NSW SCIENTIFIC COMMITTEE

Manager, Biodiversity and Vegetation Programs
Office of Environment and Heritage
PO Box A290
Sydney South NSW 1232

Attention: Biodiversity Banking and Offsets Scheme Review

Dear Sir / Madam,

The NSW Scientific Committee wishes to make a number of comments with regard to the review of the NSW BioBanking Scheme. Our comments will focus on three key components of the scope of the review, namely:

i) the performance and cost effectiveness of BioBanking;

ii) the extent to which the scheme is achieving its goal of maintaining or improving biodiversity conservation; and

iii) the operation and use of the *BioBanking Assessment Methodology* and its relationship with similar methodologies.

Summary

The NSW Scientific Committee has a number of concerns with the operation of the BioBanking Scheme and the foundations upon which it is based. As currently operating, and even with the suggested revisions in the Discussion and Methodology papers, the Scientific Committee is of the opinion that the scheme fails to achieve its critical goal of maintaining or improving biodiversity. We believe that biodiversity decline is inevitable under the current and proposed operations of the BioBanking Scheme through the use of the Assessment Methodology under the *Threatened Species Conservation Act 1995*. Several elements are of concern to the Scientific Committee:

- A large component of this failure to achieve the key goal of 'maintain or improve' is that the data that underpins the *BioBanking Assessment Methodology* is flawed and is counter precautionary. We are particularly concerned considering that many of the flaws in the database underpinning the *Methodology* were highlighted by the Scientific Committee in a letter to OEH in November 2010 and these concerns have been ignored. As a result, we have no confidence that assessments using the BioBanking Scheme and associated *Methodology* can be deemed to improve or maintain biodiversity values. Major issues are: lack of rigorous scientific data to underpin the *Methodology*; a

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counter precautionary approach; failure to consider genetic diversity and climate change; misapplication of what is viable; failure to consider species and communities that are in decline; failure to adopt best practice standards where available; and a lack of rigorous scientific and community participation.

- The suggested change to red flag terminology is inconsistent with both national and international application of the concept of high biodiversity conservation value;
- Reliance on Native Vegetation Type database for eastern NSW when it has not been properly developed and reviewed for this area; and
- the ongoing costs of the scheme at the expense of investment in other conservation measures.

Introduction

Threatened species are still declining and developments are being approved that are resulting in net harm to species and ecological communities. The NSW Scientific Committee supports the concept of regional biodiversity assessment as a strategic method of minimising biodiversity loss resulting from the failure of the planning system to adequately deal with the cumulative loss of habitat that follows from a case by case approach. The Committee also generally agrees that it would be good to move towards better alignment between the various schemes: biobanking, AOS/SIS, and implementation of the Native Vegetation Act. To be effective in conserving threatened species, regional assessment must take place at a stage in the development of the land when options remain for retention of land that is comprehensive, adequate and representative in terms of its capacity to capture biodiversity in a way that affords some prospect of its indefinite survival as natural self-sustaining populations. However, the option of Biobanking assessment will be most attractive to developers in circumstances where there has already been substantial loss of vegetation from the landscape because this is where there is a lower probability of convincing the courts, using existing TSC Act provisions, that an individual development will have no significant effect on threatened taxa.

Threatened species are often rare, which presents difficulties both for their survey and for predicting their distribution. Species that are rare are prone to local extinction due to stochastic processes, often resulting in a loose relationship between vegetation type and the precise location of threatened species. Our knowledge of the distributions of threatened species is therefore generally poor, which means there must be sufficient redundancy in any reserve system to capture the as yet unknown locations of threatened species within a probability envelope as well as the stochastic process of local extinction and recolonisation that drives their distributions. There is little option for including redundancy, however, in the heavily cleared landscapes in which the option of a Biobanking approach is most attractive to developers.

The Scientific Committee applauds the attempt, and appreciates the difficulty, of designing objective assessment methods, based on science, to determine the relative impacts on biodiversity of different approaches to habitat loss. Notwithstanding that the *BioBanking Methodology* has been based on a series of studies and has had a limited peer-review, the *Methodology* fails to adequately support the intent of 'improve or maintain biodiversity values'. Rather, the *Methodology* is a mechanism whereby biodiversity loss may be reduced in some circumstances. In this regard, there are a number of fundamental issues that remain including a number of flaws and assumptions described below. Consequently, use of the

"*Methodology*" is likely to result in the ongoing decline of many threatened species and ecological communities. Moreover, it is likely to result in new species and ecological communities becoming threatened, i.e., it will not stop the decline of species currently considered to not be threatened. A renewed focus on the declaration of critical habitat, increased attention to recovery planning and action, and particularly the implementation of threat abatement plans is likely to have greater benefits to biodiversity conservation than providing a black box approach to assessing development impacts.

The NSW Scientific Committee has identified several main issues relevant to the review of the BioBanking Scheme. None of these issues have been adequately addressed in the previous peer review (DECC 2007a) or public consultation phases of the Methodology (DECC 2008b). These issues are:

Inappropriate changes to terminology

The proposal to change the term 'red flag' to 'high biodiversity conservation value' carries the implication all others areas are not of high biodiversity conservation value. This is confusing and places the document out of context with biodiversity conservation planning in NSW and elsewhere. Areas of high biodiversity conservation value may be identified for a broad range of reasons eg. comprehensive, representative, unique, resilience capacity, connectivity, refugial, keystone, indicators, key functional types, species richness (and many others) and NOT just in relation to a narrow interpretation of threatened species and ecological community risks of extinction. Given the limited assessment under the BioBanking Scheme and the long list of issues not considered (see points below), the use of this terminology in the BioBanking Scheme is misleading, and inappropriate. It also risks undermining other conservation measures not solely focussed on threatened species and ecological communities by creating confusion in the terminology used by OEH, the government and the community (both scientific and the broader public). We suggest that the 'red flag' term used previously is more appropriate than 'high biodiversity conservation value'.

Failure to adequately assess biodiversity impacts and cost effectiveness of the BioBanking Scheme

Section 2.2 of the Biobanking Review Discussion Paper states that "...it is too early to meaningfully assess cost effectiveness and biodiversity improvements on individual sites."

However, this should not preclude a thorough explanation of when and how a 'meaningful' assessment would be undertaken in the future. The document should include a suitable framework for this future assessment including:

1. At what point in time would an assessment be 'meaningful'?
2. How and when will these assessments be carried out?
3. What measures will be used to evaluate the effectiveness of the scheme to improve biodiversity? Is it just a repeat of the 'Methodology' at each site?

The Monitoring, evaluation and enforcement details described in section 3.1.6 of the BioBanking Review Discussion Paper focus very heavily on compliance, rather than on evaluating the effectiveness of the scheme to improve biodiversity. From the description of the monitoring framework in this section it appears that the only information being collected is to ascertain if actions have been implemented by landowners, not what the impact of the actions has been. Photo point surveys and visual inspections to collect information are

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identified, but these may offer little scope for monitoring changes and associated impacts of management actions.

More information is required on how monitoring will feed in to an assessment of the objectives of the program, particularly biodiversity improvement. What are the mechanisms, then, for making changes and improvements to the program in light of monitoring findings - i.e. the adaptive management claimed?

Costs to OEH

To date, OEH costs over income have been very large (over ~$400k for 2010/11). This is a significant loss of financial resources that could otherwise have been used for biodiversity conservation measures. Over what timeframe can such losses be justified?

Single national approval process

The suggestion of moving to a single national approval process should not be tied to the current review of the BioBanking scheme. This single approval process may be a long way off given the difficulties that need to be addressed, e.g. states all have different criteria for assessing threat status; some states do not include ecological communities in their listings; the Commonwealth restricts their listings of ecological communities by arbitrary condition classes in contrast to the states; the Commonwealth like to amalgamate communities into broader national listings, etc. All these types of issues, which have been raised already in the process arising from the Hawke review of the EPBC Act, will need to be resolved before there can be any consideration of a national biobanking scheme.

Reliance on Native Vegetation Types and Vegetation Benchmarks Database

The Assessment Methodology relies on Native Vegetation Types (Section 2.2) as surrogates for biodiversity values. This section states that ‘There are approximately 1600 vegetation types, 99 vegetation classes, and 12 vegetation formations in New South Wales.’. While the vegetation classes and formations of Keith (2004) are mapped, there is no mapping of the Native Vegetation Types across NSW. The OEH Vegetation Classification and Mapping Information Section has informed the NSW Scientific Committee that the current set of Native Vegetation Types is only appropriate for central and western NSW and should not be applied to coastal NSW (the area where the bulk of biobanking is being considered). Consequently it would seem that this supposed foundation of the BioBanking scheme should not be applied in the current areas where biobanking is operating.

The Vegetation Benchmarks Database contains no information on the scale used for species richness categories, or cover classes. There is also a lack of referencing to justify the range of benchmarks being used.

BioBanking Assessment Methodology

Here we address the flaws in the Methodology and the database that underpins the Methodology. In summary, the Methodology is ecologically simplistic, poorly supported by science and the ecological interpretations made are biased toward <1% of the biodiversity in NSW, ie mobile vertebrates, and hence inappropriate for most of the threatened biodiversity in NSW. Major points are:

1. The lack of rigorous scientific data to underpin the scheme, including the Threatened Species Profile Database (TSPD); The Scientific Committee is of the opinion that the TSPD is flawed, that it should not be used in any assessments in its current form and recommends that a more precautionary approach is needed. In addition, there are problems with: i) the assessment of the large number plant species that are not long-lived, with the current methodology likely to grossly underestimate the offsets required for such species; and ii) the interpretation of what is viable.
2. Lack of a precautionary approach when data is non existent or limited (including assumptions of complete and comprehensive knowledge; assumptions about what is viable; assumptions about the fate of unprotected land; and assumptions that loss of vegetation can be balanced by offsets: inappropriate sampling of abundance in many plant taxa).
3. Failure to consider conservation of species at the genetic level. The Scientific Committee feels that this is a major flaw in the *Methodology* and that there is sufficient scientific expertise and knowledge to attempt to incorporate conservation at the genetic level into the scheme.
4. Unsupported suggested changes to earlier versions of the methodology, for example increased minimum remnant size from 4 to 10 ha.
5. Failure to consider the impacts of climate change. Key issues such as exacerbation of existing threats by a changing climate, emergence of new threats, along with a broad range of conservation planning strategies for resilience and adaptation to a changing climate need to be incorporated. The TSPD also does not address this threat, nor how it interacts with other existing threats.
6. Failure to address the increase in the numbers of species moving from not threatened to threatened. Biodiversity cannot be 'improved or maintained' by only considering those species currently listed as most threatened, nor by only protecting red flag areas. This is simplistic and ignores the first two objectives of the *Threatened Species Conservation Act* (to conserve biological diversity and promote ecologically sustainable development, and to prevent the extinction and promote the recovery of threatened species, populations and ecological communities). Clearing is also listed as a key threatening process in NSW under the *TSC Act,* and the *Methodology* may instead perversely lead to more species being listed as threatened in NSW and ongoing decline in listed threatened species and ecological communities under the guise of 'improve or maintain'.
7. Failure to adopt best practice standards where available. There is sufficient literature to adopt international standards of risk assessment for both species and ecological communities and to consider all attributes relevant to extinction risk, rather than simply one (reduction in distribution since the year 1750).
8. Excludes rigorous scientific and community participation. The lack of reliance of peer-reviewed data and reliance on expert opinion undermine the defensibility of the *Methodology*.

These issues are discussed in detail below:

1. *Lacks sound scientific underpinning*

<u>Threatened Species Profile Database</u>

The Threatened Species Profile Database (TSPD) is based on information from expert panels (DECC 2008a). This database was not reviewed during the 2007 peer review of the

Biobanking Assessment Methodology (DECC 2007a). The database is critical for a number of issues in the operation of the *Methodology,* eg. 'The improve or maintain test is based on an ecologically rigorous assessment process, which will incorporate the best and most up-to-date data available for vegetation and threatened species.' (DECC 2008b). In the opinion of the NSW Scientific Committee, the TSPD is flawed and cannot deliver a scientifically rigorous assessment of a species' ability to respond to improvement through management actions. The red flag and credits methodology assumes large amounts of information for which we can see no reliable published source nor for many cases any reasonable inference from other published sources. Moreover, where relevant published information does exist in the literature, conflicting values often appear in the Threatened Species Profile database (see specific examples in Appendix 1).

Much of the supposed 'expert opinion' is simply guesswork and there is no reliable information that would justify many entries. There are major assumptions about the improvement to a species in relation to management that are unrealistic and assume each threat acts independently, and that by addressing a single threat a response may be initiated (e.g., Table 2, p 9). Rather, there may be interactions between threats, or there may be a few major threats that if not dealt with may render all other threat mitigation ineffective. As well, the concept of scoring gain values of 0.60 (p. 44) where there is no data is dubious and a precautionary approach would be to have a minimal gain in these species as is the pattern for many taxa where there are available data (see below). The consequences of the above points lead to an inflation of the T_G score and an underestimation of the required offsets.

It is apparent in the Threatened Species Profile Database that where more is known about a particular species, there is a recognition of a lower potential for management actions to be effective. This reflects the difficulties of managing complex interacting threats impacting on threatened species. Hence, the database overestimates T_G for most species (as most have little known about them) and as a consequence underestimates the required offsets. For example, for species for which we have a detailed knowledge of the way in which fire is critical to their life histories (Bradstock et al. 1995, Auld and Bradstock 2000, Keith et al. 2002, Auld and Ooi 2008), there is a limited ability to successfully implement on-going fire management to control threats. This limited ability to manage threats is reflected in the database for some well studied species. However, for most threatened plants that occur in fire-prone habitats we have little knowledge of their fire response (apart from simple resprouting or not), but the database considers there to be a moderate or good ability to control threats in these taxa. Instead, these taxa face the same fire management challenges as the species we know have a limited ability to respond and consequently a precautionary approach for all fire-prone species would be to score them as having a limited ability to respond to threat management. Furthermore, the degree of uncertainty in our ability to effectively manage fire will increase under a changing climate and an increased risk of higher fire frequency. As a consequence many more species should be identified in the database as poorly known (one trigger for red flagging an area).

The database also includes a column to flag whether a species is 'able to withstand loss'. Loss of any individuals of any threatened species is likely to lead to decline and an impressionistic, desk-top judgement of what can be tolerated should not be imposed. Similarly, the column for the 'number considered a negligible loss' cannot be supported by any published studies and should not be used. The "data" are therefore totally speculative and call into question the whole concept of using a numerical "methodology". At the very least all of this ignores the importance of the conservation of the genetic diversity within a species across its range, and the role of soil seed banks in the life history of plants.

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For virtually all threatened taxa there is a shortage of data on life history characteristics, and there are almost no data on the relative success of management actions that may ameliorate threats. Even where data exist in the scientific literature, the database frequently overestimates the ability to control threats and the extent of available knowledge. We have illustrated this issue using a series of examples (see Appendix 1).

Threatened Species Surveys

In part 3.4 of the Biodiversity Assessment Methodology document, survey work may be undertaken to assess either:
(a) the area of habitat likely to be impacted by development or management actions (for fauna species and flora species where indicated in the Threatened Species Profile Database), OR

(b) the number of individuals likely to be impacted by development or management actions (for flora species).
For plants (b, above) this will only be appropriate for long-lived taxa. Species that are relatively short-lived (usually <10-20 years), or spend only short periods above ground, may be present as soil seed bank, or dormant organs such as bulbs, rhizomes etc in the soil. In such cases most assessments of the number of individuals at a site do NOT give a true representation of the potential abundance of the species at the site. In such cases, any estimate of abundance will ONLY be appropriate if sampling is done when abundance is maximised. This will depend on the life history and ecology of individual taxa. The best working example of this is given by Auld and Scott (2004) for the endangered species *Grevillea caleyi* which occurs in fire-prone habitats.

2. *Lack of a precautionary approach*

Assumption of complete and comprehensive knowledge

The *Methodology* assumes that there is currently a complete and comprehensive knowledge of threatened species and ecological communities in NSW. For example on Page 1 it states that the Methodology "assesses the biodiversity values currently at development sites and biobank sites, and describes the process for measuring the loss of biodiversity values on a development site from removing native vegetation, threatened species habitat and threatened species, and the gain in biodiversity values on a biobank site from protecting native vegetation, threatened species habitat and threatened species, and from undertaking management actions that improve native vegetation, threatened species habitat and threatened species" The reality is that current TSC Act listings are subject to dynamic change as new knowledge allows re-evaluation of extinction risk. Changes may result from better understanding of the nature of the entities being listed (e.g., for species and populations, improved taxonomic, distributional, ecological, and demographic knowledge; for communities, revised concepts of how to define ecologically meaningful communities).

The *Methodology* assumes that all species are currently listed at the most appropriate threat status. This assumption fails because the Critically Endangered category is poorly documented in NSW. As this category is a relatively recent addition to the *TSC Act*, few taxa are currently listed in the Critically Endangered category, and while the Scientific Committee has reviewed a subset of Endangered taxa, most have not yet been reassessed against the criteria for the Critically Endangered category. As the higher threat status (Critically

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Endangered) is likely to impose non-variant red flags more than an endangered listing, this is a fundamental failing in the *Methodology*.

For mammal and bird species, we can assume that the existence within NSW of nearly all species is known, with relatively minor changes to be expected in distributional, taxonomic and demographic-trend understanding which may result in changes of category, or some de-listings, for currently listed species. Knowledge of reptiles, amphibians, and vascular plants is less well developed; most species are at least known (although there is a steady trickle of entirely new plant species recognised each year in NSW), but numerous changes in listing status are to be expected as demographic and distributional knowledge improves or actual extinction risk changes. For example, despite significant progress by the Scientific Committee in reviewing the Schedules over the last three years, many species in these groups that are currently listed as Endangered or Vulnerable have yet to be re-assessed against the recently introduced criteria for Critically Endangered status which commenced in October 2005. Similarly, the status of non-endemic Vulnerable species also needs periodic review. Even for these relatively well known groups of organisms, there are large numbers of un-listed taxa and populations (along with ecological communities) that might well qualify as 'near-threatened' but which have as yet been neither reviewed nor nominated for listing. As the processes causing biodiversity loss continue, the number of entities in this category can be expected to rise, and State policy needs to be able to anticipate and adapt to larger numbers of 'listed threatened' and 'near threatened' entities. For all other types of organisms, there are much greater knowledge shortfalls, and hence current listings are less comprehensive and more subject to change in the light of better scientific knowledge. Few invertebrates, non-vascular plants and fungi have been listed or considered for listing. Finally, the consideration of threatened ecological communities is also in its infancy and the current *TSC Act* schedules do not yet reflect the real extent of threatened communities in NSW. Hence the current *TSC Act* listings form only a subset of what should be listed as threatened in any areas to be considered for Biobanking. To assume that the current listings and protection measures for the currently-listed species can act as a surrogate for those taxa and ecological communities that are not currently listed is not valid, especially where such species/communities only occur in small numbers or geographic areas. Determining the conservation status of species is very much a work in progress, with the Scientific Committee listing more than 270 species and 100 communities since 1996.

The *Methodology* assumes that threats to biodiversity are known, understood and can be effectively managed. Clearly, the emerging impacts of climate change and their interaction with existing and novel threats (eg. Ooi *et al.* 2009; 2012) negates this assumption. Essentially the whole document ignores the impacts of climate change and hence severely restricts the available adaptation measures in relation to a changing climate. There is considerable potential for single events or threatening processes (e.g. introduction of pathogens, such as the recent introduction of Myrtle Rust) to radically and very rapidly change the risk status of a whole range of species, populations and communities.

<u>Assumption that unprotected land will be lost</u>

A fundamental assumption for biobanking is that land that does not have formal protection will eventually be lost. This is, in effect, an admission that existing State biodiversity policy and legislation are failing, including the *TSC Act*, the *Native Vegetation Act* 2003 and the *Catchment Management Authorities Act*. The Scientific Committee considers that where development is continuing to destroy the habitat of threatened taxa, this is not due to a failing of the Act itself, but rather in its interpretation by determining authorities and in a lack of compliance enforcement. However, the *Methodology* does not improve existing legislation by replacing the need for determining authorities or compliance. Although providing determining authorities with the *Methodology*, biobanking transfers the assessment from a transparent process to an algorithm of dubious scientific merit. The *Methodology* also acknowledges that enforcement is still required to ensure that the habitat value of land is not deliberately degraded prior to assessment and that long term habitat improvements are fully implemented. If regulation of illegal clearing is currently difficult, how likely is it that habitat devaluation will be controlled? The *Methodology* does not eliminate existing difficulties with the Act, yet it makes compromises that will have negative effects on threatened taxa. More rigorous application of the existing provisions of the Act will result in decreased loss of land that does not have formal protection.

Land without formal protection will also be retained if its characteristics are unsuitable for development, e.g. flood-prone land or land on steep slopes. To assume that this land will be lost and therefore allowable as a biodiversity credit, discounts the value of red-flagged areas. Such land should be excluded from land available for biodiversity credits.

<u>Assumption that loss of vegetation can be balanced by offsets</u>

The BioBanking Scheme assumes that loss of vegetation can be balanced by offsets. Issues such as time lags, ongoing impacts of loss on species and community decline, etc are ignored (Burgin 2008; Bedward *et al.* 2009; Moilanen *et al.* 2009). Furthermore, it assumes that vegetation and habitat loss outside of red flag areas is acceptable and will not affect the 'improving or maintaining biodiversity values'. Clearing of native vegetation (at all spatial scales) is listed as a Key Threatening Process in NSW and in the opinion of the Scientific Committee will have an impact on threatened species and cause species to become threatened. This is not compatible with 'improving or maintaining biodiversity values'.

The *Methodology* needs to clarify its application to different spatial and temporal scales. It lacks an explanation for the different spatial scales used in different parts of the assessment process including the "development site", CMA subregion, CMA area, 1000 ha assessment circle and Mitchell landscape. There is also no clear time-frame over which the desired maintenance or improvement of biodiversity will occur. It appears to discount the future, trading immediate loss for potential future gain by relying on long-term habitat improvements being fully implemented despite an uninspiring history of restoration in Australia. Moreover it makes assumptions about the likely cost of future management actions, without substantiation.

More fundamentally, the assessment, in only dealing with currently listed threatened species, assumes no value for declining species and ecological communities that, whilst under threat, have not yet reached the stage where they could be considered threatened under the TSC criteria. It also assumes vegetation types can be surrogates for general ecosystem biodiversity values. There is a diverse literature covering this subject and although vegetation may be a useful surrogate in certain circumstances it is not appropriate to consider vegetation as a surrogate for all organisms across all vegetation types and landforms. For example

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vascular vegetation cover may be a poor predictor of bryophyte and lichen diversity. This reinforces the likelihood of negative impacts on these taxonomic groups. In addition, no complete NSW vegetation typology has yet been assembled, reviewed, and published, although significant progress is being made towards this. Even so, any typology likely to be useful for scientific adaptive management needs to be constantly exposed to scientific critique and improvement, and many ecological communities need to be regarded as dynamic, not static entities in relation to extinction risk through time.

3. *Lacks consideration of genetic diversity*

The Methodology essentially gives no weight to the conservation of genetic diversity within species. By focussing on a few large patches of vegetation and allowing small patches across the landscape to be lost, the *Methodology* does not consider the effect of the loss of vegetation on the genetic composition or diversity of species or populations. Ensuring that sufficient genetic diversity is retained in species and populations is essential if they are to adapt under ongoing environmental change in the coming decades and centuries. The maintenance of diversity at the genetic level is a key component underpinning the conservation of biodiversity (one of the major objectives of the TSC Act).

As populations become smaller the available genetic pool is also narrowed, limiting the number of individuals available for mating. This leads to inbreeding and frequently reduced fitness (ie inbreeding depression) and elevates the probability of population extinction (Frankham 2005). For example, in plants this loss can induce inbreeding effects such as reduced seed production or poor quality seed that fails to germinate and thrive, both of which will limit the capacity of populations to produce successive generations.

Rare species that are naturally disjunct with little interaction through pollinator movement or seed dispersal can develop unique genetic signatures including genetic combinations not found in other populations. Removal of these populations is likely to eliminate these genes from the species entirely.

Common species can also exhibit unique genetic combinations, especially if these are growing in environments where selection pressures for particular traits such as water-use efficiency or tolerating saline conditions are strong. Removal of these populations reduces overall species-level genetic diversity and may eliminate important adaptive genetic combinations required to meet environmental change.

Whilst it may not be practical to sample all genetic variation, there has been sufficient work on this field to predict the pattern of diversity across a range of taxonomic groups or to provide information relevant to conservation planning (eg. Hogbin et al. 2000, Ayre & Hughes 2004, Frankham 2005, 2010). Frankham (2010) stresses that ‘for genetic management in the wild, the main challenge is to apply well-established genetic principles to management’. This may allow some practical guidelines to be developed that would assist in incorporating the conservation of genetic diversity into the *Methodology*. The suggestion that genetic diversity may be conserved by enhancing one patch of vegetation whilst clearing another is essentially erroneous for many taxonomic groups. As Frankham (2005) correctly suggests ‘If genetic factors are ignored, extinction risk will be underestimated and inappropriate recovery strategies may be used.’

4. *Unsupported suggested changes to earlier versions of the methodology*
The suggested modification to the interpretation of what is viable (5.3.1.2, Highly cleared vegetation types) ie an increase from 4 to 10 ha, is not based on any sound science, is counter precautionary and ignores the issues raised below (point 8) on viability. The suggested change will allow further loss of these areas of identified high conservation value. Small areas may still be viable and play a key role in both species persistence, refugia and stepping stones and it is inappropriate to assume otherwise. Many remnants of critically endangered communities may be smaller than 10 ha, particularly in urban areas. Tozer (2003) highlights this for the Cumberland Plain area of western Sydney. He states that "While it is frequently assumed that the conservation value of a remnant is proportional to its size, the results of this survey suggest that this assumption is inappropriate for conservation planning on the Cumberland Plain. First, small remnants constitute a large proportion of the remaining vegetation therefore the protection of these remnants is required to maintain vegetation cover at its present level. Second, although there was some evidence that small remnants were more susceptible to impacts from adjoining lands, many still contained a high diversity of native species and relatively few weeds. Third, given the large number of rare species recorded in the survey, the protection of all remnants is required to minimise the loss of floristic diversity." The consequence of the suggested change from 4 to 10 Ha could then be the increased risk of extinction for critically endangered communities in metropolitan areas.

5. *Failure to consider the impacts of climate change.*

Key issues such as exacerbation of existing threats by a changing climate, emergence of new threats, along with a broad range of conservation planning strategies for resilience and adaptation to a changing climate need to be incorporated. The TSPD also does not address this threat, nor how it interacts with other existing threats.

6. *Failure to address the increase in the numbers of species moving from not threatened to threatened.*

Biodiversity cannot be 'improved or maintained' by only considering those species currently listed as most threatened, nor by only protecting red flag areas. This is simplistic and ignores the first two objectives of the *Threatened Species Conservation Act* (to conserve biological diversity and promote ecologically sustainable development, and to prevent the extinction and promote the recovery of threatened species, populations and ecological communities). Clearing is also listed as a key threatening process in NSW under the *TSC Act*, and the *Methodology* may instead perversely lead to more species being listed as threatened in NSW and ongoing decline in listed threatened species and ecological communities under the guise of 'improve or maintain'.

7. *Failure to adopt best practice standards where available*

For vegetation types, high biodiversity conservation values (see p 32) are based on a single value for decline (70%) and an unpublished Vegetation Types Database. The IUCN and the NSW Scientific Committee use thresholds that are different from those in the *Methodology* for assessing conservation status in relation to decline (IUCN 2011, NSW Scientific Committee 2010). For example, these guidelines use a 50% decline threshold over three generations for Endangered status if the reduction may not have ceased or may not be understood or may not be reversible (as is frequently the case). The *Methodology* should explain why these conventional thresholds are not used and provide the grounds for adopting a 70% decline figure. It should also provide the basis for the adopted thresholds for habitat condition.

The *Methodology* also fails to fully consider the key elements used in determining the conservation value and status of species and ecological communities. The IUCN details criteria that can be used to assess the conservation status of species (IUCN 2011). For ecological communities, comparable elements exist along with consideration of loss of ecological function (Threatened Species Conservation Regulation 2002). However, the *Methodology* fails to properly consider all these elements in assessing red flags, variations to red flags and high biodiversity conservation areas. Instead, a high weight is given to decline as the key threat issue for communities, ignoring spatial distribution and loss of ecological function, etc. (For example, in Section 5.3.1.4, red flags can be varied if there is a 'relatively abundant' area of a community remaining.) As threat status is not based only on geographic distribution but rather, on a combination of either decline, geographic distribution or loss of ecological function, it is not appropriate to single out relative size of remaining area as a sufficient factor to vary a red flag. At any rate, terms such as 'relative abundance' (5.3.1.4) are not clearly defined and appear subjective.

8. *Excludes rigorous scientific and community participation*

<u>Relies on attributes for which little data are available</u>

The *Methodology* does not acknowledge: 1) that there is as yet inadequate plot data in many regions, 2) that rapid, surrogate-based survey does not substitute for exhaustive plot-based survey plus diversity survey; and 3) that our present state of knowledge has been built upon a published, peer-reviewed, and iterative refinement of knowledge for both species and ecological communities. Such a process continues to be necessary for both knowledge accumulation and for successful adaptive management of our biodiversity.

In particular, the section on viability (5.3.1ff) lacks a literature base and focussed, ecological context as justification for the implications given. The implied definition of viability (5.3.1.3) ignores demographic parameters, life history traits and threats and is not consistent with the application of this term in the ecological literature. Viability will vary for different taxa at different spatial scales and threat types. The *Methodology* makes the assumption that condition, remnant size, distance to nearest neighbour, tenure, and funding availability are the key issues that control viability of a species at a site. While there is literature on birds and mammals supporting the inclusion of remnant size and distance to nearest neighbour as elements that affect species viability, factors that control most species viability are far more complex. For example, published data for plants provides evidence that many plant sub-populations are viable in small isolated remnants (in direct contrast to the inferences from the text in 5.3.1.3 a and b). There is no consideration of life history characteristics and threat levels and types. This whole section needs to be re-drafted and replaced with a consideration of the local viability of biodiversity which is not solely vertebrate focussed.

As well, there will be major climate change impacts on biodiversity and this section should include the role of stepping stones and other key elements on the conservation strategies to maximise resilience and adaptation to a changing climate (e.g. keystone dispersal agents, role of small patches of vegetation in biodiversity conservation, see Dunlop and Brown 2008, DECCW 2010). This issue has been raised in the public comments phase of the earlier

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Methodology e.g. ‘Definition of red flags should include other areas such as stepping stones, refugia and regional climate change corridors, and consider ecosystem and landscape function issues.’ (DECC 2008b). The response ie. ‘*The inclusion of these factors would increase complexity to the identification of red flag areas. However, DECC recognises the importance of corridors and refuge areas in the assessment of biodiversity values, and the contribution of small patches of vegetation…*’ (DECC 2008b) is limited as it focuses solely on corridors and refuge areas. The *Methodology* needs to incorporate the issue that resilience to climate change involves many different conservation strategies (DECCW 2010).

In addition, loss of remnant vegetation is often associated with a loss of genetic diversity in a species and consideration of the conservation of genetic diversity needs to be addressed in relation to site viability.

There is an assumption that OEH has identified all vegetation linkages relevant to biobanking. Given that climate change has not been addressed in the methods, this assumption is not valid. The role of vegetation remnants for stepping stones, refugia, adaptation *in situ*, remnant patches across climatic gradients, etc needs to be addressed.

<u>Excludes community participation</u>

The TSC Act presently provides quality control by allowing organizations or individuals to challenge assessments in the court by producing alternative expert advice. The core elements of the *Methodology*, such as how extinction risk is addressed, the focus on red flags to the detriment of other biodiversity, and a reliance on the TSPD, need to be supported by peer-reviewed research and data. This is either currently lacking or the *Methodology* fails to adequately address what literature and data exist. In theory, an objective science-based assessment process should reduce the need for expert opinion and thus the necessity for alternative opinions. In contrast, the *Methodology* embeds expert opinion (often in contradiction to existing published literature) in the core database that underpins its operation and in doing so accepts inadequate and static data. Given this state of affairs, any third party assessment will be difficult and involve using methods that are incomprehensible to all but the most specialist assessors.

Other minor points

<u>Survey Guidelines</u>

While there are guidelines on the number of transects to be used for a given patch size, there is no guideline on transect dimensions.

Conclusion

As a result of unsustainable development, the earth is currently experiencing the highest rate of extinction since the meteorite impact that ended the age of dinosaurs. Australia has a particularly poor record in terms of recent extinctions. Urbanisation is a key cause of decline and it is therefore important that future development is properly assessed. The *Methodology* generates a false certainty by making assumptions about poorly-known elements of biodiversity to develop a numerical score that has little scientific underpinning. Rather than using a system which leads to a steady incremental gain in knowledge of threatened species, the *Methodology* assumes perfect knowledge already exists and quarantines developers from undertaking the surveys that improve our knowledge. The present system may result in development approval taking longer, but this should not be considered a weakness: rather, it is an indicator that the cost on biodiversity is being considered, and that the impact of any action is properly assessed, which is one of the objects of the Act. The Scientific Committee acknowledges that there are competing societal priorities for land use and the conservation of biodiversity is only one, but biodiversity loss – especially extinction – is irreversible. While the Scientific Committee's responsibility relates to the conservation of threatened species in order to promote biodiversity conservation, we recognise that situations will arise when socio-political constraints result in the loss of threatened taxa. However, we consider that this decision is best made transparently, rather than by introducing an abstract *Methodology* that gives the false impression that all objectives can simultaneously be satisfied.

Yours sincerely

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Appendix 1
Examples of species where the Threatened Species Profile Database does not comply with available scientific literature.

Species occurring in fire-prone areas

For most threatened plants that occur in fire-prone habitats we have little knowledge of their fire response (apart from simple resprouting or not), but the database considers there to be a moderate or good ability to control threats in these taxa. Rather, there is a limited ability to successfully implement on-going fire management to control threats. This is because uncontrollable wildfires may burn over areas independent of previous fire histories or fire management activities. Given the many predictions that under a changing climate there will be an ever increasing risk of higher fire frequency and some high fire intensities (Hennessey et al. 2006; Bradstock et al. 2009), all species occupying fire prone habitats should be assessed as having a low ability to respond to threat management. This limited ability to manage threats is reflected in the database for some well studied species e.g. *Grevillea caleyi*. Many other taxa which are less well studied will also have a limited ability to mange fire threats and an appropriate precautionary approach for all of these is a listing of 'Limited ability to control' due to fire management being difficult. Examples of species in this category include (but are by no means limited to) the list below. This list represents some 150 species and population listings of which only 20 currently recognise fire management as a limitation. Many other taxa also occur in fire prone areas and will be similarly affected (e.g. all terrestrial orchids).

Examples: A number of *Acacia* spp, (e.g. *Acacia baueri* subsp. *aspera*, *Acacia bynoeana, Acacia terminalis* subsp. *terminalis*), *Asterolasia* spp., many *Boronia* spp., *Darwinia* spp., *Dillwynia* spp., *Epacris* spp., several *Eucalyptus* spp., many *Grevillea* spp., *Haloragodendron lucasii*, *Homoranthus* spp., *Kunzea* spp., *Lasiopetalum* spp., *Leionema* spp., *Leptospermum* spp., *Leucopogon* spp., *Melaleuca* spp., *Micromyrtus* spp., *Persoonia* spp., *Phyllota humifusa*, *Pimelea* spp., *Pomaderris* spp., *Pultenaea* spp., *Rulingia* spp., *Tetratheca* spp., *Triplarina* spp., *Velleia perfoliata*, many *Zieria* spp.

Other specific examples

Acacia carneorum

- Not identified as having 'Observed recruitment issues? (e.g., infertility, clonal). This contradicts the published literature. The species lacks seed production at all but two known sites, is highly clonal and has major recruitment issues (Auld 1993).
- Age to first significant flowering is given as 5-10 years. It is likely to be >25 years as young plants spend decades as suppressed juveniles under grazing pressure (Auld 1993, Denham & Auld 2004).
- Seedbank persistence is given as 'persistent soil >2 years'. Data from *Acacia oswaldii* with very similar seeds suggest it is likely to be very short lived in the soil <1 year (Auld 1993, 1995).
- Propagule dispersal distance is given as 'local'. Rather the species, in the rare locations that seed is produced, has bird-dispersed seeds.
- Tg value of 0.63 is grossly overestimated. Under current management to reduce known threats (exotic grazers) the species is still declining across the landscape. This is thought to be due to long-term drought and heat stress under a changing climate. These threats are beyond current management practices.

Darwinia biflora

- The loss of two plants is considered to be a negligible loss. There is no literature to support this claim. Rather, even a small number of above ground plants may support large soil seed banks and hence, much larger populations in the future after the next fire (Auld et al. 1993, Auld and Scott 1997).
- Stated a 'moderate ability to control' in 'Effectiveness of management actions'. However, one of the main threats to the species is too frequent fire and fires producing low soil heating (Auld 1993, Auld and Ooi 2009). There is a very limited ability to control the former (as wildfires will burn over any prescribed fire boundaries on extreme weather days, increasing local fire frequency). There is currently no ability to control the latter in fire management.

Calystegia affinis

- Age to first seed production is given as 2-5 years. Yet seed production has only just been discovered in the wild and nothing about age to reproduction is known (Hutton 2001, Hutton et al. 2008).
- Scored as 'moderate ability to control' in relation to threats. This is overly optimistic as the species is impacted by crofton weed in remote habitats where control is largely ineffective - See DECC (2007b), Hutton 2001, Hutton et al. (2008).
- Claimed to have a persistent soil seed bank. No seed banks are known.
- Claimed to live for 5-25 years. Again this is simply unknown.
- Local dispersal scored. No dispersal event has ever been observed.
- Claimed not to be very poorly known.

Carmichaelia exsul

- Limited ability to control threats claimed. Rather the threats to this species (weeds) are currently beyond control (Hutton 2001, DECC 2007b).
- First flowering/seeding claimed to be 2-5 years. This is simply unknown and is likely to be much longer.
- Senescence age suggested to be 5-25 years. There are no data to support this claim.
- Dispersal is claimed to be local. However, this species has seeds displayed in fruits that indicate bird dispersal.

Cynanchum elegans

- 'Moderate ability' to control threats claimed. In much of the southern part of the range of this species there has been no response to any management actions. Consequently this is more likely 'Limited ability'.
- Age to flowering given as 2-5 years. Rather it is essentially unknown.

Euphorbia sarcostemmoides

- Was known from only one NSW location, but now cannot be found there. Listed in database as 'moderate ability to control' threats. The species is essentially very poorly known.

Haloragodendron lucasii

- Claimed a 'good ability to control' threats. However, one of the major threats is lack of sexual reproduction, while fire management is another. Rather there is a very limited ability to manage threats (Sydes et al. 1996, Williams et al. 1997).

Homoranthus spp.

- Claimed a 'moderate ability to control' threats. However, *Phytophthora cinnamomi* affects these species and is essentially unmanageable.

Leucopogon exolasius

- Claimed a 'moderate ability to control' threats. This underestimates the difficulty of effective fire management in this species (Ooi et al. 2006).

All *Persoonia* spp.

- Claimed a 'moderate ability to control' threats. Fire management is critical for these species. Most are very slow to mature after a fire (Benson and MacDougall 2000, Auld et al. 2007), and some occur in very low numbers at any remnant location. There is currently no effective fire management for these species. The ability to control threats is greatly overestimated.

Phaius spp.

- One species has not been seen in NSW for decades. Neither species is considered 'naturally very rare' or 'poorly known' when they should be. Ability to control threats greatly overestimated.

Solanum karsense

- Claimed moderate ability to manage threats. However, changes to water management and river flows are the key threat to the species (Auld and Denham 2001). Essentially this threat is beyond control at present given the over allocation of water on the Murray/Darling river systems.

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