

The nativeness and non-nativeness of species

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ABSTRACT

It has been usual to classify species as native or non-native. However, in relation to biodiversity conservation and species recovery programmes, it has been recognised that there are “shades of nativeness” between these two extremes. Scottish Natural Heritage has recently adopted a classification of six categories - native, formerly native, locally non-native, long-established, recently arrived and non-native. These six categories are described and examples given.

KEYWORDS: alien species, introduced species, native species.

INTRODUCTION

Webb (1985) made a systematic attempt to establish a series of criteria which could be used to reach a decision on whether a plant species is native or not. His eight criteria were fossil evidence, historical evidence, habitat, geographical distribution, frequency of known naturalisation, genetic diversity, reproductive pattern and possible means of introduction. A ninth criterion, entomological evidence, was added by Preston (1986). There are two particular features of the use of this set of criteria. First, implicitly there is a time scale: this is taken as the ending of the last glaciation 10,000 or so years ago and hence the criteria are not used for species that might have been in the geographical area being studied in inter-glacial periods. Second, the criteria are indicative rather than definitive; thus assessment of “native” or “non-native” status depends upon the balance of probabilities, weighing evidence from all of the nine criteria.

Much of the work related to implementation of the United Kingdom’s Biodiversity Action Plan (Anon. 1994) is implicitly, or at times explicitly, concerned with discriminating between native and non-native species of plants and animals. Similarly, species recovery programmes are based on enhancing populations of native species, or aim at re-introducing native species that have become extinct locally or nationally. Examples are the successful re-introduction of *Milvus milvus* (red kite) into England and Scotland and of *Haliaeetus albicilla* (white-tailed eagle) into western Scotland, or the on-going studies into re-introducing *Castor fiber* (European beaver) into Scotland (Anon. 1998b). In contrast, site management often targets non-native species for control: such species include *Rhododendron ponticum* (Usher 1986) and *Fallopia japonica* (e.g. Pope 1997).

Whereas Webb’s (1985) criteria were designed to discriminate between native and non-native species, Scottish Natural Heritage recognised that these were two of a number of possible categories. The British Ornithologists’ Union, for example, recognised rather more categories in compiling *The British List* of bird species (Anonymous 1998a). The aim of this study was therefore to review species that occur in Scotland, and to propose a classification of nativeness that would be useful as a factor in conservation practice.

CATEGORIES OF SPECIES

A geographical scale needed to be defined. For the purposes of this study the whole of Great Britain was used because of its island character. The classification, in Table 1, is therefore related to the whole island, but it could equally be applied to any defined geographical area and portions of that area.

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Native species are those that are presumed to occur in Great Britain by natural means. Examples of such native species would include such common plants as *Bellis perennis* and endemic species such as *Primula scotica*. Both of these species are native in Great Britain as a whole: however, if a smaller geographical area is used, both species are native in Scotland, whereas only one, *B. perennis*, is native in Wales.

Formerly native species are those that are known to have occurred in Great Britain since the last ice age, but which have become extinct. Many of the species in this category apparently became extinct because the environment changed (category 2a in Table 1). Birks (1997), for example, listed a number of such plants, including *Papaver* sect *Scapiflora* and *Cassiope* spp. Other species in this category might have become extinct through human activity rather than environment change (category 2b in Table 1). Examples include *Trichophorum alpinum*, whose only British site was destroyed by marl digging in the 13 years following the species' discovery in 1791, and *Pinguicula alpina*, whose only habitat was encroached by agriculture, subsequently invaded by coniferous trees, and not assisted in the mid-19th century by the avariciousness of plant collectors (Lusby 1998).

Locally non-native species are those that are native in part of Great Britain, but which have been introduced to the local area being considered. An example is *Luronium natans*, which is native in England and Wales but not native in Scotland where it has been introduced to at least three sites (Stewart *et al.* 1994); whereas it is native in Great Britain it is non-native in Scotland. There are few botanical instances where this category might be important from a biodiversity point of view, but in some cases locally non-native animals present a serious threat to native species. An example is the occurrence of *Erinaceus europaeus* (hedgehog) in the Outer Hebrides. It never naturally reached those islands, but since its introduction it has been creating serious problems for ground-nesting birds.

Long-established species have often been described as "naturalised": they have become part of food webs where the majority of species are native. An example of a long-established species in Britain is *Acer pseudoplatanus*, which Salisbury (1961) presumed to have been introduced by the Romans of the order of two thousand years ago. This species is long-established in Great Britain, whereas a species such as *Fagus sylvatica*, which is native in the southern part of Britain, is locally long-established in many northern areas.

Recently arrived species are those for which there is as yet insufficient evidence to decide whether they arrived "naturally" (category 5b in Table 1) or were assisted by some human agency (category 5a in Table 1). In a sense, it is a temporary category, a useful classification pending further scientific evidence that would allow the species to be assigned to category 1 (native) or to category 6 (non-native). An example would be the discovery of *Serapias parviflora* in Cornwall in 1989. Both Sell & Murrell (1996) and Stace (1997) inclined to the view that this orchid species was deliberately introduced (category 5a), whereas French *et al.* (1999) considered it likely to be a natural colonisation (category 5b) because it occurs in dry maritime grassland on islands off the Brittany coast. Until there is more evidence, the species cannot be assigned with certainty to categories 1 or 6.

Finally, **non-native species** are those where all of the evidence points to the fact that they have been brought to Great Britain by people, either intentionally or unintentionally. Logically, if a species has never been native in any part of Britain, then the application of the term can only be to Britain as a whole rather than to any part of Britain.

These six categories are not mutually exclusive. Categories 1, 2 and 3 in Table 1 could be referred to as British native species because, at some time during the last 10,000 years or so, they have occurred naturally in at least some part of Great Britain. Similarly, categories 4 and 6 in Table 1 could be referred to as non-native since neither category has ever occurred naturally in the country. Category 5 is more problematic, but in general 5a would fall into the non-native group whereas 5b are more likely to be treated as native. Although there are therefore certain ambiguities in the definition of the six categories and their subdivisions, they nevertheless prove useful in thinking about the conservation and management of species.

TABLE 1. SIX CATEGORIES, TWO SUBDIVIDED, FOR CLASSIFYING SPECIES ACCORDING TO THEIR NATIVENESS. THE CATEGORIES CAN BE APPLIED TO THE WHOLE OF GREAT BRITAIN (B) OR JUST TO A LOCAL PART OF BRITAIN (L).

Category	Application	Sub-divisions
1. Native	B, L	-
2. Formerly native	B, L	a. Extinct because of environment change b. Extinct due to human activity
3. Locally non-native	L	-
4. Long-established	B, L	-
5. Recently arrived	B, L	a. Arrival suspected of being human assisted b. "Natural" means of arrival suspected
6. Non-native	B	-

DISCUSSION

The categories of nativeness (Table 1) have been developed for nature conservation purposes. Both habitat loss (and fragmentation) and the effects of non-native species are seen to be the two primary causes of the loss of biodiversity on the Earth (e.g. Heywood 1995). It is therefore important to consider attitudes to the "nativeness" of species and to consider the conservation actions that might follow from such categorisation in the geographical area of concern.

The six categories listed in Table 1 were conceived in relation to Great Britain, a single island that is in many respects a single political entity. Inevitably with national biodiversity action plans and with national conservation agencies, political boundaries tend to predominate in considerations of nativeness. However, it might be preferable to conceive of more naturally-defined boundaries, such as the archipelago of islands off the coast of north west Europe (i.e. the whole of the British Isles) or, preferably, biogeographically distinct areas (cf. Usher & Balharry (1996) for a division of Scotland into twelve biogeographical zones). The efforts of the European Commission to establish trans-national conservation, on the basis of a small number of biogeographical regions encompassing all 15 Member States, is certainly an attempt to move from a national to a more natural perspective for the conservation of species and habitats (Anon. 1992). Logically, natural boundaries should be favoured over political ones, but, pragmatically, this is unlikely to be realised!

Table 1 can also be compared with the British Ornithologists' Union's categorisation of birds for inclusion on the British List (Anon. 1998a). That categorisation includes native species (A), formerly native species (B, with a date of 31st December 1949 as the decision point), introduced species that have established breeding populations (C), species that would be in another category but about which there is some doubt (D), and species that have been introduced and which have not established self-sustaining populations (E). In a comparison with Table 1, categories A and 1 are similar, as are B and 2. Category C relates to both 4 and 6, and possibly also to 5a, whereas category D relates primarily to 5b. Category E relates to 6. Nothing in the BOU list equates to category 3 in Table 1, but this could be predicted with a highly mobile (and migratory) taxonomic group such as the birds.

Williamson's (1996) consideration of biological invasions led him to prepare a conceptual framework, of which two points are particularly pertinent. First, most invasions fail, with only about 10% of introduced species establishing a population. Second, most invasions, probably around 90%, have only minor consequences. This implies that only about 1% of introduced species become "pests". Does this matter? If one takes Clement & Foster's (1994) book, which lists 3,586 non-native species recorded in the British Isles, of which 885 are established, then between 36 species (1% of 3,586) and 88 species (10% of 885 species) might be expected to pose problems for native species and natural plant communities. There is therefore potentially a large task to control and manage such a number of problematic non-native species.

Nature conservation, or biodiversity action plans, will focus on native species (category 1 in Table 1). Because a proportion of the non-native species (category 6) can become pests, it is useful

to think of controlling them, or even eradicating them, as soon as they are noticed. Re-introduction programmes can be focused on the formerly native species, but only if environmental conditions are still suitable for them to establish self-sustaining populations (i.e. category 2b). Generally there are risks in introducing species beyond their native range (category 3), but care needs to be exercised in deciding to control long-established species (category 4) because they may, over the centuries, have become part of cultural landscapes. Caution is needed with species that have recently arrived; there may be benefits in treating category 5a as if they were category 6, but it has to be remembered that species distributions are dynamic, and that distributions will change naturally under the various scenarios of climate change.

There is an increasing scientific basis for adopting a precautionary approach to dealing with the arrival and establishment of non-native species (and, by analogy, also with non-native genotypes). Williamson's (1996) study documented the problems that biological invasions can pose to a territory's biodiversity. There is also an increasing practical basis for the early control of non-native species. Once a non-native species has become established, and starts to have an impact on local biodiversity, it can be extremely expensive to mount a control campaign, even if control is ultimately possible.

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