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[00:00:00] **Yadvinder Malhi:** There's often much focus on what restoring nature can do in terms of carbon sequestration and carbon budgets. There's a role to play there, but I think the biggest role is maximizing adaptation to change, that we're already experiencing global warming. Our view of nature as something in flux, and how can we maximize those processes of flux and adaptation to help the natural world?

[00:00:21] So nature recovery isn't something that we just think about in the most pristine places. We think about it in the cities. We think about it in farming landscapes and all of those areas. It's about making things better rather than restoring to some baseline.

[00:00:38] **Nate Hagens:** Today I'm joined by ecologist and meteorologist Yadvinder Malhi, whose research challenges the conventional goal of nature conservation, protecting a pristine area beyond the human world in favor of nature recovery, which emphasizes adaptation and robustness in an irreversibly changing climate.

[00:01:02] Yadvinder Malhi is a British ecologist whose work focuses on biodiversity, ecosystem resilience, and restoration. Yadvinder is now a professor of ecosystem science at the University of Oxford, where he also leads the Ecosystems and Biodiversity Program and is a Jackson Senior Research Fellow at Oriel College.

[00:01:24] In this conversation, Yadvinder shares some of the most cutting-edge research practices aimed at studying how the flow of energy and species relationships shape and support the global ecosystems around our planet. He emphasizes that while we do need new tools and methods for nature recovery, what will move the needle the most is a shift towards viewing ourselves as a part of nature

and seeing the places we already inhabit as opportunities to foster biodiversity and a deeper relationship with the rest of life on Earth.

[00:02:01] Before we begin, if you enjoy this podcast, consider subscribing to it not only on YouTube, but on your favorite listening platform. We believe in making this content free and accessible to as many people as possible. Subscribing is one of the biggest ways you can support that. With that, please welcome Professor Yadvinder Malhi. Yadvinder Malhi, welcome to The Great Simplification.

[00:02:28] **Yadvinder Malhi:** Thank you.

[00:02:29] Great to see you.

[00:02:30] **Nate Hagens:** So you have spent a lot of time personally and professionally looking at forests in your career as places where enormous exchanges are constantly taking place between living things: the soil, the atmosphere, water, energy, all the ecological functioning in forest. Let me start here.

[00:02:56] When you began to measure and think about those ecological exchanges, what did you discover about what the forest is actually doing to and with the atmosphere above it, and was there anything surprising to you about that relationship?

[00:03:13] **Yadvinder Malhi:** My work in tropical forests in particular began after my PhD in my mid-20s, and I had a postdoc position to go to the Amazon rainforest and to work from a tower, put up sensors that measured the flows of carbon dioxide and energy in the Amazon rainforest.

[00:03:35] And this was at a time-- this was a new technology in the mid-1990s, and what we were trying to do is answer this question of whether the Amazon rainforest was absorbing carbon, ton of our carbon dioxide emissions from the atmosphere,

and therefore acting as a bit of a brake on climate change. And I went into this trained as a meteorologist, as a physicist.

[00:03:53] I wasn't an ecologist. And being in the Amazon rainforest, standing on this tower, living in Brazil, I was utterly bewitched by the forest beneath the tower. And so in terms of now that my original mission, both the tower and other measurements we did showed that the forest was absorbing carbon dioxide and was contributing to slowing down climate change.

[00:04:19] Actually, our technology proved to be not as reliable as all the forestry data that was around. So I got more and more interested in what the forest was doing in terms of trees growing and dying. And that was a real revelation to understand the richness of the processes that make a forest work. And so my mindset changed from now what I would say initially was quite an engineering mindset of saying, what does the forest do in terms of fluxes and equations, to being one that became much more interested in the complex ecosystem that was generating this net effect.

[00:04:52] **Nate Hagens:** So I actually don't know how back in the '90s or even state-of-the-art today, how do we actually measure the carbon dioxide uptake in forests? How does that actually mechanically happen?

[00:05:07] **Yadvinder Malhi:** This tower-based technology, what that does is there's a sensor called a sonic anemometer that measures the three-dimensional speed of wind several times a second, or it sends pulses of ultrasound in different directions.

[00:05:19] And if the ultrasound is going in the direction of the wind, the time between transmission and receiver is less than if it's going against it. So you can work out a three-dimensional wind field many times a second. And at the same time, an infrared sensor measures the concentration of carbon dioxide in that same pocket of air.

[00:05:37] And so you get this turbulent mixing of air, and you're constantly measuring the molecules of CO2 going up or down, or water vapor or whatever, second by second, and then you sum them up over the hour, over the day, and you get the breath of the whole forest over a day, and then do it over the seasons, and you get the breathing in in the summer, the breathing out in the winter, or depending on where you are.

[00:05:58] **Nate Hagens:** When I used to teach college in the ecology module, we always watched that video of the Earth breathing during the seasons. Oh, yes ... that was stunning. You know, it's interesting to hear the details of what you just said because a lot of people in the environment and ecology movement, I won't say are anti-technology, but they think technology is contributing to a lot of Earth's woes, and yet we're also using super cool advanced technology to measure Earth's flows in ecosystems.

[00:06:37] **Yadvinder Malhi:** In my experience, technology has both given us more information, so I think many of the things that we say about the sustainability of the Earth, how the Earth functions, how the Earth looks from space, all those things obviously are technology-dependent.

[00:06:50] So technology can sometimes distance us from the natural world, undoubtedly, but other times it can actually enhance our experience and our understanding of the natural world.

[00:07:00] **Nate Hagens:** It's downstream of our values and aspirations for sure. Yes. So you mentioned the Amazon, and in your work you paint a much richer and in-depth picture of ecosystems beyond carbon dioxide and the carbon issue.

[00:07:16] What do you think we in our culture or even in the environmental movement miss about the greater role of forests or any ecosystem when we reduce them primarily to their carbon value?

[00:07:33] **Yadvinder Malhi:** That's a great question. I think carbon can be a useful tool. So if it's a mechanism for getting more funds into protecting rainforests, restoring rainforests or other things, it certainly...

[00:07:45] We know we need all the tools we can find to do that and it is potentially a mechanism that gets more resources into forests. I think that the two dangers that I see, one is when that tool becomes a worldview and when we start seeing forests primarily for their carbon value, what they do.

[00:08:03] So it becomes essentially expansion of our accounting system, our capital accounting system to the richness and infinity of the natural world, and I think it can be a danger when it starts becoming the way we see nature rather than a tool that we use to protect nature. And the other one I think is a moral hazard as well, that if focusing on what forests do for carbon takes a little bit of a pressure and attention away from dealing with the fundamental problem, which is our greenhouse gas emissions, it can also be a danger that if people can say, "Oh, we love trees, and trees will solve all," so there's an implicit assumption that trees will save us somehow and we have to worry that little less about the fundamental problem which is greenhouse gas emissions.

[00:08:44] So I think that carbon should be used, but I think we should use it with caution as a tool. And I fear what has happened in ecology is that there is this, what I sometimes call the carbonization of ecology. That too much... I've got... I've started getting tired of papers or grant proposals starting with, "Rainforests are important because they absorb so much of our carbon."

[00:09:08] No, rainforests are important for so much, much more than that, and the carbon is just one little dimension of the multifaceted importance of any ecosystem.

[00:09:19] **Nate Hagens:** Give me a quick speed round of why else forests are important.

[00:09:24] **Yadvinder Malhi:** Well, in terms of the immediate climate benefit, one of the biggest ones that is much more poorly described is the great cycling of water.

[00:09:34] And so when water falls onto bare soil, it sinks into groundwater, goes into a river, and washes out to the ocean, so rainwater. When it falls onto a soil, the roots are able to tap that water that otherwise would sink beyond reach and cycle it back through the leaves to the atmosphere, and that generates more moisture and more rain.

[00:09:56] So when you think of something like the Amazon rainforest, as the winds come in from the Atlantic and cross the Amazon, there's three or four cycles of raining, the rainforest regenerating moisture, that raining out again, regenerating moisture as you go around. So to a significant extent, the rainforest builds the rain that builds the rainforest.

[00:10:17] It's a very reciprocal relationship.

[00:10:19] **Nate Hagens:** The biotic pump.

[00:10:21] **Yadvinder Malhi:** A biotic pump or that particular, yeah, version is one way of describing it, but I think there are many aspects linked to that. There's also cloudiness and reflectivity. But also I'd like to push beyond that. So there are many ways that rainforests can benefit us, and I think we should notice them.

[00:10:40] But I also push back against this entirely utilitarian view of nature as well, that we must protect nature because it does this for us, to actually say no, nature, the biosphere is far more old and wondrous and mysterious than our young species, and it has an inherent right to persist and exist.

[00:11:02] So if you... It's like if you were justifying looking after your mother, saying, "Well, I need to look after my mother 'cause she cooks dinner for me in the evening,"

and she did that. Yes. Or do you actually say, "No, my mother has an intrinsic right because I love her and she's nurtured me on this planet"?

[00:11:16] **Nate Hagens:** So I have tons of questions for you, but let me just double-click on something you said in passing. Can forests save us?

[00:11:26] **Yadvinder Malhi:** Forests can help us, but they certainly can't save us on their own. So forests have this ability to absorb carbon dioxide to respond to change as they've done on geological time.

[00:11:37] But the amount of carbon dioxide in particular that we're flooding into the atmosphere swamps the capacity of the biosphere to be able to respond and absorb that. And so what we find now is, for example, rainforests absorb around 15% of our greenhouse gas emissions. So they're making a difference.

[00:11:56] The rate of climate change would be faster without what rainforests are doing. But they're not a game changer.

[00:12:03] **Nate Hagens:** Unless it's a wide boundary saving, which is we come to respect and value Earth's trees and forests and prioritize maintaining and growing them, not only for carbon, but like you just said about the intrinsic right of the mother.

[00:12:23] You know, forests could be an anchor for our value systems, at least that's how I feel. Although we're maybe far away from that tipping point.

[00:12:34] **Yadvinder Malhi:** Absolutely. I think where, again, these mechanisms like carbon can help support us in our deeper values or shifting our deeper values around them.

[00:12:46] So where they can help that, I think that that's a real positive. The danger is that we do reduce them primarily to that very utilitarian value of carbon accounting as a primary value of the forest.

[00:12:58] **Nate Hagens:** Is that switching? I mean, I get that. But is that switching in the ecology movement? Are we moving further away from carbon tunnel vision or is that still pretty prominent?

[00:13:11] **Yadvinder Malhi:** It is switching. I think the prevailing narrative has become richer, and it depends what you mean with the ecology movement. I think it's everything from field ecologists who understand the richness of a rainforest to people who come from other aspects of finance markets, et cetera. And the danger is that the language that an ecologist takes as nuance, this is a new tool, not a worldview, gets translated into an account of financial accounting that doesn't have any of that nuance.

[00:13:38] So it isn't just what ecologists think about forests that matters, it's how the language that ecologists use permeates through into wider society.

[00:13:47] **Nate Hagens:** So if an ecosystem is in constant state of exchange with the atmosphere, that means that changes in climate and land are also feeding back into that ecosystem's ability to function.

[00:14:02] So after many decades of observing ecosystems and how they respond to things like drought and warming and other disturbances, what have you-- what were some of the key learnings about the resilience of these systems, especially when it comes to large scale changes in Earth's atmosphere?

[00:14:21] **Yadvinder Malhi:** This is an ongoing process that we have been studying this for decades, but there's always more to learn.

[00:14:26] I'd say one thing we've learnt is there's a difference between the resilience of species and the resilience of ecosystems. And so what you can find is that particular species or types of plant or animal are vulnerable to change, but the ecosystem as a whole then shifts in its composition, and so the forest persists even though the community within the forest has changed over time.

[00:14:48] And then different groups of species change in different ways. I've just come back from a workshop we had in Peru where we've been studying this gradient going from the lowland Amazon to the high Andes, and looking at how species are responding and moving up slope in response to climate change.

[00:15:05] And what we're seeing is quite interesting. The trees aren't moving. And we've seen this across the Amazon as well. Individual trees, of course, don't move, but over generations, trees move. They disperse seeds, and the seeds could be moving up slope and you'd have the distribution of species moving.

[00:15:22] But what we find is that the timescale is very slow for that. But while at the same time, the insects, the birds, the mammals are moving because they can move. And so what you're getting is new communities developing where the insects or the animals are no longer at the same state, they... the same relationships they were having with the host trees that they were having a century ago.

[00:15:44] **Nate Hagens:** So that, in the short term, sounds kinda cool, but I can't help but wonder what happens when there's no more slope to go up.

[00:15:54] **Yadvinder Malhi:** Yes, and I think this is certainly once you get to those mountains in the short term certainly seem to be refugia. And we see this in the paleoclimate as well, that times between the ice ages and interglacials are times when climate is changing rapidly.

[00:16:09] Mountains with all their different angles and aspects and microclimates and different elevations often tend to be where species take refuge during times of change. And then they spill out of there during times that are more stable. So the Andes, for example, have been this huge refuge.

[00:16:27] The challenge, of course, is when the change is so extreme that you get to the top of the mountain and then it becomes an isolated island, and then there is risk of extinction.

[00:16:36] **Nate Hagens:** Yeah, though, so that makes sense. So there's archeological, historical evidence that mountainous regions were the pockets of where the diversity retreated to, and then later when environmental conditions change, it spread out from there.

[00:16:54] **Yadvinder Malhi:** Yes. Yeah. So for example, in the ice ages, when the Amazon was five degrees cooler, we see species that are now only found in the Andes Mountains spread out across the Amazon. And then as we came out of the ice age, those species migrated into refugia in the mountains.

[00:17:11] **Nate Hagens:** Yeah. Oh, if it weren't for the meta-crisis, I would've loved to have been a biologist or ecologist.

[00:17:18] I've never been to the Amazon, and I imagine you've had some just amazing experiences.

[00:17:23] **Yadvinder Malhi:** I love all ecosystems, but there's something about the scale of the Amazon. And for all the loss and challenges that we need to deal with, it's still 80% there. It's a forest the size of a continent, and the sense of immense living biosphere you get when you live there is, or when you visit there, is just astonishing.

[00:17:43] **Nate Hagens:** When's the last time you were there?

[00:17:45] **Yadvinder Malhi:** Two weeks ago.

[00:17:46] **Nate Hagens:** Oh. And give me a colorful story on that trip or any trip- Okay ... about some animal or a plant or anything that- Okay ... that struck you.

[00:17:59] **Yadvinder Malhi:** Well, this is a site in Manu National Park, which is in southeastern Peru in the southwest of the Amazon.

[00:18:05] And this is probably the most biodiverse national park on Earth. It holds one-ninth of all bird species on the planet, just one national park. What? It's astonishing. And part of the reason is that it has this-- it's a mixture of mountains and lowland forests, so it's got all that diversity.

[00:18:23] It's got that refugia that the Andes create, so it's an astonishing level of diversity. And then we... There was two days' journey by boat to get to a field station called Cocha Cashu, which is seminal in ecology. In the 1970s, an ecologist called John Terborgh set up a field station there and for his field research, and it was a place where we...

[00:18:46] This has a hyper abundance of animals. It's super productive. It's, have got historically very low hunting pressure, even from indigenous peoples. And so the canopy is literally dripping in monkeys. I've never seen a sight like this. You look up, and there's hundreds of monkeys of 10 different species just roaming through the canopy.

[00:19:05] It was breathtaking. And this is where John Terborgh and others showed how monkeys most of the fruiting trees in the canopy, most of the canopy is, consists of fruits that are eaten by monkeys, and the monkeys eat the fruit and then

disperse the seeds. And so the trees clearly support the monkeys, but in the end, the monkeys end up shaping the rainforest.

[00:19:28] So showing this two-way interaction that animals simply aren't passive recipients of what plants give them, they actually end up shaping the forest, and it's a mutual relationship between plant and monkey that shapes that. So it was wonderful to have those lessons in ecology in this seminal place, but also this hyperabundant place where nature was just dripping from the canopy.

[00:19:53] **Nate Hagens:** I've been to the cloud forests in Ecuador on a bird banding Earthwatch trip, and I've been to Africa many times. But I've never been to the Amazon, and I just wonder, when you're in London and in this office, do you crave to be in a forest when you're sitting there in a university building or how is that?

[00:20:13] **Yadvinder Malhi:** Absolutely. I would... I love the stuff I do at university. It's very thrilling and stimulating, but I find a trip to the forest is like a deep recharge of the soul. It both just emotionally, spiritually, but also it reminds me of why I do what I do, that immense love and appreciation of the natural world.

[00:20:35] And so throughout my career, I've managed to keep quite a strong fieldwork program going when obviously sometimes the admin pressures and other pressures and family and everything would... That tends to make you curtail that. And I think it's made, it's shaped a lot of who I am and who I continue to be is this constant recharge in the forest.

[00:20:56] And as well as the tropical forest, just outside of Oxford, we have this wonderful woodland called Wytham Woods, which has also been seminal in ecology. It's been studied since the 1950s, and that's only a few miles away from my house. So that's my local refuge, but also a place where I train students, work out field methods that we may apply elsewhere later on.

[00:21:18] So that's my local little therapy when I can't get far away.

[00:21:22] **Nate Hagens:** Excellent. So I understand that your more recent work is increasingly concerned with the question of how do we as a culture, move from diagnosing ecological decline towards actually achieving nature recovery at scale? And when you use the term nature recovery, what exactly are we trying to recover?

[00:21:46] **Yadvinder Malhi:** Yeah. That's a good, great question. And something that colleagues in Brazil had often said in a supportive way, but sometimes critically, like you're working there on the rainforest, and yet you're coming from one of the most deforested landscapes on Earth. And your country arguably got wealthy through deforestation.

[00:22:06] And in Brazil we have the right for the same. I think the argument is flawed for many reasons, but it did make me think we should all... As well as this international work, we should look at what we can do in local landscapes in Britain, but also more widely in Europe and other regions.

[00:22:23] So I was lucky enough to– that I came together into setting up a large center and getting a funder for the Leverhulme Centre for Nature Recovery, which I direct. And one of the things that we looked at is what do we mean by nature recovery? And that was an interesting question in itself, because partially I liked the term because it was quite an umbrella term.

[00:22:44] It wasn't specific. It wasn't rewilding or regenerative farming or conservation. It was all of those things put together. And partially I think it allowed us to be a bit more systemic. So, you know, yes, we can think about practical things. Do you plant trees or do you have natural regeneration?

[00:23:02] Do you change your farming systems? But also can we look at some of the more fundamental things? What is up with our value system that we continue to

have a world where the natural world is degrading even while perhaps the human world gets prosperous in some areas as well. And so can we look at more also at our fundamental value systems as well as the more practical tools?

[00:23:26] So we try and... It's, this center is across the university, so it brings in lots of different departments and divisions, and goes from everything from the very practical, the very policy-oriented, all the way through to exploring and questioning and seeing how we can nudge our value systems. And so we also came up with a definition of nature recovery after a little discussion, and that is helping life on Earth to thrive by repairing human relationships with the rest of the natural world.

[00:23:54] **Nate Hagens:** I'll sign up for that.

[00:23:56] **Yadvinder Malhi:** There's a few- it breaks out a few things. Helping life on Earth to thrive. It's all about direction of travel, so nature recovery isn't something that we just think about in the most pristine places. We think about it in the cities, we think about it in farming landscapes and all of those areas.

[00:24:10] It's about making things better rather than restoring to some baseline. And then it's all about relationship, and not just our individual relationship, but our societal and economic relationship with the world, and it's about the rest of the natural world. So one thing we push back against is this dichotomy of humans being here and nature being out there somewhere.

[00:24:29] We are embedded in nature. We emerge from nature. We are part of the natural world, and we have to make our peace with the rest of the natural world.

[00:24:38] **Nate Hagens:** So you mentioned the monkeys and the fruit earlier, but what have you discovered? What is the role of biodiversity playing in nature recovery and restoring already degraded ecosystems?

[00:24:52] **Yadvinder Malhi:** It can play a huge role. One of the most obvious ones is where, if you've got farms or abandoned farms that you're trying to restore back to natural vegetation, you have much more success where there's a rich animal community there. And the main mechanism is through the dispersers, the birds dispersing seeds, the animals dispersing fruit, but also the way that they disturb the soil, the wild pigs, they may be disturbing the soil.

[00:25:22] Even the rodents that may be bringing in fungi that are labeled mycorrhizal fungi to build up in the soil through their poop. And so all of those processes, the more you have, not... It's not just biodiversity of one group, like in plants, but the more you have a rich ecosystem with all those interactions, the more likely you are to be able to rebuild an ecosystem in a degraded area or more rapidly as well.

[00:25:48] **Nate Hagens:** Yeah, I think that's something we feel but we miss a lot of times. I mean, just imagine a segment of the Amazon that had the entire canopy, and the trees were doing the ecological function of creating clouds and cycling the water in their roots. But imagine there were no birds or animals or insects in that forest.

[00:26:15] I don't think it would remain for long, right?

[00:26:20] **Yadvinder Malhi:** Yes. Yeah. I think there has been a dichotomy in our thinking that when we think about what are called ecosystem services, we tend to think about the plants, the trees absorbing carbon, cycling water. And the animals we think of as biodiversity and conservation, so we go and see the monkeys because they're...

[00:26:36] or the birds because they're charismatic. And what we don't often do enough is connect those two, and actually those birds and monkeys aren't just being pretty, they're actually shaping that ecosystem in the long term as well. So having

this, I particularly call it ecosystem lens helps a lot in thinking about how to do this well.

[00:26:57] **Nate Hagens:** You don't know this about me, but 20 years ago I was getting my PhD at the Gund Institute for Ecological Economics, where I originally had my aversion to the term ecosystem services, because services to me just implies an anthropocentric view. I prefer, like, ecosystem functionality or something like that.

[00:27:22] **Yadvinder Malhi:** Yeah, I tend to agree, yeah, that I think the concept of ecosystem services has helped getting some of these ideas of forest protecting catchments, et cetera, through. But again, instinctively, I... it gives us the idea of nature being in service to humanity, as it's a very... it lacks humility in my perspective.

[00:27:43] **Nate Hagens:** So let's go in the absolute opposite direction of that. Many people in this space believe the idea that nature will recover if it's just simply left alone by humans and that that course would be the best path forward for nature recovery. And based on your research, do you agree with this idea, and do you have any examples that lead you to believe one way or the other?

[00:28:09] **Yadvinder Malhi:** I can give you examples both ways. I think on average, we tend to not appreciate how often nature can recover. And so I think so, for example, with restoration, there's a huge focus on tree planting where often just letting that forest grow back, it may be a slower process, it may be a messier process, but you end up with a richer and more resilient ecosystem at the end of it.

[00:28:34] When you plant trees, firstly, you know, there's a nice thing 'cause there's a number you can report, a thousand trees planted that day, and that's, that helps you fill off, tick your spreadsheet. But you may get a faster growth overall, but you

often end up having a system more likely to fail 'cause it hasn't got the richness and connections that natural recovery does.

[00:28:55] So certainly I think there are many cases where the intervention is unnecessary in terms of ecology. It's purely other social factors that push it forward. On the other hand, I think there are ecosystems that have been so pushed into an alternative state that it would take a lot to get them on a pathway to recovery.

[00:29:14] And an example I can give is we've been doing some work on tropical islands where we look at the impact that invasive rats have had on ecosystem function, and then coconut plantings. So if you go to many islands that you may think of as idyllic, so one island we work on is Tetiaroa, which is Marlon Brando's previous private atoll north of Tahiti, and it's superficially it's beautiful.

[00:29:40] It's your archetypal tropical paradise. But until recently it was full of invasive rats that came in with European sailors and little smaller rats with the early Polynesians. And also it had been converted into a palm plantation or coconut plantation for copra in the early 20th century.

[00:30:00] And those plantations had been abandoned, but the ecosystem had been locked into an alternative state where the coconut palms were dominating the native forest, and the rats were eating all the seabird eggs, and so the seabirds couldn't come back, and they bring nutrients that help fertilize the native forest in their poop.

[00:30:22] And so the system was locked into an alternative state. And so in that case, actually eradicating the rats and then ultimately even removing some of the coconut palms helps the natural system get back onto a trajectory of recovery. So there are some cases where human effects in the past have been so severe that it takes severe intervention to get natural processes to play out.

[00:30:47] **Nate Hagens:** So humans coordinated in the example of that island. I'm curious how you see this idea of nature recovery intersecting with larger scale human coordination. What aspects of responding to global heating and ecological breakdown do you see as requiring coordinated intervention at national or even global scales?

[00:31:13] **Yadvinder Malhi:** In terms of the natural world, the living world, I think one-- there's often much focus on what restoring nature can do in terms of carbon sequestration and carbon budgets.

[00:31:24] That's a role to play there. But I think the biggest role is maximizing adaptation to change, that we're already experiencing global warming. Whatever pathway we go on, we're going to experience more global warming. What are the types of ecosystems that are most resilient and most...

[00:31:40] What are the landscapes that are resilient to that change? And landscapes that are connected, where there's bridges of connectivity between... Rather than the pockets of protected areas in fragments, we need things that are more connected. Personally, I think we need to be a bit more relaxed about what belongs and what doesn't belong in terms of these ideas of nativeness.

[00:32:01] I think in a changing climate, we've got to allow for species to come in to help with migration, to build those processes. So I think a view of nature as something in flux and how can we maximize those processes of flux and adaptation to help the natural world cope with change more.

[00:32:21] **Nate Hagens:** So let me preface this with putting you on the spot question. This isn't your expertise, but in your mind, in your scientific mind, you have probably an implied normal distribution of different global heating scenarios for the next fifty years or so. What's kind of the midpoint of that range?

[00:32:44] Where are we gonna eventually reach in terms of Celsius above pre-industrial?

[00:32:50] **Yadvinder Malhi:** I'd say I'm relatively optimist. I'd say around two point five degrees.

[00:32:54] **Nate Hagens:** Okay. Well, that will be terrible, but that is relatively optimistic.

[00:32:58] **Yadvinder Malhi:** Yes. Yeah. I think it's the optimistic end of realistic.

[00:33:01] **Nate Hagens:** Building on two and a half degrees as an optimistic case, let me ask you this. There are a lot of people working on nature recovery in the world, and they go to an ecosystem and say that, "Here's what we should do coordinated."

[00:33:17] But how many people are looking two or three steps ahead at this is what this ecosystem might look like under a two and a half to 2.75 Celsius scenario by 2050, and we have to use your example, look further up the mountain to see, to imagine how this might change. In other words, both in lots of other work, but in your work, are we chasing a moving target?

[00:33:46] And are you and your colleagues looking, anticipating where the warming is gonna be, and how do we respond ahead of that?

[00:33:55] **Yadvinder Malhi:** Yes. I think there's a fair bit of work that does now begin to look at these scenarios. And just very locally, I know the Forestry Commission in England, when they're thinking about tree planting, they're thinking of varieties that maybe genetically come from Southern Europe, for example, as being better adapted to when those trees mature in a few decades rather than British genetic varieties.

[00:34:21] So there is thinking around that. I would say it's patchy in places. There's certain policy areas that are, that is there. I think our conservation movement overall, at least in Europe, I'm less familiar with North America, still thinks in terms of protecting species in situ in protected areas rather than thinking about their migration and connectivity and how they're going to, and whether we need new species to come in to replace the ones that are declining in those areas.

[00:34:52] **Nate Hagens:** But do you think that's important as a scientist who knows we're headed to a warmer world and who understands ecosystem functionality and the movement of species, shouldn't there be... Like I talk about advanced policy, which is the economic social policies that are too unpleasant today, but we're going to need them in the future, so we should start creating blueprints and policies.

[00:35:19] Doesn't the same thing apply to advanced nature recovery? What do you think?

[00:35:27] **Yadvinder Malhi:** I think it does. There are various things in place that do try and address that and think about. I know the UK Environment Agency and others does try and think about those. Perhaps it's almost a more public cultural mindset.

[00:35:43] I think there's almost a certain sense of this new way of thinking of nature, of process and function and change doesn't sit comfortably with–

[00:35:50] **Nate Hagens:** Hmm ...

[00:35:50] **Yadvinder Malhi:** the way the conservation movement thought of nature in the '70s and '80s when it was really birthed, which was about by protecting things and having areas where these species can persist away from our interference, they'll do fine.

[00:36:03] And so I don't... At least in my experience, I think policy is grasping this to some extent, but I think public perception perhaps lags behind that. And partially it's perhaps almost a denial to not want to admit defeat to the climate change that's already with us. I mean, we've experienced, we had the driest summer in 200 years–

[00:36:24] **Nate Hagens:** But I do think culturally the people that you and I hang with are, have emotionally processed this already, but it's a really stark and depressing statement to say, "This is the warmest year of my life, and statistically speaking, it's likely to be one of the coolest of the rest of my life."

[00:36:48] **Yadvinder Malhi:** Mm-hmm.

[00:36:48] **Nate Hagens:** That's a heavy sentence.

[00:36:49] **Yadvinder Malhi:** Yes. Yes.

[00:36:51] **Nate Hagens:** Yeah. So what kinds of responses do you think in your experience might be better generated by communities responding in their local specific ecological and social conditions, and what would that look like in practice?

[00:37:08] **Yadvinder Malhi:** Well, one of the nice things I think with the focus on nature recovery is that you can have, you can have agency at a very local level.

[00:37:18] I think one of the challenges that we face with climate change and tackling climate change is there's a real sense of disempowerment. So you can vote for politicians, you can do something about your personal footprint, but there's nothing... It's very hard to see tangible changes in front of you from what you've done.

[00:37:35] But the nice thing about biodiversity recovery is you could do something in your garden, you can do something in your community area, might band together

with neighbors in your school or workplace, and you see tangible changes to biodiversity. And if they're scaled up over, they become nationally significant.

[00:37:54] So I think community-based nature recovery is a significant part. It's not the only thing. We do need the top-down support and all of that coming through as well. But it's important both because it creates mosaics of heterogeneity where ecologically are valuable. Different people doing different things at different intensities is better than a monoculture of something coming through.

[00:38:16] But also I think it does a huge thing for sense of agency and nature connection, and I think part of our problem is also increasing disconnection from the natural world and the sense of purpose that connection, being connected to the natural world brings.

[00:38:33] **Nate Hagens:** Yeah, so even if the proximate outcome of local restoration doesn't do that much, the ultimate of getting humans together to coordinate together on something that they value locally in the natural world, that could be even more important.

[00:38:51] **Yadvinder Malhi:** Yes. Yeah. I don't know, I wouldn't call it a value shift, but it's a retention of values that are there buried within many people. But the prevailing circumstances or the narratives of society often don't allow those values to come out and be expressed.

[00:39:06] **Nate Hagens:** Let me ask you this, Yadvinder, because you're of...

[00:39:09] even though you live in the UK, you're of Indian origin. I had never been to India until a couple years ago, and in my mind, my naive mind, over a billion people in a country a third the geographic size of the United States. And I was just thinking there can't really be an environmental ethic there because there's just so much population and consumption.

[00:39:36] But there is, in the tribes in the foothills and in the conversations, there's an incredible reverence for nature there. Do you wanna speak about that? Do you have any thoughts on that?

[00:39:52] **Yadvinder Malhi:** Yeah. Yes, I was in India earlier this year, so thinking very much about these topics, and we actually have a paper led by an Indian colleague in review, where firstly globally, we look at the coexistence of large animal wildlife and human populations, the grid by grid for the entire planet.

[00:40:10] And there's some interesting patterns globally, but the biggest pattern is that South Asia just stands out, glows red. The abundance of large animal wildlife living with people, not just India, Sri Lanka, Bangladesh, Nepal. There's a wider area. And so as in our paper, we explored this question a little bit of what's going on, and I was thinking, I was talking to people, I was in this landscape in Coorg, in the Western Ghats of India where you've got quite dense populations.

[00:40:41] You've got coffee plantations, smallholders, and yet in that landscape, there's tigers and elephants roaming, not in the protected areas, but in the fields. And so what's going on? Now what allows this coexistence? And I think there's two things. One, there undoubtedly there is a top-down element as well.

[00:40:57] There's Indian government's Project Tiger and other things as well. So there is a top-down element. But I think in parallel to that, there is still a deep intrinsic respect and reverence for the more-than-human world, and that's built in, I think partially into historical South Asian philosophy and culture.

[00:41:19] And so whatever the current religion, I think it's all built into the mentality of different communities there. And you see it, you know, if you wander around, you'll see a little tiger shrine in a village or an elephant shrine or something, so that there's a certain embodiment of respect.

[00:41:36] And it doesn't mean that this is harmonious. There's human wildlife conflict. Elephant and tigers kill cattle. Occasionally they kill... Well, tigers or elephants occasionally kill people. So it isn't this benign equilibrium. But there's also an acceptance that actually despite all of these tensions, those organisms have a right to coexist with us rather than we need to eliminate them or put them away in distant parks where they can't bother anyone, that they're our fellow beings on the Earth.

[00:42:10] So I think there's much... That's a particular cultural circumstance, but I think there's much to learn from those values that I think we need to try and permeate more widely. So in Europe, and particularly in Britain, there's one of the controversies we have is about the reintroduction of the wolf, which is spread across Europe.

[00:42:30] **Nate Hagens:** There are wolves in England?

[00:42:31] **Yadvinder Malhi:** No, there aren't, but there's sort of a debate about reintroducing wolves–

[00:42:34] **Nate Hagens:** Oh, yeah ...

[00:42:34] **Yadvinder Malhi:** in Scotland in particular. And there is space for them, but I think the, because it's an island, is the only way. They can't just walk across. Somebody would have to reintroduce them. And I think that creates a very contentious debate.

[00:42:48] Lots of culture wars around that as well. But I think, you know, part of the comes from thinking about that Indian mindset is that and if we expect East Africans to coexist with wildlife, Indians to coexist with tigers and elephants, why is it that, oh, in Britain we can't have the wolf?

[00:43:05] **Nate Hagens:** Well, I'm just trying to imagine the local town where I live here in Minnesota if we had a shrine to deer or a bear or something.

[00:43:14] It's, I mean, I guess we do. It's called the Elks Club, but it's not a shrine in the sense. Yes.

[00:43:19] **Yadvinder Malhi:** Yeah.

[00:43:20] **Nate Hagens:** So getting back to what we were saying, what do you think the central challenge is to coordinating human responses across local and large scales? What's the big barrier today?

[00:43:34] **Yadvinder Malhi:** I think we need everything from the international architecture to give us a guide, so a lodestar of where we're trying to get, and the Convention on Biological Diversity and other things attempt to do that.

[00:43:47] And sometimes there's cynicism about this international process, whether it's climate change or biodiversity, and it's just a talking shop and nothing gets achieved. I think that international architecture is really, really important. And then we need national governments to then come up with national policies that align with that wider international architecture.

[00:44:07] So the one example in biodiversity is that the Convention on Biological Diversity has set this target of 30% of all terrestrial and marine areas protected by 2030, which is being achieved to various degrees by different countries. But if we didn't have that target at all, we'd be achieving less.

[00:44:25] So I think it provides an architecture. Then we need national governments to try and align with that. And then-- But that can provide incentives and finance and ways of incentivizing farmers and others to do different things. But then also we need the bottom-up will, but also then support for that bottom-up will.

[00:44:46] So the finance mechanisms and other things that enable local communities to get together to explore these. So there are different high levels of the hierarchy, and then ultimately I think there's also a value system, the stories we tell about the natural world. This isn't just something nice to have.

[00:45:02] These are the webs of life that hold everything together, and if we start destroying them too much, we destroy our future as well.

[00:45:10] **Nate Hagens:** Yeah, that's where the conversation is and should be heading, but it needs to go faster. So I know you wear many hats at Oxford and have PhD students and such.

[00:45:22] Do you teach, like, general undergrad and grad students as well?

[00:45:27] **Yadvinder Malhi:** I teach grad students now.

[00:45:28] **Nate Hagens:** Like, what do you teach? What is the name of one of your classes?

[00:45:31] **Yadvinder Malhi:** So the master's ... I teach on a couple of master's courses. One is called Biodiversity Conservation and Nature Recovery, and another one's called Environmental Change and Policy.

[00:45:40] **Nate Hagens:** And how do you see the students, the young humans coming into those classes versus 10 years ago? Do you notice a change in their temperament and such?

[00:45:53] **Yadvinder Malhi:** One thing I'd say is I've constantly inspired, and I always have been, and that's one of the pleasures I think of being a– Yeah ...

[00:45:59] professor at university is the constant injection of youthful enthusiasm and belief that you can make a change in the world. And so that, it's a real pleasure just to have that interaction-

[00:46:12] **Nate Hagens:** No, I understand and agree ...

[00:46:12] **Yadvinder Malhi:** year on year. And I'd say some things have changed. I think, at least in my perspective, I think there was this peak of anxiety-driven concerns around 2018, 2019. What I see now, at least in my students, is now a more enthusiastic can-do, let's get on and make a difference attitude.

[00:46:39] And maybe that also reflects how we redesigned the course to be much more about rolling up your sleeves and what can we do in the world rather than documenting the state of the world.

[00:46:49] **Nate Hagens:** So the science that you and I attempt to understand and communicate is extremely interconnected, but the people researching it tend to be distributed across different countries and universities and disciplines and even cultures, which presents kind of a paradoxical challenge.

[00:47:12] So what are some of the qualities that you think allow a cohesive scientific network to actually function across all those divides?

[00:47:23] **Yadvinder Malhi:** There's been a critique in ecology in the last few decades of something called parachute science, of the old model where if you had some cool new technology, you could go and collect some samples in a remote tropical forest, go away, maybe acknowledge your local host as a-- in the acknowledgments, and go and get on with your career.

[00:47:44] I think that's increasingly seen as unacceptable as a way to do international ecological science. I think all science overall, that it's got to be about a

mutual sharing of capacity. And it isn't capacity building because actually many of the people in the tropical countries have huge amounts of capacity.

[00:48:02] It's often the opportunities to share that capacity is part of that challenge. So I think it-- an important part is going in with humility. I think not going in and saying, "Oh, as a European or North American scientist, we know how to code, and we've got the best statistical tools and some new cool new technology.

[00:48:21] Let us collect some data and show you how we do it, and then, you know, we will publish something." I think it's much more about let's mutually learn together about this system. And tropical ecology, I think, is interestingly at the forefront of this because all the interesting stuff is in the tropics.

[00:48:39] That's by definition, but also that's where most of biodiversity, so much ecological function is. A disproportionate amount of the funding is still in the north, the global north. And so how do you deal with that disequilibrium? And I think these longer-term projects, I think, are a big part of that.

[00:48:58] I think humility, the training workshops are important. One thing I've really enjoyed in this process is often once we've trained up students in one area, then sending them to train up students in another area. So one example, we did a lot of our early work was in Peru, and our students in Cusco at the universities there were phenomenal, really hardworking, really focused, and often coming from very underprivileged backgrounds, rural, small villages, didn't even speak Spanish until they were 16.

[00:49:29] There were indigenous languages, Quechua and others they were speaking. They got exposed to this international science, developed some really nice pieces and projects from that, and then a few of them I was able to send to the Congo to train Congolese students or to Borneo and train Malaysian students.

[00:49:46] And that, as well as that worked on so many levels. It broke the pattern that it was always wealthy northern universities that came and worked there. Actually, these were people like them, but from other parts of the world that they had no experience of. And I think for the ones doing the training, it also gave them a sense of their abilities and capacity and their ability to contribute.

[00:50:09] So I think just trying to shift away from this model that everything flows from the North to the South in terms of funding and training capacity, that you could actually build these much richer networks amongst the countries of the tropics.

[00:50:25] **Nate Hagens:** So you've also seen large scale coordination from another angle through your work in leadership roles with institutions like the British Ecological Society.

[00:50:38] I think you were president-

[00:50:39] **Yadvinder Malhi:** I was president, yeah ...

[00:50:40] **Nate Hagens:** you were. And then your Leverhulme Centre for Nature Recovery. What have your experiences in institutional leadership taught you about the difference between just understanding a problem or a scientific viewpoint and actually getting a group of people to act on that understanding?

[00:50:59] **Yadvinder Malhi:** I think what we've learnt is that it's a multi-level process. There's always many fronts you have to do. There's no single solution. But one thing is to very quickly learn is to get away from this model of science where you say, "We do the science, we collect the information, we provide it to the stakeholder or the policy maker, and say, 'Here's the science, go and do something with it.'"

[00:51:21] And then you get frustrated when the policy maker doesn't do it, because there's mutual incomprehension. You have not understood all of the multiple

constraints on the policy maker, the multiple factors coming in. And I think a far healthier way is to co-evolve with the-- you know, make allies, whether it's in media or in policy and others, and work together, develop a relationship, be constantly supporting each other.

[00:51:48] So when the-- when a journalist has a question, you respond, but when you have a little idea forming, you form an early conversation before it's even a result that you disseminate, and similarly with policymakers and stakeholders of other sorts. So I think it's more about realizing these are webs of relationship rather than science being a source of information for the wider-- the, that you collect and you step back from, and the wider world acts on.

[00:52:14] **Nate Hagens:** So I used to think we had an information deficit, and I definitely no longer believe that. The information is out there. So in your opinion, where do you think the translation from ecological knowledge and science and awareness to societal action most typically breaks down? What's the biggest disconnect there?

[00:52:39] **Yadvinder Malhi:** Soft power often comes in. So, you know, wildlife documentaries. And as you probably know, David Attenborough is our closest thing to a god in the UK.

[00:52:50] **Nate Hagens:** Have you met him?

[00:52:51] **Yadvinder Malhi:** A few times, yes. Yeah.

[00:52:53] **Nate Hagens:** Yeah.

[00:52:53] **Yadvinder Malhi:** And of course, the reverence or the soft power he has been hugely influential in the entire nature narrative in the UK.

[00:53:03] He's 100 years old now. He's wonderful. We love him. We need others to also translate across different dimensions of that. I think another important is, it's slightly cliché, but I think it is important, is schools and the education system, and to learn ecology not just as a couple of PowerPoint lectures that prepare you for exams, but is something that is genuinely immersive and connects people to the natural world, even if it's just a few weeds growing in the schoolyard, something that actually connects people to the living world.

[00:53:38] **Nate Hagens:** I don't know the school system in the UK or anywhere really, but how important do you think it would be to start teaching ecology in third grade, in grade school? And... 'Cause many people that took my class at the University of Minnesota at college had never had an ecology class until they got to university.

[00:54:03] So how important is it to start talking about the interconnectedness of trees to the soil, to the water system... before you're 10 years old?

[00:54:15] **Yadvinder Malhi:** My experience, at least with my two children who are both young adults now, was that actually until 10 there's a fair bit of this in– Oh ... in the curricula.

[00:54:22] The problem I see is between 10 and 16 or 10 and 18– Ah, yeah ... where once you start getting into the exam preparation mindset, everything gets geared around exam performance rather than experiential learning. And so I saw the ecology my kids were taught, and it was very much, "You need to learn this about rainforests and these checkboxes to be able to pass the test."

[00:54:44] And also there was very little experiential– Yeah ... learning of actually going out. I think things are changing. One of my hats is I'm on the board of the Natural History Museum of London, and one thing they've created is what's called a National Education Nature Park, where they're trying to get most schools and

kindergartens of England to have a plan for increasing nature in their parks, bringing nature into different elements of the curriculum, and have it experiential.

[00:55:15] So growing, doing a little bit of restoration on your school grounds, doing butterfly counts and things like that. And as a small step, but I think that's the sort of thing that you need. You don't... If ecology is just cramming a few facts for an exam, that's not ecology. That, no. And I think it's natural history.

[00:55:33] It's reverence for the world around you, and recognizing yourself as part of this living world. That's the value system that I think we need to make sure kids get a chance to absorb.

[00:55:44] **Nate Hagens:** I agree. So you have spent your career learning, documenting how living systems coordinate themselves, the exchanges within a forest, and as well as the networks of scientists studying ecosystems and the institutions trying to restore them.

[00:56:01] And after everything you've learned about forests and ecosystems and people, what do you really think humanity most needs to understand differently about our place within the living world?

[00:56:14] **Yadvinder Malhi:** I think we need all the information, we need the science, we need the policy. All of those things are important, but I think we need to spread as wide as possible that our starting point is emotional love and affection and humility for the natural world.

[00:56:29] It sounds simple, but it's also incredibly difficult. So as a starting point to recognize that we live inside this amazing and astonishing living thing. We know that intellectually. How often do we know that emotionally? I think you and I, from our training and other things, maybe amongst a subset that do, but I think the majority of people living in urban societies now don't get the chance to know that emotionally.

[00:56:57] And I think the more we can find different ways of that being the starting point for your value system, your morality, and then you go from that to policy and science and all the other things.

[00:57:07] **Nate Hagens:** Yeah. No, I think that's right. I just wonder how a life ethic and a recent guest, Charles Eisenstein, referred to it as a feeling of inter-being.

[00:57:22] I think it's innate in us as humans from way back, and our culture is suppressing it. I think there is some fundamental tether to the natural world, and it's just not been allowed to be expressed in our culture. Well, do you have any thoughts on that?

[00:57:41] **Yadvinder Malhi:** No, I think you're right, and I think often because the untethering, often the language to be able to express it isn't easy to access.

[00:57:50] So people may feel something when they see a sunset or walk in a forest, but articulating what they're feeling, understanding what they're feeling, contextualizing what they're feeling, all those things often have been lost in our vocabulary. And so the-- it's our job, not just as scientists, but as writers and musicians and other areas, I think is partially to help point the way with some of the language that could help in that process.

[00:58:19] **Nate Hagens:** So what are the most alive research questions for you today?

[00:58:24] Like, what is one or two things about the natural world that you're super curious about and wanna understand and learn that is relevant to human futures?

[00:58:35] **Yadvinder Malhi:** Well, one thing I've been focusing on for the last three years is ideas of energy flow in nature. So this is an old idea in ecosystem ecology.

[00:58:44] It goes back to the 1940s overall, and then seeing ecosystems as flows of energy and nutrients, the metabolism of ecosystems. And these ideas have been around a bit, but through the last few years we've been doing work showing that using this, looking at ecosystems and the flows of energy through plants and animals can be a useful way of understanding the health and functionality of ecosystems, and not just the total amount of energy, but how it spreads through.

[00:59:11] And, so I've been... Sometimes I use this term vibrancy to describe this flow and spread of energy in an ecosystem. I'd explore it-- I'm curious in exploring it in various levels. One is just describing it in different ecosystems and understanding what the patterns are. Why is there more energy flow in birds in this forest and less in this forest, and what does that tell us?

[00:59:32] But I think beyond that, I'd be interested in exploring, A, does this give us a new lens to look at nature and nature recovery in a changing world where we're looking at the vibrancy of nature, which still is not necessarily the same thing as the pristineness of nature, that there can be many human-modified systems that are full of vibrant processes.

[00:59:53] And then can that help us give another instinctive way into this thing that we were talking about, this way of understanding the inherent vibrancy of the living world. So I'm exploring it as a scientist, but I'm also exploring it with colleagues and artists and others as an emotional register as well.

[01:00:14] **Nate Hagens:** So you're talking about trophic cascades and how the energy from the sun comes into the plants, and then someone eats the plants, and then someone eats that, and you measure where that's going and what the scale is of it?

[01:00:27] **Yadvinder Malhi:** Essentially, and then how it feeds back. So it's coming back to the spider monkeys in Peru again, which we've described in a few places.

[01:00:35] Some of the work that we did has showed that actually things like rewilding or smallholder agriculture could often maintain and rebuild those energy flows far faster than they can rebuild biodiversity. And so for some metrics, when we're thinking about ecosystems changing under climate change, maybe thinking about energy and nutrient flows, not at the expense of biodiversity, I think there's still value in biodiversity.

[01:01:02] It's not an either/or, but I think it can give us an additional lens to think about how we work with nature to flourish and respond.

[01:01:09] **Nate Hagens:** If you have a few more minutes, I have some closing questions I ask all of my guests. For people aware of the global more-than-human predicament, what some call the metacrisis or polycrisis, do you have any personal advice to the viewers being alive at this time?

[01:01:30] **Yadvinder Malhi:** At a personal level, to rebuild that connection, to give yourself time. Sometimes when you're seen as a warrior, an environmental warrior in this meta crisis, you don't give yourself enough time for that immersion. You're too busy going from deadline to grant proposal to conference to whatever.

[01:01:48] So make sure that connects, that thread to the living world is there in your life and is maintained. And I think that partially is for wellbeing, but I think it's partially for just replenishing your philosophy week by week, day by day. So I think that's that personal advice. And then, you know, one question I'm frequently asked, and we touched today I think with the climate question earlier, is, are you an optimist or a pessimist?

[01:02:13] I always say I'm an optimist because optimist to me, it's a state of action rather than a state of being. It's about being clear-eyed about the state of the world and then rolling up your sleeves and saying, "What can we do given the state of the world?" And when you do that, you actually find there's lots of quite interesting

stories underneath the meta narrative of crisis, of recovery and growth and connection and community.

[01:02:37] But it's not an excuse for complacency. It's being aware of the state of the world and then saying, "What can I do?" And when you do that, you find lots of other people are saying the same, and that actually there's more agency in the world than you realize.

[01:02:52] **Nate Hagens:** Not everyone is as blessed with the natural optimistic temperament that you have.

[01:02:56] I bet you were like this when you were 10.

[01:02:58] **Yadvinder Malhi:** I probably. It's partially physiological, I'm sure.

[01:03:04] **Nate Hagens:** So you're a professor and you have young humans in your classes. How would you change that advice for people in their teens and twenties who become aware of the economic and environmental constraints to our situation?

[01:03:18] **Yadvinder Malhi:** Something I do with my class all the time, I think it is laying down the facts of the situation, but building a narrative around that is aspirational rather than one that is, we're going to fall off a cliff unless we do something. There is an importance for the worst case scenarios and the alarm, isn't it?

[01:03:37] But I think there's also space for saying, well, given this, what's the better world that we can create, and how do we go from here to there to start creating that? And I think partially it's true, you could say for wellbeing, but I think it's actually fundamentally true.

[01:03:52] It's not something I'm saying just to make them feel better. I think there are many paths forward as well as challenges. And one... And I'll mention actually a different project that we have at a very different level. We've been working with the UN Human Development Report over the last year, which produces the Human Development Index, this index of how countries are doing in terms of education and longevity and health.

[01:04:18] Which has, for a single metric, has quite a lot of influence. It is, it's not perfect, but many countries care about the Human Development Index. So we've been working with them to come up with a nature relationship index that tries to measure a country's relationship to nature. And the first-- we had a paper about this last year, but the first version of this will go into this year's Human Development Report that'll come out from the UN in December.

[01:04:43] And what this tries to do, and it's problematic, and it's going to get some backlash 'cause it's hard to measure something for every country in the world. But what it tries to do is create this aspirational narrative and a measure of it as how countries can improve their relationship with the rest of the natural world in terms of protected areas, in terms of urban green spaces, in terms of their biodiversity consumption patterns and footprint.

[01:05:09] So there's a measure that can be used there. With the idea of not saying, "This is a boundary. If you drop here, you're, we're all doomed." It's saying, "Well, actually, how can we make this relationship better?"

[01:05:20] **Nate Hagens:** You are a busy guy.

[01:05:22] **Yadvinder Malhi:** I think I probably am, yes.

[01:05:25] **Nate Hagens:** What do you care most about in the world, Yadvinder?

[01:05:32] **Yadvinder Malhi:** Care most around the more-than-human world that we're embedded in. I care about people and humans immensely, but I care about the abused more-than-human world and how we get it through what I see as a bottleneck. I think the challenges we're facing in the late 2030 or 21st century are challenges that we can get through, but how do we maintain a thriving and functioning more-than-human world in that process, in that bottleneck of our blindsidedness to get over?

[01:06:07] **Nate Hagens:** So I co-wrote a book with one of the original co-founders of Greenpeace, and the title is The Bottlenecks of the 21st Century, and that is the ethos throughout the book is exactly what you just said. Let me ask you this: Paint me a picture of the forests and the ecosystems of the world 25 years from now, 50 years from now, where the warming in the pipeline manifests, but we avoid the worst case and result in two and a half degrees Celsius, but we have stability and institutional support.

[01:06:47] Paint me a picture of what the world looks like from a scientific, ecologist, physicist, and all your background. What's possible? What might that look like?

[01:06:57] **Yadvinder Malhi:** I have a figure I did for a paper a few years ago that exactly captures this idea, and I think what it is firstly recognizing what isn't the same, that those forests have changed, those ecosystems have changed, because of two and a half degrees of warming, because of some invasive species, of other factors.

[01:07:13] There's no returning to whatever our baseline is, whether it's the 18th century or a thousand years ago or ten thousand years ago. With the natural world is shifted and changed, but it's still thriving and vibrant and rich in ecological process. So what that means is that the intact areas, such as a bit of the Amazon, have been protected and preserved, but areas that were strongly affected by people, where

they're marginal to the food system, they've been allowed to recover back into some semi-natural state, full of ecological function, even if the biodiversity is different from what it was before.

[01:07:52] And we have a thriving and flourishing human population that isn't somehow separated from nature, so we haven't got mega cities of people and then national parks outside. We have an interweaving of the two, so the cities are also full of thriving green spaces, green corridors, urban ecosystems that maintain that connection.

[01:08:16] So we have everything from altered but thriving protected areas, regenerating areas full of multiple functions, and food systems that can support that and maintain that, and then urban areas that also are interwoven with the more-than-human world.

[01:08:35] **Nate Hagens:** If you could wave a magic wand and there was no personal recourse to your decision, what is one thing you would do to improve the odds of us arriving at that future?

[01:08:45] **Yadvinder Malhi:** I would go back to what we talked about earlier with schools and education, that if we could actually get deep ecological thinking, experiential ecological thinking into every class in the world, so it became part of people's core understanding of their place on this planet, I think that would help a lot in moving towards that vision.

[01:09:07] **Nate Hagens:** We don't actually need a magic wand for that one.

[01:09:11] **Yadvinder Malhi:** No, we don't. No. No.

[01:09:12] **Nate Hagens:** Yeah. So do you have any closing comments for people watching and listening who resonate and agree with what you've laid out today?

[01:09:21] **Yadvinder Malhi:** I would say, again, going back to our message of hope, is the meta narrative can be gloomy, but within that there are so many cases of agency and hope of things changing.

[01:09:32] So I think find those sources of hope and agency and work with them, and never feel disempowered, to feel that there's always somewhere that you can find power. But then also power everything with your own love for the more-than-human world, the natural world.

[01:09:49] **Nate Hagens:** Well said. Yadvinder Malhi, thank you so much for your time today and for your work and passion on these important issues.

[01:09:57] And I know that you're gonna make a difference. You can't help, but with your enthusiasm and knowledge, so thank you.

[01:10:07] **Yadvinder Malhi:** Thank you very much, Nate. It's been a real pleasure talking to you.

[01:10:09] **Nate Hagens:** If you'd like to learn more about this episode, please visit thegreatsimplification.com for references and show notes.

[01:10:17] From there, you can also join our Hylo community and subscribe to our Substack newsletter. This show is hosted by me, Nate Hagens, edited by No Troublemakers Media, and produced by Misty Stinnett and Lizzy Sirianni. Our production team also includes Leslie Batt-Lutz, Brady Heyen, Julia Maxwell, Gabriella Sleiman, and Grace Brunfelt.

[01:10:41] Thank you for listening, and we'll see you on the next episode.