IN CONVERSATION

Michael-Shawn Fletcher with Sonia Leber and David Chesworth

SL/DC We are having this conversation on Larrakia Country, on the waters of Girraween Lagoon in Australia's Northern Territory. Together, we respectfully recognise Larrakia Elders, past, present and future.

Michael, you are currently part of a team of Earth scientists that travel here annually to work on a purpose-built raft in the centre of the lagoon, extracting sediments from the lakebed. On this trip the science team has been joined by the Larrakia Rangers. Why is this environment particularly useful as a site for investigating Australia's long-term climate record? How does this site contribute to your own understanding?

MSF As a biogeographer, I am interested in the way that the environment works and how it has come to be, and understanding the processes and various factors that have given us the landscapes we have today. I have very much a time perspective on the landscape; my interest is in how those environmental processes and biological compositions have changed through time. I am a descendant of the Wiradjuri, which is an Aboriginal group in central-southern New South Wales. My Indigenous heritage has definitely shaped the way that I view the world. It has influenced the importance that I place on forms of knowledge other than Western science in trying to understand the world that we live in, and how we live in it. My heritage is very influential in the way that I go about my science. I'm very open to different forms of knowledge and integrating different types of knowledge into understanding the records that I retrieve from sediments in the landscape.

Girraween Lagoon, where we are now, is about 30 kilometres east of Darwin in the Top End, in the savannah country. Girraween Lagoon is a rare permanent lake. Lakes and bogs and other places like this that accumulate sediment are essentially recorders. They are recording

history. The sediments at the bottom of the lake are preserving pictures of the landscape—every second, every minute, every day, year after year, for as long as they are wet. So, with various techniques, we can extract these sediments and read the history of a site.

I'm interested in this particular location because these Top End savannahs of Australia are anthropogenic landscapes. They are cultural landscapes that have been shaped and created by humans over tens of thousands of years. However, I am particularly interested in what has happened since the cessation of Aboriginal management. Aboriginal land management was severely disrupted when the British invaded, and I am interested in how that has influenced the landscape we see today. So, by extracting the sediment that has been accumulating through that more recent phase, we can understand how the changing fire regime in response to that change in land management has influenced the landscape we see around us.

This is important because time is an often-overlooked dimension of the landscapes we live in. We have a particular lifespan and rhythm to our own human lives that is not matched with the rhythms of the landscape evolving around us. For instance, say, some of the things that are living around this lake have very fast life cycles while, at the other extreme, some of these trees have been around here for many hundreds of years prior to that big land management shift after the British invaded. So, the reason we're interested in time is that often our observation window—the time that we've been observing the landscape around us and gathering information and trying to understand how it works—is a lot shorter than the actual dynamics of a system. You have very long-lived species that exist for hundreds if not thousands of years in some ecosystems that have a rhythm,

or are beating to a drum or following cycles, that far exceed our window of observation.

One of the only ways we can get information on how these systems operate—how they respond to change, how they respond to different dynamics—is by looking at what we call the fossil or sub-fossil record, the information stored deep in the sediments in these lakes and swamps.

Girraween Lagoon and other similar places are essentially history books. Information is being recorded constantly. We as scientists use all of our techniques to get that story, that history, out of these sites in an attempt to read and understand how things have changed through time.

SL/DC It's interesting that the scientists here are trying to understand environmental processes over vast time frames by analysing some of the tiniest grains of this environment, through sediment captured under the waters of this lagoon. Those compact metre-long cores filled with layered sediments and ancient pollens can be taken back to the laboratory and studied for years. Why is the selective capturing of sediment so important?

MSF The reason we are using sediment stored in the bottom of these lakes is because plants and other organisms are constantly producing material that is passed into the atmosphere. Whether that be through chemical processes where different chemicals are being released into the atmosphere, through pollen or charcoal from fires or through particulates from industrial processes, they are all bound up in the sediment that lies at the bottom of these lakes. If the lake is permanently wet, then that becomes a great preserving medium. There's not much oxygen down there at the bottom of a lake or in the mud found in swamps, so things preserve really well. And the fundamental thing about the microfossils that we look at is that they are

abundant, so we can get a lot of information. One of the complications when looking at big fossils or macrofossils is that there are fewer in number and so often we have big gaps in our understanding. They are also randomly located so you get a patchy record. But the smaller things that are produced so abundantly and constantly through time are always depositing in some environments. So, if we can find environments like Girraween Lagoon that have been recording information for almost two hundred thousand years, a gobsmacking amount of time, we can unpack that record and retrieve plenty of information.

One of the central themes of ecology is scale: there is scale in terms of space, and scale in terms of time.

SL/DC Yes, we have noticed that every Earth scientist we meet clearly identifies the particular time period that underpins their own research, and this can be wildly variable.

MSF One of the most influential factors of ecology is that at different scales different processes become important. At smaller scales weather is very important—when fires occur, this sort of thing. At longer timescales climate is more important, which is the weather averaged over a long period of time. So, long-term shifts become important in governing the ecosystems and what can or can't grow, and what does and doesn't happen. We can also study even longer time periods like orbital, planetary shifts and wobbles, where variations of the Earth's tilt and the shape of its orbit around the sun influences the overall climate, driving really big shifts such as moving in and out of Ice Ages. Over even longer timescales, slow processes like continental drift become important because the slow drift of continents drives profound changes in climate and results in the isolation and connection of groups of organisms. All of these

sorts of things are very important, but they only influence really long scales, tens of thousands to millions of years.

The sediment cores that we extract give us information on the scale of tens to many thousands of years. This resolution is important, as we can pick up some of those slower processes that are invisible to our direct observations, such as the Little Ice Age about six hundred years ago, during which there was a slight contraction of the monsoon and a drying out of the landscape around Girraween Lagoon. Our shorter-term daily to annual rhythms are embedded within these longer-term shifts, and many of the trends we observe are actually responses to the longer-term changes that ecosystems are constantly reorganising themselves around. The sediment data we collect means that we can target responses to these significant slower changes that are occurring through time, and that will continue to occur into the future, at the appropriate scale of time. This is fundamental now, because we are currently experiencing the greatest rate of change to the climate system that we know of—the pace of change that is, not how hot it's been or how much carbon dioxide is in the atmosphere. Never before have we seen such a pace of change.

So, by interrogating the records from systems like Girraween Lagoon, we can understand how these ecosystems respond to changes in different directions and that gives us the ability to effectively manage or anticipate or predict what the effects of changes are going to be in these systems.

SL/DC While the scientists have been working at Girraween Lagoon, you have been joined by Larrakia Rangers on site every day. How are Earth scientists across Australia working with Indigenous rangers and Traditional Owners?

MSF One of the really important things is engaging with knowledge holders, with people who are custodians of the landscape, like the Larrakia people. Here at Girraween, and wherever you are in Australia, there is knowledge about how the landscape is managed. When we scientists get these sediments out, we can say there was fire, there were less or more trees, less or more grass. But we don't know anything about the methodology, the cultural purpose, the intention, the way landscape was managed. So scientists can provide a very coarse lens that needs to be filled in with understanding. Traditional Owners are custodians of an incredibly rich and detailed understanding about how this landscape operates, how it used to be, and how it can and maybe should be managed into the future. So, it's fundamental that we do our science in concert with the knowledge Traditional Owners can provide.

SL/DC Do you find that Indigenous people in Australia experience time differently to settler colonial thinking? We were struck by a common alignment around ideas of deep time between the Earth scientists and Indigenous groups in the field, while many in the general Australian population have lost a connection with deep time. How are scientists shifting their own thinking?

MSF I'm by no means a social geographer, but I think our current world is so much about what's going on now that we potentially overreact to things that are going on in our environment. The one thing about traditional knowledge is that it is knowledge developed in place, over long periods of time. You never really see Traditional Owners as alarmed as we are. They are concerned about their environment, but I think their knowledge base is more in tune with the way nature has rhythms that occur through time. Although I

think that nature itself isn't really a concept within many Indigenous ontologies.

Essentially, contemporary Australia is still very much rooted in European ideologies and a lot of the environmental methodology based on the practices, ideology and knowledge that white people have brought to this country is ill-fitted. At first it was a conquest mentality, to change the country to make it more like what Europeans were used to, and now there's an increasing realisation that that's not possible and it has really negative effects. And there is still a lot of knowledge across Australia residing with Traditional Owners about how to appropriately behave in a landscape and how to view your position within a landscape. In Australia, the master/servant relationship or the subjugation mentality is not working. It has failed in most cases. We are starting to see the catastrophic effects of that as things like climate change ramp up the pressures on the landscape. The kinds of mismanagement causing fish deaths in the Darling River, for instance, are a consequence of the layered effects of poor management and modern climate challenges. I think we really can learn from Indigenous knowledge, even if it's not direct knowledge. We can learn about how to view ourselves, our role and our capacity in the environment.

SL/DC We like to think of sediment cores, when extracted from a location, as a signal of a 'deep present'. The material extracted from a particular site is like a needle through time that complicates our sense of being both in the present moment and connected across vast timeframes. We love your idea that the sediment core connects us not only with past environments but also with a lineage of people who managed those environments. For you, environments from the anthropogenic era are 'cultural environments'. What is it for you to retrieve and gaze at a core in the field? What do you see?

MSF I guess in an abstract way, in the attempt to merge different knowledge types, I find that looking at a core is a kind of universal experience. When we retrieve a core with these beautiful bands, we get really excited. Everyone knows that you're looking back through time and that something must have happened at a period of time to create these visual changes. The physical core is a place where people with different knowledges about a landscape can connect, because one thing we all have in common is a sense of things occurring before that led to today.

Cores are incredible as a visual tool, and there has never been a time when I have extracted a core in the presence of Traditional Owners or scientists that they weren't in awe of and engaged with what they saw in front of them. You can see that in their heads they are placing their own sense of history and trying to understand where it fits in relation to the storybook that's in front of them. As a scientific phenomenon, it's gobsmacking to think that I've cored a site that has been a lake for nearly a million years, and you can see these beautiful changes through all of this time. There is a history book there in those cores. Even a core with a recent history of the last two hundred years is fundamental, in fact it is more important than longer-term information in how we manage contemporary Australia. The cores provide a great nexus, a great joining of place across time, where different knowledges can fuse and converse.

Michael-Shawn Fletcher is a descendant of the Wiradjuri and a geographer interested in the long-term interactions between humans, climate, disturbance, vegetation and landscapes in the southern hemisphere, with a particular emphasis on how Indigenous burning has shaped the Australian landscape. Michael-Shawn is Deputy Dean (Indigenous) and an Associate Professor in the Faculty of Science at the University of Melbourne and a panel member of the Australian Research Council College of Experts.


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TOP KIN18 CORE 4
TOP KIN18 CORE 3
TOP KIN18 CORE 2
TOP KIN18 CORE 1