

Environmental Audit Committee

Oral evidence: [Invasive Species](#), HC 2129

Tuesday 21 May 2019

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[Watch the meeting](#)

Members present: Mary Creagh (Chair); Geraint Davies; Mr Philip Dunne; Ruth Jones; Caroline Lucas; Kerry McCarthy; John McNally; Dr Matthew Offord.

Questions 1 - 84

Witnesses

[I:](#) Professor Helen Roy MBE, Ecologist, Centre for Ecology and Hydrology, Kathryn Brown, Head of Adaptation, Committee on Climate Change Adaptation Sub-Committee, Dr Paul Walton, Wildlife and Countryside Link, Chair of the Invasive Non-Native Species Working Group, Dr Peter Robertson, Professor of Practice – Wildlife Management, University of Newcastle

[II:](#) Professor Chris Thomas FRS, Director of the transdisciplinary Leverhulme Centre for Anthropocene Biodiversity, University of York, Professor Elizabeth Cottier-Cook, Marine Biologist, University of the Highlands and Islands and Scottish Association for Marine Science (SAMS), Dr Wayne Dawson, Assistant Professor in Department of Bioscience, Durham University, Dr Alison Dunn, Reader in Evolutionary Ecology, University of Leeds

Written evidence from witnesses:

- [Centre for Ecology & Hydrology](#)
- [Committee on Climate Change, Adaptation Sub-Committee](#)
- [Committee on Climate Change, Adaptation Sub-Committee](#)
- [Dr Peter Robertson](#)

Examination of Witnesses

Professor Helen Roy MBE, Ecologist, Centre for Ecology and Hydrology, Kathryn Brown, Head of Adaptation, Committee on Climate Change Adaptation Sub-Committee, Dr Paul Walton, Wildlife and Countryside Link, Chair of the Invasive Non-Native Species Working Group, and Dr Paul Robertson, Professor of Practice—Wildlife Management, University of Newcastle

Chair: I welcome everybody to today's hearing. This is part of our work on climate adaptation and it is our first session looking at invasive species. It is an update on our predecessor Committee's inquiry into non-native species in 2014. That inquiry ran during the development of EU regulations on invasive alien species. We have had 57 written submissions and we are going to hear from some of the top people, specialists, in the country, so we are always very excited about that. You will have to speak slowly and spell out any difficult Latin words. Please introduce yourselves, starting from my left with Dr Robertson.

Dr Robertson: I am Peter Robertson at the University of Newcastle, where I do research on the risks associated with invasive species, but I have spent much of my career working for the Animal and Plant Health Agency in related areas.

Professor Roy: I am Helen Roy and I am at the Centre for Ecology and Hydrology. I am an ecologist and I have led projects for DEFRA and the European Commission over the last decade.

Kathryn Brown: I am Kathryn Brown. I am the Head of Adaptation at the Committee on Climate Change.

Dr Walton: I am Paul Walton. I am a seabird ecologist by training. I work for RSPB Scotland and I chair the Wildlife and Countryside Link Invasive Non-Native Species Working Group.

Q1 **Chair:** Professor Roy, may I kick off with you? We have had all these reports: IPCC talking about the dangers of global warming; another report this morning about the ice caps melting faster than we thought; IPBES—the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services—talking about biological collapse. In relation to the other threats to biodiversity, which are many—land use change, habitation fragmentation—where do invasive species come, both globally and here at home in the UK?

Professor Roy: From the global IPBES assessment, it is very clear from the evidence that has been gathered within that report that they are the fifth of five large drivers, but then when you look at the figures within that report, the invasive alien species do take up quite a large proportion of the threat to biodiversity systems. It is important to remember that it is not just to biodiversity systems. Invasive alien species or invasive non-native species also have effects on the economy and society. It is really important that we begin to embrace more the interactions between



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drivers of change and the way in which climate warming is likely to interact with invasions and likely to exacerbate the situation.

It is also important to remember that with non-native species and species that have been moved by humans from one part of the world to another, those species that arrive here through climate warming—for instance, the expansion of a species from mainland Europe into the UK—would not be considered a non-native species. It is to do with that human movement. When we think of all of the non-native species, it is very important to remember that about 15% are the troublesome ones. They are the invasive non-native species. There are many, many non-native species that will arrive and not pose any particular threat, but those that do are a major concern and because of that human involvement there are obvious biosecurity things that we can do to prevent their arrival in the first place.

Q2 **Chair:** Is that 15% a global figure or is it here in the UK?

Professor Roy: It pretty much is a global figure but it is very context-specific. For example, if you were to look at just all of the animals that are moving around the world, probably more than a third of those will cause some kind of problem but with the plants there is a much lower proportion. For Britain, we would term about 6.7% of the non-native plants as invasive non-native species and it is those that we need to focus our attention towards. It is really important that we understand the patterns and trends of all non-native species and it is difficult to predict whether some of them are going to have an effect or not, but I think that what we are talking about is the invasive component.

Q3 **Chair:** You said it is the fifth driver of species loss but then you said that there is an important interplay part as well. Where is it on the fifth? Is it that climate change is 40%, land use is 20% and these non-native species are at 5%, or is it 20% or 15%?

Professor Roy: It is really tricky to look at them in isolation like that, because there are clearly interactions. When you look at global figures, land use changes come out as being a major driver, but it is important to think about the context. If you were to go to an island, such as some of our UK overseas territories, invasive alien species are going to be right at the top there as a driver of change.

I have had the great privilege of leading a project for the UK Government making predictions about new arrivals for the overseas territories and consequently have visited a number of them. For example, going to St Helena you can see the way in which the landscape has been dramatically changed by the arrival of invasive non-native plants, for example New Zealand flax, and the knock-on consequences that has for the invertebrates, of which on St Helena 96% are endemic. They are found only on St Helena and so an extinction of one of those species, from my perspective, is a very serious concern.

Q4 **Chair:** You have been involved in a project about the pathways for



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invasive species reaching the UK. This was published literally now, possibly because this inquiry was happening; I don't know. I always like to think these things suddenly get rushed out when we decide to have a look at them. You have been involved in this work and, Dr Walton, you told us it was nearly two years late. Why do you think that was?

Dr Walton: It was required under the EU invasive alien species regulation. Basically, what it said was that within 18 months of the list of species of EU concern, around which that regulation pivots, first being published, all member states should produce a comprehensive pathway analysis. It is fair to say that not just the UK as a member state but other member states were relatively slow in doing it. As you say, it has just appeared. We have had a look at it and it is very interesting, a good and timely analysis. If it was indeed this inquiry that sparked it, that is great.

One of the things that is very important to remember and bear in mind about this is that there is very unusual international coherence and agreement that when you think about invasive species, prevention of establishment in the first place is by far preferable ecologically to avoid any ecological damage but economically it is hundreds, perhaps thousands, of times cheaper to prevent these problems from happening in the first place than trying to fix them after the event. It is prevention, then early warning and rapid response to newly arrived species and then long-term control. The Convention on Biological Diversity doesn't say, "Don't do long-term control, don't do major projects to try to minimise damage of species that are so well established you will never eradicate them," but prevention is terribly important to bear in mind.

There is one other point to add to what Helen Roy said that I think is very important. I have noticed over the years that policymakers often look at invasive species and think to themselves, "Are you really trying to tell us that we have to stop every egg of every shrimp ever arriving in this country?" It feels rather hopeless because that is not really practical, but I think some of the science is quite interesting. What it points to is that often the best predictor that something will actually establish in the wild is what is called propagule pressure, which is just the rate of arrival. If you can slow that rate down, if you can do something to reduce the rate at which dangerous shrimp eggs are being released into our freshwater systems, you have a real chance of reducing the probability of establishment. Even what might seem fairly modest biosecurity measures are not a waste of time. I think that is quite an important point for us all to bear in mind.

Q5 **Chair:** Thank you. Professor Roy, you worked on this. You set out 36 pathways of introduction with eight unintentional pathways being prioritised. You put hull fouling right at the top and then horticulture escapes, contaminants of ornamental plants and ballast water. Can you talk us through those top four pathways?

Professor Roy: The marine pathways, the ballast water and the hull fouling—



Chair: What is hull fouling?

Professor Roy: It would be things like mussels clinging on to the hulls. Later on you are going to hear from Elizabeth Cottier-Cook, who is a fantastic marine biologist, and you will hear a lot more from her expertise, so anything I provide will not be as good as she will provide, for sure. It is the species that attach to the hulls but also some of the species will hitchhike within the ballast water, such as little species of plankton, zooplankton, tiny immature stages of animals and plants that can move around. With shipping moving at the kind of scale that it does, species can come from far and wide. It is important to remember that in the marine habitats it is extremely difficult to manage marine species once they arrive in a place, once they are introduced by humans in one way or another. These very simple preventative biological controls and biosecurity methods can be really effective.

As far as horticulture is concerned, we have a long history of people introducing plants into botanic gardens or into their own gardens. There is much more awareness now of the problems associated with some of the plants that might have been brought in. My understanding is that the UK is one of the few countries that has a ban on the sale of some plants that are considered to be potentially quite damaging. Some great biosecurity campaigns, such as Be Plant Wise, have been introduced and used in many garden centres, for instance.

Q6 **Chair:** I printed off the list, and the Latin names in some cases are easier than the English names. Do you think people would know an Asian shore crab, a round goby, an Indian house crow or a veined rapa whelk if they came up and bit them on the beach?

Professor Roy: That is an excellent question. When we are thinking citizen science and alert systems and surveillance and getting people involved in early warning, it is really challenging with some of these species. For example, the shore crabs will be really tricky. The house crow, with the communities that we have watching birds, is probably an easier win in getting people to recognise it. Some of the invasive alien species are incredibly charismatic and easy to identify and there are some others that are cryptic and would be quite challenging.

The importance of the document that you are reading is that it is about pathway management. If you can determine which of the pathways are bringing the highest proportion of the most damaging species and in the greatest numbers, you can begin to put in some actions around those pathways to try to reduce that risk. I think that is what is critical. In the marine environment—probably in all environments—biosecurity is very important.

Q7 **Chair:** Dr Robertson, what are the main economic impacts from invasive species?

Dr Robertson: Certainly one of the main ones is impacts on agriculture and production. We see a whole suite of species that impact our crops,



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livelihoods, fisheries, all of which have direct economic impacts. Many of those are dealt with and classified under other regimes such as animal health and plant health, which are in fact all invasive species.

Q8 **Chair:** What do you think is the cost to agriculture each year?

Dr Robertson: I am sorry, I don't have the numbers handy to give you an answer.

Q9 **Chair:** What about the grey squirrels and the cost of dealing with the outbreaks of beetles and moths and things?

Dr Robertson: As Paul said, one of the most cost-effective ways is recognised as, first, preventing them getting into the country and, should that happen, dealing with them rapidly through what is known as a rapid response. I would emphasise that if we are to make good use of the funds that we have available, prioritising those activities should be uppermost in our thoughts. Let's see how we can invest money to prevent many of these species arriving or, if they do arrive, deal with them rapidly before they become a problem with ongoing expenditure. That is not to say, though, that there are not a number of cases where the long-term management of a widely established species might not be the appropriate thing to do, but to treat that with caution. We need to be assured that it is a cost-effective way of achieving an objective in the long term as an awful lot of money can easily be wasted on long-term management if it is not carefully directed.

Q10 **Chair:** There is no point trying to eradicate the grey squirrel?

Dr Robertson: I think it would be almost impossible to eradicate the grey squirrel.

Q11 **Chair:** But it is important to keep it out of the Lake District, for example?

Dr Robertson: That is right. The grey squirrel provides an interesting contrast. In most of southern England it is here to stay but is seen as a pest to forestry and most of the management that goes on in the south of England is devoted to protecting our trees as an economic resource. It is only once you get into those areas where they border up against the red squirrel that active management there takes on a different objective about trying to protect the red squirrel. It is quite a complex situation with different objectives in different parts of the country.

Q12 **Chair:** I will finish off with a question to you, Ms Brown. Tackling the oak processionary moth cost the City of London £100,000; the water industry says the costs of management of non-native species is £7.5 million a year. What calculations have you made on the economics of these hostile invaders?

Kathryn Brown: We set out the evidence that is available at the time in each of our UK climate change risk assessments. There was one of those in 2012 and another in 2017 but, as Dr Robertson was saying, we find it almost impossible to put a number, a pound figure, on these impacts



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because they are so widespread and interlinked, but also when you are looking at projecting these impacts into the future, we are not even looking at one single risk that we call invasive species. It is hundreds, if not potentially thousands, of individual risks that are very hard to quantify. The best we can do, and what we have done in previous risk assessments, is to look at individual cases and try to put numbers on those, but the costs are going to be in the billions when you add up all of these things.

Q13 **Chair:** And they are rising?

Kathryn Brown: Yes.

Q14 **Chair:** Did they rise before 2012 and 2017?

Kathryn Brown: I am not able to tell you that based on the previous risk assessments but we are just starting the third risk assessment, which is coming out in 2021. One of the major things we are looking at this time around is what has changed over the last 10 years, so I hope we will be able to do that.

Q15 **Chair:** It will be your third report and you will have a trend?

Kathryn Brown: Yes.

Chair: Excellent. Thank you very much.

Q16 **Mr Dunne:** I would like to ask some questions about islands. As an island off the continent of Europe, we are in a slightly different position to our continental neighbours in trying to protect ourselves from invasive species. I am thinking in particular of this week at the beginning of the Chelsea Flower Show and, as we have just heard from the Chairman's question, horticultural escapes is one of the biggest risks. My understanding is that the vast majority of horticultural plants are imported from Holland and further overseas. Are you able to give us a sense of whether the Government have proper, adequate biosecurity measures in place to test plants before they come into the UK for wider distribution? That is probably a question for Professor Roy or Dr Walton.

Dr Walton: I think it is a really good question. Opening by saying you want to talk about islands is very prescient because there are certain groups of animals and plants that are particularly dangerous, more dangerous than others, and there are environments that are particularly vulnerable. Islands worldwide and in the UK context are particularly vulnerable to invasive species for impacts, as are insular freshwater bodies and native woodlands, for example. These are the keys that we can use to prioritise action.

On the horticulture trade, the pathway analysis that has been produced puts horticulture quite high as being a pathway whereby invasive non-native species can arrive in this country. It is not just the plants themselves; it can be hitchhikers. For example, there are flatworms from New Zealand that would never arrive here under their own steam that



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have arrived in soil in pot plants and it turns out are predators of earthworms. The actual impacts that they are going to have ecologically are yet to materialise we don't really know, but potentially, they could be ecologically very significant.

There is an interesting policy distinction here. There is animal health and plant health for agriculture, forestry, horticulture and so on, and there are biosecurity arrangements around those. Spend in the UK at the last assessment was something like £230 million a year in protecting those industries. The record on protection is not perfect but it is pretty good. We are spending much less for invasive non-native species. It is probably about 1%. It has gone up recently but it is a lot less, really just one-hundredth of that. The main reason for that is that animal and plant health in agriculture and so on have inspectorates. There is no inspectorate for invasive non-native species and yet on the question of is this getting worse—it is absolutely getting worse.

The JNCC's biodiversity indicator that looks at freshwater, marine and terrestrial environments and the spread of 190 non-native species through the island of Britain—if I might use that expression, because for an invasive species an island is the unit—shows it is getting worse across these environments. We are dealing with an issue that is intensifying and, as climate change proceeds, the theoretical and increasingly empirical evidence is that is going to compound it as well. No, we are not doing enough, frankly.

- Q17 **Mr Dunne:** Some other nations that are even bigger islands than ours, like Australia in particular and New Zealand I believe as well, have for many decades introduced policies for biosecurity to prevent the soil on the flatworm example you have given of a hitchhiker. There are dump bins at every port of entry for people to drop any kind of animal or plant products that they are bringing into the country. Should we be doing something like that in this country?

Dr Robertson: I would say absolutely yes. Comparing the different regimes that Paul described of animal, plant, fish, bee health, all of those have inspectorate functions associated with them because they are protecting particular economic resources. We are looking primarily to protect biodiversity here but with consequences for other areas as well. Introducing an inspectorate function that looked at intervention, biosecurity, prevention and enforcement at our borders would be a key thing to preventing the number of new species establishing. We currently have something of the order of 12 to 15 new species establishing in the UK every year, of which one or two on average will probably go on to become invasive under some definition.

- Q18 **Mr Dunne:** Animal as opposed to plants?

Dr Robertson: This is across the board, animals and plants. Europe has something like 60 species establishing per year. We do not have the precautions in place to manage that influx of new numbers at the



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moment and I would argue that that should be one of the priorities on dealing with this issue, going forward.

Professor Roy: On a positive note, something that we do have, which is fantastic, is the Non-native Species Secretariat. We have a co-ordinating body for all kinds of work on invasive, non-native species. I think that is the envy of other member states across Europe, because it is allowing us to be leading in the way of risk assessments, for instance, and gathering evidence through our risk assessment panels, and also in co-ordinating activity and putting out campaigns. Last week was Invasive Species Week, which was very successful in raising awareness. We have some fantastic activity going on and we are looking to New Zealand and Australia, for instance, to see what kind of measures we can adopt and the good practice from other places. There is fantastic work going on.

However, as Paul said, the indicator that we produce from the Centre for Ecology and Hydrology every year is showing that the figure is going up and up. But if you were to look at global patterns, there was a recent paper out in *Nature Communications* where global data was gathered from many different databases, including the one that we have for the GB Non-native Species Information Portal, and the trend is the same. It is the same globally wherever you go and on the whole it is same for whichever taxonomic group you look at, whether it be fish, mammals, insects. They are all moving around at unprecedented rates.

Q19 **Mr Dunne:** The UK has responsibility for 14 overseas territories, which I think are all islands or on islands, where 90% of our biodiversity as a nation, if you include the overseas territories, is based. Have we learnt anything from predator control that we could translate back to here? That is the first question. I have another question about how helpful we are being to our overseas territories in eradicating invasive species from them.

Professor Roy: I am happy to take that, having worked on this project over the last year with the overseas territories. It has been an immense privilege to visit and meet people and see the kind of work that is going on. For example, in St Helena the biosecurity teams are amazing. The hours they put in when cargo arrives or when the aeroplanes come in, because they now have a runway, are quite spectacular.

Not only that, but on St Helena something that was inspiring to me was the restoration work they are doing. The New Zealand flax is a difficult species to manage; it is a very spiky, aggressive plant. They have been clearing areas and transplanting some of the endemic plant species. For example, there is a tiny leafhopper, a tiny insect that they thought was extinct on St Helena and endemic to St Helena, and with some of the restoration that they have done it has moved back in. There was a small pocket but it has moved in. Those kinds of conservation stories of hope that come from some of our overseas territories are really inspiring.



There are other stories of rat eradication and rodent eradication on a number of the overseas territories, which have also meant that there has been some protection for the bird populations, for instance.

- Q20 **Mr Dunne:** In South Georgia, the rat population was eradicated over 10 years, I believe, primarily through charitable endeavour. DEFRA has given us evidence that it helped with that effort, and I am not quite sure of the extent to which it did. Your example of St Helena is interesting. Did that come with any Government support or was that a totally local initiative?

Professor Roy: I think it is a mixture of funding sources. The project that I was there on was a UK Government funded project. I have also had Darwin Plus funding for work on the Cyprus sovereign base areas. Darwin provides a useful source of funding for collaborations between people around the world to make contributions to biodiversity in a whole variety of ways on the overseas territories. There are very mixed funding models. For instance, the presence of the RSPB and the work that it has been doing was really apparent on St Helena. I think that partnership working is extremely important and wonderful to see when you visit somewhere like that, and it is working well.

- Q21 **Mr Dunne:** In South Georgia I believe they dropped rat poison from helicopters because the islands are uninhabited. Dr Walton, is there anything that we can read across to reducing rodent populations on Scottish islands?

Dr Walton: That is a very good point. Of the UK's islands, 80% are in Scotland. We have to think about biosecurity protecting what we have and Scotland has some incredibly important and interesting wildlife. The RSPB, in partnership, is running an EU LIFE-funded project on seabird island biosecurity across all the UK countries. That is designing state of the art biosecurity plans and implementing those on about a third of them.

On the specific question of can you helicopter-drop very poisonous rodenticide on to Scottish islands, it is not legal to do so and I don't think it should be. It is more expensive, but on islands in the UK countries we have to use bait traps that are secured so that livestock or people can't get access to them. I am afraid the restrictions are different in different parts of the world. I have been working on this for some time. Ten years ago I was at the Non-SIP Secretariat meeting, banging the table, saying, "Come on DEFRA, come on FCO, we really need to support our overseas territories better than we are doing."

There has been a big improvement over that period of time and I don't want to seem ungrateful for that, and the UK Government have improved their performance in supporting and funding work in the overseas territories, but because so many of them are islands and are of massive importance globally, there may be room for more support in future from



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the UK Government for these small islands that often have very small human populations and not much money to play with.

That is a great question, but let's not forget that South Georgia is probably the most important seabird colony on the planet and it is an incredible achievement that that has happened.

Q22 Ruth Jones: I am going to move on to climate change and its effects on invasive species. As politicians, we have had our minds focused fairly recently on climate change much more than we had before, but over the years you have been doing a lot of work with climate change. I would like to start with Kathryn Brown. How could climate change influence the spread and impact of invasive species?

Kathryn Brown: There are a few different mechanisms. The first is that in general a warming climate is better for species that are currently restricted because of cold winters. What tends to happen at the moment is that the numbers, as we were talking about earlier, are kept in check because cold winters kill off a lot of these organisms and we know that winters are going to get a lot warmer in the future. There is that direct climate influence.

There is also a wider climate influence of prevailing conditions. If the prevailing wind direction changes—and we don't know whether it will or not, but that is certainly something that we will look at in future climate projections—you can imagine that that may well change the risk in ways we have not even thought about yet. That is the wider climate trigger.

The third way is through what we are doing in the UK with human actions. If we are changing land use, if we are putting in a large number of on-farm reservoirs, which is a very good adaptation response to reduced water availability, suddenly you have a lot more standing water, which is an increased habitat space for mosquitoes and various other insects. The interactions between climate and invasives is quite a complicated story.

The other point I wanted to make quite strongly for this session is that when we think about adaptation we don't think about invasive species as a separate policy from pathogens and diseases. To us, they are all wrapped up together. At the moment, the policy landscape across Government treats these things very separately, as Paul was saying. A lot of these invasive species are going to be vectors for diseases and it is particularly the small organisms that are hard to see: mosquitoes, ticks, all the fungal and bacterial diseases. To us those are invasive species but they are not included in the list that you see coming out of the secretariat and they are not included in the policy, as DEFRA has said in its evidence response.

Q23 Ruth Jones: You would recommend that they should be included. We should be looking in totality rather than separately?



Kathryn Brown: I think there needs to be a consideration of how best to join up these different areas in Government. There is a lot going on. This is a policy area where we see an awful lot of activity. There is a huge amount of research going on. It is a well-known issue. But what we find lacking is the consideration of how invasives are feeding into animal and plant diseases, particularly the micro-organisms. The Asian hornet is a good example where we are looking at the risk from a bee health perspective, but there is a human health perspective there as well. In my notes I have a whole list of plant, animal and human diseases that we are very concerned about that don't crop up at all when we talk about invasive species with different Departments. We think there is a gap in the policy response.

Professor Roy: I will add to that and support Kathryn about the way in which we partition our thinking. Within the academic community we tend to not think very much about the micro-organisms within our live studies, for example. The GB Non-native Species Information Portal, of which I lead the development, does not include micro-organisms at the moment, but a few years ago I led a piece of work that we published in a journal called *Conservation Letters* to question that. Why is it that on the wildlife disease side we are not thinking of them in the same way as we think about the plants and animals? There are many reasons why that is incredibly challenging and it involves us working in a very interdisciplinary way with a whole variety of different experts, but I really believe we can do better in joining up some of those gaps within the academic community and ensuring that we are better placed to share that understanding.

Q24 **Ruth Jones:** Dr Walton, do you want to add anything to that?

Dr Walton: One of the points that is foremost in my mind in thinking about this business of prevention, which we have spoken about as really important, is early warning rapid response, which is kind of related—catch something before it gets there and then the control point. What we need to get in our collective heads are some principles about how to approach these, given that the context of climate change is going to assist spread and establishment.

One of the important points that did not quite emerge from our discussion about squirrels is that when you are going to control a species that is established but you don't want it to spread any further, it is important that you do it in a strategic way. Just encouraging people to go out and shoot as many grey squirrels as they can is not the right approach, and it is certainly not the right approach to tell some inner-city children, whose only experience and contact with nature is grey squirrels in their local parks, that they are a bad thing. That is not what this is about. This is about making sure that we as human beings are much smarter about how we move animals and plants around the planet and when there is a problem that we deal with it in a strategic way.



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The approach in Scotland to grey squirrel control is a brilliant example of this. It is a strategy agreed by the Scottish Government and NGOs, which is basically three strands. You have red squirrels in the Highlands and there is a cordon sanitaire along the Highland boundary line where grey squirrels are controlled to prevent them going on; there is a pocket of grey squirrels up in Aberdeen and a localised eradication going on there that is almost successful; and then there is control of the squirrelpox-infected animals coming up across the Tweed to try to protect some red squirrel pockets in southern Scotland. That is a very strategic approach, not killing every grey squirrel. It is about taking that strategic approach to it in the context that we know that there is going to be further spread of grey squirrels, potentially. The operational side of that is led by NGOs and the Scottish Wildlife Trust and RSPB Scotland are in there as well, but it is working. I think this is quite important.

As was mentioned, at the national scale Australia and New Zealand have demonstrated that sensible biosecurity measures can work and deliver biologically meaningful results, and that is what I wanted to say. It should be seen as climate adaptation, absolutely.

Q25 Ruth Jones: Thank you for clarifying that. Dr Robertson, do you want to add anything?

Dr Robertson: One of the big problems of dealing with widespread species once they have got into the country and have established beyond the point at which removing them completely is feasible, is thinking about the scale at which these things can be managed. I agree completely with what Paul was saying—that any management needs to be done in a strategic way, needs to be carefully assessed to see whether it is cost-effective, whether it is meeting the objective of protecting the red squirrel and so on, before significant funding is put into it.

One of the most effective roles that I have seen with Government is for Government to support co-ordination of local groups to make sure that where they do these things they work at an appropriate scale. The example with the management of red and grey squirrels in Scotland is an excellent one. There is a policy there that clearly lays that out and looks at how at a large scale these different actions are co-ordinated. As I understand it, we don't have a similar policy in place for England and I think that is needed. Support from Government to try to encourage co-ordination and getting people to consider whether these big objectives are achievable is important if we are to use resources responsibly.

Q26 Ruth Jones: I will move on, maybe back to Dr Walton. How should the Great Britain Invasive Non-native Species Strategy consider species that have colonised because of climate change?

Dr Walton: Actually, in my view, when species arrive on this island because their range is changing as a response to climate change—because of the climate envelope, as the expression is—that really should not be seen as an invasive non-native species issue. The invasive non-



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native species issue considered by the IPBES report, for example, is explicitly those species that have been directly moved by human agency. That can be deliberately through the pet trade and people releasing their terrapins into ponds in Glasgow, which they do—*[Interruption.]* Yes, and all over the country. There are also the hitchhikers, such as flatworms arriving on pot plants. These are species that are moved by direct human agency, and that is really what we need to focus on.

It would be a mistake if we were to confuse these two issues and spend our time, effort and resources trying to stop species that are arriving here through climate change. It might seem a nuanced distinction but we are having bird species arriving in the south of England, some of which have not bred there for a very long time, almost certainly as a result of climate change. We should not try to prevent that from happening and try to prevent our protected areas from adapting to climate change. Nature has always been a dynamic thing. We have to be very careful about that and very careful to make the real distinction between these issues.

The issue is that, globally and in the UK, species have always moved around but now we have a pervasiveness of movement, so people are moving animals and plants across natural boundaries like oceans, mountain ranges, deserts, currents. There is a physical roughness of the planet. We are breaking down those barriers by moving species around more and more, and those barriers have encouraged evolution to proceed independently in different regions of the planet, and that generates a lot of biodiversity. The tiger is a jungle cat in India, a jaguar is a jungle cat in South America, and so on through the living world. That movement is an issue, but we have to consciously think about how we help wildlife and ecosystems adapt to climate change. It is a terribly important distinction.

Q27 Ruth Jones: Thank you very much. That is very helpful. You are saying that human intervention and the ongoing climate change are two things to be considered separately?

Dr Walton: They are two different things, but the climate angle on all of this is that climate change will improve the establishment conditions for species that we bring in, in particular in this country because of frost. In Glasgow, and in other cities, we are seeing red-eared terrapins surviving winters when they didn't previously because of frost, and I think frost will be one of the big things. Climate change is doing that and that is the interaction that the CBD is talking about when it says that invasive species and climate change issues interact. It is not the alteration of species, climate envelopes, and then species range changing as a result of anthropogenic climate change, which is a different matter.

It may be that in some circumstances we have to do some active help to allow species to adapt to climate change to prevent extinction in some particular instances. But I would encourage the Committee to be clear on the distinction in their heads between species that are directly moved by people and species that are moving under their own steam.



Professor Roy: I think those definitions are so important. I fully agree. It is not just academic pedantry; it is really important to get those distinctions for thinking of policy as well, for instance.

Kathryn Brown: May I add a slight nuance on that? What we are talking about is also the degree of negative impact that these species are having. The point about great white egrets moving into UK waters is that they are not really causing any damage and they are lovely to look at; they add something to the ecosystem. Those are the sorts of things where we don't want to say, "Hang on a minute: just because they're not native we don't want them to come in," because it is inevitable that our species composition is going to change in the UK; we are going to lose some species and we will gain some new ones. But the difficulty I have here is trying to attribute something to climate change versus other factors, because they all integrate together and there are a few invasive non-natives—Asian club tunicate and the Pacific oyster are a couple of examples—whose introduction has been attributed to climate change but are invasive.

Q28 **Chair:** What was the first Asian thing?

Kathryn Brown: Sorry, Mary, Asian club tunicate. They are both marine species.

Professor Roy: The ecology is incredibly complex but it is really exciting and beautiful. Understanding that level of complexity can be seen as a challenge but it is fantastic. I think we have to embrace that complexity. We can't do things like play a numbers game in thinking we are going to get more species so that is good—our biodiversity is increasing. It is to do with the interactions between all of those different species—the way in which they interact with one another but also the way in which they interact with the habitats in which they arrive. There is some fantastic work going on around that, and embracing that is really important.

Q29 **Ruth Jones:** Kathryn Brown, how is the Adaptation Sub-Committee working with others on looking to the future, horizon scanning for other maybe future potential invasive species?

Kathryn Brown: It is mainly through our work on the national risk assessment. As part of our statutory role, we would not necessarily get involved in horizon scanning to inform policy, but we get involved in thinking about future projections of change to inform what we think the risks are that Government should be looking at over the next five-year period. It is wrapped up in that work. We highlighted last time as a gap that there are an awful lot of studies and an awful lot of very good, amazing research looking at specific species, but that what was missing was a more risk-based approach, thinking about these unknown invasives that will be coming along, of which we may not get much warning—do we have the processes in place to deal with those on the hoof where maybe we don't have much early warning?



Q30 Caroline Lucas: I want to ask a question about prevention versus mitigation, and in particular to Dr Robertson about the Convention on Biological Diversity prioritising preventing species arriving and establishing over mitigation of existing species. I would like your views on why prevention should be prioritised and how that relates to the EU invasive species regulations.

Dr Robertson: The advice from CBD is enshrined in its guidelines on how it recommends countries should manage invasive species and the risks that go with them. One of the key principles that it works to is to focus first on much better prevention to try to reduce the flow of new species into the country, to intercept them before they arrive and become a problem, and to reduce the propagule pressure that we heard about. This is clearly the most cost-effective way of dealing with this. This is the same principle that is applied in all the other areas of biosecurity of animal and plant health and so on that we have heard about, and is the one that has the least impact on the species themselves. You don't let them come in and become a problem.

Beyond that, rapid response is the next recommendation. Should that fail and the species establish at a relatively small scale, find it quickly, and if it is considered to be a risk deal with it quickly. If this is successful it means that there is no ongoing risk of spread and damage or economic impact into the future. It is an issue that is dealt with once and then put away for the future. Its second recommendation is to put money into that, and only if those have failed, to consider long-term management, which in most cases involves an ongoing, perpetual commitment to funding a particular form of management. In many cases those forms of management have a history of often being ineffective because the funding runs out or it turns out that the species cannot be managed in that way.

It is certainly not saying, as I think Paul pointed out, to use only one or other of those three methods. An effective programme needs to have all three of those in place if it is going to be robust. Its advice is where to place the emphasis. Europe produced its new regulation a couple of years ago and has focused very much on producing lists of species that are seen as carrying risks of impact and about which member states will have to make decisions about what forms they might entail.

Q31 Caroline Lucas: Do you see that as being in contradiction to the CBD?

Dr Robertson: No. I heartily recommend and support the risk assessment process that it has put in place. The UK has its own risk assessment process that has been in place for about 15 years. I think there are a lot of examples from what we have done in the UK that were picked up primarily through the work of Helen and incorporated into what we have done.

Q32 Caroline Lucas: Is there something we should be doing more than the EU?



Dr Robertson: My concern about the European programme is about the things that it does not currently do that we do in the UK, but which I don't feel it has taken on board or are currently weak within its system. In the UK we ask basically two questions: is this species likely to become invasive—which is answered by risk assessment; can we reasonably do anything about it—and is management a feasible option to try to reduce that risk? I think you need to ask those two questions together to come up with good, sensible answers that can guide management and legislation. My concern at the European level is that it asks the question, "Is this species going to be impactable?" and it does that well, but it does not have a clear, transparent, co-ordinated process of asking the second question: "Can we reasonably do something about this to prevent and manage its impacts in some way?"

Q33 **Caroline Lucas:** What does its failure to answer that question lead it to do differently from what we would do?

Dr Robertson: For example, we look at the number of species on that list. It has listed lots of species that are already quite widely established in Europe. It has listed relatively few species that you have much chance of preventing coming in. If we are to follow the CBD guidelines, I would prefer to have seen it put more effort into listing species or pathways where there was a realistic prospect of reducing the numbers rather than adding lots of species, as they have done in the first phases, which are already widespread in Europe and where the long-term ongoing management is probably the only option for managing these things. According to the CBD, that would be better seen as a lower priority for management.

Q34 **Caroline Lucas:** We haven't mentioned Brexit yet, I don't think, so it must be about time we did. I want to ask you about the risks and opportunities that Brexit can provide in improving prevention. If we were to leave the EU, do you think there is going to be enough funding, and indeed enough staff, in order to be able to fill the gaps that would be left, if there are going to be gaps left?

Dr Robertson: I think the UK is in a lucky position with processes, in that we have had the Non-native Species Secretariat working for over 10 years now putting processes such as risk assessment, risk management and prioritisations in place for the UK. We are in a better position than much of the rest of Europe to have those processes existing already, and that we can call on. We also have the option here to target more effectively the species that we are focusing our attention on, and being an island, we have more scope for effective prevention if we have the right structures in place, such as an inspectorate, which we currently lack in this area, to try to really focus on prevention.

Q35 **Caroline Lucas:** We would need to have an inspectorate?

Dr Robertson: I believe so, yes.

Q36 **Caroline Lucas:** What kind of resource implications go with that? I don't



know whether an inspectorate is 10 people or 100 people or 500 people. What would it look like?

Dr Robertson: I would imagine something of the order of 10 people would probably do an awful lot of good. Comparable regimes like fish health and bee health, have budgets of about £3 million a year, as opposed to less than £1 million a year on invasives, and a lot of that cost goes on inspectorate functions. It is one of those areas where the more is spent the more the benefit will be, but there are an awful lot of quick wins that could be put in place if we had effective investment in preventative functions such as inspection enforcement and so on, and prioritising better where we should focus our attention. At the moment we are clearly not spending enough on invasive species in general, as we see by the continued increase in numbers that are getting in and establishing.

Q37 **Caroline Lucas:** Dr Walton, do you have something?

Dr Walton: I think there are some opportunities from Brexit and there are some very considerable risks that have not been discussed yet. The EU invasive alien species regulation—which is the same thing as non-native species, just different terminology—is focused on a species list that has 49 species on it, but it does introduce for those species very strict regulation of keeping, of sale, of movement in a way that domestic legislation in this country or other EU member states has not done previously. In that sense it brings a new focus on biosecurity, so I diverge from Peter slightly there. I think that is something that we are going to have to think very carefully about in translating not just the letter into domestic legislation but practice as well.

Then there are the associated structures around that regulation. These include a scientific forum that includes expertise from across the 28 member states. It includes an invasive alien species experts group that advises around implementation of it. There is an information support system that has been established under that regulation, to stand alongside it, which is where countries can share information about what is coming and what is newly arrived and will allow them to respond quickly. Then there is a whole financial support system as well. The LIFE funding stream is one of very few major international biodiversity funding streams that says explicitly, “We do invasive species work,” and they are very explicit about that. There is Horizon 2020, the massive EU research funding instrument that also is there to underpin delivery of policy in the form of the alien species regulation. There is rural development funding, where efforts are being made to co-ordinate that in line with invasive non-native species work, and there is cohesion funding as well.

In answers to recent parliamentary questions, we did get a response from DEFRA, which was, “We are kind of going to be all right. We will replicate the science bit with some of our existing experts and we’re good at risk assessment”—which is true; we are pretty good at that in the UK—and that should see us through.” Wildlife and Countryside Link members don’t



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share that confidence, and think that that is not enough in order to deliver what the IPBES report has called for when it says, "We can conserve nature, we can sustainably utilise nature, we can do it within the context of societal goals, but we need a transformational change in order to do that." We have an issue here that we know is getting worse; it is measurably getting worse, as Helen Roy has told us. Just cobbling together an approach to Brexit whereby we might keep pace is not really what is required, in my view.

Q38 Caroline Lucas: It is probably the same written question that we are referring to, but DEFRA basically said that access to the EU's invasive bodies and regulations and so forth is desirable. Would you actually say it is essential?

Dr Walton: Absolutely. To be honest, leaving all political considerations aside, if I may, I think it is more than desirable; I think it is essential. I don't think we can deliver effective biosecurity without close international co-operation, particularly with trading partners and particularly also among the UK devolved Administrations. That co-ordination and co-operation is going to be really important as simply a biological reality. Trade is the No. 1 broad pathway whereby invasive species are moved around.

Q39 Caroline Lucas: Did you want to say something?

Dr Robertson: I agree heartily with the call for resourcing that Paul has made.

Caroline Lucas: It was Professor Roy, sorry.

Dr Robertson: I am sorry.

Professor Roy: No, you carry on.

Dr Robertson: I would flag, though, with that great list of funding sources, a need within Europe to focus more on preventative activities. An awful lot of focus over there at the moment is increasingly going towards the management of widely established species, which I feel is potentially an issue. But there is no doubt that we need all of those functions in the UK properly funded. We need replacement of things like EU LIFE to be properly funded and at the moment I see no mechanism for doing that. In the short term, potentially, we will be considerably worse off in our ability to respond.

Q40 Caroline Lucas: The last question is about locally significant invasive species. Are they being dealt with adequately through the current regulatory system?

Dr Walton: Did you say "locally"?

Caroline Lucas: Locally, yes, the locally significant invasive species. There seems to be some distinction between the ones that are very locally significant—



Dr Walton: One should always be careful about using the word “principles” in ecology, but there is this principle that certain environments are particularly vulnerable, and I would say islands. Attempting to eradicate the brown rat, *Rattus norvegicus*, from the UK—it is not native to this country and it was brought here by human agency almost certainly—would be a bit ridiculous, but on our islands it has a huge impact on some internationally important seabird populations and populations of ground-nesting birds, like waders. We need to take a sensible approach to how we look at that.

In mainland terms, one of the issues that is particularly important to me is what are called the Ponto-Caspian species. This is a group of about 24 freshwater species of various groups and taxa that all come from the Caspian Sea and the Azov Sea and have spread across mainland Europe as a result of people moving gear from one freshwater body to another, like angling gear, canoes, jet-skis and things like that. They have an enormous impact on the freshwater system. In fact, in many of the mainland Europe freshwater bodies the biomasses of 90% of Ponto-Caspian species are native biomasses—they should be tiny.

We have four or five species currently in the UK, one of which is the killer shrimp, as it is called. It occurs in Rutland Water and some other water bodies—it is into the Nene catchment as well. Is that a locally significant issue? It may well be for those particular systems, but we know there are 23 other species sitting in the Dutch ports. Unless we get biosecurity right, they are going to be brought across to this country and then we have the whole suite of them. They act in synergy together in terms of ecological impacts on freshwater systems. The local significance point is of some significance when it comes to particularly vulnerable environments like islands, I would suggest, but quite often with this issue what happens is that species get a toehold, there are local issues, and then they become issues nationally and across the devolved Administrations. In Scotland we have some of the most pristine river systems in the whole of Europe in this regard—the Ponto-Caspians and other invasive species—and I am pretty worried about what might happen.

- Q41 **Geraint Davies:** Do you agree with me that the risk of invasive species is massively increased by Brexit because there will be huge pressure on all our customs systems, new tariff systems with the EU, and a desperate attempt to get new trading relationships with new countries on board quickly? There will also be opportunities for more trade through some regional airports, more trade to compensate for trade lost elsewhere. Just by way of simple example, I know that in Wales we will be flying more freight to Qatar from Cardiff airport and some regional airports will have more trade, maybe to make up for lost trade elsewhere. Do you think that time of change, that pressure on the systems of control, will open up big gaps in our armoury against invasive species and allow them to pour in?



Dr Robertson: Yes, I would agree. It does potentially increase the risk to quite a large extent. We know that the patterns of global trade are probably the main drivers of why we have the species we currently have and we have seen through time how the sources from where we have pulled those species have changed. In the early years, we mainly got species from Europe, because Europe was our main trading partner for maybe 150 years. Increasingly it became North American species. Now it is often temperate Asian species that we see rising most. As yet we have seen relatively few species coming, for example, from South America. If we start trading with an area such as that, I have no doubt that a considerable number of species, which we will not have previously seen at our borders, will arrive from there. Working with changing global trade partners is, I think, essential if we are to manage the risks that are only going to increase as we increase the number of countries with which we have major trade.

Chair: We do have to move on. We have a question from John McNally.

Q42 **John McNally:** I want to move on to the existing invasive species and in particular the resources you referred to, such as a central fund to deal with rapid responses. It has become apparent that what we need is an ounce of prevention, which is better than a pound of cure. Could you elaborate on the resource split between prevention and rapid response versus management, and so on?

Dr Robertson: The simplest way is to compare it with some of the other regimes. We have animal health, which currently spends something like £200 million; plant health spends about £20 million; bee health and fish health spend about £3 million a year, largely on preventative activities and then managing existing problems. The investment in invasive species at the moment is tiny, probably £1 million coming through the DEFRA funding for the secretariat. The money that is currently spent on squirrels, for example, and on large campaigns such as for the ruddy duck, is more than the entire annual budget that goes into the Non-native Species Secretariat. We are currently spending a great deal of funding on the management of existing pest problems and very little indeed on prevention. I don't have a precise figure for you, but it has to fit within that £1 million budget. We know, for example, that it cost £6 million to £10 million to eradicate the ruddy duck. Work in some of the Scottish islands is regularly multi-million pound projects dealing with the removal of invasive species. Currently we do spend the vast proportion of the money that is out there on the management of existing problems. Shifting that, so that we spend more on prevention, for me requires extra funding, and extra direction, and a focus on prevention so that we plug the hole in the bottom of the boat rather than spending a large amount of money trying to bail out a boat without first fixing the holes in the bottom.

Q43 **John McNally:** Does anybody else want to comment on that?



Kathryn Brown: You probably also want to look at all the surveillance that goes on across all sorts of agencies—the Forestry Commission, Public Health England, AHDB, because from our perspective they are a core part of the prevention story and monitoring budgets are always the first to go when there are budget cuts. We see this time and again—some of the agency budgets being reduced—and I do want to flag the numbers there as something to maybe ask about in future sessions.

Q44 **John McNally:** Advanced Invasives said many INNS are probably not managed very well at the moment and went as far as to say they are not effectively managed at all, primarily because control and management programmes are not evidence-based. That seems rather strange.

Dr Walton: If your question is, do we do prevention or do we do control, the answer is that it is difficult to say; it is a more complex issue than that. When it comes to prioritising spend on control, first I have made the point that it is much more effective to be strategic about it, as I was saying about squirrels, but we also need to consider exactly what is the biodiversity interest we are talking about. In the UK countries we have something like 80% of the world's population of Manx shearwaters and 13 Manx shearwater colonies have been lost in Scotland alone over the past approximately 150 years, mostly due to the introduction of rats because rats and shearwaters do not live well together. Basically we have just two colonies now. One is on Skokholm and Skomer in Wales and the other is on the island of Rum. They are big colonies but that is 80% of the world's population of that species. What we can do by restoring islands and removing rats is allow these birds to recolonise. We have a lot of eggs in a couple of baskets at the moment. In that instance, some control and eradication measures to restore those islands for these birds can be done. RSPB led a project on the Shiant Isles in the Minch and within a couple of years, storm petrels were back and we can expect Manx shearwaters to colonise soon. The same thing has been done in the Scilly Isles. We have to take a view on biodiversity.

Another example would be the Atlantic woodlands in the west of Scotland, north-west England and Wales where rhododendron invasion can be a big issue for what is increasingly appreciated as being a unique habitat for biodiversity. That is one issue we have not made progress on yet, but the majority of the European protected sites for that habitat are in unfavourable condition and most of that is because of rhododendron. It is a very expensive issue.

There are biodiversity imperatives and there is absolutely no doubt this issue is getting worse, and climate change is going to make it even worse. You are absolutely right to point to the opening up of new trading routes as presenting novel challenges and we have to get biosecurity right as well, which is why I am saying we need to step up with regard to the way it is resourced.

Professor Roy: Your question links to Caroline Lucas's point about local management and the question of scale is important. There can be



different scales. For some species, it can be very problematic on a local scale and there might be possibilities for management at that kind of scale. Other issues are going to be more on a national scale. It is important, therefore, that we take on board that kind of complexity of different scales; it is important around information sharing. As has already been pointed out, there are some fantastic systems that we already feed into, for example the European Alien Species Information Network, which is a database of all the non-native species in Europe and which feeds on into the Global Invasive Species Database. We are extremely well connected at those different scales through our information sharing and it is important to maintain that connection.

Q45 John McNally: One more question, if I may, also following on from Caroline Lucas's question. You mentioned local action groups and volunteers, and you will certainly be aware, I would think, of the Scottish Invasive Species Initiative that covers £3.4 million a year, I think, in projects led by Scottish Natural Heritage and various other bodies and voluntary groups. Could you give us a bit more information on that, if you do have some knowledge of it, on how it became established, and on how practical it is, working at ground level to involve local people and community groups?

Dr Walton: It is really practical. I do want to make this point about whether people recognise these obscure things. It is quite surprising how often the first warning is often given by members of the public. One example of that was the zebra mussel in the Forth and Clyde canal, spotted by a lady who was walking her dog and who happened to know what she was looking at. That is quite important. The project you mentioned, again European funded, is an important one in terms of riparian invasive plants—giant hogweed, Himalayan balsam and some other species. The key message here is that if you are going to do that kind of control, local action groups are fantastic. They can make a big difference and can give that long-term control required to make sure the species is properly eradicated, but you do have to work at the catchment scale. That is an important message. In Glasgow, in the 1980s, they decided to get rid of all the giant hogweed by spraying Roundup but stopped at the city boundaries. Beyond that, the species was dumping seed into the rivers and the species came back the following year. There was no competition, and it was worse. So you have to be clever. You have to be strategic about how you do things. However, that project is delivering some interesting information in terms of innovation. It turns out that sheep actually quite like to eat giant hogweed, which was a surprise to me. That was a finding of that project, which is one that we might want to think about in future in terms of control.

With these established species, you do have to be strategic about it or you just risk reinvasion.

Professor Roy: It is amazing what people can do, what they can identify and how they can get involved. As a volunteer, I run the Harlequin



ladybird survey. That species of ladybird is quite colour/pattern variable, so you would think it might be quite tricky, but it is amazing how good people can get at spotting a species, if they get enough information. That kind of information flow to the people on the ground is very important for connecting them to the decision making that they are ultimately going to be part of.

- Q46 **Chair:** If I might finish, I have spent some of the time looking up your list, and especially at the Japanese sting winkle, which I am very excited about. It sounds like something out of a nonsense poem, doesn't it? It is like the Jabberwock. This list was published in 2014 and we have heard that there are 10 to 12 new species a year. Are you planning on doing another list?

Professor Roy: We are. Just last year we led the work for the Europe-wide horizon scanning and we published that long list, which was very challenging because we have to get across various biogeographic zones, but it was tremendously exciting to be involved. We have just carried out the same exercise for all the overseas territories and we now have a priority list for all overseas territories of species that could arrive and have an impact, not just on biodiversity systems but also on human health and the economy. This autumn we will be repeating the exercise for Britain.

- Q47 **Chair:** So this 2014 list will be updated?

Professor Roy: Yes, it will be, and we will also reflect on that 2014 list to look at the way in which our predictions have gone. I think it is now eight of the top 10 species that we identified—and I never know whether this is a success story or not—that have been spotted within Britain. Perhaps the most notorious is the Asian hornet. Although we now have records of the Asian hornet, the success of making predictions and being forewarned is that there were processes in place for the eradication. So far, every one of the Asian hornets has been successfully eradicated, and that is again through partnership working, having information flowing from beekeepers and members of the public through our alert systems and through to the National Bee Unit so they can go out and respond. Indeed, one record came through the alert system on a Sunday and the eradication happened by the Monday. We can have that very fast action by working together, communicating well to members of the public and to other stakeholders who need that information, and then having in place the effective action required.

- Q48 **Chair:** Thank you. If you will write to us about the eight species that have been spotted, we will do some pictures for our final report. That will be exciting—lots of colouring-in opportunities.

Professor Roy: Absolutely.

- Q49 **Chair:** Finally, what should we be worried about? Are the parakeets a good thing or a bad thing? Let's just wrap it up with the parakeets.



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Professor Roy: Over to my vertebrate colleagues.

Kathryn Brown: I like parakeets.

Dr Robertson: Which ones?

Chair: The green ones that you see in Hyde Park.

Dr Walton: That is an interesting comment, because I like parakeets as well. This is absolutely not the demonised individual species.

Q50 **Chair:** Is that what they are called?

Dr Walton: It is not the parakeets' fault that they are here. This is a human-generated issue and that is very important. They are the most extraordinarily beautiful creatures. However, are they going to compete with native birds for nest sites? Quite possibly. In Barcelona I think they have six species of parakeet established now, which is quite a big agricultural problem, and quite a big problem for native birds. So, yes, they are lovely but we do have to hold these two ideas in our heads. It is not the parakeets' fault. They are beautiful animals in their own right and yet, in certain instances, they can be quite a big problem. The ring-necked parakeet is now established in this country, in my view, and we are not going to get rid of it.

Dr Robertson: I agree completely about the ring-necked parakeet. There is another parakeet breeding in Britain—the monk parakeet—again, a lovely green parrot, very attractive, very intelligent, a very charismatic bird. Unfortunately, this one does have an impact on economic activity because it builds colossal nests, the size of a small car, on the tallest tree or electricity pylon or radio mast in the area. In areas such as Florida, where the species is now widely established as an introduced species, it creates a lot of damage. These things catch fire, they short-out electricity systems, and there are now teams dedicated to doing nothing else but managing the nests of this species.

Q51 **Chair:** We did put our electricity cables under the ground, so at least we do not have those risks in our country.

Dr Robertson: So it all depends on the species.

Chair: We will leave it there. I am very sorry. We do have to move on. Thank you.

Examination of Witnesses

Professor Chris Thomas FRS, Director of the transdisciplinary Leverhulme Centre for Anthropocene Biodiversity, University of York, Professor Elizabeth Cotter-Cook, Marine Biologist, University of the Highlands and Islands and Scottish Association for Marine Science (SAMS), Dr Wayne Dawson, Assistant Professor in Department of Biosciences, Durham University, and Dr Alison Dunn, Reader in Evolutionary Ecology, University of Leeds



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Chair: I call the Committee to order and welcome our guests to our second panel. Can I ask you all to introduce yourselves, starting from my left with Professor Thomas?

Professor Thomas: My name is Chris Thomas. I am based at the University of York. I am about to become the director of what is going to be the new Leverhulme Centre for Anthropocene Biodiversity, considering how humans are affecting diversity on life. My particular research has been on all the factors that are leading to the changes of distributions of species on earth. In particular, over the last 20 years I have been working on the impact of climate change.

Professor Cottier-Cooke: I am Elizabeth Cottier-Cooke. I work for the University of the Highlands and Islands and the Scottish Association for Marine Science based in Oban on the west coast of Scotland. For about the last 23 years, I have been working with marine invasive non-native species, specialising in looking at their distributions and their impacts, both at a UK and global scale. I currently lead a UK research and innovation fund working with developing countries overseas looking at disease and pest control, and biosecurity.

Dr Dunn: I am Alison Dunn. I work at the University of Leeds where I research the impact of aquatic freshwater invaders. I also do research into biosecurity best practice, to try to slow the spread of invasive species, engaging with stakeholders on behavioural change. I sit on the Yorkshire Dales Biodiversity and INNS Steering Group, which works with stakeholders in the Dales where we have some very specific issues in such a pristine environment. I also represent the Yorkshire Integrated Catchments Solutions Programme—a big NERC-funded project—to deliver benefits to the Yorkshire economy through bringing environmental evidence to practices and that includes a biosecurity project around INNS, which I am leading, working with Leeds City Council, Barnsley MBC and nine other local authorities in the region.

Chair: I need to check that Wakefield is one of them.

Dr Dawson: My name is Wayne Dawson. I am based at Durham University. I am an ecologist. Most of my research focuses on understanding plant introductions and invasions at local and global scales.

Q52 **Chair:** Thank you. Professor Thomas, can I kick off with you, please? In your evidence you stated that the impacts of non-native species may not all be negative. Can explain why that is so?

Professor Thomas: During periods of environmental change, the way that species survive in the long run, and the way that ecosystems adjust, is by shifts in the distribution of species and changes in the relative abundance of species. Very often, when non-native species arrive, they are simply taking opportunities that have arisen through other



environmental changes that we have driven. Fundamentally, the changes we see around us are often a symptom of the fact that the biological system of the earth is adjusting to the impacts of humans rather than being a threat per se.

As for the fact that it is humans who are often bringing in some of these species, I will disagree with some of the previous speakers: I believe we cannot make a distinction between those things that have been moved necessarily by humans and those things that have moved on their own. As primarily insect ecologists, we virtually never know the precise mechanism by which a particular species has arrived in a given location. When we talk about microbes, the answer is virtually never do we know. Therefore, we should, in my opinion, deal with species, some of which are native, some of which are non-native, by the consequences of them for humanity and the things of one type or another that we are interested in, rather than on some basis of where they originated from and our speculated means by which they arrived.

Q53 **Chair:** Dr Dawson, what do you make of that approach to the non-native species?

Dr Dawson: The counter to that would be the example of some of the UK overseas territories where we clearly know which species have been introduced by humans in history. I had the great privilege of going to St Helena last year on one of the horizon scaling exercises, which Helen Roy, who spoke in the first session, helped to organise. It is very clear that on that island, in the past, livestock were introduced, rats were introduced, and they have had a devastating impact on the ecosystem present on that island. Introduced species, including invasive plants, are still threatening the last vestiges of habitat that remain in St Helena that contain some species that are not found anywhere else on the planet.

Q54 **Chair:** What about the previous panel? Do you think we should tackle invasive plant species, for example, if they are not causing local extinctions?

Dr Dawson: We have to be careful, when we talk about the impact of invasive plants, to remember that impact does not necessarily just involve extinctions or changes in species' numbers. Invasive plants can have many different impacts. For example, invasive plants can have effects on the physical environment, and on ecosystem function. One very good example that we heard about in the first session is the Himalayan balsam, which tends to invade erosion-prone riverbanks in the UK and central Europe, and it can exacerbate the erosion of those riverbanks. At the same time, it is also out-competing native plant communities.

Q55 **Chair:** Can I come to you, Dr Dunn? What do you think needs to be done to mitigate the changing risks from climate change and invasive species?

Dr Dunn: I would like to stress, as Wayne said, some of the freshwater invasive species do affect biodiversity. Obviously invasive crayfish,



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particularly the signal crayfish, compete with the native crayfish—the white-clawed crayfish, of which the north of the UK is one of the last strongholds—and spread disease as well as competing with it.

In fresh water, a lot of these species are economically important. They interfere, for example, with construction—think of Japanese knotweed. Floating pennywort produces dense mats of vegetation, which block water pipes and pumps and exacerbate flooding.

In terms of what I think we should do to mitigate the impacts, with climate change there will be more opportunities for things to move by a sort of stepping-stone, where they have already made it in Europe, but a lot of things that are introduced may or may not go on to establish and may or may not become problematic. The shift in climate can be an issue in triggering that. The previous panel's conversations around biosecurity and prevention are very important.

It is also important to think about the different scales. In the UK, for example, in the Thames, dealing with floating pennywort cost about £600,000 last year, whereas in Yorkshire we only spent £35,000 because, relatively speaking, it is only there in small patches and we have an opportunity there to try to engage an array of stakeholders and avenues in biosecurity. The DEFRA progress report is very strong on biosecurity to prevent things from coming into the country, but we also need to think about the secondary spread—things that are already in certain regions while none the less there are many areas where they are not present.

Another example is that of water bodies in Yorkshire. I think there are only about three reservoirs with zebra mussels. Zebra mussels are a big economic problem because they can restrict water pipes. They form dense colonies within the pipes so we are prone to flooding because we cannot get water away, and they are even a threat to water supply and water resilience. Yorkshire Water looks after about 400 reservoirs. If the zebra mussel were to spread to those, you can imagine the huge and spiralling cost. At the minute, Yorkshire Water only spends about £120,000 a year on cleaning out the pipes. Imagine that spiralling.

I cannot tell you beyond that. I could go and look it up and pass the information back to you.

Q56 Chair: What issues are you are dealing with in the Dales—the specific non-native species there?

Dr Dunn: The specific non-native species that are a problem in the Yorkshire Dales—we have talked about the Himalayan balsam and that is a problem because of the sedimentation that it causes. It grows up and then in the winter it dies back and the banks are very prone to sediment being moved around. We have big concerns about the spread of the signal crayfish because we do still have the endangered white-clawed crayfish, which we wish to defend, in our tributaries. The Dales are a particularly interesting example because in some areas they are pristine



and so a lot of the work we are doing there is around biosecurity to try to protect against things being moved. There is that interesting problem in the Dales of so many different uses and users of the land and at the minute being reliant on voluntary agreements to try to improve biosecurity.

Q57 Chair: Professor Cottier-Cooke, do you think I should bring the Committee on a crayfish expedition? When I said that on Twitter, someone said, "No, you would just spread them around." But if we were going to eat them all, wouldn't that be a good thing?

Professor Cottier-Cooke: Crayfish, being freshwater, are not my speciality, but maybe you could come and eat some Pacific oysters, potentially.

Chair: Happy to, yes. That would be good.

Professor Cottier-Cooke: Pacific oysters had been brought into the country back in the 1960s. If you are talking about climate change, and consequences, Pacific oysters were brought in because the seawater temperatures at the time were considered too cold for them to propagate, to reproduce, but over the years, of course, now we are seeing huge problems. On the mudflats in the Solway Firth, there are vast expanses that have now turned into oyster reefs. Unfortunately, they are not the best to eat. If you pick them up off the beach, they are quite gritty, and I would not recommend them. In all seriousness, they are now having problems in France with these feral, wild populations of oysters colonising around the cultivation areas, colonising on the cultivation bags, and depleting the phytoplankton, depleting all the food in the water column, which the cultured oysters rely on to grow. We are now seeing the northward spread of feral populations of *Crassostrea gigas*. I did a survey a couple of years ago. *Crassostrea gigas* are now in the Solway Firth, so on the border of England and Scotland, and of course we have a massive oyster cultivation industry in Scotland that we do want to protect and we do not want these feral oysters; we do not want our cultured populations to start reproducing and producing these wild populations. Farmers and hatcheries are looking into a number of methods, such as triploidy, to try to prevent the cultured oysters from reproducing, to provide sterile individuals, but it is not 100% guaranteed. It is a concern and of course in the marine environment, once something enters, it is very hard to eradicate it or manage it, so we are back to the preventative approach that the witnesses were talking about in the first session.

Q58 Chair: What about the issue of certain non-native species replacing our own species that have died out, such as the Dutch elm? We have heard the news this morning that we have the Japanese and American elm hybrid that has been bred to replace the British elm. Is that not an example where a non-native species and good plant husbandry can bring back the British elm that has been devastated by Dutch elm disease?



Professor Cottier-Cooke: I cannot talk about the Dutch elm, because it is not my area of speciality, but of course a lot of people say, well, the Pacific oyster again—we had huge swathes of seabed covered by native oysters, many, many years ago, and they were eaten and harvested, and fished out, and various diseases affected those populations, and now potentially we have the replacement, the Pacific oyster, but of course there are other unknown consequences to the introduction of many of these invasive species. It is very hard to put a pinpoint on what the impact is because of the diffuse, dispersed nature of the marine environment. I am sorry that I cannot comment on the Dutch elm.

Dr Dunn: I am thinking about an example in mainland Europe, various species of freshwater amphipod shrimp. These are not shrimps that we would eat but they are very important in the aquatic system because they process a lot of the basal resources and release energy up through the food chain. Our native shrimps in mainland Europe, and, as we heard, in Rutland Water and Grafham Water, are being very rapidly replaced by the killer shrimp. While at first sight that might look like a direct replacement, what we find is that the abundance of these killer shrimps is massive and in fact they do not shred as much detritus, they do not release as much of these nutrients into the waters and to other species, so they make a big change to the function of the ecosystem. Killer shrimps are also predatory. They eat things such as fish larvae and they are a threat to some of our vulnerable amphibians, and so on. A straight replacement? If you could look at a killer shrimp and look at a native shrimp, you might think so, but the impact on the ecosystem is quite unpleasant and that, again, is going to be exacerbating with warming.

Q59 **Kerry McCarthy:** Continuing on the issue of the marine environment, we have already touched on this to some extent—what are the biggest threats and challenges from invasive species?

Professor Cottier-Cooke: Do you mean what do I consider are the main species that are threats?

Kerry McCarthy: Yes. I suppose there are two things. One would be which species pose a threat and why are they problematic, and there is also what sorts of problems they cause. I know that a few years ago there were some suggestions, and parliamentary questions asked about it, of cholera being spread, not in British waters, but by invasive species going into certain other areas. What are the threats and why are they threats?

Professor Cottier-Cooke: I find that marine species tend to get lower priority than the terrestrial, which we can see. We can open the curtains and see Japanese knotweed or have it at the bottom of our garden, but the marine species are not so obvious. If I can give you some examples, of course we have the Chinese mitten crab, which is on the European list of species of concern, which burrows into the riverbanks and can lead to degradation as well as feeding on fish larvae and things like that. One species of particular concern to me is the carpet sea squirt, a pretty



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disgusting-looking animal, which is colonial. It is called *Didemnum vexillum* and is highly invasive. It is a species that has been in the UK now for a number of years but has now spread to Scotland. Two years ago we found it in a marine special area of conservation and this one particular area is of global significance because it hosts beautiful fan worm colonies, which are a metre in height, and it is the only place in the world where these particular fan worms form these “coral” reefs, if you like—they are not coral, they are worm reefs. We don’t know yet—there is a lot of monitoring taking place—whether this particular *Didemnum* will colonise and smother these reefs.

The *Didemnum* has smothered the seabed over hundreds of kilometres in the Georges Bank, in America, so it is of quite serious concern. In New Zealand, in America and so on, they have spent a lot of money trying to contain it. I think it was the Welsh Government that over the last few years had spent hundreds of thousands of pounds trying to contain it in one marina alone in North Wales, and they did not manage to do it. That goes back to the implications. If a species arrives in the marine environment and it is not dealt with immediately, once it has spread it is very hard to wrap a rock, or wrap a seawall in plastic, as they had to do, wrapping every floating object, in this one particular marina in North Wales where they still did not manage to get rid of it, which is a shame. There are huge challenges and that is one that has a big impact.

Another threat, which was also mentioned earlier, is the Asian clubbed tunicate, *Styela clava*, which grows to about this size, and does look like a club, like a rounders bat, that sort of shape. It has a very distinct temperature tolerance—it has been mapped throughout Europe—and needs to have water temperatures over 15 or 16 degrees for it to establish in a particular area. It is now spreading further north, through the UK, and it has huge implications—you were asking about the consequences—for the aquaculture industry. There have been numerous cases where it will settle out in huge numbers on the mussel longlines, and on other aquaculture infrastructure, and then of course there is the cost to the farmers when they come to harvest; they need to get in larger barges and lifting cranes and things like that in order to deal with it. That has both environmental and economic consequences.

I can give you one more example, if I may, and this is from our overseas territories. I was recently on the overseas territories horizon scanning programme led by Helen Roy. There are huge problems now with the lionfish. I don’t know whether you have heard of this lionfish. It is a very charismatic and beautiful-looking species that originates in the Indo-Pacific and the Red Sea, and lots of people dive there and love to see it, but this species, through the aquarium trade, has been moved out into the Caribbean and has spread considerably there. It grows quite fast so it outgrows its aquaria and people—as they have with the terrapins—have thrown it into the ocean, where it is a voracious predator. It grows incredibly fast, and it also is highly venomous. There are huge problems with the lionfish, in our overseas territories, in the Caribbean, and also in



our sovereign base in Cyprus. The lionfish not only predated upon juvenile fish species and shellfish and what-have-you, so it is beginning to change the system, but it also has a human health impact and provides challenges in that regard. In the Caribbean they are coming up with all sorts of innovative ways to control the lionfish—cooking courses and a bounty on their heads, really trying to promote fishermen to go out and catch them, but they exist down to a couple of hundred metres, so you cannot just take people out with a rod and line to catch them.

- Q60 **Kerry McCarthy:** When I was a child, my dad had a marine aquarium and my mother liked to tell the story that I sat and read up the book about all the fish. My father brought home a lionfish and I, a precocious eight-year-old, apparently said, "That's going to eat all the other fish" and the next morning all the other fish were gone. He didn't read the book.

Professor Cottier-Cooke: I cannot remember the exact spread now, from the Caribbean. I know that it is as far as Venezuela, Florida, and further north, and it is causing huge changes to those ecosystems.

Dr Matthew Offord: It started from Florida, didn't it, and within a decade it was down to the Cayman Islands, and the method of culling it is by spear and people have to be taught to use the spear. If you go scuba diving, you will probably come across three or four of them. If you kill one of them, that is fine, but one fish would have 1,000 eggs within a couple of weeks. That gives you an idea.

- Q61 **Kerry McCarthy:** Can I ask about jellyfish? They are really interesting. I gather that in terms of climate change, they can adapt very easily and they are taking over the oceans. I have a figure here. I will come up with it while you talk about them. Are jellyfish a problem?

Professor Cottier-Cooke: By the mid-1990s jellyfish accounted for 90% of the total biomass in the Black Sea.

- Q62 **Kerry McCarthy:** I have been swimming in the Black Sea. It is like swimming through tapioca, you were just scooping jellyfish.

Professor Cottier-Cooke: Yes; that is the comb jellyfish, which is much smaller. Yes, you have the larger jellyfish that we have in Scotland—we don't have lion's mane jellyfish, and so on—but you have these smaller ones called comb jellies—*Mnemiopsis leidyi*—believed to have been introduced into the Black Sea from ballast water. The Black Sea being a very enclosed sea—it is quite unusual in that respect—these jellyfish multiplied very quickly to very high densities. They fed on the juvenile fish species, both commercial and recreational, and basically caused the collapse of the anchovy fishery. I have it in my notes here: "Black Sea, in the early 1980s, collapse of the area's anchovy fishery by the early 1990s". It is held up in all the literature as an absolutely prime example of a case where a complete shift in the ecosystem took place. Interestingly, however, if you read on, another introduced species came



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in and ate the Mnemiopsis and the system has not quite recovered, but it is an interesting story that I teach my students all the time.

Q63 Kerry McCarthy: It says here that they have now entered, or been found in, the Baltic Sea and on the Atlantic coast of Norway and are wreaking havoc in the Caspian Sea.

Professor Cottier-Cooke: They are off the UK. They are everywhere now. They have spread. They are found in the North Sea now, but of course they are in much, much more open systems compared with the Black Sea, and there were other pressures going on in the Black Sea from eutrophication pollution and other fisheries pressures. But that is one very classic example that we teach the students all the time.

There are also other jellyfish—and a lot due to the currents and the wind direction and so on, but again it is noted as an example—in the Mediterranean, and around the UK sovereign base in Cyprus. There is a jellyfish called *Rhopilema nomadica*, which swarms off the Levantine coast. It was introduced through the Suez Canal and north of the Suez Canal, Israel and Cyprus—all around there—and it can form swarms in the summer of 30 kilometres in length and it is like swimming through soup. I have seen many pictures although I have not seen it myself. There is great concern about tourism, because of course a lot of these places are where people like to go on holiday, but also a power station in Israel had to be shut down. I have forgotten the year now, but it had to be shut down because of blockages caused by the jellyfish where the cooling water was drawn in. They had to get diggers in and were removing something like a tonne of jellyfish every hour for two weeks—it was that considerable—at a cost, of course, to the energy sector of the country. Jellyfish, yes, and introduced jellyfish, if given the right environments, can reproduce very quickly, can cause these swarms and can then go on to cause economic damage.

Q64 Kerry McCarthy: We could talk about jellyfish forever, but you mentioned ballast water and them coming in that way. I mentioned, slightly incoherently, in my introduction, cholera, and that is where the threat of cholera comes from. We still have not implemented the Ballast Water Management Convention. The last time I asked a question about it, which was fairly recently, in February this year, I was told by the Minister that, yes, they were going to do it, which is what they have been saying for a long time, but that they needed to gather data and information with the hope of doing something later this year. Do they not have enough data and information? Is that an excuse or is that a valid thing?

Professor Cottier-Cooke: Well, 80 other member states obviously think they have enough data and evidence to implement and ratify the Convention, so I do not understand. I have not worked directly on ballast water but I do know the team at Marine Scotland Science very well. They have led on this and represent the UK, or have in the past, at the IC's meetings. I know that we have been involved, actively, in the research, and actively in European projects and in the International Maritime



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Organisation's GloBallast programme, where hundreds of thousands of euro have been invested. All the evidence is there. Hundreds of publications have been produced. I don't get it; I really don't get it.

- Q65 **Kerry McCarthy:** The Department says, "The UK has begun the process to develop legislation...and is currently collating the data and information required in order to complete the legislative process" but it has been around since 2004 and we are one of the key maritime countries.

Professor Cottier-Cooke: I don't get it either and, with all due respect, I really would like to see that legislation.

Professor Thomas: As something of a doubter in this field, I think it is madness that we have not done this.

Professor Cottier-Cooke: Oh, thank you. Yes, yes.

- Q66 **Kerry McCarthy:** What difference would it make in terms of the issues that we have been talking about this morning?

Dr Dunn: It reduces the number of times things are introduced and the number of individuals that are introduced, so it is protection.

Chair: Moving on.

- Q67 **Dr Matthew Offord:** I would be very happy to talk about jellyfish all morning as well.

I think you have made your views on biosecurity and the importance of it very clear and you have mentioned the port in Wales, but what are the other barriers to biosecurity being implemented to prevent invasive species being introduced?

Dr Dunn: We have done some research and interviewed a range of stakeholders from Government organisations, from NGOs, wildlife trusts and so on, from industry, including the water industry, and also iCASP has run a workshop recently, which was attended by nine different local authorities—including Wakefield, in answer to your earlier question, Chair. We asked what were the barriers to biosecurity and from all the different people we spoke to, one of the things that came out is that there is a tendency to be reactionary; there is a tendency to—

- Q68 **Chair:** Reactive. Reactionary is Nigel Farage.

Dr Dunn: Yes, you are quite right, Chair. I do beg your pardon. There is a tendency to react rather than to be precautionary, rather than to guard against things. Then, of course, there is that risk of spiralling costs of invasive species, but in a climate with lots of calls on people's time and budgets, there is a concern that biosecurity may cost money and also that it may cost in terms of time; that is where the cost comes in. Local authorities have said that they need evidence about the cost savings potential from biosecurity versus these spiralling costs because that would help them to leverage funds.



Much biosecurity relies on voluntary agreements, and that stands in contrast to the shell fisheries where there is legislation, where people are obliged to have good biosecurity. Combine that with the fact that there are multiple pathways. If we look at who uses local authority land and what the land is used for, there are multiple users and there is a difficulty with that diffuse group to get everybody to engage with voluntary agreements. It is quite hard. It is that classic thing, "I do my recycling but Fred down the road doesn't, I saw them—" It is difficult, if you feel that somebody else might be posing a risk to you. People said that it was great to have local biodiversity champions but they needed top-level buy-in and legislative teeth around biosecurity. With that would come things like infrastructure. Yorkshire Water, in response to some of its work with us, has introduced a fantastic washdown station for recreational canoeists, to help slow the spread of invasive species, and Anglian Water is at the forefront of this kind of thing at Grafham, but these are exceptions. With that precautionary obligation, I think it would become very much better.

Check Clean Dry and Be Plant Wise are flagship campaigns by DEFRA and we have found that where people are aware of those campaigns, their biosecurity behaviour does change, but awareness is not very high. In fact, I think it may even, over the last few years, have gone down. Even among the people we have interviewed, who are recreational canoeists, only 20% of them knew about campaigns. Of researchers from a range of disciplines, not just invasive species specialists necessarily but people who go out into the environment, people from geography, biology and so on, only 40% were aware of these campaigns.

Q69 Dr Matthew Offord: What kinds of invasive species would canoeists spread?

Dr Dunn: Things can become attached; small propagules and things can become attached to your equipment. For example, your canoe often has a bit of water in the bottom at the end. I might come out of a river and I might have all sorts of things—fragments of plants, and one fragment of crassula or Japanese knotweed can form a whole new colony, as can the odd killer shrimp. All these things can be moved around. There can be accidental hitchhikers. They are hard to see. With the Check Clean Dry campaign, the nice thing about biosecurity is that you don't need to know what the invasive species is if you try very hard, as a routine practice, to remove anything and leave it behind, or perhaps to use hot water and kill it off as some of our research has shown. When we have tried keeping these animals or plants in a wet environment, we have found that they will live for more than 14 days—things like zebra mussels. Canoeists can inadvertently move things around, but that can be vastly reduced by good biosecurity practices and, of course, having facilities and encouragement to use them.

Q70 Dr Matthew Offord: As water stress increases across the country, there is going to be more exchange of water supplies through different water



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companies. What measures need to be taken to prevent the spread of invasive species through such water supplies? I have to show here that I am ignorant. I don't know how that water exchange would work. Would it be through a pipe, or by tankers? What would water companies need to do to prevent the spread of invasive species?

Dr Dunn: At the minute, the water companies are very good on biosecurity around equipment, movement and people, but once we look at water transfers, we are scaling up a massive amount. In Yorkshire water transfers take place through a range of routes. In other parts of the country, canals are used. In Yorkshire we use a lot of old Victorian water pipes and all sorts of things. By water transfer we are referring to the transfer of raw water, as in water that has not been treated, perhaps from reservoir to reservoir, across catchments. The Environment Agency has introduced a precautionary recommendation that any new water transfer must mitigate for a range of species, and there is a big knowledge gap there because we are talking about thousands of megalitres—I had to look up what a megalitre is; it is 1,000,000 litres—thousands of megalitres of water per hour being moved down these pipes, so clearly if you popped a sieve in there, you would block it very quickly. The resilience of our water supply and the cost to the customer are both concerns, so we do need to research how to try to mitigate these water-transfer networks so that they are effective and not too costly for the customer while retaining the resilience.

Q71 **Dr Matthew Offord:** Effectively, you don't know yet.

Dr Dunn: We do have some ideas around times, around life cycles, and there some predictive models being done in Yorkshire Water around how and when to source water, and so on, but a lot of questions need to be asked and that research needs to be done as a matter of urgency.

Q72 **Dr Matthew Offord:** Earlier we mentioned invasive species—lionfish—coming down through the Caribbean from Florida, and it is likely that someone did take a lionfish out of an aquarium and flush it, or whatever. How much public awareness do you think there is in the United Kingdom about the spread of invasive species, and what more could be done to highlight the problem to the British public?

Dr Dawson: I think the public awareness campaigns that Dr Dunn has already spoken about—Check Clean Dry and so on—have worked very well, as have similar campaigns to educate people not to dump garden waste over the fence, because that is one of the prime ways in which a lot of introduced invasive plants are spread. Something like Japanese knotweed, which can grow very easily from a very small fragment, can be spread that way, as can many of the freshwater invasive plants that we have heard about. If you have them in your pond, you don't want to go and dump them in a river or in a wild pond somewhere else because that is how those freshwater invaders spread. There probably needs to be a more sustained public awareness campaign for all sorts of different species, particularly those that can be released from dumping from



horticulture but also the pet trade. Very recently, I saw one of the terrapins that we have spoken about in the River Wear in Durham; it had clearly been let out by somebody who did not want it any more. I do think there needs to be a more sustained campaign.

Q73 John McNally: Dr Dawson, could you explain why invasive plants are such a problem despite such a small percentage of the number of non-natives being invasive? Are invasive species an issue that gets prioritised differently in different parts of the country?

The second part of my question is to you, Professor Thomas. Are the approaches to co-ordinating the eradication significantly different? Can you give us any examples where co-ordination has been especially good or especially bad?

Dr Dawson: Invasive plants are a problem, even though there may not be local extinctions occurring, because they can affect some ecosystem functions and processes. I gave the example of Himalayan balsam.

There are also cases where there are clear economic costs. We know about the Japanese knotweed example and the damage it does to infrastructure and people's properties. Buddleia is a similar species in that respect; it can damage buildings.

In terms of social cost, a species that is present in the UK but not yet established or invasive, but is in central Europe, where I have previously worked, and particularly in Switzerland, is a species called ragweed, which is a well-known producer of very large amounts of pollen. That is not the main problem with that species; the issue is when it produces the pollen. It tends to be towards the end of the growing season. It effectively extends in central Europe the period of time over which hay fever sufferers are suffering from high pollen counts. That is a nice example of a species, given that we are talking about how invasive species can interact with climate change, that could be more of a problem in the UK in the future if it gets going.

Professor Thomas: I am not going to answer your question exactly because the widespread eradication of plants—I think we need to think what it is that we are trying to do. If you take the Centre for Ecology and Hydrology's plant quadrat data from the Countryside Survey square and analyse it, you find that non-native plants still make up a small fraction of the land surface of Britain and nearly all of the ones that cover large surface areas are things, like crops and forestry trees, that we have deliberately placed there. Most of the vegetation, apart from the stuff that we deliberately put there, is still native species. If you then look at how the abundances of different species of plant have changed over the last few decades, you will find that of species that have changed the most, including increased the most, at the top of the list are native plant species, including things like nettles, not the so-called invasive species. By using the word "invasive" we are somehow coming to the view that this is an exceptional and wrong thing. The fact that native species are



increasing just as much illustrates that the key drivers of change are how we manage the land, how the climate is changing, the nutrient deposition in the landscape, and so on, and that the non-native plants, some of which people are calling “invasive”, are largely responding to the same drivers, rather than being somehow the fault and the cause.

While I am not going to dispute any of the evidence that any of my colleagues have given, I do think we heard a huge amount of emotive language. Whenever a species that has come from somewhere else is being described, if it becomes abundant and widespread, it is being described in negative language. If you think of all the common and widespread species that are British and native, then we talk about the ecosystem benefits, how they make our habitats, support our wildlife, and so on, but they are just another species that is common and widespread so I find it difficult to draw that distinction. However, if it is knotweed, which has a minuscule land surface cover in the country—absolutely minuscule—if it is in your buildings or in your garden and if it is legislated that you have to get rid of it, then it is a pain in the proverbial but it is not a major threat to national biodiversity as a whole. It is a nuisance to humans, so get rid of it, but brambles and nettles in my garden can also be a nuisance and I get rid of them with equal aplomb.

- Q74 **John McNally:** Before somebody else comes in, we had a particular local problem in my own area with Japanese knotweed. We spent some time clearing out an area, a dilapidated area, run down, for a community benefit; topsoil was brought in and we spent a lot of time and effort on it, had a great community initiative, it was ready to go, and then we discovered Japanese knotweed and it was immediately brought to a standstill. I ended up bringing in Roseanna Cunningham to speak about it. The erosion of the banks around about the River Carron and so on was horrendous. I find it incredible that you can—

Professor Thomas: Beavers erode your riverbanks. That is going to be a big one; that is much bigger, and they are being reintroduced as a native.

John McNally: Because it is a same-sex plant, if I remember correctly, it is extremely difficult to get rid of.

Professor Thomas: It would be much worse if we had both sexes.

Chair: Committee members never fail to astonish me with their knowledge of same-sex plants.

- Q75 **John McNally:** I was just going to say, Mary, that I discovered Aphalara itadori—which I thought might have been an actress—and we brought that in to try to control this. If we had known about sheep before then, maybe we could have saved ourselves a lot of problems.

Not using invasive species, to me, is quite clear and I think we need to address it. I cannot understand why you would want to choose—



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Professor Thomas: I would agree with you, but not because they are foreign. Japanese knotweed is a nuisance, for various reasons, to humanity, whereas wheat is useful to humans. They both originate from other locations. Wheat covers much more of the land surface than Japanese knotweed. From a British biodiversity perspective, if that was all you cared about, then wheat has an enormous impact and Japanese knotweed is virtually unnoticeable by comparison. There are lots of native species that are also a nuisance.

Q76 **Chair:** What about oilseed rape—doesn't that make everyone sneeze? It certainly works for me on the train. Is that not an imported plant?

Dr Dawson: Most of our agricultural crops are. Chris is completely right: most species that were introduced are useful. Most of them would be considered to not be a problem; those that are become what we call invasive established. Yes, they may not necessarily lead to biodiversity changes in terms of losses of species at a national level and, yes, in many cases they are the passengers of changes that humans wrought on a landscape.

Chair: I am very keen to hear from Alison. You had your hand up and wanted to respond to what Chris Thomas was saying.

Dr Dunn: I was a bit concerned about Chris's comment about non-native plants, some of which people are calling "invasive". I think I would be right that we are all using the Great Britain Non-native Species Secretariat definition of an invasive non-native species, which is one that was moved around by humans and has the ability to spread causing damage to the environment, our economy, human health and the way we live. I think we are using that very consistently in terms of our Invasive Non-native Species Strategy.

The other thing I could talk to, if you would like, is co-ordination of control. I am familiar with some of the Environment Agency's work on the Aire and Calder, where it has been controlling two of the big riparian problems; hogweed that causes blisters to skin, so if children or adults, indeed, get the sap on their skin it causes blisters that recur throughout the rest of your life, really unpleasant burns, and then knotweed that interferes with construction. It has been doing some fantastic work in trying to treat it consistently. Clearly things do spread naturally and are spread by human agency, so after treating one area of a river it can then be reinvaded. It has done some fantastic work on the Aire and Calder and other rivers in Yorkshire in ongoing treatment programmes.

However, knotweed can regenerate and hogweed seed will sprout after eight years, so you need to continue these treatments. There is an issue with short-term funding; you get a bit of EU funding or something to do something for two years, but we need to get rid of eight years of hogweed before the seeds are no longer sprouting.

Another issue that my colleagues in the Environment Agency point out—



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John McNally: Even if planted something like 25 feet underground and covered in black plastic—

Dr Dunn: That is right, yes.

John McNally: —so no light whatsoever would actually get to it, it would sprout again. It is unbelievably resilient.

Dr Dunn: It is unbelievable. In fact, if you remove it from your garden and then just lazily pop it in the compost—for example, Leeds has great compost recycling—you have contaminated everybody else's compost.

The other issue that they do raise is that it is difficult sometimes to be able to enforce on landowners. The Environment Agency is paying for this treatment at the minute, paying for stuff that should be the responsibility of the landowners. There is a double problem there. Some big landowners perhaps are not taking responsibility, and then there is an issue with very small landowners perhaps being unable to pay for it. Therefore it is finding the funds to do that.

Q77 **John McNally:** I have one really quick question while I have this lady here. We have heard that maybe bluefin tuna are going up through the west coast of Scotland. Can you confirm that that is a fact, and is it an invasive species?

Professor Cottier-Cook: I have not seen anything published on it but I have also heard that report. I am not a tuna expert but I would say it is a migratory species that ranges over thousands of kilometres, so I would presume—if anyone else knows—it would be just a range extension.

Q78 **Chair:** We could go all day on this, but we are running out of time. Would the Invasive Non-native Species Strategy benefit from being more holistic and including non-native pathogens such as ash dieback? Do we think ash dieback was planted into the landscape, or do we think it blew over on the wind, as a very eminent Cambridge scientist was very keen to tell me at the time when I was making a big fuss about this back in 2013?

Dr Dawson: I saw one of his posters in Cambridge last week. The suggestion was that it is actually a combination of a plume of dispersal coming from the continent but also spread has been increased through moving local provenance ash saplings and seedlings from the continent—from the Netherlands, I believe—back into the UK for growing in the landscape. It is actually the two things together.

Q79 **Chair:** Both, and we cannot disaggregate whether the plume brought in 1% or 99%, can we?

Dr Dawson: That is something you would have to ask the professor in Cambridge.

Q80 **Chair:** He was not able to tell me at the time, but this was 2013 so maybe six years on he has some answers.

Can you go back to including pathogens? Do you think those diseases



should be included?

Dr Dawson: I think it is a no-brainer. Horticulture is a major pathway of invasive plants. It is also a major pathway of pests and pathogens, either on the leaves, in the soil or actually within the plant itself. I think a more holistic approach to dealing with pests, pathogens and invasive plants would be beneficial.

Professor Cottier-Cook: I would like to reiterate my support for that. I am currently leading a programme called GlobalSeaweed STAR, which is funded through the UK research and innovation budget. It is to work with developing countries—the Philippines, Indonesia, Malaysia and Tanzania. I am working with farmers and Government agencies that look at seaweed farming. A major part of our work is looking at pathogens because in the Philippines alone they are losing over \$100 million a year in their seaweed industry through disease and pest outbreaks.

You may well wonder, “What does seaweed have to do with us?” Seaweed goes into our toothpaste, it goes into our Gaviscon, it goes into our beer, it goes into our soya milk and it goes into our paper production. Even though we do not grow seaweed here in the UK—although we are going to be starting soon—it is a very important component of a lot of products that we use every day of our lives. We believe these diseases and pests are being moved around. We are doing analysis on the legislation and policy in these countries and there is no biosecurity or very little biosecurity legislation for pests and disease, so it is very important to include this.

Chair: Thank you. I am going to move on to the final questions, from Kerry.

Q81 **Kerry McCarthy:** This is a question for everyone. What do you think are the biggest gaps in our knowledge when it comes to invasive species, if there are indeed gaps? You seem to know so much, but is there anything there needs to be more research into?

Professor Thomas: Speaking for myself, I would say the largest gap in knowledge in most people is the history of our biota and how much it has changed in the past and the presumption that when it changes again—as it is under all the environmental changes we are unleashing, particularly climate change—there is a sort of correct version of nature that ought to exist, and when it changes we should try to stop the change and put it back to what it is. The moment one thinks about long-term changes to the distributions and abundances of species driven by climate change, and even changes over tens of thousands of years, they are very relevant today because in a hundred years we are unleashing many, many thousands, or even tens of thousands, of years’ worth of climate change. Understanding how dynamic systems are means we should go with the flow, except where it has very direct consequences for humanity or biodiversity that we care about.



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For biodiversity, disease is the No. 1—top of the list. No. 2, equally from a UK perspective, are the overseas territories. With those two—disease and overseas territories—you have more or less done the big biodiversity perspective problem on non-native species.

Professor Cottier-Cook: From my perspective I see the changes. I am not a geneticist myself but I work with them very closely and I see the differences. It is looking at genetic markers, using molecular tools to identify species. They are doing it now on escaped Atlantic salmon in Norway and other places so that they can pinpoint, “That salmon came from that country,” or even that region or that cage. You can then start to say, “Okay, now you need to pay the cost of those escapes.”

There is a lot more being done on what is called environmental DNA. It is still really, for me, in its infancy. You could go to a ship in port and take a water sample from the ballast water tanks or from the port region and it will identify for you what is there, instead of relying on taking a sample and very slow sorting in a lab. To put funding—I know there is a lot of funding already—in to really enable that testing mechanism to flourish would be absolutely key.

Dr Dunn: We have always seen changes, but what is unprecedented is the rate at which new species are being introduced and then a percentage of those becoming invasive and economically problematic. I think it is important that we research the interaction between all these various changes. In order to try to encourage people to invest in biosecurity and preventative measures, we need to investigate how best to engage with people and engender behavioural change across this diffuse network of people.

Very specifically, in terms of water resilience, we are going to be even more reliant than we already are on water transfers. We need to do that research to ensure that our water supplies are resilient, while also mitigating against transferring invader species to new areas within the country.

Dr Dawson: I think one of the biggest knowledge gaps is trying to better quantify pathways—both the size of a pathway in terms of the numbers and types of species that are coming down, and the level of risk of invasion and impact associated with those species that are coming in through particular pathways and also from particular regions of origin. If we do start to trade with parts of the world more in future in a post-Brexit world, how many species from that region are going to cause a risk to the UK through trade?

Q82 **Kerry McCarthy:** I think we have covered most of the sub-questions. Dr Dawson, is the framework for linking scientific research to Government policymaking effective at the moment?

Dr Dawson: It could be better. I am secretary for the British Ecological Society’s invasion science group. One of the core things we are trying to



do in that group is to bring together the pure and applied side of invasion science. It is the usual things that crop up—better opportunities for communication, data sharing, knowing how to access information and also use of language in order to translate it more easily and effectively into policy are issues we are looking at at the moment.

Q83 Kerry McCarthy: It sounds—from what we were talking about, the Ballast Water Management Convention—that the data is there to inform policy but there is bit of a gap between that actually happening, which I suspect is not down to the lack of scientific knowledge but is down to political will.

Professor Cottier-Cook: Can I just add that one of the key components of the project I am running, GlobalSeaweed STAR, is science into policy? A lot of the research grants now have this pathway to impact where you are expected to discuss and be involved in committees such as this. I think that is a really positive move. I feel it is very much dependent on the individual researcher as to how much they do want to engage with policymakers. When it comes to giving the guidelines of these pathways to impact by the research councils, maybe something should be written specifically in there about this type of engagement to push researchers to do more.

Q84 Kerry McCarthy: There is never enough funding to do everything. The final question for me is—you have already said where you think the gaps are—in terms of priority for funding, should it be in trying to fill those gaps or should it be trying to compensate for potential lost funding from the EU? What is the most important thing as an immediate priority?

Professor Thomas: Pathogens in overseas territories.

Professor Cottier-Cook: Pathogens as well. Also—please, if I can make this plea—we have fantastic funds like the Newtown Fund through the British Council's work with overseas partners, which is great. Maybe that needs to be extended to continue working with our European partners because we cannot afford to forgo those partnerships. Many of us around this table have worked with European partners for 20-odd years and to not be suddenly working with them when they are on our doorstep—

Kerry McCarthy: Do you agree?

Dr Dawson: Yes.

Dr Dunn: Yes.

Chair: Thank you all very much indeed. We have run slightly over time but it has been absolutely fascinating.