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Transcript for Session 3: 'Curation & Conservation'

Speaker 1: Martin Gardner

A very good afternoon to you all. And it's a great pleasure to be able to make a presentation to this important conference today. What I want to do is to reflect on one or two aspects regarding plant conservation that I've been involved with here at the Royal Botanic Gardens in Edinburgh. And I've been here for some time now for almost 30 years. And I want to give a few examples whereby ex situ conservation has made a real difference. I think much of what I perhaps have to say, is probably very well known to many of you. But I do believe that we need to constantly remind ourselves about the potential role of Botanic Gardens and plant conservation protocols that we must try to follow. And of course, key to this is maintaining accurate part record.

42 years ago, Dr. Chris Paige who was then the fern and conifer expert, visited Hong Kong to research native conifers, he had an ambition to botanise the Mao Shan and the new territories and study this remarkable conifer you can see here with these extraordinary cones. And as part of this research, he collected cuttings for cultivation in Edinburgh and gladly plants from those cuttings and still thriving today. Late last year rooted cuttings were returned to Hong Kong, via the Kadoorie Farm and Botanic Garden. This followed a request by the garden who were wanting to restore the dwindling native populations. They in fact, found out that we were growing these plants by querying the BGCI database. And I think that just shows you how crucial it is to have this sort of information openly available. The RBGE assessment of *Amentotaxus* has some crucial supporting information that makes the germ plasm worthy of repatriation. First of all, we know precisely where Dr. Chris Paige collected the material. And secondly, we knew we know of his sample method. He didn't collect seed because there was no mature seed available. He took cuttings on one single individual, because that's all that was in that valley. And this single individual he noted had immature female cones. We also, of course, establish all the propagation protocols for this species. And very importantly, we passed all this knowledge on to the gardens in Hong Kong. Certainly to the success of this introduction has been the horticultural skills to keep the plants alive for 42 years and maintaining all the supporting data with the propagules. We have fully exploited this collection for conservation purposes. And I think it's a wonderful example, whereby you are integrating ex situ with in situ conservation, which sometimes is quite difficult to achieve in Botanic Gardens. And of course, collection holders are in this for the long haul.

We must keep plants alive for as long as we possibly can. And certainly, that is not getting any easier with the onset of climate change and emerging pathogens. Of course, the distribution of the plant connection holders has to be at the core of our strategy as an insurance policy against loss. As I say keeping plants for the long term has its challenges even with well established Botanic Gardens such as Royal Botanic Gardens, Edinburgh, which is now in its 350 year need some time to take time to renew and expand its infrastructure. The new glass house complex about to be built will mean unfortunately temporarily removing all the plants from the Chilean conservation terrace in here. This is an extraordinary collection of plants collected as part of a three year collaborative Darwin initiative funded programme with a University in Chile, whereby we monitored 48 threatened species from South and Central Chile. And we established a similar collection in Chile. And that was a very important goal of this project. Of course, the project has also resulted in the publication of the threatened plants of Central and South Chile seen here, the first edition came out in Spanish then one came out in English. And I'm happy to say that a new Spanish edition has now been reprinted. And this book has important information on not just distribution and conservation of these plants, but also on their propagation.





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The Chilean collection of over 40 species here at Edinburgh covers a relatively small area. I guess it's probably less than quarter hectare and but importantly has 18 threatened species. And I think this probably comprises one of the highest concentrations of threatened plants grown anywhere outside of Chile. And hopefully in the move none of this material will be lost. And importantly, we have distributed much of this material using the network of sites that has been developed through the international conifer conservation programme. Every plant in this collection has precise collecting data and importantly many of these species have been subject of horticultural research. For example, this remarkable plant here that is related to *Escallonia* in the *Escalloniaceae*. Andy seen here holding this plant has a very good understanding of how to propagate this plant. And certainly it is not a straightforward to grow, and the watering regime seems to be crucial for its survival. It comes from a remarkable location deep inside a coastal cave. But again, what is very important that we've, we've documented all this information in the wonderful horticultural journal *Sibbaldia*.

Most species in Botanic Gardens are represented by a relatively small number of living plants due to the limited available space we have. However, here at Edinburgh, through the international conifer conservation programme, we've developed a series of conservation hedges and extended this initiative to other sites throughout the network and UK and Ireland. And our mantra is that all new hedges need to have the same remit as any other plant, planting in the garden, use need to fulfil a scientific purpose and not merely be part of our utilitarian planting. And these are super hedges cramming relatively large amounts of genetic material into a small space, potentially capturing a range of traits. And we have to remember that plants such as *Prumnopitys*, are threatened in the wild. And here's an example of the species which many of many of the parts in this hedge come from the Sun Bian Dam in Chile, which at this moment, is being flooded with the loss of 1000 old growth trees. So we've not only planted this hedge, but we've established hedges in other other sites. So Glasgow Botanic Garden is the most recent Oxford Botanic Garden is another one. And in Northern Ireland, we've also established hedges. What is important of these hedges is not so much the number of plants but it's the number of genotypes. So for instance, in this hedge, we have 350 genotypes, each plant is accurately labelled. Each of those genotypes comes for as a collected seed from an individual from the wild. I have mentioned the network of safe sites that the international conifer conservation programme has developed over a period of almost 30 years, we're now working in over 200 different sites. Here is a table of some of the threatened species that we have distributed through the network. The most telling column in this table, and is the end column, which gives the number of genotypes I said before it's number of genotypes, that is that is so important that we're monitoring. It's all about broadening the genetic base of conifers in cultivation. And the numbering in brackets is the this the sum total of individuals, which includes vegetatively propagated material.

We have to be mindful of broadening the genetic basis, I say of all plants in cultivation, if they're going to have any meaningful use in assisting restoring depleted wild populations, we have to work together to make sure that we are not all growing and narrow sample size. And this is of course, exactly what happened with *Fitzroyia cupressoides*. In the early years of international conifer conservation programme, we've researched the genetic integrity of this species in cultivation. And somewhat to our surprise, we discovered that a single clone was being cultivated which happened to be female. And this represented or likely represented the original clone introduced by William Lobb in 1949. That research also included researching genetic integrity of native populations in Chile and Argentina. And as a result, this helped to guide the rest of our restoration policy in Chile. And here you can see Antonio Lara who has done so much work on *Fitzroyia*, in Chile. And with a colleague using local genetic material to restore forests in the central depression, just north of Puerto Montt. This this particular forest if you know, and you've been to Puerto Montt, you've been to the airport it's very close to the airport. Every period of 30 years, we've tried to sample from across the natural range of *Fitzroyia* and the right hand map shows those sites that we've sampled from in Chile. Sadly, it's not been straightforward and much of our frustration has actually been with trying to obtain CITES permits from within Chile. In fact, on one occasion, we sample cuttings from all the outlying and protected trees near to our area. But the permits took so long to issue in fact, over two months, by the time we got the permits, the the cuttings had



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perish. But there has to be a review, I think of how these permits are issued, I understand that many people are tormented by the present system.

So here's the distribution map of ICCP distribution map of Fitzroyia in cultivation, the blue and red dots are the sum total of our sites. And those in red represent where we have worked with landowners to plant Fitzroyia. And this is remind you that 30 years ago, there was a single female genotype in cultivation. And today through the work of the conifer conservation programme. Instead of a single genotype, we have 102, genotypes, both male and female, in 52 sites. So this is I couldn't resist showing, those of you who have not seen Fitzroyia in the wild, I couldn't resist showing you at this fantastic forest, in southern in southern Chile. And this is actually a very important site, because this is where the oldest tree was discovered. And it was discovered to be in fact, 3500 years old, which makes it the second oldest living thing on the planet. So, curiously, and interestingly, and I'm going to end on the image of a compost heap. And in doing so, I want to quote the remarkable Quentin Cronk, who once wrote a piece in the 1999 RBG catalogue of living plants that quote, the high levels of biodiversity in Botanic Gardens is the result of an equilibrium between new accessions and losses suspended between the plant hunting expeditions on the one hand, and the compost heap on the other. And Quentin Cronk went on to say, quote, the message I have for Botanic Gardens is collection managers do not manage collections. They manage biodiversity throughput by controlling a vast river of germ plasm through conduits and sluices until it's lost to the great ocean of the compost heap. Unquote. Hopefully, by the time any plant reaches the compost heap, we would have had tempted to have squeezed every piece of information from it. And that we have correctly identified the plant, perhaps banked some DNA from from it, made a herbarium voucher specimen, utilised it in education and research, and perhaps top of the list. We have used it in a programme of integrating ex situ with in situ conservation. Thank you very much.

Speaker 2: Pam Smith

Hello, I'm Pam Smith, Gardens and Parks Consultant, the National Trust in the Midlands region. My talk today looks at what we do and what we can do with our plant information, introduces the understanding and the assessment of attributing significance to plants. how we approach this in the National Trust, but also on my research and touch on the uses of botanical heritage, some of which I've talked about at other conferences, including plant network, so some of this may sound familiar to some of you. Firstly, A very brief introduction to National Trust gardens, there are more than 200 gardens, but they're not all open to the public. Each has its own approach to management and conservation, and is determined where possible by a management plan, which may include criteria such as significance, and always talking about the site spirit of place. And we don't have one size that fits all when it comes to presentation standards. We're not trying to achieve the highest horticultural standards everywhere. It really depends on the garden. Current stuff and budget cuts will mean what we can achieve even our most highly presented gardens is going to have to change and understanding what is significant about a garden and its plants can help prioritise resource, whether it's about what to water in times of drought, or where to concentrate, staff and budgets. But a common thread for all our gardens are the plants that make up the setting the structure, collections and ascetics of our gardens.

Assessing plant significance is an ongoing debate here in the National Trust, I'm particularly interested in: Do we understand the heritage value of some of our collections and individual specimens as living artefacts in their own right? How do you place a heritage value on living accessions sessions that might not be rare or in danger but are unique? In the National Trust, the term significant is used to identify what is special what is characteristic and what matters. In the context of gardens and parks significant plants are the most botanically historically, and aesthetically important individuals that grow in our land. Here you can see an extract from the National Trust internal website, we try to identify the categories of significance of which a plant or group of plants can be assessed against. Some plants will fall in more than one category, and some move in and out of significance. For example, a champion tree may not remain a champion, and some develops significance through more



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research or even as they age. We ask all our gardeners to produce a list of significant plants, and this is discussed annually and is a working document it isn't static. The list feeds into plant health risk assessments and also into garden management decisions. For the purposes of this talk today, from a horticultural viewpoint. The first three are my focus: historical cultural significance, landscape or spirit of place significance and horticultural significance. T

his is an extract from a significant Plant List for Hardwick. Details are also recorded on our database. Such lists may form an appendix in a garden management plan, and it's often developed in partnership between head gardeners or plant curator and garden consultants such as myself. Conservation approach column is where the discussion is, sometimes there are different opinions, but the decision on this approach is as important as identifying the significance in the first place. Just because the plant is significant, doesn't mean that we have to keep it or even replace it. Often, the debate is about whether to replace significant trees in a garden or parkland, there's often a presumption that we do replace everything. In this example, the decision about the walnut is an easy one. Any replacement will be significant. It's significant because it currently is the oldest plant in the garden. The garden has happened around the walnut. The loss of the walnut would prompted a rethink of the garden design perhaps but not a replacement of the tree. The cedar however, is still to be decided. We will use a recently completed conservation management plan to decide what our approach to the overall design of the West court where it's located will be and how that influences any succession plan we have for the cedar. Another example of horticultural significance may be a property that has a working orangery one that's actually used for the cultivation of citrus. Using the building for its original purpose and the skills required to maintain the plants would mean that the citrus collection will be a group of horticultural significance to that garden.

So let's try and think about a conservation approach for the black pine at Berrington Hall in Herefordshire. seen here on the top image to the left of the stables and on the lower image to the right of the hall. If it died, or was to be felled in a storm, what would the conservation approach to its loss be? Any management decisions should always start from considering a do nothing approach. In this case, don't replant? What if we were to replant do we choose something similar? The bigger the better? A big evergreen to get these settings affect as soon as possible? If we discover it's planted close to its introduction date of 1835 could we plant a new introduction to recreate the spirit of intent, or do we just go out and buy a replacement *P. nigra*? Often the conversation is about the fact it's already been propagated or replacement has already been planted. Then we were taught about what the decision was for that. And how long are the trees tend to be kept in the nursery just in case they're unlikely to be good specimens by the time they are needed. Secondly, where is the replacement tree? Can its significance be delivered if it's planted elsewhere? Often propagation and replacement or automatic responses to preserve at all costs, may need a more considered approach. It does show the importance of making and recording decisions for the future management of a garden.

You could argue a case for all of these but in this case Berrington is Capability Browns last landscape a grade one landscape and the restoration of the parkland is almost complete. Significant to this was the opening up of views from the hall. So in this case, the conservation approach is that it is not replaced because the views are more significant than the actual tree itself. So let's try that again with two of the trees. Here we see Queen Carmen silver, Penryn Castle in North Wales, trees planted by famous people are Memorial trees have historic significance. And I would argue that the significance is in the planting not the plant. When it's gone, it's gone. You could get someone else to plant a replacement, or perhaps the tree could have become horticulturally or have landscape significance, and its replacement is now argued for different reasons. Golden larch planted here at Biddulph in 1855 is believed to be the last survivor of six brought from China by Robert Fortune, it has been propagated. It's an important wild collected specimen, and it can be planted elsewhere in the garden to maintain this gene pool. I would suggest for a succession plan to always have an offspring of this golden larch in the China Garden at Biddulph. Sometimes there's no choice.



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Here is the Covington pear, understood to be the second largest pear tree in England and about 250 years old is going to be felled for HS2 and there's been a campaign to save it. Here the significance isn't its size and its age but possibly also because it's at risk. Students from Shuttleworth college have propagated it and descendants cannot be distributed around the community and its story will carry on. Understanding significance should lead to potential outputs. What are we going to do with this information? increased understanding of a garden history, a story to share and connections to make or does it have marketable value?

Here at Benthall Hall in Shropshire we know it was once home to the botanist and plant hunter George Maw. There's only one sentence on the property website showing that fact but research has been done over the years, including by the historic family, and we occasionally dig up his plant labels in the garden. Maw patented the plant labels and produce them for Kew as well as many others. I was particularly taken with his story and started to do further research and hope to publish more soon. As a result of being able to show the significance of what happened here, that Maw introduced up to 4000 species via Benthall, collected and corresponded with Darwin, and was friends and plant hunted with Hooker, and many others. We have been able to refocus the garden management plan and have selected the layer of garden history that represents Maw's time at Benthall and to be the guiding layer for the future maintenance of the garden. We intend to reintroduce some of his plants the majority were alpiners and bulbs particularly crocus. Maw wrote and illustrated the crocus monograph. As a result of the research and the enthusiasm of the property team, this five acre garden has a much bigger place to play in our botanical history than its size or visitor numbers would suggest.

Secondly, let's look at the potential of engagement and partnerships for sharing stories. These stories are often related to trees, there's even a Wikipedia page which lists hundreds of trees across the world which have a significance attributed to them. Highlighted here is the cotton tree, which featured in the BBC programme, Black and British a forgotten history. David Oluoga explored black British history by commemorating key events and people for the unveiling of plants across Britain, Africa and the Caribbean. Showing stories and inviting people to share their stories about their own and even your plants is a great way of engagement and can prompt partnership working gardens are seemingly familiar places to share unfamiliar stories.

A potential third output is marketable value. plants can be propagated, so can we duplicate significance. In the case of DNA, we know we can but what about the stories can they be attached to the offspring plant as much as its parent? Biddulph Grange is known for its monkey puzzles growing in the woods and in the monkey puzzle parterre. I will perhaps have made even more of the significance to further prompt plant sales, but they do always sell well. Do we do limited editions? Is the value increased due to where it is bought or its parentage? Here we see Woolsthorpe Manor, Isaac Newton's home a famous apple tree indeed. How about your own Newton's apple tree? There are many all over the world. What does it mean for people Have a piece of a living artefact. I'm interested in this and how we can garden beyond our dates and what the impact of sharing significant plants can have in our local communities. Firstly, is heritage transferable? I'm sure it is. And it's interesting to hear how people places communities and the commercial sector adopt or hold on to significant stories. But other models out there. Other models within exist in heritage designation criteria that we can consider when assessing ascribing value in relation to living artefacts? If not, how can we get involved to ensure this is the case? Transferrable heritage: Newtons is a great case study. And as I say, it seems that a hundreds, there's an example here from the University of York. Their tree is the flower of Kent. The tree that they planted was provided by Kew Gardens who in turn got it from Cambridge Botanical Gardens, who obtained it from the Fruit Research Station. They got their stock from the tree at Belton, which had been propagated there from Newton's garden down the road. Apparently we can also buy them they're commercially available. The tree here has prompted partnerships and seeds were taken into space and have been grown on and a sapling was planted, in January this year. We're also discussing sponsorship from Apple. We have a material transfer agreement and we are developing specific criteria to help the property team deal with many requests they receive a bit of the tree. for conservation staff working with





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plants is a different approach. We know we can give some away and keep the original at the same time. Some areas of significant assessment I'm looking at include the Historic England listing criteria, and the International Council on Monuments and Science Charters related to cultural and heritage values. We also have our own Botanic Garden discussions on heritage and the Nagoya protocol does identify cultural significance and associations with plants. I'm also looking at parallels in the collections assessment criteria from our colleagues who work with museum collections. This will all play a part of my article from the presentation for Sibalddia, and I'd be interested to hear any thoughts and examples that you have about the subject. Thank you.

Speaker 3: Clare Hart and Peter Symes

Hi, my name is Clare Hart and I'm the horticultural manager here at Royal Botanic Garden Victoria Melbourne Gardens. Today I'm going to be talking with Peter Symes, the curator of horticulture about landscape succession collection, curation, and how this landscape here Melbourne Gardens is going to transition. Peter, over to you.

Okay, and we want to share with you the story about this heritage landscape that you see behind you. And it's very diverse plant collections. And how are we going to manage that and change that over the next 50 years through climate change. And the second part of this story is introducing the Climate Change Alliance of Botanic Gardens, and how we'd like your organisation to join us.

I'd like to acknowledge the traditional owners of the land on which we are gathering a landscape of over 50,000 years of careful management and stewardship. I pay my respects to their elders past and present, and elders and other First Nation communities who may be listening today. Can you give us an introduction to Melbourne gardens tell us about the history?

So Melbourne gardens was established in 1846. It covers over 39 hectares, and it's about 2.4 kilometres from the city and the actual Botanic Gardens in the foreground of that slide. It actually is connected to the domain Park lands. And currently we're getting about 2 million visitors. So why is this landscape in particular and the collections within? Why is this so important?

Well, we have over 20 living collections in the foreground, you can see the beautiful volcano but the whole landscape is actually a mega collection on its own. That the 8000 taxa away grind represent over 190 countries of the world 98% so it's a very rich Global Diversity taxa. So that enables much richer storytelling, but also provides a very significant well being benefits for the visitors that come to our gardens.

In future projections, Peter, indicates a warmer and drier climate.

Yes, they do Clare but I want to talk about the history first. So Melbourne. Temperatures about 14.7 degrees around the beginning of the garden. And it's risen to over 16 degrees. Most of that is from global warming, but some of it is urban heat. And also with precipitation, it's trending down, we had a bit of a bumper in the 1950s and 1990s, which is unusual. But essentially, we're seeing a different world.

Are you saying that the climatic world in which this garden was established, has gone?

Its history Clare. Okay. It doesn't end there, though, because we're looking at future projections as well. So for Melbourne we're envisaging a temperature rise of about three degrees, it may even be up to five degrees, and our mean temperature will head up towards the realms of 19 degrees, precipitation, with the combination of temperature rise and precipitation drop, looking at a 20% reduction, effective soil water balance, the further these these extremes that we have to face as well. So we're looking at a fourfold increase in days over four degrees Celsius.

This is one way to look at it through graph can be a little bit difficult to grasp. Have you got any other spatial visual indicators that we can look at to understand this as well?



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Great question. Yes, I do. If we compare climate shift to geographic distance, then Melbourne could have climates similar to locations 800 kilometres away, so places like Dubbo and even further than that, but that doesn't make a lot of sense to our colleagues in Edinburgh, who at this conference at the moment so are providing you an example. So if you look at your projected temperatures, and where you might find equivalent to that geographically, you're looking at moving your whole botanic garden to a point somewhere between Nantes and Bordeaux in France. Broadly speaking, what are the risks to plant biodiversity within an Australian context?

Well, I'd like to first share with you are the limits to montane vegetation and geography so Australia, our mountains aren't particularly high. And any vegetation that's growing at the top of these, like these snow gums, with my sons in the picture there, they essentially have nowhere to move to find a cool temperature. Australia is also an island, we have a coastline, which limits where plants can move. Further, many plants are unable to really track the rate of climate change that's necessary. And if I use eucalypts as an example, there are only able to disperse this seed about one to two metres a year. So over the next 50 years, they can only move 70 to 180 metres, and they might need to actually disperse 800 kilometres. We also have higher risk of extinction events, and you have heat waves. But we also have bush fires and we had these massive fires in Victoria, back in January, which burned very significant areas of land. And now organisations actually currently involved in fire recovery work around that and you can see some of the stark images that we're facing now. Climate change increases the frequency and severity of fires so they become a real risk to biodiversity. And further new pests may emerge or existing ones become worse. And an example here is Myrtle rust. This is a image of Myrtle rust occurrence in the Botanic Gardens is not a disease that we had 10 years ago. And it's becoming of mounting conservation significance in Australia.

Given what we've just learned, how has Melbourne gardens responded to the increased risks of climate change? We realised we needed an integrated plan that brought our other plans together in responding to these risks. And we actually looked around the worlds we thought Surely there's other people who are working in this space, but we couldn't find any examples, we conducted a worldwide literature review. And we realised that we had to actually construct our own plan. So it was a clear knowledge gap there. And we developed the plan based on the concept of a living system where we're following the ecology of vegetation succession, we realise we need to act now because we need to make predictive decisions about trees that may not survive in this future climate. There's a long time frame involved in that we needed to adapt this landscape to that projected climate. And we also need to safeguard the values that we hold dear, such as our science, recreation, and our educational outreach.

Oh, looking at this image, do you think that the plant collections will be the same will it look the same Peter?

Many of the species in this fight are actually suited to a future climate and number of the palms there for example, there's an arucaria on the right. I feel reasonably confident that the collection will largely largely stay the same but some adjustments will know that there is some issues that we have to deal with, essentially want to hold this picture and see the same thing in 2090.

Can you share with us one of the outcomes of the landscape succession strategy, we commissioned a study from the University of Melbourne to evaluate the climate risks posed to collections - have never been done before. And in front of you, you see a spatial representation of that risk. So red is the highest risk, green is the acceptable risk. And this is for the extreme climate 2070, we run a whole range of scenarios. So moving from our current climate to extreme climate, we have a doubling in risk. So 26% of our taxa are facing that high risk, this might look quite alarming, but actually becomes a very useful tool. For landscape planning, we can see where the areas of highest risk are in the landscape and plan around that. And the other benefit from this is we realised there were many new species that would be suitable for a future climate. So we actually have great opportunity in front of us as well.



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So we've heard about the broad landscape impact. So let's now hear how this impacts some of the individual collections that we have at Melbourne gardens. Now like to introduce Kate Brown, Kate manages the New Zealand collection at Melbourne gardens, a heritage collection that faces significant climate challenges.

Kate tell us how the climate risk assessment has impacted the New Zealand collection and some of the things that you've put in place to future proof this collection.

Yeah, well, the climate change risk assessment was done on the whole landscape in 2017, by Dr. Campbell, and Alison Farah from the University of Melbourne. And that really showed up how vulnerable this collection is, especially to climate change. So that gave me a greater sense of urgency. That was three years into my tenure. So I've been really lucky in that I've been able to develop some great relationships with colleagues in New Zealand, mainly through scholarships, four times now, and also joining the New Zealand plant conservation network, which has been a great resource. And I spoke at a conference in November last year in Wellington. And the title of my presentation was some don't like it. And I told them about the collection and the impact of climate change on the flora here, their flora and invited them to come and use it as a resource. And really see it as a time machine as to how climate change will affect their Flora in the future. So I guess this is like 30 to 40 years might be a bit of what they're experiencing in New Zealand at the moment. So yeah, it's been a fascinating time to be New Zealand curator in Australia.

Gemma Cottrell is the curator of the Australian forest walk, she has a strong focus on collaboration with other Botanic Gardens. Gemma, how have your collecting trips influenced Australian forests walk so the collection that you curate, and how that's going to move forward in a landscape succession focus. So for example, in February 2020, we went on a collection trip to the forests of northern New South Wales that we identified as having a climate similar to what we can expect in Melbourne's future. On this trip, we collected about 60 plant species that are under propagation at the moment. And we're really hoping successful, we can plant them out into the collection to increase its resilience to climate. Tell us about the collaborations that you've built up. It's been really case to ask this. So we developed really good working relationships with New South Wales and Queensland. And through these relationships, and I would have worked together on our outcomes are so fast and take succession for them. Sometimes plant conservation and seed banking. And by collaborating on these trips, we've got better outcomes for everyone. And these relationships just continuing to grow and strengthen.

Thinking further abroad, what are the opportunities for collection development?

Living collection strategy has actually defined some future geographic regions climates suitable in the world. And that's that image you see here. The shaded areas represent an overlay of temperature and rainfall, so suitable temperature, of 21 degrees and 200 to 1100 millimetres. And this allows us to see what areas that will have future collection opportunity. And I'm just highlighting those areas now. And these are some of the plants that can be represented from those regions. And this is really an opportunity for us as Melbourne Gardens to contribute to plant conservation. We can look at species less suited for seed banking, such as some dry rainforest species, Oaks, palms And really contribute to the meta collection action concept where plants are duplicated around the world. Where can you tell us more about the underlying principles of collection development under climate change?

Well, these principles can be the basis of developing your own succession response. And there's two that I'd really like to highlight and one is to act now, because action generates information, and probably most importantly, collaborate and develop partnerships. Can you tell us more about developing partnerships?

In December of 2018, we held the botanical world's first climate change summit. This brought a diversity of expertise, skills and cultures, including scientists botanists and horticulturalists from across the world. The outcome of this summit was the Climate Change Alliance and Botanic Gardens.



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Clare, you've had a climate change summit. But why a global alliance?

Well, it was a realisation from the summit, that we cannot undertake this massive problem alone. Climate change, like plant distribution is borderless. Hence, collaboration is absolutely crucial. Here's is a representation of our global partners and the beautiful and diverse landscapes that they manage across the world.

What are the benefits of the Alliance for living collections management?

We're ensuring a robust future collection for those next generation. So essentially, we're paying a generation forward. We're collaborating now developing those relationships that are going to build our plant collections into the future. And one of the other key things that is that we're really capitalising on employee or horticultural skill set developing that with our global expertise. So with the Alliance, it's really the opportunity for botanic gardens to do what they do best, which is collections and landscapes conservation education. This really is our continuing legacy for the next generation. Since the beginning of the Climate Change Alliance of Botanic Gardens only two short years ago, we've developed into a very strong worldwide organisation. Is your botanic garden on this list? What is some of the pioneering work Peter on that the Alliance is currently undertaking?

We're working on a climate risk assessment tool for listings in the plant search database. And this is initially as a first stage focusing on 20,000 trees that are actually growing in the world's Botanic Gardens. For the first time support will be available for botanic gardens to define the climate change risks faced by the living collections. In the next 50 years, it's estimated that 20 to 50% of our current plants in Botanic Gardens and urban landscapes will likely confront temperatures those species have never experienced before. We must respond,

Climate change challenges are profound and a global response is essential. Our living world needs far less competition and much more collaboration. We invite you and your organisation to join the Climate Change Alliance Botanic Gardens and bring your unique perspectives to craft Botanic Gardens for a changed world.

We thought we'd finish here in our indigenous plant collection here at Melbourne gardens and we'd like to thank the Royal Botanic Garden Edinburgh for allowing us to present today. We've talked about landscape succession collection, curation and conservation and a little bit about the Climate Change Alliance Botanic Gardens.

And we need your expertise and involvement in the Climate Change Alliance. And to find out more, just look at the link below and join us.

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