



Darwin – Professor Jenny Davis

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Speakers: Professor Jenny Davis

Professor Jenny Davis: I'm professor Jenny Davis. I'm the head of the School of Environment at Charles Darwin University.

Hon. Justice

Rachel Pepper: Thank you very much.

Professor Jenny Davis: The first thing that I would like to do today is to provide the panel with some context regarding the background to my submission. I'm currently the head of School of Environment at CDU. I've been in this position for approximately 18 months. I spent a large part of my career, 24 years, as an academic in the School of Environmental Science at Murdoch University. Please, forgive me if I read the first part of my submission because I want to get it right.

Hon. Justice

Rachel Pepper: That's fine.

Professor Jenny Davis: The second part will be more

Hon. Justice

Rachel Pepper: Thank you.

Professor Jenny Davis: I've also held the position of professor in Freshwater Ecology in the School of Biological Sciences at Monash University for five years from 2008 to 2013. A large part of my research has focused on understanding the processes supporting the persistence of aquatic biodiversity in groundwater-dependent systems. I worked for over 20 years on the influence of water regime and groundwater extraction on wetlands on the Swan Coastal Plain in Perth, Western Australia.

I also spent almost a decade working on the impacts of cell ionisation of wetlands and rivers in the Western Australia It was this research, in particular, that alerted me to the devastating environmental consequences associated with a lack of understanding of the relationship between Catchment Hydrology and wetland ecology.

In that case, it was the removal of deep-rooted plant communities, mainly woodlands, and their replacement with shallow-rooted annual crops. This



resulted in the cell ionisation of rivers, wetlands and valley floors, and the associated loss of biodiversity over a land area exceeding the size of the state of Victoria.

Now while I was doing that work, I in no way minimised the importance of annual cropping to the Western Australia economy, particularly wheat, barley and canola. But the scale of biodiversity loss was enormous and could have been avoided if we brought more understanding of the sites of the system into play much earlier than it happened.

More pertinent to this committee, in addition to my work on Western Australian wetlands, I have had an ongoing research programme on water holes in Central Australia, so that Southern Northern Territory, that now spans more than thirty years, as well.

I first started working on the springs, river and waterholes and rock holes of the Central Australian ranges in 1986.

Most of my research has been undertaken at waterholes in Watarrka National Park, the West MacDonnell Ranges National Park, and the Finke Gorge National Park.

Initially, my work took form of surveys of water quality, aquatic invertebrates and fish because little was known about the aquatic fauna of these systems at that time. This work has been funded by various commonwealth and Northern Territory government agencies and the Australian Research Council.

This initial work that I led, added to work that was already being done and ongoing on plant communities in Central Australia, that indicates that the springs and gorges of Central Australia supported bythat have survived since the Australian continent was much wetter. There are species that still exist today that have affinities with species that were present when Australia was part of Gondwana.

The explorer Ernest Giles first recognised the scientific importance of the springs and waterholes in the George Gill Range back in 1872. However, of course, the traditional owners had recognised for literally tens of thousands, perhaps fifty-odd thousand years before Giles turned up, that those springs and waterholes were of immense, immense importance. Thus, in supporting their food and providing perennial water, and also, of course, of great cultural significance.

At this point, I would like to add my rejoicing of that to that of the traditional owners of Watarrka National Park and acknowledge the importance of the decision by the NT government to declare a mineral and petroleum reserve of all of Watarrka National Park.

This is just a fantastic outcome for that part of the Northern Territory, not only for the cultural values that, of course, the traditional owners have been



very concerned with, but for the scientific values that I personally and professionally am very concerned with.

However, I'm aware that this inquiry extends beyond the issues of Watarrka National Park. I want to point out that some of the biodiversity values associated with groundwater-dependent ecosystems in Watarrka National Park also hold for other sites in the Northern Territory. Not just arid and semi-arid regions, but also the wet-dry tropics because the dry part of the wet-dry tropics in the Northern Territory has some functional similarities to the arid and semi-arid regions of the territory once we enter into the dry season.

As for arid and semi-arid regions, it is groundwater that comes into play during the dry season. I wanted to emphasize that because I, having read the Interim Report, I realise that the Beetaloo Basin is of considerable interest in terms of exploration and possible shale gas. And, of course, the Beetaloo Basin is far to the north of where most of my research has been undertaken.

However, also, having now been the Head of School of the School of Environment at CDU for 18 months, I have become much more familiar with the research that is being undertaken in the northern part of the Northern Territory than I was prior to taking up this position.

Most recently, my research has considered the planetary change implications for aquatic ecosystems throughout arid and semi-arid regions of Australia and we wrote this up in a research paper that was published in *Global Change Biology* in 2013. I would like to actually turn to that paper to this inquiry, and I can provide an electronic copy. I can also provide copies of somewhere in the order of another 10 to 15 scientific papers-

Hon. Justice

Rachel Pepper:

Please do. That would be excellent. Thank you.

Professor Jenny Davis:

That are in that same field.

I must admit I was a little surprised that the panel didn't have them already. However, that brought home to me that as scientists, we haven't been doing our job well enough, that there wasn't enough in the public domain for it, to perhaps, immediately come into this inquiry, but, of course, this is now the opportunity for me to make sure that that does happen.

This paper that was published in an international journal with high impact as all Australian academics are now being encouraged to do. That's where we need to publish our work to survive in our field. It describes the importance of perennial aquatic systems fed by groundwater as Refuges.

Refuges for biodiversity across arid and semi-arid regions, it notes that all these refugia or refuges, are supported by groundwater, and that as global temperatures continue to increase, and certainly Central Australia has already experienced that warming, and as has the north, these refuges will become even more important.



The groundwater, which is, of course, water that fell as rain a long time ago, and often we don't know ... Well, I would say for almost all of our systems in the Northern Territory, we don't know how long ago that rain fell. Water is now there, that was rain water that fell a long time ago, effectively decouples these systems from the local climate. That means there will be water present in that landscape or there will be water supporting ecosystems. In some cases, of course, there are more soaks than there are obvious surface water areas.

That water will be supporting these systems when all surface water has gone, when no rain falls. Sometimes, for many months. Sometimes for several years. The importance of this decoupling from the local climate is enormous. This, to me, is the absolute and fundamental value of groundwater in terms of supporting ecosystems, supporting biodiversity.

I followed up this 2013 paper. I guess it did become clear that while we were getting good feedback from other scientists, it was published in an international journal, so we had that international recognition for it to even be published, I became aware that there wasn't really a lot of conversation happening around groundwater systems once you got outside, perhaps Murray Darling Basin, away from the swamp coastal plain in Western Australia, and perhaps ... well, not perhaps, definitely activities around Stygofauna in the Pilbara in particular in Western Australia.

There's still a huge amount of the Australian continent where we just haven't been thinking about the water that's there and how we're managing it. I wrote an article for the conversation, which I will also tender, and it was reprinted in the Australian Water Journal, as well, so that article that I published back in 2015, this was try to and get the need for thinking about how we manage water in Outback Australia much more into the public domain. By Outback Australia, I followed the definition of the Pew Trust, and that pretty much is all of Australia that is an arid, semi-arid, and the tropical north. It's remote Australia. It's where most Australians do not live, but it's still enormously important both economically, culturally, socially, and, of course, environmentally.

In this plan for Outback water, most of the things that I put in this plan I believe still stand. At that point, I really only mentioned coal seam gas and mining as being impact, so I could now add shale gas to those terms. There I said we should be doing things like determining the location and the extent of aquifers and catchments that support key bioersity in cultural sites, particularly in areas near proposed developments.

We need to understand, not only, how the importance of refuges: refugi or refuges, but in some cases, in particularly in the wet-dry tropics, I believe the term biodiversity hot spot also can be applied. Sites where the very last sites to hold water, my colleagues in the School of Environment, who are working in the Douglas Daly Region, as part of the Northern in this Northern Australian hub, of course, are looking very closely at how those sites, within, lets say, the Daly River that persist because their fed by groundwater are



really supporting everything that's then going to be the basis for everything moving back out into that entirety of the system when the next rain occurs.

Now this has been done in the context mainly of horticulture and agricultural development, but those same research findings, of course, can equally be well applied to anything ... any impact that may have ... any activity that may have an impact on groundwater.

I also, through my experience in Central Australia, believe that there's much more that we could be doing in providing knowledge, training and logistics for indigenous and local communities to manage, and in some cases, restore important water sites in the Outback. We also need to ensure that the environmental impact statements contain the information needed to assess the impacts of proposed developments near important water sites.

I just want to now swap to a statement here in this last part of my conversation article, that basically groundwater is a critical resource in Outback Australia. We need to know where it is, how much there is, how old it is and what depends on it before it is allocated or otherwise affected by any new development. That's a statement I still stand by very strongly.

I'm aware that we have some fantastic research occurring, very much in the groundwater space, very much being driven by people with groundwater and hydrological backgrounds and expertise. I know a lot of this has been done around the coal seam gas activities in Queensland and New South Wales.

What I would like to see, though, is that we have much greater connection between people working on what I would call the physical processes of hydrology, and the space that I work in, the ecological processes of biodiversity. It's those surface-water groundwater interaction, that area where groundwater comes to the surface and supports communities, that we value highly because we can see them, that I believe we've got a lot more to do.

I don't intrinsically believe that we should just be saying no development fullstop, but I believe that we have a responsibility to make sure that we are collecting appropriate scientific information to ensure that these developments proceed with a minimum of risk.

Now I know that shale gas is not in the same category as coal seam gas but there are still risks.

My concern is that we have for many, many years now really much treated groundwater as being out of sight and out of mind. I have a good colleague, Professor or Emeritus Professor Andrew Bolton, of course, who is leading the way with promoting our need to understand groundwater-dependent ecosystems.



I don't think Andrew is now doing a lot of work in that space, but I don't think that fact should allow us to just sit back and not continue to say the same things that he's been saying, that we really need to understand what is happening below ground. We really need to be sure that even where we're fairly confident that we're dealing with quite shallow aquifers that they will not be effected by activities that are going into much deeper aquifers.

I, myself, have been concerned that I have so little understanding of how old the water is that supports the sites where I do most of my research, which is in Central Australia. Like many academics at this stage, I regard myself as almost a charity, that I look for any funding I can find from any place to fund the important questions that I believe need to be answered.

At this point, I have cobbled together enough money to get our first analysis of groundwater at Penny Springs in Watarrka National Park. Now, some people would say well, you don't need to, that park is now protected, but I fundamentally want to know how long ago it is that that rain fell on those ranges that I now see seeping out of the rocks, and supporting a little stream community that appears to have elements of things that were there since Gondwana.

But, of course, in the best possible funding world, I would like to see us putting a lot more into really doing things like ageing that water, that water that we already know is important, the groundwater that we already know is important.

Now, according to the biogeochemists that I've consulted, it's not a precise business. At that moment, people are using it for different methods, and then you look at how they all intersect. We've got petroleum at the moment, and hopefully we're also going to do a couple of other analyses.

I also regard that that kind of information is critically important when you get into the political arena, and you need to, perhaps, convince politicians that something is important, that it does need to be protected. It's the kind of information I think that needs that anyone can grasp: how old is this water.

Now, of course, if we find that this water fell as rain last year, then that, of course, means that that is a very sustainable site. That it, in fact, will be replenished reasonably soon and that the plants and animals that are there are probably already well-adapted to that rain coming and going.

Of course, the really big systems like Lake Eyre that fill up irregularly, are those kind of surface water systems.

With systems that we know are dominated by groundwater, there'll still always be some rain water in the mix from the local rainfall. Last year was a particularly good wet year both here and in Central Australia. There'll always be a recent rainwater signal coming through. In cases where we can say, look, this water is thousands, perhaps not thousands, but hundreds of years



old, to go in and completely change it, or extract it, is the equivalent of mining a nonrenewable source.

I think that's about all I felt I needed to say at this point, but, of course, I'm very happy to answer questions. I'm very happy to very quickly try and get all the scientific publications I know together to send to you. I regret that that hasn't been done earlier.

Oh, I know. There was one last thing that I wanted to add. For anyone whose working in the Northern Territory, or who has been involved in biodiversity, and things like the threat to species hub, is now enormous concern at the lives of small mammals across Northern Australia. These are all the little furry things that we, and some very well-known things like Bilbies that we can all associate with.

At the moment, in terms of our freshwater communities, we still have intact systems. There are virtually no exotic or invasive fish in our Central Australian aquatic systems in the Finke River where native fish occur or in Northern Australia. That is a fantastic thing that we can say about this systems.

There are invasive plants. There are invasive species. There are invasive herbivores. A whole list of camels, donkeys, horses, goats, pigs, comes to mind. In terms of our aquatic systems, we can still put up a hand and say that on a global scale, we still have some of the few intact, uninvaded aquatic systems on the planet. From a biodiversity perspective, I think that's something worth protecting.

Anything that may act to change these systems, no matter how much we actually don't know about those impacts, I consider still should be treated as being incredibly important.

I don't see anything that I've said to you now to in anyway take away from the cultural importance of these systems with traditional owners. I think that in many ways we are still discovering things that have already been known. In other ways, we are bringing new scientific tools into the mix that I think will support some of the stories, and some of the values that the traditional owners already place on the sites where I've had the benefit of working.

I think I will stop there, but I'm more than happy to answer any questions that you would like to ask me.

Hon. Justice
Rachel Pepper:

Yes, no. Thank you very much Professor Davis for that very comprehensive presentation. I look forward to receiving those additional scientific papers. I'm very grateful for your endeavours in that regard.

Can you tell me just a little bit more before I let the water scientists loose on you. You mentioned potential programmes, aboriginal management programmes in relation to, was it both surface and groundwater or did you-



Professor Jenny Davis: No. Well-

Hon. Justice

Rachel Pepper: Well, I just want to know more about that.

Professor Jenny Davis: In my experience, that still has come from work mainly being done in Central Australia, but also with what's going on now with my researchers working in the north. It's always groundwater that's expressing at the surface, so it's not water that is completely underground.

Although, there are aboriginal communities in Northern South Australia who are very concerned about why I would call soaks, where you don't actually see that water expressed at the surface, but they know that the plants and things that are there, and possibly some from communities are being supported by that underground water. My area of knowledge is much more where groundwater has been expressed at the surface.

Hon. Justice

Rachel Pepper: Right.

Professor Jenny Davis: There are communities that are dependent on it. I'm aware that a lot of work is already being done in Central Australia with local indigenous communities to restore some of the springs that they've always considered to be very important but in most cases have been degraded by feral animals, particularly camels.

Hon. Justice

Rachel Pepper: It's that that I wanted to ask you about or gets some more information about. What sort of work is being done? Can you give me some examples?

Professor Jenny Davis: Well, the closest ... The colleague I work most closely with is Doctor Jayne Brim Box, who is with the Department of Environment and Natural Resources of the NT government department. She's been working with the aboriginal community at Santa Teresa, so that 80 kilometres southeast of Alice Springs. They have very strong links within area of springs. In fact, they have the closest springs to the Simpson Desert, so that the eastern most springs in, what I would call the, Central Ranges of Central Australia, and how spring and salt springs are two springs, They were enormously degraded by camels.

Initially, the men, the rangers group put in fences. They discovered pretty quickly that camels can do all kinds of things that no one expected, like only put the fences of the bottom, and camels could actually climb quite steep rocks, come over the top, and then come down and drink a spring dry.

Jane also discovered that traditionally it was the women who managed the waterholes, so having a male ranger group going, to that site and build a fence was good, but it wasn't necessarily how it was traditionally managed. It was the women who went in removed algae. If there was growing a bit rampant, they would pull it out. They would often cover with melaleucas to keep the evaporation rates down. They were protecting their water supply.



Jane, being a female herself, has worked very successfully with people like Veronica Dobson, who's well known for her work on plants in that indigenous community. She's an elder from that area.

They've been working there with women's groups to go in manage those waterholes in a more traditional way.

Jane's also working with other groups at a spring out halfway between Papunya and the West Australian border. The Allara, a waterhole, which was a much smaller spring coming out of rocks covered with paper barks, where people walking between Papunya and the Western Australia border, so that's about a 400 kilometre walk, would come into this little soak spring area, sit under the paperbarks, and be able to get water, drinking water. That was all completely trashed by camels. Buffel grass got in once. The melaleucas have been knocked over. It burnt. It's a mess, but the local rangers now want to restore that site.

There's a lot of activity going on now with indigenous ranger groups around lots of waterholes but most of the impacts have been feral herbivores.

Hon. Justice
Rachel Pepper:

Thank you. Yes, Professor Hart?

Professor
Barry Hart AM:

Thanks for the enthusiastic exposition of your groundwork, importance of groundwork. I think you can be very confident that we're with you on that 100%. It's a very, very important component.

Two comments and points. When on the age of water, yes, we recognise that that's a very useful tool for deciding on recharge rates or age of the water on the Beetaloo. We've got some conflicting information on recharge. If we just take the Beetaloo, which is where we've got most of the information, Northern Part of the Beetaloo, there are some quite variable recharge rates, but that's obviously important, particularly for the Roper and possibly the Daly too ... the Daly River.

If you look at the rainfall difference between the northern part of Beetaloo, so around Daly Water, and the southern part, around Elliot, there's a huge difference. We're very concerned that, in fact, utilisation of that northern Cambrian limestone aquifer is probably sustainable, depending on how much is taken out. But down south we're more concerned that that's a mild, as you say. Very low recharge rates, so we've got that. We certainly need more information on that.

The other thing, come back to the groundwater dependent ecosystems, and I'd like to see whether you have any information because we've had great difficulty in getting any sensible information ... any information sensible or otherwise on temporary water bodies, surface water bodies, and surface groundwater-dependent ecosystems is almost in the Beetaloo in particular.

Professor Jenny Davis: Yes.



Professor

Barry Hart AM: There's almost no information at all. We're obviously seeking that.

The statements we've had from some of the groundwater hydrologists is that it's very unlikely that there will be surface expressions because, as far as they're concerned, that the aquifer remains ... the surface aquifer, is something thirty to couple of hundred metres below the surface. To there knowledge, there's been very little information on whether there are any surface expressions. I think that it also has to be charged with the fact that there's been very little investigation into it.

So the question is, do you know of any information at all. It's a little further north, I think, than most of your areas-

Professor Jenny Davis: Yes, most definitely further north

Professor

Barry Hart AM: Yeah, what-

Professor Jenny Davis: No

Professor

Barry Hart AM: Anything you've got there would be extremely useful.

Professor Jenny Davis: Unfortunately, the short answer is no. I wish I could tell you more. I've started conversations with mainly Lindsay Hutley, who works on savannahs and fluxus. It's basically still, as far as we're concerned from a biodiversity aquatic-

Professor

Barry Hart AM: Yep.

Professor Jenny Davis: Systems surface water expressions, largely unknown territory. I note that in the southern area, of course, that's close to the springs that everyone, there are clearly springs coming into river systems.

Professor

Barry Hart AM: No question.

Professor Jenny Davis: I've myself, when I do venture into the tempi surface waters, go to think that water observations from space, which is the Geosites Australia website that's now there.

Now that's using lens imagery which is very It is a wonderful resource in that it does give you information on when water has set in the landscape for periods of time. Over the time period, that's a long time period that they've now put up, but, of course, it's gonna be cloud-free, so the closer you get to the northern part of the territory, the less that's information available. They have all confidence inand things.

Professor

Barry Hart AM: Yeah.



Professor Jenny Davis: They've, of course, I think it's something of 30 major resolutions, so doesn't catch areas of little springs that I work on.

For those big ... well, for surface water of 30 metres, or whatever greater, it's a very useful resource, so I guess I'd go and be looking at that.

I'd be looking at this ... the technology is just racing ahead. I guess that's why I find it so exciting now being head of the school environment here. We've got Sean Levesque, a new appointee, working with He's mainly working with fire. Those sort of remove sensing tools, you can go in ... we can probably get a much better look at some of the vegetation communities, which would be a surrogate for water being available.

I feel as though we are on the cusp of being able to bring in a lot more information about what might be depending on groundwater than we've ever been in the past. I still feel that there's quite a gulf, and it's because we're all busy people, between people working in water ecological physical processes, and people working on the ecological processes. To me, the sooner we come together in these common areas, the better we might make progress.

Professor
Barry Hart AM:

Thanks.

Hon. Justice
Rachel Pepper:

Thank you.

Hon. Justice
Rachel Pepper:

We'll start from the end and work our way forward-

Hi, Doctor Smith.

Dr Ross Smith:

I was suggesting that Jane go first, but thank you again, Jenny, for the presentation. It's very heartfelt and informative for us.

First, I just wanted to reassure you that Andrew is very active in his quest still-

Professor Jenny Davis: Oh, good.

Dr Ross Smith:

I know he's contributing at the national level, so if I can reassure of that.

I wanted to get back to Central Australia and the small systems that you know there whether there's been any research, which Barry Hart and I want to dig up into any interactions between the gas operations and the Amadeus Basin, south of Alice Springs, and surface water expressions of groundwater ecosystems. Are you aware of any-

Professor Jenny Davis: No. No.

Dr Ross Smith:

..... looking into that.



Professor Jenny Davis: I have been keeping a watching brief. I mean, theis very close. Well, I've got sites in the West Wodonga ranges intoto Watarrka to the West should go around the Mireenie Loop.

I'm conscious that the West Wodonga Ranges is equally important, really, into terms of aquatic refuges, etc., as Watarrka. I would hate to see that being sacrificed just because Watarrka's been protected. I'm aware that, perhaps, the people at Watarrka are just a lot better at making sure that the things they really valued were put forward.

No, I have conversations with Angus, who met the wetlands of the arid Northern Territory, and I don't think anymore information has come to light.

I have to say, we actually haven't been working ... we haven't been asking those sort of questions either.

Dr Ross Smith: Okay.

Hon. Justice
Rachel Pepper: Yes, Ms. Coram?

Ms Jane Coram: Thank you for your presentation around an issue that's very close to my heart as well.

I echo Barry, that Professor Hart's comments that we're struggling with actually even identifying we're the information is, so we'd be very grateful for anything you can give us.

I'm just wondering, in terms of resources for even understanding where the groundwater-dependent ecosystems are, how relevant have you found the Bureau of Meteorologies' Atlas of groundwater-dependent ecosystems to be in the Northern Territory?

Professor Jenny Davis: Look, I've gone in and out of that atlas at different times. I have to admit I haven't been into it recently. I guess I haven't ... I didn't find it that useful when I was using it, but I'm maybe doing them a disservice ... I certainly like BOM. I like going to that site all the time for various reasons, so I don't want to say anything negative about the Bureau of Meteorology at this point or Geosites Australia. I think they're both really where our future data will be held.

I guess that I felt that the Northern Territory has those issues of remoteness. It's the last place from where data normally comes in to any repository. I personally haven't found ... I mean the sites that I work at were, in fact, handed down by word-of-mouth from aboriginal people to the botanist Peter Letz, who grow up in Hermannsburg, and then he actually told me where to go and look at sites, which people had considered ... the local aboriginal people had considered had always held permanent water.



I tend to always have worked on permanent water because funding is so limited. Most researchers are not based in Alice Springs. There's a very small scientific community there, and here, to be truthful.

If you wanted to work on water, yeah, you need to be sure there was going to be water there, so that's why we tend to focus on perennial systems only because they tend to have enormous cultural values.

Now things are changing. Remote sensing is giving us a lot of ability to do a lot more than we ever did. I've got continuous loggers now, so there's a whole lot of things that we can do that are tracking. I still feel as though there are a whole lot of things we don't know because it's always been so expensive and there hasn't been a particular driver of any great financial impetus to go out to some of these areas.

Ms Jane Coram: So are your sites actually in the ... I'm intrigued because if that was derived largely remoteless or by..... provided by the jurisdictions.

Professor Jenny Davis: I think they are. I know if there was Angus DoGood's mapping should have lined up with those sites. I can, I mean, I can look.

I just remember being a disappointed when I did look, but I have to be truthful and say they could have been a number of years ago now.

Ms Jane Coram: Okay. Thank you.

Hon. Justice

Rachel Pepper: Anyone else with comments? Questions?

Professor, thank you very much, for as I said, you're informative presentation. We are grateful.

Professor Jenny Davis: Thank you.

Hon. Justice

Rachel Pepper: Thank you. You'll provide copies of those papers to the panel?

Professor Jenny Davis: Yes, I just need an email address actually.

Hon. Justice

Rachel Pepper: Can you email us yes? Or you can give us ... Or if you want to part with the hard copy here.

Professor Jenny Davis: Yes, I'll leave the hard copy.

Hon. Justice

Rachel Pepper: And we'll just scan it-

Professor Jenny Davis: and I've got a number of-



Hon. Justice

Rachel Pepper: And upload it onto our website.

Professor Jenny Davis: Okay, but I've got some other papers-

Hon. Justice

Rachel Pepper: No, no. Please yeah, email to the task force. That'll be very, very useful.

Professor Jenny Davis: Okay, I guess the area that I'm still working, and I've got University of Cameron, in particular, is we're very interested in this whole issue of fragmentation and activity and how things get around and how when they're already fragmented, how things may get worse. There's still ongoing research, but it all can be swept up into that pool of evidence. I will be the first to admit, it probably still needs a level of interpretation that doesn't make it immediately available for the kinds of questions you are now asking.

Hon. Justice

Rachel Pepper: Yep, well, as I said, whatever you can give us we'll be grateful for. Thank you very much.

Professor Jenny Davis: Thank you.

Hon. Justice

Rachel Pepper: Thank you.