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MICHAEL LIVERMORE: Welcome to the *Free Range Podcast*. I'm your host, Mike Livermore. This episode is sponsored by the Program on Law Communities and the Environment at the University of Virginia School of Law. With me today is prize-winning journalist and author Elizabeth Kolbert. Her book, *The Sixth Extinction, An Unnatural History*, won the 2015 Pulitzer Prize for General Nonfiction.

Her most recent book is *Under a White Sky, The Nature of the Future*, which was published last year. Hi, Elizabeth. Thanks so much for joining me today.

ELIZABETH KOLBERT: Thanks for having me.

MICHAEL LIVERMORE: So I thought we could kind of get started by zooming out a little bit. You've had a wonderful career as an environmental journalist and writer over some time. And I thought-- I was curious to hear a little bit from you about how just the field of journalism has changed and developed over the course of your career, specifically kind of environmental journalism, and what some of the good things that have developed in that period of time and what some of the downsides have been.

ELIZABETH KOLBERT: Well, as they say, I'm old enough to remember when. When I started out, I was really-- I started out in journalism-- I wouldn't say in environmental journalism. I started out at *The Times* really doing political reporting in the '80s. And this was before anyone had-- or anyone in the wide world had really even heard about the web or conceived of it.

So everything was either in print or on the radio or on TV. And the channels of communication were pretty clear. And that has obviously changed really dramatically over time. And I think that has had certain positive effects obviously that we now get a lot-- can get a lot of information from all around the world. If I want to, I can read newspapers from all around the world, watch TV sometimes from all around the world.

But it's also had the effect of, on the one hand, really hollowing out what we would call sort of mainstream media. It's very difficult to-- the economics have completely changed, very difficult to make them work. I think that's been very hard on projects that are expensive to do, which newspapers like *The Times*, which I worked for many years, and *The New Yorker* and all of the publications people are familiar with used to sponsor, that's getting tougher and tougher.

So I think that's a loss, I will say. And I think that nothing that your listeners don't know, but obviously the way the web has become a font not just of information, but of misinformation, I don't know that anyone who idealistically thought of information wanting to be free also thought of disinformation to be free. But that, I think, has really radically transformed our politics in ways that I think are very dangerous. How's that?

MICHAEL LIVERMORE: Yeah, yeah. I saw from your bio that you had spent some time in Albany working for *the Times* as the bureau chief there in the early 1990s. And I actually spent some time in Albany working for environmental advocacy groups. And I remember-- a little bit later than that, but in the late '90s, early 2000s.

And at that time, you still met face-to-face with people, you would chat with a reporter, like a notebook would come out and folks would take shorthand. And it was such a-- I don't know, it was just a very different experience than these days where so much is done over email and it's a very quick-- it's much less of a face-to-face relationship.

But for your work, it seems that you're still able to carve out a lot of time to chat with people individually and go on location and really immerse yourself in this work, which is really wonderful. And I wonder if you think more generally, again, in the profession, something is lost when everything is just converted over to screen time and you don't get out of the office and you don't build those kinds of personal relationships.

**ELIZABETH
KOLBERT:**

Yeah, absolutely. I mean, I think that one of the problems that we have with journalism now-- and it's both built into the cost structure and it's built into the web structure and it's built into everything being done remotely now-- or a lot of things being done remotely now, is just everything gets recycled and you don't get-- I think--

I'm not sure where people even get their ideas, but as you're alluding to, I assume going to the LCA room, which was the Legislative Correspondents' Association here in the New York State capital, which most people have never been to, but was a wonderful place. It was simply-- it had a lot of lore to it. There were old poker hands on the wall that the reporters had put up.

And I don't want to romanticize the days of the guys playing poker up on the shelf, but I think that-- I don't know how young reporters now starting out, and especially during COVID obviously, one had sources. Is that good? Bad? That's sort of the way journalism has always worked. I don't honestly exactly how the LCA functions these days.

**MICHAEL
LIVERMORE:**

Yeah. No, it's-- at least aesthetically it seems something's lost. But you're right. I mean, it's also important not to nostalgia as the past. But you still get out into the field quite a bit, so it seems like in any case. It seems like that remains an important part of how you do your work.

**ELIZABETH
KOLBERT:**

Well, I mean, when you do a longer form piece for *The New Yorker* or really almost any publication, it's pretty hard to do it completely unless it's what we would in the journalism biz call a think piece where you're just taking an issue and thinking about it or talking to people who are thinking about it. If you're really reporting a story that has people moving through place and time, you almost-- you have to get out there.

And that is where, I think, the value of long-form journalism, but it does get back to the point I was making before that that's getting harder and harder to support, both the time and the travel. It's expensive. And so that's why I think we see more and more-- well, we see two things. One, we just see more and more recycled content, something gets written and it just gets blasted everywhere, and that's not really very useful in my view.

But you also are seeing people trying to come up with creative ways, sort of nonprofit journalism trying to figure out ways to support serious journalism without the economic-- in the absence of the economic model that had worked for quite a while.

**MICHAEL
LIVERMORE:**

Yeah. We'll see how that all goes in the future, that certainly the trend line has just put an enormous amount of pressure on the industry. But other things-- and as you said, the internet makes it a lot easier for folks to do certain types of research and communicate with a broader audience.

So maybe just transitioning over to your recent book, *Under a White Sky*, in a sense, a book like that could have been written very abstractly. There have been versions of some of the themes that you talk about in that book that are written very abstractly. But obviously in the book, really, you're collecting these stories at a very ground level and that makes it all extremely compelling.

I guess very abstractly, the way I read it is a book about unintended consequences and also tragic choices in different ways that people relate to the environment.

And there's a bunch of really just extraordinarily interesting individual stories there. One that caught my attention, I'm sure many other readers, is the story on gene drives, which are really just a fascinating topic. I think there's just a whiz-bang element to gene drives and just the incredible kind of science and engineering behind it, but also some of the-- obviously the environmental challenges and risks that you talk about in the book.

But one of the things that kind of strikes me about that particular case is there's just this element of a tragic choice to the technology, because on the one hand, it carries these risks, like really serious risks. On the other hand, we could be talking about a technology that could end malaria, which would have-- and it just-- absolutely staggering benefits for human well-being.

So when you were kind of doing research on that, what struck you about in particular gene drives and the story that they can-- or what they tell us more broadly about human interactions with the environment?

**ELIZABETH
KOLBERT:**

Well, I guess I'll start by explaining what gene drive and then we can go from there. So gene drive occurs naturally. It just means genes that have figured out a way to evade the normal rules of heredity whereby if you're a gene-- and I should say, you're really a gene variant or an allele as the geneticists would say, you would get passed down 50% of the time.

So you'd tend to dilute over time. If you do gene-- if you have gene drive, and as I say, there are many, many natural gene drives-- or driving genes I guess they'd be called, you get passed down more than 50% of the time if you figured out a way to get your genetic material into the next generation more than 50% of the time.

And synthetic gene drive, which is what you and I are talking about, means that you basically use this new kind of gene editing tool known as CRISPR. You basically programmed the organism, you program the gene to get passed on-- along with the instructions to get passed along more than 50% of the time, how's that?

And in theory, you could get passed on 100% of the time. And that's very, very powerful if you're trying to genetically engineer this thing and then pass that trait down obviously.

And the gene drive-- the kind of gene drive that you're talking about with malaria-carrying mosquitoes is called a suppression drive, and what you would do is actually build in some kind of-- something that interferes with reproduction usually, and in a normal course of events, obviously if you had such a dangerous and damaging gene variant, it would drop out of the gene pool, but instead it spreads using gene drive, and eventually the population crashes, that's the idea.

And these gene drive mosquitoes exist. In lab tests they have populations crash just as predicted. They're in very high secure facilities in Italy right now. I think that the question of-- and they've also-- there's a lot of talk at this point of could you use it for conservation purposes? That's what I look at in the book, for example, to eliminate invasive rodents on islands, for example.

Now the problem with the technology-- the good thing about the technology is it's incredibly powerful, and the problem with the technology is that it's incredibly powerful.

**MICHAEL
LIVERMORE:**

**ELIZABETH
KOLBERT:** And so people-- some people who were among the earliest people to do gene drive organisms have really renounced it. I mean, it's a little bit like inventing the atom bomb. Do you really want this out in the world? And we haven't answered that question, honestly, and I think one of the sort of themes of *Under a White Sky* is that we are extremely technologically proficient, but our ethics and our politics can't keep up with our technology.

So we have these very powerful technologies that we don't really what to do with because we are pretty bad at governing them and controlling them. And so whether gene drive should forever remain in a lab or not is a pretty profound question that we lack even sort of the mechanisms to answer.

**MICHAEL
LIVERMORE:** Yeah. Yeah, and just speaking of the political, cultural, moral failures associated with these, one of the things that just strikes me about-- in particular, the malaria case is I suspect that if we had very serious malaria happening in Europe or the United States, this debate would have been over and we would have actually engaged in this. The technology would be out, we would be using it.

**ELIZABETH
KOLBERT:** It's possible, but I do I do want to say that-- well, there's two points that I'll raise. First of all, the Europeans are very-- the Europeans, and this shows a split. The Europeans are very anti-genetically modified crops. We eat everything. All our corn, all our soy virtually is GMO at this point. And we-- even people who are anti-GMOs are eating it. That's a fact of the matter. Now-- for better or worse.

And the Europeans have really blocked that, and in doing so, they've really blocked a lot of other countries from doing it, too, because they don't take exports of GMOs. So I don't know we can say-- even though by a lot of people's accounts, GMOs are absolutely crucial to feeding the world. So I'm not sure that we-- I don't know. I don't know what reaction would be, how's that? But you raise an interesting point, A.

And B, I do have to put one sort of caveat in here, which is having not released these things into the world, there's a lot of questions about whether they will work out in the world.

You're encountering-- you're putting unbelievable selective pressure on the organisms that genetically figure out a way to evade this. If you're trying to make the population crash, well, if I have a new mutation that allows me to subvert this, then I am going to be incredibly successful. So it's not clear whether-- when lab technology meets the real world of mosquitoes that this will work, to be honest.

**MICHAEL
LIVERMORE:** Yeah. Yeah, and I should be clear, too. Just because I think the Europeans or the US would use the technology, if we face the threat, doesn't necessarily mean I think it's a good idea.

ELIZABETH I hear-- I hear you completely, and I think that it will be a very interesting question. I think definitely-- the idea is
KOLBERT: to release them in Africa where there are high malaria rates . And whether-- and obviously has to be done in consultation with the people on the ground. And whether they will welcome it or revile it is-- that we haven't even gotten there yet.

MICHAEL Right, right. Yeah, I mean, just to reiterate the point that you make, is that once you put genes into the world, it's
LIVERMORE: really unclear what will happen with them. You have-- you can have crossover or you can, obviously as you said, there's an incredible amount of pressure. And if you have a small mutation, which is going to happen. I mean, mutations happen that we know. And so yeah, it's a very tricky thing.

ELIZABETH I mean, if it's a very risky technology, if it works, it's potentially even a risky technology if it only partly works.
KOLBERT: But it also is a very-- life finds a way, as they say. And-- as Michael Crichton said. And I don't-- I think a fair number of biochemists or molecular biologists are somewhat skeptical that you could really-- you could maybe do it in a very small controlled space.

But where there's a lot of movement-- and mosquitoes are pretty mobile, whether you could really-- whether it would really work or whether you just get new populations coming in.

MICHAEL Yeah. So another technology that you talk about towards the end of the book is geoengineering. And I don't
LIVERMORE: know, at some level, if you're interested in all of these technologies independently or if there's, in a sense, there's something of-- each of them are a metaphor for the risks of geoengineering.

But maybe we could just introduce the geoengineering that you're interested in and explored in the book. And then what I always think is the most frightening prospect with geoengineering is I think of as like the spring action or what happens if we stop geoengineering basically and the kind of consequences of that.

So maybe just one question was, was geoengineering the thing that brought you broadly to the theme of the book or did it happen naturally? And then maybe we could talk about geoengineering specifically a little bit.

ELIZABETH Well, the book emerged out of this question of what are we going to do? We have in more ways in which we
KOLBERT: realize that we are dominating natural systems and we don't like the results of that, and gene drive is one example of technology you could use to try to assert a new form of control over a biological system.

Definitely the stories in the book are fables-- they are fables. They could-- the details could be very different, but the idea that the sorcerer's apprentice, that you think you're going to control something, things get out of control, that that's definitely the theme of the book. And definitely geoengineering was always going to be the ultimate example of that, yes.

MICHAEL So there's a couple of different technologies that folks talk about. There's shooting mirrors into space, there's
LIVERMORE: placing various kinds of chemicals in the upper atmosphere.

So obviously there's two-- we should say there's two different general types of geoengineering. There's sucking carbon out of the atmosphere, which is usually understood to be quite a bit less dangerous, and then there's the solar reflectivity stuff of reducing the amount of solar radiation that makes its way to the Earth's surface. So it's really the latter that-- and you talk about both in the book. But it's really the latter that raises this kind of sorcerer's apprentice problem.

ELIZABETH Yeah. I mean, they both-- I mean, I think that the first kind, sucking carbon out of the air, is left the realm of
KOLBERT: geoengineering these days. It's more referred to as carbon dioxide removal or negative emissions. And the interesting thing about that and I would just raise, because I do think it's very significant and you're going to-- people are going to be hearing more and more about it, is that we don't have technologies that can do this at large scales at this point with any kind of economic or energetic efficiency.

MICHAEL Right, right.
LIVERMORE:

ELIZABETH But we're depending on them already. They're built into the calculations of the IPCC, of the UN of how we're
KOLBERT: going to stay even below 2 degrees C, which is considered a limit you definitely don't want to pass. So we have the whole conversation around climate change to the extent that there is a conversation around climate change, it's already in there, and I think that that is a sign-- really a sign of just how insane our world is right now--

MICHAEL Yes.
LIVERMORE:

ELIZABETH --to be frank.
KOLBERT:

MICHAEL Yeah.
LIVERMORE:

ELIZABETH OK. So that's one thing. So I do visit this very small project in Iceland where they are removing carbon from the
KOLBERT: air, sucking it out of the air and converting it into rock, which is a very-- it sounds quite cool and is quite cool, but takes energy. So then there's the question of, OK, well, why are we doing this when we basically are putting up carbon to produce energy? So it's got this weird circular logic.

So that is one chapter. And then the ultimate geoengineering-- solar geoengineering, which, as you say, involves literally blocking-- dimming the sun, having less direct sunlight hit the Earth. And the way that that's usually-- the mirrors in space is a futuristic concept and perhaps we'll get there.

I don't think in our lifetimes, but more plausible right now is we would mimic volcanoes, volcanic eruptions, put a lot of sulfur dioxide into the stratosphere, a very major eruption. And we have very good evidence from previous volcanic eruptions that that cools the Earth, that the sulfur dioxide forms these little droplets that are very reflective and they reflect sunlight back to space, and you get a temporary cooling effect.

And if you just kept replenishing that, you could get a semi-permanent cooling effect. Now the problems with this are myriad. And they range from changing the color of the sky-- that's where the book is called *Under a Bright Sky*, to potentially changing regional weather patterns, messing around with the monsoons.

And so it raises a tremendous number of questions. Now the problem is-- and this gets back to how messed up our world is, you can't measure geoengineering, the risks of geoengineering against the risks of a stable climate. You have to measure them against the risks of the way we're already messing with the climate, which is super profound. I can't emphasize that enough, it's really serious what we're doing.

So are we going to reach a point where we're going to say, well, this is so bad, what we've got is so bad, we're going to have to try geoengineering, I fear that's not impossible.

MICHAEL LIVERMORE: Mm-hmm. Oh yeah. I mean-- and then it starts to look attractive, I think, for a lot of folks. I mean, there are some economically-minded people in the world who would say, well, wait a second, what are the costs of this geoengineering enterprise? It's just a flying a few jets around and decarbonizing the whole global economy is a lot more expensive. So why haven't we been talking about this the whole time?

ELIZABETH KOLBERT: Yeah, but do you think-- I mean, if we get into that situation, then we are really and truly screwed, because you can't geoengineer your way out of perpetual carbon emissions, or if you do, you are really talking about putting a lot of stuff into the stratosphere. You are really-- carbon dioxide emissions are cumulative, so they stay up there a long time. If you keep emitting carbon at anywhere near the rate that we are doing, you have to keep ratcheting up what you're putting in the stratosphere.

So any semi-responsible geoengineering plan involves getting to net zero but using geoengineering as a palliative for that time when you reach peak heat, if that makes sense, to cut the top off of that peak heat, if you keep on-- if you think-- and I'm sure there are people out there who are thinking this, but they are wrong. If you think you're going to just merrily go along emitting carbon and then counteract that with geoengineering, then you are basically looking at a world that it will be unrecognizable.

MICHAEL LIVERMORE: It would also be very, very sensitive. I think this is an argument you raise in the book and I've heard elsewhere, which is, this is what you're talking about-- imagine the long-term-- not you, what you're talking about, but what the proponent here is talking about is an extraordinarily long-- I mean, indefinite technological project of running the solar management operation that would be extremely-- it would be resource-intensive. And it would have to constantly be maintained.

And so would we be signing ourselves up for this project that has no precedent in human history. And what we do see lots of precedents for in human history are things like really bad pandemics and wars and other sources of conflict that could interfere with our ability to carry out said long-term massive global scale project.

And just imagining a state that says, you know what? I'm not happy with the sanctions that are being issued against me based on my actions. And so if you guys don't get rid of those sanctions, I'm going to start shooting down these planes or kind of whatever could happen. And if that happens, there's kind of the nightmare scenario

ELIZABETH KOLBERT: Yeah, and I think that the war in Ukraine has really I mean I haven't spoken to any of the-- and I want to say there are very few people who would call themselves proponents of geoengineering at this point. I guess they would call themselves proponents of researching geoengineering.

But there was-- is work going on-- we get back to also this question of governance. We can't get our act together to cut carbon emissions, how can we get our act together to geoengineer? And I think that this notion that the world was a stable place, at least among the superpowers, has been shattered.

MICHAEL LIVERMORE: Yeah, it's out the window.

ELIZABETH That raises-- that makes it harder to imagine, as you would say, this collective project. Now there are people, too,
KOLBERT: I will say, and I think it's a very reasonable argument, who would say, well, can never-- even before the war in Ukraine, committing future generations to this kind of project, that's not ethical, not viable, whatever.

But on the flip side, you could say, well, we're committing them to a world of melting the Greenland ice sheet. Is that ethical, is that viable? So these conversations-- I guess another theme of *Under a Bright Sky* would be, we've kind of run out of the good choices. We've run through those because we failed to act in a timely way. And COVID is a very, very good analogy here, too. We ran out of good choices, now we only have bad and worse choices in a way.

MICHAEL Right. And one of the things I appreciate about the book in particular is that at the end, you refuse to do the
LIVERMORE: happy ending. You explicitly say, I'm not doing that even though there are climate communications people that would balk and say, no, no, no, you have to leave people with a sense of hope.

But I also just think reckoning with the situation that we're in and realizing-- I personally think that that's an extraordinarily important message as well. But I suspect you've probably taken heat from some of the climate communications people. But just-- I really appreciate you taking the time to chat with me today.

Maybe the just final question is, as someone-- you've been a close observer of these issues for some time now. And it can get very, very frustrating and it can get depressing, and obviously this is an issue that happens with advocates, it happens with scientists, it happens with journalists. And so we need-- I do think people often need some source of energy, even if it's not going to be delusional optimism.

And so I guess my final question is, where do you-- where does that source of energy come from for you? Maybe it could be anger, it could be-- it could be lots of different things.

ELIZABETH Yeah, I mean, I think there's-- as you say, there's a lot of debate in the climate communications world, which I
KOLBERT: don't really see myself in. I see myself-- I'm a journalist. We don't control how people respond to the facts. Our obligation is to the facts. Now I think what motivates me to a certain extent-- and maybe this is just my personality type or whatever, is a certain amount of panic.

And I think panic can be a motivating force and people should be panicking right now. It's just really-- we are on a glide path to a very hellish future. Anyone you who is under 40 or 50 or whatever should be worried, and anyone who has kids who are under 40 or 50 should be very worried.

And that should be motivating. And what do we do for our kids? All the things that we all spend our time worrying about for our kids, where they're going to go to school, did they make the soccer team, blah, blah, blah. Are they going to have a planet to live on? That should be the motivating force here.

MICHAEL Yeah. So I wouldn't normally say ending on a note of panic is exactly optimistic, but whatever--
LIVERMORE:

ELIZABETH Context is all right now.
KOLBERT:

MICHAEL That's right. Well, Thanks so much for joining me for this conversation, I really appreciated that chance to chat
LIVERMORE: with you today.

ELIZABETH Oh, thanks for having me.

KOLBERT:

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