



Non-native Plants: A London Perspective

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First of all, I would like to tell you a little bit about myself in that I have had a chequered career. I actually started off as a horticulturist. I studied at Kew Gardens, so I have a lot of interest in cultivated plants, from a wide range of perspectives. My doctorate is not in the green stuff at all – it is actually in fungi, but even more so, slightly off to asance, it is actually on a group of organisms called oomycetes, what many other people would really be more familiar with things like phytophthora epithelium, a very important group of pathogenic organisms which have devastated crops around the world for centuries, and a really important part of human history, and we will touch on the fungal world a little bit later on.

So, my interests around London's non-native plants have come rather late in my career. I have been interested in plants and studying botany since I was a very small child. Professionally, I have been working in it for about 25 years. But it is really only in the last eight years, my work at the Museum, starting to look at the Museum's collections, that I started to actually really become very interested in London's non-native flora, and also then, slightly more recently, taking up from Rodney Burton, my predecessor, the Botanical Society of the British Isles, as the Vice-County Recorder, which is an honorary title for somebody who is responsible for recording records for a particular part of the country, in this case Middlesex.

One of the things fair to say is that, broadly speaking, historically, botanists in the British Isles and elsewhere have not paid a lot of attention to non-native plants. They have sometimes been considered not very interesting, 'inappropriate dalliances' when we should be considering those prime pristine pieces of wonderful wildlife habitat that we have got, which is a great misfortune really because they are increasingly important, not only to our ecosystems and our wildlife, but also to our own wellbeing. And again, we have also tended to focus, as scientists, on biological invasion in these pristine habitats. We often consider looking at things like blackberries invading the Galapagos, or miconia invading Tahiti or things like this, or animal equivalents, and we rarely, as a scientific community, focus on many of the focal points of human activity, those nexuses where biological invasions occur, and, often as not, they are the urban environment, and so I feel we have got a very long way to go in actually understanding the processes of colonisation in urban areas, the impacts on the organisms themselves, and then the impacts on other aspects of biodiversity. So, my talk is going to be laden with opinions, which some of you may wince at, so I do apologise in advance.

I am going to also focus on the word "alien". There has been, particularly in urban and industrialised communities, a lot of discussion around the usage of the word "alien" when talking about non-native species. There are a lot of cultural and socio-political sensitivities around that, and no matter what we may think about that as scientists at time, it is, in my personal opinion, frankly easier to avoid using the term. So, I, as a matter of course, now refer to "aliens", as you will see, particularly in the international literature and the international legislation, certainly in terms of acknowledging the sensibilities in this country, I always refer to them as "non-natives".

This is going back to the real focus, London in the here and now. My predecessor, Rodney Burton, and a large troupe of superb amateur botanists in the London area, between the mid-1960s and the early-1970s, collected many hundreds of thousands of records of plant-life in the London area and produced this regional flora, the "Flora of the London Area", and this in itself tells you something about change in our environment. Here, we have a picture of the Tower. In front, this rather attractive – it is a rather pasty old picture, unfortunately, the colour has faded out of the book because it was in the sunlight for many years, but the exemplar of a fantastic brownfield wasteland site. I believe this was what was called Curtis Park,

now digging back into my memory. It has now got, in part, the London Assembly buildings on it. So, that in itself, this is a document of change in the urban environment, and you will see there are scattered in there natives and non-natives. In the foreground, we have got *Artemisia vulgaris*, a British native, looks like there is possibly a little bit of *Vicia*, I suspect – who knows which one that is – and the yellow blobs in the back, I suspect, are likely to be *Herschfeld erincanna*, although the flowers look a little bit big. But one of the things about this picture is really saying how things have changed.

Many of London's native plants have gone through fairly significant and sometimes catastrophic declines, and the May lily is an example of that, always a rare plant in the British Isles as a whole, very, very localised, essentially, to the east of Britain, in very small patches, and Hampstead Heath was its only place that it was known in the London area. Hampstead Heath has gone through enormous change in terms of the landscape management but also nutrient loads, particularly in the twentieth century with things like dogs, vehicle pollution, etc. etc. and there has been a massive turnover from an essentially native heathland community into a habitat that is quite heavily impacted by non-natives. This particular species has lost out, the causes of which are debatable, and in fact actually, in this particular plant, the causes are debatable as to whether it is even native in Hampstead Heath at all anyway. But the point is we are seeing quite significant declines in our native plant species diversity in urban areas, and also probably, if we really had the resources to study it, probably actually even in the biomass. You can certainly see, in certain Central London boroughs, there is a very significant shift towards non-native plant communities as opposed to native plant communities.

This is probably one of London's more historic non-natives, and I will touch on this a little bit later. This is London rocket, which famously, for those of you who are into your botany, appeared in great abundance after the Great Fire of London in 1666. It was actually recorded in Britain I think about 80 or 90 years earlier, by Goodyear. John Swindells is not in audience, is he, because he knows a lot...? No, he is not. He is a man from the LNHS who wrote a master's thesis on this plant, so he knows a lot more about it. But the interesting thing about this plant is it exemplifies some of the ebbs and flows that sometimes occur to non-native plants. We do not really know when this came into the British Isles. It is essentially Eastern Mediterranean and into the drier steppe environments of Central Asia. That is the guess as to where it came from – possibly Iran – widespread through the Mediterranean basin and other Mediterranean-type environments around the world now, but it has certainly been with us for a long time. It has always been a rarity in Britain, locally frequent or massive eruptions, like in 1666, but always rare. In fact, through the nineteenth and early-twentieth century, it became so scarce as a non-native plant in Britain it was considered essentially extinct and petered out. It has gone through quite an interesting resurgence in the London area in the last ten years. That may be environmental shifts or maybe we are just becoming more observant towards it. But this is actually on the Regents Canal – that is part of the brickwork, and the concrete you can see all around there is shrouding apparently parts of the original London Roman Wall. In fact, you can go to the Tower of London and the Roman Wall there supports small populations of it still, so it could be that this plant has been with us since the Romans – we do not really know.

One of the things we do at the Museum is we collect vast amounts of plant specimens. Essentially, we have a plant library, so feel free to pass that around to people. This is a typical example of a specimen collected at the Museum in the Middlesex area. Please try and keep it flat and do not press it or anything like that because they are relatively brittle but it has got a support board, but feel free to take a look at it. These Museum collections are a unique piece of scientific documentary evidence. We have become wildly excited in databases and data management and things like that, and interpreting data, and the molecule and DNA, all of which is fantastic, but the real object, particularly for older records and older historic material, is usually only exemplified in these things. They are irreplaceable and, increasingly, we are starting to look at these things from a perspective of "What else can this specimen tell me?" Not only is it planted there but there is phonological data in there. When was it flowering? We are starting to look at these specimens and consider things like carbon dioxide levels because the stomatal density in the leaves of these plants is in direct correlation with carbon dioxide, for example. So, there are very exciting ways that we can now start to look at these somewhat dusty old objects as relevant scientific objects for today. We often get really hung up on non-native species and panic like nothing on earth about whether they are invasive or not, and it is fair to say the vast majority are not. Many of them fit quite comfortably into the landscape and do not particularly cause problems. That is not to say I am advocating the widespread dissemination of more non-natives into the environment, but many of the ones that we have already got here are of not significant concern.

For example, *Vicia villosa*, Sand Lucerne, some very common things in brownfield sites in the London

area, actually, in many cases, in parts of London, because of the heavy and aggressive development pressure on some of our brownfield sites, these plants are probably, locally and regionally, in a degree of decline. Very important for biodiversity – lots of invertebrates are dependent upon these things.

Sycamore, there has been widespread debate about its status in the UK for a couple of hundred years or so, how long it has been here and its ecological value. It is probably fair to say that the benefit of this species in the environment probably far outweighs some of the negatives, particularly as we are seeing our rather depauperate tree population, in terms of number of tree species that we have in the British Isles, be heavily impacted by diseases, etc. which I will come back to a little bit later.

Then Mexican fleabane, which used to have the even more delightful name of *Erigeron mucronatus*, sub-species *karvinskianus*, is possibly the questionable one. This has gone through a really interesting shift. When I was a lad in Western Cornwall, this was a locally abundant plant around places like the Lizard Peninsula – you see it quite often. It grows in sunny rock communities, Cornish hedges and walls, often in competition with some of our wall-fern species and other things that like hot, sunny crevices. It has rapidly expanded its range in the British Isles over the last twenty or 30 years and is now consolidating in its abundance. Twenty years ago, this would have been like a “Who!” to see it, if you saw it in London. This is now a “Oh...”. It is fairly widespread, particularly when you go into the older parts of London. The Georgian and the Victorian parts of London often support quite high populations of these certain things, and some of it I think is actually to do with the mortar and the cement and the brickwork and things like that.

For example, wall lettuce, which is a very well and truly considered British native plant, essentially a calcareous ancient woodland indicator in many places, in London, has got a real taste for Georgian terraces, and it often grows in the street wells and places like that. So, you can often put a bit of a proxy on the date range of the building by looking at the plant communities, without even actually looking at the building itself.

Invasiveness. Fundamentally, we are looking at the capacity to change environments, change ecosystems and change habitats, and by that definition, we are, I am sure you will all realise, the supreme invasive species of all time really, unless fossil record digs up something else at some point that we do not know about it, but it is highly unlikely.

Another thing about invasive species is that you can start to predict what are the traits that are likely to cause invasiveness, and I will probably touch on them as I go along, but in a nutshell, there are things like looking at a concept called predator release or predator escape. Particularly for plants, this is quite a significant thing, and I will use a horticultural example: if you are a person interested in a particular group of plants and you go to the Himalayas and you find the plant you love, what you will do is you will find the most robust, the healthiest, the most glamorous, you will collect that, you will probably take a cutting when you do it, or you may collect seeds. You will clean it up – you will remove all the pests and the pathogens, etc. You are pulling away, you are stripping away the pathogens. You move it to a new environment. Now, if you move that to a new environment that is, say, for example, halfway around the world, it is likely as not, particularly if your plants have come from somewhere like Australia or New Zealand or South America, that your plants in your communities, in your new environment, have no phylogenetic relatedness to where the organism came from, so there will not be things that are capable of eating the thing that you have transported. This enables non-native species to really gain the upper hand, if they have got some of the nastier traits inherent around biological invasion. Bird-dispersed fruit is a good example for birds, always a one to watch out for if you have got an Australian plant with bird-dispersed fruit.

This is one of my real bugbears about how we view non-native species, and we have got some serious culture issues to deal with in the British Isles, and also, to an extent, in Europe, in that we tend to view non-native species from a perspective about how we feel about the or whether we like them. Butterfly bush, bless it, it says it straight in the name – I cannot bear calling it butterfly bush! It is *Buddleia*, to me, which is a shame because Reverend Adam Buddle was a marvellous botanist, but there you go! *Buddleia*, we like it, it is pretty, is it not? It is purple and butterflies sit on it and it is really cute. We do not like Japanese knotweed because we have prescribed it rather as a “bad weed” and it pushes over walls and it is drab and it has little things on it that we are not keen on – flies and beetles. Who cares about flies and beetles? But these are really cultural and behavioural things, driven by our behaviour. My contention is that, actually, out of the two, *Buddleia* is probably a far more serious threat to our biodiversity. I suspect, if we were to do a proper, detailed mapping exercise of the extent of *Buddleia* in London, for example, or the rest of the country, you would find, in terms of acreage, hectareage, *Buddleia* would far outpace Japanese knotweed. There are many other things about it, which are of concern. Japanese knotweed, bless her, she is an

ecological dead-end because it is essentially one clonal female. She is not capable of reproduction, apart from in one very strange circumstance, which I am going to pass around for you.

However, *Buddleia* is a sexually dynamic species. It is adapting, evolving, we have got multiple populations being introduced into the British Isles – it has got all the things going for it in terms of what makes an invasive species. It is wind-dispersed, so the seed can get all over buildings. It is a significant risk to the built environment, and increasingly, we are finding it move out of urban and suburban areas into our treasured chalk grasslands, limestone cliffs, etc. This plant is a thug, and we need to treat it as that. It is very unfortunate our legislative process in the UK – and I will touch on this a little bit more – has failed to address risk. It has been essentially a behavioural process that we have got, in terms of how we feel about it. Incidentally, I have done searches on and off over the last ten years for evidence about *Buddleia* being good for wildlife and I can find none. There is no quantifiable data that demonstrates that *Buddleia* is good for perid, nymphalid, and brown butterflies, the lot – there is no data to support this. If somebody can find something for me, I will be over the moon. The analogy I often make is: if you see a group of teenagers outside a large burger chain, you do not immediately assume it is good for them, and this is the same issue here. We really need to look at the ecology, the population dynamics, and if *Buddleia* was so darn good, why is it that this population of this plant is going upwards and the populations of most of our butterflies and other things is going downwards? There does not seem to be a particularly robust correlation there. I told you it was a bit hyperbolic, so those of you who are a bit more rigorous in your science, you can take me to task later.

Now, we are seeing very profound changes, and early meadow-grass, *Poa infirma*, is almost certainly the ancestor of annual meadow-grass, one of the most important plants in temperate environments around the world. Early meadow-grass is essentially a Mediterranean species. It was not picked up as a British wild plant, even though it had been collected in the 1880s and 1890s by William Kernot in Cornwall, until the 1950s, when it was recognised as a British plant.

So, prior to 1950, this was the extent of the British records for this. It is essentially a plant of open, weedy habitats, a bit like early meadow-grass, lawn edges, paved paths, and clifftops, where it has got not much competition and it can grow quickly in very early spring, and then it dies off. However, as the environment has shifted over the last twenty or 30 years, we are starting to see changes. Now, I am not saying that these changes are absolutely down to do with environment, but there are things that we need to look at here. If we roll the clock forward, we find a little bit wider, it has got to the Portsmouth and Southampton area, and then, who, '87-'99, significant spread, and then, we move forward again and bang! We found it for the first time in London in 2002, and once you have got your eye in, it is a fairly easy plant to identify. We are fairly confident that this spread is real. It is a spread – it is not that we have missed it over large chunks of Southern England. Things are changing. Now, some of that could well be human dispersal – vehicles, lawn-mowing etc. Certainly, in London, we think it is quite likely that it is moving from borough to borough by rented machinery cutting the grass, moving around, and we have seen certain boroughs, over the last ten years, did not have it, and then, all of a sudden, it is everywhere in the borough. Islington, it started appearing all over the place in about 2002, and vast swathes of it when it is here. So, there are possible some sort of direct human-mediated causes in that we are actually physically moving it around, but I am fairly confident – this is a Mediterranean plant in essence – that some of it is probably due to environmental change.

Another aspect of change, and this is a difficult one to pick because we have rather shot ourselves in the foot, yet again, in urban and suburban areas. We are very keen on planting trees and shrubs for conservation, mainly I suspect because it is easy to do, and they love doing reed-beds as well, which is easy, relatively speaking, with relatively little consideration for the underlying structure of the ecology and the habitat. Sadly, we have been planting a very large amount of material, which is essentially non-native. Peter Sell, who sadly recently died, was a superb herbarium botanist from Cambridge Botanic Gardens, had done some very interesting work looking at a range of these plants which had been planted on motorway verges, hedgerows and stuff like that, and found that many of these things are not what they say on the tin. Wayfaring tree has got a whole suite of look-a-likes, *Viburnum* species from other parts of the world – guelder rose and so on and so on. Our native dogwood has got various other ones that are not the same.

Now, what is the consequence there? And this is another one – this one gave me the absolute horrors when I realised it! Under this suite of look-a-likes, we have this thing, *Crataegus subsphaerica*, which is being sold in abundance as *Crataegus monogyna*, our common hawthorn. Again, we do not really know if there is any ecological – in fact, common hawthorn is one of its parents. The other one has got the

delightful name of *Rhipidophylla* – it is a species from Eastern Europe. But we are very interested in environmental change at the moment in London and elsewhere through the British Isles, and a lot of the work we do tends to focus on where people are because we are very interested in citizen science and engaging mass observation, so people are collecting data often from their doorstep or nearby. So, first off, you have got the heat island effect; secondly, and most critically I think, because we can probably account for the heat island effect, we do not really know the tax that we are dealing with, and I strongly suspect, if we had the resources to unpick all of the hawthorns in the London area, for example, you would find – and I have done a quick look in a few of the inner London boroughs – virtually every single hawthorn is *subsp. sphaerica*, so the flowering times could well be different, which means the phenology data is being skewed because hawthorn is one of the things that is being collected as phenology data. I have raised this with a couple of people, and they just shuddered and looked at me and moved away, and I have shuddered because, so far, I have only found one true hawthorn, as opposed to *subsp. sphaerica* and the other hybrids in Hyde Park, for example – slightly horrifying.

We are seeing some very significant changes, not only in these look-a-likes, but things that we have had in our parks and gardens for decades or centuries which have been quite well-behaved, and foxglove, *Paulownia tomentosa*, is a good example. Up until recently, nobody even conceived that this rather delicate, quite tropical-looking street tree would produce babies in London or anywhere else in Southern Britain, and I took great pleasure in telling Clive Stace, the current man who writes our British Flora, that we do get seedlings in London, and we get them very regularly when the climate is right. It is on the teetering point really, in the sense that we seem to be having a bit of a shift. When you get a slightly colder year, seeds are not produced and it fails, so it is on a balance, but this species is highly invasive. The Southern United States, where it has been introduced as a timber crop because it grows fast and the wood is quite desirable, it is getting out and about and it is causing a serious nuisance. We have an emerging problem here, I would say. As yet, established plants are rare.

This is another one of my significant *bête noirs*. This is a map from the London Flora Project, with Central London in the middle, as you can imagine – this is in a twenty-kilometre radius out from London – and this data is largely based upon people observing trees, not seedlings. This tree was introduced into the British landscape in the 1760s, and for probably most of the 200 years after that, it never produced seedlings, or extremely rarely. It has gone from a point of very rarely producing seeds to doing it by the hundreds of millions every year in the London area. Most of those seedlings get swept up by street cleaners, etc. Others – again, this is on the Regent’s Canal – establish in our less managed environments. This is an emerging problem for the built environment because it is as tough, if not tougher, than *Buddleia*. It is going to cause real problems for people like Network Rail and hence, ultimately, probably for our rail fares. On top of that, this plant, this is a classic example of this concept of being phylogenetically distant. There are no plants in the British Isles from which this plant comes from, the *Simaroubaceae*, so there are no pathogens, there are no fungi, anything, native to the British Isles that will eat this thing. It has got free rein and it is a thug. It is also a risk to human health. I saw a horrific picture recently of an arboriculturist who had, probably life-altering, blisters all over his face and neck and arm from him working with this tree, so watch it.

So, the sort of things that are under our nose that we tend to miss... Increasingly, you hear people grumbling about duckweeds – “Oh, yeah, duckweed is a real nuisance, clogging up my pond, clogging up the canals, clogging up the garden,” everything like this. Often as not, it is not our native duckweed species, but look-a-likes, and also, underlying problems with the environment. Many of our rivers and lakes, even though water quality is improving, are still significantly impacted by phosphates and nitrates and other pollutants, or agricultural run-off from vehicles, so many waters are heavily eutrophied still. That really shifts the ecology and plays havoc with it and, under those circumstances, some of these duckweed species go bananas. *Lemna minuta* is one of the more abundant ones, by a long chalk at the moment. It is so abundant in parts of the London area it is significantly outcompeting our native species, and it is often as not the one that people are going, “Mm, duckweed!” In fact, I have seen it so dense in parts of the Regent’s Canal that even Canada geese cannot swim through it. It is absolutely solid.

However, I am not saying that it is all doom and gloom in this particular species. Aquatic plants – and Canada pondweed is a good example – have this tendency to go up, up, up, up, and then, boom, and drop off the cliff. So, we always have to be a little bit careful with this biological invasion in what is actually going to happen on the trajectory of abundance and things like that. Sometimes the ecologies adapt – pathogens come in and things calm down. Canadian pondweed, which we were all terrified of 50 or 60 years ago, seems to have become relatively sedate, certainly in the London area. In fact, in London, nearly all the stuff you see which you think of as Canadian pondweed is another species called Nuttall’s pondweed, which is

subtly different.

But we are getting a slew of these coming in, so we now have Valdivian duckweed, and we have I think another two. My colleague, Fred Rumsey, did a superb review on this in *British Wildlife*, so if you want to get to know your London duckweeds and look out for odd ones, I strongly recommend that. So, there is at least another two species on the horizon in the London area.

As a homage to the BSVI, I must raise this issue or else they will curse me, and I agree with them. We concentrate on biological invasion, invasive species, and we tend to forget about the impacts of our native invaders. Many of these species – and these are two I will just put up quickly, stinging nettle and false oatgrass. Their shifts in abundance are largely to do with eutrophication in all its various forms and also shifts in landscape management, but we have significant issues because some of our rarer, more cherished habitats, or even the ones that are not particularly rare and cherished, are increasingly being invaded by these species, so we need to really think about the underlying causes of biological invasion because it is not always the non-natives.

Hybrid bluebell, I was party, in my early years at the Museum, in working on looking at the genetics of bluebells in the British Isles. There is still more work to be published so keep your eye out for that, but in essence, we do not have Spanish bluebells in Britain. Most of our bluebells would seem to be derived probably from Portuguese populations, but I personally have never seen a true Iberian wild-type bluebell in the British Isles. It is virtually all this thing, *massartiana*.

However, it is incredibly variable, and you can have even apparently pure populations of non-scripta, our native bluebell, that will have genes of these non-native species in. So, for example, Ruislip's Wood, if you go into there, and you think, you are in a SSI national nature reserve, and so on and so forth. In the middle of the woods, you will have native bluebells and they will have a dob of the Iberian genes in there as well. We do not really know what the impacts are there, but this is another thing that we really need to start to understand, the genetic and evolutionary processes of biological invasion. We do not understand the impacts.

Three-cornered leek, I put it in partly just to fill up this page, but also because it is a beast. This plant is virtually indestructible. It is rampaging across parts of South-West Britain, gradually establishing in the London area. I strongly recommend, if you have got it anywhere in your vicinity, dig it up and cook it – it is very tasty, but it is virtually indestructible. I dug a load out – I used to volunteer at Camley Street's Natural Park in King's Cross, and I dug a load of the bulbs up of this plant and I dropped them into a bucket of water overwinter, and I left them in water for six months, through the winter, frozen cold and drowning - spring, poured them out, and they were all as right as rain. It is an incredibly tough plant.

My colleague, Fred Rumsey, who is an absolutely extraordinary field botanist, one of his great loves are ferns. In London, we have been really lucky. Since the Victorian fern craze scoured many of our ferns from our woodlands and our walls etc., and then, industrial pollution played an even greater impact probably in terms of actually eradicating fern populations from the built environment. Many of our wall ferns, like asplenium species, have gradually re-colonised and we are doing quite well in terms of native fern species in the London area. In fact, we have got some extraordinarily rare ones turned up in Middlesex. We have probably got more species of asplenium in Middlesex than the rest of the British Isles put together at the moment, which is most curious.

Following along from that, a whole suite of non-native ferns have come along, and *cyrtomium*, the holly-fern, is probably the most abundant. We have got two, maybe three, species in the London area, partly being spread very rapidly because it has been planted a lot in the last twenty years with the current vogue for the tropical look in gardening. So, for those of you who are Islingtonians and you like your tropical look, you will probably have things like holly-fern planted under your nice *Tetrapanax*, etc. and this is gradually establishing in crevices and stuff around the London area. Probably not an invasive risk, but we do not know the competitive relationship between some of these ferns and our native fern community.

And *Pteris*, about five species of *Pteris* have turned up in London in the last few years. Again, at the moment, they are usually fairly rare, small singletons here and there, but they are denoting a significant shift in the environment. These plants are very, very frost-sensitive, so we have to consider the likelihood that either the heat island effect is getting greater or that environmental changes are having a more significant impact.

Getting smaller and smaller, we tend to think of invasive species as being things like Japanese knotweed or grey squirrels, but *Camphylopus introflexus*, which is from the Southern Hemisphere – I think it is New

Zealand – is one of the most successful invasive species in Britain. There are indications, and it is not particularly relevant for London because most of our heathlands are now kaput, that it is having quite an impact on ecosystem structure, particularly post fire-burn in some moorlands, and it seems to be affecting the successional rates in some areas.

Ah, fungi! Now, this is where it is better, much better! I said I was a mycologist. For those of you who are mycologically inclined, when I said oomycetes, I heard you muttering to yourself, “Oh, those are not fungi!” I know, but they are fungal – they behave like fungi. In fact, oomycetes, for those of you interested, are actually more closely related to brown seaweed. Potato blight is basically brown seaweed gone bad. This is a really, really interesting plant. If we go back to the world of “true” fungi, ascomycetes and basidiomycete, this is *Agrocybe rivulosa*. This first turned up, new to science, in the Netherlands, I think, in 2002 or 2004. Certainly non-native there – we do not know where it is from at all. The native origins of this species have never been discovered. It has skipped across the North Sea, possibly either directly in woodchip, which is its preferred home, or maybe wind-dispersed, and has established very rapidly in the British Isles over the last ten years. I actually just found it on the Isles of Scilly earlier this year, the first record for that area, and it has become widespread in urban and suburban environments. This particular species probably – we do not know of any likely contraindications, but again, our changing behaviours around how we use and manage the landscape need to be considered.

We have become really enthused by woodchip in the last ten or twenty years. The forestry industry love it because it is a really handy way of getting rid of junk, and garden centres love it because, again, it is a really good way of getting junk, and councils love it because it is a quick and easy way of actually managing weed cover etc. There are likely to be some quite significant negative impacts, so I am concerned. We are moving vast amounts of biological material around in things like woodchip. Many of these things are the little squitty things, the fungi, the bacteria, maybe seeds of some of these plants, and the consequences of this large-scale transport of materials is quite significant.

As you may have noted earlier on, I got slightly dark when I mentioned habitat creation and things like reed-beds and trees, and this is my other *bête noir*, is planting so-called wildflower seed mixes, which are generally rather cod. Wildflower seed mixes are almost certainly never that. They often have things which are not even European. They will be things like Californian poppy and all sorts of other delightful things from around the world. They are not proxies for meadows. They are pretty pieces of confection which are really good and they may have some biodiversity benefits for things like invertebrates, but they are not meadows.

We are also blithely and glibly transporting non-native plants in the British landscape under the name of British plants, and Austrian chamomiles is a good example. *Anthemis austriaca* is being sold as chamomile, and it is not – it is not the same as our British native species. Again, you have got a little question around trades descriptions issues around here as well.

The ecological impacts in the urban environment, I would say, stress negligible on the negativity, but this has an impact in public understanding of what we do with biodiversity, and we really need to carefully consider this. For those of us who are involved in conservation management and things like that, the messages this gives out to the public can be quite detrimental, I feel. I was really heartened to see, just recently, the RHS has proposed some guidance for how we describe these kind of seed mixes. I am not saying we should not use them, but we should be more careful about what we say they are and what they do.

Industry and transport are incredibly important in terms of transporting things around. Horticulture, I will touch on in a minute, but certainly, things like *Senecio inaequidans*, this is the modern equivalent of Oxford ragwort. Oxford ragwort, famously, Frances Druce, in the '20s or '30s, watched seed of Oxford ragwort bouncing along the railway system in Oxfordshire and used it as a way of describing how railway systems were a significant part of the transport of Oxford ragwort around the UK, and that has been followed up with large amounts of actual research to pin that down. *Senecio inaequidans* is actually not related to Oxford ragwort. It is another member of the genus, but it is a South African thing. On the Continent, it absolutely adores trunk roads. It is moving around on trunk road systems, and we are getting some indication in South-East England, particularly North Kent and South Essex, and into Central London increasingly, that it is using trunk roads as a vector for moving around.

Another thing that is really interesting about this plant is it has changed its ecology. In Lesotho, where the wild originating plants are from, we think, it is a squitty little annual, grows about that high, two or three flowers, and then dries off in summer droughts. This thing here is a big, stout, sub-shrubby perennial that

lasts for quite a few years and has impacts upon grassland structure and the habitats it moves into. Horticulture. Once upon a time, I was a horticulturalist, and horticulture is a fantastic industry, but horticulture needs to look at how it carries out its practices. The “polluter pays” principle is a very significant thing that we need to consider in all of our human activities, and horticulture at the moment, it is fair to say, does not necessarily have that principle applied. We cannot necessarily critique a community or an industry for things that have happened in the past, like say rhododendron or Japanese knotweed, but we do need to very carefully consider, for a nation of garden lovers, how we garden. As I say, that is an individual but it is also an industry responsibility, and promoting plants that have potential to be invasive is a significant issue that needs to be looked at, and the transport, inadvertently, of widespread blocks of ecology is something that needs to be really looked at.

These plants are both, almost certainly, coming to the British Isles – they are not of concern – establishing several plants in the London area through the enthusiasm for big olives in tubs, planted in municipal plantings, big palms, etc. many of which are grown in places like Central Italy, and we are transporting Mediterranean biota – and these are the things we can see. We do not really know about the beetles and all the other things, and maybe the viruses, etc. which are associated with these things. So, international trade has got a very long way to go in terms of actually what we really need to be doing.

Ecology. Climate change itself is a scientific experiment, and non-native species in urban environments are also. Not only have we got the non-native plants, but the interactions with the other organisms is incredibly important. So ring-necked parakeet, all the sorts of things that are on horse-chestnut, which in itself is a non-native species, and then, on the left, is our knotweed.

Japanese knotweed is a single clonal female in essence in the British Isles, just one lass, a big lass. She, however, because there are very few boy Japanese knotweeds, has a bit of a hard time finding a mate. She can mate with Russian vine because they belong to the same genus, and that is what you have in your hand – is the hybrid between Japanese knotweed and Russian vine, which sounds terrifying, does it not?! You think, “Oh – Armageddon, absolutely horrific!” Fortunately for us, as things stand, it has managed to get the weaker Achilles heels of both of its parents. It has not really gone for the vigorous climbing strategy of dad and it has not gone for the vicious “under the ground and come up” strategy of mum. It just wobbles somewhere in the middle, kind of saying “I do not quite know what to do with myself”. It only grows about that high and then flops over and cannot cope. It has incredibly low competitive ability, so it is actually a very, very rare plant, and it has only ever been found about seven times truly in the wild in the world, once in the Czech Republic, maybe once in Germany, and about three or four times in the London area. I found two of them!

This one here was my mate Nick Bertram from Deptford Creek and this is actually growing on Deptford Creek. It grows in places where there is very, very low competitive ability, so wall crevices or on creek-sides where big plants cannot out-compete it.

The point I am making about this is not that just this is peculiar but this is actually about how urban environments can be hotbeds for evolutionary change and process. Most plant species, it is reasoned, are what we call polyploids, which means you have a chromosome doubling. You double up the chromosomes and you get a new species. And we know this has happened in the British Isles in recent years. There is the Welsh ragwort, which is a polyploidy, and the York ragwort, which did not last very long because it was sprayed out by weed-killer. So, we know urban environments are focal points for putting things from different places next to each other and creating novelty. Who knows what would happen if the chromosomes on this double? We may find we have a unique London thug that is sexually-reproductive. This plant is sterile, so it just sits there being really rather rubbish.

I have been slightly ranty and slightly doom-and-gloomy about things, but it is fair to say we are beginning to wake up in Britain, and partly this is about research. I mentioned I was going to talk about research as opposed to my opinion, but one of the things with research is actually finding out where things are and learning from other people, even just doing basic things.

For example, creeping-water primrose is a very aggressive plant in France with major ecological impacts. We have taken, for once, in the British Isles, the proactive step of actually going out and isolating and finding founder populations of this thing and killing it before it gets a move on. The Environment Agency has collaborated with a whole range of other people, getting data from local Wildlife Trusts, biological record centres, people like me in museums with herbarium specimens, and community-based projects, to find these plants and actually take them out of the wild.

Actually, just next to it, False Hampshire purslane is a curious thing that is currently, at the moment, just residing, as far as we know, in one pond on Wimbledon Common. In itself, we do not know whether it is going to be, necessarily, an invasive species. It lives in a habitat which is so heavily impacted by invasives itself, it is quite hard to work out which one is the worst, because it has also got *Crassula helmsii*, which is an absolute fiend, and *Myriophyllum*, parrot's feather, which is also diabolical. So, it is living in this community with basically no native vegetation left.

But it may, if it gets down to Hampshire, come into contact with our rare British native, the Hampshire purslane, and possibly have quite detrimental effects in terms of the genetics of our plants, going back to bluebells, or out-compete it. In London, we have started to take action locally, and I sit as an advisor on a thing called the London Invasive Species Initiative, and we have drawn up a list of various things that are of concern, two of which, we have started to take action on.

Johnson-grass, *Sorghum halepense*, is a very serious invasive species in warm, wet, temperate grassland communities and in the Tropics. Again, if you read the standard literature in the UK, it says, "Oh, it does not reproduce in Britain." It does. We have a colony on the Regent's Canal which we are attempting to eradicate, and it produces seedlings. Thankfully, in this particular case, it is almost entirely surrounded in concrete, and our chances of eradication for this founder population are quite high.

The other one, pale galingale, I am starting to lose hope on, it has to be said. We thought it was going to be a quick win. This has got scattered populations all over the world. It is a very close relative of a species that is considered one of the hundred most damaging, non-native invasive species in the world, so we decided to take action on it. There is loads of it all around Regent's Park, around the canal, around there, and we have spent a large amount of time digging it up and spraying it, and we thought we were getting on top of it and then I walked along, a little bit earlier, late-summer, and there were vast cohorts of seedlings coming through. This is one of the things to bear in mind: managing invasive species is incredibly expensive. We need to take action before they are established, and this really is the case in point why. Back to fungi again, we really, really need to get our act together, both in the European Union and in the UK. We need to start looking at biological invasion, whether it be diseases, plants, agricultural materials, veterinary, etc. etc. not as bunkers, because we are repeating things in these little niches, but actually look at it for what it is. These are all biological invasions, and we need to look at them from a proactive point because these things are expensive.

I have had the pleasure of going to several of the meetings in and around Whitehall with regard to chalara, and it is looking very, very bad. Certainly, having seen the pathogen in action in Switzerland and in the Netherlands recently, the outlook for our British populations of ash is very, very serious indeed, and that is in part why cities are so important, because that human activity we do in cities, it ripples out into the wider landscape, so when we start planting new trendy trees in streets, or have new ways of managing landscape, those things impact the wider environment, so we cannot think of places like London as little bubbles, separate to the rest of our landscape.

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