Rethinking Hydropower

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SPEAKERS

Russ White, Emilio Moran

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Russ White 00:00

I'm Russ White. This is MSU Today and it's a pleasure to welcome Emilio Moran to the program. He's a John A. Hannah distinguished professor at Michigan State University. Emilio, welcome to the program.

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Emilio Moran 00:12

It's nice to be here.

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Russ White 00:13

Could you tell us a little bit about your research interests? What do you like to research? What are you working on?

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Emilio Moran 00:19

Well, I've been working for several decades, mostly in the Amazon. But I've also worked in Africa and other countries besides Brazil. I've worked on agriculture, I've worked on what is known as land use land cover change, I've worked on migration and demography. And for my work is probably best known and why I was elected to the National Academy of Science for my work, which for the first time, you use remote sensing in order to examine very small fields in farms, to understand how people make decisions about how much

rainforest to cut, how much to cultivate. And so that became my focus of my work. And also study what happens after you deforest the rainforests, I study, what is the rate of secondary growth after you deforest the rainforest as a function of the soils as a function of the kind of use that you made of that area that used to be forest during the agricultural period. So that consumed my interest. And that was, at the time I did it fairly new, nobody had actually studied root secondary growth from space. Of course, we started from with space data from satellite Landsat. But we also studied on the ground, we spent a lot of time in the field. Checking out what's there really, because all you see in satellite data are pixels and you see digital data, you don't see the forest, you see just little dots. So you have to interpret with the dots mean, and so we spent a lot of time on the ground trying to figure out for this particular spot, you know, what's here? Is it a cocoa plantation is corn, is it beans, is it, you know, secondary growth? And then we were able, you know, after 10 years to do it, for the first time, be able to follow that rate of regrowth and that I think that's why I was elected to the National Academy. And that was work done in the 90s and early 2000s. And then what I'm going to be talking about the trustees, on next Friday, is new work that I've done. Really, since I came to Michigan State in the same region where I had been working for several decades on issues of land use and deforestation and demographic change. They started building the biggest dam in hydroelectric dam in in Brazil, the third largest in the world. And so right in the backyard where I was doing my agricultural and environmental work, so to me was just irresistible when I first went to the Amazon, because they were building the first highway, across the Amazon Basin, you know, a big infrastructure project. I didn't call it that back then. But I realized now that's what it was a huge, you know, 3000 mile highway cutting for the first time the Amazon open to migration and development. And that's what I studied for, you know, for the last three decades. And then I realized that dam building had been going on in Brazil for some time, about 30 years. But it had just really begun to be a big thing in the Amazon, I hear is the biggest one of all being built right in my backyard in that sense, because that was my second home. And so I felt I just had to study it. And that lead me to all kinds of new things. I mean, the earlier work took me to agronomy, ecology, you know, deforestation, agriculture. This new work is taking me to engineering. And so I began to look for engineers here at Michigan State that might help me with this new project that I conceived. And I applied and got funding for the National Science Foundation to study well, the social and environmental impacts of the construction of this largest of the dams in in Brazil and the Amazon. So I was successful in getting that funding. I brought in not only the engineers a turbine in engineer and environmental engineers to help me with that I brought into the team, people from hydrogeology, because we want to understand the whole hydrology of the Amazon Basin, because that's what they're trying to tap into. They're trying to tap into the water as a source of energy. So we want to understand, I know what's not involved. And the other thing is we were trying to we began by questioning, in fact, the title of that proposal to NSF that was successful $2.5 million grant

was "Rethinking Dams." You know, how can we have sustainable power for communities in the region. And the reason for rethinking is that I've worked there for a long time. And I realized that the only other previous dams in the region, or the energy didn't go to the people who are most profoundly affected by the dam, those people were resettled. Those people would've lost their homes, you know, through flooding, and the reservoir, they they never got land of comparable quality to what they had before. They often became impoverished they lost their fishing livelihoods because they lived by the river. And how is it possible that you build these big structures to produce energy? And then you forget the people who are most profoundly affected? So I began to to say, Okay, let's let's rethink this, which is why, which is why I, I brought in the engineer, a turbine engineer into it, and my charge to the engineer was, That will be a revolutionary. And then, and then can we do it without killing the fish? Every time we met every month, during our project, we had my first I was turned to the engineers and say, remember, we don't want to make sushi. that's, that's what made it exciting is a new kind of what I call reverse engineering. In other words, we're not trying to have the most efficient turbine in the world, we're trying to find the one that's most fish friendly, and still produces enough energy for people. So that's what we've been working on for the last five years. And that's mostly what I will be talking about. In the trustees meeting next Friday. We just got funded in October for a new project, that kind of piggybacks on that one. But, again, we just getting started, we just had one or two meetings, to get to know each other. And that's going to basically try to develop the prototype to put on the communities and work with the community to modify the technology to meet their needs. It's actually the other ones designing the technology. This one is to implement, you know, the, the actual technology and the ground, but I can't talk about it. Because I mean, other than, you know, it's, I know what I want to do for the next is a five year grant for $3.2 million. I know where we want to do, but we just got it. I'll be talking about what we have done in the last four years.

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Russ White 08:54

I'm talking with Emilio Moran on MSU. Today, he's a John A. Hannah Distinguished Professor at Michigan State University, and a member of the United States National Academy of Sciences. And you started to talk about some of it Dr. Moran, but a little bit more on what you've found so far, what questions you still hope to answer with this research?

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Emilio Moran 09:17

Well, we found but there are many dimensions to this work. I mean, the turbine is the you know, the thing we want to deliver at the end, something very practical, usable, that people can can be given energy for, you know, how can we serve off grid communities,

anywhere in the world? We just, you know, again, because I have credibility of working in the Amazon for so many, many years. You know, people believe me when I say I can, I can do this. Most people can't can't do it. I mean, still harder place to work. But people believe that I can do it. I've done it for a long, long time. I've published a great deal and everybody has to kind of refer to my work if they're gonna work in the Amazon pretty much you know, a better quality of life, better water, better sanitation, all those things are promises made to get people to not fight against them coming. And that people generally, you know, believe that this very powerful people can deliver that. So, but we found that, in fact, in this dam, is one of the biggest nightmares of all the dams, in fact, because it is so big. You know, there were 22,000 people who had to be resettled or resettle, you know, far away from the river. So all those people who are living off the river to fishing and other activities suddenly get put in a community that's built for them and nice, nice houses, sure, but too far away from where they can make a living. At the beginning, for the first two years didn't even have bus service to the community. So they have to pay taxis, if they want to get out to the bank or to a grocery store. There was no retraining of people for a new job that they could have. So the social part of the project got into all this social impacts. And then we got into the environmental impacts. We look at the fisheries, we hire postdoc who's a fishery ecologist. And then we found again, how the decline, you know, radical decline, not only in fish amounts, but in fish diversity, because some of the first fish would disappear when you build a dam are the big ones. You know, the big catfish, I'm talking about, you know, six feet long. catfishes. And that was the lifeblood of, of the fishermen because they're easy to catch, they're big. And they bring a lot of money to the fishermen, suddenly those but those are all migrating species, you put a dam and they can't migrate anymore, and you break their spawning behavior like you did with salmon. You know, this has happened to a lot of rivers in North America. With salmon, you block their migration. So then as your salmon population collapses, well, here you have, you know, hundreds of species, you know, you know, we cry about salmon, but, you know, they got hundreds of species in the Amazon, that suddenly are start disappearing. I mean, there's one river that we have been studying in this project, that before the dam was built, they documented 1047 species of fish. It's the most biodiverse river in the world, by far, twice as much as even the Mekong, for example, or the Congo in Africa. And they put up two dams in it. Well, now you no longer have any of the catfish. You don't have that famous Pirarucu fish, which is two and a half meters long. And, you know, you can go and look at it at the Washington zoo, but is disappearing. And if you find any, they're tiny. And only in some small affluent, where it has survived. But the big ones which take advantage of the big river and all the big sediment and rich nutrients on the big channel, the river disappear. So I mean, their oldest dimensions, you know, fissures collapses, that people's lives are made worse. They promised them clean water and sanitation. Well, I'm for I had a student doing her doctorate on water and sanitation. And she shows how the the building company violated the law. For They're supposed to

improve the water and sanitation whenever they build a big infrastructure. With it, they didn't. Have the governments of state, local, state federal get ready to provide all that is needed to soften the shock of social big infrastructure project coming to your community? You can't just arrive and do it afterwards. It's too late.

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Russ White 15:17

Well, Dr. Moran, let me ask you as the projects move forward in your research, what are sort of some challenges and some opportunities maybe on the horizon?

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Emilio Moran 15:27

Well, the opportunity is that we have in this project that we're in the final year of with the engineers have done some very good estimation of this technology's potential, we found that just putting solar panels So there is a solution that doesn't require dams. So that's really what we're doing what we're trying to get to, in our project, here is solution floating panels. You know, we did not invent that idea. I mean, there are, there are Japanese floating panels, not for several years, there's some of the UK there are some in Brazil, in small areas, as experimental floating panels, it does work. People are just not thinking big enough that this could actually replace dams without any of those dams damaging things that are associated with dams. I mean, just throw them in on already existing dams you don't have to build anything new, in order to get that 30 gigawatts of energy, which is a lot. that we can generate 63% of the total energy that's planned to be generated by conventional hydropower, and the next 10-15 years using in-stream turbines. And so the damage can actually be worse for having 14-15 small conventional dams compared to a big. And in fact, that's in our in another project that I have, we're working on investigating, comparing a stream of, of small hydropower dams with, with the big ones to see which one actually has more damage, I'm sure, we'll be doing that for the next three or four years.

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Russ White 20:23

When you present to a group, like the Board of Trustees are there a couple of messages you hope they take away, or that you want to get across to people about this project in your work?

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Emilio Moran 20:33

Support science, I mean, ah, and let people that people, you know, encourage them to innovate. Not to think inside the box. I mean, it's so easy. I mean, we've been building

hydropower dams for a long, long time since since the turn of the century. In fact, the first the first dam was built in Grand Rapids, Michigan. So we have a history of of building dams, we have over 2000 dams in Michigan at the moment. Everybody somehow is comfortably enjoying the reservoir for their recreational activity, not thinking that all those a lot of those reservoirs are high risk dams that are likely to breach unless either we invest a lot of money in fixing them. Or we spend a lot of money removing them. But as they stand, it is a high risk situation for human life for human property. And I think our research offers a solution again, it does solve the problem having a pretty likly wish to bolt on. But if what we want is hydropower, sustainable energy source, we have this, this technology can do it. But even putting something in the same place to show that we can generate power for Old Town, for example, is something that we might we might undertake, if we had the resources to undertake it. I was hoping that maybe maybe as trustees or somebody else might decide that this will be a good investment for Michigan that will take us in the direction that would be safer for our citizens. And that will put us at the forefront of new technology for the nation.

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Russ White 23:42

Well Dr. Moran, it's comforting to know you're working on this problem though I can sense your passion and really appreciate all your great Spartans Will. work and telling us about it today.

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Emilio Moran 23:52

Yeah, I think I think MSU was a good fit for me. I'm whatever I do I'm very passionate about. it's something that can apply over most of the United States. And we still were mostly thinking of small dams, as opposed to having some other way to get that power.

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Russ White 24:23

Well, that's Emilio Moran. He's a John A. Hannah Distinguished Professor at Michigan State University and a member of the United States National Academy of Sciences. And I am Russ White. This is MSU Today.