

## **Yale Talk: Conversations with Peter Salovey**

*Episode 28: Providing solutions to climate change*

*Guest: Indy Burke, Carl W. Knobloch, Jr. Dean of the School of the Environment*

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### FULL TRANSCRIPT

**Peter Salovey:** Hello, everyone. I'm Peter Salovey and welcome to Yale Talk. Today, we're observing Earth Day, a global event dedicated to environmental protection. Around the world, melting ice caps, accelerating extinction rates, and rising temperatures point to a grave and growing emergency. Last month, for instance, East Antarctica experienced its first-ever ice shelf collapse amid a historic heat wave. A recent U.N. assessment cautioned that one million plant and animal species are at risk of extinction. And the new IPCC report has again revealed the risk of rising temperatures: it says the world faces unavoidable multiple climate hazards over the next two decades with global warming of 1.5 degrees Celsius. Human-accelerated environmental change is clear. It presents one of the greatest challenges of the 21st century, and the vast scope of these threats requires solutions that match their scale and complexity. Here with us to discuss the climate crisis is Indy Burke, the Carl W. Knobloch, Jr. Dean at the Yale School of the Environment. Indy is also a professor of ecosystem ecology, and her research interests focus on carbon and nitrogen cycling in dry land ecosystems. Indy, thank you so much for joining me.

**Indy Burke:** Happy to be here.

**Peter Salovey:** So let's start with the IPCC—that's the Intergovernmental Panel on Climate Change report that I just referenced—it talks about a rapidly closing window to secure a livable and sustainable future (that's their language). And although near-term actions can't eliminate all projected hazards to humans and ecosystems, the report affirms that effective adaptation strategies can reduce risks. So to what extent do you believe the climate crisis can still be mitigated?

**Indy Burke:** Well, it's a great question. And actually, there was another IPCC report that came out on April 4th that focuses on mitigation of climate change. And they make it quite clear that we're emitting more and more greenhouse gases, and we're by no means on track to meet the Paris Accord to stay below one and a half degrees centigrade—unless we accelerate mitigation efforts by 2025. And if we want to keep temperatures below two degrees centigrade, which scientists think is a real tipping point, we need to accelerate mitigation by 2030. These greenhouse gas emissions have increased in every sector. So if we're going to think about mitigation, we need to think about where mitigating is most important. And currently, in order of importance, those are: energy supply, industry, land use, transportation, and buildings. So the question you just asked is whether we can reduce emissions in each of those sectors. As the situation is urgent, we have to use every tool we have. And I'm going to assert that I do think it's possible. And the report does have some optimism in it because of human ingenuity and

innovation. And we have knowledge in so many disciplines, but we'll have to focus on low-emission technologies, increasing efficiencies, policies that support their implementation (which is one of the major barriers right now)—and quickly, so that we can have deep, rapid, and sustained emissions reductions. We'll need smart energy management through artificial intelligence and sensors, and we'll need to engage in carbon dioxide removal from the atmosphere, either through natural solutions or through industrial solutions. So I think we have some effective mitigation strategies in places we can work, and we have great people at Yale who are working in these areas. Professor Karen Seto, who actually led one of the chapters in this report that came out on mitigation, has stated that urban areas have the most opportunities because of the concentration of individuals, the rate at which cities are being built, and all the opportunities to better design green infrastructures.

**Peter Salovey:** It's both cities on the emissions side, but also on the mitigation side.

**Indy Burke:** Yes. And there are other opportunities. We have economists such as Ken Gillingham working on “how do you provide economic and behavioral incentives to accelerate renewable energy?” We have policy experts and economists such as Bill Nordhaus and Matt Kotchen create solutions about carbon taxes and estimating how much those should be: pricing carbon to represent the social cost. We have engineers, such as Julie Zimmerman, working on using algae as a renewable energy source. We have chemists, such as Gary Brudvig and Paul Anastas, working on using carbon as a feedstock. We have ecologists working in coastal systems and working in tropical forests. And really, the gap exists in taking the solutions we have either in hand, or nearly to be developed, and implementing them at scale. Much of that requires political will.

**Peter Salovey:** And of course, there's sometimes a gap between what we know is the right thing to do, public support for it, and therefore political will. And maybe a little later in our discussion, we can talk about climate change communication. Before we do that, though, the IPCC also talks about the need to have a strategy that involves every region around the globe: cities—yes; but also rural areas, and of course, the developing world. At one level, everyone around the world is aware that environmental degradation is a shared threat. We all suffer for it. But vulnerability to climate hazards differs substantially among regions. So where there is inequality, where there's conflict, where economies are still in early stages of development, it may be harder to do things like pass regulation around food security, and around health, and around clean water. What do you do in these regions of the world, these very vulnerable regions where you have fewer tools, and yet they need to be protected?

**Indy Burke:** Yeah, I think we need to think about it from a global action point of view, because it's global action that influences, for instance, island nations. So we have to keep in mind the well-being of individuals across the planet. One of our first alumni, Aldo Leopold, wrote a great deal about the intimate connections between health of people and health of the environment. And he promoted this idea that if you invest in the environment and take care of the environment, it will take care of you. But the problem is this geographic distribution, and the problem that lower

income communities are suffering more from climate change. So a big part of our policies needs to consider how we can improve living standards for all people so that the environment can improve well-being for all of those individuals.

**Peter Salovey:** Yeah. So last year a group of Yale faculty, and I think some students too, were at COP26. And you talked about, in the wake of that conference, your desire to see a renewed emphasis on what universities can contribute as drivers of solution-based science. And earlier in our conversation, you were ticking off the names of faculty, from all parts of the university, who are contributing their knowledge and their research. So when you think about universities, perhaps our university, perhaps our campus-wide Planetary Solutions Project and the centrality of the School of the Environment in that, do you think we can move quickly enough in knowledge creation in research to make a difference?

**Indy Burke:** I do. I think there are some things that we have to pay special attention to with our partnerships. There's a lot written about this "valley of death."

**Peter Salovey:** Comes out of the drug discovery world. They would talk about the gap between the basic research and the early science, and then the actual ability to commercialize something for humans. And so many candidates for therapeutics die in that 'valley of death' between the two. And I hadn't realized there's also a 'valley of death' in environmental science.

**Indy Burke:** Absolutely. So we need to be conducting problem-focused science.

**Peter Salovey:** It's that same valley between the basic research and the applied.

**Indy Burke:** That's right. And in order to do that, we need to, in some cases, understand what the problem is ahead of time. But in others, be listening to individuals who are working in the environment, who are in industry, who are in business, who are in government, who can bring us problems. And then we need to partner with them, because if we develop solutions, they need to be implemented. And the first and most important way to get them implemented is to have partnerships so they can be brought to market at an accelerated rate, and at scale. But I also think we need to disseminate knowledge. And we need to do a really good job at that, from technical solutions to policy solutions, and get in there and make sure that businesses hear us, industry can hear us, governments can hear us. And then regarding climate change communication, the public understands not only the problem, but also the solution, so that they can enact, through their democratic will, the implementation. And then the third part is training leaders who not only understand the science—and I don't mean just natural science, I mean social science as well—but can also be nimble thinkers because the problems of the environment tomorrow, I guarantee you, will not be the same as they are today. So they have to be nimble thinkers and problem solvers who can learn and adapt as the planet changes.

**Peter Salovey:** And of course, a professional school like the School of the Environment, sure, it's hosting research. And sure, there is a group of students who are receiving a graduate

education designed for them to become researchers themselves. But, there is also a huge group of students who are going to leave the school when they graduate, and they're going to be policymakers, they're going to be thought leaders, they're going to be influencers. Maybe they're going to be teachers themselves, who knows? And for all of them to have the kind of education that you provide really is an investment in the education of future leaders. You know, that's what Yale's always been all about, and seems really important in this area.

**Indy Burke:** And they're from all over the world. And I think that's really important, too. So the students go home to Peru, Bhutan, Iceland. Those are all places where we have leaders in the ministries of the environment that came from Yale.

**Peter Salovey:** And closer to home, as well.

**Indy Burke:** Yes, that's right.

**Peter Salovey:** As I mentioned, we have something at Yale called the Planetary Solutions Project, which is an attempt to bring the full weight of our expertise campus-wide to bear on the global environmental crisis and to do that through research, to do that through education, to do that through our own practices on campus. How do we model being a greener campus? And that Planetary Solutions Project emerged as one of the top five priorities when we were discussing our science strategy a couple of years ago. One part of Planetary Solutions has been the Center for Natural Carbon Capture, which was funded by a \$100 million gift from FedEx. And I'm wondering if you could talk a little bit about what that center's goals are, and what the thinking was behind the creation of a center focused on natural carbon capture.

**Indy Burke:** Sure, I'd love to. This has been something I've been focusing a lot of attention on.

**Peter Salovey:** I would imagine you're worried about it.

**Indy Burke:** So, at Yale, as you know, we were fortunate to have two of the lead thinkers in global carbon cycle back in the fifties and sixties, and that was G. Evelyn Hutchinson, who was in the ecology department, and Robert Berner, who was then in the geology department. And so we have this real legacy of thinking about global carbon cycling. The center builds on this legacy of work in these areas, and we have three areas. The first is biological solutions, using the process of photosynthesis, which is the fastest carbon pump on the planet. And we know a lot about how tropical forests are this crazy important biological pump. But many of the tropical forests have been cut down. So there are lots of opportunities in restoring tropical forests that have been degraded. There are opportunities in restoring wetlands that have been degraded, and coastal areas that have been degraded, and in building up land use that can increase photosynthesis. So there's opportunities there, but they're limited in the fact that there's only so much carbon biology can store. And, there's photosynthesis that's balanced by respiration on the other side—which is all the heterotrophs like you and I, wandering around, burning up our carbon and reducing it back as CO<sub>2</sub>. So there's the other opportunity, which is geological. And

the geological cycle is slow, really slow. But the biggest pools of carbon on the planet are present in carbonate rocks, and they occur through this very slow process of weathering, where carbon dioxide dissolves in water, reacts with minerals, and then becomes carbonate rocks, which can be stored for millions and millions of years. So we're really interested in how we can speed that up. And we have leaders in the Earth and Planetary Sciences Department working on ways to do that. And then finally, the idea is to use industrial processes to mimic biological and geological processes to capture CO<sub>2</sub> from the atmosphere and turn it into product. And that would either be fuels, or plastics, or other kind of carbon-fiber products, even cement, that can be stored on the planet for a long time. So the gift allows us to expand our research in those areas, and hopefully bring science to solutions at a rapid rate.

**Peter Salovey:** Fred Smith (he's the CEO of FedEx and a Yale College graduate), he told me that his goal would ultimately be to figure out enough ways to provide natural carbon capture to entirely offset the carbon emitted by the aviation industry as a whole. FedEx—relying on airplanes to deliver packages—so, of course he is very concerned. I think it's a great goal, and it sets our sights high, and I like thinking about it that way.

**Indy Burke:** Yeah, it's a challenge—that's a gigaton of carbon per year. But we're hopeful that we can do that.

**Peter Salovey:** I loved your discussion of photosynthesis because it's not just how can we create a lot more photosynthesis and take carbon out of the atmosphere. It's also, how can we mimic photosynthesis as a producer of fuel, as a producer of energy? There's environmental science there. There's chemistry there. It's a fascinating area. And I know our Energy Sciences Institute is working on this issue as well, from the energy side as opposed to the carbon mitigation side.

**Indy Burke:** Yeah, you sort of pushed my favorite chemistry button there. CO<sub>2</sub> is the lowest energy form of carbon. And so when plants take it out of the atmosphere and turn into carbon, carbon bonds in plants, it requires the input of energy. And in that case, it's light. So the trick is figuring out how to do that with other sources of energy that aren't producing greenhouse gases as a consequence.

**Peter Salovey:** It's a fascinating area of research and we represent it well across a couple of different departments at Yale. We've been talking about science, and science is incredibly important in combating the climate crisis, but it's only part of the equation. Political commitment, public will is so important. And in my field, which is social psychology, we talk a lot about how sensitive people are to the way in which information they received is framed in terms of benefits they'll receive if they take a certain action, or risks that can occur if they don't take action. And there's lots of different ways to frame a message. And political will depends on public support, largely. And I wonder whether you'd be willing to say a few words about the Yale Program on Climate Change Communication because of the important way in which they're filling the gap in our ability to connect the science to public support, to political will for change. It seems that communication is the pivotal variable in all this.

**Indy Burke:** Yeah, I'm so proud to house the Yale Program on Climate Change Communication because when people say, "what can Yale do over a ten-year period?" That's my go-to for answering the question. Because of this gap in knowledge, that program asks questions about what do people currently understand? What are their values, and how can you best communicate with people about the science, given their frame of reference? So whether it's southern Georgia or New York City, what does their community give them in terms of cultural biases that allow us to communicate with them in the appropriate way? And I think it's just been fantastic. Among the things that the Yale Program in Climate Change Communication does is identify who in communities are the trusted source of information. And one of the things they've found is that meteorologists are really trusted by local communities. And so they run training programs and workshops for meteorologists about how to talk about weather events in the context of climate change as one important axis, for instance, of communicating with individuals in the U.S. They're hoping to expand their program across the globe. So they're surveying attitudes and perspectives about climate change in much of the rest of the world, and are finding that as many as a billion people on the planet have never heard of climate change. So there's a real opportunity to expand our program, expand the understanding, and public will for addressing climate change.

**Peter Salovey:** And that's Professor Tony Leiserowitz, right, who is doing this work? And he's in your school.

**Indy Burke:** That's right. And he was recognized by Reuters as being the second most impactful climate scientist in the world.

**Peter Salovey:** Wow. That's a fantastic recognition. I did want to ask you about another program in your school, and that's the Yale Center for Business and the Environment. Maybe you could talk a little bit about that center, and their survey that shows that business students around the globe believe that businesses should play a key role in addressing environmental and social issues. And more than half of the respondents—these are business school students everywhere, not just Yale—said, "I would accept a lower salary if it meant the ability to work with a sustainability-forward employer." So I was interested in your own thoughts about the Yale Center for Business and the Environment, their surveying work, and then, how does the Yale School of the Environment prepare leaders for the business world?

**Indy Burke:** Great question. Yeah. I mean, I think everybody recognizes that policy development is limited by the pace of government in a very divided society today. But businesses are much more agile and nimble. And this generation, and the millennials that were probably surveyed for this, care so much about climate change that they're anxious to make a difference. And they see business as the path for them to invest their time and hearts and careers to help make a difference for the future. So it really shows up clearly in that survey. We have a large number of applicants who apply to specialize in business and the environment. We have a joint degree with the School of Management, but we also have a specialization within our school for the Master's of Environmental Management in Business and the Environment, and the Center

for Business and the Environment sits in the middle and serves these students, and they advise the students from both management and environment, and they do lots and lots of programming. They provide ideation workshops with businesses who come to ask, "How can I solve my problem?" And they're not interested in going to consultants sometime because consultants give them answers they can predict, but our students give them crazy, wonderful, creative answers that they're more interested in hearing about. And we get internships for our students with businesses. It really provides fantastic programming for students with an interest in business and the environment.

**Peter Salovey:** And the students that you're describing—many of them are in a dual-degree program, is that correct? That's doing both a master's degree in the School of the Environment, and an MBA from the School of Management.

**Indy Burke:** Yep, that's right.

**Peter Salovey:** And that would be one of the things that the School of the Environment does especially well. You seem to collaborate with other professional schools at Yale, and add a sustainability environmental aspect to whatever it is students might be studying elsewhere. So architecture and sustainable building practices, or as we just discussed, business and sustainability. And maybe say a few words about joint degrees and the pivotal role of the school in them.

**Indy Burke:** Yeah, it's wonderful because the students who are in joint degrees bring us enormous value in the classroom, and to our faculty. We also have a joint degree with Divinity. So students who are interested in religion and the environment.

**Peter Salovey:** First course on ecology I ever took—I think I was 11 or 12 years old—and it was in Hebrew school. It was a course on ecology and the Bible.

**Indy Burke:** Is that right?

**Peter Salovey:** And it was all about practices that were in Old Testament scripture that have an environmental consequence. And the discussion was always about what did they know back then that we could learn from? Everything from crop rotation to leaving fields fallow. But I had never thought about it since that there could be a really strong connection.

**Indy Burke:** Yeah, we have an annual conference that the students put on in that area. We actually have a new joint degree with engineering, a masters in environmental engineering.

**Peter Salovey:** And of course the School of Engineering has a department called environmental engineering with some real expertise from Professor Elimelech and his colleagues on water purification, for example, and many other environmental issues that they're looking to technology as the solution to address them. And so it's a natural fit.

**Indy Burke:** We'd love to recruit some students into that program.

**Peter Salovey:** That would be great. If there are students listening to this podcast who might be interested in the interface between a school of the environment, environmental sustainability and a school of engineering like environmental engineering, we hope maybe you will apply at Yale. Indy, any other issues that you want to talk about with respect to your school and with it being Earth Day.

**Indy Burke:** I think that Yale is just so well positioned to lead in this area. If we don't start mitigating climate change quickly by 2025, we're in rough shape. And I look forward to Planetary Solutions helping us harness the energy to do that.

**Peter Salovey:** I am confident that this will be a successful project, being university-wide, and with your own experiences and deep roots in this field, you're the natural leader of an effort that needs the collaboration of multiple sectors in order to effect change. Your whole career has been working across those kinds of boundaries. Indi, I would like to thank you for providing such an insightful perspective on a pressing issue of our time. You were appointed as dean of the School of the Environment in 2016, and reappointed to your second term last March, and your remarkable leadership in the role has forged a more sustainable future for all of us. Of course, the climate crisis presents unprecedented challenges, but it has also revealed anew the promise of global research universities. When I walk around campus, I'm filled with hope. Yale is a place of ingenuity, where students and scholars advance the frontiers of knowledge. Our work to safeguard our planet is a down payment on what we owe future generations. And I, for one, am optimistic—optimistic that we will make good on our obligation.

To friends and members of the Yale community, thank you for joining me for Yale Talk. Until our next conversation, best wishes and take care.

The theme music "Butterflies and Bees" is composed by Yale Professor of music and director of university bands Thomas C. Duffy and is performed by the Yale Concert Band.