>> Welcome to the podcast series of Raising the Bar Sydney. Raising the Bar in 2019 saw 21 University of Sydney academics take their research out of the lectures theatre and into bars across Sydney, all on one night. In this podcast, you'll hear Cameron Webb's talk, Climate Change and The Rise of Mosquitos. Enjoy the talk.

>> Good evening, everyone. For those of you who might be thinking that I probably have one of the worst jobs that you can ever imagine. Because my summers are filled with chasing mosquitos through the swamps and suburbs of Sydney, trying to understand their interactions with the local environment. And trying to keep Australians safe from mosquito bites. We know mosquito's one of the most annoying animals on the planet. I can agree with you all there. I'm not trying to convert you into liking mosquitos. I'm not putting forward a defence for mosquitos just at the moment. But I hope that with this presentation, you'll leave with at least, a little bit of fascination for Australia's mosquitos. Maybe a little bit of fearfulness about what's coming in the future. But at least I hope that you leave with a bit of an understanding that mosquitos are a group of insects that are incredibly fascinating, they're interesting, they're part of our local environment, and we're going to have to learn to live with them for many years to come. So, like I said, I agree with you, all mosquitos are pretty annoying. So, for most of you, your interactions with mosquitos, are things like that lone mosquito that buzzes around your bedroom at night. That little whine that you can hear that keeps you awake on those summer evenings. Rest assured, I feel exactly the same. And I don't even bring my work home with me. So, there's mosquitos in my backyard that come into the bedroom and cause a disturbance. But then there's the mosquitos that cause problems in our backyards. So, I'm sure all of us have set out on that nice bummy kind of summer afternoon to enjoy a barbecue in the backyard or maybe just a couple of drinks in the backyard. And before you know it, the sun goes down and these swarms of mosquitos come in, and sort of send us kind of scuttling back inside the house. Or perhaps we kind of reach for the insect repellent to put it on our arms so we can stop those mosquito bites. So, mosquitos are annoying, there's no doubt about that. But they're also incredibly dangerous. And they're often considered one of the most dangerous and deadly animals on the planet. And one of the reasons for that is that mosquitos transmit pathogens that kill more than half a million people every year. They also infect more than hundreds of millions of people every year with viruses and parasites that can make people sick, really sick, seriously sick. That can result in very serious and debilitating illness. And so, internationally, we often think about malaria as being one of the worst sort of mosquito borne pathogens. And, I often think that malaria was really my gateway into being interested in mosquitos because when I was like, just fresh out of high school, I was heading off on my first surfing trip to Indonesia. And I think mostly at the insistence of my parents, I almost begged the doctor to give me these antimalarial, because I was sure that I was going to come back with some of these horrible diseases. This is really interesting kind of almost 30 years on now, and we've had great strides in reducing some of the burden of malaria around

the world. We've seen a steady decline in the number of cases and the number of deaths caused by the malaria parasites in many parts of the world. So, it's kind of good news when it comes to mosquito borne disease. The problem is, is that there are also many other parts of the world where that decline hasn't been – kind of hasn't been shared, it's still increasing. And that includes not only countries in Africa, but even countries kind of in our local region. Most like select Papua New Guinea and areas of the Pacific where malaria still is a sort of major health concern for local authorities. But the other thing we have to worry about are the viruses. So, there's a whole suite of viruses that are spread by mosquitos; dengue, yellow fever, Japanese encephalitis, chikungunya virus. All these pathogens can result in some pretty significant burdens of disease in many parts of the world. Dengue in particular, creates an incredible burden of disease in parts of South America, Southeast Asia and the Pacific. And so, when I think about stopping Australians getting sick because of mosquito bites. I have to think about all those young Australians that are travelling overseas. One of the best places you can go in the world, if you want to contract dengue virus is Bali. It's cheap to travel to, and rest assured, many of our young Australians travelling to Bali are not thinking about taking mosquito repellent with them and putting it on responsibly and protecting themselves from mosquito bites. But in this age of globalisation, people are moving around the world faster than ever before. And so, while we think about those travellers going to Bali, and the ways in which we want to keep them safe, we have to think about what they're bringing back with them. And that's not just those people that are coming back with illness carrying the virus in their blood that might infect local mosquitos, but it's those people bringing back souvenirs. These souvenirs that might contain mosquito eggs. That might be a pathway of introduction for some of these more exotic mosquito pests around the world. And we don't want them coming to Australia. Because Australia is actually quite lucky. We're generally free of some of the more serious mosquito borne diseases around the world. We were declared freeze malaria in the 1980s. And we only really see a handful of cases of things like dengue in far north Queensland. We do have diseases though in Australia that are caused by parasites and it's caused by pathogens that are spread by local mosquitos. And one of the most common of those is Ross River virus. It causes a disease that can give you a range of symptoms from fever, rash, headache, joint pain. It won't kill you, but it can make you really sick and you can be bedridden for many weeks or months. And one of the interesting things about Ross River virus is that people often say to me, "Oh, Cameron, with climate change, Ross River Virus must be coming down to Sydney. We're going to get it in southern areas of Australia, aren't we? But in actual fact, there are mosquitos rot around the country that can spread that virus. In recent years, we've seen major outbreaks of disease in New South Wales, southeast Queensland. We see outbreaks in Western Australia, south of Perth around place like Mantra. And even Victoria a couple of years ago experienced their biggest outbreak of mosquito borne disease, our biggest outbreak of Ross River virus on record. Even in Tasmania last year, we saw a few cases of mosquito borne disease. So, it's a misconception I think, to consider

our changing climate as bringing these diseases south because they're already in many parts of Australia already. But when we think about climate change, and the future risks that might bring for mosquito borne disease, I'm sure a lot of you think about tropical diseases. We think about a warmer, wetter world being better for mosquitos. And if it's better for mosquitos, surely, it's more likely to lead to outbreaks of mosquito borne disease, isn't it? And that seems pretty logical. And I don't know if any of you are like me? If I'm bored on a Friday night, I like to Google the latest outbreaks of mosquito borne disease around the world to find out what's happening. And time and time again, you see these headlines that proclaim that there's a new outbreak of dengue in a country that's never seen dengue before. Or it's the biggest outbreak of dengue in a country for decades. Perhaps it's the introduction of a new virus into a new part of the world, or that reoccurrence of what might be considered a really rare mosquito borne pathogen that causes major illness. In recent years, we've seen outbreaks of dengue in Japan. Would you expect to see an outbreak of dengue of Tokyo? I certainly wouldn't. Probably one of the most startling ones recently is just in the last month or two, there's been one of the biggest outbreak of dengue in record in Nepal. Would any of you expect to be exposed to dengue when you're travelling to Nepal? It's these outbreaks that really kind of highlight how important it is in terms of the change in risk of mosquito borne disease into the future. We've seen viruses move around the world from continent to continent. The most famous of that really was in 2016, when we saw an outbreak of Zika virus in Brazil. I don't know if you will remember that. But that was a pretty significant outbreak of disease. Because women, particularly those in the first trimester of pregnancy that were infected with a virus that contributed to the birth of babies that was suffering from a condition called microcephaly. It was so serious in fact of the World Health Organisation declared a public health emergency of international concern. You might remember that people were even calling for the cancelling of the 2000 Olympics in Rio because of the risk of Zika virus. Now, it's easy to think that well, all of these things that Cameron's talking about are related to climate change. Surely a warmer world is leading to these outbreaks of mosquito borne disease in new parts of the world. But it's not as simple as that, it's very complicated. And so the outbreak of Zika virus in South America wasn't due to a warmer planet. It was due to globalisation. The mosquitos that transmit those viruses are already there in these countries. It's travellers that are bringing the virus around with them. Globalisation is a contributing factor there. Mosquitos are like the tinder in the forest. And they're waiting for that spark of the infected traveller to bring the virus into the local area. And that's why we see outbreaks. And so, that's why for me, when I'm thinking about mosquito borne disease into the future, I'm thinking about trying to stop some of these exotic mosquitos coming into the country that might predispose us to outbreaks of some of these more serious illnesses. Things like dengue, chikungunya and Zika virus. But, before I talk about that in a little bit more detail, I think we need to talk a little bit about, you know, mosquitos, and how we have to understand their biology to kind of predict how they're going to respond to a change in climate. So, there's no doubt we're going

to have a warmer world. Some of Australia's going to get actually wetter. We're going to have sea level rise, which changes the dynamics of some of our coastal wetlands. And we're going to see more frequent extreme weather events. And so, understanding how all of those factors are going to change and influence mosquito populations, to do that, we need to understand the mosquito. So, I understand that you're not all like me, you don't fall asleep thinking about what it's like to be a mosquito and where you want to lay your eggs and who you want to bite. But, this is really important stuff that people like me think about. So, in Australia, we have about 300 different types of mosquitos. So, there's not just that one mosquito that you're worried about that you slept on your arm at the summer barbecue. There are hundreds of different mosquitos that are a natural part of the Australian environment. So, from the coastal rock pools, over Kuchi and Bondi. You can find mosquitos that were in those rock pools there that are filled by sea spray and waves that are crashing over the rock shelf. There are mosquitos that live in the salt marsh and mangroves along the Parramatta River. They love salty conditions. I love those environments where tides come in and fill these pools and ponds during summer. It only takes about a week after those pools and ponds get filled with tides, mosquitos can hatch out of eggs, emerge and start flying around. Those mosquitos are often found in incredible abundance. They fly long distances from the wetlands, often two or three or four or five kilometres away. And so, if you live in any of the suburbs around the coastal estuaries of New South Wales, you're going to get bitten by those mosquitos during summer. There's just so many of them. But then, there's mosquitos that live in these freshwater environments, the type of environments you'd expect the mosquito to be found in. Perhaps, these kind of pristine or polluted ponds, maybe even storm water drains and things like that in our cities. There are these mosquitos that love freshwater. Different species like different conditions. They love permanent water, maybe some of them like really highly ephemeral water. These sort of small rainwater pools that only occur after we get a big downpour during summer. The small puddles in the bush land areas. Their eggs are sitting in that environment, just waiting for the perfect conditions to hatch. There's even mosquitos that are found in snow melt streams in our Alpine regions. So, if any of you gone skiing this winter, you would have seen that sort of snow covered mountains. Underneath all that snow are billions of mosquito eggs sitting around the streams and ponds, just waiting for the snow to melt to fill up with water and to hatch out. So, almost every type of environment you can imagine that contains water, mosquitos have called that home. And I think that's one of the reasons why I'm quite fascinated by mosquitos. I've got a bit of a confession to make. I quite like mosquitos. I know that might annoy some of you to think that someone actually wants to defend mosquitos. But I'm really quite fascinated by them. And I think one of the reasons is that when I was young and trying to – you know, I was starting to kind of develop that spark of interest in environmental science. I used to love watching wildlife documentaries. And you know, looking at elephants and lions and wombats and koalas, that was all kind of pretty good. But I loved those sort of strange critters that had adapted to some strange ecological niche,

like a deep sea ocean vent, or a rain forest stream, pool or something like that. I think that's why I like mosquitos so much. They just the most incredibly adaptive animals that can evolve to any type of conditions. So, I'm fascinated by them. But it's also why I worry about them. Because mosquitos have been around for about 100 million years. We know that there are fossils are in the fossil record. We even know that there's kind of examples of kind of blood fed mosquitos in amber and things like that. Mosquitos have been around for a really long time. And they're going to be around for a long time into the future. And we've got mosquitos in Australia that have adapted that would have originally been found in water-filled tree holes and the water capturing plants like [inaudible] or the leaf axles of plants. These mosquitos, you know, love these natural environments. But they've given that up now, and they've moved into our homes. And so, we've got these mosquitos that now live in pot plant sources, drains around our back patio, our roof gutters, our rain water tanks. The discarded kids toys in the backyard from last summer that are catching water after we get this rain. Mosquitos are incredibly adaptive. And the way they adapt to the environment that humans are changing, is the same way they're going to adapt to a change in climate. And this is something that really worries me. So, one of the things I kind of really want you to leave today's sort of talk thinking about is that, I've got no doubt that the climate is changing. I've got no doubt that we're going to see more mosquitos. But climate change isn't the only thing that's going to be influencing that. Perhaps, it's the way that humans respond to a change in climate that's going to predispose us to more mosquito borne disease risk. The ways we adapt to heat waves, the ways we adapt to drought and extreme weather events, even the way we respond to sea level rise, may all contribute to the future of mosquito borne disease. And so, for those of you who are now starting to get a little bit worried. Don't worry, I'll make sure I finish this presentation today with some tips on how you can prevent mosquito bites into the future.

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>> So, let's talk about the way temperature is changing mosquito populations in Australia. So, it's no surprise that mosquitos love warm weather. They love warmth, they love water. So, a little bit of a quick sort of summary of mosquito biology. All mosquitos, no matter how diverse they are need water and warmth. They like warm weather, but they also need water. Because almost scalars have a life cycle that contains both water. And that's where the immature stages complete their development. The eggs are laid in and around water. When these sort of ponds or pools or pots fill up with water, the eggs hatch and the mosquitos wriggle around and complete their development. Some of you have noticed maybe these little wrigglers in sort of water hauling containers around the backyard. Your pet's water bog, your swimming pool before you've cleaned it out, or maybe in a [inaudible] in the backyard. During summer, it only takes about a week for those mosquitos to complete development and emerge. Then, the adult mosquitos fly around maybe only for two or three weeks. And during that time, they're really only interested in one thing. The

male mosquito is interested in mating, which is no surprise. But, the female mosquitos are interested in blood. So, mosquitos need lot, but it's only the females that need blood. Because she needs that protein hidden in the blood to develop her eggs. So, when I keep my colonies at West [inaudible] hospital, I can keep them alive on just sugar water. I might give them a piece of fruit if I'm feeling really generous. But if I don't give them blood, they won't lay eggs. And so, this adaptation of mosquitos to feed on blood is a really tricky and really smart one, because it gives them an advantage to get this really great energy hit to lay lots of eggs. Assure the next generation of mosquitos that it means one of the reasons why they can persist for so long in the environment and be so adaptive. But the problem is mosquitos get blood from a whole range of animals. And as they feeding on those animals, they can also pick up viruses that they can then transmit to us. But, these things get really complicated now, really messy, really hard to predict outbreaks of disease because mosquitos are a little flying hypodermic syringe transferring droplets of infected blood from person to person. The mosquito itself has to get infected with a virus before it can then pass it on to us. So, if a mosquito was to land on someone that was infected with dengue virus and while taking a blood meal. That blood meal has virus in it. The mosquito starts to digest that blood. The virus escapes out of the gut of the mosquito, spreads to its legs, its body, its wings. Eventually infects the body and head of the mosquito and infects its salivary glands. Takes about a week or so. Then, when a mosquito goes to bite somebody else, the first thing she does is inject the proboscis, delivers a big mouthful of spit into your skin. And it's in that spit that the virus might be transmitted. So, if you know anybody who's been diagnosed with a mosquito borne disease, they've been basically infected with mosey spit. That's the process of transmission. But only certain mosquitos can transmit certain viruses. Not all mosquitos can transmit all viruses. So, in Australia, we've got 300 species of mosquito. About 40 of those mosquitos are quite good at transmitting Ross River virus. And only one is able to transmit Dengue virus. So, when we try to win account the areas that are at risk of dengue outbreaks in the future, we can't just think about the temperature, we didn't think about the mosquitos that are present in the local area. It also gets even more complicated when we think about local mosquito borne pathogens like Ross River virus, because mosquitos don't hatch out of the wetlands infected with the virus. They have to bite wildlife first. Mosquitos pick up Ross River virus by biting mostly kangaroos and wallabies. And so, wildlife is a really critical part in mosquito borne disease in Australia. So, it's no surprise that Ross River virus is sort of the true homegrown Australian mosquito borne disease. Because, it's spread by local mosquitos. And those mosquitos pick up the virus from local animals. So, when I'm trying to predict outbreaks of disease, I have to think about the mosquitos, the wetlands and the wildlife, not just the climate. And so, hopefully, you can start to see it gets a little bit complicated now. I can't just look at the predicted changes in temperature and rainfall, I have to think about what's happening with the animals as well, because they play a really important role. So, one of the other issues we have to deal with temperature is heat waves. We all know we're going to live in hotter, drier cities.

And so, what is the way we can mitigate some of the health impacts of heat waves? We can green our cities? It makes perfect logical sense, doesn't it? If we have greenest cities, we've got more shade we can be protected from some of those impacts, those health impacts of heat waves, and it's good for our health and well-being as well. Green cities are also pretty good for mosquitos as well. Where are we going to get a lot of water from to keep the plants alive? We're going to build wetlands, we're going to recycle water. And these efforts to recycle water in our cities create opportunities for mosquitos. A lot of the work that I do looks at the construction of wetlands in our cities. Constructed wetlands are great. They provide a habitat for birds and frogs, but also mosquitos. But what about your backyards? How many of you have got rainwater in tanks in your backyard to capture that rainwater to keep your gardens going during the summer? Rain water tanks are a great habitat for mosquitos. And so, as we're trying to drought proof our cities, provide opportunities to conserve water, perhaps we're even providing opportunities for mosquitos. And so, one of the things we think about in terms of rain water tanks is not just the local mosquitos that can call that home, but some of these exotic mosquitos. Some of these mosquitos that can spread pathogens like dengue, chikungunya and Zika virus. Because at the moment, they're not in Sydney. I prefer to keep it that way. Because I don't want to have to deal with outbreaks of dengue in Western Sydney into the future. So, a lot of people say to me, "Well, Cameron, the weather is warming. We might not get more rain in Sydney, but it's going to get hotter, surely, it's going to be good for these dengue mosquitos to move into the city." And if you read the academic papers, there's lots of modelling that's undertaken that looks at temperature, and predicts the spread of these mosquitos. And they say, well, these mosquitos one day will make their way to Sydney. There's always a flaw in some of these papers, I think. And sometimes, we're too focussed on the future, and we don't look to the past. Because in actual fact, during the 1940s, up until the 1950s, dengue mosquitos were in Sydney. It might come as a surprise to, you know, to know that actually local transmission of dengue has occurred as far south as the Central Coast. So, where do these mosquitos go? These mosquitos were once in Sydney. If you look at the newspapers, they were in the 1920s, 1940s. In Sydney, they were warning about outbreaks of dengue. We started the move away from rainwater tanks, didn't we? We started to use insecticides more, we started to mow our lawns and the mosquitos disappeared. The mosquitos actually retreated back up into central and far north Queensland and haven't sort of spread much further since. And so, for a lot of us who work with mosquito borne disease we're thinking about why was there this massive retreat of mosquitos from some major metropolitan areas in Australia where they brought a risk of dengue? And we keep coming back to this idea about water storage in our cities. And perhaps, even though I'm a big advocate for rainwater tanks, the problem is, that we are setting the scene for these mosquitos to move back into our cities. Is it only a question of when that some of these mosquitos will move into our cities. And one of the mosquitos that I'm really worried about is a mosquito called on the Asian tiger mosquito. Its scientific name is Aedes albopictus. We're very fortunate at

the moment that we don't have that in Australia, in mainland Australia. It has been found in the Taurus Strait. But the mosquito is not in mainland Australia. It's a mosquito that's can spread dengue and chikungunya virus. It loves laying its eggs in water holding containers. It's one of the worst nuisance biting pests in the world. People who have this mosquito in their suburb don't like to go outside. Studies in the US have even suggested that where this mosquito is present and you don't do mosquito control, your kids will be overweight because they won't go outside and play. This mosquito is knocking on our door. We've detected this mosquito at the airport with our colleagues from the Department of Agriculture and Water Resource. They monitor seaports and airports. Mosquitos like this being detected at major airports around Australia. The introduction of this mosquito into Australia is not going to come because of temperature. It's going to come because of globalisation. Somebody is going to bring in a souvenir from Southeast Asia, maybe a little garden ornament the traps water containing mosquito eggs. They're going to bring it into their backyard. And then next time it rains, if everything goes to plan or misfortune, depending on your perspective, those eggs hatch. And next thing you know, you've got this mosquito buzzing about. And I really worry that I might really know about that mosquito being in Sydney, until we start to see local outbreaks of something like dengue or chikungunya or Zika virus. So, we've got to work really hard with our local authorities to try to develop capacity to kind of keep these mosquitos out. And if we were to detect it, how we respond really quickly to it. So, this is another example where surely, climate change will suit this mosquito. But other factors are at play before we sort of see that coming into cities like Sydney. It's going to be with human activity, not just a change in climate. So, I'm sure that you've all heard about the global decline in insect populations is the major concern that's got for a lot of people around the world. I'm not sure if many of you are worried about declining mosquito populations. But maybe we'll see a decline in some mosquito populations with the climate change, and particularly sea level rise. Some of the wetlands that call our coastal coastal environments home, the mangroves, the salt marsh, as a sea level rise, those wetlands may disappear, and perhaps we'll lose those mosquitos as well. Now, I'm not getting too worried about these mosquitos because they're major nuisance pests and they cause outbreaks of disease. But it's just one example about how for some mosquito species, they may actually go extinct with climate change. When we lose the habitats mosquitos are so attunely adapted to, maybe we'll lose some of those mosquitos. And then raises the question, what good the mosquitos do anyway? How many people to think about kind of what's the point of a mosquito? Apart from keeping Cameron employed? We worry about what role does a mosquito play in the local environment. And so, while on one hand, you might be thinking, well, how's climate change going to impact these mosquitos? That's one perspective to take. But the other perspective is to think about some of these emerging technologies for mosquito control. The release of genetically modified mosquitos is new technologies that may give us the ability to actually eradicate mosquitos, even locally from certain parts of the world. That's the sort of thing scientists are talking about now. And so the question I

have is, if we can do it, should we do it? Now, how many people would be signing the paperwork to eradicate mosquitos from the planet? Mosquitos that might be food for birds, bats, fish, frogs. They might pollinate some plants. They might help recycle nutrients in our urban wetlands. Should be eradicate them from the planet? Is it worth the cost for the benefit to some burden of disease? For some Aussies, I'd be happy to do it. I think the burden of disease is far too great. But I certainly don't want to see the disappearance of all mosquitos from the planet just yet. So, have I got you worried anymore about sort of mosquito borne disease into the future? I think in summary in terms of the future mosquito borne disease risk, what we're likely to say is probably not an explosion of malaria, dengue and chikungunya and Zika virus in our major cities in Australia. What we're likely to see is an extension of the mosquito season. We're going to say more moseys in spring more moseys in winter. Maybe we will see more cases of local mosquito borne diseases like Ross River virus. And so, just from that point alone, I want you to remember that when you're out and about this summer, and you've been bitten by mosquitos, even if you are kind of in the metropolitan area of Sydney, there's a health risk that comes with those. We know we see activity of Ross River virus on the outskirts of Sydney every year. So, you need to protect yourself and your family, because I don't want you to getting sick this summer. I don't want you to be one of those 5,000 cases of disease that we see every year caused by Ross River virus. So, I'll leave you with some tips. First of all, when you're choosing a mosquito repellent, choose a product that you get from your local supermarket or pharmacy. Choose a product that contains either the keratin or [inaudible] they will provide the longest lasting protection. Put it on as a nice even coat over all exposed areas of skin. That will provide the longest lasting protection against mosquitos. If you miss a bit here or there, mosquitos will find a way through. So, don't put a dab here and there. A nice coat over all exposed areas of skin. Try to avoid being outdoors at dawn and dusk. That's when mosquitos are most active. I know it's also the coolest part of the day. So, you want to spend time out there. So, if you do want to in areas where mosquitos are most active, cover up with long sleeve shirt, long pants and covered in shoes. Especially the game bush walking or fishing or spending time around our local wetlands. Finally, it's not just about the mosquitos you're exposed to when you're outside the home, but it's the moseys that you're breeding in your own backyard. So, take a look around your backyard. Mosquitos love wherever there's water holding in containers or plants in the back. So, tip out, cover up or remove any of these water holding containers in the backyard. The best thing we've done for mosquitos, I think, is create the plastic bucket. Because a bucket in our backyard full of water is a perfect opportunity for mosquitos. Clean out your gutters, clean out your drains and make sure you run more tank is green, because that'll reduce the opportunity for mosquitos coming inside and providing a problem in your own backyard. Because at the end of the day, we don't want moseys buzzing around our backyard disturbing that time outside during the summer. So, I guess finally, I want you to leave here with a couple of kind of reminders of what you can do and think about moving into the future. Some of the things I want

you to think about as you're falling asleep tonight thinking about what it's like being an entomologist that studies mosquitos. Mosquitos are a natural part of the Australian environment. So, we should appreciate them just as much as we do kangaroos and wallabies and fish and frogs and things like that. We've got to learn to live with them. They're an environmental hazard, in much the same way that we learn to live with bushfire and flood. And I think when we look to the future, there's no doubt we're going to see more mosquitos. But we're probably unlikely to see major outbreaks of disease like dengue and malaria in our cities. But that doesn't mean we don't have to be cautious. And some of the work that we do with the University of Sydney is working with the local authorities to prepare for the introduction of these exotic mosquitos, or this extension of the mosquito season that we may be dealing with. And finally, even though mosquitos are home to our local wetlands in our cities, get out and enjoy them because they're amazing environments. And they're great to spend time with. It's good for your health and well-being. But just in the middle of summer, take that mosquito repellent with you, so you avoid mosquito bites. So, thanks very much for your attention. I hope you've learnt just a little bit about mosquitos tonight. And you're a little bit fascinated by them as well as maybe being a little less fearful maybe in terms of the future mosquito borne disease risk. So, thanks very much.

[Applause]

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