

# Beginner Farmer Resources

## Grazing Sheep in Solar Farms

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### Introduction

Welcome to the NC Choices webinar series Teaching Tools for Beginning Farmers funded by the United States Department of Agriculture Beginning Farmer and Rancher Development Program.

I am Johnny Rogers, coordinator of the Amazing Grazing Program, and I'm going to present the module on Grazing Sheep in solar farms. If you are interested in other resources offered by NC Choices you can find out more on our website or on our YouTube channel.

### Why are there so many solar farms in North Carolina?

As I said we'll talk about grazing sheep in solar farms this morning and it probably begs the question why are there so many solar farms in North Carolina? And there's a couple reasons for that. One on August 20th of 2007 North Carolina became the 25th state - and the first in the Southeast to enact a mandatory renewable energy efficiency portfolio standard into law. So basically what this says is that a high percentage or about 12.5% of the electricity sold by the utilities in North Carolina need to be generated by renewable sources by 2021.

### Solar Farms in North Carolina

There's also been some tax incentives to help stimulate the solar industry in our state so this graph just shows that North Carolina is the second largest or in some cases. The third largest state in the nation led by California and North Carolina is certainly behind them. But you can see that solar farms are becoming a very large part of the North Carolina landscape. This indicates that North Carolina would be the number three state as far as megawatts generated by solar capacity and it's enough to power nearly a quarter of a million homes across our state.

So it is very significant as we look at electric generation in North Carolina and this is just an example of one of the solar fields that you might see dotting the landscape as you drive around North Carolina. One of the things that has become an issue is how do we maintain the vegetation or manage the vegetation that lies within these solar farms.

### Solar Farm Vegetation Management

We have several options with one mowing by mechanical means with either a tractor and some type of rotary cutting device or maybe a zero-turn lawn mower. Chemical mowing with

herbicides that actually suppress grass growth have been used in some cases and some solar sites will have an impervious layer. But even with an impervious layer with gravel and filter cloth you still have the challenge of grass will begin to establish and you may have to use some type of chemical to suppress those plants.

The other thing that we'll talk about today is grazing these sites with sheep. Sheep are a really good animal to use in these sites and we'll talk about that here in just a little bit. Why are sheep good grazers in solar farms? Well initially you would think about maybe cattle or goats could be used. But in the case of cattle, they are simply too large and they would like to rub and scratch on the panels. Just because of their sheer size they could inflict some damage on the equipment. Goats would be another option. But goats inherently like to climb and they also like to chew on things like exposed wiring. So that could obviously again lead to damage and something we don't want to have happen in our solar farms. Mowing is quite expensive and when you also think about mowing we're obviously burning fossil fuels and you know the whole idea of solar farms is greener cleaner energy. So anything we could do to reduce the use of those fuels would certainly be beneficial and it would make the whole system more sustainable.

So grazing has a lot of options. Grazing the forage using a rotational or an adaptive management system just offers tremendous advantages. It utilizes the grazing resources that's in the solar farm and converts that into animal protein. It improves forage stands because grasses need to be grazed in order to stay viable and healthy. Proper grazing management will actually build soil health which will improve water infiltration and retention into the soil and have many benefits from a water quality standpoint. It also offers local farmers an opportunity to build or expand on their grazing system. So if you're a farmer that's near a solar field you may choose to expand your sheep operation by grazing or adding the vegetative maintenance as an additional enterprise to your sheep farm. Or maybe you're not a sheep farmer today but you always wanted to farm and this can offer you an opportunity to get the land access that you need to to start your enterprise.

## Solar Farm Owner Benefits

If you're a solar company or if you own a solar farm what are the benefits to grazing sheep to you. Well one is obviously vegetative control. That is your number one priority because shading and plants actually touching the underside of the panels can reduce the efficiency of electricity generation by the solar panels. So we need to keep the plants away from the solar panels as much as possible. Also we need to maintain the perimeter fence. Most of these sites have a chain-link secure fence around the perimeter so that obviously needs to be maintained and that's something that the sheep can graze very close up to with minimal chemical intervention or minimal weed eating. It is a sustainable maintenance practice because again

we're managing this area as a pasture on a farm. We have enhanced site security because farmers are actually on site each day or multiple times per week and this actually can add to the security for folks who want to enter the solar farm. Farmers can often serve as a local first responder because a lot of the solar companies have sites across the state of North Carolina. So having that farmer there as a first responder can be a valuable part of this enterprise. It's also a very positive story because again it's a blending of agriculture and electricity generation on the same land. It's kind of the shared use of land and is a very positive story when agriculture can work with this new industry.

## Sheep Farmer Benefits

If you're a sheep farmer what are the benefits why would you want to consider grazing a solar farm? First and foremost it has a very secure fence pasture in most cases like I say most cases you will have a chain-link fence securing the perimeter of the solar farm and that can obviously keep the sheep in the solar farm. But more importantly can actually help to keep predators out of the solar farm which can protect your sheep. It can be free grass but you know obviously nothing's really free so you will have some challenges that we have to overcome. In some cases it's actually more than free grass. Some sheep farmers are actually being paid to manage the vegetation in these solar farms. Again that adds value to their enterprise with shelter and shade. Many times in open pastures during the summer livestock operations can struggle to find shade for their livestock from the summer heat and the sun. Obviously a solar farm actually has mostly shade underneath the panels which can actually be beneficial to the livestock and again I've already made the point of being paid to graze for a grazing service would be a great benefit to a sheep farmer in this system.

## Grazing Solar Farms Challenges

I alluded to before some of the challenges that we can see when grazing solar farms. First off I wanted to just throw this out that sometimes it's hard to find out who to contact. Probably the best thing to do is most solar farms will actually have some type of signage out front that will have some contact information. Addresses, phone numbers and a lot of times websites or emails. That's a good place to start and contact the solar company directly and see if they would be interested in grazing sheep in that facility. Now you're probably going to come up with some roadblocks first and foremost because they're going to have some concerns about grazing sheep in solar farms. I received quite a few calls throughout the year from both producers and solar companies about how to overcome some of these challenges. Solar companies are obviously afraid that sheep are going to damage their panels and to this point we have not had any damage reported from sheep damaging the solar panels. That's good news. Risk associated with farmer injury and again there may be some insurance requirements that farmers will have to have that are higher than they would have to have than their

traditional farming liability policy. Some of the solar farm workers that are in and out of the farms on a periodic basis may have to work around some temporary fencing. We encourage the use of temporary fencing inside the solar farm to actually set up a rotational grazing system inside the farm. That way we can manage the grass in the most effective manner and can increase the vigor of the forage stand over time. Sheep escapes from solar farms are a concern and solar farm workers need to be schooled a little bit and educated on the importance of keeping the perimeter gates closed. So that way we don't have any sheeps wandering outside of the solar farms. Sometimes livestock guardian animals can be a challenge particularly livestock guardian dogs. They can be very protective of their flocks. Again as we have solar company employees moving in and out of the farms that's something we have to be aware of. It may have to be addressed.

Obviously these solar farms were set up to generate electricity and not set up initially as grazing systems so water availability can become quite a challenge. Some of the larger sites throughout North Carolina they've actually dug wells to have permanent water installations. But in most cases shepherds and sheep farmers are actually hauling water and this can be very effective because the water requirements for sheep are not very high. Again if you have to haul it some distance it can become just another cost and another time consuming activity that is necessary. As we look at grazing solar farms this is just an example of a water system setup that's actually pressurized water and a permanent system. You can also use some above ground pipe and quick-connect couplers to deliver water to sheep grazing in solar farms.

Another challenge that I've encountered as I grazed my sheep in solar farms is finding and counting the sheep. If you have a pasture that's 25 acres it would be very easy to go out and find your sheep in that 25 acre pasture. Now imagine that you build a solar farm on that 25 acre pasture. It becomes much more difficult to find, count, sort, gather, and herd your animals because they can run up underneath the panels. It becomes a little more challenging. Certainly a lot of producers have addressed this by using feed to toll their sheep and to gather them in a temporary catching pen or some actually use herding dogs that can be very effective and move more swiftly underneath the panels to help gather the sheep in handling facilities and loading facilities. Obviously when you bring the sheep into the solar farm it is pretty easy to unload them, but once you want to load them back up most producers are using some type of temporary panels and those can be purchased and will last a long time. They're very durable and easy to set up and easy to take down and move to the next farm. So that's pretty easy to overcome. Again this is just another picture of sheep grazing around one of the temporary enclosures or temporary pens that you would have to manage the sheep while they are in the farm.

Another very frequent question is I've got a 25 acre solar farm how many sheep can I run within this 25 acres? Unfortunately there's not a lot of data out there from a scientific standpoint about what the proper stocking rates might be. We do know that it's going to be less than what we would typically find in a pasture near that solar farm that has the same soil type, same rainfall, and the same management. We can look at realistic yield estimates to give us some guidance. You know when we look at a forage stand and then how many animals we might want to run there. It's probably safe to say that at least a third to a half of that production level that could be expected will actually be reduced by a third to a half. This is because of equipment traffic that can compact the soil which will limit grass growth. Plus you have the shading effect of the panels which will obviously decrease forage production. Currently we would recommend starting with about two mature dry ewes per acre and use good grazing management and adjust based on conditions.

Also we have to think about whether this is going to be a seasonal or a year-round grazing enterprise on this solar farm. So in other words, are you only going to have animals on this farm during the green growing season of the year? Or are you going to try to maintain that flock there year-round? The solar farms that I've seen throughout North Carolina are very highly variable in terms of grazing conditions because of prior vegetative management. A lot of the solar farms are actually being constructed out on pasture and obviously that can lead to a very vibrant stand to forage because it's already established. Many solar farms are actually being built on sites that were obviously forested land and obviously the site prep soil amendments a lot of things can come into play as far as what type of forage production we might find in that type of situation. So it really goes from one extreme to the other. You can have some sites that can be very productive and you can have some sites that will be very limited in their production initially. But as we manage those pastures with good grazing management, good pasture management, good fertility we can obviously build those into high quality grazing systems.

Another challenge is establishing grass in solar farms and sometimes the farmers may have limited input because the farmer coming in to graze these solar sites are actually coming in after the solar farms have been built. So we need to think a little bit about, as we are farmers, we need to think a little bit about and offer suggestions where we can and try to avoid some of the turf type or contractor blends of grasses that you might see out there. Because they may not offer good long-term productivity and persistence from a grazing standpoint. And we also need to be aware that some solar companies like to use herbicides that can actually retard the grass growth and limit grass growth and this can actually impact our grazing. Obviously, the quantity of forage that we would have for grazing and it may alter the botanical composition because some of those are actually broadleaf herbicides we all know she'd like to graze broadleaf weeds plant species. So that can obviously have a pretty big impact.

Also with most cases, with adapted grazing management, we're going to be a big proponent of using temporary fence. Within solar farms using temporary fences can be somewhat limited in terms of options that we have. But it can be done. So here's an example of a solar farm in 2015 that we subdivided and it's those yellow lines will kind of show you where the temporary fences were located and the circles on each three locations actually show you where the water source is located. So we could rotate the sheep through this system and it's very easy to construct fence when they run the same direction parallel to the panels. Now in 2016 on this particular farm, this is the same farm, so you can see we kept the same lines that run parallel with the rows of panels but we also subdivided even further with actually a temporary fence down the middle of the solar farm and that worked out pretty well. We used a UTV to put out the temporary fence and we also used a solar energizer. It's kind of ironic sometimes that there's not electricity available in the solar farms so you're probably going to have to use a battery-powered energizer for your temporary fence or maybe some type of solar energizer. And the placement of the temporary fence, actually in this case, it was actually wider between the arrays of panels so that's where we, it was just easier to walk through, there and that kind of gave us some nice equal subdivisions. Using temporary fence, some fiberglass posts, as well as step-in posts, we found to be very effective at controlling sheep inside of these solar farms.

Another challenge that we run into is predators. You know predators are a huge problem with any type of sheep operation or goats and using guard animals can be very effective. And this will vary between different types of solar farms. You can see that in this case on the picture on the right there's actually quite a bit of distance there and a very easy path coming across that ditch where predators could enter and sheep could obviously exit that. That would need to be addressed.

Another common thing that we see is a lot of time farmers are asked to mow between the panels during grazing events and that can be quite stressful because it is hard to maneuver with traditional agricultural equipment inside a solar farm. So that might lead to another challenge which might mean capital investments in new equipment here you would see a zero-turn lawn mower very heavy industrial type that can be used to mow a solar farm very effectively. But those can obviously add expenses to the farming enterprise. Also there have been very limited incidences where sheep have actually injured themselves, mainly back injuries, as they're going underneath the solar panels. Those have been some kind of minor cuts and abrasions that have been treated and the sheep have actually recovered and done quite.

Some other additional training might be necessary for farmers that are asked or that are looking into grazing solar farms. You might need to complete an OSHA training so you can use good practices and maintain safety inside the solar farms. There may be as I mentioned before

insurance requirements that would be much higher than what you would typically have on a farming operation and of course there will be contracts between the farmer and the solar company. So again you would need to kinda just make sure you have someone to help you go through that process and that's obviously something that North Carolina Cooperative Extension can certainly help you with as well as the Center for Environmental farming systems.

## Summary

So in summary sheep production in solar farms can be a very viable enterprise we're really excited about this opportunity. We do think that it's key to have good communication between the solar company and the farmer. Grazing sheep in the solar farm; it's a win-win situation. It maintains the vegetation, it generates electricity and it can produce animal protein or food for people.

Research is needed to determine the optimal stocking rates. You know the stocking rates that we can have to both control the vegetation that we have there but also maintain a high level of performance and health for our sheep. And potentially economic models could assist in controlling traveling cost and the distance that needs to be that between each solar farm and the other cost associated with this enterprise. Thank you for your attention.

## Thank you

Any questions can be directed to [jrroger3@ncsu.edu](mailto:jrroger3@ncsu.edu).