**Queensland Chief Scientist**

**Professor Hugh Possingham**

*Professor Hugh Possingham was appointed Queensland Chief Scientist in September 2020. Prior to taking the role he was Chair in the Department of Mathematics and Biological Sciences at the University of Queensland where he led several research centres and held Australian Research Council Professorial, Laureate and Federation Fellowships. He has had a long and distinguished career developing mathematical and economic tools for solving nature conversations problems. He co-development the Marxan software for conservation planning, which has been described as “the most significant contribution to conservation biology to emerge from Australia's research community.” He was Director of the Australian Research Council Centre of Excellence for Environmental Decisions, as well as the Australian Government's Threatened Species Recovery Hub. In 2016 he became the Chief Scientist at The Nature Conservancy, a global conservation organisation with 400 scientists and 4000 staff. In 2016, Professor Possingham was elected a Foreign Associate of the US National Academy of Sciences. He has co-authored more than 650 peer-reviewed papers, with more than 30 in the world’s top two scientific journals*Science *and* Nature*. He has a Bachelor's degree with Honours in Applied Mathematics from Adelaide University and was a Rhodes Scholar at Oxford University graduating with a doctorate in Ecological Modelling.*

**Announcer:**

This is a Queensland Department of Education podcast.

**Virginia Bowdidge**:

Professor Hugh Possingham is the Queensland chief scientist. He is a mathematician and scientist with an impressive and distinguished career. As the Chief Scientist, he advises government on scientific matters and works to inspire Queenslanders to take an interest in science.

Hi, I'm **Virginia Bowdidge** from the Queensland Department of Education. And joining me is Professor Possingham to talk about his role, and why in 2021 science is more important than ever. Thanks for joining me, Professor Possingham.

**Professor Possingham:**

Thanks, Virginia.

**Virginia Bowdidge**:

Can you tell me a little bit about your background and what first sparked your interest in science?

**Professor Possingham**:

I was interested in science, partly because I was interested in birdwatching. My father was a birdwatcher. We spent a lot of time out in the Woodlands around Adelaide. I sort of started asking ecological questions at the age of 11 or 12, without really knowing they were ecological questions. "Why are there two species of tree creeper? Why does one like rough bark trees and one like smooth bark trees? Now, why aren’t there 10 species of tree creeper, and why aren't there just one?" I suppose, without knowing it, I was starting to ask those questions. And in fact, my father then gave me a Princeton University monograph. Princeton University, have a very famous series of monographs in ecology and evolution, when I was 15, that had a lot about bird communities and a lot about mathematics. And I suppose that was the first time I suddenly realised that there was a small chance mathematics could be useful because it was being applied to the thing that I love, which was how to understand how bird communities are structured and what birds are where and why.

**Virginia Bowdidge**:

You were obviously a very observant child. Do you think that's important in science?

**Professor Possingham**:

I think it is. I mean, observation, I think is critical to science. Either through pictures or through data, you start to learn things. I was once also struck by being in Italy a long, long time ago and seeing Giotto's frescoes in Padua. That was the start of the Renaissance. And I thought, "Well, why is that the start of the Renaissance? I don't get it." And somebody pointed out there, my wife, who studies ancient Roman and Greek things, well, this is the first time somebody, for five or 600 years, actually painted two Oak species, and they were, you can still identify that from the painting. And there was a woman with a tear on her eyes and there was the first stats, sort of three dimensional pictures. You suddenly realize that if you can't accurately picture things, which for several hundred years in the middle ages in Europe, people were not allowed to accurately draw things, because all that was symbolic, then you can actually work out what things are.

So you do have to not only able to observe the difference between two Oak species, but you didn't have to be able to explain it to somebody else and represent it in an accurate picture. And if you're denied the ability to observe and record then science goes nowhere at all. So the bird stuff, my father and I, I suppose we went to the same places. We were a little bit data obsessive, so we count everything and we'd record details of where birds were. And I think once you start recording stuff, you start to look for patterns in that information.

**Virginia Bowdidge**:

What is the role of Queensland's Chief Scientist?

**Professor Possingham**:

Queensland chief scientist has many roles. I am in the Department of Environment and Science as a public servant, but I answer to all the ministers and the Premier. In theory, any minister or any part of the Queensland state government who have a science issue, and that could be clarifying, how do we manage the dingoes on Fraser Island, hydrogen economy, all those things, which are major wildlife issues, economic issues, manufacturing issues, where there's science is important. They can come to my office and we can give them the information they need and or assemble the experts to give them the information they need. So that's part of the job is being responsive to government on issues of science and looking for new directions in science, where do we invest in science? So Queensland has made a lot of investments over the last 20 years to really make sure that leading the country in terms of scientific endeavors.

And of course, science is great for the economy. So the second part of the job is getting out there in the community and encouraging people to love science, technology, engineering, and mathematics. Partly for their own benefit because it's one of the best ways to get a job and a good salary, but also it’s just important for the prosperity of the entire nation to be honest.

Those prosperous countries, the ones that do train a lot of people in that space. And of course there's enormous gender and socioeconomic biases and racial biases in who, and Australia is doing science, technology, engineering, and mathematics. And part of our job is to redress those biases.

We need more mathematicians. We need more engineers. Where are they going to come from? One of the simplest ways is to make sure that people who typically don't do those things like engineering, and still very few women are doing engineering. It's not 50-50 at all. To encourage to redress that gender imbalance, racial imbalances, socioeconomic imbalances, because that's the best way to increase our engineering technology, mathematics and science workforce. There's no reason why it shouldn't be 50-50. That makes no sense at all. And that's where we're losing out enormously. I think in brilliant women, being able to do those jobs.

**Virginia Bowdidge**:

The COVID-19 pandemic has seen enormous changes throughout the world, and has highlighted more than ever the value of science. How important is a STEM education for Queensland students?

**Professor Possingham**:

STEM education does underpin the economy. The reason why people don't necessarily see it is because they don't see a lot of science on the news. So, if you look at the news, what is it, it's about 10 minutes of disasters, floods, famine, strange politicians saying strange things in countries you don't know and then there's a whole heap of sport. And you don't see a lot of science. But the pandemic, the COVID-19 pandemic, has actually put science front and centre of the news. It's put data front and centre of the news, hasn't it? We're seeing graphs, we're seeing people talking about transition rates. We're seeing people giving statistics on the efficacy of different vaccines. And they're quoting scientific surveys and results, and that is extremely unusual for that to be at the top of the news.

So, I think it's a great opportunity, I suppose, for us to explain to the world and the general public, that science is what runs the society. It's what drives prosperity. And in this particular case, it's in everybody's interest because some people, to be honest, are worried about dying. People worrying more about their health than anything, and that's completely understandable. They might worry about the environment second or jobs second, but they certainly worry about their health first. And the COVID-19 epidemic has meant that some sciences will truly front and center. Science is, how do we understand the issue, and science is, how we solve the issue.

**Virginia Bowdidge**:

Following up from that then. Do you think there is an understanding in the community of the importance of science, innovation, and STEM education?

**Professor Possingham**:

Well, in general, no, I don't think it is. I think it's because it is so hidden. People often don't know where scientific research happens because it's not front and centre of the news, and the new cycle, or Facebook and Twitter. So, why would they know? I suppose my favorite area is mathematics and the use of mathematical skills. And of course, even I, was very puzzled for a long time about what mathematics was for. And probably other than thinking about birds a bit, it wasn't until I did second year applied mathematics and for the first time in my life, we had lecturers talking to us about the use of mathematics to control traffic lights. So, how long is the traffic light cycle in two directions of an intersection, depends on the queuing rate of cars. And should you keep them green for 32 seconds or 27 seconds in which direction? All of that is an optimisation problem. It's when Professor Ren Potts went through that with us (and then another lecturer talked to us about the use of game theory in international politics, and actually, animal behaviour), I suddenly realized, okay, relatively straightforward and simple mathematics, it's not too hard to understand is what is running the economy, is running a transport, is running business. It's running the banking sector. It's running all of engineering. But until then, and it was disappointing that it took me to the age of 18 or 19 before I suddenly realized how important mathematics was. And that's the problem. And that’s a problem I think.

**Virginia Bowdidge**:

I think there's lots of people older than 18 or 19 that don't realize the importance of it.

**Professor Possingham**:

And even the fact that there was a study in the U.S. a long time ago, 10 or 15 years ago, that basically said people's attitude for mathematics in their following year of high school was the primary determinant of their salary. The primary determinant of their salary. And it didn't mean they had to be a mathematician. They could be a lawyer. They could be a doctor. They could be an engineer. They could be anything. They could be a business person, work in industry. It doesn't really matter but people's enthusiasm, and it's not necessarily their talent, it's more their enthusiasm for mathematics is really the determinant of their success in their career often.

**Virginia Bowdidge**:

That's quite phenomenal, isn't it?

**Professor Possingham**:

Yeah, and people say, "Why do Maths?" There aren't jobs that say, we want a mathematician. They don't call them that. So, mathematics is used everywhere. It's all engineering. It's in the defence sector and the transport sector, the banking sector, but they don't actually advertise specifically for mathematicians or statisticians yet they are everywhere.

**Virginia Bowdidge**:

Can we trust science?

**Professor Possingham**:

We trust it now. We run the entire economy on it. We get in airplanes and they are driven by science. And I don't understand, to be honest, really how this thing that weighs hundreds of tons gets off the ground. It baffles me, but I get on the plane and it works every time. And also how they land in complete darkness when there's hundreds of other planes landing. And that's all driven by science and optimization, and mathematics and engineering. So I think we do trust science in routine day-to-day activities. It's when new things come along, then we worry. New things, whether it be climate change or pandemics. Things that we don't experience on a day-to-day basis. So, we definitely trust science all the time.

When something else happens, there's a little bit left field, then I suppose it's right that we should be skeptical about it, and we should ask lots and lots of questions. Some people are very happy to follow the flock and say, ‘yes, great’ the scientists say. Other people will be completely anti-science and say, ‘question it to the highest degree’. And I think it's healthy that we have that skepticism in society. Though that said, one has to move forward eventually, and you can't continue to question everything in the face of the undeniable mountains of evidence. And so, you do eventually have to accept the science, I think, when the evidence mounts up to an enormous degree.

**Virginia Bowdidge**:

Given the enormous advances we have seen in science this year in particular with the COVID vaccine, and given that, as you said, we do trust science in our everyday lives, why does there seem to be a growing mistrust of science by some people?

**Professor Possingham**:

Yes, good question. I mean, I don't, in my day-to-day work, I suppose, I don't see a growing mistrust of science. So, I don't know who those people are. I always fear there's a media beat up on such issues. So, as I say before, I mean, I do like the fact that people are skeptical and questioning, but generally I feel as though, the bulk of society believe in science. And I think it's a bit like the climate change issue. If you listen to the mainstream media, you start to think, ‘oh gee, this is something that's still in dispute sometimes’. But to be honest, it's not in dispute. It's not in dispute among scientists. It's not even in dispute amongst 95% of Australians. Most Australians know that climate change is happening. They see it themselves. They've seen the data. They look at the sea level rise gauges and the bureau of meteorology. They look at the graphs of the number of extreme days of heat. They observed the fires, cyclone. I don't know anybody, other than maybe one or two people, who've ever disputed that climate changes happening. And I think those weren't those few that dispute it. Now, it's good that they argue about it. It's good that society fights about these things, but they'll come along very quickly.

**Virginia Bowdidge**:

How can we spot scientific misinformation in the media or on social media?

**Professor Possingham**:

And exactly what is misinformation? Sometimes misinformation, it's not always black and white. I'll try and give an example. Somebody might ask the question, ‘what is the biggest threat to koalas?’ And then somebody will say, ‘well, I think it's... Look at the koalas that are coming into the koala hospitals. I think it's disease in cars and dogs’. And that might be what, in general, appears to her koalas, but somebody else will say, another scientist say, ‘well, that's not the problem. The problem is that we're clearing too much habitat that causes the koalas then to be hit by cars and attacked by dogs and get diseases.’ If the questions are posed vaguely, like ‘what is the main threat to koalas’, there can be multiple answers and you can end up with somebody saying it's disease in dogs or somebody else saying it's habitat clearance.

And then somebody else just saying, ‘there's too many people on the planet’. They're all right. But they've all answered the same question in a different way.

So, what am I trying to get at? I would say most disputes around issues of science are not really disputes around the data. Their disputes around what I'd call semantic uncertainty. So, we aren't always expressing ourselves super clearly in the questions we ask and the answers we give. I think there are very few disputes about the data and the information is just how we communicate science is often flawed because of our sloppy or poor use of language.

To stop the spread of misinformation, I think we need to rely on more characters that you get in a tweet. So, the stories often just requires more communication and more detailed information, and more caveats and clarity, which the headline news doesn't like. And Twitter says a lot, they want a simple statement of fact, well, things aren't simple statements or facts. They're more nuanced than that.

**Virginia Bowdidge**:

So, we shouldn't believe the headlines, we should delve further.

**Professor Possingham**:

Exactly. I mean, in fact, it's amazing how often you read headlines or you listen to the first sentence of a news report, and then by the end, it doesn't even match up with the headline. The headlines there appears to say something that's going to get you ‘to the read to the next bit’ and often is there to poke you, or harass you, or stress you a little bit, or intrigue you a little bit but when you read the whole story, you often realise that there's much more detail behind it. There's a much more subtle argument. It's often gray. It's not black and white, but what can you say in 144 characters, or a headline which is, what, usually about 20 or 30 characters.

**Virginia Bowdidge**:

So, how as, educators and parents, do we encourage our students and children to take a keen interest in STEM?

**Professor Possingham**:

That's what I said before. The main reason to be interested in STEM is so completely a mercenary reason to be interested in STEM. You will almost certainly make more money. You will also have a lot of job security. People again, like engineers and mathematicians, are very rarely unemployed, if ever. And thirdly, an interest in STEM, not only at that high school and university, but also during the rest of your life is going to be essential in a world where jobs and careers are changing so fast.

So, my brother and father finished their careers and both of them had one job with one employer. They were both engineers. I've had about five over my life. That might be it for me, but now we expect most people finishing high school or university will may well have 10, 12, 15 different employers, and they may have three or four quite disparate careers. You'd have to be more flexible. And basic STEM schools is what makes you flexible, those basic quantitative skills. But also not just those skills, communication skills, all those basic skills enables you to move through what is a rapidly changing world of job opportunities. It's going to get more and more complicated. And my predecessor, Jeff Garratt often said that most of the jobs that will exist in 2050, we don't even know what their names are now. So there'll be jobs of the future that actually we can't even envisage.

**Virginia Bowdidge**:

That's interesting and scary.

**Professor Possingham**:

It is. It is sort of interesting and scary. And of course, the uncertainty, I think, it is comforting to think you would get a job with one employer and it stayed there for 40 years. Sort of comforting, also maybe a little bit, dull. But generally people do like certainty in their lives. And I think that's the key, the youth of today are having to deal with a lot of more uncertainty, a lot more flexibility, rapid change. I still vividly remember the Maths department I was in at Adelaide University 25 years ago. One of the associate professors said, "I wish they'd stop changing everything. We changed things so fast. We never work at if anything we're doing works". And he was founding the pace of change of universities too fast, 25 years ago. And I can guarantee you that universities and governments and industry have been changing faster every year. It is an accelerating change, both technologically, bureaucratically, administratively, politically. And so, you have to wonder whether the human brain can continue to keep up with this pace of change.

**Virginia Bowdidge**:

Do you think it can?

**Professor Possingham**:

Well, seems to be doing it. But then again, also one has to wonder, and I am not an expert in this area, but some of the, what appears to be, we have a COVID epidemic, but I think we also have a bit of a mental health epidemic. So I think despite the fact that most people, well, many people in Australia, have reasonable access to resources like food and shelter. We do have growing numbers of mental health issues. And one has to wonder whether the speed of change is driving those mental health issues.

**Virginia Bowdidge**:

As the chief scientist, what advice would you have for students interested in pursuing a STEM-based career?

**Professor Possingham**:

I think the first advice is to do what you just love doing. Try and be as broad as possible as early as you can. So, I think now a lot of the universities offer double degrees. And some of the most interesting degrees in STEM are things like journalism and science, or business and engineering, economics, and engineering. So, keep yourself broad, I think, as long as possible. Hopefully sometime in your first two or three years at university, you'll find a professor, a lecturer, a topic that you just love. And I think that generally happens. And if you love it, don't worry too much about whether it's good or bad, just pursue it because you will do well if you're doing something you love. That's what I did effectively. And they'll come to me and say, "which particular courses or degrees shall I do to maximize my chance of getting a good salary and a good job?" I'll say, "there's no answer to that question." If you love something, you will get a good job in that space and you will have an excellent career, but you've just got to find out what you're passionate about.

**Virginia Bowdidge**:

Thanks for talking to me. It was very interesting.

**Professor Possingham**:

Thanks a lot, Virginia. Good to chat.

Announcer:

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