

Chapter 4

THE RISE AND
FALL OF BIOTIC
NATIVENESS:
A HISTORICAL
PERSPECTIVE

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4.1 INTRODUCTION: THE NATIVENESS PROBLEM

Nativeness is an organizing principle of numerous scientific studies and findings, and the *sine qua non* invoked by many management policies, plans, and actions to justify intervening on prevailing ecosystem processes. In recent years, leading invasion biologists (for example Richardson et al. 2000; Pyšek et al. 2004, 2008) have revisited and subtly revised categories, concepts and definitions related to nativeness to promote increased taxonomic rigor and improve the field's data collection and analysis. Others (for example Klein 2002; Bean 2007) have relied on, applied and extended these revisions. Critiques have emerged from within and without examining invasion biology's concepts and practices (for example Milton 2000; Subramaniam 2001; Sagoff 2002, 2005; Theodoropoulos 2003; Colautti & MacIsaac 2004; Brown & Sax 2005; Gobster 2005; Larson 2007; Warren 2007; Davis 2009; Stromberg et al. 2009). Most of these questioned the appropriateness of the native–alien dichotomy to some degree and some have argued against its continued use (see especially Coates 2003; Aitken 2004; Townsend 2005) whereas others were content to explore its cultural influence (for example Trigger et al. 2008). Given the significance attributed to the distinction between native and alien biota and the growing concern over its quality, it is important to be clear about what these concepts mean. Is nativeness conceptually defensible? Does it accomplish any theoretical work?

Pyšek et al. (2004) argued that 'The search for a precise lexicon of terms and concepts in invasion ecology is not driven by concerns of just semantics'. In that spirit, this chapter reviews the categories underpinning science and policy from historical and conceptual perspectives, not the labels that ecologists and policymakers use. Nevertheless, when scientists describe categories, we must credit their choice of words with meaning, and they must allow us to evaluate their categories by the descriptions they provide.

We address several interpenetrating questions:

- 1 How did the conception of biotic nativeness develop in historical context?
- 2 How is nativeness diagnosed and applied?
- 3 What theoretical considerations does nativeness embody?
- 4 What rights or privileges does biotic nativeness confer?

In answering, we conclude that its categorical meaning and significance both dissolve under scrutiny. Biotic nativeness is theoretically weak and internally inconsistent, allowing familiar human desires and expectations to be misconstrued as essential *belonging* relationships between biota, places and eras. We believe much well-intended effort is wasted on research contrasting 'native' and 'alien' taxa, and by conservation projects focused primarily on preserving or restoring natives.

4.2 NATIVENESS CODIFIED

In recent discussions, human dispersal is said to render populations, and indeed any successor populations, non-native (Klein 2002; Pyšek et al. 2004; Bean 2007). Nativeness is therefore revocable, but non-nativeness is permanent. Being once human-dispersed accomplishes a mutagenic denaturing. Simberloff's (2005) declaration that 'Non-native species DO threaten the natural environment!' (emphasis original) makes sense only if a human act of dispersal renders nature unnatural.

Should dispersal history determine present belonging? Bean (2007) approvingly cites Ross and Walsh's (2003) reason for distinguishing between native and alien plant taxa: 'Recognition of a taxon as a native, especially if it has a restricted distribution or is known from only a few populations, may result in the expenditure of considerable resources to try and ensure the survival of populations. Conversely, classification as an introduced species may result in efforts being made to eradicate populations'. Ross and Walsh moved seamlessly from elucidating dispersal histories to intervening on those that evidence human participation. They gave no *reason* for intervening, but it must be that 'native' valorizes what 'dispersal history' describes. Fortunately, the conception has a history that provides some insight into its present meaning.

Nativeness is an ancient notion in human social, legal and political contexts from neighbourhood to nation. The idea is codified in modern civil discourse in two basic forms: *jus solis*: right of the soil, or birthplace; and *jus sanguinis*: right of the blood, or inheritance (Alonso 1995). Commonly, citizens by 'native' right of blood, or soil, or both are legally superior in some sense to 'naturalized' citizens. The US Constitutional requirement that Presidents be 'natural born citizens' is a familiar example.

Identifying specific biota with specific places has a deep history, extending to Sumerian epics of about 2500 BCE. Partitioning taxa into *native* and *alien* populations is a relatively modern practice, but it significantly predates invasion biology, which coalesced in the late 1980s (Davis 2006). Before the late 18th century, *native* was a catchall conception for uncultivated or undomesticated biota, i.e. the free-living products of a local landscape. Encounters with unknown taxa and peoples in far-flung locations allowed European civil and biotic applications of *native* to cross-pollinate in new ways.

As biogeographical studies accumulated and floras and faunas were documented, it became common practice to signify additions to existing lists with an asterisk (*) (for example Curtis, 1783, p. 24). Asterisks were applied to inventories for other reasons; notably, when a taxon seemed doubtfully identified or likely introduced through human agency (for example Haller 1742, p. 374). Asterisks identified doubtful botanical claims the way they now identify sports records achieved by 'performance enhanced' athletes. Asterisks increasingly denoted suspicion of human dispersal, and were routinely applied to agricultural weeds and relict cultivars.

Well into the 19th century, botany was practised largely by physicians, apothecaries and amateurs. Increasing professionalization produced increasing nuance. A stark dichotomy denoted by a single symbol was inadequately informative. Cambridge botany professor John Henslow proposed adding two more standard symbols: the degree (°) denoting obviously introduced plants, and the dagger (†) for uncertain cases (Henslow 1835, p. 84). Almost immediately, Hewett (H.C.) Watson, a well-heeled and sedulous amateur botanist who was apprenticed in law and educated in medicine, adopted Henslow's notation for *The New Botanist's Guide to the Localities of the Rarer Plants of Britain* (Watson 1835a). Later that year, Watson elaborated on the topic in *Remarks on the Geographical Distribution of British Plants*. Ellipses in the quotations below generally indicate that we have elided species listed by authors as exemplars in order to focus on conceptual issues.

'Species originally introduced by human agency now exist in a wild state; some ... continued by unintentional sowings ... while several keep their acquired hold of the soil unaided, and often despite our

efforts to dispossess them. Both these classes certainly now constitute a part of the British flora, with just as much claim as the descendants of Saxons or Normans have to be considered a part of the British nation. But there is a third class ... plants which have yet acquired a very uncertain right to be incorporated with the proper spontaneous flora of the island ... species springing up occasionally from seeds or roots thrown out of gardens, and maintaining themselves a few years; and ... those designedly planted for ornamental or economical purposes. Such are no more entitled to be called Britons, than are the Frenchmen or Germans who occasionally make their homes in England.' (Watson, 1835b, p. 38)

Subsequently in *Remarks*, Watson cited, refined and expanded on Henslow's notational scheme, applying asterisks to 'species generally supposed to have been introduced, but now to some extent established', daggers to 'species more or less strongly suspected to be in the like circumstance, although now occurring spontaneously', and another mark, the double dagger (‡) to distinguish 'such as may possibly have been introduced, being weeds of cultivated ground or inhabited places' (Watson 1835b, p. 185).

A dozen years later, dissatisfied with daggers and asterisks, Watson published his intention of establishing 'the civil claims and local situation of [British plant] species in accordance with a scale of terms' (Watson 1847, p. 62). In an apparent first, he named his categories, producing an *ad hoc* botanical redefinition of *native*, *alien* and three additional, fully codified categories of intermediate establishment and/or uncertainty:

'Native: Apparently an aboriginal British species; there being little or no reason for supposing it to have been introduced by human agency.

'Denizen: At present maintaining its habitats, as if a native, without the aid of man, yet liable to some suspicion of having been originally introduced.

'Colonist: A weed of cultivated land, or about houses, and seldom found except in places where the ground has been adapted

for its production by the operations of man; with some tendency, however, to appear also on the shores, landslips, &c.

Alien: Now more or less established, but either presumed or certainly known to have been originally introduced from other countries.

Incognita: Reported as British, but requiring confirmation as such. Some ... through mistakes of the species ... others may have been really seen [as] temporary stragglers from gardens ... others cannot now be found in the localities published for them ... some of these may yet be found again. A few may have existed for a time, and become extinct.' (Watson, 1847: 63–64)

Three of Watson's terms came from English common law regarding human citizenship rights, as is clear from jurist Sir William Blackstone's *Commentaries on the Laws of England 1765–1769* (1922). Blackstone wrote, 'the first and most obvious division of the people is into aliens and natural-born subjects. Natural-born subjects are such as are born within the dominions of the crown of England; that is, within the ... allegiance, of the king; and aliens, such as are born out of it' (Blackstone 1922, p. 365). By contrast, 'a denizen is an alien born, but who has obtained ... [documents] to make him an English subject ... [he] is in a kind of middle state between an alien and natural-born subject, and partakes of both' (Blackstone 1922, p. 374). These civil concepts were discussed in parliament contemporaneously with Watson's work (Anonymous 1843). The son of a lawyer, for a time apprenticed as one, Watson's familiarity with such terms is unsurprising.

Common law regarding colonies was complicated. The 'civil claims' Watson meant to apply to botanical 'colonists' remain uncertain. 'If an uninhabited country be discovered and planted by English subjects, all the English laws then in being, which are the birth-right of every subject, are immediately there in force'. (Blackstone 1922, p. 107). The law differed for any inhabited country or ceded territory where a legal system (recognizable to Englishmen) existed. *Incognita* had no specific civil application; it meant *disguised* or *unknown*.

Watson was open to the idea that species were inconstant (Egerton 2003, pp. 147–162), but he had

no better grasp of the mechanics of evolution than his predecessors. He plainly saw plant species as usefully analogous to human individuals. They had places of origin, and by extension, places of belonging. Watson identified a place (the island of Great Britain) and specified that 'native' plant species belonged there by virtue of having appeared, arisen or arrived there without the aid of 'human agency'. Others exhibited lesser, artificial attachments.

Second-generation Zurich phytogeographer Alphonse de Candolle devoted himself to reconciling Genesis with empiricism by expanding his father Augustin's conception of botanical 'centers of creation' (Chew 2006). In 1855, Candolle responded to Watson by publishing his own suite of categories. However, aside from a special emphasis on human intention evidenced by dedicated categories for crops and crop weeds, his conception resembled the Englishman's:

'Cultivated'

1. Voluntarily [undefined as if self-evident].

2. Involuntarily: Species which absolutely exist only in the fields, gardens, etc., without being in open country in a spontaneous state.

Spontaneous

1. Adventitious: Of foreign origin, but badly established, being able to disappear from one year to another.

2. Naturalized: Well established in the country, but there is positive evidence of a foreign origin.

3. Probably foreign: Well established ... but according to strong indications, there are more reasons to believe them of origin foreign than primitive in the country ... the odds favoring a foreign origin are better than even.

4. Perhaps foreign: Some indications of a foreign origin, though the species are long and well established in the country. For one reason or another, one can raise some doubts about their indigenesness.

5. Indigenous: Aborigines, natives ... spontaneous species whose origins are not doubtful, which appear to have existed in the country before the influence

of man, probably for geological rather than historical time.' (Candolle 1855, pp. 642–644; translation from Chew 2006)

Pyšek et al. (2004) traced the native/alien dichotomy to Candolle, but did not discuss the potential implications of basing modern theory and practice on a pre-Darwinian conception. Neither did they note Candolle's citation, discussion and incorporation of Watson's ideas.

In the fourth (mid-1859) volume of his *Cybele Britannica*, H.C. Watson critiqued Candolle's effort and refined his own, providing additional insights into his thinking:

'To the category of *Native Species* we must unavoidably assign all those in regard to which no grounds are now seen for supposing that they were first brought into Britain by human agency. The application of the term is thus simply negative. It can rarely or never be known, whether the species existed in Britain before the advent of mankind, or have immigrated into this country more recently, and if the latter, whether their immigration has been effected by natural means of transport only, as distinguished from those afforded to them by human agency. It is possible that none of these species were aboriginal natives on the present surface of Britain. It may be that all of them were immigrants into the British islands, at different dates, from other lands; those lands, or some of them, having subsequently ceased to be. Such uncertainties belong at present rather to geological, than to geographical botany; and they cannot be here discussed. The broad line of distinction is here to be drawn between natural and human agency; – natural agency being assumed, where human agency is not obvious or suspected.

'In the second category, that of *Introduced Species*, are placed all those which are supposed to have been brought into Britain through the instrumentality of mankind. In some few instances they are known to have been so introduced; notably in the case of some American

species, which were unknown in Europe before the discovery and settlement of the Western Continent. In far the majority of instances botanists only infer or suppose that a species has been introduced, because they can detect some remaining indications of human agency in the conditions under which it is still observed to exist here; the inferences suggested by the present conditions being occasionally corroborated by historical or traditional evidences also. But it seems quite within possibility, and even within reasonable probability, that the indications of human agency may have become obliterated in various instances. And if such instances do occur, the plants so situate, although only naturalised aliens, are now unavoidably placed in the same category with the aboriginal natives' (Watson 1859, pp. 65–66).

Watson went on to discuss the relative merits of Candolle's and his own intermediate categories, asserting unequivocally: 'The distinction between native and introduced species is absolute and real; the only difficulty or uncertainty being in a verdict on the matter of fact. There are not degrees of nativity, or degrees of introduction; though there are differences of opinion regarding the evidences in support of either view in reference to individual species' (Watson 1859, p. 68).

By the publication of his fourth *Cybele* volume, Watson was aware of the July 1858 co-debuts of Darwin's and A.R. Wallace's papers on natural selection. Indeed, Darwin's *Origin*, published in November 1859, acknowledged a 'deep obligation' to Watson for 'assistance of all kinds' (Darwin, 1859, p. 48). Watson's book was finalized first; only in a postscript did he allude to the *Origin*: 'If the views of Darwin ... had been earlier explained in print, some change might have been made in ... this volume, where remarks occur on the inequality and permanence of species' (Watson 1859, p. 525).

Darwin sent Watson an advance copy of the *Origin*, and Watson was a quick study. A day before the book went on sale and three before its official publication, Watson wrote 'an enthusiastic letter' to Darwin, speculating on natural selection's implications for human evolution (Burkhardt & Smith 1991, p. 385; Egerton

2003, pp. 191–192). However, the suggestion of human evolution by natural selection, which undermined the nature/artifice divide, failed to dim Watson's enthusiasm for the 'absolute' distinction between his botanical natives and aliens. In 1868, he revisited the categories in detail. 'Native' survived unedited from 1847. To 'denizen' Watson appended 'by human agency, whether by design or by accident'. He elaborated 'colonist' with new examples. 'Casual' replaced 'incognita' but remained a category of ephemeral 'chance stragglers', a subset (like colonists and denizens) of 'alien species ... certainly or very probably of foreign origin; though several ... are now well established amid the indigenous flora of this island; others less perfectly so' (Watson 1868, p. 62).

The practical aspects of Watson's civil model of biotic nativeness remain to be discussed, for it was a model, not an explanation, proposed with specific, limited purposes in mind. Both Watson and Henslow sought to distinguish natural productions from artificial ones, a defining, 'boundary' issue for any natural historian. Each also hoped to discourage what Watson termed 'vainglorious' collectors from artificially establishing discoverable populations (Chew 2006). As an emulator of Humboldt, Watson wanted a 'British' flora whose distributions reliably indicated the natural effects of latitude, altitude, and exposure. He believed only natives were susceptible to such correlation. Undocumented aliens threatened to cloud the picture.

Even though he acknowledged the possibility of extinction (still considered a rare, unlikely phenomenon), Watson (1870, pp. 467–468) did not extend his concerns to conservation, and seems never to have considered suppressing aliens to accommodate natives, much less extirpating aliens as an end in itself. His model of botanical 'civil claims' appreciated natives but did not criminalize aliens.

From these modest, unfamiliar-seeming ambitions, the concept of biotic nativeness has been transmogrified into an obsession of conservationists (Smut 2003) and a pillar of modern ecology. A simple accounting demonstrates that nativeness now stands prominently among ecology's 'title' themes. At mid-20th century, only a handful of articles classified as 'ecology', 'biodiversity conservation' or 'botany' included the term 'native' in their titles. The number did not regularly exceed 10 articles per year until 1980 or 20 per year until 1990, ramping up by nearly an order of magnitude (to 175 per year) by 2007 (ISI Web of Science, <http://apps.isiknowledge.com>, accessed 3 June 2008).

We extracted another indicator of the prevalence of nativeness in current ecological thinking from the programme of the 10,000+ member Ecological Society of America's 93rd Annual Meeting (Ecological Society of America 2008). An electronic text search one month before the meeting revealed that the combined terms 'nativ*' and 'indig*' (capturing most variants of native and indigenous) occurred 603 times. For comparison, 'ecol*' (ecology, -ogical, etc.) occurred 1685 times; 'effect*' and 'affect*' combined occurred 2016 times, and 'universi*' (university, -ität, -idad, etc., mostly identifying presenter affiliations) occurred 2449 times.

In summary, an olio of ideas from pre-Darwinian botany and pre-Victorian English common law still underpins even the most recent, expert conceptions of biotic nativeness. To the (wide) extent that biotic nativeness is considered actionable and presumed to rest on scientific findings, it is important for scientists, journalists, lawmakers, conservationists and other citizens to understand that those findings express some common beliefs about humans, but nothing about the essences of biota or of particular taxa. How does all this show itself in current science and conservation?

4.3 DIAGNOSING AND APPLYING NATIVENESS

Biotic nativeness is generally diagnosed by time and location indexes that vary with place and purpose. Richardson et al. (2000), Pyšek et al. (2004) and Bean (2007) summarize several such schemes. They share the tradition of distinguishing natives from non-natives by evidence of human intervention and a resulting range expansion. However, what 'human intervention' means to each depends on cultural context. European scientists generally regard human intervention to denote the scale and timing of human impact rather than the fact: 'it is common for an indigenous plant to be regarded as one that was present before the beginning of the Neolithic period (when the widespread growing of crops commenced)' (Bean 2007). In Britain, some make a pre-Roman distinction or identify other temporal thresholds (see, for example, Preston et al. 2004). In the Americas, 'native' usually identifies taxa believed present before 1492, even though there is good evidence of widespread, long-distance trade and plant domestication by pre-Columbian Americans. In Australia, taxa mentioned in the 1770 Banks and Solander flora are considered

natives, again despite evidence that plant materials were transported around the Western Pacific and Southeast Asia for millennia before Banks and Solander arrived with Captain Cook aboard *Endeavour*.

Invasion biology has adjusted natural history's strict distinction between nature and artifice to exempt dispersal by pre-commercial, subsistence-level societies, i.e. it is not human agency per se that engenders aliens, but 'civilized' agency; more specifically, European agency wielding complex technologies to exploit far-flung resources. We follow that lead for the remainder of the chapter. Even under this presumption, taxa are still designated *native* purely by default, absent evidence of dispersal by human agency. This is what Watson meant by a 'simply negative' conception. Positive evidence that human agency has never affected a taxon's distribution is hard to come by.

Even thus clarified, the nativeness standard relies on two tacit conceptual transformations. The first takes nativeness to mean a taxon *belongs* where it occurs, geographically, temporally and ecologically. The second takes *belonging* to signify a morally superior claim to existence, making human dispersal tantamount to trespassing. Because human agency is a geologically recent development, this verdict invokes civil rights of prior occupation described earlier. However, neither transformation is deducible from an absence of evidence. Judging *what ought to be* based on *what cannot be demonstrated* seems problematic at best for the purposes of scientific inquiry, recalling the old saw: 'Absence of evidence is not evidence of absence'.

Candolle's primary categorization is likewise tacitly, routinely echoed by invasion biologists who suspend the nativeness criterion for livestock and crops, extending to them rights of occupancy. Here, fulfilled human intentions are treated as essential traits of biota, trumping a defining history of human agency, and even of landscape-scale displacements of natives. (Given the qualitative distinction between subsistence and commercial cultures already described, it seems noteworthy that this 'fulfilled intentions' exemption extends even to international agribusiness.) In contrast, thwarted human intentions obviate any exemption for intentionally introduced species such as common carp (*Cyprinus carpio*) in North America, rabbits (*Oryctolagus cuniculus*) in Australia and muskrats (*Ondatra zibethicus*) in Europe. Iconic instances of recent dispersal *sans* human intention, like the trans-Atlantic segment of the 'remarkable worldwide range expansion' of cattle egrets (*Bulbulcus ibis*) (Telfair 2006) are also exempted

(see, for example, Davis 2009) even though human agency clearly underlies this species' subsequent pattern of American establishment (Telfair 2006).

'Simply negative' native belonging is deployed as a moral imperative for augmenting dwindling populations or re-establishing extirpated ones, to the detriment of (sometimes through detriment to) robust alien populations. That paraphrases Ross and Walsh (2003, quoted earlier) and returns us to evaluating their statement. Favouring natives over aliens as they propose would justify returning Europe to a pre-Neolithic condition, and the Americas to a pre-Columbian one. Such proposals (for example Popper & Popper 1987; Donlan et al. 2006) have achieved notoriety but little traction. However, there are situations where conservation biologists have espoused a more limited version of such a view and attempted its implementation.

The fascinating case of pool frogs (*Pelophylax* (formerly *Rana*) *lessonae*) in Britain represents such an effort. *Pelophylax* species (collectively known as 'water frogs') occur across Europe, and it was long assumed that all pool frogs in Britain were descended from central European animals introduced in the 1800s (Williams & Griffiths 2004). They fulfilled a human desire and thwarted no other, and thus enjoyed the Candolle exemption until the advent of nativeness-based conservation genetics. Genetic analysis indicates that two disjunct, localized Scandinavian pool frog populations, morphologically unremarkable but characterized by a minor vocal 'inflection' are distinguishable at the molecular level from central European populations. This finding was conceptually transformed to signify that different clades of pool frogs belong in different regions of Europe (Beebee et al. 2005).

In 2005 Beebee and coworkers examined a lone male *P. lessonae* specimen that was captured in Norfolk and kept captive until its death in about 1998 (Jim Foster, English Nature, personal communication). This frog, they concluded, sprang not from central European stock, but from the northern (Scandinavian) clade. Archaeologists contributed two pre-12th century bone fragments (from a pool of some 10,000 unhelpful frog bones) morphologically attributable to *P. lessonae*. Lacking evidence for introductions from Scandinavia, Beebee et al. (2005) concluded that 'northern clade' frogs were British natives, and had been extirpated with the death of their test specimen.

After much investigation and planning, conservation ecologists were authorized to release Swedish frogs

in Norfolk. Citing a lack of appropriate habitat, they undertook site alterations (tree clearing, pond dredging, artificial water supplies, even pond creation) to favour the return of the 'natives'. In addition, British legal protections were extended to the ex-Scandinavian frogs but specifically denied to the other populations of pool frogs already on the island (Buckley & Foster 2005). Frogs from different *P. lessonae* 'clades' look very much alike, and as far as anyone knows, are ecologically interchangeable. They freely interbreed, and no subgroup has been called uglier, identified as a pest or a disease vector, or as in any way threatening to any other interest. The only reason for preferring the northern clade is a determination of nativeness, but *how* does it provide that reason?

In this case nativeness itself is being treated as both an essential trait and an inherently valuable characteristic of a taxon (but not of its members, which could be experimented with.) This ordinary case embodies an extraordinary logic that requires examining: just what are native taxa, and why should we prefer them? What is it about a finding of nativeness that would move British conservationists to accept the costs of (oxymoronically) creating a new 'native' population from Scandinavian imports when the move confers no further advantages? What hope, expectation or inherent value motivates us to intervene in the name of nativeness?

4.4 BELONGING IN PLACE

This section examines whether and how biotic nativeness accomplishes the theoretical work demanded of it. Nativeness is applied as though a characteristic or trait of a taxon or population, but (as we have seen) it is not diagnosed that way. Once diagnosed, it catalyses conversion of 'rights' of prior (even former) territorial occupation into rights of future occupation. In civil contexts this works tolerably well, if all parties respect the rule of law. It works less well where claims and authorities compete, long-displaced peoples assert long-disputed rights, or current and prior possessors alike claim moral authority. The question germane to biotic nativeness is whether putative natives are contextually (ecologically and geographically) more correct, and thus due some superior consideration. Do plants and animals belong in some places and not others? How can we tell? In any given case, nativeness might be used to assert one or more of the following:

1 A connection between the origin of a species or other taxon and a place. For example, 'This speciation centre [the southeastern part of the Indo-Turanian Centre] harbours nearly 50% of the species of *Tamarix* ... One of its southeastern corners may have been the cradle of the genus' (Baum 1978).

2 Long-standing occurrence (i.e. tenure) in place. For example, '*Castanea sativa* is probably a native species of central and northern Italy' (Tinner et al. 1999).

3 Evolutionary or ecological relationships between biota. Rosen (2000) suggested a co-evolutionary relationship between taxa of some dinoflagellate algae and scleractinian (broadly, reef-forming) corals might have prevailed since the Triassic.

It should go without saying that the biological world differs from the civil world in important respects. Two notorious cases illustrate this point. The northern snakehead (*Channa argus*) is a target of extirpation efforts in the USA, mainly because it is considered alien (Chew & Laubichler 2003). Officials posted a notice asking 'Have you seen this fish?' reading, in part: 'the Northern Snakehead from China is not native to Maryland and could cause serious problems if introduced into our ecosystem' (Derr & McNamara 2003, p. 127). Presumably, a similar objection could have been voiced when channids arrived in China from India or Southeast Asia during the Pleistocene. Episodes accrue through several iterations: there are fossil channids in Switzerland and France dating from the Oligocene (Reichenbacher & Weidmann 1992). Even at the species level, it seems likely that the most common channids in China migrated (or were derived) from species that originated further south (Courtenay & Williams 2004; but see Banerjee et al. 1988). We are not postulating an Oligocene France or a Pleistocene China. We are arguing that with or without human agency, ranges are dynamic. Claims about nativeness like that in the USA 'unwanted poster' are presented as though they adequately capture simple facts, but they mask important complexities. 'Native' does not mean much without a great deal of interpretation. Do snakeheads *belong* in China? How can a fish demonstrate belonging other than by being, surviving and persisting *here, now*, any of which probably exceed its awareness of the issues at hand?

One might similarly ask whether any species of the habitually maligned genus *Tamarix* belongs in the American west. Several species of the shrubs were introduced to the USA from Old World locations during the 19th and early 20th centuries (Chew 2009).

Widely planted, they thrived and spread along riparian corridors and reservoir edges. Three species (*T. chinensis*, *T. ramosissima*, *T. aphylla*) not known to hybridize where their Old World ranges overlap are doing so in the USA, producing unprecedented, fertile hybrids (Gaskin & Schaal 2002; Gaskin & Shafroth 2005). These lines may constitute new species; hypothetical *Tamarix americana** (a taxonomist's asterisk) paradigmatically native because they evolved within their current ranges and endemic because they exist nowhere else.

We doubt that any of the interests currently devoted to eradicating *Tamarix* in the USA will quail at the suggestion that they are attacking a native species. They can reply, *sensu* Pyšek et al., that the progeny of non-natives are themselves non-native, endemic or otherwise. However, that undermines the distinction licensing eradication in the first place. Where does any *Tamarix* belong? Is it native only to the spot where it first evolved, or where the genus arose? Palaeobiogeography is rife with redistributions and speciations that generated competition for space and resources, the stuff of natural selection (Hall 2003).

Arguments relying on place suggest that places are reliable. Most ecologists likely accept that in the very long term of geological processes, places are unreliable. To appropriate a sentiment from Gertrude Stein, it is also sometimes catastrophically the case that 'there is no *there*, there'. Suddenly or gradually, globally or locally, owing to asteroid impacts, axis wobbles, earthquakes or ice sheets, places with one suite of characteristics are 're-placed' by the advent of another suite. Some 10,000 years ago, iconic elements of the Sonoran Desert flora and fauna including saguaro cacti (*Carnegiea gigantea*), creosote bush (*Larrea tridentata*) and presumably desert tortoises (*Gopherus agassizi*) arrived in what we now call Arizona and supplanted the region's former occupants (see Anderson & Van Devender 1991). Does that sanction an attempt to restore piñon–juniper woodland? To what end?

It is widely asserted that ongoing anthropogenic replacement is a more precipitous process than 'natural' change, as if that adequately explained the native–alien distinction, but it does not. It suggests something about human capacities to generate, understand and deplore particular aspects of change, but reveals nothing essential about biota. Biota persist or not under prevailing conditions, regardless (and presumably ignorant) of how they arose and whether they will change further.

These problems can be solved for certain purposes by stipulating which taxa are native to certain places at certain times and then stipulating what is meant by *place*. This merely shifts the problem to defending the stipulations. Nativeness seems to be unreadable from purely biological or geographical details, undermining any argument that particular taxa *belong* in particular places. Today's native may have displaced some previous native when it arrived. Should we extirpate more recent natives and replace them with less recent ones? Where does the regression stop? Is it simply a matter of expedience? How do we know when we have got back to 'nature's original plan'? (International Association of Fish and Wildlife Agencies 2005).

4.5 BELONGING TOGETHER

We have argued that places and taxa change in ways that make ascriptions of nativeness unstable and uninformative. One might reply that such a view is artificially synchronic. Perhaps events in particular places at particular times matter less than the history of biotic relationships expressed as co-evolution. One obvious rejoinder is that system boundaries are products of particular theories and empirical approaches and therefore not uniquely determinable. Ever-longer views exempt ever more changes leading to ever more indefensible lines. However, this is to miss the heart of the objection: is it not ongoing interdependencies – symbiosis in the broadest sense – that at least some of those who privilege native species are concerned with? Is this what motivates accusing *Tamarix* of 'stealing' water (for example Robinson 1952) or degrading wildlife habitats (for example De Loach et al. 1999)?

Tamarix establishment follows and generates changes to ecological processes, but even the most precise measurement of the most unprecedented changes cannot stand as scientific evidence that those changes should not have occurred. In the most inclusive view, large-scale replacements of some taxa by others are commonplace. How inclusive should ecology's view be?

Taking the least inclusive view, scientists can declare that *Tamarix* is, for any expressible reason, less desirable in an ecosystem than some alternative. We can then promote replacing tamarisk with an alternative. Neither calls for an assertion of nativeness; from scientists it requires primarily 'a lever, and a place to stand' that will facilitate the desired changes.

In a middling, more inclusive view, we can tell the story of taxa that suffered unjustly and declined when human agency inflicted *Tamarix* on them, usurping their places and resources. We can then argue that the prior occupants should be reinstated regardless of their own undocumented (but pre-modern) origins, perhaps even at the high cost of perpetual intervention to suppress the interloper. Science needs to enter this equation first forensically, to sort perpetrators from victims; then, as before, to identify methods for accomplishing our design.

In the most inclusive view, we can see *Tamarix americana** as a taxon demonstrating high fitness under prevailing conditions by replacing and perhaps even displacing a less fit flora that happened to arrive first. Perhaps that earlier flora out-competed another, and then another. Such are the fates of less fit taxa. After all, the American west has not always been American, or even a west. Under this assumption, scientists can read the landscape, describe the processes underway, and hope to elucidate how and why they happened and where they may lead. In doing so, they adhere to science's traditional ideal of maximizing objective knowledge production, rather than facilitating a preferred outcome.

In asking which of these approaches is 'correct', we clearly have a challenge. The first invokes proximate desires, privileging whatever serves best for now, regardless of origins or displacements. This is the basic story of agriculture, horticulture, urbanization and even strip-mining, all of which produce economically rational short-term goods. It dominates the debate, seeming 'to hang over the whole world' as the imperative to meet basic human needs (Elton 1958, p. 144).

The second view deplores *Tamarix* because it harms 'natives' without concern for how natives became native. It rests on a *mis*-anthropic principle of denaturing taxa associated with denatured humans, a struggle of purity against contamination. It asks scientists only for endorsement, but any scientific rationalization broadens its effectiveness by reinforcing sympathetic feeling with intellectual authority. It occupies a qualitatively comfortable middle space between seemingly stark economic rationality (pure need) and seemingly stark intellectual disinterest (no need at all). It is more likely to ally itself with the wholly pragmatic former. In the case of *Tamarix*, those who deplore it as an alien and those who believe it harms their economic interests have formed the 'Tamarisk Coalition', which would be more aptly named the 'anti-Tamarisk Coalition' (Chew 2009).

The third view eschews superficial value judgment and concentrates on ecology. In today's American west, *Tamarix* has evidently landed in extremely favourable habitat. Conditions will not remain so favourable. Over time, and perhaps quite quickly, something will discover, develop or evolve a taste for *Tamarix*. (Coalition interests, led by the US Department of Agriculture, have imported a *Tamarix*-defoliating insect to the region). The iteratively revised or self-revising ecosystem may approach an equilibrium that omits some of the taxa now present. This is theoretically fertile but culturally sterile ground. The story has no monsters, no heroes, no resolution and no moral.

Telling multiple stories demonstrates that ecological relationships, places, taxa and human motivations are all plastic. Places change, taxon boundaries shift, symbioses wax and wane, values and inclinations vary. Better and worse depend on the standard of comparison in the frame. Instead of nativeness we might prefer novelty, diversity, rarity or beauty. If we decide to privilege natives, we must still decide which natives to privilege most. Science can inform, and take a role in writing any of these stories. It must do so if our desire is to impose a particular outcome or condition.

4.6 CONCLUSIONS: BELONGING BELIED

It is remarkably easy to unravel the conception of biotic nativeness. We have argued that the idea is recursive, and that dynamics of places, taxa, ecologies and desires render the label *native* uninformative, even deceptive. Carefully limiting it only reveals that our habit of preferring natives to aliens is poorly founded.

None of the relationships comprising biotic nativeness is an inevitable, permanent or dependable object supporting a conception of belonging. Furthermore, the fact that some organisms thrive 'out of context' mocks rights-based contextual propriety. Yet preference for nativeness permeates ecological thinking, supporting a multi-hundred article-per-year publishing effort. Ecologists can demonstrate that in a relatively small (if quite noticeable) subset of interactions, 'aliens' demonstrate fitness superior to 'natives'; but we cannot explain – in biological terms – how inferior fitness is consistent with superior belonging.

The problem lies not with inadequate terminology or definitions. Many a scientist has attempted and ultimately abandoned categorizing since John Henslow

stuck his dagger into the asterisk. Nativeness is a living fossil of an outmoded phytogeography, conceived during the heyday of amateur natural history while a young Darwin explored South America, and fully elaborated before he described natural selection. Nativeness senesced with creationism before ecology or genetics or much else that constitutes modern biology even began, and none of those developments offer to reinvigorate it.

The real crux of the matter is revealed in the publication and presentation statistics discussed in section one, in light of the obvious weakness of biotic nativeness. The dominant 'theoretype' of today's ecological science evolved to reflect the relatively high institutional, organizational, cultural and fiscal fitness of explaining problems in media-friendly terms: misanthropy, misonicism, injustice and displacement. Nativeness is the easy way in. It has been (and will be) fiercely defended and endlessly massaged because it is comfortable and confers advantages; but there is no easy way out. Accommodating nativeness is hampering progress in ecological science. Abandoning nativeness, and with it the hope of belonging, will be costly to those who are overinvested in it. Without nativeness, the ecological past offers us data, but not counsel.

AUTHORS' NOTE

This chapter does not critique civil conceptions of nativeness applied to human individuals, and we consider it inapplicable in that regard.

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