



Solar Farm Grazing Best Management Practices (BMPs) for Sheep

August 2021

Objective: To maintain vegetative ground cover under and around the solar panels in a condition that will minimize soil erosion and storm runoff, while utilizing managed grazing of sheep to control vegetation within the solar farm installation area.

Background/Considerations:

BMPs should be viewed as guidelines, with an understanding that management of living systems requires flexibility and adjustments. These BMPs provide a starting framework for planning purposes, and actual conditions may necessitate allowance for some changes.

Soils - Soils can vary widely in their production potential, due to various factors such as drainage and rooting depth. Site-specific soil characteristics should be considered when estimating a stocking rate of sheep for each site. (See NRCS [Web Soil Survey](https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm) (<https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>) to obtain site-specific soils information.)

Site Characteristics – Site characteristics such as slope and topography should be considered by managers. Sloping and/or concave and toe-slope landforms are more prone to runoff and associated erosion potential.

Establishment of ground cover – Appropriate vegetation can provide both erosion control and animal forage. On sites where a grass/forb community is already present, assess existing vegetation for grazing suitability and identification of problematic weeds or invasive species that may need to be controlled.

Soil pH and fertility should be tested, and lime and fertilizer should be applied in accordance with soil test results recommendations. (See University of Maine Soils Testing Lab: [Home - Analytical Lab and Maine Soil Testing Service - University of Maine \(umaine.edu\)](https://extension.umaine.edu/publications/2272e/)). Optimum soil pH and fertility helps to ensure viability of the new planting and will give desirable forages an advantage over undesirable plants.

On sites where seeding is needed, utilize a permanent forage mix that is suitable for grazing and contains certified seed. Avoid seed mixes that contain Kentucky 31 Tall Fescue (to avoid entophyte issues) or Reed Canary grass, (slow to establish and potentially invasive). Visit <https://extension.umaine.edu/publications/2272e/> for seed mix options. A mix with a minimum of three species of grass and legumes/forbs is recommended. A nurse crop may not be necessary on plantings done before May 20. Nurse crops (such as oats sown at a rate up to 35 pounds per acre) are recommended for plantings done after May 20.

The forage must be fully established to a stable, well-rooted condition before animals are brought on site. An initial light grazing or mowing of the new seeding will help plants fully establish to a stable rooted condition. Avoid grazing the new planting when the soil is wet. Once target grazing height is realized consistently across the pasture, the grazing plan as described below may commence.

Grass Growth - Vegetative conditions and growth rate will fluctuate naturally during the grazing season, from a spring “flush” of new growth early in the season, to a slower regrowth rate or even dormancy during summer heat and/or periods of low precipitation or drought. In these situations, either stocking rates or frequency of grazing should be adjusted up or down as needed.

Rotational Grazing Management – The following BMPs are based upon use of a rotational grazing management system. Rotational grazing management promotes a healthy root system, which reduces soil erosion, increases infiltration of rainfall into the soil, and enhances forage productivity and quality.

In this system, the total area to be grazed (i.e., the solar farm unit) is managed by use of portable fence to provide areas or sub-units we will refer to as “**paddocks**”. Animals are confined to each paddock for a specified **residency period**, i.e., the number of consecutive days of grazing before being moved to a new paddock. This approach allows the remainder of the pasture a **rest period** to regrow. The rest period necessary for grass to recover to grazing height averages 30 days in good conditions. It will generally be faster in early spring, and slower in late summer/fall, and is influenced by soil characteristics and weather variability.

The residency period is chosen by the producer, based on how frequently they wish to move their animals. A typical paddock residency period for sheep is 1 to 3 days, but should not exceed 5 days. Paddocks must be sized to provide adequate feed for the duration of the residency period. (See attached *Sheep Solar Grazing Rotational Grazing Management Plan Worksheet*.)

Regardless of the length of the planned residency period, the actual move or rotation to a new paddock must ultimately be based on plant height thresholds we will refer to as “**start grazing**” and “**stop grazing**” height. For example, if the planned residency period is 3 days, and the stop grazing height is reached on day 2 in the paddock, animals should be moved to prevent over-grazing. Move animals to another paddock that is at or exceeds the start grazing height.

Fence – For sheep, portable electrified polywire netting with a fence energizer (battery or solar powered) is used for creating paddocks within the unit. Solar arrays are configured in long rows with occasional breaks within the row where cross-fencing can be located. The panel arrangement may dictate paddock dimensions. Electrified fencing should be posted to prevent accidental shocking of people, and must be properly installed to function effectively.

Water source – Prior to bringing animals to the site, the manager will identify a dependable source of water and the method of delivery to the flock. Water must be available to the animals at all times.

Animal Health – Animal managers are responsible to ensure the safety and well-being of the flock. Regardless of rotation schedule, regular monitoring of the flock, water supply, and the forage height, condition and quantity is required. Daily monitoring is recommended. See BMPs, below.

Rule-of-thumb stocking rate for average conditions *

Stocking rate is a number of animals, or number of pounds of total livestock weight, per acre of the entire solar unit acreage. Graziers need flexibility to manage stocking rates and residency periods, but must adhere to start and stop grazing height guidelines.

The following general stocking rate should provide grazing throughout the season with a fixed number of animals. Note: early in the season when grass is growing fast, adjustments to stocking rates and forage management may need to occur. **

For the total *grazable* acres of the solar installation:

Stocking rate = 4 adult sheep OR 3 ewe-lamb pairs /acre

Example: solar installation with 20 grazeable acres X 4 adult sheep/ac = 80 adult sheep

Example: solar installation with 20 grazeable acres X 3 ewe/lamb pairs/ac = 60 pairs

These stocking rates are based on an estimated animal/forage balance on ground that has good soil drainage, fertility, pH and appropriate vegetative species for grazing. The manager may adjust the stocking rate during the season by adding or removing some animals while adhering to start and stop grazing heights.

Best Management Practices for Grazing Sheep on Solar Energy Farms:

- A rotational grazing management system will be used to control grazing heights, maintain desirable forage species, optimize ground cover and increase precipitation infiltration.
 - Animals will be moved to a new paddock at **minimum** every 5 days OR when the stop grazing height of 4 inches is reached, whichever is sooner.
- Utilize the attached *Sheep Solar Grazing Rotational Grazing Management Plan Worksheet* to estimate paddock size for a designated residency period (grazing days per paddock stay).
- Start and stop grazing height guidelines will be followed:
 - Start Grazing = minimum height should be 6-8 inches (exception first early grazing in spring when grass is growing fast, can start at 5 inches***)
 - Stop height = no less than 4 inches
- The spring grazing season will not commence until the soil has dried sufficiently to avoid significant damage by hooves.
- When there is no start grazing height forage available on the unit during the grazing season - due to weather, advance of the season, or other factors - remove animals to another location for the remainder of the year, or until forage reaches the start grazing height.
- End of season - A minimum of 4 inches of forage height will be left on the unit at the end of the grazing season when animals are removed.
- When sheep are present, the sheep producer should monitor the site regularly (daily or every other day is strongly recommended) to appraise the status of forage and water supply, and to check animal condition, safety and well-being.
- Water will be available to the sheep at all times. Sheep-appropriate minerals should be provided either continually or on a regular and frequent basis. The producer will take necessary action to

address feed/water deficiencies, veterinary problems or equipment issues immediately or as soon as is practically possible.

* The following values were used for the rule-of-thumb stocking rate:

- Adult sheep average assumed body weight 150 lbs.
- Ewe/lamb pairs average assumed body weight 225 lbs.
- Daily dry matter intake needs for sheep = 3.5% of body weight
- Assumed grazing start height 8 inches, stop height 4 inches = 4 inches grass removed = 1,000 pounds DM per acre/ rotation (will vary based on conditions at the commencement of grazing and seasonal weather /precipitation fluctuations)
- Assumed residency period (active grazing) 3 days
- Assumed minimum rest/regrowth period is 21-42 days, varying with month and rainfall

**Note: Using this rule-of-thumb stocking rate in May-June will likely result in the need for mowing of as much as 50% of the acreage. Manager may choose to increase the stocking rate for this time period to alleviate the need for mowing. Regardless of stocking rate, always adhere to grazing height guidelines.

*** Strategies for beginning spring grazing of established vegetation stands:

- To get a head start on the spring flush you may need to start grazing at a height of 5 inches.
- Consider a temporary increase in paddock size (i.e., double the paddock size but keep residency time period the same) to move animals faster through the unit, leaving more forage behind (a taller stop grazing height) than planned. By early to mid-June, follow normal grazing heights.
- Mowing may be needed to prevent excessive forage production on a portion of the acreage

Sheep Solar Grazing Rotational Grazing Management Plan Worksheet to Estimate Paddock Size

Step 1. Estimate the Forage Demand: How much forage is needed?

The forage demand is the amount of forage weight on a dry matter basis (DM) that is required by the flock for one day. It is calculated based on the rule of thumb that sheep require an amount of forage dry matter equal to about 3.5% of their body weight per day.

Number of adult sheep _____ X 150 lbs. = _____ X .035 = _____ lbs. DM needed /day

OR

Number of ewe/lamb pairs _____ X 225 lbs. = _____ X .035 = _____ lbs. DM needed /day

Example:

Number of adult sheep 25 X 150 lbs. = 3,750 lbs. X .035 = 131.25 lbs. DM needed /day

Step 2. Estimate the Forage Supply: How much forage Dry Matter is available?

Estimated Forage Supply is the amount of forage dry matter that is predicted to be available for grazing per acre on each full rotation through the solar farm unit acreage (i.e., all paddocks grazed once). The numbers presented are for broad planning purposes only. A grazing stick or other method of forage estimation may be used for site-specific estimation.

Use 1,000 lbs DM/ac available forage unless forage is measured on site.

(Derivation of estimate:

Assume 250 lbs. of DM per inch of grass height

Assume a start-grazing height of 8 inches and a stop-grazing height 4 inches = 4 inches of grass available

250 lbs. DM per inch x 4 inches available for sheep = 1,000 lbs. DM /ac available per rotation through system.)

Step 3. Select Residency Period : How often will sheep be moved to a new paddock?

Residency Period is the amount of time sheep will remain in a particular paddock. 1-3 days is the recommended residency period for sheep (more frequent moves will have positive effects on the forage). Do not exceed 5 days in any one paddock.

Residency Period _____ days

Step 4. Determine Paddock Size:

The paddock size is based on meeting the total forage demand for the number of days of the Residency Period.

Forage Demand _____ lbs. DM needed/day ÷ Forage Supply 1,000 lbs. DM /ac = _____ ac/day X

Number of days in Residency Period _____ = _____ acres per paddock

If desired, convert acre to square feet: multiply paddock acres _____ X 43,560 = _____ sq. ft. per paddock

Step 5. Calculate the Number of Paddocks: Based on forage Recovery Period

The number of paddocks required is based on how long it takes forage to regrow to start-grazing height. this Recovery Period can range from 15 days in May to 42 days in September. 30 days is a good working average. Adjustments in paddock size or stocking rate may be necessary throughout the season to meet start- and stop-grazing height parameters.

Planned Recovery Period _____ days ÷ Residency Period (Step 3) = _____ days + 1 = _____ Number of Paddocks Needed

Examples:

For a 3-day rotation and 30 day recovery: 30-day Recovery Period ÷ 3-day Residency Period = 10 +1 = 11 paddocks needed

For a 5-day rotation and 30 day recovery: 30-day Recovery Period ÷ 5-day Residency Period = 6 +1 = 7 paddocks needed

Stocking Plan:

Number of acres in solar farm unit: _____ acres

Number of sheep _____

Residency Period (frequency of rotation) _____ days

Estimated paddock size _____ acres or _____ sq. ft.