

Full Transcript – Interview: Preserving Species by Protecting Habitats with Dr. Varsha Vijay

Erin: Hello, and welcome to this audio interview from the National Socio-Environmental Synthesis Center, also known as, SESYNC. SESYNC is supported by an award from the National Science Foundation to the University of Maryland. Join us as we bring together the science of the natural world with the science of human behavior to find solutions to complex environmental problems. I'm your host, Erin Duffy.

Erin: Protecting habitats is essential to the preservation of species and as such, conservationists stress the importance of not only maintaining, but expanding, what are known as protected areas. However, at the same time, there is an increasing demand for food production. As cropland is responsible for widespread habitat loss, this presents an increasingly urgent issue, especially in areas with both high biodiversity and high food insecurity. To address this problem, Dr. Varsha Vijay, who is a former SESYNC postdoctoral fellow, and her colleagues published a paper in which they established a baseline estimate of where and why cropland occurs inside of protected areas globally. Join us as we discuss their findings and how they envision this new information can be used to help ensure the long-term efficacy of protected areas in meeting both ecological and socio-economic goals of conservation.

Following her time at SESYNC, Dr. Vijay became a postdoc at the National Institute for Mathematical and Biological Synthesis or (NIMBioS). In addition to that, she holds a joint appointment as a Solutions Engineer at terraPulse, which is a remote sensing startup. Her research focuses on global biodiversity and anthropogenic land use using a socio-ecological systems perspective. Dr. Vijay's work fuses landscape ecology, remote sensing, mathematical modeling, and participatory research methods to develop more effective and just conservation solutions.

Erin: Could you start by giving us a definition of what a protected area is exactly and why they're so important to species conservation?

Varsha: A protected area is, kind of, a place—a geographic area that's set aside to prioritize nature. The reason that that's so important is that we're in the midst of the sixth mass extinction. So this is an anthropogenically caused loss of species and ecosystems. And that habitat loss is actually the primary driver of species extinctions. So when we look across, especially, the terrestrial portion of this earth—which is kind of where I focus, certainly this is also true in aquatic and marine systems, but—we can see human impacts everywhere. And so much of this earth is impacted by our activities. So protected areas really think explicitly about setting aside some areas where nature is at the forefront of what we're thinking about and prioritizing those areas, rather than human or anthropogenic uses.

Erin: Our listeners may have some familiarity with say, National Parks, which fall under one category of protected areas. Can you tell us a little bit about this category system, that is, who created it, and what the different categories mean?

Varsha: The idea of protected areas really is an umbrella idea set by The International Union of Conservation of Nature, that fits across a bunch of different management approaches, a bunch of different entities that apply those management and moderating approaches. They thought about these management categories as kind of ranging from category one or kind of the most strictly protected and those really were strict—where humans could enter, how they're going to use the land all the way to protected areas that allow for some limited resource use inside of those areas, some limited amount of human activity—sustainable harvest, timber, for example, can occur in some areas, or other traditional uses of land as well. A national park is a strict protection category. So there is certainly a range and those all kind of fall within the protected area system that we think about internationally. So we acknowledge that there are a lot of differences even within a management category because they're different countries, there are different national entities, there are different goals that those nations have for the protected areas, but overall this is a critical strategy. And I really want to emphasize: this is a critical strategy we have to slow species extinctions.

Erin: So it sounds like there is a spectrum, so to speak, of this protected area network, where some areas are designed to incorporate limited human land uses whereas others are designed to remain as close as possible to their natural states. But, what really floored me in reading your paper is that according to your estimates, cropland actually occurs inside of all management types, with 22% occurring in strictly protected areas! That's pretty astounding. And to get more specifically to your paper, let's start with the title, it is called: Pervasive cropland in protected areas highlight trade-offs between conservation and food security. Could you explain what you found?

Varsha: Obviously food production is one of these really critical goals and we see that highlighted actually in the U.N. Sustainable Development Goal framework. And that's another decadal target, which is thinking human wellbeing and placing it in the natural systems context, so it kind of has flavors of both, but is thinking about human societies primarily. And that no—that reduction in food security—or, kind of, “no hunger” as it's framed in goal two, is a critical part of what we're aiming for in the next decade. However, as we rush to produce more food—we have actually expanded cropland at the expense of natural systems. So, that means forests have been converted to cropland, natural grasslands have been converted to cropland, wetlands have been drained and converted to croplands.

Erin: So does encroachment occur only because of food security concerns or are there different reasons in different places?

Varsha: That's a great question. Yeah, I mean there are different—there are both different reasons and different potential impacts. So some of the areas that have the most amount of dominant cropland are actually in the mid-northern latitudes. So that's in places that we might characterize cropland as being incorporated into protected areas. So they might be historical croplands or something like that. And then there are parts of the world more characterized by the tropics and subtropics where cropland incursions occur inside of protected areas. And in those areas where the habitat is replaced by cropland—that can have a really dramatic impact on species diversity. So these are the areas that are the most biodiverse on earth. So that conflict or that trade off is potentially highest between species and this like cropland pressure in the tropics and subtropics. That's also the region of the earth that's characterized by some of the highest levels of food insecurity.

Erin: So there are vastly different reasons why you would find cropland inside of protected areas across the world, as well as different implications for both nature and humans depending on where you are.

Can you talk a bit about the different questions that might arise when thinking about strategies to combat these problems?

Varsha: I would say in those parts of Europe where we do see a lot of cropland inside protected areas, in fact that is where the majority of it is found. I think it behooves us to think about OK, well, we've met this area based target or some percentage of land that's inside of a protected area, but like, what are we actually protecting? And if you talk about just increasing that percentage—are you incorporating more croplands? And if you have the ability to do so—should we set aside more natural lands that are more natural? Should we think about restoration? And how do we alter our management adequately? And then you think about this other side—this other scenario that's happening in the tropics and subtropics and you think well, gosh, in these places were there's so much pressure for food production—where there is high food insecurity and where biodiversity is great—it's an urgent problem, but also requires real cooperation between food production programs, between protected area monitoring programs—so that we not only kind of mitigate some of the issues of cropland production and expansion, but we also really know what happens when those areas are converted to cropland, so we know what the impact is on particularly threatened species when the cropland conversion occurs.

Erin: You mentioned threatened species and, of course, one of the main goals of protected areas is to preserve habitats to conserve species. Are there certain species that are more vulnerable to negative impacts of habitat destruction than others?

Varsha: Our impact on the earth really has drastically impacted the persistence of many species, particularly those that are rare, threatened, and habitat specialists. And that last category is species that depend on natural systems that they evolved to live in.

Erin: What is the scale of this problem? Or in other words, what did your research find in terms of the percentage of areas that have been designated as protected, but are actually comprised of, or are being converted to, croplands?

Varsha: Yeah, that's a really good question. So, we estimate that approximately 6% of protected areas are actually occupied by cropland. So, I said that number in a couple different audiences and if I'm talking to conservation biologists, it's like, "Oh my gosh!" Or if I would talk to other people, they're like 6%, that's kinda low. But actually, I think this is a really important minority. So if we think about overall anthropogenic impacts—some folks have estimated that something like a third of protected areas are deeply impacted by human activities. And cropland is kind of one of these very drastic land conversions. You know, once it's cropland, for the most part—especially, the types of cropland we do detect—that is, kind of, not easily going to return back to a natural state. So that six percent is actually something like, you know approximately twenty percent of that total anthropogenic impact. And for one single thing, that's quite a lot.

Erin: If cropland encroachment is only one kind of anthropogenic impact, what are some other threats to protected areas?

Varsha: Added to that is other types of agriculture. For example, we don't address grazing, it's kind of particularly difficult to get at that with remote sensing tools that we're using in the study—in the work that I had done at SESYNC. But that's another huge one and that impact is potentially even greater than the cropland impacts we see. There's infrastructure development—so roads cutting through protected

areas; power lines; there's extractive industry—which is what my early work focused on inside of protected areas. There's urban expansion. There's hunting and poaching. So I mean in general the human systems' threats to protected areas are really great—great as in not good, but, like, are huge. So, the challenges are huge.

Erin: What do you think is the best way to address these big problems?

Varsha: What we've seen is when effective management is joined with a greater understanding of what actually is in a protected area, what the impacts of those land use changes are, we can actually do amazing things.

And there is sort of, I think, something that we don't talk about enough in science, which is you don't address big problems alone. Like you go after these problems and the only appropriate response; the only appropriate implementation involves policy professionals, health professionals, you know, ecologists who specialize in the relevant species in that area, conservation professionals, who are focused on management, as well as someone like myself.

Erin: Speaking of yourself, I'd like to turn to the nuts and bolts of how you actually conducted your research using remote sensing techniques. Can you tell us about that?

Varsha: Just to say, this is one approach. I actually started my career in conservation in a very different way. I was doing a lot of community based conservation. So that's hyper site specific. I went to a specific protected area, worked with specific communities, and that was incredibly rewarding. And that kind of depth of knowledge is something that you can only get at that level—when you're there, boots on the ground, understanding what's happening in a specific area. The work I was trying to do here is looking at a broad and global extent. So what that means is it helps us understand patterns on the earth; so it helps us understand the where and why of cropland in protected areas. But it doesn't, again, like, tell us exactly the mechanics of why it may happen. So that mechanism is really difficult to tell at that hyper local level without going boots on the ground. However, remote sensing—um, which in my case, is through the use of satellite imagery—is an incredibly important resource for monitoring the integrity of protected areas, the ecological value provided by them, and also understanding a lot of the dynamics of ecosystems.

Erin: During these times of COVID, many things have transitioned to being remote. Has remote sensing been a useful tool during these times?

Varsha: So, during the pandemic there's also been an increasing need for conservation professionals and ecologists to access what's happening on the ground in places that we now can't get to. So remote sensing also provides this tool that allows us to say, you know, "what is happening in a far off part of the world?" And of course there are inherent errors associated with that—there's all sorts of processing you have to do to be able to convert that image data to the thing that you want to know. But when you do that, when you harness all those data—all of a sudden you can start to address all kinds of questions that have really been persistent.

Erin: So it sounds like remote sensing has been a great tool during the pandemic. But, it also sounds like it's a great tool to fill research gaps for areas that are always difficult to get to due to topography and/or available resources in the area. Is that right?

Varsha: Yeah, you're absolutely right. I think that just highlighted sort of an existing issue that was there. So for example, there are parts of the world that we don't do a good job sampling and so we might have biases that tell us more about, kind of, my back yard—where it's really easy to get to and not the parts of the world that it's really difficult to get to.

Erin: Can you give us an example of a place where it's usually really difficult to collect on the ground data and what that might look like?

Varsha: Actually a lot of my dissertation work and my previous work, prior to coming to SESYNC, was in the Amazon and in the western Amazon specifically. And so there would be parts where we would go and do survey work, but we were able to use those areas that we went as validation to develop an algorithm to tell us about places that we couldn't see, so, like, places that we couldn't access. So, this can, in some way, even the playing field, but at the same time it's complementary to the sort of things that you can collect on the ground.

Erin: Can citizen science ever be used to provide some of the local on the ground knowledge that you mentioned?

Citizen science is also a big important tool in the broader tool kit of conservation. And that's how I kind of think of it. I mean protected areas are, you know, a tool in the tool kit of conservation—they're not the only one. And similarly remote sensing, species observation, camera trap data, citizen science—these are all tools within the tool kit that help us understand what, again, the patterns and processes are on earth. And we just get a little bit better at understanding those as time goes on.

Erin: Do you have a personal philosophy that informs the work that you do in terms of how you think about the sometimes competing interests of natural vs human systems?

Varsha: This is just kind of like an overall philosophy that I think about. Why conservation—why do we have to think about that? But, to me, kind of a foundational belief that comes out of thinking on the rights of nature is really that all life, all ecosystems, are just deeply intertwined on this planet. So that includes human beings, so there's no conservation, there's no ecology, without thinking about what the roles of humans are in shaping the patterns that we see. So, when I'm thinking about protected areas, I'm thinking about it in the broader context, what the natural systems goals we have—so what those ecological goals we have—are, as well as, the human systems goals we have. Which include things like cultural conservation and ecosystem services goals that we have for those same areas.

Erin: You just mentioned cultural conservation, could you expand on that more.

Varsha: To me, there is no conservation work that is effective or that is just without acknowledging the rights, sovereignty, and knowledge of local and indigenous people. And finding a balance where protection actually is compatible with land tenure—is compatible with rights and beliefs of local people—is kind of the only conservation that's going to be effective. It is truly dependent on the will of the people who live, work, play—experience those systems. And I have found in my career, as I've grown, that it takes some level of humility, also, to step back and say, we only have one perspective, we don't have all the knowledge. And that's the same as when I was saying it kind of takes collaboration with other scientists in other fields. It definitely also takes collaboration with local people to ever make change on the ground because we are really only getting the answer to the question we ask. Which means there are so many other questions that don't show up in this work. Among those is the fact that

indigenous people are incredibly effective land managers—they have a huge amount of traditional knowledge—traditional ecological knowledge on the species and ecosystems and their functioning and their processes that we kind of don't even know what many natural systems would look like without the imprint and without the work of people who have lived in those systems for millennia.

Erin: We've talked about the different ways to collect data, as you just said, remote sensing, on the ground observations, etc. as well as the different players involved, for example management professionals, ecologists, and someone like yourself. Can you tell us how your research fits into this melting pot of collective effort?

Varsha: A lot of my work is actually addressed to those international governing bodies, to the national levels as strategy is formed. So a lot of this work maybe you could think of as informing strategy.

Erin: In a broad sense, what are some of your goals for the future of your work?

Varsha: Some of my follow-up work, after just, kind of, assessing the scope of cropland in protected areas, is to look at, for example, how those trends might change with population growth, how they might change with climate change, and how also we can think about leveraging different resources.

Erin: Population growth, climate change, and access to resources are definitely very important issues now and in the future. I look forward to seeing how that work develops.

Erin: We hope you've enjoyed this audio interview. Please stay tuned for future interviews by visiting our website or signing up for the newsletter at www.sesync.org. And if you'd like to learn more about Varsha's work, check out her website at Varshavijay.com. Both of these links are available in the episode description. Thanks for listening!