha of HMV within the Growth Centres, only 27 ha or 7% will be lost as a result of development within the certified lands. This component of the impact to the listed community comprises just 2% of the total impact. The majority of the area to be lost (710 ha or 60%) is comprised of the smallest, most isolated and disconnected patches across the Growth Centres; that is, the areas that were determined to be of LMV.

Within the North West Growth Centre adjoining the Air Services Australia site at Shanes Park, there is an additional area of 14 ha of HMV Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest. This area of the community occurs within non-certified land shown as hatching on Figure 33. The hatched areas are subject to Relevant Biodiversity Measures 14, 15 and 16. These measures require detailed further assessment at the precinct planning stage to determine whether the community within these areas meets the criteria of HMV as detailed in Schedule 3 of the Biodiversity Certification Order. Based on the outcomes of this on-ground assessment, DECCW will provide advice to the NSW Minister for the Environment and Climate Change as to whether or not the areas should be included within the certified

areas or the non-certified areas. It is considered that potential impacts to these areas of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest will be avoided based on the implementation of these Relevant Biodiversity Measures.

Table 10: Amount (ha) HMV, MMV and LMV of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest to be lost within the certified lands of the Growth Centres

Area	Biodiversity Value and Ecological Viability			Total
	HMV	MMV	LMV	
NW Growth Centre	4	278	332	614
SW Growth Centre	24	172	378	574
	27	450	710	1,187

Potential impacts to Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest also need to be considered for areas that fall outside of the certified lands within the Growth Centres. These areas include:

- the lands identified as flood prone and major creeks land and transitional land;
- the conservation zones defined in the Growth Centres SEPP, including the Environment Conservation zone, the Public Recreation – Regional zone, the Public Recreation – Local zone, as well as the additional conservation zones determined through detailed precinct planning.

FLOOD PRONE AND MAJOR CREEKS LAND AND TRANSITIONAL LAND

Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest is afforded some protection within the areas identified as flood prone and major creeks land and transitional land through the vegetation controls in the Growth Centres SEPP. These controls ensure that direct impacts to the listed community will be minimised. However, there are a number of potential indirect impacts to the community which need to be considered.

In general, urban development has the potential to impact adjoining areas of bushland through various edge effects such as:

- the introduction of weeds and exotic species;
- the spread of rubbish;
- introduction of domestic animals (cats and dogs);
- increased disturbance from pedestrian access;
- runoff from construction containing nutrients, sediments and other pollutants; and
- inappropriate water, sewer and stormwater management leading to erosion.

CONSERVATION ZONES

The areas of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest that occur within the conservation zones defined through the Growth Centres SEPP and through the detailed precinct

planning will be managed for conservation. Areas that are zoned through the detailed precinct planning are likely to generally remain in private ownership. Development controls relating to the removal of native vegetation and a limited range of permissible land uses in these areas will protect the conservation values. Direct impacts to the listed community will therefore be avoided within these areas. However, the same potential indirect impacts to the community as those outlined for the flood prone and major creeks land and the transitional land need to be considered.

The Program has incorporated a range of mitigation and management measures to ensure that these potential indirect impacts are adequately addressed. These measures are detailed in Section 4.2.4.

4.2.4 PROPOSED MEASURES TO PREVENT, MITIGATE AND MANAGE POTENTIAL IMPACTS TO CUMBERLAND PLAIN SHALE WOODLANDS AND SHALE GRAVEL TRANSITION FOREST

The key measure used to prevent, mitigate and manage potential impacts to Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest involves the retention and protection of substantial areas of the community, and particularly those areas with the greatest biodiversity value and ecological viability.

Up to 998 ha of the listed community will be retained within the Growth Centres (see Table 11).

Table 11: Amount (ha) of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest to be retained within the Growth Centres

Area	EPBC Condition Category			Total
	A	B	C	
NW Growth Centre	461	35	27	523
SW Growth Centre	127	297	50	475
North West Precincts				
Flood prone and major creeks land	41	26	19	86
Environment Conservation zone:				
Marsden Park Precinct	248	5	4	256
Marsden Park North Precinct	27	1	0	28
Riverstone Precinct	30	1	0	31
Public Recreation – Local zone:				
Riverstone Precinct	18	0	0	18
Public Recreation – Regional zone:				
Marsden Park Precinct	42	0	0	42
Riverstone East Precinct	0	3	4	7
Existing retention:				
M7 offset adjacent to Colebee Precinct	41	0	0	41
M7 offset in Area 20 Precinct	0	0	1	1
Non-certified land **: <ul style="list-style-type: none"> Marsden Park Precinct 	8	0	0	8

Marsden Park Industrial Precinct	6	0	0	6
South West Precincts				
Flood prone and major creeks land	18	16	18	52
Public Recreation – Regional zone:				
Catherine Fields North Precinct	0	40	0	40
Kemps Creek Precinct	1	0	1	2
Transitional lands**	5	58	0	63
Edmondson Park zones:				
6(a)	0	2	2	4
6(b)	1	0	1	2
8(b) Regional Park	8	60	5	73
Existing retention:				
Kemps Creek Nature Reserve	84	1	0	85
SEPP (Western Sydney Parklands)	12	103	21	136
M7 offset adjoining the Western Sydney Parklands	0	16	1	17

** These areas will be retained subject to confirmation of the presence of the community through survey at the precinct planning stage.

Table 12: Amount (ha) of HMV, MMV and LMV of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest to be retained within the Growth Centres

Area	Biodiversity Value and Ecological Viability			Total
	HMV	MMV	LMV	
NW Growth Centre	272	158	93	523
SW Growth Centre	91	189	195	475
North West Precincts				
Flood prone and major creeks land	0	33	53	86
Environment Conservation zone:				
Marsden Park Precinct	218	9	30	256
Marsden Park North Precinct	0	28	0	28
Riverstone Precinct	0	27	4	31
Public Recreation – Local zone:				
Riverstone Precinct	0	18	0	18
Public Recreation – Regional zone:				
Marsden Park Precinct	40	0	2	42
Riverstone East Precinct	0	3	4	7
Existing retention:				
M7 offset adjacent to Colebee Precinct	0	41	0	41
M7 offset in Area 20 Precinct	0	0	1	1

Non-certified land **:				
Marsden Park Precinct	8	0	0	8
Marsden Park Industrial Precinct	6	0	0	6
South West Precincts				
Flood prone and major creeks land	6	8	38	52
Public Recreation – Regional zone:				
Catherine Fields North Precinct	0	40	0	40
Kemps Creek Precinct	1	0	1	2
Transitional lands **	0	59	4	63
Edmondson Park zones:				
6(a)	0	1	3	4
6(b)	0	0	2	2
8(b) Regional Park	0	49	24	73
Existing retention:				
Kemps Creek Nature Reserve	84	0	1	85
SEPP (Western Sydney Parklands)	0	16	119	136
M7 offset adjoining the Western Sydney Parklands	0	16	1	17

** These areas will be retained subject to confirmation of the presence of the community through survey at the precinct planning stage.

As shown in Table 12, the area of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest that is being retained and protected represents the vast majority (93% or 363 ha) of the community assessed as having the highest biodiversity value and ecological viability. The Growth Centres development and protected areas have purposefully focused on the conservation of the high and moderate management viability vegetation that have the best prospects of long term survival. The key figures relating to this outcome are:

- A total of up to 998 ha of the listed community will be protected and retained within the Growth Centres through zoning, development controls and acquisition for conservation purposes.
- All together up to 710 ha of HVM and MMV will be retained.
- Up to 288 ha of LMV will be retained.

A suite of measures have been incorporated into the Program to ensure adequate conservation of these areas of retained Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest, particularly those areas of HVM.

Retention of up to 998 ha of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest is provided for through the zoning and development controls outlined in the Growth Centres SEPP and the Relevant Biodiversity Measures associated with the Growth Centres Biodiversity Certification Order. The retained Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest is located within the following areas defined by Program:

- 138 ha retained within flood prone and major creeks land;
- 315 ha retained within the areas zoned for Environment Conservation;
- 90 ha retained within the areas zoned for Public Recreation – Regional;
- 18 ha retained within the areas zoned for Public Recreation – Local;
- 73 ha retained within the areas zoned as a Regional Park;
- 6 ha retained within the additional areas zoned through detailed precinct planning;
- 280 ha retained within existing conservation areas;
- 14 ha expected to be retained within non-certified land if confirmed present; and
- 63 ha expected to be retained within transitional land if confirmed present.

The 6 ha retained within the additional areas zoned through detailed precinct planning is within the precincts completed at the time of publication. As new precincts are released and precinct planning is completed additional areas are likely to also be identified.

Whilst the key measure to prevent impacts to the listed community is the avoidance of important areas of vegetation, it is also necessary to recognise the improved outcome for much of these areas of the community. The majority (around 70%) of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest that is being retained through the Program is contained within areas that are zoned through the Growth Centres SEPP and will be acquired by the NSW Government or relevant local council for conservation. The vast majority of the listed community with HMV that is protected through the Program is contained within these areas.

The management, restoration and protection of these remnants of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest in perpetuity represent an important conservation gain for the community. In the absence of the Growth Centres Program, constraints to the protection and management of these areas, such as high land values and limited funding and resources, place them under considerable threat from weed invasion, inappropriate use and other “edge effects”.

GROWTH CENTRES SEPP ZONING

In accordance with the relevant objectives of the zones, there will be no direct impacts to Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest within the areas zoned for Environment Conservation, Public Recreation – Regional, Public Recreation – Local, the Regional Park as well as the additional zones 6(a) and 6(b) within Edmondson Park. There is a total of 502 ha of the listed community within these zones. These areas will be protected and managed in perpetuity.

The protection and on-going security for these areas is enabled through the respective zoning objectives and proposed public ownership.

Indirect impacts to these areas will be actively managed to minimise and avoid degradation which can result when there are environmentally sensitive lands adjoining urban areas.

FLOOD PRONE AND MAJOR CREEKS LAND AND TRANSITIONAL LAND

The vegetation clearing controls outlined in the Growth Centres SEPP provide for the retention and protection of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest within the areas

identified as flood prone and major creeks land and transitional land. There is a total of 201 ha of the listed community within these lands.

4.2.5 PROPOSAL TO OFFSET POTENTIAL IMPACTS TO CUMBERLAND PLAIN SHALE WOODLANDS AND SHALE GRAVEL TRANSITION FOREST

There will be an impact to Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest as a result of development within the Growth Centres. This relates to the potential loss of approximately 1,187 ha of the listed community within the certified lands, of which 27 ha is of HMV and 450 is of MMV.

The Program provides for a \$530 million (in 2005/06 dollars) biodiversity offsets package to protect high conservation value areas both within and outside the Growth Centres. 75% of this amount (\$397.5 million in 2005/06 dollars) will be spent protecting high quality vegetation remnants with similar ecological values outside the Growth Centres. 70% of the \$397.5 million (in 2005/06 dollars) for offsets outside the Growth Centres will be prioritised to secure the conservation of matters listed under the EPBC Act. As a first preference, these funds will be directed towards identified priority lands across the Cumberland Plain (shown in Figure 29 and Figure 30).

These priority lands contain 3,210 ha of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest that are currently not in DECCW reserves. However, there are a number of issues constraining the potential investment in these areas for the purpose of biodiversity offsets.

Firstly, approximately 925 ha of the listed community are a low priority for investment as an offset on the grounds of cost-effectiveness. These occur on properties which contain:

- Less than 4 ha of the listed community.
- More than 4 ha of the listed community, but are located in areas of intense African Olive infestation and so are of high risk for investment.

Secondly, the Commonwealth Department of Defence owns properties containing 895 ha of the listed community. Any potential offsets on these lands will depend on discussions between the NSW and Commonwealth Governments.

Thirdly, 690 ha of the listed community occurs in other existing reserves or areas with pre-existing commitments to conservation, such as the ADI site at St Marys and the conservation area at Harrington Grove.

A conservation outcome has already been secured over 34 ha of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest through the Growth Centres Offset Program. This has been secured through a biobanking agreement over the St Marys Towers site (refer to the case study in section 4.3 of the draft Program Report).

This leaves approximately 700 ha of the listed community which is potentially available for protection through funding from the Offset Program funding. The ability to protect these areas will depend on the level of interest from landowners. From past experience, only a proportion of landowners are expected to be interested in a conservation investment on their land. Recognising these constraints, DECCW will

make every effort to secure suitable land containing Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest as a first preference for the Offset Program.

While there are numerous constraints to securing offset areas within the Cumberland Plain, opportunities exist for substantial offset areas in the broader Sydney Basin. As discussed briefly in section 4.2.1, Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest is floristically similar to a number of other Grassy Woodland communities within the Sydney region. Many areas supporting these other Grassy Woodland communities are significantly less degraded compared with the vegetation on the Cumberland Plain. As a result, they tend to be more diverse in numbers of species, providing important habitat areas for a variety of animals and plants. The opportunity to retain these areas for conservation is therefore highly attractive.

In order to determine the potential relevance of offsetting impacts to Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest with other Grassy Woodlands, an assessment was undertaken to determine the level of similarity between the listed community and other communities in the region. This assessment is presented in Text Box 1 on the following page.

A component of the Growth Centres Offset Program funding that is not directed towards protecting areas of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest is proposed to be spent on conserving areas supporting Grassy Woodland communities of similar floristic composition. There are considered to be good prospects for fully offsetting the loss of 1,187 ha of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest at a ratio of 2:1 (refer to Text Box 1).

This commitment of a component of the Growth Centres Offset Program funding will provide:

- the ability to protect an offset area many times the area of loss of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest within the Growth Centres due to significantly lower land prices in these regions;
- a “like for like” offset due to the similarities in floristic composition to Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest;
- the potential to protect EPBC listed threatened flora species that also occupy areas of the grassy woodland communities; and
- an offset area which is still functioning as an ecosystem in ways that much of the remaining Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest does not.

The overall offset commitment relating to Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest, the NSW Government will allocate 70% of the \$397.5 million (in 2005/06 dollars) Conservation Fund for offsets outside the Growth Centres to matters listed under the EPBC Act. The NSW Government will make every effort to ensure the protection of at least 2,400 ha of either Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest or other “grassy woodland” communities within the combined area of the Sydney Basin Bioregion (IBRA v6.1) and the Hawkesbury Nepean Catchment Management Authority Area. Preference will be given to Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest followed by White Box, Yellow Box, Blakely’s Red Gum Grassy Woodland and Derived Native Grassland.

Text Box 1: The similarity of vegetation types within the Sydney Basin to Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest*Summary*

Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest has been compared with the other vegetation types within the Sydney Basin to identify those that are most similar to the listed community. The basis for this comparative analysis is the amount of overlap in the plant species comprising the vegetation types. The principal finding is that Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest is similar to the woodlands found on moderately fertile soils with relatively dry climates across the Sydney Basin. The woodlands most similar to Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest occur in the Hunter Valley, the Capertee Valley and the tablelands.

What was done?

10,000 vegetation plots which cover the full spectrum of environmental variation across the Sydney Basin were used for this analysis. These plots are 20m by 20m in size and include every plant found within the plot and their cover abundance scores. These plots were assigned into similar groups using PATN. The groups derived by PATN are based on the level of similarity of the species in each plot. In other words, groups of plots with higher number of species in common will form closely related sister groups. A group of plots with fewer species in common with another group will be more distantly related. Thus, the groups identified by PATN are arranged into a hierarchy based on increasing dissimilarity between the groups. PATN identified 102 groups (vegetation types) at the level where the grassy woodlands of the Cumberland Plain formed a discrete unit. These 102 vegetation types were in turn grouped into 12 broad vegetation types.

What was found?

The majority of the vegetation on the Cumberland Plain fell into two broad groups. Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest fell into a group which includes a suite of Grassy Woodlands found on reasonably fertile clay soils in relatively dry climates. These woodlands have a diverse array of grasses and soft-leaved shrubs. They have a more restricted array of forbs, which are best represented in the Grassy Woodlands of higher rainfall areas. There are 12 vegetation types within this group.

The second group comprises a suite of Shrub-Grass Forests found on soils that are transitional between fertile and infertile substrates. The resulting soils tend to be less fertile than those typical of the Grassy Woodlands of the other group. As a result, the understorey within this group includes a number of hard-leaved, sclerophyll shrubs and more wiry grasses. There are 12 vegetation types within this group, including Castlereagh Ironbark Forest and Shale Sandstone Transition Forest, both of which occur on the Cumberland Plain.

The important implication of this grouping is that Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest is more similar to its sister vegetation types within the Grassy Woodland group than any of the vegetation types within the second group. In other words, Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest is more similar to the Grassy Woodlands in other parts of the Sydney Basin such as the Hunter Valley than Cumberland Plain vegetation such as Castlereagh Ironbark Forest.

This suggests that soil fertility and climate are more important in driving plant distributions than geographic proximity.

What are the opportunities like for offsetting with the closest relatives of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest?

The closest vegetation type to the grassy woodlands of the Cumberland Plain is found in the diatremes of the Putty Valley and basalt caps around Yengo National Park. The woodland in these locations is limited in extent. They would provide some opportunities for offsetting, but the total area of this community is limited. The next nearest neighbour of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest occurs in the Hunter Valley. The White Box Woodland of the upper Hunter is severely fragmented and would present similar challenges to Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest if targeted for offsets.

The next two nearest vegetation types occur in the western Blue Mountains. The White Box Woodland of the Central West Slopes has some relatively intact examples in areas such as the Capertee Valley. Dawson's Box – White Box Woodland occurs on footslopes below the western escarpment of the Blue Mountains from the Capertee north to the Hunter Valley. Relatively intact examples of both of these vegetation types still exist. Hence, both of these vegetation types offer reasonable prospects for offsetting.

The next two nearest neighbours of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest again occur in the Hunter Valley. The Narrow-leaved Ironbark – White Box Grassy Woodlands of the central part of the Hunter Valley are highly fragmented and prospects for offsetting would be limited. The Spotted Gum – Narrow-leaved Ironbark – Grey Box woodlands of the central part of the Valley occur on steeper Carboniferous sediments and would offer some prospects for offsetting.

The next four nearest neighbours are all woodlands of the tablelands. They share a suite of understorey species with Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest, but naturally also have some higher altitude species that are absent from Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest. Red Box – Capertee Stringybark Shrub-Grass Woodland has some relatively intact examples in areas such as the Wolgan and Capertee Valley and would offer reasonable prospects for offsetting.

The remaining three woodland types from the tablelands have limited occurrences within the Sydney Basin. Yellow Box – Ribbon Gum Woodland occurs around Berrima, Hartley, Wallerawang and Ben Bullen. Silvertop Stringybark – Yellow Box Woodland only occurs around Murrurundi. Hence, both these communities would offer limited opportunities for offsetting. Silvertop Stringybark – Yellow Box – Forest Ribbon Gum Forest of the Liverpool Range does not occur at all within the Sydney Basin and hence would not be eligible for offsetting under Growth Centres Offset Program.

The final member of the grassy woodland group, and least similar to Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest is White Box Grassy Vine Thicket of the upper Hunter, which differs due to the presence of mesic species. This vegetation type is highly limited in extent.

4.2.6 CONSERVATION OUTCOME FOR CUMBERLAND PLAIN SHALE WOODLANDS AND SHALE GRAVEL TRANSITION FOREST

There is a total of approximately 2,185 ha of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest within the Growth Centres. This area is highly fragmented and generally contains a greater proportion of areas of LMV compared with the Cumberland Plain as a whole.

Development within the Growth Centres will lead to the loss of around 1,187 ha of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest and the retention of up to 998 ha.

The Growth Centres development and protected areas have purposefully focused on the conservation of the better quality remnants that have the best prospects of long term survival. In particular, development within the Growth Centres will lead to the protection and on-going management of almost 90% of the listed community that is of HMV.

A comparison with the alternative status quo situation is particularly relevant to the conservation outcome for Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest being achieved through the Program. As mentioned previously, much of the remaining areas of the listed community are highly fragmented and in poor condition and are likely to further decline in terms of management viability. The areas that remain in good condition with higher biodiversity value and ecological viability are therefore of particular value to the on-going preservation of the listed community. In the absence of the Program, constraints to the protection and management of these areas, such as high land values and limited funding and resources, place them under considerable threat from weed invasion, inappropriate use and other “edge effects”.

In addition to the areas of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest to be retained within the Growth Centres, the NSW Government will prioritise 70% of the \$397.5 million (in 2005/06 dollars) Offset Program funding on matters listed under the EPBC Act through the acquisition of land with similar ecological values outside of the Growth Centres. The NSW Government will make every effort to ensure the protection of at least 2,400 ha of either Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest or other “grassy woodland” communities within the combined area of the Sydney Basin Bioregion (IBRA v6.1) and the Hawkesbury Nepean Catchment Management Authority Area. Preference will be given to Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest followed by White Box, Yellow Box, Blakely’s Red Gum Grassy Woodland and Derived Native Grassland.

CONSISTENCY WITH THE DRAFT CUMBERLAND PLAIN RECOVERY PLAN

There is currently a draft recovery plan for the Cumberland Plain (DECCW 2009b) which addresses the EPBC listed Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest community as a component of the threatened biodiversity on the Cumberland Plain.

The conservation activities and outcomes for this community that will occur as a consequence of the Program are not inconsistent with this draft recovery plan. The Program will make a substantial contribution to the delivery of the proposed recovery objective of the Plan “*to build a protected area network, comprising public and private lands, focused on the identified priority conservation lands.*”

4.3 SHALE SANDSTONE TRANSITION FOREST

4.3.1 ECOLOGICAL COMMUNITY DESCRIPTION

Shale Sandstone Transition Forest is listed as an endangered ecological community under the EPBC Act. The relevant listing advice contains limited information to help define the community under the EPBC Act. For the purposes of this assessment, the definition of the community under the NSW TSC Act has been adopted.

The Shale Sandstone Transition Forest ecological community is naturally restricted to transitional areas between the clay soils derived from the Wianamatta shale and the sandy soils derived from Hawkesbury Sandstone on the margins of the Cumberland Plain, within the Sydney Basin Bioregion (Threatened Species Scientific Committee 2001). The ecological community generally occurs on soils derived from a shallow shale or clay material overlying sandstone, or where shale-derived materials have washed down over sandstone-derived substrate (DECCW 2010a).

Shale Sandstone Transition Forest occurs on plateaux and hillsides and at the margins of shale cappings over sandstone. Many occurrences of ecological community are as linear stands, which may be as narrow as 20m. The small size and scattered distribution of the remnant stands of the community makes provision of a comprehensive map of occurrences impractical (DECCW 2010a).

The ecological community occurs as forest or woodland, and the floristic composition includes species characteristic of, or occurring in, either sandstone or shale habitats. The main tree species include Forest Red Gum *Eucalyptus tereticornis*, Grey Gum *E. punctata*, stringybarks (*E. globoidea*, *E. eugenioides*) and ironbarks (*E. fibrosa* and *E. crebra*) (DECCW 2010b, NPWS 2004a). Other characteristic tree species may be locally important, including *Eucalyptus resinifera*, other stringybarks (*Eucalyptus sparsifolia*, *Eucalyptus agglomerata*) and ironbarks (*Eucalyptus paniculata*, *Eucalyptus beyeriana*) (DECCW 2010a).

Shale Sandstone Transition Forest has an understorey which may be either grassy and herbaceous or of a shrubby nature. In areas that have not been burnt for an extended period of time, the understorey may be dense (DECCW 2010a).

There are two forms of Shale Sandstone Transition Forest: low sandstone influence and high sandstone influence. The high sandstone influence form includes sandstone species such as *Kunzea ambigua* and *Persoonia linearis*, and is most widespread in the southern section of the Cumberland Plain. The low sandstone influence form has an understorey layer that is closer to the Cumberland Plain Woodland ecological community (NSW listing) and includes a shrub layer dominated by *Bursaria spinosa* with grasses such as *Themeda australis*, *Echinopogon ovatus* and other herbs such as *Dichondra repens* (NPWS 2004a).

Species composition varies between sites depending on geographical location and local conditions (e.g. topography, relative influence of sandstone or shale). Depending on the disturbance history of a particular site a proportion of the species may be present only in the soil seed bank (DECCW 2010a).

In the absence of any EPBC condition criteria for this community, a consolidation of a broader list of categories described in *Native Vegetation Maps of the Cumberland Plain Western Sydney, Interpretation*

Guidelines (NPWS 2002d) have been used to provide guidance for when a patch of the community retains substantial conservation values.

Two condition categories are defined for this assessment. The “ABC” category, comprising the A, B and C categories from the Interpretation Guidelines, is generally based on more intact areas of native vegetation that maintain structural integrity. Patches are more than 0.5 ha in size and have greater than 10% canopy cover, or if canopy cover is less than 10%, patch size must be greater than 5 ha. The “Other” category comprises the SA, Cmi, Tx, Txr, Txu and X categories from the Interpretation Guidelines. The “Other” category includes more disturbed vegetation that does not maintain as much structural integrity. These remnants may consist only of the canopy layer (no mid or understorey), have an understorey dominated by weeds, have a very discontinuous canopy cover, and often occur in areas where the dominant land use is agricultural or urban.

It is unlikely that remnants in this “Other” category would contain enough integrity to meet the definition of the EPBC listed Shale Sandstone Transition Forest ecological community. However, a precautionary approach has been applied in this assessment to include all of these mapped conditions of the community when describing presence and distribution. As the “Other” category is generally considered to have no long-term management viability, it is reported separately to the “ABC” category in this assessment.

RELATIONSHIP TO THE NSW LISTING OF THE COMMUNITY

The EPBC definition of the community generally corresponds to the NSW TSC Act listing of “Shale Sandstone Transition Forest in the Sydney Basin Bioregion”. This community is listed as endangered under the NSW TSC Act.

The floristic composition of the two listings is the same. For this reason, research undertaken in relation to the NSW listed community is generally applicable to the EPBC listed community.

Adjacent communities on shale soils are generally Cumberland Plain Shale Woodlands, while adjacent communities on sandstone soils are generally part of the Sydney Sandstone Complex (DECCW 2010a).

APPROACH USED TO MAP THE COMMUNITY ACROSS THE CUMBERLAND PLAIN

DECCW have collected a substantial amount of data over the last 12 years which they have used to map the distribution and extent of native vegetation across the Cumberland Plain. This data for the NSW-listed Shale Sandstone Transition Forest in the Sydney Basin Bioregion ecological community has been used for the purposes of this strategic assessment to map the EPBC listing of the community.

THREATS TO THE COMMUNITY AND CURRENT DISTRIBUTION ACROSS THE CUMBERLAND PLAIN

Before European settlement, Shale Sandstone Transition Forest was extensive at the edges of the Cumberland Plain, particularly in the southern half, and covered approximately 45,000 ha. Today, it is reduced to 9,950 ha or approximately 22 % of its original extent in an area bounded by Sackville in the north, Mulgoa to the west, Wilton in the south and Revesby to the east, with the bulk of the community occurring in the Campbelltown, Hawkesbury, Hills Shire, Liverpool, Parramatta, Penrith, and Wollondilly local government areas (NPWS 2002a, NPWS 2002d, DECCW 2010b, Tozer 2003).

A large proportion of the area where Shale Sandstone Transition Forest occurred in the past has been cleared for agriculture and urban development, and remnants are often small and scattered (DECCW 2010a). The greatest threat to Shale Sandstone Transition Forest is clearing for agriculture and urban/rural residential development, and the subsequent impacts from fragmentation (NPWS 2004a, DECCW 2010b). Due to its location within the Sydney Basin Bioregion, the ecological community is subject to other ongoing threatening processes such as grazing, weed invasion, mowing, physical damage from recreational activities, rubbish dumping, inappropriate water run-off which leads to increased nutrients and sedimentation, and inappropriate fire regimes, which have altered the appropriate floristic and structural diversity. These threats effectively reduce the community's regeneration processes (Threatened Species Scientific Committee 2001, DECCW 2010a, NPWS 2004a). All vegetation layers should be maintained as the removal of the understorey followed by slashing/mowing encourages weeds. Once threatening processes such as grazing and mowing are removed, Shale Sandstone Transition Forest can regenerate strongly. Wattle and pea species have seeds that can persist in the soil seedbank and, following fire, will colonise disturbed margins. Woody weeds should be controlled to prevent them dominating the understorey (NPWS 2004a).

The current distribution of Shale Sandstone Transition Forest across the Cumberland Plain is shown in Figure 37.

BIODIVERSITY VALUE AND ECOLOGICAL VIABILITY OF THE COMMUNITY

The biodiversity value of patches of Shale Sandstone Transition Forest varies throughout the Cumberland Plain. As outlined in the introduction to this Section, past and existing land uses, and pressures from the surrounding landscape, have strongly influenced the condition of remnants and their ecological viability in the long-term.

The biodiversity value and ecological viability of Shale Sandstone Transition Forest has been determined across the community's range using the criteria described in the introduction to this chapter (see Figure 38).

This analysis found that, of the 19,352 ha of extant Shale Sandstone Transition Forest (all condition categories), approximately 5,360 ha (or 28%) comprises areas of HMV; 2,430 ha (or 12%) comprises areas of MMV; and 11,562 ha (or 60%) comprises areas of LMV.

The LMV data includes 2,133 ha of "ABC" category vegetation and 9,429 ha of "Other" category vegetation.

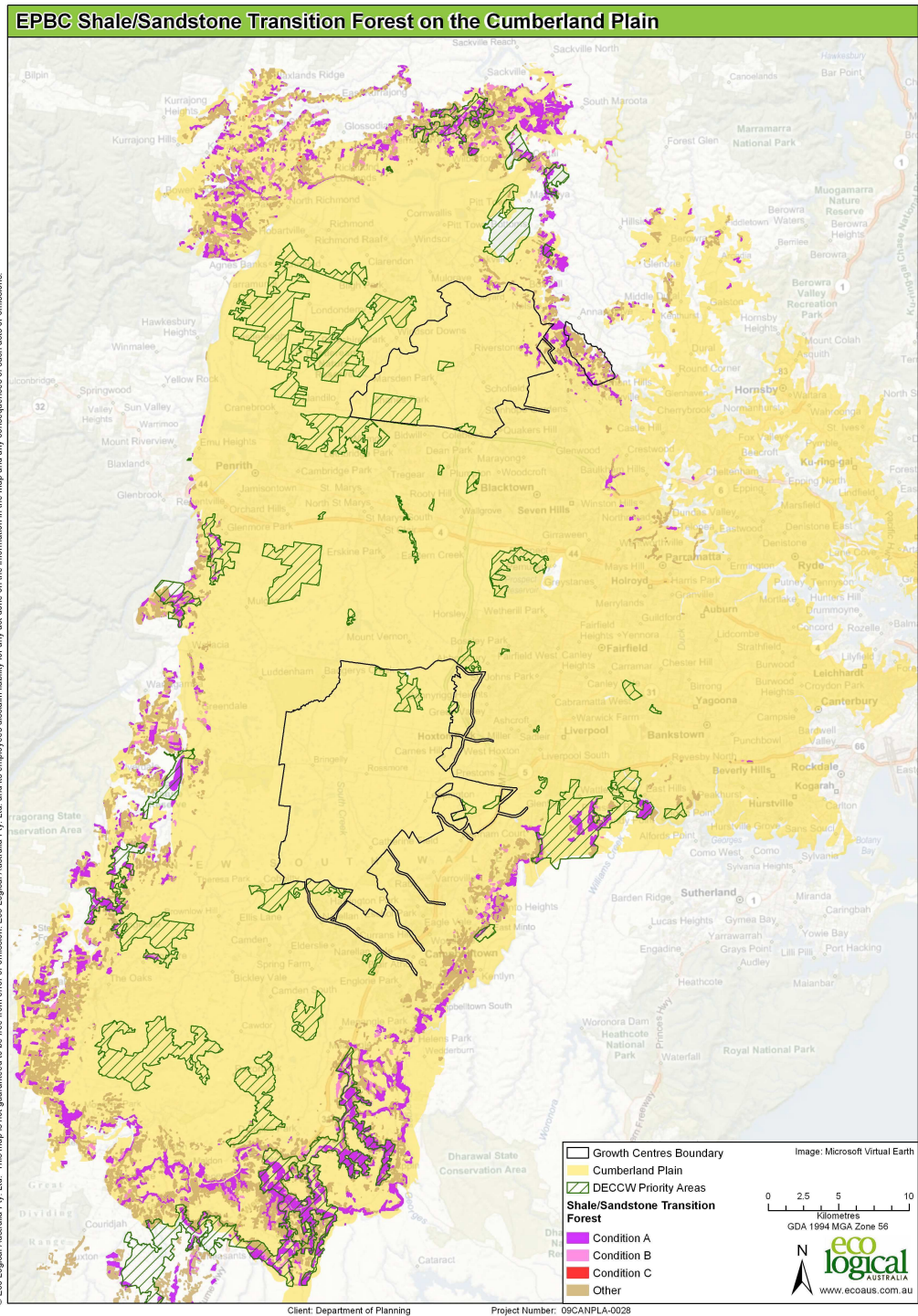


Figure 37: Distribution of Shale Sandstone Transition Forest across the Cumberland Plain

Note - The DECCW Priority Areas in this map are those areas identified as Priority Conservation Lands in the draft Cumberland Plain Recovery Plan. They differ slightly from the priority areas on the Cumberland Plain identified in the Hawkesbury Nepean Catchment Action Plan (2008).

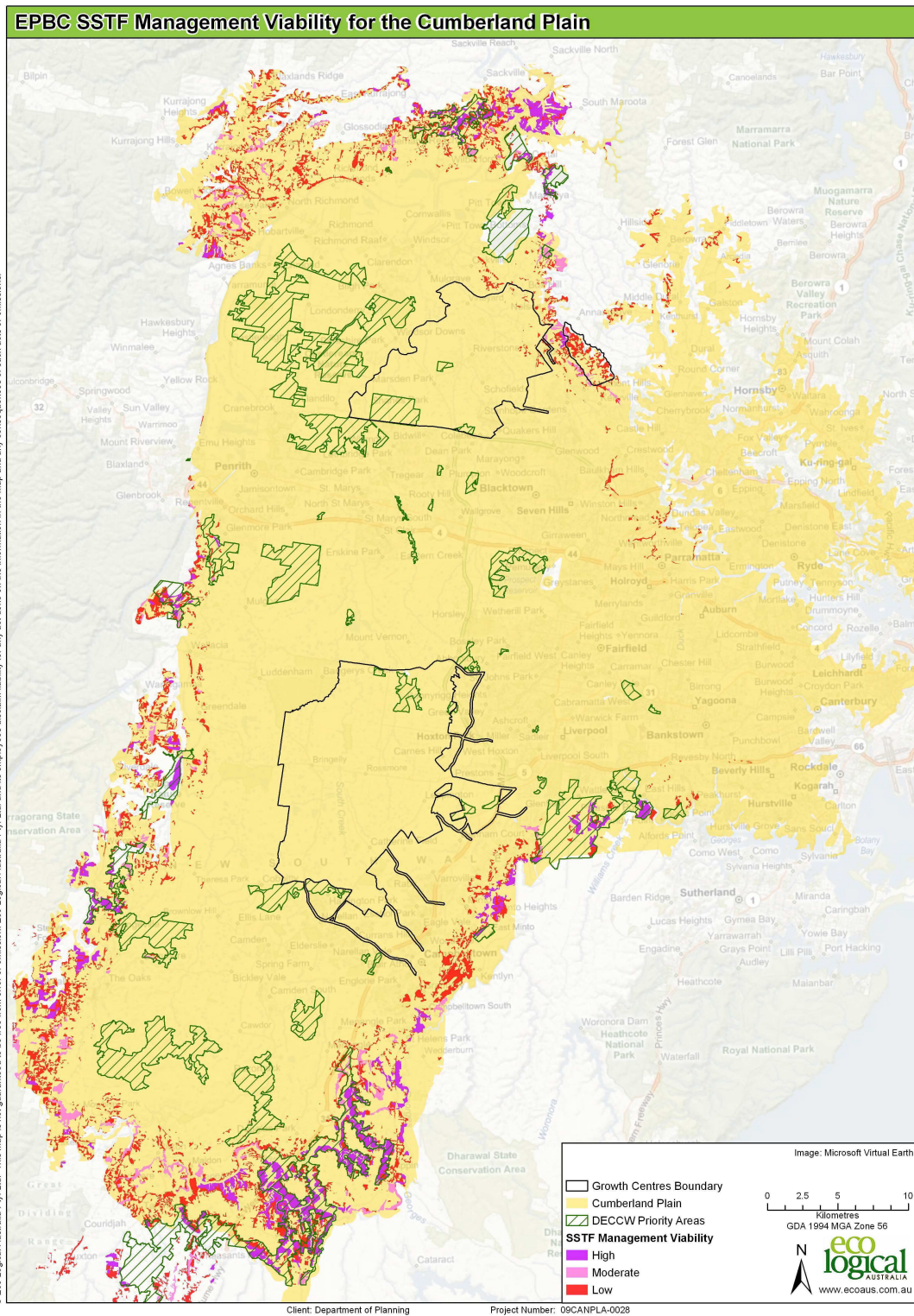


Figure 38: Biodiversity value and ecological viability of Shale Sandstone Transition Forest across the Cumberland Plain

Note - The DECCW Priority Areas in this map are those areas identified as Priority Conservation Lands in the draft Cumberland Plain Recovery Plan. They differ slightly from the priority areas on the Cumberland Plain identified in the Hawkesbury Nepean Catchment Action Plan (2008).