



Can rangelands store soil carbon?

Featuring Megan Nasto

Research Scientist, Working Lands Conservation

DJ May

Welcome to the Decode 6 Podcast where we take your questions about carbon and ecosystem services and match them to the experts with the answers. I'm your host, DJ May. Today we're asking can range lands actually store carbon? And if so, how can we get started? Dr. Megan Nasto is our expert with the answers. Meghan is a research scientist Working Lands Conservation and ecologist and avid user of public lands. Megan is excited to work with stakeholders to balance the many resources that public lands provide. Whether these resources or environmental, cultural, recreational or financial, Megan strives to provide a quantitative framework for decision making that benefits all who call themselves public landowners. While Megan has worked in a variety of systems from the Central American tropics to the Rocky Mountain West, she has become increasingly interested in working lands. These lands and the soil at the heart of them provide individuals with a means of living communities with a source of pride and society with a sense of wellbeing. As such, Megan values a strong and mutual relationship with the earth and will work tirelessly to help us all become better stewards of the land. She is a great person to tackle the question of sequestering carbon on working lands, and all the CO benefits that that can bring. So Megan, welcome.

Megan Nasto

Hi, thanks, DJ. Thanks for having me here.

DJ May

Yeah, great to have you on. So, we're just gonna get straight into it. The big question that we're looking for is can range land sequester carbon? But before we get into all of that, why is there this perception that it's really hard to sequester carbon on range lands?

Megan Nasto

Well, I think there's a it's a great question and one that is currently, you know, being debated amongst a lot of folks within the field of rangelands, science, arranged land management, but I think there's a group of folks out there that just want to write off rangelands, especially rangelands of the Western US as being a focus, or an area of focus for soil carbon sequestration, given that these rangelands tend to be arid and semi-arid. So, they are rather limited or constrained by rainfall and temperature, thus not experiencing as great of vegetation productivity, as you might see in other types of agroecosystems like crop lands, or even other natural systems that are warmer and wetter. So, I think there's a lot of folks out there that just want to ride off rangelands, and not really consider them to be an area of focus for carbon sequestration.

So, I feel like that's point number one, but other than that, I'm not so sure for everyone else within this field. I'm not so sure that they think it's fundamentally tough to sequester soil organic carbon in western rangelands, but rather, it's incredibly difficult to measure sequestration in western

rangelands. And that can really deter people from entering these types of projects or altering land management in such a way for the end goal of sequestering carbon.

DJ May

Okay, talk me through that. So why I mean by acreage, obviously, rangelands take up a ton of space. So you would think there'd be a lot of interest in sequestering soil carbon on them. But why is there this perception that it's tough to measure?

Megan Nasto

Yeah, that's a great question. Like, yeah, like, you know, I think the US is comprised of about 300 million hectares, or a little over 300 million hectares of rangelands. So there is this interest for a lot of people to focus on it for carbon sequestration, benefits and purposes. And it's not necessarily because they have this great capacity to soil to sequester carbon in any given location. It's just that the range land, as a land resource in the US is so massive, that even with the small rates of sequestration, when you scale it up to those 300 million hectares, it can really amount to something meaningful and impactful when you're when you're thinking about the climate crisis and mitigating co2 emissions. But it is incredibly difficult to measure. And I think the primary reason why it's so difficult to measure is because these rangelands, especially in the western US are really heterogeneous, meaning they vary greatly in terms of their climate, their topography, vegetation type and density and soil type and texture, as well as their past and current land management practices. So, all of these factors, in and of themselves and together operate at these at a rate

Just scales from the micro to the macro. And when we're trying to measure a small rate of soil organic carbon sequestration, against a backdrop of immense variability, it requires a significant amount of time and resources. And we must have a really strong understanding of the landscape and the capacity to extract a large number of soil samples and the capacity to process and analyze them. And these, you must have to do this type of work well, can be extremely costly in terms of personnel time and laboratory use. So, it just becomes, in a lot of cases too, logistically difficult, or just economically infeasible to engage in this type of work. That being the case, though, there's a lot of great folks out there that are pushing for technological advances in estimating soil organic carbon sequestration, via remotely sensed platforms. So, platforms that are on drones, or on satellites.

And if they work, and if they work, well, they have the potential to dramatically reduce that number of soil samples needed, the amount of personnel hours, the labor that goes into all of that work, and make it much easier than to scale up the sequestration rates across these very, very large and complex landscapes. And I'm super excited about the belt those technological advances. I'm eager to see where it gets us. I don't currently feel like we're there yet to do it robustly and rigorously. So the approach I like to take is really built off generating this strong understanding of the range land itself and breaking apart all of the factors that drive the variability on the range land, and this approach is called stratification. And then for range linear, stratified, adequately. And a reasonable number of soil samples can be extracted and are needed to estimate soil organic carbon at the landscape scale very robustly. So again, it's not that I don't think a lot of people feel it's tough to increase carbon on rangelands, it's just really, really tough to measure accurately.

DJ May

Okay, okay. So just to make sure that I have what you're saying clear: Essentially, it comes down to like, can you break up rangelands into smaller components? You know, like maybe areas that are more similar so that you can get better estimates?

Megan Nasto

Absolutely, yeah. I think the key to doing this work well, as it stands right now is exactly that: breaking apart the landscape stratifying the range land into these different and distinct components.

So, say you're on, say you're in like a sagebrush steppe rangelands. There are different types of sagebrush that have different rooting depths, and thus could have different rates of below ground inputs. So, breaking apart the area's on the range land that is comprised of one type of sagebrush, and then breaking apart the range limb that's comprised of a different type of sagebrush, or breaking apart the rangelands, that is composed of sandy soils versus clay soils. And once you have that broken apart and stratified and mapped really well, you should be able to sample less within each of them, but then scale up to the entire landscape. If that makes sense. No, no, that makes that makes perfect sense. So, one thing that I know comes up with carbon sampling is that it's not a one and done thing. Like obviously, you have to go back to see how management changes impact soil carbon. So, it sounds to me like this stratification method is a good way to minimize how many times you have to go back to these different areas to resample to Yeah, I would, I think so. We believe very strongly in the stratification method. I mean, otherwise, if you're not stratifying, your rangelands very, very well. You could be in a situation where any estimate of soil carbon that you generate will just have so much air surrounding it that then you feel inclined to go and sample more and more and more and more. And before you know it, you could be sampling, you know, 20 individual locations within a hectare. And when these rangelands are upwards of 80,000 hectares a piece like that's you just can't do that that's not feasible.

Stratifying well is a way to reduce the amount of samples, but still generate accurate and robust estimates of soil organic carbon. And I'm hoping that can be incorporated into more and more projects and get us going in the right direction while people are still trying to move forward the technological counterparts to this type of work.

DJ May

Yeah, okay, perfect. So, I think that covers the measurement side, but then you talked about the other aspect being maybe changing management to help sequester carbon. Talk me through that. What does changing management look like to get more carbon into these rangelands?

Megan Nasto

Yeah, so there's a lot of different ways we can sequester organic carbon on rangelands, and considering that the predominant use of rangelands in the western US is for livestock grazing, I think it's fair to start there. So livestock grazing can be used or can be managed to improve soil health, and increase organic carbon as well as benefit many other ecosystem services. And though there's still research that's needed to fill certain gaps in our understanding, it is somewhat well accepted that the duration meaning the length of time in which livestock graze a given area,

and then the timing so when within a season or across a couple seasons, a livestock graze a certain area. These two things duration and timing can be used as tools to sequester soil organic carbon. And of course, the impact of this type of management practice may not be the same across all rangelands, but the potential is there. And by managing the duration and timing we can stimulate vegetation production, which decreases the amount of bare ground on the surface soil and increases the inputs of carbon below ground for the soil microbial communities to then process in store for the long term.

But there are other ways in which I think you can increase soil organic carbon as well. One is through implementing different restoration actions on riparian areas are on streams. So, streams on arid and semi-arid rangelands are really these biological hotspots experiencing elevated rates of above and below ground productivity. So, they inherently have this capacity to sequester more soil organic carbon than their upland counterparts. But because their biological hotspots with forage and water, livestock do tend to congregate there. And if the livestock aren't managed very well, on these riparian corridors, the health of the streams can diminish. But of course, there are a number of things that can be done to mitigate that you could exclude cattle altogether. But that comes with tradeoffs to the ranchers and the rancher communities. You could also but so instead, you can implement things like hot wire fencing or virtual fencing to keep land to keep cattle or livestock off of streams for certain periods of time. And then you can even implement other types of actions like building Beaver Dam analogues, if that's appropriate for your rangelands. So replicating what may naturally have been there already, such as beaver dams to really expand the riparian areas on these rangelands and ensure that you're getting hydrologic hydrologic connectivity between the stream and the groundwater.

And that I would probably say another way you can increase soil organic carbon see question on rangelands, if it's appropriate for their, your ranch land would be to conduct prescribed burns, or manage the density of woody shrubs, both of which can stimulate vegetation production, in particular grasses, things used for forage and then increase the amount of inputs of carbon below ground.

I do just want to make what I think is a really important note here is that I don't mean to make any one of those management practices sound easy, because they aren't. And they're certainly not cheap. The rangelands of the Western US are very large landscapes, and much of it occurs on a matrix of publicly and privately owned lands. So not only is it very expensive to implement any one of these management practices, but it's very complex given the multi-jurisdictional nature of the landscape. We feel very strongly I feel very strongly that time and care must be taken when working through these types of carbon sequestration projects that you I just feel like well, a lot of time needs to be spent thinking it through and trust really needs to be built with rancher communities and then continuity of project partners is really critical. Because if there is ultimately money to be made off of sequestering carbon within soils with a different management practice, as is becoming more and more prevalent within this carbon marketplace space, we need to make sure or we need to make sure we develop pathways for that money to go back to the communities that make their livelihoods off of these lands, because these management practices implementing these new management practices is not cheap. And if there's a way to bring that money back into the communities to offset those initial startup costs, and sustain operations, that's just really critical to the type of work that that we engage in. And that I think is important for everybody to think about.

DJ May

No, that's a great point. I'm glad you brought that up. I guess taking how difficult it can be to get started. Do you have any advice for maybe a rancher or land manager who's been thinking about this, but is struggling with some of those challenges you mentioned?

Megan Nasto

Yeah, absolutely. I would say, you know, don't ever hesitate to reach out to your local NRCS field office. The NRCS is full of great folks dedicating to serve producer operations and Rancher communities. And they can be a really great resource to rely on. They could also point you in the right direction to organizations that engage with multi stakeholder groups to to improve rangelands health. If you're fortunate enough to live in a state that has a grazing program within their department of agriculture, don't hesitate to reach out to them because their sole purpose is to serve you as well and find ways that can pay for these alternative management practices to be implemented on the rangelands that you work on. And then, of course, I'm always open and available. I love talking with new folks, our organization working lands, conservation is always eager to explore new projects with new folks and new communities and we just simply love to visit in love to get that information out there. It's my favorite part of the job. Besides playing in dirt, of course.

DJ May

No, that's great. Um, if someone wanted to reach out how could they get ahold of you, Megan?

Megan Nasto

Yeah, great. Um, so you can visit our website, it is workinglandsconservation.org. And you can find our information there. And in addition, my email is my name Megan, megan@workinglandsconservation.org A little long and cumbersome, but I'm there.

DJ May

Perfect. Well, thank you so much for all of that information. It was great to have you on today.

Megan Nasto

Yeah, thank you. I really appreciate taking the time to visit with you DJ.

DJ May

Well, there you have it. If you're interested in upping your soil carbon sequestration on rangelands, consider improving grazing practices, restoring streams and trying out prescribed burning or shrub management. And if you enjoyed this episode and want to learn more, check out the show notes for related research. Finally, if you want to dig deeper into carbon and ecosystem services, come visit us at decode6.org. We'll see you there!