Feasibility Analysis Report
Agrivoltaics / Livestock Grazing

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1.0 Introduction

Ameren Missouri has requested WSP USA Environment & Infrastructure Inc. (WSP USA) to conduct a feasibility analysis for potential integration of sheep grazing into solar power projects located throughout Missouri and Illinois. This analysis focuses on sheep grazing both because it is the most common type of solar grazing and because sheep are particularly well-suited for this application. Included in this feasibility study is a review of the benefits and detractors of solar grazing, active and planned solar grazing projects throughout the Midwest, elements of solar grazing projects, and the operating costs associated with traditional vegetation management versus livestock grazing schemes. As part of this analysis, WSP requested quotes from solar graziers and mowing operations, focusing on those that service Illinois and Missouri. This analysis indicates that solar grazing is an emerging vegetation management practice in the Midwest that can be cost-competitive with mowing, depending on several factors, including whether the sites have groundcover suitable for livestock grazing, a predator-proof perimeter fence, access to water, and are proximate to an experienced grazier with an adequate number of sheep.

2.0 Benefits and Challenges of Solar Grazing

2.1 Benefits

Solar grazing is a type of agrivoltaics[1] that incorporates livestock and solar energy generation and is one of the few agrivoltaics practices that is being successfully employed at the utility-scale (> 5 MW) in the United States (EPRI 2024). When site characteristics allow, solar grazing can be implemented as an alternate vegetation management strategy over traditional options such as mowing and herbicide application and has been reported to reduce operations and maintenance (O&M) costs (Abdullah Al Mamun et al. 2022, Gerke 2024). In addition to potential O&M savings, use of livestock grazing in place of mowing to manage vegetation at solar sites can provide supportive ecosystem services such as habitat for pollinators and other wildlife, increased soil health and carbon sequestration, and improved fire suppression (Kochendoerfer and Thonney 2021, Towner et al. 2022, ASGA 2024b, EPRI 2024). Grazing is considered more beneficial for pollinators and other wildlife than mowing because plants can "rebound faster than they would following a mowing event," and depending on the mowing regime, rotational management of pastures may allow for more gradual or staggered bloom periods (ASGA 2024b). Employing livestock for vegetation management may be of particular benefit at sites that present challenges for mowing, such as those with rocky terrain or in areas of high rainfall (Gerke 2024, EPRI 2024). Additionally, use of livestock grazing may reduce or eliminate damage to panels and other site equipment, such as collisions and rocks/debris kicked up during mowing (Grasby et al. 2021, McCall et al. 2023). Beyond these benefits, solar grazing has the potential to improve community support for solar projects, in turn facilitating successful project deployment (EPRI 2023, EPRI 2024, SETO n.d., Guarino and Swanson 2022). For instance, an 800 MW solar project in Ohio that had been met with local

[1] Agrivoltaics in the simultaneous use of land for solar photovoltaic power generation and agricultural production of crops, livestock, and livestock products (NYSERDA 2023).

opposition received approval partly due to its incorporation of agrivoltaics, including 1,000 sheep (Gilbert 2024).

2.2 Challenges

In a case study summarizing three examples of utility-scale (35 – 550 MW) solar grazing sites in three different regions (California, Georgia, New York) of the U.S., EPRI (2024) found that common challenges included predator protection, soiling of equipment pads, uneven grazing at the lower edge of panels, poor vegetation establishment, and transportation of water. To protect sheep from predators, some projects have installed electric fencing along the inside of the perimeter fence for added security. Introducing guarding dogs is another way to address predation issues. To prevent sheep from resting on and soiling equipment pads, fencing can also be installed to exclude them from these areas. To manage vegetation close to the panels, the lower edge of the panel should provide enough clearance for sheep to graze comfortably. A 61 cm (24 in) minimum, lower edge ground clearance for static solar arrays is recommended. If grazing larger statured wool breeds, a higher ground clearance (75 - 90 cm, or 30 - 36 in) is recommended. To establish a competitive groundcover suitable for grazing, it is important to minimize soil disturbance during construction and to select a seed mix that is regionally adapted. Solar infrastructure/cable systems should be designed to allow equipment to pass between panel rows for groundcover maintenance and reseeding. Provision of on-site water sources (i.e. water wells) can eliminate costs associated with transporting water to the site; however, even when on-site water sources are present, transportation of water within the site may still be necessary and can require considerable time and labor. Many of these challenges may have cost implications for the initial investment or ongoing use of solar grazing.

3.0 Elements of Solar Grazing and Active Projects

3.1 Active and Planned Projects

Depending on some of the factors noted above, sheep can be integrated into solar sites without significant modification to traditional, utility-scale solar design, and have been the dominant livestock choice for solar grazing enterprises (ASGA 2024b, McCall et al. 2024, NYSERDA 2024). According to the American Solar Grazing Association (ASGA), over 80,000 sheep are grazing close to 100,000 acres on 500 solar sites across 27 states (ASGA 2024a).

Solar sheep grazing is occurring at multiple locations across the Midwest, though the practice is in its infancy. Additional solar grazing projects are planned or are in the early stages of trial. Active and planned projects across the Midwest include the following (see Figure 1):

- ACCIONA Energía is grazing approximately 450 Dorper sheep at High Point Solar Farm, a 500-acre, 100-megawatt (MW) project in Stephenson County, Illinois (Acciona 2024).
- Madison Gas and Electric (MGE) is grazing 70+ Katahdin sheep on 30 acres of its 6-MW Tyto Solar site in Dane County, Wisconsin (Schulz 2024).
- Minnesota Power is grazing 100 Katahdin sheep a Jean Duluth Solar, a 9-acre, 1.6-MW facility in St. Louis County, Minnesota (Minnesota Power n.d.).

- Doral Renewables' Mammoth North Solar in Starke County, Indiana is a 4,500-acre, 400 MW project grazing 1,500 St. Croix sheep (Fischer 2024; Lund 2024).
- Louisville Gas & Electric's (LG&E's) E.W. Brown solar facility is grazing more than 200 Shetland sheep at its 50-acre, 10-MW site in Mercer County, Kentucky (Puckett 2023).
- Researchers at the University of Missouri are establishing a demonstration solar grazing site at the South Farm Research Center in Boone County, Missouri. The research site is the first of its kind in Missouri and is expected to begin operations in 2024 (Beck 2024).
- Alliant Energy is planning to graze 60 Texel Sheep at its 32-acre, 5-MW Ledgeview Solar Project in Fond du Lac County, Wisconsin (Caporale 2024; Quandt 2024).
- Savion's Oak Run Solar is a 6,050-acre, 800-MW project in Madison County, Ohio, expected to begin construction in 2025. Oak Run is set to be the largest agrivoltaics project in the country, with integration of at least 1,000 sheep and 4,000 acres of crops (Eisenson 2024).

3.2 Livestock Selection

Sheep are considered ideal for solar grazing due to their docile temperament and short stature, which depending on site characteristics, can allow them to integrate into sites "with little to no modification of conventional structures" (ASGA 2024b, McCall et al. 2024, NYSERDA 2024). While any breed of sheep can potentially be used for solar grazing, the most popular breeds used by solar graziers are Katahdins and Dorpers (Hartman 2023, ASGA 2019). Both are hair sheep that are prominent throughout the Midwest (EPRI 2023). Compared to wool sheep, hair sheep are typically smaller in stature, do not need to be shorn, and are more tolerant of heat and humidity (EPRI 2024). Additionally, hair sheep are reported to have higher lambing rates and greater parasite resistance (EPRI 2023; Grasby et al. 2021). Table 1 details the breeds and characteristics of sheep grazed at the Midwest solar projects listed above.

Lincoln University's research farm grazes approximately 600 Katahdin ewes year-round in Missouri. Chris Boekmann, Farm Superintendent, reports that Katahdins are hardy, have good foot health, are resistant to internal parasite issues, and lamb successfully on open pasture without the use of facilities. He notes that the source of the breeding stock is an important consideration as the genetics of the animals, as well as pasture/grazing management, is critical in determining the level of parasite resistance the sheep will display (C. Boekmann, personal communication, August 13, 2024).

Table 1: Sheep Breeds and Characteristics

Solar Project Name (State)	Sheep Breed	Breed Type (Hair or Wool)	Characteristics
Tyto Solar (Wisconsin); Jean Duluth Solar (Minnesota)	Katahdin	Hair	Medium stature, hardy, adaptable, docile, parasite resistance, good foragers[1, 2]
High Point Solar Farm (Illinois)	Dorper	Hair	Medium to large stature, hardy, adaptable, good foragers[3, 4]

Mammoth North Solar (Indiana)	St. Croix	Hair	Small to medium stature, adaptable, docile, parasite resistance, excellent foragers[5, 6]
E.W. Brown Solar (Kentucky)	Shetland	Wool	Small stature, hardy, adaptable, docile[7, 8]
Ledgeview Solar (Wisconsin)	Texel	Wool	Medium stature, adaptable, docile[9, 10]

[1] The Livestock Conservancy n.d.(a)
[2] Oklahoma State University n.d.(b)
[3] Oklahoma State University n.d.(a)
[4] Bennett and Diehl n.d.
[5] The Livestock Conservancy n.d.(c)
[6] Oklahoma State University n.d.(d)
[7] The Livestock Conservancy n.d.(b)
[8] Oklahoma State University n.d.(c)
[9] Texel Sheep Breeders Society, n.d.
[10] Heritage Sheep Reproduction, n.d.

3.3 Design Considerations

The panel height and spacing typical of most ground-mount solar configurations allow for integration of sheep, though other modifications to facility layout, design, and infrastructure may be needed for solar grazing to be successful (NYSERDA 2024, ASGA 2024b, McCall et al. 2024). Design considerations for "grazing-ready" solar facilities include adequate fencing, site access, and critically, water access. A predator-proof perimeter fence is essential infrastructure for a solar grazing operation (Kochendoerfer and Thonney 2021, DePillis 2021, NYSERDA 2024). The perimeter fence "does not need to be higher than 7 feet" and common types include agricultural woven wire and chain link (NYSERDA 2024). Other fence types, such as the standard game fence used by Ameren, may also be suitable, though adequacy of the perimeter fence for protecting and containing sheep should be discussed with the grazier (DePillis 2021). Electrical fencing or barbed predator wire may be installed along the inside of the perimeter fence for added protection (EPRI 2024, NYSERDA 2024). To accommodate safe passage of livestock and personnel, 20 to 24-foot exterior double gates are recommended (NYSERDA 2024). Above-ground cable management systems should provide 24 to 32 inches of clearance to allow passage of sheep underneath without interference, and all wires and cables less than 36 inches from the ground should be neatly tucked and secured to prevent damage to sheep and equipment (NYSERDA 2024). Other site equipment such as switches, inverters and concrete equipment pads should be protected with fencing (i.e. livestock panels, woven wire, or mesh fencing) to exclude livestock (NYSERDA 2024, ASGA 2024b, Macknick et al. 2022, DePillis 2021). For instance, ASGA (2024) references a custom bracket that was built to prevent sheep from rubbing against an emergency switch. On-site amenities such as wells or connection to municipal water lines and power outlets are ideal, and water access may indeed be critical to the feasibility of solar grazing at many sites (Agrivoltaic Solutions 2020, Kochendoerfer et al. 2019, NYSERDA 2024). While solar graziers can use transported water, water hauling is one of the main costs of sheep grazing, so access to on-site water will substantially reduce investment and operating costs for graziers (McCall et al. 2022, Agrivoltaic Solutions 2020). Developers may also consider installing interior fencing or otherwise adjusting the site layout to assist with rotational grazing (ASGA 2024b). Solar infrastructure and cable systems should be designed to allow for the passage of equipment between panel rows for reseeding groundcover; a typical part of pasture maintenance, and other maintenance activities (EPRI 2024; Agrivoltaics Solutions 2020). In some instances, property owners may not allow livestock grazing and may require re-negotiation of land agreements, which may impact cost.

3.4 Forage and Rotational Grazing

3.4.1 Forage Mix

When selecting a forage mix, it is important to select species that are regionally adapted, shade-tolerant, meet solar site height criteria (not exceeding 18 to 24 inches in height), and are suitable for grazing livestock (Agrivoltaic Solutions 2020, Fulwider et al. 2024, Gelley et al. 2021). Other site characteristics such as soil type, pH, and prior crop history should also be considered when selecting an appropriate seed mix (Gelley et al. 2021). A typical pasture blend includes 60-70% grasses, 30% legumes, and up to 10% forbs (Agrivoltaic Solutions 2020). For solar grazing sites in the upper Midwest, the University of Wisconsin (UW)-Madison recommends a mix of cool-season grasses (ex. orchardgrass, meadow fescue, and Kentucky bluegrass) and legumes (ex. red clover) for their shade tolerance and forage quality and provides rates and ratios for a sample mix (see Table 2) (Fulwider et al. 2024). At 76% grasses and 24% legumes, UW-Madison's sample mix generally aligns with Agrivoltaics Solutions' (2020) recommendations. Kevin Betley with DJM Ecological Services, Inc. estimates that the installation cost (materials and labor) of the seed mix in Table 2 would be similar to a native pollinator mix (personal communication, November 20, 2024).

Table 2: Sample Solar Pasture Mix

Species	%	Pounds (Lbs)/Acre
Meadow fescue (*Schedonorus pratensis*) or orchardgrass (*Dactylis glomerata*)	60	15
Kentucky bluegrass (*Poa pratensis*)	16	4
Red clover (*Trifolium pratense*)	24	6

Source: Fulwider et al. 2024

Fulwider et al. (2024) explains that meadow fescue and orchardgrass are likely to produce better under single-axis trackers than fixed tilt panels, and regardless of the panel racking, will need to be grazed in a timely manner to prevent panel shading as they can both reach heights up to 4 feet. Pasture mixes generally require two to four harvests annually to maintain grass height below the solar panel and nutritional value for livestock (Gelley et al. 2021). A list of cool-season grasses and legumes that are recommended forage for solar grazing sites in Ohio and the broader Midwest can be found in Ohio State University's factsheet, "*Forage as a Vegetative Cover for Utility-Scale Solar in Ohio*", included in Attachment A (Gelley et al. 2021). The list includes species characteristics such as maximum growth height, seeding rate and depth, and ease of establishment. Experts recommend consulting with university extensions, the USDA Natural Resource Conservation Service (NRCS), or grazing experts to develop site-specific seed mixes that will support livestock and meet developer needs related to panel shading and Storm Water Pollution Prevention Plan (SWPPP) permitting requirements (EPRI 2023).

3.4.2 Forage Establishment and Maintenance

Pasture establishment should occur in early spring or late summer/early fall; if construction occurs outside of these windows, it may be necessary to plant a cover crop to suppress weeds prior to establishing permanent pasture (Fulwider et al. 2024). Care should be taken to minimize soil

disturbance during construction to support soil health and forage establishment (EPRI 2024). If possible, establishment of forage species should occur prior to solar array installation; however, "solar panel installation will often occur before vegetation establishment" and can be accomplished by drilling between panel rows and broadcast seeding underneath panels (Fulwider et al. 2024, Macknick et al. 2022, Hartman 2023). As noted above, cover crops such as annual rye, oats, and winter wheat can be planted prior to or at the same time as seed mixes to suppress weeds, control soil erosion, and serve as a nurse crop for seedlings (Andrew et al. 2024, Macknick et al. 2022, Agrivoltaic Solutions 2020). Re-seeding may be necessary in the first couple of years following construction, and periodically thereafter to maintain the pasture (Agrivoltaics Solutions 2020). Agrivoltaics Solutions (2020) explains that construction at newly developed solar sites will reduce the percent vegetation coverage during the first one to two years, but reseeding efforts are expected to produce full vegetation coverage once the site has recovered from construction.

3.4.3 Forage Yield and Quality

Studies suggest that forage grown on solar sites produce lower yields but are of similar or higher nutritive quality to those grown on open pasture (Portner et al. 2024, Andrew et al. 2021). Portner et al.'s (2024) research in Minnesota found that while panels reduce forage yield by 50% due to shading, they do not reduce forage quality, "based on similar or higher crude protein, fiber content and digestibility, and mineral levels" of forage planted underneath solar panels vs. open air. Researchers at Oregon State University found that lambs that grazed on open and solar pastures grew at similar rates, despite reduced forage yield in the solar pastures (Andrew et al. 2021). This finding was attributed to higher forage quality in the solar pastures and to lower heat stress experienced by the lambs due to the provision of shade by the panels. Research by Deboutte (2024) at three different solar facilities in France found that both forage biomass and nutritive value increases under the shade of the panels, possibly due to lower soil temperatures and higher soil humidity. Deboutte's (2024) observation of greater forage biomass under panels conflicts with Portner et al. (2024) and Andrew et al.'s (2021) studies referenced above, as well as Cornell University's finding that forage production underneath panels was 2.5 times lower than forage production in unshaded conditions (Kochendoerfer et al. 2022).

Andrew et al. (2024) cautions that extreme weather conditions (ex. drought, waterlogging) combined with lower light conditions under the panels can make solar pasture establishment and maintenance very challenging. Weed pressure and heavy trampling underneath panels caused by grazing animals seeking shade[3] were noted as additional factors complicating forage production. Andrew et al. (2024) concludes that "the conventional setting of ground-mounted solar panels, although providing an important opportunity for livestock grazing, was not optimized for pasture production at the site." To optimize solar pasture production, the authors suggest diverse pasture mixes incorporating species tolerant of both shade and heavy traffic, and intensive weed management, particularly at the pasture establishment phase (Andrew et al. 2024, Andrew et al. 2021). Regardless of the vegetation management

[3] Andrew et al. (2021) found that "sheep prefer to spend more than 40% of their grazing time and practically all of their resting time (>95%) beneath solar panels."

approach (i.e., mowing, grazing, pollinator habitat), poor forage establishment can lead to higher costs, as supplemental mechanical controls will be needed to manage weeds (Lawrence 2022, EPRI 2024).

3.4.4 Toxic Plants

While toxic plants such as milkweeds (*Asclepias spp.*), buttercups (*Ranunculus spp.*), St. Johnswort (*Hypericum perforatum*), and white snakeroot (*Eupatorium rugosum*) can be common in pastures, livestock will normally avoid these plants if they have access to abundant, good quality forage (Fulwider et al. 2024, Foulk 2023). To prevent toxicity issues, UW-Extension emphasizes a grazing plan that includes regular soil testing and management of soil fertility and pH levels to help desired species outcompete weeds (Gildersleeve et al. 2013, UMain Extension 2021). Severe infestations of toxic and unpalatable species can be managed by mechanical mowing or herbicide application[4] (Fulwider et al. 2024). Additionally, turf type grasses should not be used for livestock forage, as they may contain fungal endophytes which improve the stress tolerance of the plants but produce compounds that are toxic to livestock (Gelley et al. 2021).

Some sources report that ingestion of subterranean clover may trigger chronic copper poisoning in sheep (Gupta 2018; Watt 2021). British breeds or crosses such as Suffolks, Oxfords, Shropshires, and Texels are more susceptible to copper toxicity (Gupta 2018, Watt 2021). Measures to prevent chronic copper poisoning are consistent with good pasture management and include application of molybdenum fertilizer, lime, and planting a mix of grasses and clover (Watt 2021). Clovers, including subterranean clover, are not noted as having toxicity concerns for sheep in UW-Extension's "*Toxic Plants in Midwest Pastures and Forages*," suggesting that clover toxicity is not a common concern for sheep in the Midwest region (Gildersleeve et al. 2013).

3.4.5 Rotational Grazing

Solar graziers often use rotational grazing for vegetation management at solar sites (EPRI 2023). Rotational grazing "involves the frequent movement of livestock through a series of pasture subdivisions called paddocks," unlike continuous grazing where animals roam freely on an open pasture (USDA Climate Hubs n.d., Agrivoltaic Solutions 2020). Graziers typically delineate paddocks within the perimeter fence using temporary electric fencing (Kochendoerfer et al. 2019, Hartman 2023). The benefits of rotational grazing include improved soil and animal health (due to reducing animal traffic), forage yield, and weed control (EPRI 2024, Agrivoltaics Solutions 2020). Macknick et al. (2022) suggest that solar facilities under construction for grazing develop a Prescribed Grazing Plan (PGP), or strategic grazing plan. The PGP provides a blueprint for grazing that determines target animal stocking rates, timing of animal moves, and duration of pasture rest periods post-grazing. Additionally, PGPs will outline forage testing protocols and specify what if any mechanical methods the grazier will use to supplement livestock grazing at the site (Agrivoltaics Solutions 2020). PGPs may be developed by a rangeland consultant or the grazier, in coordination with the developer (EPRI 2024). Kochendoerfer et al. (2022) advises sheep farmers grazing solar sites to "take into consideration that up to 2.5 times less forage produced in panel-shaded areas" when planning their grazing rotation to avoid over-grazing.

[4] UW-Extension recommends not grazing for at least a 14-day period following herbicide application (Gurda and Renze n.d.).

Agrivoltaic Solution's (2020) "*Preliminary Sheep Pasture Rotation and Grazing Plan*" is an example of a PGP that was developed for EDF Renewables for use by graziers, and is included in Attachment B.

3.5 Additional Considerations

3.5-2 Solar Grazing Contract

Details including site access and security, signage, vegetation management standards, insurance requirements and costs, roles, responsibilities, and expectations across all parties should be clearly defined in writing (Macknick et al. 2022). There are two template solar grazing contracts that are currently publicly available at no charge and can be used as a starting point. One was developed by the ASGA in coordination with the Food and Beverage Law Clinic at Pace University and is included in Attachment C (ASGA n.d.). The second was developed by the North Carolina Cooperative Extension (NCCE) and Center for Environmental Farming Systems (CEFS) Initiative and is included in Attachment D (CEFS n.d.). These templates offer similar but varied approaches to allocation of risk and responsibilities between the solar utility entity and livestock grazier (Guarino and Swanson 2022). The template contracts include insurance requirements for the grazier, including commercial general liability, commercial automobile liability, and workers compensation; where the solar site manager is named as an additional insured. The template contracts also include provisions for supplemental vegetation management (i.e., mowing) if sheep alone will not effectively manage the vegetation.

3.5-1 Communication and Site Access

To facilitate livestock grazing, the solar facility owner/operator must arrange for the grazier to have 24/7 access to the site and provide an internal or external staff member to coordinate with (DePillis 2021, EPRI 2024). Communication between the grazier, site owner/operator, and site employees is key to the success of the vegetation management plan (EPRI 2024; Hartman 2023). A rangeland consultant can help facilitate communication between the site owner/operator and sheep grazier and can assist with developing the vegetation management and grazing plans (EPRI 2024).

Hartman (2023) emphasizes that most site employees will have no experience with livestock and will need to be educated so they know what to expect. Additionally, existing labor agreements should be updated as needed to include interactions with livestock. Signs should be posted on gates informing workers of the presence of livestock with instructions to keep gates closed, and emergency contact information (ASGA 2024b).

4.0 Comparing Costs: Mowing vs. Livestock Grazing

McCall et al. (2023) analyzed vegetation O&M costs associated with four different ground cover types at ground-mounted solar sites: Native vegetation, sheep grazing, turfgrass, and gravel. To determine the total costs associated with each ground cover type, the authors considered the following individual activities: Mowing, herbicide application, weeding, trimming, grazing, fencing, and site monitoring. The costs they arrived at did not factor in other expenses that may exist for a given site. They found that turfgrass has the lowest vegetation management cost, averaging $265/acre per year. The average cost of sheep grazing was higher at $307/acre per year. The authors suggest that sheep grazing costs are higher despite lower costs for individual management activities (i.e., mowing, trimming, herbicide

application) because "more individual activities are required" (McCall et al. 2023). They qualify this finding by noting that O&M costs are variable based on site specific conditions and note that "other driving factors related to permitting, social license to operate, ground cover resilience, visual impacts, and individual company standards often outweigh potential cost differences."

Horowitz et al. (2020) analyzed installed costs for different ground-mounted dual-use[5] photovoltaic (PV) designs (PV + crops, PV + sheep grazing, and PV + pollinator habitat) to installed costs over bare ground. All dual-use PV scenarios were found to have a higher installed costs than PV over bare ground, with PV + sheep grazing scenarios incurring the smallest price premium of +$0.07/Watt. While site preparation costs were generally expected to be lower for grazing systems than for systems over bare ground, the authors assume that PV + grazing systems may require higher site investigation costs, additional fencing, and water well installation.

While McCall et al. (2023) and Horowitz et al. (2020) suggest higher installed and vegetation O&M costs for PV + grazing compared to more traditional systems, other sources indicate that sheep grazing could be, depending on the site, more cost-effective than traditional vegetation management approaches:

- At Louisville Gas & Electric's (LG&E's) E.W. Brown solar facility in Kentucky, the cost to use sheep to manage 10 acres of the 50-acre site was $11,500 the first year and $9,000 the second, compared to $14,000/year using mowing (Warren 2023).
- KDC Solar in New Jersey saw a 50% reduction in O&M costs on a 16-acre test site, which led them to expand the practice to other locations (Pickerel 2016).
- At BHE Renewables' Topaz Solar Farm in California, price quotes indicated that the cost of grazing was 33 – 66% lower than mowing. Currently, sheep graze 3,500 acres within the arrays, while cattle graze 1,700 acres around the perimeter fence (EPRI 2024).
- Silicon Ranch's Bancroft Station Solar Farm in Georgia reports an average 20% cost savings in vegetation management using solar grazing compared to mowing, but notes that "cost is highly dependent on the density of unpalatable weeds and subsequent need for mowing" (EPRI 2024).
- At Novis Renewable's Finger Lakes Solar Sites in New York, solar grazing was sometimes more cost effective than mowing. The relative cost of solar grazing compared to mowing varied site-to-site based on factors such as terrain and forage quality (EPRI 2024).
- A study at Cornell University found that managing vegetation with sheep requires 2.5 times fewer labor hours than mowing and string trimming, suggesting lower costs. The additional labor hours for mechanical management were attributed in part to uneven ground and narrow rows between panels that are "time consuming to navigate without damaging the solar panels" (Kochendoerfer et al. 2019).

Lexi Hain, founder and former-Executive Director of the ASGA, reports that utility scale rates for solar grazing are between $250 - $400/acre (Grasby et al. 2021). This aligns with Cornell University's report that solar grazing fees in the eastern U.S. average $326/acre (Kochendoerfer et al. 2019). However,

[5] "Dual-use" is another term for agrivoltaics.

United Agrivoltaics[6] reports a much wider range, estimating grazing fees between $380 to more than $1,500/acre based on site location and vegetation management needs (ASGA 2024b).

WSP contacted 26 sheep graziers in Illinois and Missouri to request per acre vegetation management quotes and received 13 responses ranging from $165 to $1,000/acre per year (see Table 3 and Figure 2). Many graziers noted that their costs included additional trimming and mowing as necessary. Graziers relayed that costs vary based on factors such as site acreage, location, layout (i.e., solar array design and cable management system), access to water, and forage quality. Coyote Ridge Farm in Edina, MO identified access to water as the biggest determining factor on their price, indicating access to on-site water can reduce grazing fees by $100/acre (personal communication, October 22, 2024).

Generic (i.e., not site-specific) mowing estimates received by WSP are similar to grazing estimates (see Table 4). ** _____ **quoted ** _____ ** per year for a 34.4-acre site, or ** ____**/acre per year. ** _____ ** quoted ** _____ ** over four years for a 20-acre site, for an average cost of ** _____ ** or ** ____**/acre per year. ** _____ ** by the ** _____ ** in ** _____ .**estimated a range of ** _____ */acre per year, based on variables such as site location, array design, and the need for herbicide sprays. A confidential renewable energy developer reported to WSP that the cost to mow and spray a 50-acre site is typically ** _____ ** per year (** ____**/acre per year) for the first three years, dropping to ** _____ ** per year (** ____**/ acre per year) for years four and beyond.

Based on the quotes WSP received, the average generic cost of grazing is $361/acre per year at the low-end, and $500/acre per year at the high-end (see Table 3). The average cost of mowing is $377/acre per year at the low-end, and $468/acre per year at the high-end (see Table 4). These costs are for ongoing maintenance of the site, and do not factor in any upfront investment cost increases or other maintenance costs that could be incurred at the site due to use of solar grazing.

Table 3: Generic Sheep Grazing Cost Estimates Per Acre/Year

** [redacted]	State	** [redacted]	Per Acre/Year Quote – Low	** [redacted]
[redacted]	Missouri	[redacted]	$165	[redacted]
	Missouri		$250	
	Missouri		$500	
	Missouri		$550	
	Missouri		$300	
**	Missouri	**	$200	**

[6] United Agrivoltaics is a sheep grazing firm currently grazing 15,000 sheep on 5,100 acres of solar sites in nine states across the U.S. (ASGA 2024b). They also offer consulting services to assist with permitting,
[6] United Agrivoltaics is a sheep grazing firm currently grazing 15,000 sheep on 5,100 acres of solar sites in nine states across the U.S. (ASGA 2024b). They also offer consulting services to assist with permitting,
agrivoltaics design, seed mixtures, water solutions, and more. They have farm partners in at least 15 municipalities throughout Illinois, including Tin Can Farms in Peoria (see Table 3).

** [redacted]	Missouri	** [redacted]	$290
[redacted]	Missouri	[redacted]	$250
[redacted]	Missouri	[redacted]	$475
[redacted]	Illinois	[redacted]	$525
[redacted]	Illinois	[redacted]	$225
[redacted]	Illinois	[redacted]	$600
[redacted]	Illinois	[redacted]	$250
[redacted]	* Illinois	** [redacted]	$480
Average			**$361**

[1] Assumed "Per Acre Quote – Low" cost when calculating average.

Table 4: Generic Mowing Cost Estimates Per Acre/Year

** [redacted] **

5.0 Conclusion

The generic cost estimates WSP received for mowing are similar to those received for grazing, suggesting sheep grazing could be, depending on site characteristics, a cost-competitive alternative to mowing. Key site considerations that would impact the costs include any upfront investments needed, predator-proof, perimeter fencing, groundcover suitable for livestock grazing, access to on-site water; and proximity to an experienced grazier with an adequate number of sheep. These considerations and other factors determining a site's "grazing readiness" are listed in the "Grazing Readiness Checklist" (see Table 5). The initial investment associated with establishing a "grazing ready" facility may ultimately determine if grazing is a cost-effective strategy at a particular site. Chief among the factors listed in Table 5 is site access and security. Without fencing that is suitable for containing and protecting livestock and 24/7 site access for the grazier, solar grazing cannot occur. Access to on-site

water is another factor that can significantly affect the feasibility of grazing. Pasture quality also drives the cost and feasibility of grazing as unpalatable plants that are not grazed will require alternative management, such as mowing.

A site that has been optimized for grazing (i.e., access to on-site water, high quality and abundant pasture, interior fencing to assist with rotational grazing) can expect lower grazing fees than a site that is less optimized or meets only the minimum requirements. Tin Can Farms' (a member of United Agrivoltaics) "Sheep Readiness Solar Site Rating Scale" provides pricing guidelines based on the size and class of the site (see Tables 6 and 7, or included in Attachment E). The site class is determined by characteristics such as site security, access to water, and forage quality. Sites receiving a "Bronze" classification have the minimum requirements for grazing and will incur the highest management fees. Sites receiving a "Platinum" classification are considered optimal for grazing and will see lower fees which United Agrivoltaics assures will be "less expensive than mechanical mowing." These scales can help Ameren understand the factors contributing to grazing fee pricing and assess if sheep grazing may be an economical solution to vegetation management at future sites.

Table 5: Grazing Readiness Checklist

Grazing readiness checklist *Does the site have...*
Land access permissions for livestock?
Challenging terrain and/or area of high rainfall?
Predator-proof perimeter fencing with 20 to 24-foot exterior double gates?
24/7 grazier access?
On-site water?
On-site power outlets?
High-quality, sheep-friendly vegetation?
Fencing around equipment pads and inverters?
24-inch minimum ground clearance at the lower edge of panels?
Above-ground cable management systems with 24 to 32 inches of clearance?
Wires and cables less than 36 inches from the ground neatly tucked and secured?

Table 6: United Agrivoltaics' Grazing Readiness Scale

Grazing Readiness Scale		
Class	**Considerations**	**Vegetation**
Bronze	Well fenced for sheep, gates latch tight, common access code, lock, or lockbox	Any
Silver	Retention ponds or live water nearby, access to 110	Pre-sprayed with targeted herbicide and free from thistles, dogweed, vines, burdocks and poisonous plants
Gold	Water well on site	Sheep friendly vegetation such as low grow pasture grass mixture
Platinum	Space for staging/handling, subdivided with inexpensive pasture fencing to reduce or remove need for portable fences, inverters fenced in separate	High quality sheep friendly vegetation

Table 7: United Agrivoltaics' Pricing Tiers by Size

Pricing Tiers by Size	
Pricing Per Acre	**Site Size**
Case by case	< 10 acres
Baseline	10 to 50 acres
Price reduction	50 to 150 acres
Additional price reduction	150 to 350 acres
Additional price reduction	350 to 500 acres
Case by case price reduction	> 500 acres

Figures

Figure 1: Midwest Active Solar Grazing Project Map

Project	Location	Project Size (Acres)	Total Megawatts	Type of Sheep	Number of Sheep
High Point Solar Farm	Stephenson County, IL	500	100	Dorper	450
Tyto Solar	Dane County, WI	30	6	N/A	70
Jean Duluth Solar	St. Louis County, MN	9	1.6	Katahdin	100
Mammoth North Solar	Starke County, IN	4,500	400	St. Croix	1,500
E.W. Brown Solar Facility	Mercer County, KY	50	10	Shetland	200
South Farm Research Center	Boone County, MO	Project to begin operations in 2024			
Ledgeview Solar	Fond du Lac County, WI	32	5	Texel	60
Oak Run Solar	Madison County, OH	6,050	800	N/A	1,000

Legend

● Active Projects

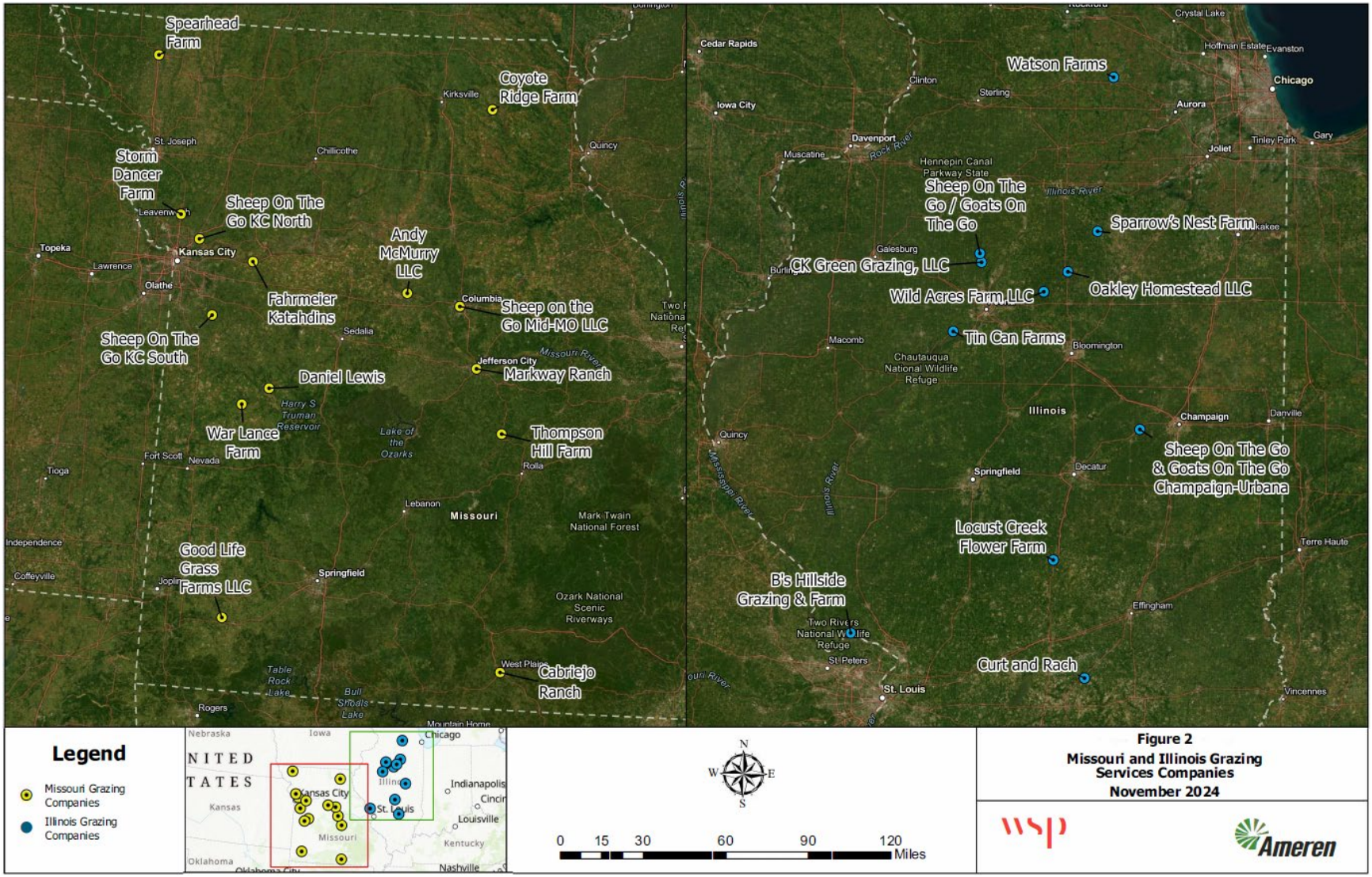
N W E S

0 30 60 120 180 240 Miles

Figure 1
Midwest Active Solar Grazing Projects Map
November 2024

Ameren

Figure 2: Missouri and Illinois Grazing Services Companies



References

Abdullah Al Mamun, M., P. Dargusch, D. Wadley, N. Azwa Zulkarnain, and A. Abdul Aziz. (2022). A Review of Research on Agrivoltaic Systems. Renewable and Sustainable Energy Reviews. DOI: https://doi.org/10.1016/j.rser.2022.112349

Acciona. (2024). ACCIONA Energía introduces sheep grazing in two of its solar farms in Texas and Illinois. https://www.acciona.com/updates/articles/acciona-energia-introduces-sheep-grazing-in-two-of-its-solar-farms-in-texas-and-illinois/?_adin=11734293023

Agrivoltaic Solutions. (2020). Agricultural Integration Plan: Managed Sheep Grazing & Beekeeping. https://www.edf-re.com/wp-content/uploads/004C_Appendix-04-B.-Agricultural-Integration-Plan-and-Grazing-Plan.pdf

American Solar Grazing Association (ASGA). (No Date, a.) "ASGA Solar Grazing Contract Template." https://solargrazing.org/contract/

American Solar Grazing Association (ASGA). (2019). What is Solar Grazing and How Does it Work? https://solargrazing.org/wp-content/uploads/2019/06/Solar-Grazing-Brochure.pdf

American Solar Grazing Association (ASGA). (2024a). ASGA Call 76 Replay: How Big Is Solar Grazing in the U.S.? (ASGA Census Results). https://solargrazing.org/asga-call-76-replay-how-big-is-solar-grazing-in-the-u-s-asga-census-results/

American Solar Grazing Association (ASGA). (2024b). Solar Grazing Best Management Practices. https://www.agrisolarclearinghouse.org/solar-grazing-best-management-practices/

Andrew, A.C., C.W. Higgins, M.A. Smallman, M. Graham, and S. Ates. (2021). Herbage Yield, Lamb Growth and Foraging Behavior in Agrivoltaic Production System. Frontiers in Sustainable Food Systems. DOI: https://doi.org/10.3389/fsufs.2021.659175

Andrew, A.C., C.W. Higgins, M.A. Smallman, D.E. Prado-Tarango, A. Rosati, S. Ghajar, M. Graham, and S. Ates. (2024). Herbage and Sheep Production from Simple, Diverse, and Legume Pastures Established in an Agrivoltaic Production System. Grassland Science Journal. https://onlinelibrary.wiley.com/doi/abs/10.1111/gfs.12653

Beck, S. (2024). A bountiful harvest: Agrivoltaics blends solar energy with agriculture in innovative research project at University of Missouri. https://cafnr.missouri.edu/stories/a-bountiful-harvest-agrivoltaics-blends-solar-energy-with-agriculture-in-innovative-research-project-at-university-of-missouri/

Bennett, L. and B.N. Diehl. (No Date). Selection of Sheep Meat Breeds in Florida. https://edis.ifas.ufl.edu/publication/VM264

Caporale, C. (2024). Sheep grazing at solar projects. https://www.alliantenergy.com/alliantenergynews/illuminate/cef-073124-sheep-and-solar

Center for Environmental Farming Systems (CEFS). (No Date). Sheep Grazing Agreement. https://cefs.ncsu.edu/food-system-initiatives/nc-choices/solar-grazing/

Deboutte, G. (2024). New agrivoltaics data shows improved grass, forage production under solar panels. https://www.pv-magazine.com/2024/06/28/new-agrivoltaics-data-shows-improved-grass-forage-production-under-solar-panels/?itid=lk_inline_enhanced-template

DePillis, A. (2021). Solar Grazing Checklist for Shepherds and Solar Site Managers. Vermont Agency of Agriculture, Food & Markets. https://solargrazing.org/wp-content/uploads/2022/01/Solar-Grazing-Checklist-for-Sheperds-and-Site-Managers-Updated.pdf

Eisenson, M. (2024). Ohio Approves Nation's Largest Agrivoltaics Project, Finding It Will Serve the Public Interest. https://blogs.law.columbia.edu/climatechange/2024/04/01/ohio-approves-nations-largest-agrivoltaics-project-finding-it-will-serve-the-public-interest/?itid=lk_inline_enhanced-template

Electric Power Research Institute, Inc. (EPRI). (2023). Evaluating Opportunities for Sheep Grazing at Utility-Scale Solar Facilities in the United States: A Review. https://www.epri.com/research/products/000000003002028650

Electric Power Research Institute, Inc. (EPRI). (2024). Evaluating Agrivoltaic Opportunities at Solar Facilities: A Case Study on Grazing. https://www.epri.com/research/programs/113056/results/3002024795

Fischer, A. (2024). Indiana's largest solar power plant about to come online. https://pv-magazine-usa.com/2024/07/10/indianas-largest-solar-power-plant-about-to-come-online/

Foulk, D. (2023). Managing Toxic Pasture Plants. https://extension.psu.edu/managing-toxic-pasture-plants

Fulwider, W., D. Mayerfeld, J. Cavadini, and C. Ihde. (2024). Preliminary Forage Recommendations for Grazing Solar Sites. University of Wisconsin-Madison Extension. https://cropsandsoils.extension.wisc.edu/files/2024/05/Preliminary-forage-recommendations-for-grazing-solar-sites-May-2024.pdf

Gelley, C., J. Morris, and E. Romich. (2021). Forage as Vegetative Cover for Utility-Scale Solar in Ohio. Ohio State University. https://solargrazing.org/forage-as-vegetative-cover-for-utility-scale-solar-in-ohio-_-ohioline/

Gerke, P. (2024). No More Sheepless Nights: Enel Inks Largest Solar Grazing Contract. https://www.renewableenergyworld.com/solar/no-more-sheepless-nights-enel-inks-largest-solar-grazing-contract/#gref

Gilbert, S. (2024). Under a Texas sun, agrivoltaics offer farmers a new way to make money. Washington Post. https://www.washingtonpost.com/business/interactive/2024/solar-farms-agriculture-agrivoltaics/?nid=top_pb_signin&arcId=&account_location=ONSITE_HEADER_ARTICLE&itid=nav_sign_in

Gildersleeve, R., A. Gurda, P. Reedy, and M. Renz. (2013). Toxic Plants in Midwest Pastures and Forages. University of Wisconsin-Extension. https://walworth.extension.wisc.edu/files/2014/03/A4019_ToxicPlantsWisconsinPasturesForages.pdf

Grasby, S., K. Campbell, J. Stepanek Shifflet, M. MacKenzie, N. Manapol, R. McCann, L. Hain, & L. Fox. (2021). Mount Morris Agrivoltaic Study. https://www.agrisolarclearinghouse.org/wp-content/uploads/2022/01/MountMorris-AgrivoltaicReport2021-WEB.pdf

Guarino, J. and T. Swanson. (2022). Emerging Agrivoltaic Regulatory Systems: A Review of Solar Grazing. Chicago-Kent Journal of Environmental & Energy Law. https://studentorgs.kentlaw.iit.edu/ckjeel/wp-content/uploads/sites/23/2022/11/v12i1-2022-2023-1-Guarino_Swanson.pdf

Gupta, R.K. (2018). A Review of Copper Poisoning in Animals: Sheep, Goat, and Cattle. International Journal of Veterinary Sciences and Animal Husbandry. https://www.veterinarypaper.com/pdf/2018/vol3issue5/PartA/3-4-16-920.pdf

Gurda, A. and M. Renz. (No Date). Common Poisonous Plants of Concern for Wisconsin's Livestock. University of Wisconsin-Extension. https://fyi.extension.wisc.edu/forage/common-poisonous-plants-of-concern-for-wisconsins-livestock/

Hartman, D. (2023). Sheep Grazing to Maintain Solar Energy Sites in Pennsylvania. Penn State Extension. https://extension.psu.edu/sheep-grazing-to-maintain-solar-energy-sites-in-pennsylvania

Heritage Sheep Reproduction. (No Date). UK Sheep Breeds: Texel. https://www.heritagesheepreproduction.com/blogs/uk-sheep-breeds/texel

Horowitz, K., V. Ramasamy, J. Macknick and R. Margolis. (2020). Capital Costs for Dual-Use Photovoltaic Installations: 2020 Benchmark for Ground Mounted PV Systems with Pollinator-Friendly Vegetation, Grazing, and Crops. National Renewable Energy Laboratory (NREL). https://www.nrel.gov/docs/fy21osti/77811.pdf

Kochendoerfer, N., A. Hain, and M. Thonney. (2019). The Agricultural, Economic and Environmental Potential of Co-Locating Utility Scale Solar with Grazing Sheep. Cornell University Atkinson Center for a Sustainable Future. https://bpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/c/9310/files/2020/12/Atkinson-Center-report-2018_Final-22l3c5n.pdf.pdf

Kochendoerfer, N. and M.L. Thonney. (2021). Grazing Sheep on Solar Sites in New York State: Opportunities and Challenges. Cornell University Department of Animal Science. https://bpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/c/9310/files/2021/03/Solar-Site-Sheep-Grazing-in-NY-v2.1.pdf

Kochendoerfer, N., C. E. McMillan, M. A. Zaman, S. H. Morris, and A. DiTommaso. (2022). Effect of Stocking Rate on Forage Yield and Vegetation Management Success in Ground Mounted Solar Arrays Grazed by Sheep. Cornell University. https://solargrazing.org/wp-content/uploads/2022/12/Effect-of-Stocking-Rate-on-Forage-Yield-and-Vegetation-Management-Success-in-Ground-Mounted-Solar-Arrays-Grazed-by-Sheep.pdf

Lawrence, J. (2022). Planning and Managing Permanent Vegetation Under Solar Arrays. https://blogs.cornell.edu/whatscroppingup/2022/09/01/planning-and-managing-permanent-vegetation-under-solar-arrays/

Lund, A. (2024). Sheep and solar: A sensible pairing. https://www.farmprogress.com/conservation-and-sustainability/sheep-and-solar-a-sensible-pairing

Macknick, J., H. Hartmann, G. Barron-Gafford, B. Beatty, R. Burton, C.S. Choi, M. Davis, R. Davis, J. Figueroa, A. Garrett, L. Hain, S. Herbert, J. Janski, A. Kinzer, A. Knapp, M. Lehan, J. Losey, J. Marley, J. MacDonald, J. McCall, L. Nebert, S. Ravi, J. Schmidt, B. Staie, and L. Walston. (2022). The 5 Cs of Agrivoltaic Success Factors in the United States: Lessons From the InSPIRE Research Study. National Renewable Energy Laboratory (NREL). https://www.nrel.gov/docs/fy22osti/83566.pdf

Makhijani, A. (2021). Exploring Farming and Solar Synergies: An Analysis Using Maryland Data. Institute for Energy and Environmental Research. https://ieer.org/wp/wp-content/uploads/2021/02/Agrivoltaics-report-Arjun-Makhijani-final-2021-02-08.pdf

McCall, J., J. Macdonald, R. Burton, and J. Macknick. (2023). Vegetation Management Cost and Maintenance Implications of Different Ground Covers at Utility-Scale Solar Sites. Sustainability. DOI: https://doi.org/10.3390/su15075895

McCall, J., B. Staie, W.S. Carron, and J. Jamison. (2024). Initial Feasibility Assessment of Agrivoltaics in Jackson County, IL. National Renewable Energy Laboratory (NREL). https://www.nrel.gov/docs/fy24osti/88816.pdf

Minnesota Power. (No Date). Solar Projects. https://www.mnpower.com/Environment/SolarProjects

New York State Energy Research and Development Authority (NYSERDA). (2023). Growing Agrivoltaics in New York State: Advancing Understanding of Opportunities to Integrate Renewables into Working Landscapes. https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/Research/Other-Technical-Reports/23-25-Agrovoltaics-in-New-York--acc.pdf

New York State Energy Research and Development Authority (NYSERDA). (2024). Considerations for "Grazing-Ready" Solar Facilities Planning for Integration of Sheep. https://static1.squarespace.com/static/6260206fe4469352cbb94a72/t/667efc7aa1eeed15f02e9611/1719598205657/Grazing-Ready+Solar+Facilities+%281%29.pdf

Oklahoma State University. (No Date, a). Dorper Sheep. https://breeds.okstate.edu/sheep/dorper-sheep.html

Oklahoma State University. (No Date, b). Katahdin Sheep. https://breeds.okstate.edu/sheep/katahdin-sheep.html

Oklahoma State University. (No Date, c). Shetland Sheep. https://breeds.okstate.edu/sheep/shetland-sheep.html

Oklahoma State University. (No Date, d). St. Croix Sheep. https://breeds.okstate.edu/sheep/st-croix-sheep.html

Pickerel, K. (2016) Don't eat your solar O&M costs — leave it to those with four legs. https://www.solarpowerworldonline.com/2016/08/dont-eat-solar-om-costs-leave-four-legs/

Portner, S., B. Heins, E. Buchanan, & M. Reese. (2024). Forage Biomass and Nutritive Value of Grasses and Legumes Grown Under Agrivoltaic Systems. AgriVoltaics Conference Proceedings. https://doi.org/10.52825/agripv.v2i.979

Puckett, A. (2023). Shaker Village of Pleasant Hill Solar Grazing in Kentucky. https://www.agrisolarclearinghouse.org/shaker-village-of-pleasant-hill-solar-grazing-in-kentucky/

Quandt, A. (2023). Mercury Marine, Alliant Energy renewable partnership receives regulatory approval. https://boatingindustry.com/top-news/2023/11/28/mercury-marine-alliant-energy-renewable-partnership-receives-regulatory-approval/

Schulz, J. (2024). 'A great partnership': Fitchburg farm grazing sheep at Dane County solar site. https://www.wpr.org/news/a-great-partnership-fitchburg-farm-grazing-sheep-at-dane-county-solar-site

Solar Energy Technologies Office (SETO). (2024). American-Made Large Animal and Solar System Operations (LASSO) Prize. https://www.energy.gov/eere/solar/american-made-large-animal-and-solar-system-operations-lasso-prize#:~:text=The%20LASSO%20Prize%20seeks%20to,operations%20to%20facilitate%20wider%20adoption.

Solar Energy Technologies Office (SETO). (No Date). Agrivoltaics: Solar and Agriculture Co-Location. https://www.energy.gov/eere/solar/agrivoltaics-solar-and-agriculture-co-location

Texel Sheep Breeders Society. (No Date). About the Texel Breed. https://texelsusa.org/about-the-breed/information/

The Livestock Conservancy. (No Date, a). Katahdin Sheep. https://livestockconservancy.org/about-us/conservation-successes/katahdin-sheep/

The Livestock Conservancy. (No Date, b). Shetland Sheep. https://livestockconservancy.org/heritage-breeds/heritage-breeds-list/shetland-sheep/

The Livestock Conservancy. (No Date, c). St. Croix Sheep. https://livestockconservancy.org/heritage-breeds/heritage-breeds-list/st-croix-sheep/

Towner, E., Karas, T., Janski, J., Macknick, J. & Ravi, S. (2022). Managed sheep grazing can improve soil quality and carbon sequestration at solar photovoltaic sites. ESS Open Archive. https://essopenarchive.org/doi/full/10.1002/essoar.10510141.1

United States Department of Agriculture (USDA) Economic Research Service (ERS). (2020). Sheep, Lamb & Mutton Sector at a Glance. https://www.ers.usda.gov/topics/animal-products/sheep-lamb-mutton/sector-at-a-glance/

United States Department of Agriculture (USDA) Economic Research Service (ERS). (2023). Cattle & Beef Sector at a Glance. https://www.ers.usda.gov/topics/animal-products/cattle-beef/sector-at-a-glance/#:~:text=Cattle%20production%20is%20the%20most,cash%20receipts%20for%20agricultural%20commodities.

United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). (2019). Prescribed Grazing. https://efotg.sc.egov.usda.gov/api/CPSFile/23095/528_NC_CPS_Prescribed_Grazing_2019

University of Maine Cooperative Extension (UMain Extension). (2021). Solar Farm Grazing Best Management Practices (BMPs) for Sheep. www.maine.gov/dacf/ard/resources/docs/solar-farm-grazing-best-management-practices-vfinal.pdf

Warren, C. (2023). How Grazing Sheep Can Reduce Vegetation Management Costs and Bolster Community Support for Solar Projects. https://eprijournal.com/solar-sheep/

Watt, B. (2021). Secondary Copper Poisoning in Ewes on Subterranean Clover. https://www.flockandherd.net.au/sheep/ireader/secondary-copper-poisoning.html

Attachments

Attachment A – Ohio Perennial Cool-Season Grasses and Legumes
Attachment B – Preliminary Sheep Pasture Rotation and Grazing Plan
Attachment C – ASGA Sheep Grazing Contract Template
Attachment D – NCCE and CEFS Sheep Grazing Contract Template
Attachment E – United Agrivoltaics' Sheep Readiness Solar Site Rating Scale

Attachment A – Ohio Perennial Cool-Season Grasses and Legumes

also increases due to variability between needs of each plant type. Each vegetative cover mix contributes benefits and challenges to providing soil cover in the solar field. The best cover option depends on the long-term maintenance plan and the priorities of the community where the site is located.

Cool-Season Pasture Species to Consider

When choosing the appropriate seed mix, site managers should consider the soil type, pH, prior crop history, and shading of the stand to select species that will thrive on location for the long term. The seed mix should provide uniform site coverage, be maintained below the height of the panels, and provide secondary benefits including improving soil health, carbon sequestration, and adding value to the community as a habitat for wildlife or as feed for livestock. All of the forages recommended in Tables 1 and 2 are perennial, cool-season forages with good to moderate shade tolerance.

Table 1: Ohio Perennial Cool-Season Grasses

Attributes	Max. Growth Height (ft.)	Tolerance to Acidic Soils	Seeding Rate (lb./ac.) & Depth (in.)	Environmental Stress	Frequent Defoliation Tolerance	Ease of Establishment
Kentucky bluegrass *Poa pratensis*						
Long-lived, short-growing, sod-forming grass	3.5 ft.	Medium	16 lb./ac. ¼–½ in.	Good	Good	Good
Meadow fescue *Schedonorus pratensis*						
No alkaloid problem from endophytic fungi	3.5 ft.	Medium	16 lb./ac. ¼-½ in.	Good	Good	Good
Festulolium *Festulolium Asch. X Graebn*						
Hybrid cross of four potential grasses, with varieties available for different growing conditions	3.5 ft.	Medium	25 lb./ac. ¼-½ in.	Fair	Good	Excellent
Perennial ryegrass *Lolium perenne*						
Best suited for the northern half of Ohio	3.5 ft.	Medium	24 lb./ac. ¼-½ in.	Fair	Excellent	Excellent
Orchardgrass *Dactylis glomerata*						
Choose late-maturing varieties to help manage	4 ft.	Medium	10 lb./ac. ¼-½ in.	Good	Fair	Excellent

aggressive spring growth						
Smooth bromegrass *Bromis inermis*						
Later maturing than orchardgrass	4 ft.	Medium	16 lb./ac. ½ in.	Good	Fair	Good
Timothy *Phleum pratense*						
Late maturing Best suited for the northern half of Ohio	4 ft.	Medium	8 lb./ac. ¼-½ in.	Poor	Fair	Good
Novel enophyte tall fescue (NE+) *Schedonorus arundinaceus*						
Novel endophyte tall fescue, has an endophytic fungus present that does not cause animal health issues and is ideal for animal feed use	4 ft.	High	15 lb./ac. 1/3-½ in.	Excellent	Excellent	Good

Table 2: Ohio Perennial Cool-Season Legumes

Perrenial Legume Forages for Consideration	Max Growth Height (ft.)	Tolerance to Acidic Soils	Seeding Rate (lb./ac.) & Depth (in.)	Environmental Stress Tolerance	Frequent Defoliation Tolerance	Ease of Establisment
White clover *Trifolium repens*	1 ft.	Medium	5 lb./ac. ¼-½ in.	Excellent	Excellent	Excellent
Red clover *Trifolium pratense*	3 ft.	Medium	11 lb./ac. ¼-½ in.	Good	Good	Excellent
Alfalfa *Medicago sativa*	3 ft.	Low	15 lb./ac. ¼-½ in.	Good	Good	Good
Birdsfoot trefoil *Lotus corniculatus*	3 ft.	High	9 lb./ac. ¼-½ in.	Excellent	Good	Poor

The information in tables 1 and 2 is referenced from: Sulc, Barker, and Tilmon 2017; Lacefield et al. 2000; and Van Sambeck et al. 2007.

Site Preparation, Seed Establishment, and Maintenance

Follow recommendations for forage establishment as provided in the *Ohio Agronomy Guide*, Chapter 7 (Sulc, Barker, and Tilmon 2017). Complete all soil tests and adjustments prior to seed selection and planting. Choose seed that is adapted to the growing site; has a high

Attachment B – Preliminary Sheep Pasture Rotation and Grazing Plan

Morris Ridge Solar Energy Center
Case No. 18-F-0440

Preliminary Sheep Pasture Rotation and Grazing Plan

Prepared for:

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2020

1. Introduction

Ground-mounted solar sites, by nature of their planned design, have ample fenced areas. From the view of an agriculturalist and grazier, the fencing at solar sites is uniquely suited to serve as grazing areas that, once subdivided into grazing paddocks will assume ideal conditions for a pasture rotation with sheep. The perimeter fencing serves as predator deterrent, the solar panels provide shading and shelter for the animals, and the land used for solar arrays provides palatable pasture species for ruminant nutrition. In turn, rotationally grazed sheep provide adequate and comparatively cheap vegetation management, optimal ground coverage, and thus reduced erosion and run-off, as well as agricultural usage of lands that can add to the viability of farming communities.

1.1. Goals for Managed Grazing at Morris Ridge Solar

The Morris Ridge Solar project, located in the Town of Mount Morris, Livingston County NY, will be sited on approximately 1,060 acres. A managed sheep grazing system is being proposed at the project site to:

- Prevent vegetation from shading the solar panels
- Control invasive plant species
- Avoid the growth of woody plants near solar panels,
- Maintain a diverse plant community
- Maximize pollinator habitat & co-location opportunities with apiaries while still controlling vegetation
- Maximize the opportunity for soil carbon sequestration by increasing topsoil and root mass, and
- Control erosion.

To achieve these goals, a rotational grazing system is proposed, and a grazing plan has been designed as a template for the potential grazier(s). Rotational grazing is a technique where animals are moved as one group, from one pastured area ("paddock") to the next (Hodgson, 1979). Only one paddock is grazed at any given time throughout the rotation, while the other paddocks are given a rest period to achieve pasture regrowth. The sheep are managed in a controlled manner and not allowed to freely roam or continuously graze. Compared to set-stock (continuous) grazing, rotational grazing inhibits weed growth, improves the health of pasture, sustains healthy vegetation, and improves sheep health.

2. Rotation Planning

The Morris Ridge Solar project was assessed for a planned grazing rotation based on the preliminary project layout. The project was grouped into 6 separate pods (or "sections"), each surrounded by agricultural or chain link perimeter fences (Figure 1). Each of these fenced pods will be subdivided into permanently fenced arrays, which will be further subdivided into individual temporarily fenced areas called paddocks.

The grazing plan maximizes the benefit of the planned installation of paddocks and lays out a schedule for the movement of the sheep to facilitate the goals of managed grazing, stated above. Specifically, the managed grazing allows both rest time and growth time for the vegetation within each solar pod. Rest time and growth rates of vegetation are the fundamental elements around which rotational grazing are planned.

2.1. Defined Terms

Project: The Morris Ridge Solar Energy Center in its entirety.

Pod (or Section): The perimeter fencing of the project creates the opportunity to divide the project into smaller areas for planning the sheep rotation based on the fencing that is already planned for the project. The project has

6 subdivisions known as *pods*. Each pod will, as explored below, range from 65 to 290 acres. A separate sheep flock will be assigned to each pod by the flock manager. The precise number of sheep in a pod may be adjusted over the season according to the flock manager. The flock is sized to be enough sheep to cover the entire pod in a full rotation. A full rotation is +/- 40 days in reality, but 45 days on the reference tables below.

Permanently Fenced Array: Pods are subdivided into contiguous groups of panels by interior fencing (typically 3-foot high woven wire fence on wood posts) to create individual permanently fenced arrays. The entire group of permanently fenced arrays forms one contiguous block of fenced panel areas.

Paddock or Grazing Paddock: This is the smallest unit under discussion. It is a grazing unit created by the design of this Grazing Plan. Their individual average size for Morris Ridge is projected at 4.5 acres. Paddocks will be created using cross fencing – typically a temporary fence that cuts across the solar array and meets the perimeter fences at each terminus.

2.2. Grazing System

The following describes the progression from largest (project) to smallest subdivision (grazing paddock) discussed in the grazing plan:

Project → Pod → Permanently Fenced Array → Grazing Paddock

This grazing plan allows that there will be 6 managed flocks of sheep across the project. Each one of the 6 *pods* will be grazed by a separate flock and enrolled into a separate grazing rotation. As outlined in Table 1 below, the stocking rate of each pod will be set at 3.6 sheep per acre.

Each flock's projected size is calculated to be enough sheep to cover an entire pod in a full rotation, i.e. for Pod 1, the amount of sheep needed to graze 65.6 acres in a 45-day rotation. The precise number of sheep in a pod may be adjusted over the season according to the flock manager. The number of sheep planned per pod can be found in Table 1.

Table 1. Grazing Plan Morris Ridge Solar Project

	Item	*Section 1*	*Section 2*	*Section 3*	*Section 4*	*Section 5*	*Section 6*	*Total*
Rotation	Section size, ac	65.6	243.6	131.9	263.9	246.4	108.5	1,059.9
	Number of paddocks	24	45	30	47	44	43	233
	Paddock size, average ac							4.5
	Rest period, days	45	45	45	45	45	45	45.0
	Days in paddock	1.9	1.0	1.5	1.0	1.0	1.0	1.2
Sampling and analysis	Vegetation cover: %, ac	75% 49.2	75% 182.7	75% 98.9	75% 197.9	75% 184.8	75% 81.4	75% 794.9
	OM / yard², lbs	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	DM % / yard², lbs	18% 0.4	18% 0.4	18% 0.4	18% 0.4	18% 0.4	18% 0.4	18% 0.4
	DM / ac, lbs	1,742	1,742	1,742	1,742	1,742	1,742	1,742.40
	DM / paddock, lbs	85,726	318,336	172,367	344,865	321,996	141,788	1,385,077
	Refusals: %, lbs	30% 25,718	30% 95,501	30% 51,710	30% 103,459	30% 96,599	30% 42,536	30% 415,523
	Total paddock DM, lbs	60,008	222,836	120,657	241,405	225,397	99,251	969,554
	Average sheep weight, lbs	160	160	160	160	160	160	160
	DM Intake: % BW, lbs	3.5% 5.6	3.5% 5.6	3.5% 5.6	3.5% 5.6	3.5% 5.6	3.5% 5.6	3.5% 5.6
Section total	**Total acreage**	65.6	243.6	131.9	263.9	246.4	108.5	**1,059.9**
	Total sheep	238	884	479	958	894	394	**3,847.4**
	Stocking rate	3.6	3.6	3.6	3.6	3.6	3.6	**3.6**

Each pod of the Morris Ridge Solar project is not directly connected to the adjacent pod but spatially separated based on landowner participation in the project and available land. The advantage for a flock manager to consider each pod individually is threefold:

1. The flock remains within one pod and can potentially be moved with minimal trucking;
2. The size of each flock remains manageable within the fenced pods; and
3. The individual pods can be administered individually, i.e. bid on and subsequently managed by different farmers during the RFP process.

The grazing plan requires additional division of each pod into a permanently fenced array, which is typically done with 3-foot high woven wire fence on wood posts. Figure 1 demonstrates a preliminary breakdown of pods into permanently fenced arrays.

Each permanently fenced array will be further divided into smaller temporary grazing units. These grazing units, known as *paddocks*, are created by using the planned permanent perimeter fencing and portable, battery charged Electronet® fencing. The Electronet® is a portable fence that is a product familiar to farmers in in the grazing community. It is a white, lightweight fence that is energized using a portable battery, battery/solar combination, or 110V power supply. This fencing is simple to power on/off and will only be located inside the permanently fenced areas.

The Electronet® will be installed by the grazing manager according to the grazing plan. It will allow for an optimal use of the permanent fencing to form some paddock walls, although some paddocks may be formed entirely by lengths of portable fencing. It is a versatile product that will allow the grazing manager a high level of control over the vegetation. The portable, battery charged Electronet® fencing would allow for a simple, logical rotation.

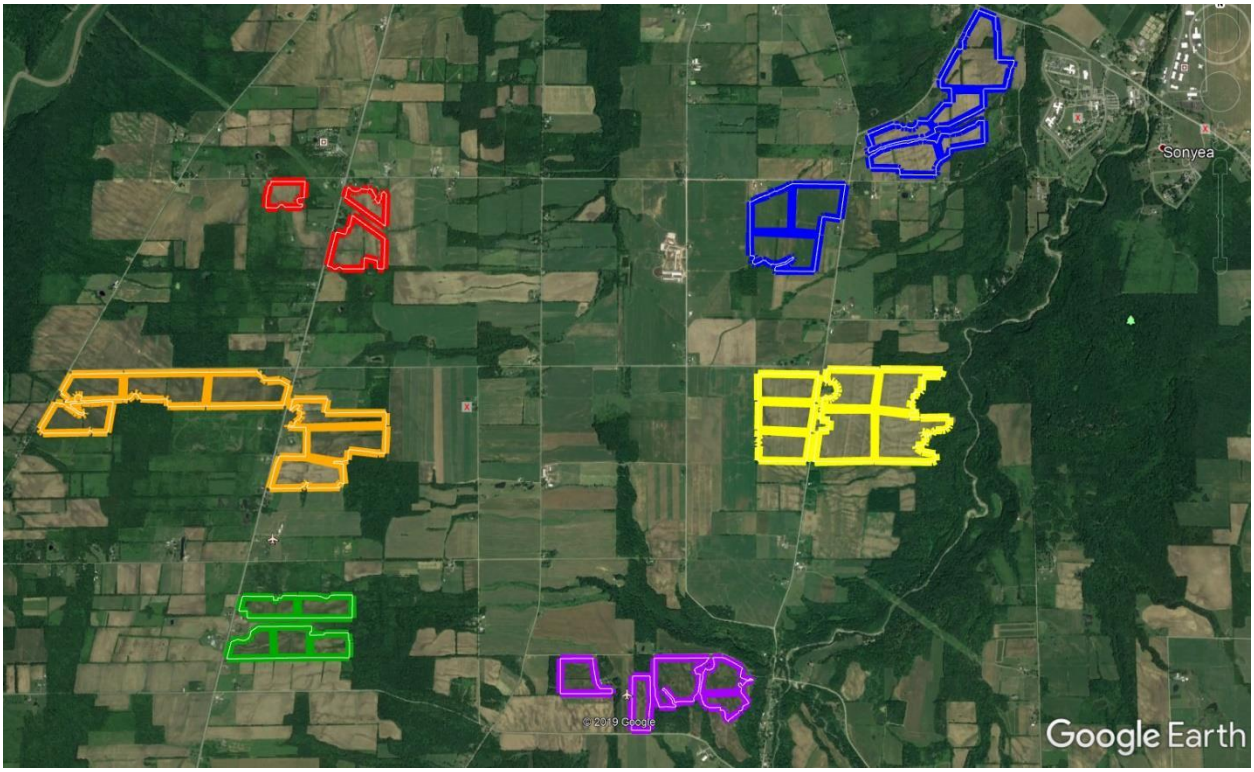

Figure 1. *Morris Ridge Project Site Layout with Distinctly Colored Pods (Trending West to East). Please note that this is based on the preliminary layout and is not the final layout.*

Pod 1: red. A total of 65.6 acres containing 3 permanently fenced arrays and divided further into 24 grazing paddocks

Pod 2: orange. A total of 243.6 acres containing 7 permanently fenced arrays and divided further into 45 grazing paddocks.

Pod 3: green. A total of 131.9 acres containing 6 permanently fenced arrays and divided further into 30 grazing paddocks

Pod 4: blue. A total of 263.9 acres containing 8 permanently fenced arrays and divided into 47 grazing paddocks

Pod 5: yellow. A total of 246.4 acres containing 7 permanently fenced arrays and divided into 44 grazing paddocks

Pod 6: purple. A total of 108.5 acres containing 4 permanently fenced arrays and divided into 43 grazing paddocks

The grazing paddock calculations are based on the total number of sheep per pod and a targeted number of days that sheep will be allowed to graze each paddock (i.e., the grazing period, which will be four days or less). The grazing period is a key factor guiding each grazing paddock's planned acreage. The grazing paddock's size determines the overall number of grazing paddocks within each permanently fenced array the pod. As explained further below, the overall grazing rotation of a pod is determined based on a combination of the size of the individual paddocks, the size of the flock, and the rest period (i.e., the period of time that a paddock will be allowed to rest and regrow between grazing periods).

(Permanently fenced array (ac) / Grazing paddock size (ac) = Number of paddocks (#)

Rest period (days) / Number of paddocks (#) = Grazing days per paddock (days)

2.3. Grazing and Rest Periods

The amount of time the sheep will spend in a paddock (i.e., the grazing period), should be considered through the lens of forage regrowth. To allow for optimal plant regrowth, the time any flock spends in any one grazing paddock should not exceed 4 days. The regrowth of forage species starts after 4 days of being grazed, and any grazing of this early regrowth can adversely affect plant health. Furthermore, a 4-day maximum rotation period reduces fecal matter contamination, minimizes the creation of sacrifice areas (e.g., areas associated with water or mineral supplements that may potentially receive excessive livestock use), and improves pasture hygiene.

The rest time for a given grazed area is largely guided by management for the sheep flock's health. The rest time can be considered the window during which the sheep are not present in a paddock and forage species are provided an opportunity to recover and regrow. The pasture rest period (time between grazing periods) in the US Northeast should not be less than 40 days to minimize internal parasite pressure for sheep. Internal parasites are a health risk to the sheep but not to humans.[1] As the managed grazing is partially aimed at optimizing the health of sheep and their food sources, this health risk to sheep is minimized by following the prescriptive grazing plan below.

Guiding the recommended rest period of each area is part of the life cycle of a sheep parasite known as the barber pole worm. The specific concern of graziers around which grazing plans in the Northeast are designed is the barber pole worm or H. contortus. *H. contortus.* It lives in soils in humid climates such as New York State. Barber pole worm can climb up the stems of vegetation cut short and, while grazing, be ingested by sheep. From there it makes its way to the sheep's 4th stomach where it acts as a parasite. It has a life cycle of 40 days; thus, a clean pasture, or pasture

[1] The internal parasites of sheep are not zoonotic and therefore a threat only to the health of sheep.

that will not contain barber pole worms, can only be achieved with rest periods of 40+ days to avoid reinfection through ingestion of larvae. However, in effective grazing regimens with parasite-resistant sheep flocks, exceptions to the 40-day rule can be made by the flock manager if the vegetation pressure is too high to adhere to a 40-day rest period before re-grazing.

Guiding the recommended grazing period is another aspect of sheep health. The recommended grazing period for any given area of a solar array is not to exceed 4 days. The flock manager will determine the right grazing period for the sheep within the 4-day allowance. This decision is determined typically by the quantity of vegetation in the area, the quality of vegetation available and other pasture or flock management goals. Once the sheep are moved to a new paddock, the grazed area is to be rested (i.e. not grazed) for 40 or more days before the flock returns to it.

2.4. Additional Details

Construction of the solar array will initially reduce the percent vegetation coverage in newly commissioned solar sites. Full vegetation coverage cannot be expected in the first 1-2 years. Our estimate for New York State solar sites is to adjust coverage expectations down by 15 to 35% during those first couple of years. This number will be adjusted upward as reseeding efforts take effect. Because full vegetation coverage is possible in and around the panels, there should be no reduction in the productivity of the solar site as compared to a traditional pasture once the site has recovered from construction. This grazing plan accounts for changes in growth using systematic forage testing in order to calibrate the grazing schedule with the forage or food availability for the flocks.

The project also consists of access roads, inverter pads and other site infrastructure that may consume a few percent of the area within each pod and effectively reduce the overall vegetation cover of the area. This acreage should be estimated and considered separately for each individual paddock by the flock managers.

As previous management regimes for solar sites might consist of hay fields, crop fields, marginal pastures or brush areas, the vegetation coverage is expected to be heterogeneous after installation is complete. Vegetation sampling must be performed following construction in order to determine sheep stocking rate and density, which is a requirement prior to establishing a grazing rotation. Tabular dry matter and nutrient values as they are published for uniform stands of established crops, hay field or other, are not adequate for evaluating solar array site vegetation for grazing. A detailed organic matter (OM) vegetation sampling protocol is published on the American Solar Grazing Association (ASGA) website [www.solargrazing.org]. The grazing rotation will largely depend on the amount of forage dry matter (DM) growing within the individual areas. Flock managers may perform vegetation sampling at regular intervals each season to analyze the nutritional value and quantity of the forage. This will allow for adjustments to the planned grazing rotation.

Forage analysis laboratories such as Dairy One provide detailed analyses that can be used to calculate the available DM per grazing paddock from submitted OM samples. Dry Matter is the percent plant weight not including water content. These DM values are necessary to establish the amount of available feed for sheep, and eventually the sheep stocking rate and density. Typically, pasture DM values in the Northeastern US for well-maintained pastures are between 18-25%, depending on the season. Pasture utilization should be between 70 and 85% to ensure optimal regrowth and animal nutrition. Thus, pasture refusals (uneaten vegetation remaining after grazing) should be part of the calculation and should be between 15% and 35%. Trampled vegetation is also included in refusals and is a normal part of the regenerative process, feeding the soil.

It is recommended to graze uniform animal groups such as: dry (non-lactating) ewes, open (non-pregnant) ewes, ewes in their early stages of pregnancy, yearling ewes or growing lambs of at least 60 lb. Alternatively, 50% of their mature body weight in case of small breeds. In the case of groups of growing lambs, the lambs should be of the same sex or the males neutered.

Depending on the breed and uniformity of the group of sheep, an average weight for the individual animals in the flock can be determined.

Table 2 gives an overview of BW (body weight) and feed intake across popular Northeastern sheep breeds. According to NRC nutritional requirements for small ruminants (NRC, 2007), daily DM consumption per animal can be estimated as a percentage of bodyweight.

Table 2. Body weight and feed intake.

Breed	*Stage of production*	*Body weight, lbs*	*Feed intake, DM %BW*	*Feed intake, lbs DM*
Katahdin hair sheep	Growing lamb, 50% mature BW	65	2.5	1.6
	Yearling	110	3.0	3.3
	Open, dry ewe	130	3.5	4.6
Polypay composite	Growing lamb, 50% mature BW	80	2.5	2.0
	Yearling	130	3.0	3.9
	Open, dry ewe	160	3.5	5.6
Texel	Growing lamb, 50% mature BW	90	2.5	2.3
	Yearling	150	3.0	4.5
	Open, dry ewe	180	3.5	6.3

These calculations can be used to determine the optimal number of sheep per paddock according to body weight and stage of production. By using this with the chosen grazing rotation days (or rest period), the stocking rate (the necessary sheep number for the calculated grazing time within each paddock) can be calculated. Once the stocking rate is determined, a grazing plan can be established (see Table 1).

Forage Species:

Soil testing will be performed at the Morris Ridge Solar project site before the commencement of grazing. The soil testing will inform the species suitable for seeding on the site. A typical pasture blend for solar sites would include 60-70% grasses [2-4 species that are regionally adapted, meet solar site height criteria and are selected for grazing suitability], 30% legumes [2-4 species that meet the above criteria] and up to 10% forbs [broadleaf plants that are tolerant to grazing, regionally adapted, non-toxic to sheep and contribute to the site's biodiversity]. The exact seeding rates and sequence will be determined from the soil testing results and information about current crop production across the project area. Any reseeding, which is a typical part of pasture maintenance, should be accomplished with an eye towards maintaining a rich blend of grazing friendly, solar compatible, pollinator friendly species.

In addition to this, the seeding of various establishment species may be recommended to reduce soil erosion and serve as nurse crops to complement the perennial solar site pasture mix recommended above. The establishment species would be installed prior to the start of Project construction, if appropriate.

Typically, well managed Northeast pastures can achieve yields above 2,500 lbs DM per acre. The yield discussed above is substantially lower; as it is expected that the solar array pastures will take time after establishment to reach their full potential. It is necessary to plan a grazing rotation prior to the grazing season, which would be used to guide a flock manager's rotation plan. The flock manager would then use his/her own experience and observations to decide on a daily basis if the rotation plan is reasonable and responsible, and to make necessary adjustments in rotation days and stocking rates.

Two examples of common adjustments to rotation plans include:

- First, in late spring after rain events and with the warming weather, stocking rates may have to be increased to be able to clear the vegetation growth.
- Secondly, in the summer, sheep may have to be moved from paddock to paddock faster than they were in spring or fall due to the slowed growth of cool-season vegetation.

Predator Protection:

Based on the final facility design, if any culverts are determined to require predator barriers to protect grazing sheep, appropriate features will be added such as culvert grates, an example of which is shown below. Note that these barriers would only be required if a culvert of sufficient size is constructed that may allow predators such as coyotes to enter grazing areas.

3. Animal welfare

Regardless of season, ad libitum clean and fresh water access is crucial for animal welfare (NRC, 2007). Site-specific amenities like well water or connection to municipal water lines are ideal, but transported water is typical of solar grazing operations. Prior to the commencement of grazing, suitable fresh water sources will be identified for the project site. Municipal water is not currently available to the project site; therefore, sources that will be considered include existing wells, new wells, existing ponds, or the use of water tanks on-site that are filled by fresh water transported to the site via truck.

The total number of sheep anticipated for this project (3,000-3,500) will be broken into 6 sub-flocks, one per pod. If feasible, a well or water source will be available for each of the six pods. It is anticipated that the wells or other water source will tie into 1-inch plastic irrigation line that lays on top of the ground and can reach each paddock in the array. Watering troughs will tie into this and the line can be drained in the fall and remain in place for the winter.

For sheep of the recommended production stages (non-lactating and > 60 lbs growing lambs), water requirements are very low in spring and fall, and higher during the summer months. Typically, dry, non-gestating ewes will consume between 5 and 10 % of their body weight in water daily. Each well/water source will likely be serving up to 400 to 600

sheep, and should not need to draw more than 500-600 gallons a day in the hottest part of the summer. In early spring and late fall, the sheep will need close to no water from the wells/water source.

A map of the preliminary water sources that are being considered is included as Figure 2.

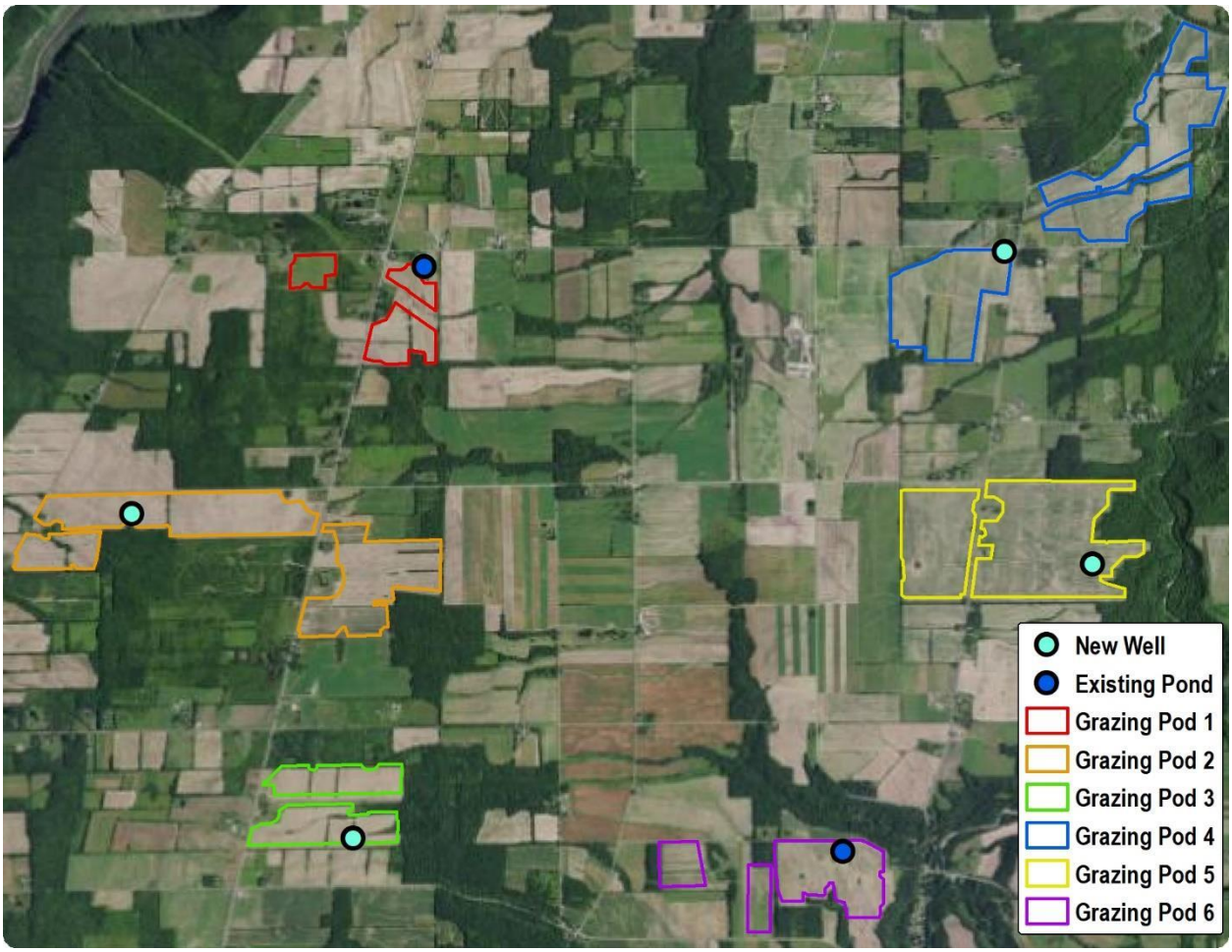

Figure 2. *Morris Ridge Project Site Layout including pods and the location of water sources (new wells and existing ponds) under consideration. Please note that this is preliminary and not the final design.*

Granulated mineral feed (Cargill, 2019) must be available ad libitum and contain adequate concentrations. This is an important animal welfare and nutritional requirement that cannot be overstated. Mineral feed should be offered in troughs that can be moved with the flock according to the rotation and rotation days. Mineral feed is specially blended and commercially available for sheep producers.

Sheep will be visually inspected on every rotation day by the flock manager. Moving the flock(s) to their next paddock is a great time to seek out, monitor, and care for any sheep that require it.

A closer inspection of each member of the flock is recommended at regular intervals (every 6 weeks on site). This inspection is only possible with the use of a handling system. A well thought-out handling system will be an essential tool for the flock manager. Handling systems for sheep can be portable or permanent.

The handling system can be located at a central location for each pod and be permanent, or it can be collapsible and transported on a trailer. Either way, the possibility to gather the flock(s) to perform management tasks at any given time throughout the grazing season must be ensured. The system must allow gathering, leading in a single-file line through a treatment chute, stopping, and sorting of sheep. There are several commercial manufacturers of these systems available in the US, including Sydell, Premier 1, and D-S livestock.

Whatever the flock managers at the project choose, there will be areas available to dedicate to a handling yard in each pod. Handling yard siting within each pod can be decided once the final civil layout is made.

Animal health and well-being:

Each spring, before the flocks begin the grazing season, certain protocols are recommended to ensure they are in optimal health before their work at the solar site begins.

Sheep care and protocols should include, and can be done in a handling system chute:

- Feet must be checked and trimmed
- Ear tags replaced or added, in compliance with USDA regulations
- Wool sheep must be shorn
- Body-condition scored before moving on site. This is a measurement that can easily be performed in a chute on-site and is part of normal management chores. It provides information about the nutritional and health status of any animal on site and can be used to adjust the grazing rotation.
- Sheep should be individually handled and scored using the FAMACHA (FAffa MAlan CHArt) protocol, a visual inspection of the blood vessels under the lower eyelid. FAMACHA scoring is a standard practice in the sheep industry developed in South Africa to promote more effective practices for management of internal parasites that cause anemia and, sometimes, mortality.
- In compliance with FAMACHA protocols, sheep that score high should be treated with a commercially available de-wormer 24 hours prior to entering the pastures every season. Prior to being moved onto the solar site, the sheep should be kept in a dry-lot and be fed hay after deworming. This practice prevents reinfection of the sheep [from internal parasites: again, not a zoonotic concern].

Approximately every six weeks at the solar array the flocks should be run through the handling systems with the following objectives:

- FAMACHA (Wyk and Bath, 2002),
- 5-point checks (Bath and van Wyk, 2009) and parasite monitoring or treatment.

4. Conclusion

A successful grazing rotation on large solar sites with sheep is based on the following:

- Initial, planned grazing rotation
- Experience and ability to observe when the rotation days and stocking density must be adjusted throughout the season
- A well-managed and clean, healthy flock deployed on pasture
- Stringent treatment protocols for flock specific health issues
- Fulfilled nutritional requirements
- Access to mineral feed and clean and fresh water 24/7
- Pasture hygiene (limited fecal contamination, moving of high frequency areas like water and mineral)
- Health checks on every rotation day
- Well-designed handling systems for 6-week animal checks and parasite monitoring and treatment

At the Morris Ridge Solar project, we anticipate the flock managers will follow these protocols and achieve success.

5. Additional Terms

Forage: (1) Edible parts of plants, other than separated grain, that can provide feed for grazing animals, or that can be harvested for feeding. Includes browse, herbage, and mast. (2) The material found, harvested and consumed by livestock themselves that fulfills their nutritional needs. Credit Oregon State Animal Science Dept & Purdue University Extension

Forage Mass: The total dry weight of forage per unit area of land, usually above ground level and at a defined reference level. Credit Oregon State Animal Science Dept

Paddock: A relatively small subdivision generally fenced (permanently or temporarily) and used to control livestock grazing. Credit Purdue University Extension

Pasture: A grazing management unit, enclosed and separated from other areas by fences or other barriers, that's devoted to producing forage for harvest, primarily by grazing. Credit Purdue University Extension

Refusals: Forage remaining on the land after grazing.

Rest: To leave an area of grazing land ungrazed or unharvested for a specific time, such as a year, a growing season, or a specified period required within a particular management practice. Credit Oregon State Animal Science Dept

Stocking rate: Is the relationship between the number of animals and the size of forage resource on which they are placed. It is typically calculated as the amount of available forage divided by pounds eaten per month. Credit, University of Florida Extension.

Stocking Density: The number of animals on a part of pasture for a certain portion of time. Credit, University of Florida Extension.

OM: Vegetative Organic matter: Everything contained in a feed or forage sample including the water.

DM: Dry Matter: Dry Matter represents everything contained in a feed sample except water; this includes protein, fiber, fat, minerals, etc. In practice, it is the total weight of feed minus the weight of water in the feed, expressed as a percentage. It is determined by drying the feed sample in an oven until the sample reaches a stable weight. Credit University of Georgia Extension

Literature

Bath, G. F., and J. A. van Wyk. 2009. The Five Point Check© for targeted selective treatment of internal parasites in small ruminants. Small Ruminant Research 86(1):6-13. doi: https://doi.org/10.1016/j.smallrumres.2009.09.009

Cargill. 2019. Cargill Lamb & Sheep Mineral Premix, http://blogs.cornell.edu/newsheep/management/feeding/agway-sheep-mineral-mix/.

HODGSON, J. 1979. Nomenclature and definitions in grazing studies. Grass and Forage Science 34(1):11-17. doi: 10.1111/j.1365-2494.1979.tb01442.x

NRC. 2007. Nutrient Requirements of Small Ruminants: Sheep, Goats, Cervids, and New World Camelids. The National Academies Press, Washington, DC.

Wyk, J. A. V., and G. F. Bath. 2002. The FAMACHA system for managing haemonchosis in sheep and goats by clinically identifying individual animals for treatment. Vet. Res. 33(5):509-529.

Attachment C – ASGA Sheep Grazing Contract Template

AMERICAN SOLAR GRAZING ASSOCIATION, INC.
SHEEP GRAZING MASTER SERVICES AGREEMENT TEMPLATE

This template was developed by student interns at the Food and Beverage Law Clinic in collaboration with the American Solar Grazing Association, Inc. The Food and Beverage Law Clinic is a part of John Jay Legal Services, Inc., a non-profit legal services organization housed at the Elisabeth Haub School of Law at Pace University. This document does not reflect or constitute legal advice. Your use of this document does not create an attorney-client relationship with the Clinic or any of its lawyers or students. This template was last updated on May 12, 2022.

INSTRUCTIONS FOR USING CONTRACT TEMPLATE:

This document is a template contract for a "solar grazing" arrangement, i.e. an arrangement in which sheep graze at a solar site for purposes of vegetation management. It is contemplated that the contract will be entered into between a sheep farmer and a solar site manager (which may be the site's owner or a manager contracted by the site's owner, as applicable).

This template contains three parts:

1. **Master Services Agreement (MSA)**, which sets forth the general agreements between the sheep farmer and solar site manager that apply to every site the farmer maintains for that solar site manager.
2. **Form of Statement of Work (SOW).** Each SOW will contain the unique details (terms, payment, location etc.) for a specific solar grazing site. Thus, for every new solar grazing site between the sheep farmer and solar site manager, there must be a new SOW, but not a new MSA.
3. **Optional Riders** for provisions on fencing, signage, and security that may be added to the MSA if the parties so choose.

This contract is a template; it is not a one-size-fits-all contract. The following should be addressed by the parties in addition to any other changes the parties may negotiate:

- All provisions that are ***[red, bolded, italicized, and bracketed]***
- All provisions with blank spaces (_____)
- All guidance footnotes
- All optional provisions in the Optional Provisions Exhibit B

Once the MSA and any corresponding SOW is complete, **DELETE** all footnotes throughout the documents, this instructional page, and any unused optional rider provisions.

SHEEP GRAZING MASTER SERVICES AGREEMENT

This Sheep Grazing Master Services Agreement (this "**MSA**"), dated as of ***[date]*** (the "**Effective Date**"), is entered into by and between ***[sheep farmer name]*** ("**Sheep Farmer**") and ***[solar site manager name]*** ("**Site Manager**"). Sheep Farmer and Site Manager together constitute the "**Parties**".

WHEREAS, the Parties desire and intend to enter into this MSA to facilitate the grazing of Sheep Farmer's sheep on one or more solar sites managed by Site Manager for the purpose of vegetation maintenance;

NOW THEREFORE, in consideration of the mutual agreements made herein and for other good and valuable consideration, the Parties, intending to be legally bound, agree as follows:

Section 1. Statements of Work; Solar Grazing Services.

(a) The Parties may, from time to time during the term of this MSA, enter into one or more statements of work, in substantially the form attached hereto as Exhibit A, to govern the specific terms applicable to a solar site where Sheep Farmer will provide solar grazing services (each, a "**SOW**").

(b) For each of Site Manager's solar sites subject to a SOW with Sheep Farmer (each, a "**Solar Site**"), Sheep Manager shall provide sheep for the purpose of grazing for vegetation management in accordance with the terms and subject to the conditions set forth in the relevant SOW and this MSA (the "**Services**").

Section 2. Fees. In consideration of the provision of the Services, Site Manager shall pay Sheep Farmer the fees set forth in each SOW, payable by check unless otherwise specified in the SOW.

Section 3. Vegetation Maintenance Standard.

(a) For each Solar Site, Sheep Farmer shall cause the "Vegetation Maintenance Standard" set forth in the relevant SOW to be fulfilled.

(b) In the event that the sheep alone will not effectively maintain the vegetation in accordance with the applicable Vegetation Maintenance Standard, Sheep Farmer shall fulfill the Vegetation Maintenance Standard through other means such as subcontracting a landscaping service or other service in accordance with Section 8 of this MSA.

Section 4. MSA Term.

(a) The term of this MSA is ***[three years]***[1], beginning on the Effective Date and ending on ***[___]*** (the "**Initial Term**"); provided that if any SOWs are outstanding at the expiration of

[1] **Note to drafter:** Consider frequency and seasonality of work between Site Manager and Sheep Farmer. For example, a 3 year MSA term may be appropriate should Sheep Farmer work with Site Manager for non-consecutive years.

the Initial Term or any renewal term of this MSA, the terms of this MSA will continue in effect for purposes of each such SOW until all such SOWs have expired at their stated "End Date" or otherwise have been terminated.

(b) At the expiration of the Initial Term or any renewal term, this MSA will be renewed automatically for an additional ***[one year]*** period unless, at least ***[30]*** days prior to such expiration date, either party gives the other party written notice of its intent not to renew this MSA.

Section 5. Early Termination

(a) **Early Termination of SOW by Site Manager**

i. **For Cause**. By written notice effective upon receipt, Site Manager may terminate a SOW prior to its stated "End Date" upon Sheep Farmer's material breach of any of its obligations under the SOW (or under this MSA as it relates to such SOW); provided, however, that if such default is capable of cure, then such notice shall be subject to a 30 day cure period from the date thereof, and if Sheep Farmer cures such default prior to expiration of such period, termination will not take place.

ii. **Without Cause**. By written notice effective upon receipt, Site Manager may terminate a SOW without cause prior to its stated "End Date", provided that Site Manager must pay Sheep Farmer ***[the entire remainder of the contract price set forth in the SOW] OR [the early termination fee set forth in the SOW]*** upon such termination without cause.

(b) **Early Termination of SOW by Sheep Farmer**

i. **For Cause**. By written notice effective upon receipt, Sheep Farmer may terminate a SOW prior to its stated "End Date" (A) if severe weather conditions or unforeseen Solar Site conditions no longer permit safe and effective solar grazing for the remainder of the relevant SOW Term, (B) upon Site Manager's failure to make a required payment in accordance with the relevant SOW or (C) upon Site Manager's material breach of any of its obligations under the SOW (or under this MSA as it relates to such SOW). If default under clause (B) or (C) occurs and is capable of cure, then such notice shall be subject to a 30-day cure period from the date thereof, and if Site Manager cures such default prior to expiration of such period, termination will not occur.

ii. **For Toxicity of Soil**. By written notice effective upon receipt, Sheep Farmer may terminate a SOW prior to its stated "Start Date" if toxicity testing of the soil at the Solar Site performed prior to the Start Date reveals the soil contains levels of contaminants which are toxic to sheep and threaten the safety of any sheep.

iii. **Without Cause**. In the case of a multiyear SOW, Sheep Farmer may terminate the SOW without cause prior to its stated "End Date", provided that such termination

must occur at or following the end of a grazing season and written notice of such termination must be provided at least ***[75 days]*** prior to the commencement of the next grazing season (as such seasons are specified in the SOW).

(c) **Effect of Termination on Payment Obligations**. No termination by either Party shall relieve Site Manager of its obligation to pay Sheep Farmer for Services properly performed prior to such termination, and such payment will be adjusted on a ratable basis accordingly. Site Manager shall reimburse Sheep Farmer for reasonable termination expenses, which shall not include consequential damages, unperformed work, or anticipatory profit. In no event will termination costs plus all compensation paid under a SOW exceed the total price agreed for the services under the SOW.

Section 6. Post Termination Land Access. Upon expiration or termination of a SOW by either Party, Site Manager shall provide Sheep Farmer reasonable time and access to remove sheep, equipment, and supplies from the Solar Site.[2]

Section 7. Sheep Management, Health, and Welfare.

(a) **Sheep Farmer Rights and Duties.**

i. Sheep Farmer shall be responsible for the health and wellbeing of sheep, including keeping adequate water and mineral supply; and Sheep Farmer shall be permitted to station watering cubes and other portable watering distribution and dispensing equipment at the Solar Site.

ii. Sheep Farmer shall have access to the Solar Site periodically throughout the Agreement Term to perform toxicity testing of the soil at the Solar Site. Upon request, Site Manager shall provide Sheep Farmer with any previously performed toxicity tests of the soil at the Solar Site.

iii. Sheep Farmer shall have 24 hour access to sheep at the Solar Sites. Sheep Farmer shall keep Solar Site access details confidential.

iv. Sheep Farmer shall be permitted to keep herding and guardian animals including but not limited to dogs, at the Solar Site.

v. If Sheep Farmer becomes aware that its activities have caused any damage to the solar equipment at the Solar Site, Sheep Farmer shall notify Site Manager within 24 hours.

(b) **Site Manager Duties.**

[2] **Note to drafter:** A hard cutoff date may be added to this provision by adding: ***"provided that such period will be no more than [10] days after expiration or termination for retrieving sheep and [30] days after expiration for retrieving other equipment and supplies."***

i. Site Manager shall provide prompt verbal notice to Sheep Farmer if Site Manager becomes aware that any of the sheep are apparently suffering from illness or accident, followed by written notice.

ii. Site Manager shall provide Sheep Farmer with 24 hours' notice (except in the case of an emergency, when Site Manager shall provide as much notice as is reasonably practical) of need for repairs or of need to access panels within a sheep grazing area so that Sheep Farmer may assist with managing sheep during such repairs or access.

iii. Site Manager shall not plant the prohibited vegetation types, if any, listed in the SOW for the Solar Site.

Section 8. Fencing, Signage, and Security.

(a) Site Manager shall provide permanent, secure perimeter fencing and gating to ensure that sheep may not escape the Solar Site and that predators may not enter the Solar Site. Secure perimeter fencing means that such fencing has rigid tension, is flush to the ground, has fenced culverts, and has gates that close tightly. Other than opening the gate for entering and exiting the Solar Site, such fencing and gating shall be closed at all times. If Site Manager must modify existing fencing, gating, and signage to meet the above-described standards, Site Manager shall be responsible for all costs associated with obtaining and installing such fencing, gating, and signage.

(b) Site Manager shall permit Sheep Farmer to install interior fencing at the Solar Site that is reasonably necessary to ensure orderly management and security of sheep. Site Manager shall permit Sheep Farmer use of interior electrical and power supplies at the Solar Site or, alternatively, use of auxiliary electrical and power supplies at the Solar Site. Sheep Farmer shall not be responsible for any costs incurred from use of such interior or auxiliary power and electrical supplies at the Solar Site.

(c) If Site Manager fails to perform its obligations set forth in this Section 8 and such failure continues 24 hours after notice from Sheep Farmer (except in the case of an emergency when no notice shall be necessary), Sheep Farmer may perform Site Manager's obligations or perform work resulting from Site Manager's acts, actions, or omissions and Site Manager shall reimburse to Sheep Farmer, upon demand, the total cost of such performance.

Section 9. Use of Herbicides, Pesticides, and Fungicides. Neither Party nor their subcontractors shall use herbicides, pesticides, or fungicides on the Solar Site without prior written consent of the other Party.

Section 10. Subcontractors. Site Manager authorizes Sheep Farmer to subcontract the performance of the Services. Sheep Farmer authorizes Site Manager to subcontract the performance of its fencing, signage, and security obligations or other maintenance services. No subcontracting shall relieve either Party from its duties, responsibilities, obligations, or liabilities under this MSA and the SOW(s). Each Party shall be solely responsible for the acts, omissions,

or defaults of its subcontractors, and for payments owed to its subcontractors by the terms of their subcontracts.

Section 11. Visitors. Site Manager shall provide Sheep Farmer with 24 hour's electronic notice of all planned visitors who are not regular workers at the Solar Site, including (a) any person visiting for a short duration who will not perform work at the site and (b) any contract worker who does not normally perform extended work at the Solar Site such as a delivery driver.

Section 12. Notice. All notices required or permitted under this MSA or a SOW may be personally delivered, sent by e-mail or other means of electronic transmission, sent by recognized overnight delivery service, or sent by mail to the following addresses and are effective at the time of personal delivery, transmission or mailing:

Sheep Farmer: ***[enter name, address, phone number, and email address]***

Site Manager: ***[enter name, address, phone number, and email address]***

Section 13. Indemnification.

(a) Sheep Farmer shall indemnify and hold Site Manager, its affiliates and their respective employees, directors, officers, shareholders, and agents (the "**Site Manager Indemnified Parties**") harmless against and from liabilities, obligations, damages, costs, charges and expenses, including, without limitation, reasonable attorneys' fees, which are imposed upon or incurred by any of the Site Manager Indemnified Parties arising out of the performance of the Services to the extent caused by (i) breach by Sheep Farmer of any material representation, warranty, covenant, or other obligations set forth in this MSA or an SOW or (ii) the gross negligence or willful misconduct of Sheep Farmer or any of its employees, directors, officers, shareholders, agents, and subcontractors in connection with the performance of its obligations under this MSA or an SOW.

(b) Site Manager shall indemnify and hold Sheep Farmer, its affiliates and their respective employees, directors, officers, shareholders, agents, and subcontractors (the "**Sheep Farmer Indemnified Parties**") harmless against and from liabilities, obligations, damages, costs, charges and expenses, including, without limitation, reasonable attorneys' fees, which are imposed upon or incurred by any of the Sheep Farmer Indemnified Parties arising out of the performance of the Services to the extent caused by (i) breach by Site Manager of any material representation, warranty, covenant, or other obligations set forth in this MSA or an SOW or (ii) the gross negligence or willful misconduct of Site Manager or any of its employees, directors, officers, shareholders, agents and subcontractors in connection with the performance of its obligations under this MSA or an SOW.

(c) Notwithstanding anything to the contrary in Sections 13(a) and (b), (i) Sheep Farmer hereby releases Site Manager from any claims arising from any injury or death to sheep on a Solar Site or any damage to Sheep Farmer's personal property on a Solar Site caused by natural events, except to the extent such injury, death, or damage results from the gross negligence or willful misconduct of Site Manager or any of its employees, directors,

officers, shareholders, agents and subcontractors, and (ii) Site Manager hereby releases Sheep Farmer from any claims arising from any injury or death to persons on a Solar Site or any damage to the solar equipment or other personal property on a Solar Site caused by the natural activity of the sheep, except to the extent such injury, death, or damage results from the gross negligence or willful misconduct of Sheep Farmer or any of its employees, directors, officers, shareholders, agents and subcontractors.

Section 14. Sheep Farmer Insurance Requirements.

(a) During all SOW Terms, Sheep Farmer shall, at Sheep Farmer's own expense, maintain and carry in full force and effect at least the following insurance coverage:

(i) commercial general liability with limits of at least ***[$1 million]*** for each occurrence and ***[$2 million]*** in the aggregate;

(ii) commercial automobile liability to the extent required by governing law; and

(iii) workers compensation insurance to the extent required by governing law.

(b) All insurance coverage required by this section shall name Site Manager as an additional insured. Sheep Farmer shall provide Site Manager with copies of the certificates of insurance and policy endorsements for all insurance coverage required by this section, and shall not do anything to invalidate such insurance.

Section 15. Assignment. No Party's duties, obligations, and responsibilities under this MSA or any SOW may be delegated nor its interests assigned to any third party without the prior written consent of the other Party, which will not be unreasonably withheld.

Section 16. Severability. If any part of this MSA or any SOW is invalid or unenforceable, the balance of this MSA or such SOW shall remain effective, absent such provision, if the essential provisions of this MSA or such SOW for each Party remain valid and enforceable.

Section 17. Compliance with Applicable Laws. Both Parties and their employees, representatives, and agents shall comply at all times with all present or future applicable laws, rules, ordinances and regulations governing or relating to the Services.

Section 18. Waiver. The failure of either party to insist in any one or more instances upon strict performance of any of the provisions of this MSA or any SOW or to take advantage of any of its rights will not be construed as a waiver of any such provision or the relinquishment of such right.

Section 19. Entire Agreement. This MSA, together with the SOW(s), exhibits, schedules, attachments and appendices, constitutes the sole and entire agreement of the Parties with respect to the subject matter contained herein, and supersedes all prior and contemporaneous understandings, agreements, representations and warranties, both written and oral, regarding such subject matter.

Section 20. Survival. Sections 5, 12, 13, and 15-22 of this MSA shall survive termination of this MSA, and any other provisions in this MSA and a SOW which by their nature should remain in effect beyond termination of this MSA or such SOW will survive until fulfilled.

Section 21. Amendments. This MSA and any SOW may be modified or amended only by written agreement executed by the Parties.

Section 22. Governing Law. This MSA and each SOW shall be construed and governed by the laws of the State of **/_____/.**[3]

SIGNATURE PAGE TO FOLLOW

[3] **Note to drafter.** Insert state in which work will be rendered or, if work to be rendered in more than one state, the state law parties agree to govern the contract.

IN WITNESS THEREOF, the parties hereto have executed this Master Services Agreement on the dates below their signatures.

Sheep Farmer:

[*INSERT NAME OF SHEEP FARMER*]

[*Signature block if Sheep Farmer is an individual:]*

_____
Date:

[*Signature block if Sheep Farmer is a business entity:]*

By: _____
Name:
Title:
Date:

Site Manager:

[*INSERT NAME OF SITE MANAGER*]

By: _____
Name:
Title:
Date:

EXHIBIT A

STATEMENT OF WORK

SOW Date: _____
SOW Number: _____

This Statement of Work (this "**SOW**"), dated as of the date set forth above, adopts and incorporates by reference the terms and conditions set forth in the Solar Grazer Master Services Agreement (the "**MSA**") dated as of the date referenced below between the Sheep Farmer and Site Manager referenced below. Capitalized terms used but not defined in this SOW shall have the meanings given in the MSA.

Section 1. Master Services Agreement.

Master Services Agreement Date: _____
Name of Sheep Farmer: _____
Name of Site Manager: _____

Section 2. Location of Services to be Provided.

Solar Site Name: _____
Solar Site Address: _____
_____

Estimated Acreage: _____

Section 3. Description of Solar Site.

Provide a narrative description and/or attach photograph or map that clearly depicts Solar Site boundaries and area Sheep Farmer will maintain:[4]

_____
_____
_____

Section 4. Vegetation Maintenance Standard for Solar Site. Sheep Farmer shall cause all vegetation on the Solar Site to be maintained as follows at substantially all times on substantially all areas specified in Section 3, subject to the schedule set forth in Section 6 below:[5]

Check all that apply:

[4] **Note to drafter:** This should include specifics of the area within the solar site that will be maintained (excluding areas for wildlife, forested areas, etc). This may or may not include maintaining outside the fence-line grasses (and trees) a specified number of feet away from the fence line to the standard described in section 4.
[5] **Note to drafter:** Pick the option(s) most appropriate for the site in question or input own standards determined by Sheep Farmer and/or Site Manager.

- ❑ ☐ Vegetation will not shade the solar panels.
- ❑ ☐ Vegetation will not reach a height taller than approximately _____ inches.
- ❑ ☐ Vegetation will remain between approximately _____ inches and ____ inches.
- ❑ ☐ *Describe other standard:* _____

[Vegetation Maintenance Standard for Other Areas. Sheep Farmer shall cause all vegetation in [*describe area outside the fence line or other areas outside Solar Site itself that are subject to this SOW, if applicable*] to be maintained as follows at substantially all times on substantially all such areas, subject to the schedule set forth in Section 7 below:

Check all that apply:

- ❑ ☐ Vegetation will not reach a height taller than approximately _____ inches.
- ❑ ☐ Vegetation will remain between approximately _____ inches and ____ inches.
- ❑ ☐ *Describe other standard:* _____]

[6]

Section 5. Dates of Service.

SOW Start Date:[7] _____
SOW End Date: _____
The period commencing on the SOW Start Date and ending on the SOW End Date is referred to as the "**SOW Term**".[8]

Section 6. Work Schedule and Deliverables.

DELIVERABLES/MILESTONES[9]	**DATE(S)**
Include any and all milestones and agreed-upon deliverables and dates.	

[6] **Note to drafter:** This section is optional based on whether Sheep Farmer plans to graze outside the fenced-in area of the Solar Site.
[7] **Note to drafter:** The SOW start date must be on or after the governing MSA's Effective Date
[8] **Note to drafter:** This applies for both multi-season and single-season SOWs. If this SOW spans multiple seasons, be sure to clarify key performance and milestone dates over each season.
[9] **Note to drafter:** At a minimum, be sure to include: (1) when and for what time period the Vegetation Maintenance Standard must be met by sheep farmer (2) separate entries/date ranges for when sheep will be on-site if a multi-season SOW and sheep will not be on the site continuously (with the understanding that there is a "buffer period" for delivering the sheep per section 5).

Section 7. Fees. Site Manager shall pay Sheep Farmer for the Services for the Solar Site according to the following payment terms and schedule:[10]

Payment No./ Description of Services	**Due Date**	**Amount**

[Section 8. Early Termination Fee. *The early termination fee for termination by Site Manager without cause, as described in Section 5(a)(ii) of the MSA, is $_____.]*[11]

[Section 9. Prohibited Vegetation Types. *Site Manager shall not plant the following vegetation types at the Solar Site: _____.]*[12]

Section 10. Other SOW-Specific Terms and Conditions.

Insert any other specific terms and conditions agreed for this Solar Site and SOW, if any:

_____

_____

_____

[SIGNATURE PAGE FOLLOWS]

[10] **Note to drafter:** Insert fees and payment schedules for each grazing season (in each respective year, if applicable). Fees may remain the same each year, may increase by a fixed percentage each year, or may be determined by some other method by the parties.

[11] **Note to drafter:** Include this provision if parties agree to an early termination fee rather than agreeing to Site Manager paying the remainder of the SOW price in the event of Site Manager's early termination without cause.

[12] **Note to drafter:** Include particularly if this is a multi-year SOW where site manager may be planting vegetation during non-grazing seasons.

IN WITNESS THEREOF, the parties hereto have executed this Statement of Work on the dates below their signatures.

Sheep Farmer:

[*INSERT NAME OF SHEEP FARMER*]

[*Signature block if Sheep Farmer is an individual:]*

_____
Date:

[*Signature block if Sheep Farmer is a business entity:]*

By: _____
Name:
Title:
Date:

Site Manager:

[*INSERT NAME OF SITE MANAGER*]

By: _____
Name:
Title:
Date:

OPTIONAL RIDERS ON FENCING, SIGNAGE, AND SECURITY

Instructions for use: *Include any or all of the additional provisions on fencing, signage, and security as desired* ***at the end of the MSA Section 8*** *as new clause(s) and update lettering accordingly.* ***Delete all unused optional provisions.***

(c) Site Manager shall maintain adequate records of all persons entering and exiting the Solar Site, including regular maintenance and operations personnel, and such record shall include names, dates, and duration of stay. These records shall be available to Sheep Farmer upon request.

(d) No vehicle(s) (cars, pickup trucks, trucks, trailers) are allowed in the Solar Site, unless for loading and unloading during the performance of the agreed-upon service, and only upon Site Manager or Site Manager's point of contact's consent. In the event of vehicle access (for example, for loading and unloading purposes), the vehicle must park in the open area just next to the gate entrance. Under no circumstances are vehicles allowed around the solar arrays.

(e) Site Manager shall supply visitors, including without limitation, all employees, contractors and subcontractors, students, and researchers with the "Meet the Grazing Sheep" informational sheet, attached hereto as Exhibit B, prior to or upon arrival at the Solar Site.

(f) Site Manager shall post signage at entrance gate and at **[additional locations]** to alert visitors that sheep are present on the Solar Site, to direct visitors to close the gates at all times, and to instruct visitors not to feed the sheep at any time. The following notice shall serve as an adequate signage message:

CAUTION: SHEEP ON SITE
DO NOT APPROACH ANIMALS
IMMEDIATELY CLOSE GATE

(g) Sheep Farmer shall be permitted to install surveillance technology, gate alarm, or other system to keep track of who enters and exits the site.

(h) Sheep Farmer shall be permitted to install additional temporary fencing on the solar site in order to ensure sheep safety.

ONLY INCLUDE IF THE OPTIONAL MSA PROVISION SECTION 8(e) REGARDING VISITORS WAS ADDED TO THE FINAL MSA

EXHIBIT B
MEET THE GRAZING SHEEP

MEET THE GRAZING SHEEP

Hello! Welcome to the Solar Site. This Solar Site has grazing sheep. These sheep are owned or managed by a local farmer and will be kept at this site as a way to manage the site vegetation.

Sheep are friendly but can be scared easily by loud noises, stray dogs, people chasing them, and other threats. Please treat the sheep with respect.

Sometimes the sheep will have a portable electric fence around them called an *electronet*. The electricity in this fence is low voltage and designed to give the sheep a gentle reminder about where to stay.

The electronet is controlled at the *solar power charger* or at an *auxiliary power unit*. The electronet may be turned off, but simply stepping over the fence is preferred. **If you turn the electronet off during your visit, please TURN IT BACK ON before you leave.**

When you visit the solar site, here are a few guidelines to follow:

1. You may contact _____ at _____ for emergencies.

2. Please CLOSE THE GATES! The sheep can escape if you do not close the gates.

3. Please do not feed or approach the sheep.

4. Remain calm and avoid eye contact with sheep.

5. All photos and media coverage are prohibited without permission from appropriate authorities.

6. Please leave all fencing, chargers, and other sheep supplies where you found them.

Thank you! And please close the gates behind you!

Attachment D – NCCE and CEFS Sheep Grazing Contract Template

United States Department of Agriculture
National Institute of Food and Agriculture

This project is supported by the Beginning Farmer and Rancher Development Program competitive grant no. 2018-70017-28550 of the USDA National Institute of Food and Agriculture.

This template was adapted from Cornell University by Carolina Creative Works. This project is supported by the Beginning Farmer and Rancher Development Program competitive grant no. 2018-70017-28550 of the USDA National Institute of Food and Agriculture. For educational purposes only.

STATE OF NORTH CAROLINA

COUNTY OF _____

SHEEP GRAZING AGREEMENT

This Agreement ("Agreement") is effective as of _____ ("effective date"), by and between [insert solar facility operator] ("Operator"), a [insert state or organization] limited liability company (or corporation), with an address of _____, and _____, with an address _____ ("Contractor") (hereinafter collectively referred to as "the Parties").

WHEREAS, Operator manages and has operational control of a photovoltaic generating facility located _____ County, North Carolina, on a tract of land with the parcel identification number _____ ("Facility"); and

WHEREAS, Contractor provides grazing and mowing services using sheep.

WHEREAS, Operator desires to contract with Contractor for the provision of such grazing services at the Facility upon the terms set forth below.

NOW THEREFORE, in consideration of the foregoing and mutual promises set forth below, the Parties agree as follows:

1. **Scope of Work**. Contractor agrees to perform services per the specifications described in **Exhibit A** ("Service"). Operator has the discretion to change the specifications of Contractor's scope of work to meet the business needs and requirements of Operator and/or its customer. [Note that Operator may or may not be the owner of the land or the solar equipment.] In the event Operator modifies the scope of work, Operator or Contractor may request a reasonable adjustment to compensation. In the event the job specifications and/or cost of services are modified; all other terms and provisions of this Agreement shall remain in full force and effect.

2. **Project Facility**. The Service has to be performed in one or more locations, as described in **Exhibit B** ("Facility" or "Facilities"). The Scope of Work and any other service is not required and allowed outside the Facilities described in the Exhibit B.

3. **Term**. Subject to the rights of Termination provided for in Paragraph 6, the term of this Agreement shall be for a period during Spring, Summer and Fall, e.g. from March 1 to November 30 during the current year when this Agreement is executed. The actual period is agreed between the parties and described in the **Exhibit B** ("Season"). Operator has the option to renegotiate and renew this Agreement each subsequent year. The following conditions apply for a given Season as described in the **Exhibit B**:

3.1. **Season Extension**. In the event the Contractor requires to perform the Service before or after the Season, then the Terms and conditions of this Agreement shall continue to govern Contractor's performance until its obligations have been discharged. Any extension of the Season period must be agreed in written between the Parties, and it will not affect the Contract Price. No penalty will be claimed to Contractor for leaving the sheep longer than the end of the Season.

3.2. **Season Shortening.** Contractor may, subject to approval in writing by the Owner which shall not be unreasonably withheld in any case, require to short the Season period. In this event the Contract Price shall be renegotiated and reported in a new Exhibit B, along with the agreed Season period.

3.3. **Emergency Removal.** Should a new condition of the Project Facility occur that may result in a safety hazard for the sheep or for the workers, Contractor is required to promptly remove the sheep. The new Season period will be negotiated as per 3.2.

4. **Contract Price, Payment Terms and Invoicing**. Contractor must submit invoices for payment. Operator will compensate Contractor with the Contract Price, which is a flat and fixed price as descripted in **Exhibit B**, that represents sole compensation for Services. Contractor may invoice Operator for half (50%) of the Contract Price between June 1 and June 30 (payable by Operator within fifteen [15] days), and the other half or any remaining balance of the Contract Price after the end of the Season described in Exhibit B. The invoice must specify the project Facility/Facilities, the dates of the Service, and Service performed for the applicable time period. Final payment will be processed within thirty (30) days of receipt of final season invoice.

4.1 **Address for Invoicing:** Accounts Payable, _____

6. **Termination**. Operator may terminate this Agreement with or without cause, upon thirty (30) days written notice to the Contractor. In such an event, the Contract Price will be reduced proportionally based on the portion of the Season for which services were performed.

7. **Indemnification**. Contractor agrees to indemnify, defend and hold harmless Operator from all claims, demands, losses, liability, lawsuits, liens, and judgments, including all reasonable attorneys' fees and expenses incurred, to the extent caused by Contractor's (i) negligence, misconduct or other fault in the performance of each of their respective deliverables, services, provision of materials and/or products; (ii) relationship with its employees or agents; or (iii) any action or inaction by Contractor or any of its employees.

8. **Insurance**. Contractor will comply with the insurance terms specified in Exhibit D ("Insurance template"), incorporated herein by reference only. The actual Certificate of Insurance must be submitted before Contractor access to the Facility.

9. **Assignment**. Contractor's duties, obligations, responsibilities under this Agreement may not be delegated nor its interests assigned to any third party without the prior written consent of Operator.

10. **Severability**. The Parties acknowledge and agree that should any provision of this Agreement or the application of such provision to the Parties, any other person(s) or circumstance(s) be ruled contrary to law in any way, by any Court or any authorized agency, the remainder of this Agreement or other provisions shall not be affected by such ruling.

11. **Governing Law**. This Agreement shall be construed and governed by the laws of North Carolina.

12. **Notice and Emergency Contact**. Any notice permitted or required by this Agreement shall be sent to the following Parties' representatives:

OPERATOR
□ Main Contact: [insert name], [insert email], [insert phone]
□ Backup contact: [insert name], [insert email], [insert phone]

CONTRACTOR
□ Main Contact: [insert name], [insert email], [insert phone]
□ Herd manager: [insert name], [insert email], [insert phone]

(Contractor must inform Operator about the details (name and phone number) of the herd manager providing services at the Facility.)

13. **Facility Conditions**. Operator is not responsible for the general Facility conditions with respect to the health and safety of the sheep. However, Contractor is encouraged to ask further information to Operator and to inspect the Facility to evaluate environmental conditions suitable for grazing sheep. Specific operational attributes include:

13.1. **Water.** Contractor is allowed to use existing irrigation, streams or ponds available on Facility, however Operator is not responsible of the quality and quantity of the water available on Facility, in form of ponds, streams,
wetlands, or any other form.

13.2. **Grazing.** Rotational grazing with movable fencing is allowed under safety conditions and restrictions, in particular:

□ No electrical connection with any circuit of the solar farm or at the point of interconnection

☐ Battery or charger supplied fencing are allowed upon Operator's approval of the technical specification.

☐ No fence shading over the panels

☐ Fence moving plan shall be communicated in advance to Operator for approval (if the movable fence include any equipment of the solar plant, Contractor must to communicate the safe procedure to access to the equipment)

13.3. **Access.** Operator must grant to Contractor the access of the Facility during all the Season, and in the event that sheep remain inside the fence. Contractor will keep the access details (e.g. lock box code) confidential between Contractor and Contractor's subcontractor (if any) that access the Facility for performance of services.

14. **Subcontractors**. Operator authorizes Contractor to subcontract the performance of the Services to one or more subcontractors. No subcontracting of the Services relieves Contractor of its duties, responsibilities, obligations or liabilities hereunder. Contractor is solely responsible for the acts, omissions or defaults of its subcontractors. Each subcontractor must comply with applicable laws, and the Contractor remains directly responsible towards the Operator in relation thereto. The Parties agree that Contractor shall be exclusively responsible for the payments to any subcontractors upon the terms and conditions provided in the relevant subcontracts executed between the Contractor and the subcontractors. Contractor's subcontractor must be included in the Contractor's insurance coverage.

15. **Visits**. Access to the Facility is allowed to Contractor and Contractor's subcontractor only, unless upon written approval by Operator. Any visitor must read, sign and return the **Exhibit C** before the visit. External visitors, other than Contractor or subcontractor's personnel have to be covered in the insurance policy.

16. **Entire Agreement**. The Parties acknowledge and agree that the terms of this Agreement are contractual in nature. The Parties further acknowledge and agree that this Agreement embodies and sets forth the entire agreement and understanding of the Parties and supersedes all prior oral representations or written agreements, understandings or arrangements with respect to the subject matter hereof. All modifications to this Agreement must be in writing. This Agreement may be executed in identical counterparts, with each such counterpart being deemed an original, and all such counterparts being deemed one and the same document.

17. **Waiver**. The failure of either party to insist in any one or more instances upon strict performance of any of the provisions of this Agreement or to take advantage of any of its rights will not be construed as a waiver of any such provision or the relinquishment of such right.

18. **Exclusivity**. Contractor shall negotiate or dispute this Agreement or any changes or possible amendments with the Operator only, and no other companies (e.g. Facility Owner, Landowner, etc.), both verbally and in writing.

19. **Public Affairs**. Contractor agrees to notify Operator in the event that Contractor is approached for or interviewed impromptu by any media outlet. Contractor agrees to mention working in concert with Operator in any press statement or interview that is given by Contractor regarding use of sheep at the Facility.

IN WITNESS WHEREOF, the parties have executed this Agreement the day and year first above written, and each of them acknowledges receipt of an executed counterpart hereof.

OPERATOR:
_____, LLC [or Corporation as applicable]

By: _____ (Name and Title)

Date: _____ Address: _____

Signature: _____

CONTRACTOR:

_____

By: _____ (Name & Title)

Date: _____ Address: _____

Signature: _____

LIST OF EXHIBITS
Exhibit A: Service and Scope of Work
Exhibit B: Facility/Facilities and Contract Price
Exhibit C: Visitor Rules and Acknowledgement

EXHIBIT A: **Service and Scope of Work**

This Exhibit A outlines the scope of work and relevant restrictions under the Agreement.

1. **Sheep Number and Vegetation Control.** Contractor agrees to maintain the vegetation on Facilities by grazing using sheep. Contractor can decide and modify the number of sheep during the Season as vegetation growth requires, or upon Operator's request. Contractor must inform Operator regarding the current number of Sheep. Such number is determined based on climatic conditions and grass growth, with the sole goal to maintain weeds and grass at an acceptable level, not to exceed approximately two (2) feet high or in any case no higher than the bottom edge of solar panels, in order to avoid any shade on the solar panels. Contractor may add or take sheep away from the Facility, or work with a rotational grazing, but anyway must keep a proper sheep number capable of maintaining weeds and grass at an acceptable height as stated herein.

2. **No Shading.** For avoidance of doubt, the main Contractor must assure that all grass, weeds, bushes and vegetation inside the fence will not shade the solar panels. In case sheep would not effectively chew any particular vegetation that can shade the solar panels, it is Contractor's responsibility to trim vegetation to keep such from shading solar panels.

3. **Sheep Only.** Contractor will provide sheep and ewes only. It's understood that Contractor will not provide goats or other ruminants that could bite and chew the electric cables or other electric devices present in the Facilities.

4. **Fencing and Sheep Safety.** Operator is responsible to keep the fence of the Facility in good condition, at its own cost. Contractor is the only Party responsible for the safety of the sheep, including but not limited to accidental attack from predators, for which the Operator is not liable in any condition. Contractor is invited to check the fence of the Facility to make sure sheep are safe inside the Facilities. If a repair of the fence is required, then Contractor will notify
Operator providing photos, and Operator must repair the fence at its own cost.

5. **Care of Animals and Reporting.** Contractor is responsible for mobilization, healthcare, animal husbandry, providing adequate potable / fresh water as needed for the number of sheep on Facilities. In particular Contractor is the only Party responsible to check the health and well-being status of the sheep with periodical visits (at least on a weekly basis). During these visits the Contractor must note the status of the area, and report to Operator the following information:

   a. Number of sheep inside the fence
   b. Wellbeing status of sheep
   c. One or two representative pictures (e.g. taken with smartphone quality) of the level of the weed and grass growth, for the purpose of ensuring that the solar panels are free from shading.

6. **Site Visitors.** The visits plan must be communicated to Operator in advance, reporting: name of the visitor, planned entry date/time, exit date/time, and frequency of the visits. Once a month Contractor will provide a visits log report (who/when).

7. **Mobilization.** Contractor will begin to mobilize sheep to the Facility at the beginning of the Season of each year and maintain them in the Facility until the end of the Season. With respect to the Season timeline, sheep may be mobilized to the Facility earlier or removed later, based on Contractors' recommendation, subject to Operator's written approval. No additional cost will be charged to Operator in case the Season will be extended.

8. **Site Introductions.** In the event any Operator's contractors are present on Facility or accessing the Facility during the Service, Contractor herd manager must introduce him/herself and disclose the purpose of his/her presence on Facility and confirm he/her can perform the Service safely.

9. **Workmanship.** All Service must be performed by qualified workers in a manner that will meet or exceed accepted industry practices. Contractor's herd manager must read and sign the Visitor's Orientation (see **Exhibit C**) before access to the Facility.

10. **Labor and Materials.** All labor and material are the responsibility of the Contractor. Any deviation from the specifications above resulting in extra charges must be approved in advance in writing by Operator.

EXHIBIT B: **Facilities and Contract Price**

Facility or Facilities means one or more of the following listed here below, only where Contractor will sign (initial). For the other projects, Contractor should write "NO" in the square next to the name of the Facility, and they will not be considered part of the Facility/Facilities. Each Facility comes with the approximate size of the area ("Acre").

Facility 1
Name: _____
Acres: _____
Address: _____
Parcel ID: _____
Google map link: _____
Season: March 1 through November 30
Compensation: $_____

Facility 2
Name: _____
Acres: _____
Address: _____
Parcel ID: _____
Google map link: _____
Season: March 1 through November 30
Compensation: $_____

Facility 3
Name: _____
Acres: _____
Address: _____
Parcel ID: _____
Google map link: _____
Season: March 1 through November 30
Compensation: $_____

TOTAL CONTRACT COMPENSATION: $_____

(NOTE: As per Agreement paragraph 4, Contractor may present first invoice for ½ of compensation between June 1 and June 30 [with payment within 30 days], and the second invoice with the season balance after November 30 [payable by December 31])

Exhibit C: **Visitor Information and Orientation**
[Note: Visitations may be terminated in Operator's sole and reasonable discretion, including violation of rules, emergencies, adverse weather, or interference with operations]

1. **Visitation Information**
   1.1 Facility and Location
   Name: _____
   Address: _____

   1.2. Visitor Information
   Name: _____
   Company: _____
   Address: _____
   Affiliation: _____
   Purpose of visit: _____

Visitors include:

- Any person who is visiting the Facility for a short duration and who will-not perform work under the Agreement at the Facility
- Any contract employee who does not normally perform extended work at the Facility (e.g. a delivery driver)

2. **Visitation Rules (invitation of Contractor)**. All visits with no exceptions must be communicated to Operator's and/or Facility's Owner. Contractor is responsible for the conduct of visitors under their invitation.

2.1 **No Vehicles Within Facility.** No vehicle (cars, pickup, trucks, trailers) are allowed in the Facility, unless for loading and unloading during the performance of the Service, and only upon Operator's consent. In the event of vehicle access (for example for loading and unloading purpose), the vehicle must be parked in the open area just next to the gate entrance. Under no circumstances vehicles are allowed around the solar arrays).

2.2 **Visitor Attire**.

Required	**Recommended**	**Not Allowed**
Hiking or work boots	Steel toe boots	Short pants or skirts
Reflective vest or attire	Safety glasses	Flip flops or bare feet
Long pants	Gloves	Tank tops

2.3. **Incident Reporting**. All accidents, injuries, and near misses must be reported immediately to Operator's POCs and/or Facility's Owner

2.4. **Material Handling.** Use Proper lifting technique at all time. Visitors must get help handling materials weighing over 50 lbs, that are longer than 10 feet in length, or are awkward in shape

2.5. **Training.** It is the responsibility of the party inviting you to provide Training you may need to perform your job. If you are asked to perform a task that you are not trained for, stop and do not perform the task.

2.6. **Zero Tolerance**. Absolutely forbidden are the following:

- Cell phone use while operating equipment or vehicles
- Horseplay
- Theft
- Illegal Drugs or alcohol
- Fire Arms
- Smoking

3. **Basic Facility Safety Rules**. These Basic Facility Safety Rules are in addition to any rules, regulations or requirements required by any public agency with appropriate jurisdiction.

4. **Acknowledgement.** I understand that it is my responsibility to learn and follow all the applicable safety rules and regulations that pertain to my scope of work and visit to this Facility. I also understand that it is my ultimate responsibility to ensure that my work area is safe prior to entering and performing work. I have had the opportunity to ask questions and understand that violation of the Facility safety rules may result in disciplinary action, including removal from the project Facility. I have had the opportunity to ask questions about any Facility-specific hazards and conditions and I am aware of where to get further information regarding the safety rules (i.e. Operator's Safety Manual). In consideration for granting permission to the undersigned to enter such premises, the undersigned does hereby RELEASE AND FOREVER DISCHARGE Operator their agents and servants, and all other persons, firms and corporations connected therewith of and from any and all liability, actions, claims, demands, or suits whatsoever for personal injuries or death suffered or resulting from any acts or omissions of said company whether from known or unknown, apparent or unapparent hazards on the Facility.

I have read and understood the information contained in this orientation and agree to be bound by the rules of the Facility (each person accessing the Facility must sign this form)

Print Name: Last, First, Middle Initial _____
Company _____
Signature _____ Date _____

Attachment E – United Agrivoltaics' Sheep Readiness Solar Site Rating Scale

Sheep Readiness Solar Site Rating Scale

United Agrivoltaics pricing guidelines are based on size of the site and the class of the site as defined below. For each class of sheep readiness or consideration, as well as size, the costs go down. When considering how to reduce the future vegetative maintenance costs on grazed solar sites it is important to know how they are perceived by the farmer. Reductions in price are due to economy of scale and what equipment and input are needed by the farmer to provide vegetation management using sheep.

When determining a cost for a site we grade on a scale Bronze to Platinum, Bronze costing the most to graze as it is simply the baseline for being grazeable. In almost every scenario, Platinum sites typically cost about ½ per acre compared with Bronze, due to the upfront inputs being minimal on the part of the farmer and in the big picture, and without a doubt would be less expensive than mechanical mowing.

Grazing Readiness Scale		
Class	**Considerations***	**Vegetation***
Bronze	Well fenced for sheep, gates latch tight, common access code, lock, or lockbox	Any
Silver	Retention ponds or live water nearby, access to 110	Pre-sprayed with targeted herbicide and free from thistles, dog weed, vines, burdocks and poisonous plants
Gold	Water well on site	Sheep friendly vegetation such as low grow pasture grass mixture
Platinum	Space for staging/handling, subdivided with inexpensive pasture fencing to reduce or remove need for portable fences, inverters fenced in separate	High quality sheep friendly vegetation

*Each tier's considerations and vegetation build onto the next.

Pricing Tiers by Size	
Pricing Per Acre	**Site Size**
Case by case	< 10 acres
Baseline	10 to 50 acres
Price reduction	50 to 150 acres
Additional price reduction	150 to 350 acres
Additional price reduction	350-500 acres
Case by case price reduction	> 500 acres