

## ***Invasive plants – ecology, history and perception***

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### **Introduction**

Exotic or alien plant species and especially invasive ones are accepted as causing some of the most serious conservation and economic problems. These are increasingly significant and are becoming global in scope. Yet whilst the problems are real and observable, many underlying issues are given scant or no regard. Our responses to alien species are often very subjective. Human perception and definition of what is ‘alien’ and of what constitutes ‘a problem’ are fundamental to any debate. Furthermore, an understanding how aliens arrive, and how they spread is vital for any control measures to be effective. Deciding when, where, and even how to intervene is important. But often ignored is the basic question of ‘why?’. Even in deciding what is native and what is alien there can be difficulties. Charles Warren in his book in 2002 highlighted the issues with regard to the control of alien species in Scotland, arguing that it is ‘*problem*’ species that should be controlled, not necessarily ‘*alien*’ ones. This very basic idea is conveniently over-looked or ignored in many situations. Deciding what is a problem is so very difficult, and is often left until the situation is too late and out of control to be easily resolved. ***Not all aliens are problems, and not all problem plants are aliens.*** Bracken for example can be a huge problem but is a native species, and even Gorse can be a weed in some circumstances. Our view of what is a problem and also of what is native or alien is not fixed.

In fact many alien species, if they establish in a new territory, do so quietly and unnoticed – slender speedwell (*Veronica filiformis*) in the UK for example; or perhaps Sweet Cicely (*Myrrhis odorata*). Some never achieve any degree of abundance whereas others do, but are not perceived badly. This applies not just to plants to animals too. An extract from a popular book on wildlife in the Peak District exemplifies the split in attitudes:

*‘Another certainty is the continuing colonisation of so-called alien species. Historically, many non-native species were introduced deliberately into some parts of the country and subsequently expanded their range into the peak District. Rabbit, grey squirrel, mink, signal crayfish, little owl, Canada goose and pheasant are just a few of the well-known species that have been introduced in the past. Some, like the little owl and pheasant are welcome additions to the Peak’s wildlife, while others such as mink and signal crayfish predate native species and are viewed as pests.’ (Hamblin, 2003).*

The article goes on to note following a description of Rhododendron and Himalayan balsam, that: ‘..... Other contenders for the Peak’s most loathed plants are Japaenese knotweed, a highly-invasive species that is difficult to control, and giant hogweed, a Trifid-like plant of gargantuan proportions which shades out everything in its path.’

### **Some Key Issues**

A key question is to do with the rate of spread since introduction or establishment, and the actual or potential impacts on assumed native species or wildlife habitats. This is actually far more problematic than it seems at first sight, due to a paucity of data. On the one hand it is obvious that many exotic species around the globe have caused massive environmental impacts. The worst effects are of course the widespread extinctions of island communities by European exports, and the suffering and damaged sometimes caused to wildlife and people in such areas. It is also likely that these impacts will diversify and grow in the future. On the other hand, for most alien plants and animals we often know little of when they arrived and how fast they are spreading. Only in recent years has this been more effectively recorded.

For many alien plants essential information on population establishment, distribution and spread is often missing. Lacking key data on distribution and abundance from time of arrival to the present day, it is very difficult to assess rates of spread and to establish effective control policies. There is often no logical or systematic vision of management and control.

This raises a further point in that we are by nature a conservative species or culture, in that we tend to dislike change. For perhaps psychological reasons we are comfortable with certain perceptions of the state of the world including the environment. These are inherently subjective and probably established quite early in life. Change and fluidity are troubling to us, and yet all we know of the environment and landscape history confirm the scale of changes, and the ebbs and flows in the state of the world. With enhanced global warming we can expect these changes to get bigger in the years to come. But this is important in conservation since it determines our point of reference that we perceive as a satisfactory condition. With changes in climate and in land use over the last 1000 years, it is clear that many species of animals and plants in the UK have come and gone, have ebbed and flowed. The ‘Little Ice Age’ for example, had huge impacts. Yet we don’t have reliable data for the bulk of the species and we have little real information on how flowering plants for example have responded. There are very few botanical geographical records before around 1600 A.D. Many ‘native’ species will have fluctuated dramatically over this time and will continue to do so. In South Yorkshire the prickly lettuce (*Lactuca serriola*), hemlock (*Conium maculatum*), and grass vetchling (*Lathyrus nissolia*) have all spread or extended their ranges across the region since the late 1980s. Yet even today there is no information on former or current distribution, and also nobody has really noticed.

### **Recombinant Ecology**

Another issue in all this is that in many cases, like it or not, situations aliens do and will have roles and functions in emerging future landscapes. This is a new ecology and has very slowly begun to be recognised with work in Eastern Europe, and more recently in the UK. It is the basis of the developing field of ‘*recombinant ecology*’ (Barker, 2000), and understanding this, and planning conservation management to recognise this framework will be vital in many areas. Moreover, this understanding will be important to effective resolution of some, though not all, of the problems that alien plant cause.

Exotic species may cause massive problems or none at all. However, that naturalising aliens in general, and alien plants in particular pose huge problems to ecology, economy and even health, is not to be doubted. The evidence is over-whelming. Derek Ratcliffe (1984) gave a succinct description of the well-known alien, invasive plants in Britain and of their impacts on native environments. Yet the scale of these problems, and the appropriate responses to them, are to be debated. In the first place it helps to be clear what we mean by alien or exotic. Quoting loosely from John Cleese in the film *Clockwise* – ‘----- it is where you are, and when you are, that influences what you are.’ In this context the idea vision of what is alien depends very much *where* and *when* we are observing, and *where* and *when* it is being observed. In a world where issues and solutions are preferred if simple, clear and straightforward, this complication is often ignored. Warren (2002) noted how alien species such as Sitka Spruce in Scotland that are regarded as a problem here, but in Canada as an icon for conservation. Indeed, without the exotic conifers the British forestry industry (as distinct and different from traditional woodland management) would not be competitive. Seeking a balance between pure conservation and sustainable economic development is an important issue in the debate on alien species.

The general truth of ‘*Alien = bad = eradicate*’ is clear and unequivocal. Unfortunately it is also often misguided. The natural and human worlds are far more complex and the issues are

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much less clear, and opinions on what is acceptable and on what is alien vary with time. In the 1930s for example the Little Owl or ‘*Frenchie*’ was considered a serious threat to native species and especially to game, and there were serious campaigns for its extermination. There was even a special report by Alice Hibbert-Ware (1938) to investigate little owl diet and hence likely impact on game birds. Today it is a highly valued and regarded member of the avifauna. There are also issues for internationally rare species such as Eagle Owl (now naturalised in small numbers in Northern England) and where despite a lack of evidence either way, it would seem likely that it was native in prehistoric times. So should they be welcomed or not? Even more problematic are internationally rare animals such as Chinese Water Deer, for which as an exotic species, Britain has a significant proportion of the total World population.

Discussions about aliens also relate to perceptions of ‘*natural*’ and ‘*wild*’; concepts which with significant subjectivity, are increasingly open to debate and challenge. This is particularly the case in Britain where people live mostly in what are at best semi-natural areas and significantly very much cultural landscapes. Our landscapes are shaped both by nature and by human history. To address some of these problem botanists have recently adopted the term ‘*archaeophytes*’ to cover long-established non-native plants. There may also be a time period after which a species may be accepted almost as an: ‘*honorary native*’.

Finally, another important issue to consider is how the spread of exotic and invasive species interacts with and reflects other environmental changes. It is clear that climate change, land use change, creeping urbanisation, disturbance and eutrophication, are all acting to mould landscapes around the world. To what extent is alien invasion a reflection rather than a cause of environmental problems?

## **A public perception**

Alien species are very much in the public gaze. In fact, most people love them and many people are employed through them in gardens and horticulture. Some people take a further step and actively promote both exotic plants and animals beyond the pale and into the wild, and this is where many problems begin. But more of this later!

Some alien species are deeply embedded in our culture. Giant hogweed (*Heracleum mantegazzianum*) for example was immortalised in a rock ballad of the 1970s:

### The Return Of The Giant Hogweed

Turn and run,  
Nothing can stop them,  
Around every river and canal their power is growing.  
Stamp them out,  
We must destroy them.  
They infiltrate each city with their thick dark warning odour.

Still they're invincible,  
Still they're immune to all our herbicidal battering.

Long ago in the Russian hills,  
A Victorian explorer found the regal Hogweed by a marsh,  
He captured it and brought it home.  
Botanical creature stirs, seeking revenge.  
Royal beast did not forget.  
He came home to London,

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And made a present of the Hogweed to the Royal Gardens at Kew.

Waste no time,  
They are approaching.  
Hurry now, we must protect ourselves and find some shelter  
Strike by night  
They are defenceless.  
They all need the sun to photosensitize their venom.

Still they're invincible,  
Still they're immune to all our herbicidal battering.

Fashionable country gentlemen had some cultivated wild gardens,  
In which they innocently planted the Giant Hogweed throughout the land.  
Botanical creature stirs, seeking revenge.  
Royal beast did not forget.  
Soon they escaped, spreading their seed, preparing for an onslaught,  
threatening the human race.

### The Dance of the Giant Hogweed

Mighty Hogweed is avenged.  
Human bodies soon will know our anger.  
Kill them with your Hogweed hairs  
HERACLEUM MANTEGAZZIANI

Giant Hogweed lives

(From: Genesis: *Nursery Cryme*)

Also, it is very clear that the public at large like alien and exotic species. Both accidentally and often deliberately they also either release them, or at least facilitate their escape into the 'wild'. This is not good news for environmentalists and particularly nature conservationists. So whilst nature conservationists see exotic and alien species as a huge environmental problem, the wider public are not always with us – the argument has yet to be won. This is an important point since many conservation organisations and many conservationists assume that people understand the issues and that even if they don't, that 'education' will win them over. Both assumptions are often wrong. Many people understand the issues and seek to disagree anyway – they like alien and exotic species, and they even like them naturalising. In fact in some cases they like them *especially* when they are naturalising! There is a major line of tension in this debate, one rarely addressed, and that is between the gardening public and the nature conservation manager. Considering that the economic value of hobby gardening in the UK is now around £4bn per year, and on top of this is garden visiting, the lobby is important, educated and economically active. Additionally, many of gardeners are also members of and so paying for organisations such as the RSPB, The Wildlife Trusts, the National Trust, and the Woodland Trust. This makes the issue one of even more interest and relevance.

Generally speaking, people like naturalised alien plants such as *Buddleia* - the 'Butterfly Bush', and find hedgerows in Devon and Cornwall lined with garden *Montbretia* tremendously attractive. But they also like garden escapes such as Honesty and many are fond of plants such as *Rhododendron* and Himalayan Balsam too.

### Aliens in woods, forests and wild areas

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Wooded and wild landscapes in Britain generate particular interest because of their high public profiles and public values for many people. Semi-natural, ancient woods and forests are particularly valued, along with heaths, bogs and riversides. Many areas are also economically important and of high value for tourism and leisure. Here the potential conflicts come to a sharp focus. Whereas in the urban commons, and the urban fringe, aliens may be over-looked or even welcomed, here they may cause significant damage and serious concern. There is a further element here too, and this relates to the public perception issues discussed above. Many of these areas or sites such as woods for example, have on-going and visible management. There is therefore to an obvious process of decision-making and management implementation. Ironically of course, the fact that many of these areas have high visitor pressures may be a key factor in the arrival and the spread of exotic plants. It is the combination of visitors and management of many wooded sites that generates disturbance, often a vital key factor in alien invasion.

That many people visit our woodlands, and they are sometimes unwitting, but often deliberate agents of introduction, is another factor to consider.

## So what do we mean by alien?

It is worth considering what the term ‘alien’ means. Dictionary definitions suggest:

- ‘Belonging to another person, place or family especially to a foreign nation or allegiance. Foreign in nature, character or origin’ (1673)
- ‘A stranger or a foreigner. A resident foreign in origin and not naturalised’ (1330)
- ‘One excluded from citizenship, privileges etc’. (1549)
- ‘A plant originally introduced from other countries’ (1847). (Friedrichsen, 1990)
- Clement and Foster (1994) used ‘alien’ in a broad sense to denote all plants whether or not, they were believed to have arrived as a result of human activities. They include plants referred to by other authors as adventives, casuals, ephemerals, exotics, introductions and volunteers.
- Ellis (1993) wrote a very useful and pocket-sized introduction to invasive plants in Britain. He suggests that for many, an alien plant is essentially one that is not native. In this case a native plant is one that arrived in Britain prior to the closure of the English Channel around 7-8000 years ago, and so an alien is a species arriving after such a date.

## Why and how introduced

For plants in particular the mode of arrival or of introduction is central to both definition and to an understanding of the issues. Ellis (1993) took alien plants to be those introduced by people, both deliberately or accidentally. But he also notes that in reality, and with a longer time perspective, most native flora could be considered alien invaders. This is due to the dynamic and fluctuating nature of vegetation in a landscape with long-term changes of key factors such as climate. This latter point may become increasingly important in the years to come.

This is something to be aware of, but it complicates the underlying priorities for contemporary conservation management. It does serve to emphasise that much important

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conservation management is based substantially on subjective human needs, opinions and priorities. It is not necessarily founded on ecological science.

## **Alien plants arise from a diversity of sources:**

### **Cultivation:**

- Agricultural seed
- Grass seed
- Garden escape
- Greenhouse escape
- Relic from cultivation
- Introduced

### **Foodstuffs:**

- Grain
- Bird-seed
- Animal feed
- Oil-seed
- Food refuse
- Spice

### **Other commodities**

- Wool
- Cotton
- Coir
- Ballast
- Timber and wood products

They can be ‘casual’, ‘persistent’, or ‘established’, and are often also described as either ‘introduced’ or ‘naturalised’. The latter implies a self-sustaining and expanding population.

## **The problems with naturalising alien or exotic plants in Britain**

There is absolutely no doubt as to the potential scale of damage and potentially of economic cost by invasive, problem plant species – though not all, for example Bracken, are aliens. Problems can include almost total eradication of the original vegetation (such as with *Rhododendron ponticum*, Japanese Knotweed or Himalayan Balsam), and loss of feeding or breeding habitat for associated fauna. Landscape quality may be affected and sometimes there is a major impact on land management economics. This can in extreme cases be very detrimental to farming or forestry businesses, sometimes to the point of non-viability.

It is important to recognise that this is not always the case, in terms of exotic species generally, and even for particular known invaders in every case. It is vital to identify the factors that trip the switch from modest spread to major invasion. There are also many benefits to both wildlife and people from exotic plants – both in cultivation, but even when they naturalise. Interestingly, many conservationists are uneasy when faced by this. As noted earlier many people like exotics, and some actively spread alien plants across the countryside.

## **Rate and mechanisms of spread**

For many plants that key data on dates of introduction, and on rates and mechanisms of spread are often lacking. Some of the best sources for early information are regional floras and particularly early gardening books. However, since many botanists have viewed invasive aliens as hardly worthy of note vital information on the early spread of many species has been

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difficult to find. Interestingly, the active involvement of the public and in particular the gardening public has proved informative. They provide often anecdotal accounts, but sometimes with information of huge local and regional interest. They do this because of their interest in plants, and often because of their direct involvement in their cultivation and spread.

Armed with this new information we can begin to put together a picture of the introduction, cultivation and subsequent spread of many of these plants. Plants like Rhododendron, Himalayan Balsam, Japanese Knotweed, and Giant Hogweed, all spread rapidly across Britain, aided by Victorian ‘Wild Gardeners’ and often by foresters and estates managers. This was especially during the 1800s and early 1900s. These early invaders are now joined by a whole raft of others such as: *Montbretia*, *Buddleia*, and Cherry Laurel. As a general pattern, rates of spread build slowly over perhaps 50-100 years through suitable environments. They then move into an exponential and explosive expansion. A more recently invasive species is the Variegated Yellow Archangel. This plant which now appears to be a Victorian cultivar is spreading rapidly wherever they are introduced to suitable habitat – woodland or hedgerow. It is able to cover several hundred square metres of woodland ground flora in only 10-15 years from a single point introduction. As it doesn’t seem to produce viable seed, this spread is totally by vegetative spread, and its introduction is always originally by direct human agency.

This raises an interesting point. Whilst a mechanism for propagation is a vital prerequisite for invasion, this is usually but not always by seed. Two of Britain’s most successful invaders – Japanese Knotweed and Variegated Archangel, at least in Britain, do not produce viable seed. In many cases, accidental or deliberate introductions and anthropogenic dispersal have been absolutely vital to success.

## Perceptions

As already stated, perceptions of alien status are wide ranging, personal and complex. Some tree species pose particular problems. Beech for example may be native to the south of England but not in the north at the critical date thousands of years ago. But with time and climate change surely Beech would of its own accord, have spread to the north by now. So should it be seen as native or alien? Margaret Atherden has recently demonstrated Beech presence in pollen profiles in North Yorkshire, and so establishing its early presence even if rare. Of relevance to Scotland in particular is the case of the Sycamore. The debate is well-known and may still be unresolved, but there is increasing evidence that it may have been native, and most likely in Scotland itself. This doesn’t alter either Sycamore’s potential detrimental impact on say ancient ash woods, or its merits as a landscape tree or a timber tree. It just alters the debate about where and when it is a good tree to have. However, it may affect the moral high ground taken by those wishing to remove it, and help generate a more balanced debate.

The same issues apply to many tree species used in forestry and forming self-supporting, naturalising communities of, for example, Scots Pine or European Larch. So how long does a plant need to be here to get a free pass?? This question should be more widely discussed and considered.

## The role of history and the Victorian ‘wild gardeners’ and foresters

An assessment of the British flora confirms that many of today’s most problematic alien ‘weeds’ come from deliberate introductions. These releases were into domestic and landscape gardens, and to forest and woodland estates, from the 1700s to the early 1900s. Inspired by William Robinson, The Victorian Wild Garden movement was responsible for the introduction and subsequent escape of many plants. Some of these are our most spectacular invaders such as giant Hogweed, and Giant Knotweed – stunning garden plants for the ‘Wild

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*Garden*’ of the late 1800s. Over the same period however, was a change from traditional coppice management of native woods to high forestry. This was often with exotic tree species, and supplemented by introduction of exotic trees and shrubs such as rhododendron, snowberry, *Mahonia*, and *Gaultheria*, for woodland management for game preservation. In many ways the seal was now set on the alien plant issues for our contemporary landscape – and there is no going back.

Since this ‘*golden age of plant introductions*’ there has been a continual release of new exotic species into the Britain’s landscape. This has been both from gardens and from modern plantings of exotic trees and shrubs. From the latter a wide range of berry-bearing trees and shrubs is rapidly establishing throughout our woods and forests. Ratcliffe (1984) notes the beginnings of spread by shrubs like *Berberis* and *Cotoneaster*. Exotic cultivars of holly and of *Sorbus* are also spreading into woodlands old and new.

## **Conclusions: So where does this leave us?**

There are perhaps three key thoughts from this argument. Firstly, the potential havoc wrought by aggressively invasive plants, especially in a situation of rapidly changing environmental conditions, is undoubtedly massive. Furthermore and often overlooked in discussion, the impacts on emerging economies and subsistence communities across the Globe are even more catastrophic. Secondly, the continuing presence and further spread of both the existing suite of plants, but with new additions is inevitable. Thirdly, along with the detrimental impacts are huge social, environmental and economic benefits of exotic species, and whilst some of these are restricted to plants in ‘*captivity*’, not all are.

The pragmatic approach is perhaps acceptance but with targeted, effective, conservation management. Hopefully, by understanding the issues, trends, and both ecological and sociological factors at play, we can identify effective and appropriate management i.e. *what is possible*. We can also determine what we want to achieve through management i.e. *what is desirable*. However, not all that is desirable is possible, and not all that is possible is desirable. Aliens are here to stay, many people like them, and more and more interesting species are being introduced to gardens. With the strong likelihood of climate change, then ever more plants will leap over the garden wall, and often with more than just a helping hand!

## **The social and historical context**

In order to understand the issues of invasive alien and exotic plants, it is vital to appreciate the social and historical background. This is important if the serious problems of invasive aliens are to be addressed effectively. Unfortunately this is not the case, and many seeking to control or even to eradicate problem plants often do so in ignorance. This is a problem when the issues are in many cases very real, and the damage done by either ineffective or inappropriate management may be severe and costly.

To assume that the public are conservation minded, or both understanding and sympathetic to the issues is a serious miscalculation. Failure to address this may lead to serious public relations issues and potentially jeopardize a vital control programme.

The debate must reflect the fact that some alien plants, especially those effectively naturalising, are here to stay. They may even have important and positive economic and nature conservation impacts.

The most damaging impacts, and a point often missed in the debate on aliens in Britain, is that the most damaging impacts have not been here, but elsewhere around the world. Whole ecosystems have been disrupted by alien introductions, often from Europe and Britain, and



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many endemic species especially on islands have been wiped out. The spread of alien invasives around the planet does not increase overall biodiversity but has dramatically and clinically reduced it.

## **Targeted management**

There is absolutely no doubt that alien species have had, are having and will increasingly have major and often damaging impacts on British wildlife and the economy. There is also a tendency to act on this very much after the event, and it could be argued when it is too late. However, for action to be effective, it must be strategically conceived and rigorously implemented. It must also be pragmatic in that it should recognise the limits of what can be achieved and also of what can be scientifically or socially and culturally justified.

There are further problems in that currently management is often left to individual landowners such as foresters or farmers, with only limited strategic or financial support from agencies and others. Very few local authorities have the resources and vision to employ specialist advisors in this field, and Government Agencies are woefully under-funded. With the obvious exception of plants such as Japanese Knotweed, in the south-west of Britain and *Rhododendron* in parts of Wales and Scotland (where the National Trust and the Forestry Commission are heavily involved in active control programmes), there is very limited real effort being applied in either active control of problems, or in addressing the cultural issues that arise.

There is currently little real advice available to the public through garden centres for example about risks attached to particular species, or to the horticultural industry in terms of screening new plants for likely naturalisation and impacts. Furthermore, there still seems to be a lack of rigorous science in terms of likely impacts of establishment of say hybridisation between related exotic and native species. Bluebells and daffodils are two examples where there has been considerable concern expressed and we now have teams of volunteers roaming local woodlands to eradicate white bluebells as nasty aliens. In doing this they have certainly removed some interesting and quite rare pink and white forms of native bluebell. The question remains as to whether there is any science to back the fears of spread. It would need to be shown that:

- 1. The native and exotic species are able to cross;*
- 2. That the progeny produced viable offspring;*
- 3. That the offspring of these or of back-crossing are fitter than the native in relatively natural environments, and will spread competitively to the disadvantage of the native.*
- 4. Action can be taken that will have a significant and sustainable long-term effect, or as Oliver Gilbert once told me ..... the change is going to happen whether you like it or not!*

It is not apparent that the research is done or that agencies are considering funding it. Until the gap is closed then the case is at best unproved. At worst the misapplication of concerns is causing damage and diverting action away from more pressing issues.

Attached to all this is the lack of information on many species at local and regional levels, overlooked by most of the national surveys. Yet it is at the local levels where the initial impacts happen and where the genesis of future problems may lie.

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