In Conversation with Dr David Little

Oil: from a lifetime of damage-limitation to outrage

This is a written transcription of David Little's GDI 'In Conversation' Podcast, interviewed by David Hulme on 27th April 2021. You can find the audio below.

Soundcloud audio

David Hulme: Hello, I'm David Hulme, Professor of Development Studies at the Global Development Institute at the University of Manchester, and it's my great pleasure today to be able to interview a friend, who I first met just 50 years ago. He's Dr David Little, an environmental consultant who now lives just outside of Cambridge, UK, and has worked internationally on oil spills for a major part of his life.

I think we'll be giving you a link to a paper we've written together, or David has written most of it and Stephen Sheppard and I, colleagues over the years (well friends over the years of David's), have tried to help him sharpen it, but I'm not sure whether we achieved that.

David, do you want to just introduce yourself?

David Little: Hello, yes, as David says I've been working on oil spills for a very long time, not all the time; they occur unpredictably. I worked for the Field Studies Council (FSC), an NGO with then about a dozen field centres around Britain and now many, many more and, of course, hopefully very important in these modern times.

I got a job in Milford Haven (1975); then, and now, probably one of the biggest oil ports in the country and indeed northwest Europe. I worked there for another part of the same NGO [in] monitoring (well first of all teaching geography, geology and ornithology to various ages of 'kids' and of course, they were interested in pollution, they were interested in the refineries in the estuary of Milford Haven). And we graduated from there (my wife and I) to a research post across the other side of the Haven, monitoring North Sea and estuaries as the oil industry grew through the '70s.

That led in the end, really I suppose, to the oil spill assignments, which gradually got more exotic. [After] starting in Milford Haven, I worked for two and a half years, more or less full time, on the 'Exxon Valdez' 1989 to '91. We relocated to Seattle and Alaska to do that; came back just in time for the 'Braer' spill in 1993 in Shetland, and following that in 1996 the 'Sea Empress' back home in Milford Haven.

So that was a kind of circle completed and since then, largely under private practice and semi-retirement as well, I've worked for UNEP [United Nations Environment Programme], just after the Lebanon war (2006), where a big power station was bombed by the Israeli air force in retaliation for Hezbollah rocket attacks. And I did "so well" under a year after the hostilities ended, that UNEP signed me up to review their landmark report on the Niger Delta; and I'll come to that, probably, in later questions. But from 2011 I've worked for UNEP in Nigeria (maybe 10 or 12 visits) and also for the United Nations Compensation Commission in Saudi Arabia (6 visits 2008-2012), after the 1991 Gulf War. And that brings us up to date, because the clean-up in those two areas is ongoing decades later, and that kind of summarizes how I got to this position.

David Hulme: That's great David. We've both taken different career paths since we started off with common interest in the environment, bird watching, the Velvet Underground, working in Nigeria together, but we've gone our separate ways.

I wonder if I can just ask you, you mentioned the 'Exxon Valdez' and 'Braer', and for people of our age that's something we can probably remember those names, because those were very important incidents. But, I wondered whether you could tell us a little bit about the specialization that you developed when you were looking at oil spills, because I think you went down a scientific route for quite a while.

David Little: Oh for those spills, I was really just part of a team. But you're right, because the specialisms had to come in, because you can't really respond to any environmental pollution incident without a kind of multidisciplinary approach and a sort of human geography approach as well. You know, I think it's becoming more and more fashionable for scientists to reluctantly admit that they haven't got all the answers, and I think we're seeing that with the Covid-19 pandemic; that we need good communications, we need people to work in teams, and we need politics to keep out of it as far as possible.

So I think the specialism that I got into, well, it really started with being a sort of technician. When I first started, after teaching for two and a half years, I was the only non-ecology or biology person, being a geographer. Although sympathetic, you know, having done biogeography courses, I sort of knew part of the language but [was] never a proper taxonomist or theoretical ecologist.

So I was basically sieving sand or, you know, using a Coulter Counter to measure the particle size of the mud, so that the biologists could write very professional and authoritative reports on monitoring programmes from the North Sea or West Africa or wherever; and there was like twenty or so biologists, and only one or two chemists and one or two geography types, looking at the sediments.

Then I got "snatched" by one of the trustees of the Field Studies Council, who was a geologist from King's College London, and I registered under him as an MPhil then PhD student at London; which I did part time for over a decade and wrote up after 'Valdez' (without mentioning 'Valdez'). So I was registered in '82, submitted in '92 or '93 having, you know, more-or-less finished my contribution in Alaska and writing up in Seattle. So I didn't get my specialism by doing a PhD; I kind of consolidated that and then parked it again, having done a lot of spills before writing the PhD. Unusual. It was a Natural Environment Research Council (NERC) [part-time] industrial studentship.

David Hulme: I won't take you onto that, but PhDs are much more structured nowadays. There are all sorts of hoops and most universities wouldn't allow you 10 years.

When writing the paper that Stephen and I sort of contributed to with you, I mean, I was horrified to understand the scale of damage which [response] caused in certainly those early oil spills in which you were involved; in which the chemicals seemed to be worse than the oil that was to be treated. I wonder if you could just talk us through the sort of…

David Little: Yeah, and that goes back to how I really - you know at the age of 14 or so both Stephen and I had already been [shocked] (along with most people young and old), when we saw the March 1967 'Torrey Canyon' [spill]. Black and white, it was almost "sepia and white" footage on the TV; and then the RAF came in and tried napalm and incendiary bombs. They tried sinking the oil - this is off the Scilly Isles, beautiful - you know Harold Wilson was in charge then and he went on his holidays in the Scilly Isles, so 'Torrey Canyon' was an outrage basically; an instantaneous outrage at a global level.

And so we were already birdwatchers (as you were although I hadn't met you then), and my mum and dad were sort of counselling me almost. [My] dad had just retired a year or two before from the Royal Navy, and one of his jobs in one of these ships was supervising re-fuelling [at sea]; where if it goes wrong, it ain't just an oil slick and some storm petrels or fulmar petrels that get covered in petrol. You know, it's risky to human life. They have to hitch up lines, get them across to the other vessel in whatever weather conditions. And you know listening to my dad, I just thought - and watching the telly about 'Torrey Canyon' - it just literally seemed like a crusade was needed.

And it became more and more specialized and more and more mundane in a way, as knowledge increased. The driving force with me was birds and environmental impact, but I only came back into it as a technical person *via* my physical geography and sieving sand and working out how to write a [Basic] computer program for data reduction. We did thousands of samples a year and we had to integrate all that with the ecology data. It was a great team effort.

And working for a charity was great too. There was never any of the management consulting and kind of spin aspects of what is now taken to be environmental consulting in the modern world.

David Hulme: I mean so what are, you've been seeing these spills for a while, what are the main things that have been learned? What do people do very differently now, that they didn't do then?

David Little: Your previous question was the first wake-up call. When 'Torrey Canyon' happened, as I implied with the napalm and the sinking agents they used (which were heavy minerals), everything they threw at that disaster seemed to make it worse. And biologists from Plymouth and also Pembrokeshire are still periodically looking at those shores. The shores that were only slightly oiled or moderately oiled, but were not cleaned in an aggressive way have recovered, basically; recovered enough for people to be able to detect the impacts of anti-fouling tin from ships on the community. So you've had one impact, a recovery, and you've got back to a kind of natural balance as it were (I hesitate to use that word, but such that a new impact can be determined); but on the shores that were aggressively cleaned, it's decades. Initially the shores were covered in green weed, because everything that normally eats the green weed (mainly limpets) had been killed as soon as the oil and the chemicals got mixed up and they ingested both of them. Whereas on the oil-alone shores, many of the invertebrates and the grazers survived, so that the algae didn't have this horrendous bloom which then took years to actually work through, for a 'proper' community to re-establish itself.

Then, having learned that lesson, the next major spill was Amoco Cadiz (1978). Again it was rocky shores and big sandy bays, lots and lots of seafood (unlike us the [French] love their mussels and oysters and everything); so that was a huge impact both economically and ecologically. And we also learned the lesson there that you can't send untrained people with the best will in the world to clean up, which is largely a manual operation. They used a lot of heavy equipment and diggers as well, and did intrusive clean up on fine-sediment shores, which are very slow to accrete. They get colonized by vegetation. If you take that sediment away because it's got oil in it, you're actually setting back the geomorphological evolution of that piece of shore to a point where, you know, before the critters arrived and before the mud had arrived and before the plants arrived and grew. So that took many years to recover, maybe six or seven years from memory. You can transplant and [try] things like that. And simultaneously with the 'Amoco Cadiz' our [FSC] group was experimenting at our worst oil refinery site in Southampton Water, where Esso had (since the 1950s) managed to kill off a large area of saltmarsh, and it was completely denuded of macrophytes. And we were taking little plugs of sediment from nearby marsh and plugging them in like a hair transplant. Those clumps were visible, slowly growing, and I last visited it in about 2005 and the marsh flora was uniform again; not uniform in terms of composition, but at least there were no areas of bare oily mud.

So, no chemical dispersants were used there (Southampton Water), no mechanical clean-up was used there, but people used ecological restoration - phytoremediation is what it's called now. Let the plants recycle the carbon, including the oil, and it becomes less and less toxic. So we learned that if you can “weather the storm” and get the heaviest accumulations of whole oil (bulk oil), and get them onto pocket beaches that you can boom and then recover that oil, you'll get 90% of the oil that you can pick up (and send back to the refinery) in just those few sites.

If you chase all the sheens and throw chemicals at thin oil, you're going to do more damage than just leaving that oil to disperse and weather naturally. And that's a hard sell when the media and even [some] conservation NGOs still are very reluctant to approve dispersants in those places where dispersants will help; namely offshore (but not so far offshore that nothing much is going to get harmed by the oil being left alone).

There are lots of other lessons; I mean there are a lot of institutional arrangements. For example I’ll just list them: the compensation packages; internationally agreed treaties; best practice manuals; the whole idea of surveillance, you know remote-sensing from aircraft, even at night using sideways-looking airborne radar; false-colour photography, all of those things, and also Landsat, all of that technology, let alone the computer and the GIS materials that are needed to sort it all out and say how damaging was it, or not. All that stuff's evolved since ‘Torrey Canyon’.

And I suppose now the key is making sure that you can stage [a response], and manage and learn the lessons quickly enough, every day as you go through a response, given that there are so many specialities and so many vested interests and technologies to kind of keep your arms round.

David Hulme: Yeah, so things have got more complicated, but when you were talking certainly early on, about the sort of the damage done by the dispersants, it's funny those of us who work in development and picking humanitarian work would sort of recognize that you had to learn a “do no harm” principle. That you can't assume that the first thing you think will be good, will be good. You do need to test it out, because quite often well-intentioned people, doing what seems intuitively the right thing to do, can actually cause harm.

David Little: That’s right. The acronym in the spill community is NEBA (Net Environmental Benefit Analysis), and “do no harm” is exactly right. The danger with specialisms is that they all have champions, even if they're not motivated by “flogging some snake-oil magic potion” that's not really proven or tested, even if they're acting in good faith, they're still in a sense vested interests. A good on-scene commander or incident commander will have both an almost dictatorial executive function, but [also] the good ones, he or she will always have all of these potentially competing interests pretty much in the forefront of their minds. And the best outcome is one that minimizes damage in as many of the sensitive compartments, both biota and human communities, as you can.

And of course there are easy semantic scales [on sensitivity] that needed to be surveyed around the world; like what types of shoreline or inland spills are most susceptible to damage? And which parts of the oil: is it jet fuel, is it diesel, is it petrol, is it heavy reduced crude, or these emulsions that form at sea? All of these have different physico-chemical behaviours and some of them do not respond at all well to different technologies that worked rather well in other areas or on other oils. So it is complex.

You’ve got to do what you can at sea and, first and foremost, you look to the casualty; be it an oil rig on fire or a tanker aground or a tanker sinking or on fire (all of the above), and of course human casualties. I didn't list the human casualties in the table in the article because there's not that many due to marine oil spills. There are far more human casualties resulting from the first Gulf War [1991]

and certainly the second Gulf War [2003], let alone the Iran-Iraq war that preceded both of them in the '80s. The human outcomes from that have been, and are being, disastrous right till today. So in a way it's a little bit precious to sort of wring your hands about some "bugs and bunnies" that didn't quite make it.

And the large part of our paper, in the central section of it, is really about those intractable problems that have been made intractable not so much by the amount of oil or the fact that it was on fire or the fact that it blew up or whatever; it's the fact that those areas have not recovered from a human standpoint and those areas are also in conflict still, and many cases are corrupt. So it's very difficult to mount any kind of response if people are trying to kill each other, or are not agreeing, or are stealing from each other in one way or another.

David Hulme: Like I said, do you want to give us a bit of detail because you've been looking into Ogoniland and some of the pretty horrendous results of oil extraction in Nigeria. Can you tell us a little bit about your work there and what's happening?

David Little: Well they've had oil coming out pretty much in profitable ways since - well, it was first discovered in the late, very late 50s and by the time Nigeria became independent in 1960 it was very well known to everybody that it was a major crude oil reservoir. It's quite shallow, the oil type is very, very low sulphur and therefore it is called "sweet", because you don't have to process it as much to refine it. So it was a sought-after asset to the global oil industry, and that has been dominant, especially in the onshore period (even now most of the oil reserves are available onshore), which is unusual around the world in a sense. It's moved offshore, partly because of security, because as you know, it's a very densely populated part of Nigeria and the local people did not move out just because it became industrial; which in the global North (or the West) would not have happened probably. You've got this cheek-by-jowl juxtaposition of actually very poor communities of human beings, mostly fisherman-based originally, but in the uplands which are about a metre or more above the high water mark there is farming and there are also forests. It's a huge mangrove forest with an equatorial rainforest inland, and it's probably the second biggest area of those habitats in Africa. But it's also the most damaged.

Shell came along and dominated the onshore and all the companies have had occasional, actually quite small, accidents compared to 'Torrey Canyon', 'Amoco Cadiz', 'Exxon Valdez', and certainly to the 'Deepwater Horizon' [2010] and the Gulf War spills of 1991, they're tiny spills; just a few tens of tonnes at most. The two spills that I got involved with, starting in about 2011, were the result of pipeline maintenance failures [2008]. The pipelines concerned run from the oil gathering stations in southeast Niger Delta, to the Bonny Island terminal where the oil is pumped - it's metered and pumped - onto super-tankers that then come to the various oil refineries.

What the local people decided to do when these two spills happened was - well obviously I'm not going to classify the local people in one dimension - many, many local people expected, naturally, the oil to be cleaned up. Well, in fine sediment mangrove areas it's almost impossible to pick up all that oil. So expectations were understandably very high, the stakes were high, tensions rose when some people also poor enough (in my opinion) to be recruited by organized crime, took to stealing oil from that and other pipelines. There's always been some vandalism and there's always been some, sometimes disastrous, hot-tappings of lines, where ordinary people come along with plastic and tin drums, fill up the oil, the men having broken into the pipeline and then they rush home and use that in dare I say, cooking or in their vehicles, once it's been "refined" in 45-gallon oil drums over open fires. So they basically boil up the stolen oil and it distils out according to its boiling-point range and they make very passable petrol and diesel from it. Of course, the heavy residue and the tar and

all the carcinogenic smoke that gushes out from these fires - it's just left there - it goes into the air and it goes into the soil.

And there are hundreds of these refineries; you can see them as you fly over the delta from dark blue smoke coming out of the forest. And after a few years of operation they become the size of about two or three tennis courts of just black oil, and Shell cannot stop that because it's not their doing. They can't even keep up with the leaks that have occurred anyway, and the new leaks. If they rush in, they have a security problem.

When Nigeria was a dictatorship, and it has been a dictatorship several times since independence, probably one of the longest running was under President Abacha and he decided that the oil industry must have its oil, because that's even today where most of the [Nigerian] foreign currency revenues come from. Long story short, Abacha decided the way to guarantee that the revenues would keep on coming in would be to suppress any illegal activity or any dissent of any kind in the most affected area which is called Ogoniland.

Eventually nine leaders, including artists, intellectuals and the poet Ken Saro-Wiwa (poet and writer), were rounded up, tried, and hanged - convicted and hanged - and this is an outrage twenty-five (25) years ago (as I was writing that section on Nigeria in the article last autumn). And Shell can't be blamed for that; I'm sure they didn't collude in that. On the other hand, they've carried on making the money from this sweet oil which is easy to extract. It's about six and a half kilometres shallower than the oil in the north Caspian [Sea]. And the shallower the reservoir, the less pressurized it is; the deeper the reservoir, if there is an accident, the more likely you are to get oil coming out under immense pressure. So you're going to get much more physical and fire damage and loss of life at the surface. And that, to a large extent hasn't happened onshore or offshore.

There's been only one major blow-out in Nigeria, and that was just in the near offshore, and we did a response for that in 1980 with Nigerian partners, and I remember back then in the Field Studies Council lab, there was discussion about whether the impacts that were being reported on the villagers; the fact that these are fishing villages, with just boat access, no roads and the oil was coming into the creeks. People were saying who'd been over there, in the coffee room back in Wales; they were saying: "imagine a small village in Dorset or Hampshire or in Holland perhaps, where it's all canals and ditches, or indeed the fen edge in Cambridgeshire. Imagine each of those ditches filled with oil and it's not going away. No-one is picking it up; no one's come up with a way of remediating it, or replacing the mangroves. So every day you go out, and you come back with fewer and fewer fish. The fish are bearing [oil], you know the day you catch them they've still got oil in their flesh. There's oil coming out every time it rains, and in the rainy season it rains nearly every day". So you've got oil coming out of the flares from the oil industry, and that was what UNEP wrote about; and I recommend people look at the UNEP (United Nations Environment Programme) 2011 report. It's in our reference list and the photography alone is a wake-up call.

David Hulme: And that report was looking to try and bring justice to the people of Ogoniland, and that's still being waited for?

David Little: It is, and UNEP really have only just seen some of their initial recommendations (over 10 years later) begun. In a recent 'Zoom' call with the people trying to do the clean-up there, having written a draft of this article, I challenged one of them to just get more involved with the human geography, to get more involved with the social justice side. And, of course, the websites of all the international oil companies are absolutely full of the good works that they're doing, and I'm not being sarcastic, they are trying to do good works.

But, in the case of Nigeria, you know after I made my fairly passionate plea that they have to think of all the people and not just tar (if you'll excuse the pun), not just tar everyone in the local area with the same brush that they're oil thieves and ne'er-do-wells; because you know it's completely outrageous. I said this and one of the executives on the call said: "Yes, but David we're not here to solve world hunger". At which point I sprayed my bottle of water out and said "No, but you *can* try to undo the damage that *is* about the oil and then the world hunger in that part of the world will take care of itself, hopefully". They only have to get clean fish, have clean bathing water, because most people's water in these coastal hamlets is just the creeks. That's where the kids would swim and play, you know. No more.

David Hulme: Okay, now what we were hearing is that most of these big corporations are signing up to the UN Sustainable Development Goals, which include ending hunger; but that's a different division, it's not the for-profit divisions, it's for their corporate social responsibility.

When you were writing the article, I mean you started off about oil spills, but the outrage is not about oil spills, the outrage is about where you think there's not sufficient outrage at the moment.

David Little: Well it is, and I think the launching pad from that is we've got to do both. I mean the people who are qualified, and interested and experienced, in oil spill response in its wider sense, including the human impacts, really have to up their game in my opinion, firstly, to make sure that it's more equitably distributed in terms of coastal communities around the world [that] are unevenly endowed with resources and capability and access and transport and infrastructure to respond to a spill. But just because they are still farmers and fishermen doesn't mean that that's not a subsistence income or, indeed, an industry, an artisanal industry. It doesn't mean they don't need decent places to live. I don't think that the social responsibility and much less the environment and social governance trend of today is cognizant of that - until we see the supply chain issue.

If someone's producing something that we in the 'West' use, then we are dependent on that supply chain and if you follow it back, as many investigative journalists, and geographers and scientists are doing, they'll find many injustices in the areas where such-and-such a crop is grown, I mean the palm oil or the cotton or whatever it is. And in the case of oil and gas (as we move to the bigger problem that you've alluded to - that of climate change), the macro-problem is those supply chains: to break the hydrocarbon one and get off our addiction to oil and gas. We have technologies already, but they need rare earth elements, and copper and cobalt. Even if we move away from nickel and cadmium and zinc in battery technology which we now can do, and have done, it doesn't mean there aren't enormous holes in the ground, you know single mines with four to six thousand employees.

And there will always be men and women who want to work for those expatriate companies in the Copper Belt, in Ghana, all around the world really; because the choice is to do that or maybe not have any other income, as [pressure on] the natural habitats and the global population rise. You know, this is why I think we're seeing people who can hunt - they've gone out and started hunting Pangolins or Bats, whatever it is. Once Covid-19 struck, there was this possible link between habitat deterioration, habitat diminution, simplification, and previously unforeseen concentrations of mammals in certain areas, maybe as they get isolated and corralled, canny hunters will go and get those, and sell them in the so-called wet markets.

So whilst reading about all that this time last year (you know in common with everybody else in the world probably), I got to thinking about this rough draft of something on the history of oil spills from a kind of personal point of view. And it was that moment I felt I'd kind of wasted my life because really, if [only] we'd paid attention to the impact from the earliest days when it was getting

undeniable that global warming was happening and that it was being abetted by anthropogenic emissions. You know, let's say twenty-odd years, twenty something years ago if we put the effort that was put in from the March 1967 with 'Torrey Canyon' over the next almost 50 years exactly, if [only] we'd had already twenty, going on twenty-five years of effort, at that level of intensity that was shown for oil spills in the rich world (by and large), but we'd done it for the whole world? And [if] the target of our efforts had been adapting and mitigating climate change, I think we'd be significantly further on than we are now. We certainly wouldn't have had or tolerated… if Donald Trump *had* happened in 2016 I think his four years (depending on your point of view you know - passion, or comedy, or satire, or beyond satire, or just hell on earth - whatever your point of view) that four years would not have disrupted the Paris Agreement. [The] Paris Agreement would have already been stronger because we'd have had just as much real effort as the oil industry and governments have done for 50 years, focused on something that was to actually replace oil and gas and use it only as a specialty chemical. People should be rewarded for shutting in the wells. Keeping it in the ground should be the fiscal goal.

David Hulme: So we need to invert your market economics on its head and I don't know, maybe that'll be possible but I fear at some future stage…Maybe just something to finish off with, we've got a minute left, I work in the same sort of wicked world as you do, but I remain optimistic and that's partly because I've tended to look at extreme poverty, and that has reduced pretty significantly over my lifetime. The sort of horrendous scenes we saw of malnourished kids which were normal in Nigeria back in the early '70s, when we went there, I now find it very hard to find children that [are] malnourished, except in humanitarian crisis areas. And also I've worked on Bangladesh where incomes have improved for the majority of people, and where human development and life expectancy has really transformed; so that's sort of gives me an optimism. But what sort of future are you…can you be optimistic, or do you think we really need, in a way, to be realistic and maybe pessimistic? Where are you up to when you think forward?

David Little: Well, I honestly think…Well, first of all, just to pick you up on the Nigeria thing, I mean the Biafran civil war in the late '60s you know, when you and I worked for a couple of months in northern Nigeria, we didn't work in that area but we knew; everywhere we went people told their stories of how people from the Delta (who had been in early contact with Western countries, England primarily), had got better English and ran the bureaucracies, but those people were run out of the North because they were on "that Biafran side", as it were. So people were still telling us about… well, ugly scenes of retribution were being meted out. But it was fundamentally about oil as well. When Biafra realised it had virtually all the oil, they drew a line around it, and said: "Biafra!" and tried to secede.

But I take the point, and the famines on the scale I suppose with Ethiopia, being honest, you know, like 1983-84 with the Sahel drought, I'm optimistic in that we can join those two dots up and see that the Sahel drought was not helped by what we now call anthropogenic climate change in retrospect. Very few people were talking [in those terms] about that Sahel drought in '84. You and I were probably reading papers about how our warblers coming into Britain were changing in their abundance, long before they really changed in their arrival dates due to global warming. They were changing in their abundance because of desertification.

But I'm optimistic in the sense that we do seem to learn, but it seems *painfully* slow in the incremental way that human beings learn. It seems that we almost have to keep putting our hand or, "better still", someone else's hand into the fire before we go "Oh yeah, *now* we should do something about that because it's really not tolerable to have this self-inflicted wound".

I still think - and this is where I get less optimistic - although we have slowly made progress and people mostly now seem to accept climate change is happening, and it's dangerous, and it's partly down to us and wholly down to us to do what we can. But I'm getting less optimistic when I think that, you know, the environmental movement is still…people still stigmatize bits of it. There's a lot of neoliberal propaganda against "WOKE-ism"; where you know the climate change strikes inspired by Greta Thunberg are scowled at by TV personalities who are very proud of being petrol-heads (and "biffing" people, you know, producers whom they disagree with) and other people who should remain nameless. And I just think that to still have that stigma about "tree huggers", and to allow neoliberals and populists, just megaphone men (and they are mostly men), to sort of shout at a teenager who's doing something that - you or I in 1967 - we would have just jumped out of our skin, we would have been petrified. And she's made a huge difference!

At a time when people like George Monbiot just a few years ago you know were saying… that children, I think his quote (I've written down some sort of paraphrasing here) there's one where he said "Those in greatest need of rewilding are our children." And he was referring to going back to the Field Studies Council and how I started, working with education in the open air. You know, I think Greta Thunberg and the people who've turned out around the world on these climate strikes, they may not be experts on rewilding, but they are reaching back to something that lots of the generations between you and me and these 'kids' now, have been moving away from: with computer games, and urbanization, and lack of access to the countryside in all countries.

So I'm less optimistic about that [cultural gap], even less optimistic when I think that, you know some of the other quotes I wrote down: a couple of them that are in the paper and in the blog by Gus Speth, I won't repeat that, but [writer] Václav Havel, the first President of independent Czech Republic and friend of Frank Zappa said, "There is a global revolution in human consciousness that is needed to improve the human condition." And actually a distant relative was the poet P.K. Page who, in 1979 the year after 'Amoco Cadiz', wrote something like "Art and the planet tell us change your life!" You know… and I think you can add to that the ecologist E.O. Wilson, where he referred to "cultural stories that are consistent with biological and physical reality" is where the progress is needed to be made. So here are a range of artists and scientists, just human beings basically, who understand that it's really down to us; not exactly what specialism you need to do this or that. We're getting most of the technology specialisms, we need to improve them, incentivize the markets around them, and get people mobilized on this cultural (not culture wars) transformation.

David Hulme: So I think we'd better wrap up now. So we are, we can see that humanity seems to be learning, but at a much slower pace than required and hope that these cultural transformations, perhaps arts-led rather than science-led, or a combination of very different specializations coming together. David, it's been great to talk to you. Great to catch up again and look at these things in some detail and can I say thank you on behalf of the University of Manchester and the audience that hopefully will listen to this, for sitting down by the fireside and talking with me, thank you.

David Little: Thank you David.