



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)

<b>Nominated Ecological Community - Summary of eligibility</b>	
<b>6. Name of Ecological Community</b>	
Cumberland Plain woodland	
<b>7. Category for which the ecological community is nominated under the EPBC Act</b>	
Current listing category Unlisted Critically Endangered <input checked="" type="checkbox"/> Endangered Vulnerable	Proposed listing category <input checked="" type="checkbox"/> Critically Endangered Endangered Vulnerable Delisting
<b>8. Criteria that form the basis for this nomination</b>	
<input checked="" type="checkbox"/> Criterion 1 – Decline in geographic distribution. <input checked="" type="checkbox"/> 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.	

## Section 1 – Conservation Assessment

### Conservation Theme

**1. How does this nomination qualify for assessment under the current Conservation Theme?**

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

### Classification

**2. What is the name of the ecological community?**

The name of the ecological community is Cumberland Plain woodland. Shale plains woodland and shale hills woodland make up the community and the use of these names refers to Cumberland Plain woodland.

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

All studies/surveys/authorities use the name Cumberland Plain woodland when referring to this community.

**4. How does the nominated ecological community relate to the other communities that occur nearby or that may be similar to it? Does it intergrade with any other**

**ecological communities? How would you distinguish the ecological community in areas where they overlap?**

There are a number of ecological communities occurring on the Cumberland Plain where Cumberland Plain woodland is found. These include blue gum high forest, Agnes Banks woodland and turpentine ironbark forest (Tozer 2003). These communities all differ in composition of species, elevation, annual rainfall and geography of where they occur. On the eastern edges of the Cumberland Plain, shale plains woodland (part of Cumberland Plain woodland) grades into turpentine ironbark forest as annual rainfall increases above 950mm (Tozer 2003). Shale plains woodland also grades into shale gravel transition forest and shale sandstone transition forest. The width of the intergradation zones is not known.

Cumberland Plain woodland is distinguished from the other communities by its composite species (which will be discussed in more detail in question 7). More information on the composite species in all communities found on the Cumberland Plain can be found in Tozer 2003.

**Legal Status**

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

Cumberland Plain woodland is currently listed as Endangered under the NSW Threatened Species Conservation Act (1995). There has been a nomination submitted this Act to upgrade the listing of Cumberland Plain woodland to Critically Endangered. This nomination is currently in progress.

**6. Does the ecological community provide a habitat for any listed threatened species?**

To date there have been no specific studies done to determine whether threatened animal species exclusively rely on Cumberland Plain woodland.

Table 1 comprises a list of threatened animal species recorded in the Nepean-Hawkesbury Catchment Management Authority Cumberland sub-region. Since Cumberland Plain woodland originally covered most of this area, it most likely represents those threatened species that would be found in the community.

**Table 1. Threatened species within the Cumberland CMA sub-region (Nepean-Hawkesbury) listed under the NSW *Threatened Species Conservation Act* and the Commonwealth *Environment Protection and Biodiversity Conservation Act*.  
 E = Endangered; V = vulnerable (NPWS 2007).**

Scientific Name	Common Name	NSW TSC listing	EPBC listing
<i>Meridolum cornoevirens</i>	Cumberland land snail	E	-
<i>Heleioporus australiacus</i>	Giant burrowing frog	V	V
<i>Litoria aurea</i>	Green and golden bell frog	E	V
<i>Varanus rosenbergi</i>	Rosenberg's goanna	V	-
<i>Calyptorhynchus lathamii</i>	Glossy black-cockatoo	V	-
<i>Climacteris picumnus</i>	Brown treecreeper (eastern subsp.)	V	-
<i>Grantiella picta</i>	Painted honeyeater	V	-

<i>Lathamus discolor</i>	Swift parrot	E	E
<i>Lophoictinia isura</i>	Square-tailed kite	V	-
<i>Melanodryas cucullata cucullata</i>	Hooded robin (south-eastern form)	V	-
<i>Melithreptus gularis</i>	Black-chinned honeyeater (eastern subspecies)	V	-
<i>Neophema pulchella</i>	Turquoise parrot	V	-
<i>Ninox connivens</i>	Barking owl	V	-
<i>Ninox strenua</i>	Powerful owl	V	-
<i>Pyrrholaemus sagittatus</i>	Speckled warbler	V	-
<i>Stagonopleura guttata</i>	Diamond firetail	V	-
<i>Tyto novaehollandiae</i>	Masked owl	V	-
<i>Xanthomyza phrygia</i>	Regent honeyeater	E	E
<i>Dasyurus maculatus</i>	Spotted-tail quoll	V	-
<i>Falsistrellus tasmaniensis</i>	Eastern false pipistrelle	V	-
<i>Miniopterus schreibersii oceanensis</i>	Eastern bentwing-bat	V	-
<i>Mormopterus norfolkensis</i>	Eastern freetail-bat	V	-
<i>Myotis adversus</i>	Large-footed myotis	V	-
<i>Petaurus norfolcensis</i>	Squirrel glider	V	-
<i>Phascolarctus cinereus</i>	Koala	V	-
<i>Pteropus poliocephalus</i>	Grey-headed flying-fox	V	V

## Description

### 7. List the main features that distinguish this ecological community from all other ecological communities.

Cumberland Plain woodland is made up of shale plains woodland and shale hills woodland. Both shale plains and shale hills contain similar species, with a few differences in shrub and ground strata.

The distinguishing feature Cumberland Plain woodland is that it consists mainly of grey box (*Eucalyptus moluccana*) and forest red gum (*E. tereticornis*), and in some areas ironbark (*E. crebra*). While these species may occur in other communities, the distinctive aspect of the Cumberland Plain woodland is that these species may make up 70% of the total basal area and 60% of the total stem density of sites examined (Benson and Howell 1990a).

### 8. Give a description of the biological components of the ecological community.

Shale hills woodland is dominated by *Eucalyptus moluccana* and *E. tereticornis* with *e. crebra* occurring less frequently. A small tree stratum often occurs, mostly consisting of *Acacia implexa* together with a variety of the above-mentioned *Eucalyptus* spp. (Tozer 2003). There is also typically a shrub stratum dominated by *Bursaria spinosa* and may also include *Acacia falcata*, *Breynia oblongifolia*, *Indigophera australis* which *Dodonea viscosa* subsp. *cuneata* (Tozer 2003). There is often a good cover of grass and herb species but this can become quite sparse under *Bursaria spinosa* and the introduced *Olea europea* subsp. *africana*. Herb and grass species include *Dichondra repens*, *Brunoniella australis*, *Aristida ramosa*, *Desmodium varians*, *Microlaena stipoides* var. *stipoides*, *Themada australis* and *Cheilanthes sieberi* subsp. *sieberi* (Tozer 2003).

Shale plain woodland is also dominated by *E. tereticornis* and *E. moluccana* with *E. crebra* occurring less frequently, but *E. eugenioides* and *Corymbia maculata* also occur less frequently. These last three species often form a separate small tree stratum that sometimes includes *Exocarpus cupressiformis*, *Acacia decurrens*, and *Acacia parramattensis* subsp. *parramattensis* (Tozer 2003). The shrub stratum is also dominated by *Bursaria spinosa* but may include *Dichondra repens*, *Aristida vagans*, *Microlaena stipoides* var. *stipoides*, *Themeda australis*, *Brunoniella australis*, *Desmodium varians*, *Opercularia diphylla*, *Wahlenbergia gracilis* and *Dichelachne micrantha* (Tozer 2003).

Other typical plant species within these sub-communities and Cumberland Plain woodland can be found in Tozer 2003 and Benson and Howell 1990a and 1996.

**9. Give a description of the associated non-biological landscape characteristics or components of the ecological community.**

The abiotic characteristics of this community are those of the Cumberland Plain, which is the only location of Cumberland Plain woodland. The Cumberland Plain comprises gently undulating plains and low hills rising gradually from the flat low-lying areas just above sea level in the north, to an altitude of around 300 m on the rolling hills of Razorback Range in the south (Tozer 2003).

The Cumberland Plain occupies the driest part of Sydney, where rainfall is approximately 700-900 mm/annum (Benson and Howell 1990b). Average temperatures range from 28-29°C in the summer to lows of 4.5°C in winter (Benson 1992). The soils are deep clays and due to its texture the soil retains moisture and has a slightly higher nutrient level than soils of surrounding areas (Benson and Howell 1990). Cumberland Plain woodland largely occurs on soils derived from Wianamatta Shale, but also occurs on Holocene Alluvium in well drained areas (Tozer 2003). Isolated patches may be found on soils derived from the Mittagong Formation, but only near outcrops of almost pure shale (Tozer 2003).

**10. Provide information on the ecological processes by which the components interact.**

Shale hills woodland most often occurs in undulating country with a relatively high degree of ruggedness and reaches its northern limit at Mulgoa Nature Reserve and Prospect Reservoir. On very steep sheltered hillsides it often grades into shale plains woodland (Tozer 2003). Shale plains woodland is the most widely distributed community on the Cumberland Plain and is found at lower elevations.

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

The only variation within Cumberland Plain woodland is the subtle differences between shale plains woodland and shale hills woodland as described in the previous questions. These sub-communities differ slightly in species composition and elevation, but are quite similar. Cumberland Plain woodland is only found on the Cumberland Plain and as such there is no regional variation in this community.

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

Major studies on Cumberland Plain woodland are:

- Benson, D.H. (1992). The natural vegetation of the Penrith. *Cunninghamia* **2**(4): 541-596.
- Benson, D. and Howell, J. (2002). Cumberland Plain woodland ecology then and now: interpretations and implications from the work of Robert Brown and others. *Cunninghamia* **7**(4): 631-650
- Cuneo, P. and Leishman, M.R. (2006). African olive (*Olea europaea* subsp. *cuspidata*) as an environmental weed in eastern Australia: a review. *Cunninghamia* **9**(4): 545-577.

- Tozer, M. (2003). The native vegetation of the Cumberland Plain, western Sydney: Systematic classification and field identification of communities. *Cunninghamia* **8**(1): 1-75
- Wilkins, S., Keith, D.A. and Adam, P. (2003). Measuring success: Evaluating the restoration of a grassy eucalypt woodland on the Cumberland Plain, Sydney, Australia. *Restoration Ecology* **11** (4): 489-503
- von Richter, S.J., Little, D. and Benson, D. (2005) Effects of low intensity fire on the resprouting of the weed African Olive (*Olea europeae* subsp. *cuspidata*) in Cumberland Plain woodland, Western Sydney. *Ecological Management and Restoration* **6** (3): 230-233
- Hill, S.J., and French, K. (2004) Potential impacts of fire and grazing in an endangered ecological community: plant composition and shrub and eucalypt regeneration in Cumberland Plain woodland. *Australian Journal of Botany* **52** (1): 23-29
- Hill, S.J., Tung, P.J. and Leishman, M.R. (2005) Relationships between anthropogenic disturbance, soil properties and plant invasion in endangered Cumberland Plain woodland, Australia. *Austral Ecology* **30**: 775-788

### **13. Describe the national distribution in Australia.**

Cumberland Plain woodland is only found on the Cumberland Plain, in Western Sydney, NSW. It is found nowhere else in Australia. The Cumberland Plain is found in the Sydney Basin Bioregion. The Cumberland Plain is located west of Parramatta, south to Campbelltown and Camden, northwards to Richmond and Windsor and west to the Nepean-Hawkesbury River (Benson and Howell 1990a).

Cumberland Plain woodland can be found in the Local Government Areas (LGAs) of Hawkesbury, Baulkum Hills, Blacktown, Penrith, Liverpool, Fairfield, Holroyd, Parramatta, Bankstown, Wollondilly, Auburn, Campbelltown and Camden. The locations of the occurrences of this ecological community can be found in Attachment 1 and their specific occurrences in LGAs can be found in NPWS (2002).

### **14. What is the national distribution (in ha) for the ecological community?**

#### **a. What is the current distribution?**

The most recent study, conducted in 1997, gives the current distribution of this community as 11,054 ha (Tozer 2003). The real current distribution however is likely to be considerably less than this because land clearing has continued in the 10 years since this survey was conducted.

#### **b. What is the pre-European extent?**

The pre-European extent of the community was 125,449 ha (Tozer 2003)

#### **c. What is the estimated percentage decline of the ecological community?**

The estimated percentage decline of the ecological community is 91.2% as calculated from the above figures (Tozer 2003). Again, the real figure is likely to be considerably higher but there are no up-to-date data with which to accurately estimate the decline.

#### **d. What data are there to indicate future changes in distribution will occur?**

The proposed Growth Centres Conservation Plan will see the future distribution of Cumberland Plain woodland decline by 1329 ha if the plan is brought into action (Growth Centres Commission 2007) because it sanctions the destruction of this area of Cumberland Plain woodland for urban development.

All the above figures relating to the size and pre-European extent of the community are based on a study conducted by Tozer in 1997 (Tozer 2003). The figures represent the area of occupancy for the community. Aerial photograph interpretation was carried out to determine the extent of remnant woody vegetation for the study conducted by Tozer (2003).

### **15. Is the ecological community considered to be naturally rare or restricted, based on its original distribution?**

Cumberland Plain woodland is not considered to be naturally rare or restricted based on its pre-European distribution as this is over 100,000 ha. Cumberland Plain woodland once covered about 30% of the Sydney district east of the Nepean-Hawkesbury River, a total of 125,449 ha.

**16. What is the typical size for a patch of the ecological community?**

The median patch size is 3.3 ha (inter-quartile range is 1.5-10.5 ha). 95% of patches are less than 100 ha in size (Tozer 2003).

**17. Quantify the percentage or area required for a patch to be considered viable.**

There is not enough information to calculate this figure. Patches greater than 100 ha in size may not require active management so long as they are not under threat from invasive weeds.

## Functionality

**18. Is the present distribution of the ecological community severely fragmented?**

The 11,054 ha of remaining Cumberland Plain woodland is severely fragmented (see map) because of land clearing for urban development. The connectivity between remnants rapidly declines when clearing levels across the landscape exceed 70%, and the Cumberland Plain woodland has been reduced in extent by 91% (DEC 2005). This results in the subsequent accelerated loss of biodiversity and thus the decreased viability of the ecosystem (DEC 2005). It is clear from the NPWS maps (NPWS 2002,2003) that the remaining stands of Cumberland Plain woodland are incredibly fragmented. This fragmentation has left the remaining remnants susceptible to further reductions in size and to degradation through invasion by exotic species.

**19. Has there been a loss or decline of functionally important species?**

There does not seem to have been a loss or decline of functionally important species in the remaining fragments of Cumberland Plain woodland.

**20. Describe any processes that have resulted in a reduction in integrity and the consequences of these processes.**

The invasion of exotic weeds has resulted in a reduction in integrity. In a study conducted by Benson (1992), between 2 and 19 exotic species were recorded at every site of Cumberland Plain woodland examined. Similarly, in the woodland Conservation Area of Mount Annan, the floristic list includes 126 native and 62 exotic species, meaning exotics make up one third of all species (Benson and Howell 2002). The most common are flatweed (*Hypochaeris radicata*), *Conzys floribunda*, plantain (*Plantago lanceolata*), paspalum (*Paspalum dilatatum*) African lovegrass (*Eragrostis curvula*), African olive (*Olea europea* subsp. *africana*), bridal veil creeper and Rhodes grass (*Chloris gayana*) (Benson 1992). Invasion of native plant communities by exotic perennial grasses such as African lovegrass and Kikuyu is an identified threat to the Cumberland Plain woodland.

Two exotic species, *Olea europea* subsp. *africana* (African olive) and *Myrsiphyllum asparagoides*, are identified as a major threat to the conservation of native flora due to their widespread distribution and ability to out-compete native species (Tozer 2003).

The Camden-Campbelltown area in the southern edge of the Cumberland Plain in western Sydney is the most established centre of African olive occurrence in Australia (Cuneo and Leishman 2006). African olive poses a major threat to the long-term existence of Cumberland Plain woodland with substantial infestations occurring. 985 ha of infestation have been recorded, representing 9% of the total community (Cuneo and Leishmann 2006).

Land use changes have allowed exotic species to establish and are now rapidly changing most Cumberland Plain woodland remnants and pose a major problem for

management as they out-compete native species and alter the structure of the community (DEC 2005).

## Condition Classes

### **21. What features do you consider to be most valuable for identifying a patch of the ecological community in good condition?**

A patch of Cumberland Plain woodland in good condition would have minimal disturbance from anthropogenic factors such as rubbish dumping and grazing. A relatively large patch size would be preferable (e.g. larger than 10 ha). The composition of the patch should reflect those species listed in question 8 for each sub-community, with a diverse understorey free from exotic weeds such as African olive and introduced grasses such as kikuyu. However, due to the intensity of the pressures upon this community, identification of a patch in 'good' condition must be assessed acknowledging these pressures. Consequently, although this is an ideal description of a good quality patch of Cumberland Plain woodland, in reality 'good' patches will be identified on a spectrum from this ideal to the totally degraded and weed-infested.

## 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.**

Cumberland Plain woodland has been well surveyed, but the last comprehensive survey was conducted 10 years ago and so the data are likely to be somewhat outdated. In the 10 years since Tozer's (2003) survey, land clearing and weed infestation has continued and no doubt various Cumberland Plain woodland remnants have been lost.

In a study conducted by Cumberland Plain botanical expert Doug Benson of the National Herbarium of NSW, the area of vegetation types found in Cumberland County (the County of Cumberland includes about 80% of the Cumberland Plain) in 1788 were compared with those of 1990 (Benson and Howell 1990b).

The most recent survey was conducted by Tozer in 1997, where all vegetation on the Cumberland Plain was surveyed and mapped, including Cumberland Plain woodland (Tozer 2003). Although this is a relatively recent survey, it is likely that the current distribution and patch size may be less than that measured in 1997 due to probable further losses from invasion of exotic weeds, land clearing and further fragmentation.

All areas containing Cumberland Plain woodland have been surveyed. There is no official ongoing monitoring program.

## Threats

### **23. Identify past, current and future threats to the ecological community indicating whether they are actual or potential.**

*Invasion of native plant communities by exotic perennial grasses and others.*

#### **a. How and where it impacts on this ecological community?**

In a study conducted by Benson (1992), between 2 and 19 exotic species were recorded at every site of Cumberland Plain woodland examined. Similarly, in the Woodland Conservation Area of Mount Annan, the floristic list includes 126 native and 62 exotic species, meaning exotics make up one third of all species (Benson and Howell 2002). The most common are flatweed (*Hypochaeris radicata*), *Conzys floribunda*, plantain (*Plantago lanceolata*), paspalum (*Paspalum dilatatum*), African lovegrass (*Eragrostis curvula*), African olive (*Olea europea* subsp. *africana*), bridal veil creeper and Rhodes grass (*Chloris gayana*) (Benson 1992).

Invasion of native plant communities by exotic perennial grasses such as African lovegrass

and kikuyu is an identified threat to the Cumberland Plain woodland. Two non-grassy exotic species, *Olea europea* subsp. *africana* (African olive) and *Myrsiphyllum asparagoides*, are also identified as a major threats to due to their widespread distribution and ability to out-compete native species on the Cumberland Plain (Tozer 2003). The Camden-Campbelltown area in the southern edge of the Cumberland Plain in western Sydney is the most established centre of African olive occurrence in Australia (Cuneo and Leishman 2006).

**b. What its effect has been so far?**

Land use changes have allowed exotic species to establish and are now rapidly changing most Cumberland Plain woodland remnants and pose a major problem for management as they out-compete native species and alter the structure of the community (DEC 2005).

African olive poses a major threat to the long-term existence of Cumberland Plain woodland with substantial infestations occurring. 985 ha of infestation have been recorded, representing 9% of the total community (Cuneo and Leishmann 2006).

This is a known threat and probably affects almost all patches, even those within conservation reserves.

In addition to the direct impact of competition with native vegetation, the spread of exotic species leads to a gradual weakening of the community as a whole, leaving it more vulnerable to other threats such as grazing, climate change and fragmentation. The community's resilience is reduced, which may in turn impact the native fauna which depend upon it.

**c. What is its expected effect in the future?**

There is not currently any supporting research/information that this threat will continue. It can be assumed, however, that without significant intervention the current *status quo* will continue, and weeds will continue to spread and represent a major threat to all remaining patches of Cumberland Plain woodland. The likelihood of the continued spread of exotic species is increased by the location of the community in a densely populated urban area, where exotic species are widely planted in suburban gardens and the native vegetation therefore exists in a matrix dominated by weeds.

*Clearing of native vegetation*

**a. How and where it impacts on this ecological community?**

Clearing has led to fragmentation of the landscape which has resulted in increasingly isolated fragments that are vulnerable to other impacts such as weed infestation. Clearing of Cumberland Plain woodland also means there is less habitat to support the native fauna species whose habitat it represents. Clearing of Cumberland Plain woodland has affected its entire distribution and is likely to continue to do so because of the location of the community within the sprawl of the Sydney metropolis and under continual pressure for spreading urban and suburban development.

**b. What its effect has been so far?**

The effect that land clearing has had on the Cumberland Plain woodland has been dramatic to say the least and has affected all patches.

The most recent assessment of the extent of Cumberland Plain woodland fragments was conducted by Mark Tozer in 1997. This included an assessment of the entire distribution of Cumberland Plain woodland (not just those in the County of Cumberland). Table 3 shows the results of his study. The pre-European extent of Cumberland Plain woodland was 125,449 ha, whereas in 1997 there was only 11,054 ha remaining. This represents a decline of 91.2% since European settlement. In a study conducted by Cumberland Plain botanical expert Doug Benson of the National Herbarium of NSW, the area of vegetation types found in Cumberland County (the County of Cumberland includes about 80% of the Cumberland Plain) in 1788 were compared with those of 1990 (Benson and Howell 1990b). In 1788 Cumberland Plain woodland occupied approximately 107,000 ha and by 1990 there was only 6,420 ha or approximately 6% of the pre-European extent left (Benson and Howell 1990b). Clearing for grazing and later suburban development disturbed ground layer species and replaced them

with introduced grasses, particularly kikuyu (*Pennisetum clandestinum*) and African lovegrass (*Eragrostis curvula*) (Benson *et al.* 1996).

**c. What is its expected effect in the future?**

There is only 8% of Cumberland Plain woodland remaining in conservation areas (DEC 2005). As the rest is on private land it can be assumed that there is a very strong likelihood that it may be cleared in the future. The area it occupies is within the Sydney metropolis and therefore subject to intense pressure from urban and suburban development, and without legislated protection it is unlikely that clearing will not occur on an ongoing basis into the future.

Another future reduction in range will come with the introduction of the Growth Centres Conservation Plan for western Sydney. This is a 30-year planning document detailing two areas of urban growth (northern and southern) in western Sydney (Growth Centres Commission 2007). The plan seeks to obtain “biodiversity certification” from the NSW Minister of Environment, which if granted means that no further assessment of the impacts of development on endangered species or communities is required for urban developments. 2,001 ha, or 18% of Cumberland Plain woodland is found within the area targeted by the Plan. Of this, 1,329 ha will be destroyed, with only 672 ha protected. This represents a loss of 66% of the Cumberland Plain woodland within the Growth Centres and would equate to a loss of 12% of the total community, bringing the percent lost since European settlement to 7.7%.

*Fragmentation of habitat*

**a. How and where it impacts on this ecological community?**

This threat impacts on those parts of Cumberland Plain woodland that are not currently located in conservation reserves by removing the connectivity between areas and leaving those remaining fragments under increased pressure from other threats. As the community becomes broken into increasingly smaller fragments its resilience decreases and so it becomes more vulnerable to other threats and pressures; the ecological phenomenon known as the ‘edge effect’ is increased, therefore reducing the amount of intact native habitat available and reducing the overall integrity of the site; its ability to perform ecosystem functions is decreased and again therefore the quality of the habitat it provides for native fauna is decreased.

Cumberland Plain woodland has been impacted by fragmentation throughout its range, again primarily because of its highly vulnerable position within the sprawl of Sydney’s suburbia.

**b. What its effect has been so far?**

The connectivity between remnants rapidly declines when clearing levels across the landscape exceed 70%, such as in the Cumberland Plain woodland whose extent has been reduced by 91% (DEC 2005). This results in the accelerated loss of biodiversity and thus a reduction in the viability of the ecosystem (DEC 2005). It is clear from the NPWS maps (NPWS 2002,2003) that the remaining stands of Cumberland Plain woodland are incredibly fragmented. This fragmentation has left the remaining remnants susceptible to further reductions in size and to degradation through invasion by exotic species.

**c. What is its expected effect in the future?**

As mentioned in the previous threat of *clearing of native vegetation* the fact that 92% of remaining Cumberland Plain woodland is not protected in reserves means that it is vulnerable to further fragmentation as more vegetation is cleared.

**24. Identify catastrophic threats that are likely to severely affect the ecological community.**

*Global warming*

Increasing evidence is mounting to indicate that global temperatures will rise in the near future and impact the Australian environment. The Intergovernmental Panel on Climate Change (IPCC) predicts that 20-30% of animal and plant species are likely to be at an increased risk of extinction if global temperatures rise by 1.5- 2.5 degrees (IPCC 2007). As

the species contained within Cumberland Plain woodland have evolved to live in the current temperature range, an increase in temperature will probably have a very dramatic effect on the community.

#### *Drought*

The Cumberland Plain is already the driest part of Sydney, with most of the plain receiving less than 800 mm of rain each year. If a severe drought were to hit the area, the remaining remnants of Cumberland Plain woodland would be under more stress than they are now. As mentioned above, global warming is a growing concern and the latest report from the IPCC predicts that those areas that are already drought affected will get worse, such as the Cumberland Plain (IPCC 2007). The Cumberland Plain woodland's susceptibility to increased drought will be heightened due to the weakening of the community's resilience, as mentioned in previous sections.

#### *Cyclone*

If a severe cyclone were to hit the Cumberland Plain remaining fragments of Cumberland Plain woodland could be destroyed completely. This would have a very deleterious effect on the community as there is very little of this community remaining.

### **25. Identify and explain any additional biological characteristics particular to the community or species within that are threatening to its survival.**

There are no known additional biological characteristics that are threatening its survival.

### **26. Relative status of remnants within the community.**

It is not possible to quantify the areas of Cumberland Plain woodland that are in good, medium or poor condition as the state of each patch (such as species composition and weed invasion) is unknown.

A patch of Cumberland Plain woodland in good condition would be identified as a large patch, probably over 100 ha in size. There would be minimal weed invasion and the structure of the community, including species composition should represent that as described in question 8.

A patch in poor condition would be small with most of it invaded by exotic weeds. There would also be a large amount of anthropogenic disturbance such as rubbish dumping and grazing of stock.

A patch in medium condition would be one whose components fall in between that of the above described poor and good condition.

The relative condition of existing Cumberland Plain remnants has not been directly assessed in the surveys of the community.

## **Threat Abatement and Recovery**

### **27. Identify key management documentation available for the ecological community.**

The NSW Department of Environment and Conservation (DEC) is currently preparing a draft recovery plan for the Cumberland Plain region. The plan will cover reservation and acquisition of open space, land use planning, land management, and promoting community involvement and research.

### **28. Give an overview of how threats are being abated/could be abated and other recovery actions underway/proposed.**

There are several community groups and local councils that have, and continue to, restore remnants of Cumberland Plain woodland. A list of some of these groups can be found in question 34.

When the DEC recovery plan for the Cumberland Plain is prepared, it will continue the development of a network of protected areas, such as national parks, council parks, or private lands under a conservation agreement. It will also work towards conservation through

the land-use planning system, by identifying areas for conservation up-front when: releasing land for urban development, preparing local environmental plans, or when rezoning land, doing site planning for large 'greenfield' areas before release for urban development and assessing development applications. The Cumberland Plain's endangered ecological communities are largely on private land. This means that it is critical to the success of the recovery plan that the local community has an awareness and understanding of the plan and the issues it addresses, and is involved in its implementation. The plan will set research priorities, promoting research that increases our ecological knowledge of the endangered ecological communities. Guidelines have been produced, covering such things as bush regeneration, seed collection, replanting, and ecological fire management and these can be found in DEC 2005.

**29. What proportion of the current extent of the ecological community is protected in a reserve system?**

Only 880.2 ha of the remaining remnants of Cumberland Plain woodland is currently protected in a reserve system. This represents only 0.7% of the remaining 11,054 ha of the ecological community (DEC 2005).

Sites that contain remnants of Cumberland Plain woodland can be found in:

- Bents Basin Nature Reserve
- Burratorang State Conservation Area
- Cattai National Park
- Fairfield City Farm
- Kemps Creek Nature Reserve
- Leacock Regional Park
- Mulgoa Nature Reserve
- Mount Annan Botanic Garden
- Noorumba Nature Reserve
- Nurragingy Reserve
- Plumpton Park
- Rouse Hill Regional Park
- Scheyville National Park
- The Crest Reserve
- Western Sydney Regional Park
- William Howe Regional Park
- Windsor Downs Nature Reserve

**30. Provide data that demonstrates why the ecological community meets at least one of criteria for the nominated category of threat.**

*Criterion 1: Decline in geographic distribution.*

Cumberland Plain woodland once covered an estimated area of 125,000 ha, about 30% of the vegetation of the Sydney district east of the Nepean-Hawkesbury River (Benson and Howell 1990b and 2002). It has since been extensively cleared by two centuries of agriculture and urban development (Benson and Howell 2002).

Since European settlement the reduction in Cumberland Plain woodland has been extensive, with the community now highly fragmented in many disconnected fragments. In a study conducted by Cumberland Plain botanical expert Doug Benson of the National Herbarium of NSW, the area of vegetation types found in Cumberland County (the County of Cumberland includes about 80% of the Cumberland Plain) in 1788 were compared with those of 1990 (Benson and Howell 1990b). In 1788 Cumberland Plain woodland occupied approximately 107,000 ha and by 1990 there was only 6,420 ha or approximately 6% of the pre-European extent (Benson and Howell 1990b). Similar reductions also occurred in Cumberland Plain areas outside the County of Cumberland.

The most recent assessment of the extent of Cumberland Plain woodland fragments was conducted by Mark Tozer in 1997. This included an assessment of the entire distribution

of Cumberland Plain woodland (not just those in the County of Cumberland). Table 3 shows the results of his study. The pre-European extent of Cumberland Plain woodland was 125,449 ha, whereas in 1997 there was only 11,054 ha remaining. This represents a decline of 91.2% since European settlement.

Of the current extent of Cumberland Plain woodland, only 80.2 ha or 0.7% of remnants are found in conservation reserves (DEC 2005). This leaves the remaining 99.3% vulnerable to threats such as land clearing and the invasion of exotic weeds, especially in this area in which the urban demand for land for development is high. Tozer found that in the Cumberland Plain, nearly all recorded species were present five times or less and 22% were recorded only once. This suggests there is a high likelihood that further clearing will lead to a loss of floristic diversity (Tozer 2003).

Another future reduction in range will come with the introduction of the Growth Centres Conservation Plan for western Sydney. This is a 30-year planning document detailing two areas of urban growth (northern and southern) in western Sydney (Growth Centres Commission 2007). The plan seeks to obtain “biodiversity certification” from the NSW Minister of Environment, which if granted would mean that no further assessment of the impacts of development on endangered species or communities is required for urban development. 2,001 ha, or 18% of Cumberland Plain woodland is found within the area targeted by the Plan. Of this, 1,329 ha will be destroyed with only 672 ha protected. This represents a loss of 66% of the Cumberland Plain woodland within the Growth Centres and a loss of 12% of the total community, bringing the percent lost since European settlement to 7.7%.

*Criterion 2: Small geographic distribution coupled with demonstrable threat.*

As mentioned in the previous section, there is only a small proportion of Cumberland Plain woodland remaining (8.8%) and this is severely fragmented. The remaining Cumberland Plain woodland can be considered to have a small distribution that is very restricted. That is, it has patch size that is generally less than 10 ha. From question 16, the median patch size is only 3.3 ha (Tozer 2003).

This small patch size is a very large problem when other threats are considered. There is a wide range of demonstrable threats (exotic plant species, land clearing, fragmentation) which significantly impact Cumberland Plain woodland, and which have been discussed in question 23. These threats are all exacerbated by the occurrence of Cumberland Plain woodland in an area much sought after by developers for urban and suburban development. As such the normal threats to native vegetation are magnified, as illustrated by the proposed NSW Growth Centres Plan which openly intends to clear 2,001 ha of the remaining community.

## **Additional information on legal status**

### **31. Does the ecological community have legal protection under other legislation or political agreements?**

Cumberland Plain woodland is currently protected as an endangered ecological community under the NSW *Threatened Species Act* (1995).

## **Additional information on distribution**

### **32. Give locations of sites for proposed management, preferably that have been identified in recovery plans.**

The existing conservation reserves as mentioned in question 29 are the main sites for proposed management, in particular Scheyville National Park and Western Sydney Regional Park. There may be other sites for proposed management.

## **Conservation Advice**

**33. Give details of recovery actions that are or could be carried out at the local and regional level.**

The NSW DEC has prepared 'Guidelines for best management' for communities of the Cumberland Plain (DEC 2005). This plan includes possible actions that could be implemented to recover these communities. As more than three quarters of endangered bushland of the Cumberland Plain is in private ownership the Guidelines state that protecting remnants is the top priority and there are three key steps to better management: to retain all existing native vegetation where possible, protect any retained native vegetation and to manage all retained and protected native vegetation (DEC 2005).

Restoration of degraded remnants that currently reside in conservation areas is necessary. This includes erosion control, revegetation, watering, fencing and weed and feral animal control. Restoration has been and continues to be carried out by community groups and local council groups.

Additionally, more effort is needed to encourage private landowners to enter into conservation agreements in order to protect the remnant community patches without the land having to be sold. Since such a vast majority of the remaining community exists on private land, this should be a priority to be addressed by both the NSW Department of Environment and the Commonwealth Department of Environment and Water Resources.

Of vital importance in terms of conservation rather than recovery is the immediate rejection of the proposed NSW Growth Centres Plan which intends to clear 2,001 ha, or 18%, of the remaining Cumberland Plain woodland.

## Community Networks

**34. Is there an existing support network for the ecological community that facilitates recovery?**

Apart from Local Governments, there are a number of groups that perform restoration/recovery of remnants of Cumberland Plain woodland. These include:

- Greening Australia
- Earth Repair and Restoration
- NSW National Trust Bushland Management
- Conservation Volunteers Australia
- Banksia Ecology

## Survey Methods

**35. Describe methods for identifying the ecological community including when to conduct surveys; length, intensity and pattern of search effort; and limitations and expert acceptance; recommended methods; survey-effort guide.**

The methods used to identify Cumberland Plain woodland could be similar to that used by Tozer (2003). A survey could be conducted at any time of the year but should be conducted in fine weather and at a time of day to ensure sufficient day-light. Tozer's methods for height range and recording species should be followed and the community identified using the requirements listed in question 7.

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

The community is distinct in that *E. tereticornis* and *E. moluccana* may make up 70% of the total basal area and 60% of the total stem density of sites examined (Benson and Howell 1990a). It can be detected using this factor as well as the other composite species mentioned in question 8 and factors such as soil type and annual rainfall.

## Other

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

This nomination seeks to upgrade the listing of the Cumberland Plain woodland from its current listing as an Endangered Ecological Community under the *Environment Protection and Biodiversity Conservation Act 1999*, to a Critically Endangered Ecological Community. Since the original listing, there does not appear to have been a further reduction in range but the heightened threat of future range reductions and the loss of ecological function warrant an upgrading.

The nominator believes that the community meets Criterion 1, and 2 for a Critically Endangered Ecological Community listing. Under Criterion 1, the community has undergone a very severe decline in geographic distribution. Once covering 30% of the Sydney district east of the Nepean-Hawkesbury River, the Cumberland Plain woodland is now reduced to a multitude of fragments representing only 8.8% of the original extent. Under Criterion 2, the geographic distribution of the remaining community is very highly restricted and fragmented, and threatening processes such as land clearing and invasion by exotic weeds would cause it to decline in extent or ecological function over time.

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Tozer, M. (2003). The native vegetation of the Cumberland Plain, western Sydney:  
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1-75

**39. Has this document been reviewed and/or relevant experts been consulted?**

This document has not been reviewed.

The only relevant expert consulted was [REDACTED]  
from the NSW Department of Environment and Conservation.