The precautionary principle: what is it and how might it be applied in threatened species conservation?

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ABSTRACT

The Precautionary Principle is incorporated in law and policy via Ecologically Sustainable Development provisions but it is widely misunderstood and frequently ignored. Threatened species typically satisfy key elements of the Precautionary Principle in that serious or irreversible damage would be caused by inappropriate development or management, and scientific uncertainty usually surrounds an understanding of their ecology and prediction of impacts. Where could the New South Wales *Threatened Species Conservation Act* 1995 be precautionary? The listing process could be, but a significant amount of information is needed before a population, species or community can be listed, so nominations of taxa for which little information is available are likely to be unsuccessful. A precautionary approach to listing would be to use the IUCN classification "Data Deficient" as a category, especially if was designed to trigger a process of ecological study to gather relevant data, and a Species Impact Statement in cases where a data deficient taxon was likely to be affected by a specific development proposal. The assessment of likelihood that significant impacts will result from a development could be precautionary if determining authorities assumed a significant impact wherever scientific uncertainty existed. Currently, the application of precaution here is variable. The 'Eight-part-test' is effectively a checklist that is applied to determine whether there is 'likely to be a significant impact', thus triggering a Species Impact Statement, under the NSW threatened species legislation. Eight-part-tests that conclude no significant impact, perhaps with mitigation works, are often accepted despite questions about their validity. A conclusion that there is likely to be a significant impact will not necessarily halt a development proposal, because compromises with socio-economic benefits can be made. We urge a more thorough application of the Precautionary Principle, to force decision-makers to acknowledge this compromise, rather than hiding behind the pretence that lack of knowledge implies no detrimental impact.

Key words: scientific uncertainty, threatened species, biodiversity, conservation, policy

The precautionary principle – definition and misuse

Much has been written of the Precautionary Principle in relation to environmental issues (e.g. Deville and Harding 1997; Harding and Fisher 1999; Calver *et al*. 1999 a, b; O'Riordan *et al.* 2001; Harremoes *et al.* 2002), and it is a topic of debate and discussion (e.g. UPEM 2004). This principle first arose as the "Foresight Principle" in relation to environmental policy in Germany in the 1960s and it was used, according to Stein (2000), as a way of assessing political decisions about the environment. The Precautionary Principle was given international status at the time of the Rio Declaration on Environment and Development, in 1992, as one of the "Guiding Principles" for achieving ecologically sustainable development (ESD). Principle 15 is worded as follows:

> "*In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.*"

While the Rio Declaration is not binding on Australia under international law, Principle 15 has been adopted as part of the commitment to ESD. Under the *National Strategy for Ecologically Sustainable Development* (1992)[1], the Council of Australian Governments accepted the precautionary principle as one of the "guiding principles" of ESD, and the Intergovernmental Agreement on the Environment (1992)[2], signed by the Australian Government, States, Territories and Local Government, makes specific reference to the principle (Spry 1997, Nagorcka 2003). In 1999, the Productivity Commission reviewed the extent of adoption of ESD in Australian

[1] <http://www.deh.gov.au/esd/national/nsesd/index.html> Accessed May 28th 2004.

[2] <http://www.deh.gov.au/esd/national/nsesd/index.html> Accessed May 28th 2004.

Pp 49 - 58 in *Threatened species legislation: is it just an Act?* 2004, edited by Pat Hutchings, Daniel Lunney and Chris Dickman. Royal Zoological Society of New South Wales, Mosman, NSW, Australia.

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Government Agencies (Productivity Commission 1999) and concluded as follows: "…at the broadest level those agencies which have accounted for ESD objectives have either done so explicitly (specific recognition of ESD principles and objectives or use of similar terms) or implicitly (no specific recognition of ESD principles and objectives or similar terms but ESD principles are incorporated in decision making processes). However, very few actually refer to ESD objectives specifically."

In NSW, the concept of ESD has been incorporated into many pieces of legislation bearing on environmental management (Stein 2000) and the policies of a number of State agencies (e.g. Roads and Traffic Authority Environment Policy[3]; Sydney Water ESD Policy[4]; National Parks and Wildlife Service Corporate Plan 2000-2003[5]). The relevant definition is to be found in section 6(2) of the *Protection of the Environment Administration Act* 1991. In relation to the present discussion, this Act provides:

> "*… [E]cologically sustainable development requires the effective integration of economic and environmental considerations in decision-making processes. Ecologically sustainable development can be achieved through the implementation of the following principles and programs:*
>
> *(a) the precautionary principle - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:*
>
> *(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*
>
> *(ii) an assessment of the risk-weighted consequences of various options…"*

It has been argued often that several features of the precautionary principle limit its power. Its content is obscured by the way it is written, with the use of multiple negatives; "**lack** of full scientific certainty should **not** be used as a reason for **postponing** measures to **prevent** environmental degradation" (Nagorcka 2003). Further, various parts of the principle assume some level of objective assessment, such as what constitutes serious or irreversible environmental damage. This may not be achievable. Fisher and Harding (2001) presented a range of reasons explaining why the precautionary principle is only weakly implemented in Australia. Whether as a deliberate political strategy or by ignorance, or both, the precautionary principle is often ignored or undermined by presenting it as "unscientific". Both internationally and in Australia, there are worrying examples of this interpretation, as illustrated in the following examples.

The World Trade Organisation's "Sanitary and Phytosanitary Measures" (SPS) agreement provides guidelines for the limiting of free trade in order to protect human, animal or plant life or health (WTO 1998). A country wishing to bar imports on these grounds must show, using a risk-assessment process, that an unacceptable level of harm will occur and that it cannot be mitigated. Although the SPS agreement does allow for some trade restrictions, as a temporary measure, in cases of scientific uncertainty (Article 5(7)), there is clearly a view that the application of the precautionary principle is somehow unscientific. The following statement by Secretary of Agriculture[6], Ann Veneman, reveals both satisfaction at having prevented the use of the precautionary principle and also a misunderstanding of the place of science in precautionary decision-making when there is uncertain knowledge:

> *"We were successful in precluding the Europeans from including what is called the precautionary principle, so to speak. Now, that principle they wanted in there to be able to use, we believe, could have undermined the whole sanitary and phytosanitary agreement, allowing countries to say: 'well, in the interests of precaution, we're going to take this action', undermining the sound science that's contained in the sanitary and phytosanitary agreement … That we could not live with, and that was not allowed to go in to the text."*

Consider the similarity between this reaction to the precautionary principle and the situation surrounding the nomination for listing "Changes to plant-pollinator associations caused by bumblebees, *Bombus* spp." as a Key Threatening Process under the Australian Government's *Environmental Protection and Biodiversity Conservation Act* 1999. The following criteria are considered in judging whether a nomination is eligible for listing:

(i) the process could cause a native species or an ecological community to become eligible for listing in any category; or

(ii) it could cause a listed threatened species or a listed threatened ecological community to become eligible to be listed in another category representing a higher degree of endangerment; or

(iii) it adversely affects 2 or more listed threatened species or 2 or more listed threatened ecological communities.

[3] "The RTA will demonstrate due diligence in the provision of its services, manage its work activities in a manner that is consistent with the principles of ecologically sustainable development, and will deliver continuous improvement in environmental performance…" (RTA 1997).

[4] "The purpose of this Policy is to commit Sydney Water to ensuring the principles of Ecologically Sustainable Development (ESD) underpin our decision making processes, and as such, how ESD is incorporated into our activities." (Sydney Water 2003). This policy explicitly refers to the precautionary principle as one part of giving effect to ESD.

[5] "…the conservation of nature be undertaken within the framework of ecologically sustainable development..." (NPWS 2003).

[6] Address by Secretary of Agriculture, Ann Veneman, to the US National Association of Farm Broadcasters. Friday, November 16, 2001. <http://www.usda.gov/news/releases /2001/11/0236.htm> Accessed January 10th 2004.

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In recommending against the listing of changes to plant-pollinator associations caused by bumblebees, *Bombus* spp." as a Key Threatening Process, the Scientific Committee emphasised lack of certain knowledge:

> "*Difficulties in assessing this process arise as it is a relatively recent event and the evidence available does not strongly prove a negative effect, only a possible potential to threaten listed species and broader ecological processes. A number of experts state there is insufficient or no evidence against any of the criteria to justify listing, some believing the evidence presented is circumstantial and conflicting. Others believe that although data is lacking there is a clear potential for impacts and that the nomination is comprehensive and balanced. Further views include that waiting for compelling evidence would mean leaving* Bombus terrestris *unchecked and that listing and abatement should occur as a precautionary measure.*"[7]

In considering whether the process could cause a native species or an ecological community to become eligible for listing in any category, the Scientific Committee concluded as follows: "… considers that while potentially invasive, the ecological effects of this process on unlisted native species and ecological communities are not clearly defined or easily predicted, and that there are few quantitative data on actual or potential impacts. The information is considered insufficient to determine whether the threatening process meets this criterion at this time." In considering whether it might drive already listed species to a higher level of listing, the committee concluded: "…the potential for this process to cause the Swift Parrot, Helmeted Honeyeater or Regent Honeyeater to become eligible for listing in a category representing a higher degree of endangerment, is not sufficiently known, nor easily predicted. The information is considered insufficient to determine whether the threatening process meets this criterion at this time." Finally, in relation to adverse effects on already listed species or communities, it concluded: "…although the process may be adversely affecting the listed Swift Parrot, there is, as yet, no evidence of an effect, and the process is not currently adversely affecting the Helmeted Honeyeater or the Regent Honeyeater. The threatening process is not adversely affecting at least 2 listed threatened species and is therefore not eligible under this criterion."

In a reaction similar to that expressed by Veneman, above, the decision by the Minister for the Environment not to list changes to plant-pollinator associations caused by bumblebees as a Key Threatening Process was lauded by the Australian Hydroponics & Greenhouse Association[8]: "Mr Graeme Smith, President of the Australian Hydroponics & Greenhouse Association, welcomed Dr Kemp's decision as cautious good news for the industry, although there is still much work to be done. 'The Minister has taken a sensible approach, and it shows that good science does prevail,' he said." In this case, too, there was a perception that applying the precautionary principle would have been somehow unscientific.

There is a growing literature on the relative merits of the precautionary principle and other ways of accommodating scientific uncertainty, such as environmental risk assessment (e.g. Goklany 2001). We consider that the precautionary principle should not be treated as an alternative approach to risk assessment, because its objective is not to assess the risk. Rather, its purpose is well summarised by Fisher (2004) as follows: "In terms of its substance, the principle is concerned with the process of decision-making or with how decisions are made. … The focus is upon how the quality of the scientific evidence in relation to setting a standard is factored into the decisionmaking process."

The following example illustrates a misuse of the term precaution in describing policy that was formulated to guide conservation management. The honeybee *Apis mellifera* is an introduced insect that is the basis for an important domestic and export honey industry. Many commercial hives are located so that the bees can harvest nectar and pollen from native vegetation communities, some of them in national parks.[9] A summary of the possible impacts of honeybees is contained in a review commissioned by the Australian Nature Conservation Agency[10], in which Paton (1996) concluded:

> *"At some plants, seed production was reduced when honeybees were frequent floral visitors (e.g.* Callistemon rugulosus*) while at others seed production was enhanced (e.g.* Banksia ornata*). Plant species whose seed production increased were those that received inadequate attention from their native pollinators. Plant-pollinator systems are vulnerable to perturbations like habitat clearance and degradation, and some Australian plants may now depend on honeybees for full pollination because their native pollinators have declined dramatically or even disappeared in some areas. Whether honeybees should be included or excluded from selected areas will depend on which native taxa are to be favoured in those areas. Some plants may benefit by the presence of honeybees while other plants and animals may continue to suffer degradation in their presence."*

This combination of potential for impact and a high degree of scientific uncertainty about how the potential impacts might be realised in particular situations is surely a good argument for applying the precautionary principle to the formulation of policy. On the face of it, this appears to be

[7] *Environment Protection and Biodiversity Conservation Act* 1999 <www.deh.gov.au/ biodiversity/threatened/ktp/unsuccessful/ bumblebees.html> Accessed January 10th 2004.

[8] *Practical Hydroponics and Greenhouses*. Issue 72 (Sept.-Oct. 2003) <www.hydroponics. com.au/current_issue/np72.html> Accessed January 10th 2004.

[9] Mostly as a result of the transfer of Crown Lands and State Forests to the National Park estate, over the past several years.

[10] Now called the Department of Environment & Heritage. <www.deh.gov.au/ biodiversity/invasive/insects/bees/index.html> Accessed January 10th 2004.

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the case, because the beekeeping policy[11] adopted by the NPWS, is introduced as adopting "…a precautionary and pragmatic approach to the issue of beekeeping on Service managed land by allowing existing sites to continue but not allowing any new/additional sites." The detail in the policy indicates that it is not, in fact, precautionary at all. One of the objectives of this policy is to provide managers with guidance for deciding on the need to relocate sites. To give effect to this, the Relocation Protocol states "…the Service will examine the need for relocating a site where … scientific studies have shown that a particular landscape may be susceptible to adverse impacts from foraging honeybees" (s. 34). A precautionary approach would assume some degree of impact (given well-cited indications of the potential for impact but a paucity of scientific studies to quantify the impact in particular circumstances) and therefore relocate hives from conservation areas until studies have been conducted and have shown that there are no adverse impacts. A compromise position, between precaution and pragmatism, would be to initiate (and fund) scientific studies at all sites not being relocated, as an integral part of applying the policy, in order to ensure that relevant information is being collected on which to base a judgment of the urgency of relocation, rather than committing to action only after a relevant study happens to have been done.

Many populations, species or ecological communities that are rare or threatened will typically satisfy the key elements of the precautionary principle: (i) serious or irreversible damage would be caused by inappropriate development or management, and (ii) scientific uncertainty usually surrounds prediction of impacts. It is therefore worthwhile examining the ways in which the NSW *Threatened Species Conservation Act* 1995 already has the potential to be used in a precautionary way, and considering how it might be changed so as to make it more precautionary in practice – in line with the NSW commitment in the National Strategy for Ecologically Sustainable Development (1992) and the Intergovernmental Agreement on the Environment (1992).

Precaution in Listing

Listing is the key foundation for action under the NSW *Threatened Species Conservation Act* 1995. It triggers both reactive processes, which occur in response to a development proposal or other "action" (e.g. Species Impact Statements, Licensing), and also proactive processes aimed at improved management including acquisition of better knowledge (e.g. Recovery Plans, Threat Abatement Plans).

In assessing a nomination for listing of a population, species, or community, the Scientific Committee uses a range of criteria. A species can be listed as endangered if there is a likelihood of it becoming extinct in NSW, through factors threatening its survival or evolutionary development[12] or it is in immediate danger of extinction because numbers of individuals have been reduced to a critical level or its habitats have been "drastically reduced".[13] Listing as vulnerable is warranted if a species is likely to become endangered unless the factors that are affecting its survival or evolutionary development are removed.[14] A population can be classed as endangered if it is facing a high risk of becoming extinct in NSW *and* it is of conservation value because it is disjunct or near the limit of its geographical range[15], likely to be genetically, morphologically or ecologically distinct[16], or it is of significant conservation value for some other reason[17]. Eligibility for listing an endangered ecological community revolves around determining whether the definition of an ecological community ("an assemblage of species occupying a particular area"[18]) is met in a particular case and showing that the community is likely to become extinct if the factors threatening the survival and evolutionary development are not removed.[19] A process may be listed as a key threatening process if it is adversely affecting two or more listed species, populations or ecological communities or if it could cause species, populations or ecological communities not yet threatened to become threatened.[20]

It is safe to assume that not every population, species, community or process in New South Wales has been thoroughly considered for possible nomination, even though there might now be some systematic assessment of the status of species and communities (for example, the process of developing listings under the NSW *Endangered Fauna (Interim Protection) Act 1991* involved a systematic process of expert assessment of all vertebrate fauna in NSW; Lunney *et al.* 1996). Thus, it is almost certain that there are species that are rare, declining, or otherwise under threat of extinction but about which so little is know that they are not yet the subject of nomination. Smith (1997), for example, claimed that some species have become extinct while waiting for listing to take place under the *Endangered Species Act* 1979 (USA).

[11] NPWS Beekeeping Policy 2002 <http://www.nationalparks.nsw.gov.au/npws.nsf/ Content/Beekeeping+policy> Accessed January 10th 2004.

[12] TSCA s. 10(a).

[13] TSCA s. 10(b).

[14] TSCA s. 14.

[15] TSCA s. 11(a).

[16] TSCA s. 11(b).

[17] TSCA s. 11(c).

[18] TSCA s 4(1).

[19] TSCA s. 12(a).

[20] TSCA s. 15(a) and (b).

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Furthermore, as Farrier (1999) pointed out, criteria for listing typically demand a high level of scientific evidence. In Victoria, for example, under the *Flora and Fauna Guarantee Act* 1988, a taxon or community of flora or fauna is eligible to be listed if it is "in a demonstrable state of decline which is likely to result in extinction". The NSW legislation likewise demands an assessment of likelihood of extinction and of levels of threat to species' survival and evolutionary development that is impossible, given the current state of scientific knowledge. To help the Scientific Committee assess a nomination for the listing of a species[21], a nominator is asked to provide information on the following: past and current distribution of the species in NSW; past and current population size in NSW; information on threats to the species, the intensity of the threat and whether the threat(s) occurs throughout the whole range or parts of the range of the species; details of any recent surveys; in the case of a species which is presumed extinct, details of any surveys for the species in the last 50 years; information on occurrence of the species in National Parks and Wildlife Service reserves or State Forest reserves. Most of the information needed to assess a nomination for listing is lacking (even for some of the species and communities that are currently known to be common and widespread!) and the NSW Scientific Committee makes a considerable effort to find the information that does exist. Although the IUCN categories of conservation status and the decision rules supporting them are generally accepted internationally, Akcakaya *et al.* (2000) argued that there is considerable uncertainty due to limited knowledge, measurement error, environmental variability and vagueness in the definitions of some parameters.

Uncertainty is explicitly addressed in the 2001 revision of the "categories and criteria" in the IUCN Red List of Threatened Species[22]:

> *"The data used to evaluate taxa against the criteria are often estimated with considerable uncertainty. … The way in which this uncertainty is handled can have a strong influence on the results of an evaluation. Details of methods recommended for handling uncertainty are included in Annex 1…"*

Annex 1 of this IUCN document addresses the adoption of precaution in deciding on the conservation category as follows:

> *"… assessors need to consider whether they have a precautionary or evidentiary attitude to risk (known as risk tolerance). A precautionary attitude will classify a taxon as threatened unless it is certain that it is not threatened, whereas an evidentiary attitude will classify a taxon as threatened only when there is strong evidence to support a threatened classification. Assessors should resist an evidentiary attitude and adopt a precautionary but realistic attitude to uncertainty when applying the criteria; for example, by using plausible lower bounds, rather than best estimates in determining population size, especially if it is fluctuating."*

Given the various uncertainties, and the potential for serious or irreversible damage to biodiversity if bad decisions are made, an extreme precautionary approach would be to list all known (extant) species as endangered unless and until there is sufficient evidence available to warrant down-listing to vulnerable or to support removal from a list altogether, as indicated in Annex 1 of the IUCN document. This is probably an unrealistic goal, given political realities and also concern by scientists that the many nominations for de-listing that would inevitably flow from this approach would damage their credibility (e.g. Bonham 1999), and it is logistically unachievable in practice. We therefore argue for a "*precautionary but realistic attitude to uncertainty*" in listing.

One way of using precaution in listing would be to follow the advice given by the IUCN: namely, to use the lowest value in a range of estimates of population size or species range as if they were the real values for numbers and distribution when assessing status. Another way of achieving precaution in the face of uncertainty would be to make explicit use of the IUCN's "Data Deficient" category. This category is defined as follows: "A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate."

We argue that it would be valuable to include a schedule to the TSCA for "Data Deficient" species. Listing on this schedule would trigger a SIS if a listed taxon were to be deemed likely to occur in the area of a development proposal, and the Director General's requirements would include gathering of relevant data to allow the assessment of impact. Listing as data-deficient would also trigger a survey and research program to be completed "as soon as practicable", as is the case with species recovery plans for those taxa listed as endangered,[23] at which time an assessment of a nomination for listing under one of the threatened categories ("vulnerable" or "endangered") would be required.

Notwithstanding our comments above, in relation to the problems of adequately incorporating precaution into the listing of populations, species and perhaps communities, an examination of the recent nominations

[21] NPWS 2003. For example, nomination form for listing a species as vulnerable or threatened. <www.nationalparks.nsw.gov.au/npws.nsf/Content/How+to+nominate+a+species+ as+threatened> Accessed January 20th 2004.

[22] The IUCN Red List of Threatened Species: 2001 Categories and Criteria, Version 3.1. <www.redlist.org/info/categories_criteria2001.html> Accessed January 20th 2004.

[23] TSCA s 56(1).

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for the listing of Key Threatening Processes under the NSW legislation does indicate some level of precaution. First, the Scientific Committee made a preliminary determination in December 2003 listing the introduction of the 'large earth bumblebee' *Bombus terrestris* as a Key Threatening Process (EPAAss 34A, 5C). Interestingly, this decision was informed by the same body of scientific evidence as the decision by the Australian Government **not** to list under the federal legislation (*EPBC Act* 1999), namely studies on the effects of feral bumblebees in Tasmania (e.g. Semmens 1996; Buttermore 1997; Hingston and McQuillan 1998; Hingston *et al.* 2001; Low 1999). Second, the importation of the 'red imported fire ant' has been listed in NSW, based on general knowledge of the biology of this introduced species, preliminary studies of the impact on biodiversity of colonies that have become established in Brisbane, and climatic modelling suggesting that this species, if imported, could inhabit most of the NSW coastal belt and the more mesic inland areas. Listing its importation therefore represents a precautionary approach. Third, as mentioned above, competition from feral honeybees has been listed as a Key Threatening Process in NSW, once again based on an understanding of the general biology of honeybees, the knowledge that feral colonies are widespread in NSW, and a range of studies suggesting the potential for deleterious ecological effects of interactions between honeybees and native fauna and flora.

It is worth noting that, even if listing of these Key Threatening Processes is viewed as precautionary, in practice there may be a long time lag between listing and action. Listing triggers the preparation of a Threat Abatement Plan but, to date, only two have been completed (Predation by the Plague Minnow; Predation by the Red Fox)[24] out of the 20 Key Threatening Processes so far declared.

Precaution in Assessing the Likelihood of Significant Impacts

Assessing nominations for listing, and some of the planing processes that are triggered by listing (for example, recovery planning, threat abatement planning, and, as we propose, research planning to overcome data deficiency) are conservation actions that can be (and should be) undertaken well in advance of specific development proposals. In addition, there are environmental planning instruments made under the *Environmental Planning and Assessment Act* 1979 (EPAA), which can regulate development likely to affect threatened species, for example by identifying areas that should be zoned for environment protection. The Director-General of the Department of Environment and Conservation[25] must be consulted where proposed environmental planning instruments may affect threatened species, populations or ecological communities, or their habitats. However, Farrier *et al.* (2002) argued that, in practice, species conservation issues usually surface at a point when approval is sought for a particular development proposal. There is often uncertainty in the information available to consent authorities on which they must base an assessment of the likely impact of the proposed development on listed taxa, yet, at this late stage in the process, significant time constraints make it difficult to carry out adequate scientific research into potential environmental impacts.

This difficulty is partly acknowledged in the multi-stage process that must be followed by a consent authority (usually a local Council) on receipt of a development proposal (see Farrier *et al.* 2002):

1. The Council must first decide whether listed species or the habitats of a listed species are likely to be present on the site.

If so…

2. The Council (and ultimately the courts, in the few cases which get that far) must decide whether the proposed development is likely to significantly affect any listed species identified as being present, or their habitats (the so-called "eight part test").[26]

If so…

3. The developer must provide a species impact statement (SIS), complying with the requirements of the Director of National Parks and Wildlife, which must be placed on public exhibition along with the development application.[27]

Then…

4. The Council must consider potential impact on species and their habitats (including any SIS that has been prepared) in making a decision on whether to grant development consent and, if so, what conditions should be attached.[28]

If the Council proposes to give consent…

5. The agreement (concurrence) of the Director-General of National Parks and Wildlife is required in situations where the proposed development is likely to significantly affect threatened species or their habitats.[29]

If the Council refuses to give consent, or cannot give consent because the NPWS refuses to give concurrence…

[24] <http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Threat+abatement+plans +by+doctype> Accessed January 10th 2004.

[25] Formerly the Director General of the National Parks and Wildlife Service.

[26] EPAA ss 78A(8)(b), 5A.

[27] EPAA s 78A(8)(b); TSCA s 111; EPAR cll 5(1)(c), 87, 89.

[28] EPAA s 79C.

[29] EPAA s 79B(3)(b). See Farrier (2002).

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6. The developer may appeal on the merits of the case to the Land and Environment Court, which, in essence, makes the decision in the place of the council,[30] without needing to get the concurrence of the Director-General of National Parks and Wildlife if it decides to give consent.[31]

Even at the first step of this process, deciding whether listed species or habitats are present at the site of a development proposal, information can be elusive. Brown (2003) described the case study of *Tetratheca glandulosa* (Elaeocarpaceae) in a proposed housing subdivision in Sydney (Aquatic Drive, Allambie Heights), in which difficulties stemmed from the fact that this listed species is cryptic when not flowering. During the development assessment process and subsequent Land and Environment Court merit appeals, there was considerable argument surrounding the question of whether *Tetratheca glandulosa* occurred on the parcel of land in question (see also Farrier *et al.* 2002). Precaution could be exercised at this step if Council officers negotiating with developers assume that a listed species occurs at the site, where there is a reasonable chance of it occurring based on the nature of the vegetation, soils and other site characteristics, even if there are no specific records of presence. Achieving a precautionary approach at this stage requires that relevant Council officers have sufficient ecological experience and training, or at least access to appropriate information, to allow them to make the judgement – and also to have sufficient credibility in negotiating with a proponent of a development about the need to determine whether there is likely to be a significant impact on a listed taxon (population, species, community). We have knowledge of situations in which Council officers do indeed exercise this judgement.

The second step of the process outlined above is the "eight-part-test", which is a check-list designed to help the consent authority decide whether there is likely to be a significant impact on a threatened (listed) entity (population, species, community) as a result of the proposed development.[32] As part of this process, the consent authority can take into account ameliorative measures proposed in the development application. This raises scientific uncertainties at two levels: firstly, assessment of the significance of the impact of the proposal on a listed taxon and the likelihood that the impact will happen; secondly, the likely response of the listed taxon to the amelioration measures. The questions here are of cause-and-effect. We argue that, in practice, there will be little scientific knowledge to provide guidance, partly because the extreme level of complexity in ecological systems makes it likely that cause-and-effect relationships are going to be highly site- and species-specific and hence not readily predicted from previous studies in a specific situation. In any case, there have been few previous studies for most species on any site.

If precaution were to be exercised here, uncertainty should lead to an assumption of a significant impact and assumption that amelioration measures will not mitigate the impact sufficiently, thus leading the proponent into the preparation of a Species Impact Statement (SIS). However, the evidence from Claire Brown's work (Brown 2003) on *Tetratheca glandulosa* and *Darwinia biflora* (Myrtaceae), and some statistics on how few development applications proceed to a SIS and therefore require the concurrence of the Director General of the Department of Environment and Conservation (see Farrier *et al.* 2002), suggest that Councils are likely to accept a conclusion that there is not likely to be a significant impact, perhaps as a result of mitigation works that are assumed to be likely to be effective. For example, in the site of a proposed subdivision, which contained a population of the vulnerable plant species *Darwinia biflora*, the proponents included the establishment of a bushland habitat corridor as a mitigation measure, to avoid the isolation of the population from remnant bushland adjacent to the site.[33] The vegetation in the corridor did not provide suitable habitat for the plant, but the assumption was that it would facilitate pollination of the isolated plants by enabling the movement of insects involved in pollinating the species.

In this case, there was no knowledge about whether the pollinators of the plant would move through the proposed corridor and adequately pollinate the *D. biflora* plants in this otherwise isolated population. Indeed, the identity of the insects that might be responsible for pollination of this plant species is currently unknown! Nevertheless the Council officer dealing with the application was prepared to accept that such a corridor of remnant vegetation would have a mitigating effect.

The acceptance of such a proposition in relation to insect pollination of an isolated plant population is perhaps understandable, because the idea that the retention of a linear strip of habitat between at least two patches will increase animal movement and allow for the persistence of individual populations is attractive, sounds reasonable, has found its way into conservation biology texts, and has been demonstrated for insect pollinators (butterflies) in one study – albeit in the USA (Haddad 1999; Haddad and Baum 1999). However, the limited research that has been carried out has shown that the effectiveness of corridors in enhancing animal movements is highly likely to be species- and landscape-specific (Beier and Noss 1998) and there may even be costs in terms of disease transmission, spread of fire and predation by domestic animals (Simberloff and Cox 1987). We could find no empirical research published on the role of vegetated corridors in facilitating pollinator movements or enhancing the reproductive success of plants in the remnant populations. In this case study, we see scientific 'folk lore' being used in the course of the decision-making, far beyond legitimate limits of current

[30] EPAA s 97(1), (5).

[31] *Land and Environment Court Act* 1979, s 39(6).

[32] EPAA ss 78A(8)(b), 5A

[33] This is relevant because section (d) of the eight-part-test asks whether "an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species…"

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knowledge. Brown (2003) has argued that, in many cases, accurate completion of an assessment of whether there is likely to be a significant effect, using the eight-part-test, would need the results of the studies that are conducted to prepare a Species Impact Statement (step 3, above).

The preparation of a Species Impact Statement (SIS) may appear to be outside the realm of the precautionary principle, because it is a data-collection exercise with the potential to overcome scientific uncertainty before a decision is made on a development proposal. However, time limitations and financial constraints on environmental consultants imposed by an imperative for rapid decisions mean that there is typically a lack of data and often debate about the appropriateness of the design of studies. The scientific uncertainty here should lead consultants to apply the precautionary principle in interpreting their results, perhaps by using particular statistical approaches (e.g. Quinn & Keough 2002), but we doubt that this occurs in most cases.

As the Director General of the Department of Environment and Conservation sets requirements for an SIS[34], there is an opportunity for precaution to be exercised at this stage, if there is uncertainty about the evidence for potential impacts, by requiring that sufficient work is done in the SIS to inform the Council's decision on the development application. The SIS must have regard to the principles of ESD in describing any feasible alternatives to the action that are likely to have lesser impact and giving reasons for carrying out the action in the manner proposed.[35] There is an implication that these factors should be salient ones for councils in making a final decision. However, there is no requirement that councils should *apply* the precautionary principle when making a final decision on whether a proposal should be allowed to go ahead, and in deciding whether or not to grant concurrence, the Director-General of National Parks and Wildlife is simply directed to take the precautionary principle into account, not to apply it.[36]

The degree to which precaution might currently be being applied in these three steps of the process (steps 3 to 5, above) is hard to assess, given that the decision-making process is decentralised, with a large number of local councils involved and so few development applications judged to be likely to have a significant impact on threatened taxa, so as to require the preparation of a SIS and the concurrence of the Director General of the NPWS. This would be a fruitful and important topic for further investigation.

Benefits of Better Use of the Precautionary Principle

The foregoing review indicates that the precautionary principle is embedded in policy in NSW (mostly as an implicit part of ESD) and there are many opportunities for the application of the precautionary principle in decision-making within the processes of the TSCA, and in policy. Nagorcka (2003) argued that an examination of the use of the precautionary principle can reveal how much the natural environment is valued by assessing the extent to which decisions that are made forgo socio-economic benefits, which are often certain and quantifiable, in order to achieve some poorly quantifiable and uncertain environmental benefits. We are concerned that opportunities to use the precautionary principle are too often being ignored.

There may be several explanations for this reluctance. First, the precautionary principle is not well understood and is being portrayed as "unscientific", especially in comparison with a risk-assessment process. This is clearly wrong, because the precautionary principle is an approach to decision-making in situations of uncertain scientific knowledge – it is not a method for evaluating a level of risk or predicting likely outcomes (see Farrier *et al.* 2002). Second, individual staff who have a responsibility for decision-making (e.g. Council officers dealing with development applications) may not be sufficiently well trained or experienced to judge the state of ecological knowledge and hence scientific uncertainty in particular situations. As a result, they may be too easily convinced that there will not be a significant impact on threatened taxa and that proposed mitigation works will be effective. Third, there is an exaggerated fear as to the role the precautionary principle might play in halting development, arising from a fundamental misunderstanding of the way in which it operates. The precautionary principle does not require environmental impact to be given a higher weighting in decision-making processes than socio-economic considerations. Rather, it addresses the issue of scientific uncertainty about the environmental impact of activities. It simply helps decision-makers to determine what that environmental impact should be presumed to be, in a context where scientific research is scant or ambiguous. When the decision-maker comes to make the final decision, socio-economic considerations relating to a particular activity may be considered to outweigh environmental impact, however significant that impact is taken to be, using either direct evidence of impact or inferring the impact by applying the precautionary principle. The precautionary principle should make it difficult for a decision-maker to dismiss potential environmental impact on the grounds of lack of clear evidence. In particular, the principle should operate to outlaw the use of economic considerations to justify sloppy "science" at earlier stages in the decision-making process – in the context of eight-part tests of significant effect and SISs. In situations where there is sufficient scientific evidence to trigger the operation of the precautionary principle, there should be no question of the presumed environmental impact being rebutted by, for example, the results of species surveys carried out at the wrong time of year because proponents are not prepared to devote the time and resources necessary to do a proper job.

[34] TSCA s111 (2).

[35] TSCA s 110(2)(h).

[36] EPAA s 79B(5).

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We conclude that proper understanding of the precautionary principle and its proper application in decision-making processes will lead to greater understanding of potential environmental impacts and greater transparency in decision-making. Decision-makers will be forced to acknowledge that they are approving proposals even where the impact on threatened species or their habitats is presumptively significant. Adoption of the precautionary principle prevents the assumption that scientific uncertainty is indicative of minimal environmental impact, which admits the possibility of presenting a compromise decision as a win-win situation for development and the environment. Thus, the decision on whether the eight-part-test indicates the likelihood of a significant impact would trigger a SIS whenever there is uncertainty about threatened taxa involved. Likewise, the NPWS Beekeeping Policy would assume that there are going to be significant impacts of licensed beekeeping sites and require relocation, unless a judgement of socio-economic benefit is perceived to outweigh these detrimental environmental effects. Finally, the statements on the NPWS web site on how threatened species affect developers and landowners[37] would be modified. It currently states: "In most cases, a development can be modified to accommodate the interests of both the landholder and the NPWS, to ensure the continued survival of the threatened species, population or ecological community." Given the level of scientific uncertainty, and consequent adoption of the precautionary principle in making judgements of potential impacts, it could state instead: "Where there is some scientific evidence that there may be serious or irreversible harm to threatened species, populations or ecological communities from proposed development, but the evidence is not conclusive, it must be assumed that there will be threats to their survival, unless adequate evidence is produced to undermine this assumption. However, development applications may still be approved when social or economic benefits, or both, are judged to be more important than the potential damage to threatened taxa."

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