



Season Three: Episode Two
CRISPR, Dodo Birds, Woolly Mammoths, & Gene Editing
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[Mux: CEZ_CEZ_4486_01801_Secret_Laboratory_APM-02]

Hillary Ribaud: So, Luke, we all learned about extinct animals when we were growing up. And I remember I was obsessed with the movie series, *The Land Before Time* and *Little Foot*. He was an apatosaurus—you know the ones with the really long necks?

Luke Charest: Oh yeah. I love dinosaurs. My favorite was the velociraptor.

Hillary: And of course, science fiction has taken advantage of scientific developments to imagine scenarios where we bring back creatures that are long gone from the face of the earth, like in *Jurassic Park*.

[Mux: PRM_PRM_0285_00101_Immersive_Vision_APM.0-11]

Luke: Okay, let me read a passage.

Luke - Jurassic Park: “...*Genetics is a bit complicated, but you're probably wondering where our dinosaur DNA comes from.*”

Hillary: You're listening to a segment from the 1990 book that inspired the movie. It was written by Michael Crichton.

Luke - Jurassic Park: “...*We need the entire dinosaur DNA strand in order to clone. And we get it here. He held up one of the yellow stones—from amber—the fossilized resin of prehistoric tree sap.*”

[Music theme APM_APMC_0166_04501_L_Is_A_Strong_Word_Rhythm_Mix_APM]

Hillary: Well, dinosaurs are not being cloned today but a company called Colossal Biosciences is actually working on bringing back the woolly mammoth —or at least a similar animal.

Luke: And they are doing it because Mammoths could unlock an old ecosystem to help us battle climate change.

Hillary: I'm Hillary Ribaldo

Luke: And I'm Luke Charest

Hillary: And this is Unseen Upside by Cambridge Associates, where we explore investments beyond the returns.

Luke: This whole season Hillary and I are talking to innovators and investors that are helping to bring what once was thought as science fiction into the real world.

Hillary: And in this episode, what it takes to de-extinct a species —well, sort of... stay with us...

[End Mux Theme]

Act I - BIODIVERSITY, EXTINCTION AND DE-EXTINCTION

[Underwater sounds]

[Mux:STR_STR_0022_00301_Deep_Ocean_Dream_APM-03]

Tom Chi: When I would swim on the reef, I would always snorkel. And if you just listened, then you could hear so many layers of things. There is like a shimmering sound, which is actually these huge schools a fish that were moving and eating and doing their thing.

Hillary: Tom Chi is the founder and managing partner of At One Ventures, a venture capital firm that invested in Colossal. Before beginning his career as an investor, Tom worked for a number of the top tech firms, like Google X, also known as The Moonshot Factory and now simply referred to as X, Google's semi-secret research and development facility. He also worked for Microsoft and Yahoo.

Tom: I was this kind of hotshot executive. I was running a large team by my late twenties at Yahoo helping to run a multi-billion-dollar business across 44 countries. And I did the kind of cliché thing of buying a second home in Hawaii. As fate would have it, that home was like a two-minute walk from the front door to an astounding coral reef.

Luke: Coral reefs are stunning and vibrant underwater ecosystems. You might have seen these multicolored plant-like structures attached to rocks in tropical ocean waters. Well, they are actually made up of thousands of tiny animals called coral “polyps”. These invertebrates are related to jellyfish. As they grow, they connect to one another creating colonies. And as colonies grow, they build coral reefs that can be hundreds of miles long, providing space for other animals to thrive.

Tom: To this day still the most beautiful thing I've ever seen with my own eyes. And I built a really close relationship with that reef over the course of five, six years

Hillary: Coral reefs are some of the most diverse ecosystems on our planet– or at least, they should be...

Tom: At one point in 2011, I watched that reef go from every color of the rainbow and life popping outta every pore to gray and brown and no life in less than two months.

Hillary: Tom had a front row seat to a coral reef collapse.

Tom: I don't know how to describe seeing that, other than it left a little hole in my heart.

Luke: Today, over 30% of the world's reef-building corals are in trouble according to The International Union for Conservation of Nature. The IUCN runs the Red List of Threatened Species, the world's most comprehensive source of information on the extinction risk of animals, fungi and plants. The list indicates how close a species is to becoming extinct. Now, extinction is a natural process, the same way new species are evolving all the time. Through fossil records we have learned that there's a base rate at which things go extinct, but...

Tom: The rate that we are currently extinguishing species on the planet is somewhere between a hundred to a thousand times the base rate. So, it's extremely severe.

Hillary: And of course, you know, it's humans who are causing this accelerated extinction rate through habitat destruction, climate change, overfishing, and so on.

Tom: If we ended up wiping out all of the corals on the planet, it would take 10 to 15 million years for those things to re-evolve. These are not things that you go one direction and it's just as easy to go back. Actually, the temperature of the planet is a little bit more flexible. You know, we've had glacial periods, we have interglacial periods. We've seen that the planet can go through these temperature ranges, but the reason that those did not cause mass extinctions, or at least not anything of the order of what we're doing right now, is there was a lot of time for those things to happen.

And like over several thousand years even trees can move because trees can go drop their seeds a little bit further south and migrate their populations and then back up north once the conditions shift the other way. But what we're doing right now is of a velocity that is just completely discombobulating everything. You know, we have fire ants which are endemic to Central America up in Minnesota. This is not how it's supposed to be.

Hillary: Okay, so now I'm sure you're feeling pretty depressed. We hope to give you some hope with this next part:

[Mux: ES_Sustained Hope - Martin Gauffin-02]

Hillary: Restoring ecosystems can slow the pace of biodiversity loss, while also increasing carbon storage. And there's a conservation process that aims to restore natural ecosystems by restoring species that were lost or harmed by human activities. It is called rewilding.

Luke: And with rewilding, some people are thinking very, very big. Like woolly mammoth big. Bringing back large herbivores to the Arctic tundra could restore a lost ecosystem called the "mammoth steppe"; and this process could help mitigate global warming by keeping the carbon frozen underground.

Ben Lamm: There's actually more carbon stored in the arctic, in the permafrost than anywhere on the planet. It's actually about 1.6 trillion metric tons, which is about double the amount of carbon in the atmosphere.

Hillary: Ben Lam is the co-founder and CEO of Colossal Biosciences, the world's first de-extinction company that's also focused on species preservation.

Ben: If the permafrost melts, then we will all die. And so, you know, keeping the permafrost cool is a major need for humanity. People talk about like the Paris Accord, right? And that's not just about putting more solar panels up in looking at clean alternative energies, which we obviously should be doing in all aspects. But about 66% of the pledges require nature-based solutions, so rewilding, reforestation, introduction and preservation of biodiversity.

And so, there's been about a 20-year, study that has shown that Arctic rewilding or the reintroduction of cold tolerant fauna, bison, horses, camels, and reindeer and others with the right level of population density and the removal of some of these coniferous trees that aren't very efficient at carbon sequestration, can replenish the arctic grasslands. And the grasslands are about 2 to 3 times more efficient reflecting light backing space that isn't absorbed and about 7 times more efficient than trees at actual carbon sequestration.

Hillary: Arctic rewilding has been found to significantly reduce ground temperatures, with research showing a potential decrease of more than 1.5 degrees Celsius or 2.7 Fahrenheit. That's the limit for global temperature rise to avoid things like extreme weather events or rising sea levels among many other catastrophic consequences. So, with help from biotechnology and genetics, Colossal is taking this idea all the way to its core.

Ben: So, our goal is to bring back extinct species that mankind had a role in their, extinction, return them, or at least proxies of them, to reintroduce them back into ecosystems that are degraded, the purpose of ecosystem restoration in kind of filling that ecological void that species or sets of species left, you know, in their absence.

Luke: In the Arctic, a keystone species that had a major impact on the ecosystem was the woolly mammoth. And that's why Colossal was born. Ben approached his now co-founder, George Church, who is a rockstar in the scientific world. He's famous for his work on genetics, molecular engineering, and chemistry, to the point that he's regarded as the "founding father of genomics."

Ben: He wanted to bring back the mammoth and create arctic elephants for the purpose of carbon sequestration, and you know, we thought we could build a pretty big business that helps the world through conservation, can repopulate the Arctic, create a new population of cold tolerant elephants to save the elephant lineage, combat manmade climate and make a lot of money on carbon credit. So, it was this massive, weird dream but, you know, as I dove more into it, I really realized that it was just a function of focus and funding that was preventing it. There weren't really major scientific gaps in order for us to achieve it.

[Mux: BRU_BTV_0221_01101_Natural_Forces_APM.0-02]

Hillary: Now, there are documented examples of successful rewilding. One of the most famous examples happened at Yellowstone National Park in the Western United States.

Ben: In 1925, they actually hunted and killed all of the wolves in Yellowstone cuz there was this belief that predators are bad. We're finding through research is absolutely not the case.

Luke: And that actually toppled the balance of the ecosystem.

Ben: The elk and deer populations had gotten sedentary with no natural predators, they grew too large, they stopped migrating. They ate all of the plants and small trees that beavers use along the rivers.

Hillary: So, 70 years later in 1995, fourteen gray wolves were released in the park and things began to change, starting with wolves hunting deer.

[MUX:CEZ_CEZ_4465_00701_The_Rights_of_Nature_APM.0-01]

Ben: It actually forced them to start migrating. It started thinning the populations, flowering trees, and plants along rivers came back.

Luke: And with them came more berries and bugs...

Ben: Beavers returned, new populations of fish returned because beavers dammed the rivers. The rivers then got deeper, songbirds came back.

Hillary: And populations of hawks, red foxes, and eagles rose. Reintroducing wolves even changed the shape of rivers in Yellowstone!

Ben: This is all about balance. Nature's pretty good about figuring things out and balancing them.

Luke: Ok, so Yellowstone is a big park in Wyoming, Montana, and Idaho. But the Arctic is...the top section of the globe! How could we put mammoths back in the arctic if they have been long-gone from the planet? Well, we need to de-extinct them.

[Mux: ES_Into the Forest - Jakob Ahlbom]

Ben: Woolly mammoths are amazing. And a lot of people think of them as pre-historic animals and they think, "Oh, those were running around with T-Rexes and Velociraptors," which they weren't.

Tom: I know that mammoths sound like insanely old, but they didn't die out until after the pyramids were built and it's 4,000 years ago.

Luke: Tom Chi again

Tom: And modern humans, homeless sapiens have been here for 200 to 300,000 years and the genus homo has been here for 2 million years, and we coexisted with mammoths for most of that 2 million years. They were all part of what this earth was and could be.

Hillary: Woolly mammoths lived in that mammoth steppe we heard about before. It was widespread across North America and Eurasia, although there's evidence that some populations also lived in forests of what today is the Midwestern U.S.

Luke: We know that the last woolly mammoths lived on an island in the Arctic Ocean, between what today is Alaska and Russia. A place called Wrangel Island that's about the same size as Yellowstone National Park. And these last mammoths likely went extinct due to a combination of factors including isolated habitat, extreme weather events...

Ben: Low population genomics and lack of food as well as inbreeding. And they were pushed up there based on human-base-hunting.

Hillary: So, mammoths are extinct. And the first step towards bringing them back is to find a living relative.

Ben: The Asian elephant is 99.6% a woolly mammoth genetically, and it's its closest living phylogenetic relative, you know, the lineage of the mammoth still exists in their genome on some level. Not all-- obviously all the cold tolerant phenotypes that we associate with a woolly mammoth, the dome cranium and small ears and additional kind of brown fat layer.

Hillary: Most mammoths were about the size of an elephant, but...

Ben: They did come in other shapes and sizes, and there was even a pygmy mammoth that was like the size of a small horse.

Luke: And the remains of many of these animals were frozen by nature.

Ben: Our hope is that, given the fact that we have ancient DNA preserved and we have a closest phylogenetic relative, and we have the tools, that we can actually work, to bring them back, which is really exciting.

[Mux: JMP_JMP_0130_01201_Every_Continent_Collaborates__a__APM]

Hillary: Okay, as Michael Crichton wrote, “Genetics is a bit complicated,” so bear with us for a minute. Genes are segments of DNA, you can think of them as the basic unit of inheritance, so they carry the information necessary to describe physical and biological features and are transferred from parents to their offspring. And the genome is the entire genetic material on an organism, basically all of their genetic information.

Luke: So, to proceed, scientists needed to find the mammoth's genome. The team got the woolly mammoth genome from bones and frozen tissue samples found in the Arctic.

Ben: Given that it's older DNA, you have to go through a whole process of assembling that and creating a reference genome. Now, what's interesting about Colossal is, we have about 54 mammoth genomes, so we may be the largest holder of mammoth genomes in the world.

Hillary: They use AI and machine learning to compare the mammoth and elephant genomes, and the process allows them to understand...

Ben: How closely they are related, where are the genes that exist in one species versus another, which ones are overexpressed or under expressed.

Luke: For example, these mammoths were woolly, so they overexpressed genes related to hair or fur, while elephants not so much, so that's an under expression.

Hillary: Once Ben's team understands what physical attributes they are looking for, they can use genetic tools to change those parameters. And one of those tools is CRISPR gene editing. A genetic engineering technique that in essence copies fragments of DNA from the mammoth genome and pastes them into elephant cells. Then the natural DNA repair process takes over.

Ben: Essentially what we're doing is we're de syncing genes and creating proxy species, right? So, we're not cloning a mammoth, we're engineering one.

Luke: And though they are not cloning a woolly mammoth per se, they will use cloning technologies in the process. Ben says that once they get to the genome they are looking for, they'll go through the cloning phase. In very simple terms, they'll take the new genetic material and implant it into a host cell –in this case from an Asian elephant. And then they'll stimulate that cell to start its division.

Ben: And that process can either happen in a surrogate species.

Hillary: Think mama elephant

Ben: Or in an ex-utero device

Luke: Now, artificial wombs and ex-utero devices are still in the experimental stage, but recent breakthroughs have shown promising results. Humanity hasn't yet grown any complex animal from an embryo all the way to birth on these external devices, but in 2017, researchers at the Children's Hospital of Philadelphia successfully managed to keep a baby sheep alive for four weeks in an artificial womb.

Hillary: The team at Colossal think these gestational technologies would help not only the new woolly mammoths but also other critically endangered species.

Ben: Look at the northern white rhinos a great example, right? There's two females left, Najin and Fatu.

Hillary: They are mother and daughter.

Ben: One of them just aged out. So, they're not using her for surrogacy. Cause she's too old, too big of a risk. So, no matter how much. Two rhinos love each other. They're not gonna produce a viable offspring. So, we have to use genetic rescue technologies in order to do that. So that's either IVF and risking one of those animals, or you can grow a hundred of them in a lab and then work with top conservation and rewilding partners that understand rhino behavior and rhino rewilding. Our goal is not to be that rewilding expert. There's much smarter people in conservation than that our goal is to provide them with better tools for species preservation. So, imagine the ability to grow a thousand koalas after a terrible bushfire and reintroduce a diverse set of koalas from biobanks that could help preserve that species, versus just praying they come back.

Hillary: Ok, back to the baby mammoths. If Colossal successfully brings a proxy of these magnificent creatures to life, having them among us is just the beginning of their mission. The idea is that someday they'll be reintroduced to the land of their ancestors: The Arctic. But this generates a whole new level of complications.

Luke: How does one rewild a species, right? Like, do you call Canada and say, "Hey, we've got some mammoths, mind if we drop them off?" Or like, how do you even begin to think about that process of introducing a species into a habitat?

Ben: The one-word answer is thoughtfully. I don't think that we fast forward and show up with the mammoths and say, look what we got. We've started now, right? So, it's a combination of talking to the general public and getting their feedback. It's also really important to work with the local indigenous people groups. How do they feel about it? How do these animals, especially extinct species, affect their culture?

You've gotta work with local governments. You have to work with the EPA or national governments in this case, you've gotta work with the military and the Army Corps of Engineers and others. So, it's really a collaborative process. In any rewilding example that's worked well is like you start with a small location, with a limited number of animals, you ensure that it works. You then expand to a larger private and then eventually public, right?

And so, every major rewilding case takes that journey. I think that process just has to be done slowly, done thoughtfully, and we believe we'll have mammoths in the next five to six years, you know, it's still gonna probably take four to five years for them to reach the level of maturity. Before we're ready to introduce them. So, we have the better part of a decade to work on it. But it's important to start those conversations now, to really be as inclusive, as thoughtful, and as measured as we can be.

[Mux CEZ_CEZ_4484_01001_A_Question_of_Ethics_APM.0-02]

Act II - KEYSTONE SPECIES, ETHICS, AND OTHER PRODUCTS

Hillary: Thoughtfulness has a critical role in what Colossal is trying to achieve. After all, deciding to bring back to life an extinct species opens the conversation to ethical ramifications and so many other questions.

Tom: The bioethical issues are the big ones, it's actually the thing that we debated the most before getting into the deal.

Luke: Investor Tom Chi again

Tom: And we cut a deal with Ben that said that we're willing to do the deal only if we get to oversee a number of the bioethics activities.

Luke: In this process they dived deeper on humanity's relationship with keystone species, which like the mammoths and the wolves, are organisms that help hold an ecosystem together.

Tom: In our process of talking with scientists and refining the definition, I think we came on one which is way more elegant, which is that keystone species are species where their presence in the environment facilitate the maximization of diverse nutrient flows. And if you put a species into that environment, and it basically is having that net effect, that it's acting in a keystone manner. What I would hope for humanity is that we become the keystone species that takes care of keystone species.

Hillary: Working toward that idea, Colossal enlisted quite a battalion of brilliant minds for its scientific, conservation, and executive advisory boards. The board members are leaders in technology, translational medicine, chemical engineering, biotechnology, molecular genetics, and software. You thought I was done? Nope! Colossal's board also includes practicing physicians, researchers, authors, inventors, professors, and winners of various international scientific awards.

Ben: We're so fortunate to have this level of horsepower behind it. Some of the questions we talk about is like, which animal should we do and why? You know, what we found is that everyone has their favorite living animal. Everyone has their favorite endangered animal. Everyone has their favorite extinct animal, and so we just have to be thoughtful about where we draw those lines and I think that as long as we are, transparent, with the public,

you know, have conversations like this and, are constantly opening our doors to everything we can, that kind of helps bring in the feedback to keep us on our ethical balance.

Luke: Fiscal balance matters, too.

Ben: You know, we think there's a huge opportunity to generate quite a bit of revenue for the company in a myriad of different ways. And our hope is that all technologies that we develop that have conservation applications are free. For example, for the Thylacine project, we're working on this exo-pouch.

Hillary: You may know the Thylacine by its common name: the Tasmanian tiger. It was a carnivorous marsupial.

Luke: Like kangaroos or koalas except these last two are not carnivorous.

Hillary: They went extinct in 1936 and Colossal is working on bringing a proxy of them back, too.

Luke: In their case, the team needs to replicate marsupial pouches because that's where the majority of young marsupial growth occurs. Pouches serve as a warm, secure environment outside their mother's body where this animal can develop.

Ben: There's not a massive total addressable market for marsupial pouches and nipples. I don't know that when you woke up this morning, if you thought you'd be talking about marsupial nipples, but...

Luke: This is better than I thought.

Ben: Yeah, but even Tasmanian Devils have four nipples, but they still give birth to 20 to 30 Joey's at a time.

Hillary: Young marsupials are called joeys.

Ben: So, the vast majority of them actually die through natural selection. So, if we can engineer a pouch that not only helps us with our Thylacine mass production, but can be given to those conservation groups, that's transformative.

Luke: Colossal's goal is to subsidize this kind of technology and make it available for free to help in conservation efforts.

[Mux: KOS_KOS_0826_01101_Expectation_To_Hopeful_Reggaeton_APM]

Hillary: Restoring extinct species requires time and money. Besides the Woolly Mammoth and the Tasmanian tiger, the team at Colossal is working on de-extincting the dodo bird. And so far, they have raised \$225 million dollars. If things go according to plan, we will see these fluffy giants roaming around sometime this decade.

Ben: I think that 2027 is a realistic timeline based on where we are today, but yeah, since there are no real scientific gates in what we're doing, it's just engineering challenges.

Hillary: And Ben says that everyone asks about a certain movie.

Luke: Do I have to worry about any velociraptors when I'm going out to play with my son in Central Park in 10 or 15 years? Are there gonna be any Colossal branded, uh, raptors rolling around?

Ben: No, we're not working on dinosaurs. You can't bring back dinosaurs, there's no DNA for we're not interested in it. And there's not even a path to it if you wanted to.

Act III - CONSERVATION, INVESTMENT AND THE FUTURE

[Mux MYMA_JUST_0108_02901_Wood_Adventures_A_APM]

Hillary: Protecting Earth's natural resources for current and future generations has taken root in an official, international way, too. In a historic move, a landmark agreement to protect biodiversity was signed at the United Nations Biodiversity Conference in Montreal, Canada, in December 2022. The agreement commits nations to preserving 30% of the world's land, oceans, and coastal areas by 2030, marking a significant step towards safeguarding the planet's natural ecosystems.

John Calvelli: That's a huge statement

Luke: John Calvelli is the Executive Vice President for Public Affairs for the Wildlife Conservation Society.

John: governments are saying, "yeah, we need to really do something about this."

Luke: The pledge includes supporting work towards halting species extinction. Because – as you've just heard – bringing back species is much more complicated than preventing their extinction in the first place.

John: It's sad when you lose a species and one of the things that you realize is if you lose some of your apex species, if you lose your elephants, you lose your tigers, you lose your sharks, right? You're losing the top of the food chain. And once you lose that, the chain breaks apart and has consequences that will fundamentally alter and in some cases destroy that whole ecosystem.

Hillary: John works from the Bronx Zoo.

John: I always joke that I have not gotten very far in life. I was born three blocks from the zoo. I went to Fordham University, which is kind of a northwestern corner of the park, and now I work here. So, from my office I can see pretty much my whole life in front of me.

Hillary: The Wildlife Conservation Society was founded in 1895, making it one of the oldest conservation organizations in the country. And in its early days, the society was built on two pillars.

John: One was to help educate the public on the importance and the relevance of nature and wildlife. And the other was to actually go out and save wildlife in wild places. Obviously, zoos had existed, and that was the place where we were educating literally millions of people. But this idea of going out into these wild places and helping to save them, that was just revolutionary for its day. And fast forward over the last 125 years, what we've been able to do is we work now in 60 countries and help protect areas that are home to 50% of the world's biological diversity. So, half of the world's biological diversity can be found in the sites where we work right now.

Luke: Over the past century, WCS has established a long-term presence committed to conservation in the last remaining wild places across the Americas, Africa, Asia, and Oceania. They work building partnerships and knowledge in pro-conservation and educational efforts.

Hillary: John says their work right now is driven by climate change and biodiversity loss. A 2019 report by the United Nations says that "around 1 million animal and plant species are now threatened with extinction, many within decades, more than ever before in human history."

John: When you talk about climate change, nature is a third of the solution. So why would we want to destroy nature and these last wild places when it is the easiest, cheapest and most relevant solution.

Luke: And in the case of animal conservation, each situation has its own set of drivers and responses. Like in the case of the mammoths' descendants, the elephants. WCS works both with Asian and African elephants, but a few years back there was a crisis of African elephants being poached and killed because of the ivory on their tusks.

[Mux CEZ_CEZ_4036_03501_Dibombe_River_APM.0-03]

John: So, there's two types of elephants in Africa. There's savanna elephants and then you have forest elephants that live in the rainforests, and what we had seen was that there had been this precipitous drop in the number of elephants, in both savanna, but really in forest elephants. And the numbers were around, 36,000 a year, which worked out to 96 elephants being killed every day and what we realized was we needed to deal with those three crises, stop the killing, stop the trafficking, and stop the demand. So, we literally launched a campaign called 96 Elephants.

Hillary: The campaign, which was based on WCS's scientific research in elephant habitats, was launched in 2013 to raise awareness about the devastating impacts of the ivory trade. Since then, there have been positive developments.

John: We help to close the ivory markets in New York, in California, and in Hawaii, which were the three largest markets within the United States.

Luke: And many countries, including the United States and China, have banned the import and export of ivory, reducing its demand.

John: So therefore, you're starting to see a stabilization in the numbers of elephants. And you're starting to see in certain places elephant numbers actually going up.

Hillary: Increasing elephant populations is good for them and good for the planet.

John: The elephant is what we call an environmental engineer. They create their environment. They eat, they digest, it leaves, and guess what you have? New forest created. I joke about it, but it's the truth. You think about the role that these animals play in how our environment is created. And you realize that by losing that, you're not only losing these incredibly charismatic animals, but you're impacting so many other species and then ecosystems.

Luke: So, what does John think about Colossal's effort to create a proxy of the woolly mammoth?

John: What they're doing is raising awareness and highlighting the fact that we've lost these species and getting people excited about the possibilities, right? So, on that level hats off incredible work for who they are and what they're doing. I will say that from my perspective, there's so much that we need to do right now, right here on the ground and as cool as a woolly mammoth may be. I've gotta tell you, I am as just as excited when I was able to see a tiger or an elephant, or a shark. These are animals that bring out so many different emotions in people, and I think that's what they're tapping into this connection that people have to wildlife and to nature. So, I would humbly say that as exciting and important as that is, we have so much work to do for the species that are still on this planet.

Tom: When something's healthy, that's actually the best route cuz we can't engineer it nearly as sophisticated as nature can just do it.

Hillary: At One Ventures' Tom Chi again.

Tom: And it's way cheaper to keep a species alive than to extinct it and try to bring it back. But in a lot of places where we've created damage or a lot of places we're just gonna take an inordinate amount of time to be able for things to get back on track, then I think there's room for better tools and techniques for us to go play our part.

Luke: Both traditional conservation and de-extinction need investment. Remember when seeing the coral reef disappear made Tom feel like he had to do something?

Tom: I reached out to all these coral scientists, about a dozen of them, and they basically let me know that it wasn't just my reef, but about 10% of all reefs on the globe that year had sustained substantial damage from bleaching. And I was like, if we could lose those sort of

percentages in that kind of time period, then how much time do we have left? and the consensus amongst the 12 folks was roughly 35 to 40 years before we extinct shallow water coral from the planet, which would entail losing 25% of all species in the oceans immediately with it, cuz those live directly on the reef and cannot exist without the reef. Anyway, these things basically just reset my timelines.

Luke: So, he decided to start At One Ventures

Tom: I believe the mission of helping humanity become a net positive to nature will probably take about two to 500 years. And I wanted a name that would still mean something 500 years from now. And I think, oneness with ourselves, nature in the universe will still mean something.

Hillary: The At One team defines nature in four categories: air, water, soil and biodiversity.

Tom: And what's nice about every one of those categories is it's very clear when you're making things better and it's very clear when you're making things worse.

Hillary: Their strategy supports innovation addressing the root of problems.

Tom: Think about the great Pacific garbage patch, for example. The amount of energy and effort that's required to go deal with that. It's way harder to do that than to go fix the plastics problem on the front end of the extruder. So before even the material comes, fix that material. So, it's not a material that ruins the planet. Now, you don't need to worry about marshaling hundreds of ships with specialized equipment and post processing tech in order to go and deal with a garbage patch; you just put materials out there that wouldn't create that problem.

Luke: And when thinking about climate action and biodiversity, Tom has a theory of change that focuses on unit economics.

Tom: Right now, we are having a very compelling wave where we are finally trying to get the economy into the act as well, as opposed to just trying to do it through regulatory or protests or, you know, just opting out of existing in society. Because of that then there's a lot of entrepreneurs, there's a lot of investors that are wanting to place capital in these things. But what I've seen is that the majority of entrepreneurs that are getting to this space, they have some variation on the green premium idea. You know, I kind of summarize this, like if you're scrolling Instagram and here's these hundred dollar yoga pants with eight recycled water bottles in them, and on one hand it's like, okay, well let's better than zero recycled water bottles. But on the flip side, I cannot imagine a world where that actually solves the plastic pollution problem. And yet those companies are being funded-- actually most of the capital in the space is going to green premium style bets.

And to me it's a bit of a head scratcher. Like those are not the things that are gonna drive systemic change. And given that we don't have infinite capital to go and address these issues, it would be helpful to be a little bit more judicious.

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Hillary: We are used to measuring our life in days, months, years and even decades, so it's easy to forget that nature operates on an entirely different scale.

Tom: A lot of things in ecosystem function take hundreds of years, a thousand years plus in order for it to get to a true level of health. And it poses a really important question, which is, could we become the kind of civilization that learns how to take care of things over the course of 500, 1,000, 2,000 years. Cause if we wanna have that kind of deep relationship and become a true net positive to nature in the long haul, then that's the kind of civilization that we need to be. Now that sounds almost impossible, but we have been that in the past.

John: We can't give up, right? We need to invest in our planet. The fact is, we can't do this alone. We have to do it in partnership with others. We need to live in a place called hope.

–FOR PROMO EPI 303.

[Mux:SON_SCDV_0140_04301_Precision_Under_Pressure_A_APM-04]

Luke: Next time on Unseen Upside:

Andrew: An electric vertical takeoff and landing vehicle, eVTOL, is just a new class of aerial vehicle.

Hillary: Join us as we check out a new generation of aircrafts taking flight.

Andrew: The vehicles themselves can be mass produced in ways that are cheaper and much faster than today's aviation industry allows.

[Closing Mux]

Narration: If you want to learn more about De-Extinction, or venture capital, please visit us at cambridgeassociates.com/unseenupside or check out the show notes. Stay tuned for more upcoming episodes and if you like what you're hearing, leave us a review and tell your friends and colleagues.

At Cambridge Associates, our podcast team includes Luke Charest, Michelle Phan and me, Hillary Ribaud.

From PRX Productions, Sandra Lopez-Monsalve is our producer and Genevieve Sponsler is our editor. Production assistance by Isabel Hibbard at PRX and by Cara Shillenn and Megan Nodolski at Goat Rodeo. This episode was mixed by Samantha Gattsek. The executive producer of PRX Productions is Jocelyn Gonzales.

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For more about conservation visit wcs.org, and they also have an amazing podcast called "Wild Audio" where you get to meet WCS scientists from all around the world.

Before you go, one of our colleagues has an important message about the contents of this podcast.

[Mux theme fades]

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