

Episode 272

What is the problem with plastic? – with Emily Penn

The show notes: www.houseplanninghelp.com/272

Emily: I spend my time looking at plastic pollution in our world's oceans. I've spent the last ten years really researching these accumulation zones, what we call gyres where the plastic ends up. It's through sailing expeditions and taking people from all different backgrounds out to really see the problem.

Ben: It was through a talk that you gave that really started me on my plastic journey. Let's just go back to the beginning and get some stuff straight. So, what is plastic?

Emily: Plastic is really a material that's very useful in our daily lives. We touch it every day, hundreds of times, whether it's food packaging which is great for increasing how long food actually lasts and removes food waste; we use it a lot for hygiene, so in hospitals and in our daily lives to keep things clean; we use it in buildings as well where it's proved to be a very useful material for keeping water out because it's waterproof.

It's got lots of great properties and there are really good reasons why we use it. It's lightweight, it's easy to transport, it's cheap to make. But it also lasts forever and we've started using it for different types of uses that are actually designed to be used once. That's where we've run into this problem of having a huge amount of pollution in the world.

Ben: Where does it come from to begin with this plastic? How is it made?

Emily: It comes from oil that we take from the ground. It then gets turned into a polymer and it gets turned into different types of polymers depending on the uses.

PET is what we make our bottles, like our Coca-Cola or water bottles out of. HDPE is what our cloudy milk bottles are made from. Then we've got PVC, which is used in windows, drain-pipes and things like that. We've then got low-density polyethylene; that's things like plastic bags; polypropylene, a much more hard and

durable plastic; polystyrene which we usually know in the expanded context where it's very good protective packaging or we also see it being used for take-out containers. Then the final category, number seven, is really a catch-all for everything else including biodegradable plastics that we can talk about as well.

Those are all of the different types. They're all made with slightly different chemical structures based on the different types of properties that they have.

Then they're also made with a lot of additives and that gives them additional properties. So, something like a phthalate is added to plastic to make it particularly flexible or stretchy, which is a lovely property but unfortunately phthalates are these chemicals that can end up getting into our own bodies and lead to problems there.

Ben: I certainly want to talk about this in a minute. But going back to oil for a second, if oil is used as a fuel, does that mean that this is a waste product or is this an alternative use of oil?

Emily: It's really an alternative use. There is some interchangedness here; we can actually use plastic waste as a fuel, for example, and then turn it back into it. But really, it's being made as a standalone plastics industry product.

Ben: How did you first find out about plastic or start on this journey?

Emily: I actually did a degree in architecture and lined up my first job in Australia. But I wanted to get there without taking an aeroplane and so, I ended up hitching a ride on a boat from England, across the Atlantic, across the Pacific towards Australia. But along the way, really in the middle of the Pacific Ocean, I started to see plastic. We would be a thousand miles from nearest land and seeing a toothbrush or a cigarette lighter or a bottle-top just floating by.

Ben: Wow. Why is that there? How does it get there?

Emily: A lot of it is due to the ocean currents. Because our planet is spinning, creating the Coriolis effect, we have these big rotating currents in our oceans.

In the Northern Hemisphere, they move clockwise; Southern Hemisphere, anticlockwise. But in the middle of these fast moving currents that are a few thousands of miles wide, there is this calm patch. And as meteorologists, we would call it the centre of the high, but as scientists looking at plastic, that's what we call a gyre.

Ben: But these plastics, are they dumped off ships? Have they somehow come from land, rivers and then into the seas?

Emily: The data shows that about eighty percent of the plastic in the ocean is coming from land and twenty percent coming from ships.

For ships, that would be fishing that is really the biggest contributor, losing fishing line, losing polystyrene lids that go on the fish bins when they're trying to keep fish cold. But really, it's the lines and the nets and all the different types of plastic things they use on a fish farm that end up there.

We also then find things that have fallen off shipping containers. It's surprising how many actually.

Ben: Fall off? It's either the whole shipping container, or does the door open?

Emily: Well, they do get lost; they fall off. There was this interesting story around rubber ducks where a whole container of rubber ducks were lost and they started showing up in literally every corner of the planet. That's where scientists started to learn about these ocean currents.

There was an interesting one off Cornwall recently. It was a bunch of Lego that came off a container. But the quite interesting thing was, it was all pirate-themed Lego and it's been washing up on the beaches of Cornwall.

Ben: A slight coincidence there. So, you'd think being out at sea that the plastics would just break down. I suppose that is happening but maybe you can tell us about the end cycle of plastic?

Emily: It is breaking down and I think this is one of the biggest misconceptions. We expect there to be this island of plastic; something quite tangible, something we can go and easily clean up. But the reality is, when we get out there, we find more like a soup of microplastics.

So, the UV rays from the sun, the wind and the waves, all work at breaking down those bigger bits of plastic into these small fragments that we call microplastics; so that really determines anything that's under five millimetres. Smaller than your little fingernail, I like to say.

Ben: Do those still sit on top of the sea or can they just get anywhere?

Emily: A bit of both. It depends on the type of plastic.

On the surface of the ocean we find a lot of HDPE, which was that number two, the cloudy milk bottle that I mentioned, because it's less dense than saltwater. Other types of plastic though, PET and polystyrene when it's no longer in its expanded form with air bubbles in between, is actually more likely to sink in the marine environment especially when it's got biofoul on it. When the algae and the barnacles start to grow, it then causes it to sink as well.

We're only just starting to understand really how much is on the top versus the bottom but some of the statistics show we've got eight-million tonnes of plastic that leaves land going into our ocean each year. That's what's making up that eighty percent that I mentioned of the amount of plastic, making its way down streams, drains, rivers and waterways, leading into the ocean. Eight-million tonnes going in but we can only account for a quarter-of-a-million on the surface.

That suggests that the missing plastic, it might be getting eaten, it might be so small that it's going through our nets. But most likely, the majority of it is sinking into a place so deep that we don't really know what's going on down there.

Ben: This plastic is pollution but does it do anything more than that, than just sit in the water?

Emily: We are starting to see the way it impacts the food chain. It's very easy for fish, seabirds, marine mammals to mistake that plastic for food. They end up eating it and then they die of starvation because they've got so much plastic inside their stomach, they can't get any good nutrients inside and there's no way of them getting it out.

Just a couple of months ago I was in Hawaii doing a dissection of a sea turtle and we found seventy-eight pieces of plastic in one stomach and gut of the sea turtle. Just to give you an example of how much it's really impacting the marine life.

It's the same with birds, particularly the albatross, and then fish. So many of the fish we catch have it too.

So, it impacts them through entanglement, through starvation, but another potential impact that is still very under-researched is whether there's any human impact as well.

Ben: Before we go to human impact, presumably it's not just a case of it sitting in its stomach. It could affect them in some other way? I'm just guessing here.

Emily: Yes. And I guess that's the bit as well that's being more researched in humans. But trying to understand about plastic and the chemicals associated with plastics, so the phthalates that I mentioned earlier.

There are also chemicals like fluorinated compounds that make a plastic waterproof like the wet weather gear that we wear when we're sailing or our camping kit. There's other chemicals, brominated compounds that make things fire resistant. All really useful chemicals but when they end up as a pollutant in the marine environment, which so many of these chemicals eventually do because they get washed down our washing machines, down the drain and eventually make their way into the ocean, then they're a pollutant that can get back into organisms.

And the impact that they have, some of them are carcinogens that lead to cancer. Others are endocrine disruptors, so they mimic hormones and they prevent those hormones, important chemical messages, going from our brain to different parts of our body. They prevent them actually moving around our body.

Particularly for women during pregnancy, having hormones carry those messages while we're growing a child inside us is really, really vital. And the other thing I realise is the only way we actually get rid of these chemicals is when we give birth and when we breastfeed. We can actually pass them on to our children.

Ben: It's scary. The actual plastic, there's no good way of getting rid of it though, is there?

Emily: Not when it's in the ocean. Because it's so small and it's the same size as the marine life, the algae, the zooplankton, that fundamental basis of the marine food chain, it's so hard to extract one from another. So, trying to take out these five-trillion fragments of microplastic that are floating on the surface of the ocean...

Ben: But even on land. What's the solution?

Emily: The solution is to look as far upstream as we possibly can to prevent plastic getting into the sea or on land.

Ben: And then things are good? Or it just sits in a controlled area? Surely it can't really be contained. You don't know one-hundred percent, and that's it. When I started on this plastic journey over the last year since your talk, it was just realising, oh my goodness, this is everywhere. And some of the plastic we find in our bodies must be coming from the supermarkets first of all because all of our food is wrapped in plastic.

Emily: Absolutely. So, by getting to the source, I mean exactly that, actually getting away from plastic completely.

If you look at the spectrum from source to ocean, down at the bottom you're trying to clean it up. You're trying to control it. Then you're trying to prevent it getting in. But better still, the next stage is closing the loop. If we are using plastic, how can we make sure it gets recovered right at the point that it's finished its use so it can stay in a closed loop system?

But better still than that is just avoiding it completely. How can we switch to alternative products and really alternative systems that mean we can live life without plastic?

Ben: You mean the systems that used to exist sixty years ago!

Emily: Yes, a lot of it is looking back to how we used to do things, but also recognising that life has moved on. We've had massive urbanisation, we've had massive progress in expectations and the way we live our lives, so it needs to be a bit of a balance. Looking back to how we used to do things but also working out how we're going to manage to do that in the twenty-first century.

Ben: As someone who's been around this subject for a while, outside of the single use plastic sector, is there still justified use for plastic even if you wanted it around for twenty, thirty, fifty years, maybe longer?

Emily: I think a lot of it comes down to picking the right material depending on the function that you want it to have. And the great thing about plastic is that it's designed to last forever. So, if you want something to last forever, then it should be a good choice of material.

But it's thinking about doing it in a way so that when it does come to the end of its life, if you are using something you think maybe will be around for fifty years, thinking that plastic is still going to be there in fifty years' time and will have a lot more life left in it. So, how can I build this in a way where maybe you can take it apart at the end and it can be used for something else? And trying to avoid these composite materials that we use a lot of today that are different types of plastic all stuck together in a way that you couldn't then use it again.

Ben: You mentioned closed loop. What do you mean by that?

Emily: The most obvious example of closed loop is in Norway and Germany at the moment, they are doing bottle to bottle recycling.

Ninety-eight percent of their bottles are recycled in a closed loop system.

To make that work, you have to artificially inflate the value of the plastic by putting a financial deposit on it that you pay when you buy it which means there's much more incentive to bring it back in a good quality state by the person who's used it. And to do that, they have things like reverse vending machines. So, instead of putting your money in and getting your chocolate out, you put your bottle in and you get the money out.

They're in a lot of supermarkets now in Europe and potentially soon to be here in the UK.

Ben: But we've talked about fragmenting of plastic. What's to say that as plastic is used, that it's not fragmenting even if we can't see it?

Emily: Absolutely. That is definitely a concern. When you're drinking from a water bottle, are you more likely to get plastic in your body from that water bottle than you would be if you were drinking it from a glass? And some of the initial research shows probably yes.

That is certainly a health question. And the fact with that plastic, there are small amounts of it breaking down. Which is why the closed loop options are definitely worth exploring right now but they're still not at the very top of that source-to-ocean spectrum. Because avoiding plastic completely is ultimately where we want to go, especially for that type of use of bottle to bottle.

I think when it comes to things like building materials though, we just need to think intelligently about what we're using and think, if this is something that is going to be here for a very long time and it makes more sense to use plastic instead of some other material, for whatever reason, assessing the lifecycle analysis really of those materials, then we need to think carefully about how could it then be reused.

We so often design for the primary function but we don't design for end-of-life. And I think that's the ultimate message. We just need to think about what happens at the end.

Ben: A very good point. Are there good alternatives that just get shoved out of the way because plastic is easier?

Emily: Absolutely. It's easy and it's cheaper. And it's cheaper because we don't pay for the full cost of actually getting rid of the plastic at the end and turning it back into oil, that raw material. We just pay for

the use of it without any consequence of the impact; the financial impact it has on the environment as well.

I think that's really something to keep in mind.

Ben: What about recycling then? Let's say we have our plastic, and this is perhaps where I was a year or so back thinking I'm being really good here with everything going in for recycling. How effective is that?

Emily: At the moment globally, nine percent of the plastic that we use actually gets recycled. I was pretty shocked when I found out that number. I really thought it was higher. I think when we're at home in our kitchen and we're unloading our shopping, we feel like we're putting a lot in that recycling bin.

But the reality is, because of all of those different types that I mentioned earlier, only really types one and two, that PET and HDPE, get recycled here in the UK. Other places around the world, not even that. So, it's bearing in mind that the yoghurt pots and all of the other things in your shopping aren't getting recycled at all.

Then it's the contamination piece. If you have a toothbrush which is obviously made of plastic as well, there's no way that can be recycled because it's got four different types of plastic all stuck together.

That's one side of it. But the other side of it around recycling is that when you say the word 'recycling' you have this image in your mind of three arrows going around in a circle and it makes you think it's something that's going on and on forever. In reality, the recycling that we have, you're turning that bottle or that piece of PET packaging into a drainpipe or a bus shelter or a carpet. Something that can't then be turned into anything else after that. So, it's not this closed loop system. It's more like down-cycling rather than recycling.

I think that's one of the biggest misconceptions around recycling.

Ben: What have you done in your own life? I've heard you mention toothbrushes there. We now have bamboo toothbrushes. You're never one-hundred percent sure when you start making these changes what your impact is, but you hope it's in the right direction.

Emily: Yes. A bamboo toothbrush is a really great alternative, or even using a toothbrush where you can just switch out the head is a good step because instead of switching out the whole thing, it's a much smaller piece.

I think for me in my own life, there's all of the obvious things that I feel like we hear about every day. There's the coffee cup, the water bottle, having your own cutlery, a reusable bag, using beeswax wrap instead of clingfilm, all of those sorts of things. It's actually quite easy and fun to eliminate single use plastic from your daily life in that way.

The thing I struggle with the most is food packaging. It's really quite hard when you're on the go, you're busy, you're constantly shopping in different places because we all travel a lot and trying to feed yourself healthy food without plastic.

Ben: It complicates life. This is what happens. You start using a refill shop. We have food coming from various different sources now because that's a way of getting the packaging down. But then you have to be about five days ahead of yourself instead of just a couple, grabbing stuff from the local shop.

Emily: Exactly. It's the biggest challenge. But things are changing. We now have zero waste shops here in the UK which simply didn't exist five years ago.

Ben: That's what my wife is doing today. She's going to the opening of a local shop which is quite interesting because we've been using one that's half-an-hour away and you just think that you can only go there a couple of times a year or whatever. So, it's happening.

Emily: It is. And that's what it's going to take to get the change and bring those prices down.

So, we're heading in the right direction.

Ben: What are you doing then on your own personal journey? Because you're very much based at sea, organising people to go out and do research.

Emily: Absolutely. So, eXXpedition around the world, this year we set off for a two year circumnavigation of the planet to do scientific research. And the research is really around trying to pinpoint where the solutions lie.

We need to understand, of this microplastic soup out there which is very anonymous, really where is it coming from? Is it tyre dust coming from our cars? Is it polyester microfibres coming from our clothes when we put them in the washing machine? Is it nurdles, the preproduction pellets that haven't even been made into a product that's got into the consumer hands yet but is getting lost in

the supply chain? There's actually very little we know as to the make-up of that quarter-of-a-million tonnes floating on the surface.

That's a big part of what we're trying to find out because we really think it will pinpoint where the opportunities lie on land.

So, there's science. But the second of our three aims is storytelling. It's the fact that our ocean covers seventy percent of the planet and we spend so little time out there getting to know it, understanding the challenges it's facing, but also how beautiful, amazing and important the ocean is for our survival and life on land.

There are a lot of important messages that still need to get out to the general public from having eyes and access on the ocean.

Then the third is all around building this community. I certainly realise that there's not one way to solve this problem, but the good news is there are hundreds of things that we can do. We need different people working from different skillsets, different backgrounds and different countries, all doing their piece in solving the problem.

So, by taking these three-hundred women on the boat, it's really helping to build that army that we need to drive solutions.

Ben: Is this going the right way at the moment or is the problem just getting bigger?

Emily: The awareness side of things is definitely going the right way. The last couple of years here in the UK have been incredible in seeing the general public consciousness. That's had a massive knock-on effect to industry, because companies are really waking up and all wanting to do something about it. Even if they're not sure exactly what they should be doing yet, there's certainly a desire to do something.

The challenge we have now is turning all of that great awareness into action so that the ocean can feel the results. Because I crossed the Pacific again last summer, ten years on from that first time, and there was more plastic in the Pacific last summer than really actually any of my other expeditions. That was a little bit disheartening especially among all of this great energy around the issue.

But I don't think it's too late. I think we need to act now but I do think we can do it.

Ben: Is there a message for self-builders who are going to build their own homes? I imagine the single use plastics are mainly coming from things like packaging. There's so much packaging. Is there anything that they can contemplate whilst they go about their projects?

Emily: I completely agree. Packaging is the hardest bit of it. And it's tricky because if you are ordering materials that you're putting on a house that's going to last many decades, you don't want them to be damaged because that's even more wasteful. So, packaging is important but doing single use packaging that then is just going to get thrown away is not clever at all.

I think it's a case of working with the companies. Can you get on the phone to them and try and find a solution? Maybe they supply significant products to you, things that are coming in large orders that might come with large amounts of packaging. Can you work something out where they send it in something reusable, whether it's wrapped in blankets or whatever it might be, that you can then return to them? Can they drop it off and you can carefully be ready to take something out and send the rest back?

There is a conversation to be had and I think a lot of companies are open to it. It saves them money too if they get to take the packaging home with them and use it for another order that they're taking out. It's much easier than something like Amazon which is just firing out thousands a day when you come to more significant purchases on a building.

Then I think looking at reclaimed. There's so much material already out in the world. Simply when it comes to plastic, it's quite horrifying to think that every piece of plastic you've ever used in your entire life still exists on this planet. There's so much waste material. I appreciate you probably don't want to use waste food packaging on building a house but thinking broadly about the different places that we can get reclaimed materials is key.

Also, just thinking about the site itself. Are there materials already, whether it's something old that you're taking down or something that you're modifying, where you can really keep as much material on site as possible so you're not producing waste or importing new things.

Ben: If we wanted to take this subject further either with you, going on one of the expeditions, or just learn more about what we can be doing in the world of plastic in our own homes and perhaps also on a wider scale to keep on the backs of politicians, what do you suggest?

Emily: Certainly following along with eXXpedition – the website is exxpedition.com and it's on social media. Being part of that movement, absolutely.

We've also put together a platform called OceanChangeMakers.com which has got a whole pack of resources really for people to be able to take into their own lives, into their own homes, their own business and really look at what more they can do. That's packed full of resources on there to take things further.

But most of all, I would just encourage everybody to ask questions, realise that actually lots of other people around them are asking the same questions, and have these conversations. Whether it's your supplier who you're working with or some sort of waste that you're trying to deal with. Start talking about it because there are always ways to solve these problems.

Ben: Emily, thank you very much.

Emily: No problem.