MARTY ROSENBERG
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NICK ARMENTROUT INTERVIEW

Hi, and welcome to GridTalk. Today we have with us a really special guest, Nick Armentrout from Maine, and we're going to go down on the farm and study what we need to know about solar voltaic and agriculture, and solar grazing. If you go to Nick's LinkedIn website, it says he is a grass farmer and horseman and a solar grazing specialist, and if we want to look at his background, he's president of an organization called American Solar Grazing Association.

Q: Hi, Nick. How are you?

A: I'm doing great, Marty. Thanks for inviting me to be here with you.

Q: Okay. If we have our listeners scratching their heads and asking, why solar grazing agrivoltaics, one-third of the American landscape is earmarked potentially for grazing, is that correct?

A: Yeah, that's right. It's a maybe not known by folks walking down the street but a great deal of agriculture in the United States is grazing lands, is pastures and grazing lands. Not all

acres are appropriate for tillage or production agriculture and cropping. There's a lot of land in the U.S. that's really most suitable for grazing with all different types of livestock and utilizing the forages there to grow other products and I think other meat products.

Q: Our last podcast we focused on ramping up energy storage in America that the Department of Energy has a program going out through the Sandia Laboratories to boost storage so the question on the other side of the fence to use the agricultural term is, where's the solar going to come from? And this little niche we're focusing on is quite fascinating. And tell me how putting solar on grazing land becomes an opportunistic benefit to our energy economy, to our farm economy, to small independent farmers? What's the vision here?

A: I think what you're asking, Marty, is quite a large question in that, where are we going to be citing ground-mounted solar energy facilities in the U.S. and how and when are they going to interact and overlap and/or compete with agricultural land uses that are already in place, and that can be here in the Northeast where I'm from in the State of Maine and they can be across the more expansive open acres in the West. There's certainly an opportunity to cite renewal energy facilities on some of that open acreage, some of the open land that's not

occupied by housing stock that might perhaps not be in cropping typical commodities rotation of corn and soybeans and wheat and alfalfa but in some cases as well, the land that is in pasture in the United States, it may not always be appropriate for other intensive types of food production. It may be best utilized as grazing lands. It may be that those soils can grow forages and plant species that humans may not be able to directly benefit from but grazers, four-legged herbivores may be able to convert that into a meat that we can consume and benefit from so there are acres in the U.S., a vast number that are most appropriate for pasture and grazing and those might be acres that renewable energy may be cited on and some of this conversation perhaps will be around how we can do that appropriately in a symbiotic way and not compete as a competing land use.

Q: So, let's get down to ground level here and in 2023, there were 100,000 acres that were grazed with sheep. Tell us; that's a lot land; that's 156 square miles, that's not a piddling amount. How fast is it growing and who are the players and what are the challenges; what are the opportunities? Talk about the business, how it happens.

A: Sure, yeah, that's a great question and a super observation on those numbers so first of all I would say that grazing under solar was a practice that was brought here by some number of

European energy developers that were already utilizing some of these practices in Europe and in Asia, and some of those more progressive companies brought that with them across the pond to the U.S. market as a way to maintain the vegetation growing under their solar sites, so we learned this from this practice within the renewable energy industry from solar developers already using it abroad, but in this country we would also say that we know this practice well. We consider any application of herbivores that are grazing as a form of targeted grazing so targeted grazing can be used to control invasive species. It can be used to control fire fuel loads and when it comes to human's manipulating animal movements for desired outcomes, that's not something that came from Europe at all. It's something that's been around for a very, very, long time. First nations and indigenous cultures have practiced it long before renewable energy took hold of it. But…go ahead…

Q: So, the key player here will be a solar company comes through. A man or woman owns some acreage that's in grazing and says, we'd like to put some panels out and the question becomes what happens under the panels, what's growing under the panels? So, tell me how grazing comes in there.

A: Yeah, sure. So, when a solar ground-minted solar facility is constructed there's steps that are taken to control the

stormwater that's coming off of the impervious solar panel surface and falling onto the ground, the previous soil surface. And there's a desire to control that stormwater flow, to control the flow of the water across the ground and to control erosion, and mitigate polluting the local watershed. The way to do that, the best management practices for doing that is to establish and to revegetate those soils to stabilize the soils. I am not a restoration ecologist or an engineer but again here the farming agriculture at USDA, the practice is to revegetate soils to stabilize them and control erosion so these solar sites are constructed and post construction, ideally during construction, there is vegetation in place to control stormwater. After the site is turned on and is operational, now you need to maintain that vegetation. You don't want it to grow too tall and shade the panels and impact actual production why those panels are there, their output production, why they're there in the first place and you also don't want the vegetation cropped too short where it can't provide the important stormwater functioning and also soil stability function. So, yes, you can use mechanical controls, your typical zero-turn mower or larger agricultural equipment and mowing and tractors, etc. You can also use grazing animals to do this. And it doesn't take a genius to say, "Well, huh, maybe we can put grazing animals in there and let them do

the work and we can park the mowers and let our staff go home at the end of the day and the grazers keep working through the night." There's an efficiency; there can be some cost savings to having grazing animals on the site versus machinery maintaining the vegetation. Most often that's recognized in damages, associated damages. Grazing animals don't throw rocks like a mower does that could damage panels and as I mentioned before, they work 24/7 whereas most of our folks, we like to go home at the end of the workday so there are advantages.

Q: Would the solar developer typically go to somebody who has a grazing operation and say, "How'd you like to get a stream of income equal to X per year?" And then, would they want to plant specific foliage that their animals like?

A: Yeah, great question so, yeah, in the early days, there were as solar facilities became increasingly common, there were farmers in the community, new or seasoned that might have said, "Huh, that's essentially a fenced pasture that I'm looking at. I could put my animals in there," and they may have driven up to the entrance gate and found a contact number and called the company. Similarly, there were forward thinking folks on the energy side, the energy and development side of the table saying, "Hey, we've observed grazing on forest service or BLM land, Bureau of Land Management, property in the West, in the

arid West or we've seen grazers introduced into a housing community to control fire fuel load in areas in California. Could they be doing that in solar so some of these folks were finding one another. Now, there are organized means of doing so such as the American Solar Grazing Association or even the Solar Energy Industries Association knows that there are ways to reach grazers. AgriSolar Clearinghouse also comes to mind. So, there was a second part to you question though but that I have now glossed over.

Q: Well, do they plant plants that their animals would benefit from?

A: Yeah, thanks, so yes, so again in the early days these solar developments may have used short turf grasses that mature in a shorter stature that were not a potential threat for growing to shading the panels. Some of those early sites may even have been constructed with gravel with no vegetation at all. Over time it's been discovered that there's an opportunity to more deliberately design seed mixes that might help to reestablish native grasses, pollinator habitat, and when we're thinking about grazers, grazing animals in a site, certain grasses, forms and legumes may be not only enticing but provide a great diet for the grazers so yes, those grass mixes

increasingly are being thoughtfully designed with grazing in mind or with habitat restoration in mind, yeah.

Q: So, would you consider this movement of agrivoltaics in the grazing community in its infancy? Is it going gangbusters? Is it already big and getting bigger? How would you describe it?

A: Yeah, I guess I'd say I'm kind of close to this so I am biased bYut yes, it is growing quite significantly so in 2021, the American Solar Grazing Association ventured that there was between 15,000 to 25,000 acres of solar existing facilities being grazed at that time. Part of a multiyear grant we received from the Department of Energy National Renewable Energy Laboratory specifically, their InSPIRE Project, was to study the phenomena of grazing in the United States and some of its impacts and some of the practices at play to; it was the first census of solar grazing in the U.S. The preliminary results from that in 2023 showed that there was at that time about 100,000 acres being grazed so it blew us away; we were quite surprised, and those were only the preliminary results. We will be releasing probably after the first of the year, the final data collected from that census which was a chance for us to make sure we had dotted all our I's, crossed our T's and had accurate information but it now is apparent in this year, 2024, over 120,00 acres of solar are being grazed in the United States so

that is more than any other country that we're aware of on the globe, so the U.S. is taking a leadership position here, grazing solar.

Q: So, looking at it from the 30,000-foot level, is it large agriculture, industrial agriculture grazing that's pushing it? Is it the small independent farmer or does it make sense at both ends of the spectrum?

A: I would say it's making sense at both ends of the spectrum so you look at Texas that is known as an energy state so there's also, and it's also a phenomenal agricultural producer so there are some pretty well-established livestock folks there who have flocks of sheep and that were ready to pivot to meet the opportunity so they were longtime grazers that they may have paused for a generation or two but it's a part of their family history and heritage, and they were able to meet the opportunity in solar. But there are almost as many new and beginning farmers who they're not daunted by the idea by trying to put together an agricultural system that can be married with solar. Certainly, there are farmers in the mix that aren't winners that say hey, look I have invested over the years in the kind of equipment and the kind of infrastructure that doesn't match with solar and it's not for me. You might in that circumstance meet farmers that are therefore interested in leasing some of their land to

earn some additional income to supplement their ongoing operations. It's also a chance for an up-and-coming generation in the farm family to do something different than dad and grandad. They may be looking for an opportunity to move the farm forward and put their mark on the family operation and this could be a chance for them to do so, so it touches a lot.

Q: Do these farms where this happens, this grazing holdings, does the electricity stay local? I mean, does the farm tap into it? Does it see a significant cut in its energy costs?

A: So, there's a couple of different ways to answer that and I'll do so in a very rudimentary way so there's on-farm solar would be in part defined as solar that is producing for the immediate needs of that operation so and there are lots of examples of that and there has been and there are many different forms of on-farm energy production. So, USDA Reap Program, rural energy program incentives on-farm solar production in support of the needs of freezing, cooling, refrigeration needs or running the milking equipment at a dairy; those are examples of on-farm. Then there are perhaps examples of where the farm has decided that it wants to engage in a lease with a larger-scale multimegawatt ground-mounted solar facility and that generation goes into the grid, the local grid, and then may be picked up

and sent out to a regional or into a larger energy infrastructure.

Q: Are farm co-ops players in this; are co-ops making this happen or is it independent solar producers or all of the above?

A: I think it's all of the above; I mean, I'm not so close to the co-op side that I can answer that but there are some organizations that are working to develop co-operatives and there's certainly are community solar programs where you can buy your energy from a local facility that's producing energy in your state and is feeding the grid that you're drawing power from in your state. It's a little tougher; I happen to live in a community where we have our own independent power producer, it's a small, little nonprofit so there's an opportunity for me to feed that grid in my community for my local school or grocery store but that's somewhat exceptional.

Q: Nick, take a minute and describe to me and tell our listeners what the Department of Energy large animal and solar system operations prizes by the Department of Energy?

A: The LASSO Prize, yeah, that's an exciting initiative the DOE launched in 2023 that I'm mostly aware of through the American Solar Grazing Association because of course, we're quite interested in seeing grazers on solar across the United States but essentially, the DOE came forward through a

partnership with the HeroX system of trying to invigorate research and design, meet design challenges to put large animals, beef and cattle in a solar site and again, I'm biased. I'm a sheep, a lamb, and wool guy but there are a lot of people who consume beef in this country so there's been a real push to try to figure out what has to be done to open up solar to more larger ruminants, so the DOE's thrown millions, over $8 million dollars and they've come back and supplemented that with some additional funding as well to try to invigorate design challenges and engineering to meet that need.

Q: So, do you have universities working on this? Tell us where the money's going? How's it being distributed?

A: I don't know where it's going; Marty, I don't know exactly where every bit of the money's gone. (This is because awards haven't been made yet - the current funding phase remains open until March 6, 2025: https://www.energy.gov/eere/solar/american-made-large-animal-and-solar-system-operations-lasso-prize)

Q: Just give us the big picture.

A: I do know that some researchers from Colorado State have been involved with some developers in the southeast for instance, Silicon Ranch and Center for Agricultural Resilience which is part of White Oak Pastures and Will Harris, to look at developing systems for grazing cattle so that's one model but

there are others that have thrown their hat in the ring; other developers and other researchers and other agricultural organizations that have partnered to try to meet and put together research. I'm not versed with all of them.

Q: Well, I mean, you've got broad knowledge and that's why we tapped you. When you and I chatted offline…

A: Sure.

Q: And we talked about the possibility of getting geese and even grazing pigs in on the act…

A: Yeah, that's right.

Q: So, what's good about that?

A: Yeah, I mean I think that's the concept of agrivoltaics is absolutely about integration so I selfishly and also at American Solar Grazing, we talked about hazarding the excitement of developing the solar facility over here for sheep and the other one over here that's for cattle. What we need to figure out is how to integrate all of the above, multi-species grazing or following one livestock species like cattle on a leader/follower model where then sheep might follow them through and they're each trying to graze and they're attracted to different forages and vegetation in the site and also not susceptible to the same parasites and pathogens. Folks have been in fact looking at different types of grazers. There are some heritage breeds of

pig, Kunekune and Idaho Pasture Pigs that are true grazing animals. They really do want to eat grasses. Geese and ducks will eat grasses as well so there are folks who have looked at how they might scale poultry and grazing and solar, and hopefully, this keeps going, yeah.

Q: Does this…do you think for those people that are concerned about animals and their living conditions, getting them out into graze situation, is that going to have an appeal?

A: I think it's; I think it's a fantastic situation, I mean, we're just scratching the surface on livestock and grazing solar and the potential benefits for the animals in the system so there's plenty of research on the benefits of grazers on the landscape but not as much yet on the potential of grazers in the solar landscape so we do know that there's decreased heat stress; it's a cooler microclimate underneath the panels and that's important for cattle and beef and sheep. They benefit in that environment. They tend to thrive in that environment. We've underestimated the importance of shade is what it comes down to.

Q: Hum, and when you think of that, your Association, what are some of its priorities? Do you need legislation, policies, public awareness? What are the driving main objectives of your Association right now?

A: Well, you've touched a bunch of it already. We absolutely need legislation; the United States needs legislation. Importantly, we need a federal definition of agrivoltaics so there's been some noteworthy marker bills, Senators Heinrich, Braun, Sorenson; there were the co-sponsors back here in Maine by Chellie Pingree to try to come up with a unified definition for what agrivoltaics is. As the farm bill's been delayed, some of those marker bills that might have come through and included that language and open the door to defining and greenlighting for the innovation for agriculture and solar has also been delayed so lacking that federal definition, we're still left to struggle with this on a state-by-state basis and sometimes a county-by-county basis so we need a federal definition for agrivoltaics. We also need workforce development which has started to happen on the solar and electrical generation side but we need to work hard on the agricultural side to educate and bring forward the next generation of farm workers, laborers and agriculturalists and pastoralists that want to work in solar. That's one of the key things that American Solar Grazing Association offers. We offer a certified grazing training. I referenced White Oak Pastures and the Center for Agricultural Resilience; they're one of our partners. Most importantly is our partnership with the American Lamb Board. They have solar

grazing trainings across the country but we also partner with some individual trainers like one I'm quite close to here in Vermont, which is called Agrivoltaic Solutions who also offers solar grazing training. Moving forward, we anticipate some of these trainings and the workforce developments being picked up at the state level. There's already important work that's happening in North Carolina and I referenced Colorado, and Oregon State is a big one; Arizona State so lot's happening and we hope to see more but it is important; we need to educate and train the next generation of farmers to farm energy facilities.

Q: Nick, it's amazing that we've for decades now, we've talked about solar farms thinking many of us that they need to go in and close to cities and this morning, you're telling us, solar farm may have a really good home down on the farm as well.

A: Absolutely, yeah, no, it's not all good; there can be some challenges but what I like to talk about with folks who are interested in it is to say, it's not all bad either. It's okay that this gives us pause as a culture to say, "Wait a second; what are we doing?" I think that how we use that time to think through and deliberately design for these industries that really need each other; energy and agriculture really need each other. If we can design systems where they can truly be symbiotic and work together for myriad benefits then so be it. That's what we

can perhaps use that pause for but it would be a shame if we simply sit and wring our hands when there's really great potential benefit in the pairing of the two. There also can be important benefits to the community and the municipality but to the farmers themselves so there are plenty of farms that a small lease, hosting some generation can supplement the existing overall agricultural enterprise. It's not necessarily selling the whole farm; it can be hosting solar on a portion of the farm. And again, there are folks who may not currently have access to farm acres. They may not be part of a generational farming family. They may not have access to generational wealth to purchase farmland, let alone, lease but they may find themselves undaunted by knocking on the door and trying to build a farming system that fits within solar and so there are just as many opportunities as there are challenges right now. I would say more so, more so opportunities than challenges but we have to figure it out. We work together and figure it out.

Q: Great. Thanks, Nick. Thanks for joining us.

A: Yeah, thank you, Marty. It's really been nice to talk with you. Appreciate your questions.

We've been talking with Nick Armentrout who fashions himself as a solar grazing specialist but also happens to be president of the American Solar Grazing Association.

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