Regenerative Grazing for Carbon Offsets Protocol

Developed by:

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I. Duke Carbon Offsets Initiative Background

In 2007, Duke University signed the American College and University Presidents' Climate Commitment (ACUPCC) and set a target of achieving climate neutrality by 2024. To be climate neutral, Duke will have to offset an estimated 185,000 metric tons per year of carbon dioxide beginning in 2024. The Duke Carbon Offsets Initiative (DCOI) was created to help Duke University reach climate neutrality. Since the DCOI's inception in 2009, it has developed a number of innovative carbon offset projects in swine waste-to-energy, energy efficiency, residential solar, and urban forestry. Building on its experience as project developers and carbon offset project process familiarity, DCOI works to expand offset opportunities within higher education by fostering collaborative project ideas and bolster educational missions by easing offset project implementation.

II. Protocol Description

This regenerative grazing carbon offset protocol ("Protocol") outlines the methodology for measuring the carbon offsets generated from a regenerative grazing project (RGP). This protocol should be used to ensure that the carbon offsets generated from the project meet the basic criteria of a carbon offset:

- **P**ermanent – The reduction must last in perpetuity;
- **A**dditional – The reduction would not have occurred during a business-as-usual scenario;
- **V**erifiable – The reduction must have been monitored and confirmed to have occurred;
- **E**nforceable – The reduction must be counted only once and then retired; and
- **R**eal – The reduction must actually have occurred and not be the result of flawed accounting.

In addition to PAVER, this protocol provides information on co-benefits considered when developing projects, such as educational, social, environmental, economic, scalability, and public relations and partnership benefits. Co-benefits of carbon offset projects are often key reasons cited in decisions to implement offset projects and are principal factors determining offsets' value. Co-benefits typically build climate resilience within their localities and prepare communities for climate change impacts.

This protocol informs project implementers on how to develop a project that meets the PAVER requirements to generate carbon offsets and tangibly impact the climate, but it also strives to incentivize projects with high co-benefits.

III. Benefits of Regenerative Grazing

Regenerative grazing has the ability to sequester carbon, improve the soil's water retention capabilities, increase pasture and animal health, promote healthy soils, and provide ecosystem services. In a continuous grazing pattern, the cattle eat their preferred grasses first, which causes weeds to proliferate at a faster rate. Further, the cattle will graze plants to the point where the forage cannot regenerate, preventing the root system from extending deeper into the soil profile. When cattle are grazed in a rotational pattern, the root systems of the plants develop more extensively and the above-ground plant matter regenerates more rapidly, which also encourages diverse forage as the plants develop at a more uniform rate. The new growth of the plants pulls carbon from the atmosphere through photosynthesis and sequesters the carbon via the root system into the soil.

A. Co-Benefits of Regenerative Grazing

Beyond the carbon sequestration benefits of regenerative grazing, these practices offer a host of additional benefits with proper management, including:

1. **Environmental**
   - **a.** Reduces soil erosion due to continuous root systems in the soil
   - **b.** Improves soil health by increasing soil organic matter and microbial populations, which strengthen soil structure and aggregation
   - **c.** Improves water infiltration to replenish groundwater and increases water quality of nearby surface water systems from reduced runoff of soils and fertilizer
   - **d.** Increases water absorption and drought and flood resistance of working lands, which is particularly important for climate change resilience
   - **e.** Improves the biodiversity and quality of forage for livestock
   - **f.** Improves pasture nutrient management by increasing the rate of nutrient cycling and decreasing the use of fertilizers
2. **Economic**
   - **a.** Involves partnerships along the supply chain, from farmers to processors to retailers, and builds a stronger local, farming community
   - **b.** Promotes local and sustainably raised meat products, keeping dollars in the hands of producers closer to home
   - **c.** Reduces needs for feed, saving farmers money on inputs
   - **d.** Reduces needs for fuel and inorganic fertilizer, saving farmers money on inputs

   - **e.** Improves welfare of animals in a pasture-based operations compared to feedlot operations

3. **Social**
   - **a.** Promotes the movement towards more sustainable and climate friendly food products. Consumers are also interested in purchasing more sustainable products and purchasing meat that has been grown sustainably.
   - **b.** Reduces environmental nuisances associated with Concentrated Animal Feeding Operations (CAFOs)
   - **c.** Maintains North Carolina's agricultural heritage and rural landscapes, preventing the conversion and development of valuable agricultural land
   - **d.** Engages student and faculty participation in the soil sampling and monitoring
   - **e.** Enables farmers who are interested in regenerative grazing to be taught easily by farmers already implementing these practices
   - **f.** Informs community members about the benefits of regenerative agriculture

IV. Abbreviations/Acronyms

BAU - Business as Usual

DCOI - Duke Carbon Offsets Initiative

ERT - Emissions Reductions Tonne

GHG - Greenhouse Gas

RGP - Regenerative Grazing Project

SOC - Soil Organic Carbon

tCO2e - Tonnes of Carbon Dioxide Equivalents

V. Definitions

Actual sampling depth: The depth to which sampling occurs at each sampling site if the nominated sampling depth is or isn't achieved (the actual sampling depth must be less than or equal to the nominated sampling depth in each layer).

Additionality: a term used in markets for tradable greenhouse gas (GHG) emissions reductions (carbon offsets). It means that a project or activity that reduces GHGs would not have happened without the offset buyer or collective buyers in the market.

Aggregate: Discrete clusters of soil grains.

Air-dry Soil: Soil that has been dried at approximately 40°C to constant mass.

Baseline: The amount of soil organic carbon in the Project Area on the Project Start Date.

Buffer Pool: Each year after the RGP Start Date, a certain percentage of the Project's carbon offsets must be set aside and contributed to what is called a Buffer Pool, which is designed to cover unavoidable losses associated with natural disasters (e.g. hurricanes, wildfires, flooding).

Buffer Pool Contribution: The amount of ERTs that each RGP must contribute (Total Risk score % multiplied by Total ERTs generated for reporting period = Buffer Pool Contribution in ERTs at time of issuance).

Bulk density: The mass of soil per unit volume.

Carbon Sequestration: A natural or artificial process by which carbon dioxide is removed from the atmosphere and stored in different carbon stocks or reservoirs, such as soil.

Carbon Offsets: Measurable, quantifiable, and trackable units of greenhouse gas (GHG) emissions reductions, which are used to counterbalance or compensate for ("offset") emissions from other activities. Produced by projects that carry out on-the-ground emissions reduction activities. Typically measured in metric tons (tonnes) of carbon dioxide equivalents, or tCO_2e.

Carbon Stock: A reservoir where carbon is located. Carbon can be transferred between different stocks. The main carbon stocks are the atmosphere, living organisms, frozen ground, soil, rocks, and the oceans. For this protocol, carbon stock refers to carbon stored in soil.

Central Sampling Point: The center point of a sampling site. This point is established permanently with a marker or GPS data.

Co-Benefits: While offsets are traded based on their climate benefits, many projects also have a host of additional impacts, known as "co-benefits." These co-benefits are often in line with other aspects of sustainable development, such as supporting the local economy through job training and creation, preserving watershed areas that supply clean water, or safeguarding biodiversity. In many cases, co-benefits are integral to the project and often one of the main reasons that suppliers and many buyers are engaged in voluntary markets for carbon offsets.

Composite Sample: A sample created by combining and thoroughly mixing individual soil subcores collected from different cores in the same sampling site. For this protocol, each composite sample will be made up of subcores from the same soil depth (i.e. one composite sample will contain soil from the 0cm - 7.5cm range of each core, another from the 7.5cm - 15cm range, etc.).

Continuous Grazing: When cattle graze a pasture for an extended amount of time with no, or infrequent rest to any of the plants on the pasture from grazing.

Coring Device: A cylindrically shaped device (mechanical or manual) used to extract a known volume of soil. Sometimes referred to as a soil probe.

GHG Registry: A database, usually publicly available, for collecting, verifying, and tracking emissions data from various emitters. These often serve as markets for buying and selling carbon offsets.

Grasslands: Lands with more than 250 mm mean annual precipitation covered by natural and managed herbaceous cover that lack trees over 5m in height with greater than 50% canopy cover (forests).

Grazing animal: Mammals that eat primarily herbaceous plants or the leaves of shrubs; in this protocol, applies to livestock species subject to control by the RGP Practitioner.

Monitoring Report: A report of data collected by following the Monitoring and Verification section of this protocol, which will be submitted to the RGP Developer.

Nominated sampling depth: The soil sampling depth that is chosen by the RGP Practitioner for the Soil Sampling Methodology. For all RGP Projects the nominated sampling depths are 0 cm - 7.5 cm, 7.5 cm - 15 cm, and 15 cm - 30 cm.

Pre-Project Land Use: Activities taking place on the land up until the Project Start Date.

Project Area: The geographic boundaries of the area on which livestock will be grazed.

Project Crediting Period: One 40-year term marking the time during which carbon offsets from an RGP will be monitored and credited. RGP Practitioners may choose to renew for another Project Crediting Period at the end of the last one.

Project Lifetime: The total length of time for which a project is operational. Usually one Project Crediting Period plus the 40 years following.

Project Start Date: The start date of the Project for project impact estimation purposes. The day that carbon accumulation, for the purposes of generating carbon offsets, formally begins.

Regenerative Grazing: Farming and grazing practices that, among other benefits, can mitigate climate change by rebuilding soil organic matter and restoring degraded soil biodiversity – resulting in both carbon sequestration and improving the water cycle.

RGP Developer: The entity who will contract with the RGP Practitioner to purchase the carbon offsets generated by the RGP Practitioner.

RGP Practitioner: The person or entity who implements regenerative grazing practices and follows this protocol to produce carbon offsets.

Risk Factor: A quantification of potential risk that can arise from project grazing animals being subject to stressors that might cause reversals of carbon stocks back into the atmosphere, such as disease and natural disasters. Additionally, the Project Area can be subject to stressors such as financial, project management, social/policy, pests and natural disasters.

Rotational Grazing: A type of regenerative grazing. Various practices of planned grazing in which animals are restricted, by herding or fencing, to small portions (< 25%) of available grazing lands for relatively short periods of time, followed by movement to new portions of available grazing land. The restricted access and time is designed for livestock grazing animals to eventually visit all or most of available grazing lands but still allow forage plant species sufficient time and resources (water, nutrients) to regrow and set seed following grazing or to complete growth and seed set before grazing.

Sample: An individual soil core which is being analyzed separately; or, each separate layer of soil from the soil core which is being analyzed separately; or, a composite. A more generic term that applies to several types of samples described in this protocol.

Sampling Event: Every time the RGP Practitioner or person contracted by the RGP Practitioner takes samples, i.e. the baseline and subsequent monitoring.

Sampling Intensity: The number of sampling sites established per strata.

Sampling Plan: The spatial layout of soil core locations arranged around the Central Sampling Point.

Sampling Site: A discrete location, centered around the Central Sampling Point, where soil cores are taken. At each sampling event, 6 cores are taken from each sampling site.

Soil Sampling Methodology: Instructions on the spatial layout of sampling locations, the number of samples, the compositing of soil samples and the subsequent analysis.

Soil core: A discrete sample of soil that has been extracted with a coring device.

Soil Organic Matter (SOM): The organic matter component of soil, consisting of plant and animal detritus at various stages of decomposition, cells and tissues of soil microbes, and substances that soil microbes synthesize. Organic matter makes up just 2–10% of most soil's mass and has an important role in the physical, chemical and biological function of agricultural soils.

Soil Organic Carbon (SOC): A measure of the carbon contained within soil organic matter. While soil organic matter includes all the elements in soil, such as hydrogen, oxygen, and nitrogen, soil organic carbon includes just carbon. Because organic matter is difficult for laboratories to measure directly, they usually measure total organic carbon instead.

Soil Organic Carbon Density: Amount of carbon in the soil, expressed as a mass per unit area rather than as a percent.

Strata: Divisions of a pasture for soil sampling purposes. Soil conditions may not be homogeneous across a large geographic region. Non-homogeneous conditions may affect the validity of baseline calculations and additionality checks. Therefore, pastures shall be subdivided into smaller units or strata that are considered homogeneous for the purpose of testing for soil organic carbon. Strata should be selected based on soil type and ecological characteristics (soil texture, aspect, slope, hydrology, plant composition).

Subcore: A portion of a soil core. In this protocol, soil cores are divided into 3 subcores according to nominated sampling depth.

VI. Project Participants

The following participants are the most likely roles that an RGP will include. However, if there are additional or different roles for participants that you believe would fit your project well, please contact RGP Developer.

A. Regenerative Grazing Project (“RGP”) Practitioner

a. The RGP Practitioner is responsible for maintaining the pasture and livestock, implementing regenerative grazing practices, and monitoring carbon sequestration. Typically, the RGP Practitioner will be a farmer. The RGP Practitioner may own the pasture on which their livestock graze, or they may lease or arrange to use someone else’s pasture. Any of the RGP Practitioner’s duties may be contracted to another party; however, the RGP Practitioner is ultimately responsible for the completion of these duties. The RGP Practitioner is responsible for any project reversals that might occur. The RGP Practitioner is also responsible for project quantification, monitoring and reporting throughout the project lifetime.

B. RGP Developer

a. The RGP Developer is a person or entity, such as DCOI, that wishes to support carbon offsets achieved through regenerative grazing practices. The RGP Developer must contract with the RGP Practitioner to obtain ownership of the carbon offsets created from the project. The RGP Developer is also responsible for contracting with a third-party to verify the amount of carbon sequestered by the RGP Practitioner.

VII. Carbon Offset Ownership

a. Carbon offset ownership will be flexible. Options include the RGP Developer owning credits in exchange for up-front funding to an RGP Practitioner to help initial adoption of grazing practices; A landowner owning credits in exchange for free or reduced-cost grazing pasture for the RGP Practitioner to use; or the RGP Practitioner owning credits. The chosen arrangement should be memorialized in a signed agreement. At a minimum, the signed agreement should specify who owns the land, who owns the project grazing animals, who will be responsible for maintaining the project grazing animals, and who will own the carbon offsets generated by the project.

VIII. Eligibility Conditions

This protocol uses the following eligibility conditions. However, depending on program needs, these conditions may be adjusted, so long as adjustments are approved by the RGP Developer.

The Project shall meet the following conditions:

A. Project Area

- **a.** The Project Area is the geographic extent of the RGP. The Project Area may be made up of pastures and other lands that are either contiguous to each other or scattered. There are no size limits to the Project Area.
- **b.** At the start date, all land within the Project Area must meet one of the following three Pre-Project Land Use Possibilities:
  - **i.** Pasture or grassland that has been continuously grazed by any party for a minimum of two years prior to the Project Start Date.
  - **ii.** Cropland, mixed farming land, or fallow land.
    - **1.** Note: The RGP Practitioner may not remove forests to convert them to crop or farmland to compensate for any crop or farmland that is converted to grazing sites for this Project.
  - **iii.** Silvopasture that does not involve forest removal after the Project Start Date.
- **c.** The Project Area can either be owned or leased by the RGP Practitioner.
  - **i.** RGP Practitioner must report to the RGP Developer whether Project Area is owned or leased.
  - **ii.** Communication regarding Project Lifetime and completion must occur to ensure the project continues to meet the required standards if ownership or lease of Project Area is transferred to another person.
- **d.** The Project Area must be structured to keep grazing animals within the Project Area, and the RGP Practitioner must be able to enforce the boundaries of the Project Area.
  - **i.** Note: grazing animals may be removed from the Project Area to conduct maintenance of the Project Area, so long as that maintenance does not disturb or damage the carbon stored within the Project Area.
- **e.** Lands within the Project Area may be used concurrently for other purposes, such as livestock production, conservation, hunting or tourism.

B. Project Start Date

a. This Start Date notes the day that carbon accumulation, for the purposes of quantifying Project Area SOC changes, formally begins.
b. Within one year of the Start Date, the Project's initial soil organic carbon estimation, i.e. the baseline, in accordance with the Soil Sampling Methodology accounting must be measured.
c. On or after the start date, new livestock can be introduced within the Project Area over the Project's Lifetime.

C. Project Activities

a. Project Activities adjust the number, type and husbandry of grazing animals and/or introduce herbaceous grassland species as potential forage for grazing animals or to restore degraded soils with the goal of sequestering carbon in the soil.
    i. These activities do not meet the eligibility requirements of this protocol under the following conditions:
        1. Practices that involve mechanical vegetation removal or soil tillage.
        2. The Project Area receives a net import of organic carbon through fertilizer applications.

D. Project Crediting Period

a. The carbon offset crediting period for an RGP is one 40-year term. Projects may be renewed but must calculate an updated baseline of soil organic carbon before offset generation is continued. The original baseline may be held throughout the 40-year crediting period. An updated baseline must reestablish Project Additionality and ensure that no new laws or regulations have been passed impacting the Project.

E. Minimum Time Commitment

a. The Project Crediting Period plus an additional 40 years to ensure permanence (See PAVER section below).
b. Projects must monitor, report, and undergo verification activities for 40 years following the last credit issued to the Project. The timeframe of 40 years was selected in coordination with the DCOI's belief that carbon offsets are a bridge to

a time in which a lower carbon economy has taken hold and to create effective permanence within the protocol.

F. Program Criteria for RGP

a. All projects and programs shall meet the requirements set out in the RGP Developer program documents.
   i. See Section VII: "Procedure for Demonstrating High Quality Offsets" for more details on each of the following principles.

IX. Procedure for Demonstrating High Quality Offsets

This section will discuss the components of a high-quality carbon offset with in-depth descriptions of P.A.V.E.R. requirements.

Offset Criteria and Definition	Required Data and Program Procedures
Permanent The reduction must last in perpetuity and the emission reductions cannot be reversed	It is important to ensure the net sequestration of soil carbon by maintaining intensive grazing practices and avoiding tillage or other practices that release sequestered carbon. This protocol requires the maintenance of SOC stocks for at least 40 years beyond the Project Crediting Period, as documented through continued monitoring and verification. Therefore, if the Project commences in the year 2020, and the final credit is granted in the year 2060, the Project cannot implement practices deemed ineligible under Project Activities eligibility requirements that would lead to SOC reversals at the Project Area until 2100. It's important to consider the nature of soil carbon stocks, which can be unintentionally emitted due to soil tilling, wildfire, or financial hardship which causes changes to the Project Area's management. These issues pose a risk that carbon sequestered in the soil will be "reversed" and re-emitted into the atmosphere. Therefore, it is important to determine a Buffer Pool Contribution to take these factors into account. For more information on this, please read the "Risk Analysis & Buffer Determination" section below.

Offset Criteria and Definition	Required Data and Program Procedures
Additional The reduction would not have occurred during a business-as-usual scenario.	To demonstrate additionality, the Project must show that there are significant barriers to adopting regenerative grazing practices, such as funding or labor limitations. RGP Practitioners must also show how the Project removes barriers and increases regenerative grazing practices that demonstrate SOC accumulation. For more information about additionality, please read the "Procedure for Determining Additionality" section of this document.
Verifiable The reduction must have been monitored and confirmed to have occurred.	At a minimum, the required data to ensure the verifiability is project acreage, actual sampling depth and lab measurements of SOC and bulk density. This data must be provided as indicated in the soil sampling methodology explained in the "Procedure for Determining a Baseline" section. At a minimum, carbon stocks and bulk density must be measured every 5 years.
Enforceable The reduction must be counted only once by a single organization and then retired.	After the Project Area's SOC change has been calculated, each individual offset can only be used by a single organization and then retired (i.e. cannot be used again). To properly enforce ownership of offsets, a contract between the RGP Practitioner (and any associated land owners, if the RGP Practitioner does not own the land) and RGP Developer should state which organization(s) receives the offsets and how many offsets are to be given to the organization(s). All projects shall be registered with an existing GHG Registry to provide an added layer of accountability.
Real The reduction must actually occur, be measurable, and not be the result of flawed accounting.	The baseline must be established to gauge the impact of a RGP. The Soil Sampling Methodology and the Monitoring Report should be transparent and made available to the public.

A. Procedure for Determining Additionality

Additionality is at the core of producing high quality offsets. Offsets will only be awarded to projects that realize incremental carbon sequestration above a BAU scenario. Offset revenues must be instrumental in catalyzing the adoption of regenerative grazing practices that are reasonably expected to lead to additional carbon sequestration. To demonstrate compliance with these two principles, this protocol relies on a checklist of conditions that RGPs must satisfy in order to be considered additional. RGP Practitioners must document compliance with this checklist in order for the Project to be eligible for offsets.

Additionality Checklist

- **a.** Identify any requirements that the RGP Practitioner must meet outside of the requirements of this Protocol that would improve SOC stock, such as grant requirements.
  - **i.** If there are any external requirements that will lead to increased SOC stocks, then the RGP Practitioner must incorporate those requirements into a BAU scenario (see below) and demonstrate that the reductions and removals of carbon from this Project are above (additional to) the business-as-usual scenario.
- **b.** Identify the most credible alternative land use scenario, or the BAU case. This scenario may be a continuation of pre-project land use or a conversion to another type of land use. The BAU scenario should be legal, feasible, and based on local trends.
- **c.** Demonstrate that the project is not a common practice and faces at least one implementation barrier that would prevent the realization of the Project without offset revenues. Barriers can include technological, institutional, ecological, social, or market. Provide evidence of these barriers when possible. This evidence can include anecdotal, sectoral surveys, market analyses, written documentation by experts, educational institutions, or professional associations.

B. Procedure for Determining Baseline

This protocol will determine a site-specific baseline amount of SOC using either a Soil Sampling Methodology or a modeled methodology. The baseline serves as a starting point for the project and is measured within a year of the Project Start Date. Only SOC stocks above the baseline will be eligible for offsets.

a. Sampled Baseline

i. The RGP Practitioner can determine the baseline by taking soil samples to measure the amount of carbon sequestered in the soil at the beginning of the project. The RGP Practitioner must follow the soil sampling methodology described in Appendix A.

b. Modeled Baseline

C. Risk Mitigation (Insurance/Buffer Pools)

All RGP's must mitigate the risk of unintentional (unforeseen and/or unavoidable) reversals (releases back into the atmosphere) of carbon sequestered during the Project Lifetime To mitigate risk, each RGP must contribute a certain amount of Emissions Reductions Tonnes (ERTs) to a Buffer Pool. The amount of ERTs that each RGP must contribute is called the Buffer Pool Contribution and shall be calculated using the "Risk Factor Calculation Procedure" detailed in this section. The RGP Practitioner shall conduct this calculation and propose a corresponding contribution to a Buffer Pool (if applicable). The risk assessment, overall risk category, and proposed buffer contribution shall be included in the compliance forms. The verifier of the Project will evaluate whether the risk assessment has been conducted correctly.

If no reversals occur, the Project's Risk Factor and Buffer Pool Contribution (if applicable) will remain unchanged for five years. If a reversal does occur, the Risk Factor and Buffer Pool Contribution (if applicable) shall be re-assessed and re- verified immediately.

Risk Categories

Project grazing animals can be subject to stressors that might cause reversals such as disease and natural disasters. Additionally, the Project Area can be subject to stressors such as financial, project management, social/policy, pests and natural disasters.

1. **Financial risk:**
    a. The risk that the RGP Practitioners will experience financial failure that leads to an inability to continue overseeing or financing the Project. This may occur due to an inability to secure buyers or a sufficient price for generated carbon offsets, bankruptcy, or a lack of capital needed to continue monitoring and/or verification.

2. **Project Management risk:**
    a. The risk that the RGP Practitioners will not be able to effectively manage the Project throughout its lifetime. This inability could be due to a lack of technical expertise, poor management skills, or non-adherence to reporting and monitoring requirements.

3. **Social and Political risk:**
    a. The risk that social, political or legal landscapes affecting the Project might change. Changing policies and laws could result in new requirements or incentives that lead to reversals of sequestered carbon. Social risks can include changes in resource needs or public perception.

4. **Natural Disaster risks:**
    a. These risks are associated with natural events that lead to unintentional reversals. Such natural events might include wildlife that dig up the pasture, releasing carbon, wildfires that burn surface litter, inundation, or various slow-onset risks, such as saltwater intrusion or sea level rise.

Buffer Pool

The Risk Factor, calculated below, must be translated into a number of offsets that must be deposited into a Buffer Pool owned by the GHG Registry which the Project is registered under (Buffer Pool Contribution). The Buffer Pool is owned and operated by the GHG Registry. If a project experiences an unintentional reversal, the GHG Registry will retire ERTs from the Buffer Pool in an amount equal to the total amount of carbon that was reversed. This will require quantification of carbon stocks after the reversal, at the RGP Practitioner's expense, to ascertain how many ERTs have been lost.

The Buffer Pool Contribution functions like a premium in conventional insurance. The premium is determined based on assessed risk (the Risk Factor), and in the case of a covered event the insurance company (here, the GHG Registry) pays damages above a deductible amount. In this case, the deductible will be 10% of any ERTs exceeding the initial Buffer Pool Contribution. Following unintentional reversals, the RGP Practitioner is not required to replenish the buffer, but the Project is considered a greater risk and the Buffer Pool Contribution will increase.

Many GHG Registries offer "refunds" for ERTs contributed to Buffer Pools in the case that no reversals occur. Most GHG registries retain any ERTs not reversed during the Project that are left at the end of the Project Crediting Period, unless the RGP Practitioner chooses to renew for another Project Crediting Period.

Note: While the Offset Network does not currently have an active buffer pool, the Bass Connections Team hopes to see such a pool come into existence in the future.

Risk Factor Calculation Procedure

To determine how many ERTs should be contributed to the Buffer Pool, each RGP should calculate a Risk Factor, using the following procedure. This Risk Factor shall be updated at each verification event for values that have changed.
Each project must claim one value from each of the following risk categories. Then, calculate the risk score percentage by summing the scores from each of the applicable risk categories. Apply this percentage to the total Emissions Reductions Tonnes (ERTs) generated for the reporting period to determine how many ERTs should be contributed to a Buffer Pool.

Select **one** value from each of the following risk categories that apply to your Project:

1. **Financial:**
    - **a.** 4% Default Value
    - **b.** 3% US Public and Tribal Lands

2. **Project Management:**
    - **a.** 4% Default Value
    - **b.** 3% US Public and Tribal Lands

3. **Social/Policy:**
    - **a.** 2% Default Value for all projects

4. **Conservation Easement Deduction:**
    - **a.** -2% Default value

b. -3% if the easement requires regular onsite monitoring of activities related to carbon-specific conservation activities

5. **Fire:**
    a. 1% Default Value for all projects

6. **Livestock Insurance:**
    a. -2% if the RGP Practitioner owns livestock insurance on all project grazing animals

7. **Other Natural Disaster Events:**
    a. 2% Default Value for all projects

Risk Factor Calculations

1. Sum of applicable risk category values = Total Risk score %

2. Total Risk score % * Total ERTs generated for reporting period = Buffer Pool Contribution in ERTs at time of issuance.

Intentional Reversals

In circumstances in which the RGP Practitioner wishes to discontinue Project Activities before the Project Crediting Period has finished, the RGP Practitioner may exercise a "buy-out option." This means that the RGP Practitioner can drop out so long as they fully replace any credits that have been issued up until the time the buy-out option is exercised.

X. Monitoring and Verification

The purpose of Project monitoring is to ensure the Project Area is achieving the goals of generating offsets by sequestering atmospheric CO_2, as projected for the Project Lifetime. Verification, which is conducted by either a third-party or a peer institution (see below) ensures that the Project and associated data collection are compliant with this Protocol.

A. Monitoring Requirements

a. Once a year, the RGP Developer will conduct a site visit to complete a visual inspection of the Project Area to ensure that grasses are present and regenerative grazing practices are still occurring. These annual assessments must be documented by the RGP Developer.

   i. The annual assessment can also include testing for soil microbial activity and other soil nutrients.

b. Project Monitoring must occur every 5 years after baseline establishment. A monitoring event includes estimating SOC using the Soil Sampling Methodology. These monitoring events are complemented by a verification event as detailed below.
   i. See Soil Sampling Methodology (Appendix A) for more information on required sampling practices.
   ii. If needed, strata can be collapsed or expanded dependent on the results of soil sampling and SOC estimates. See Soil Sampling Methodology (Appendix A) for more details.
   iii. The data collected above needs to be documented in a Monitoring Report that is submitted to the RGP Developer, who is responsible for identifying a verification entity and publication on the GHG Registry.

B. Verification Requirements

a. There are two possible methods for verification under this protocol:
   i. Third Party Verification
   ii. Educational Institution Peer Verification
b. The verification entity will produce a report following the verification event. Both the verification report and monitoring report should be submitted to the GHG Registry.

C. Timeline for Monitoring and Verification

a. Monitoring and Verification should be conducted every 5 years until the end of the Project Lifetime, which in the case of this protocol, is at least 40 years after the Project Crediting Period, as stated in the permanence section of the PAVER requirements.

Time Since Baseline Establishment	**Verification Event**
5 Years	Monitoring and Verification
10 Years	Monitoring and Verification
15 Years	Monitoring and Verification
20 Years	Monitoring and Verification
25 Years	Monitoring and Verification
30 Years	Monitoring and Verification
35 Years	Monitoring and Verification
40 Years	Monitoring and Verification

XI. Appendices

A. Soil Sampling Methodology

This methodology is used for determining soil organic carbon in the Project Area during sampling events - the baseline determination and subsequent monitoring.

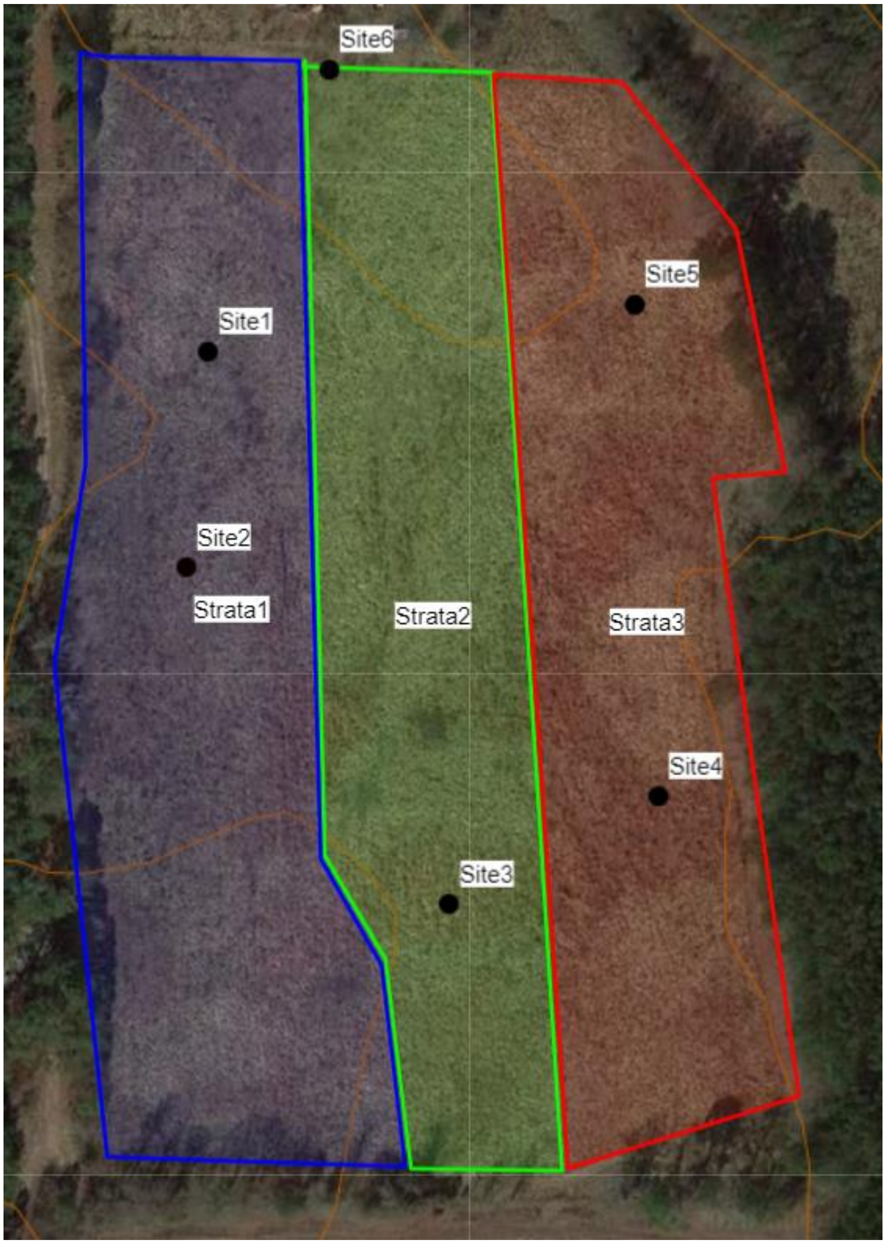
Equipment

- Coring Device (e.g., soil probe) capable of taking soil cores to 30 cm of depth - hinge style recommended
- Compass
- Transect measuring tape or 3-meter measuring tape
- Ruler or measuring tape with centimeter markings
- Offset spatula for removing soil from coring device
- Metal file to create depth markers on coring device
- Log for recording soil cores
- One-gallon Ziploc or paper bags for storing composite samples
- Permanent marker
- 3 buckets for mixing composite samples
- GPS device, phone or handheld
- Bent rebar and flagging tape
- Bulk density equipment

Stratification

Stratification is a tool for increasing the accuracy of soil carbon measurements and decreasing the intensity of sampling required. The Project Area will be subdivided into different strata based on factors such as management history, slope, aspect, soil type, erosion, compaction, and vegetation type. The idea is to determine strata that maximize variation between strata and minimize variation within strata.

The determination of strata is highly dependent on the specific Project Area. Land may be relatively homogenous and consist of only one strata. Strata do not need to be contiguous. See map below for an example of stratification on a 10-acre field. Once strata have been determined, the RGP Practitioner must develop a map of the strata that are located in the Project Area.



Strata Number	Acreage	Description
1	4	Western aspect with 1 to 4-degree slope, primarily soil type Wedowee sandy loam, main drainage pathway - wetter
2	3	Central portion of land, soil type Wedowee sandy loam, drier
3	3	Eastern aspect with 1 to 3-degree slope, primarily soil type Wedowee sandy loam, bordering pine forest and increased acidity of soil

Sampling Intensity: Number of Sampling Sites per Strata

This methodology sets a lower bound on the number of sampling sites in order to minimize the risk that the change in SOC is due to spatial variation rather than management practices. In each strata there must be at least three sampling sites established. If any one strata accounts for more than 50% of the Project Area, then that strata must have at least five sampling sites.

Sampling

Determining Sampling Location and Season

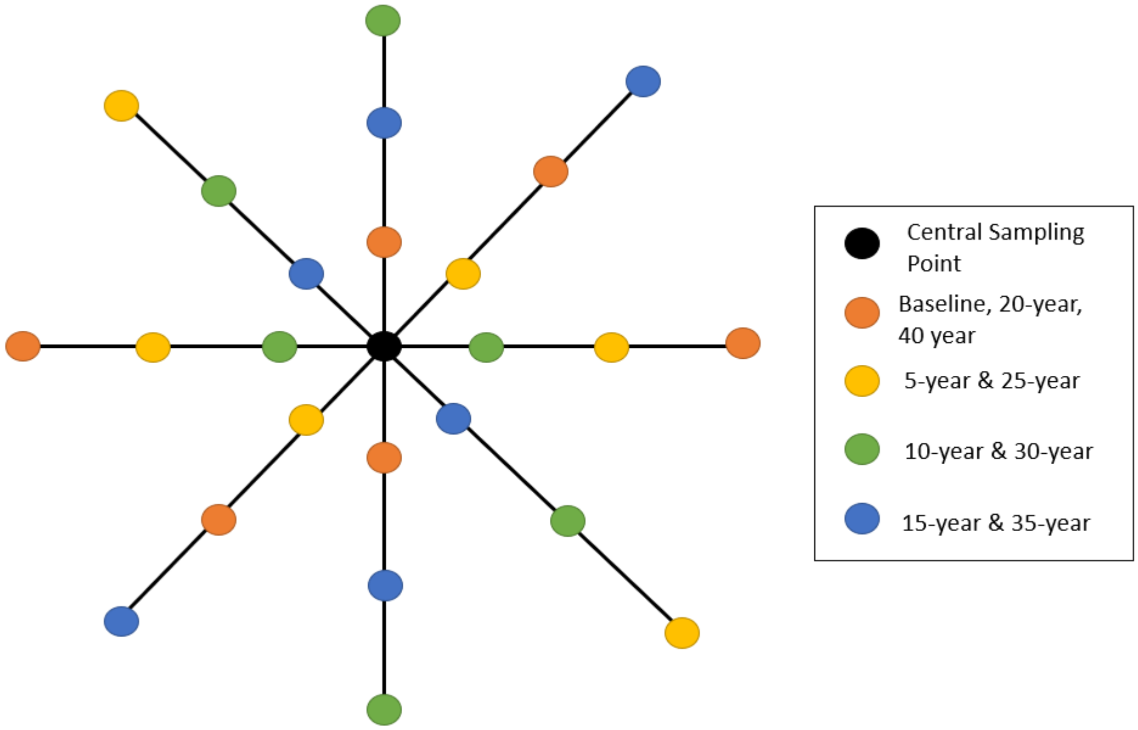
Once the strata and sampling intensity have been determined, the RGP Practitioner must establish sampling sites. Sites should be representative of the strata. RGP Practitioners should avoid sampling in irregular locations such as low points, areas near fences, or areas subject to increased compaction. Sampling at each site will cover a 3-meter radius from the central sampling point and the entire area must be contained within a strata. Future sampling events should occur at roughly the same time of year to ensure comparability. The ideal time of year for soil sampling can vary by soil type, but sampling during the summer or winter can be difficult due to very dry or frozen soil.

Establishing Central Sampling Point

The sampling sites determined in the baseline will be revisited during monitoring, so the locations of each site need to be recorded. The preferred method is to drive a length of bent rebar into the ground, mark with flagging tape, and record the GPS coordinates to facilitate relocating the point. In areas where this method is not possible, the GPS coordinates of the central point must be recorded and the RGP Practitioner must take detailed notes of nearby landmarks, measuring distance from landmarks when possible to facilitate relocation of the central sampling point. Name each central point and label on the map.

Sampling Plan

At each sampling site, the RGP Practitioner will take 6 cores. Multiple cores reduce the chance that the SOC measurement is due to an irregularity in the soil. From the central sampling point, use a compass to determine magnetic north. The baseline cores will be taken one meter north and south of the central point, 2 meters northeast and southwest, and three meters east and west as represented in the image below. This method will allow for subsequent sampling to occur without resampling the same locations disturbed by the baseline coring.



Preparing a Log

Prepare a log before going into the field and note the following for each core:

- Core name (will correspond to the name given to the central sampling point and the appropriate cardinal direction, i.e. A-Northwest)
- Date of core
- Strata
- Nominated sampling depth
- Actual sampling depth
- GPS coordinates of central point
- Notes
    - If taking a bulk density sample, note the diameter of the sampling device.
    - Note reasons for any disparities between actual sampling depth and nominated sampling depth.

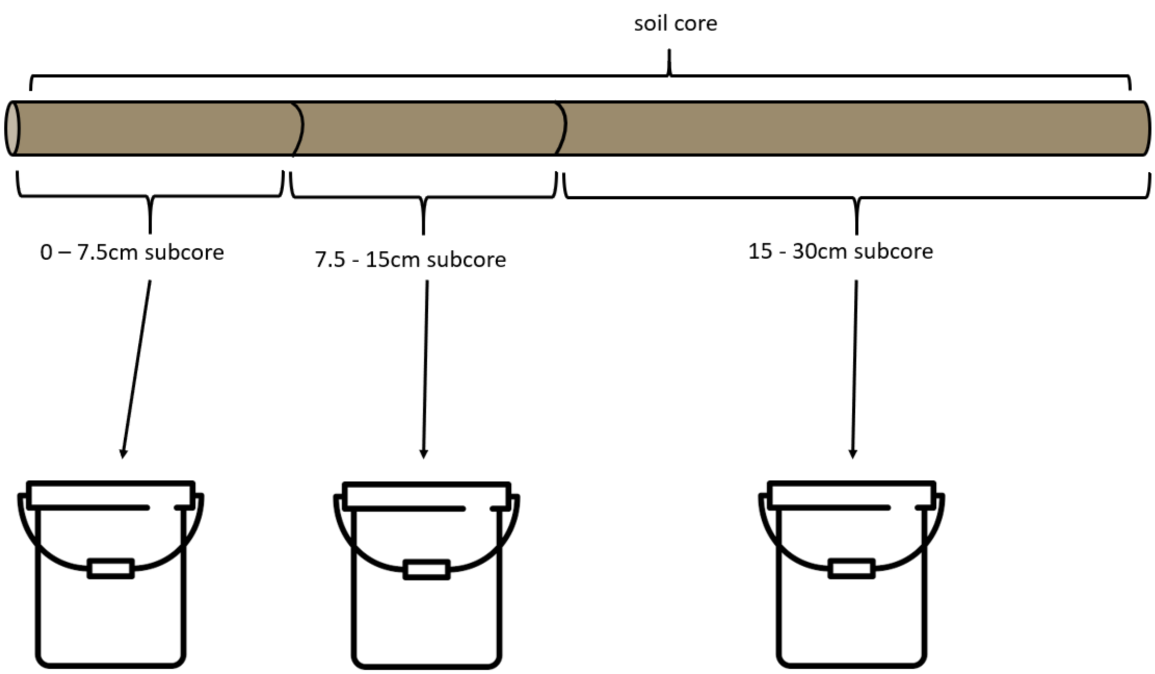
Taking Samples

To reduce lab analysis costs, this methodology relies on composite sampling. Subcores from the 6 cores will be aggregated based on soil depth; ultimately each sampling site will yield 3 composite samples.

Clear away any grass, pats, or debris to get to the topsoil level. Carefully sink the coring device (e.g., soil probe) into the ground and pull up the core. If the full 30 cm cannot be extracted, attempt to resample in the immediate vicinity of the first location. If the soil cannot be adequately sampled due to bedrock, hard pan, or soil composition, you can choose another central sampling point or log the actual sampling depth that you were able to reach.

Divide the core into three subcores based on the nominated sampling depth - from 0-7.5 cm, from 7.5-15 cm, and from 15-30 cm. Using a metal file to mark these depths on the probe can speed the process of determining where to divide core into subcores. The offset spatula is a useful tool for dividing the core into subcores and removing subcores from the coring device. Discard any soil beyond 30 cm.

Place each subcores into a different container labelled with the appropriate depth range.



Repeat for the remaining 5 cores, until you have 6 subcores in each container. Then bag the contents of each container in a 1-gallon Ziploc bag and label with date, central sampling point name, and nominated sampling depth. Each sampling site will result in three composite samples, one for each depth range. Log each core taken to capture any differences between the actual sampling depth and nominated sampling depth. Repeat this process at each sampling site.

Taking Bulk Density

Bulk density is the dry weight per unit of volume of undisturbed soil. The soil cores determine the mass of carbon per mass of soil, but it is not well suited for measuring the volume of soil, because probes compact the soil, disturbing the measurement. Bulk density allows you to extrapolate the SOC measurements from the core samples to calculate the SOC measurements for the Project Area.

This methodology recognizes the validity of several different ways of taking bulk density samples. Cores for bulk density must be at least 5 cm in diameter but can be obtained in a variety of ways. Bulk density sampling kits are available for purchase, sharpened pipes can be hammered into the soil, or custom probes can be machined for this purpose. Resources for taking bulk density are listed at the end of this appendix.

During each sampling event, one bulk density sample must be taken for each strata. Bulk density should be sampled within a 3-meter radius of one of the central sampling points in each strata. The bulk density sample should not be taken in a location that will interfere with the cores that will be taken in future sampling events, as described in the Sampling Plan. Bulk density samples must be taken for nominated sampling depths of 0-7.5cm, 7.5-15cm, and 15-30cm. If the soil cannot be adequately sampled due to bedrock, hard pan, or soil composition, you can choose another central sampling point or log the actual sampling depth that you were able to reach. Each sample must be bagged separately and labeled with the central sampling point and the nominated depth. Log each sample, noting the diameter of the sampling device.

Lab Analysis

Samples measuring SOC and bulk density must be analyzed by a lab. Many land grant universities will prepare the samples and perform the required tests at a reasonable price. See the resource section for more information about labs in the Southeastern US. Labs may have different requirements for receiving samples. The RGP Practitioner should contact the lab before taking samples to get specific instructions for drying or packaging samples. Generally, the RGP Practitioner should air-dry soil as soon as possible.

This methodology recommends analyzing SOC using a dry combustion test, reporting the mass of carbon per the mass of soil. Labs will also measure the mass of the bulk density samples.

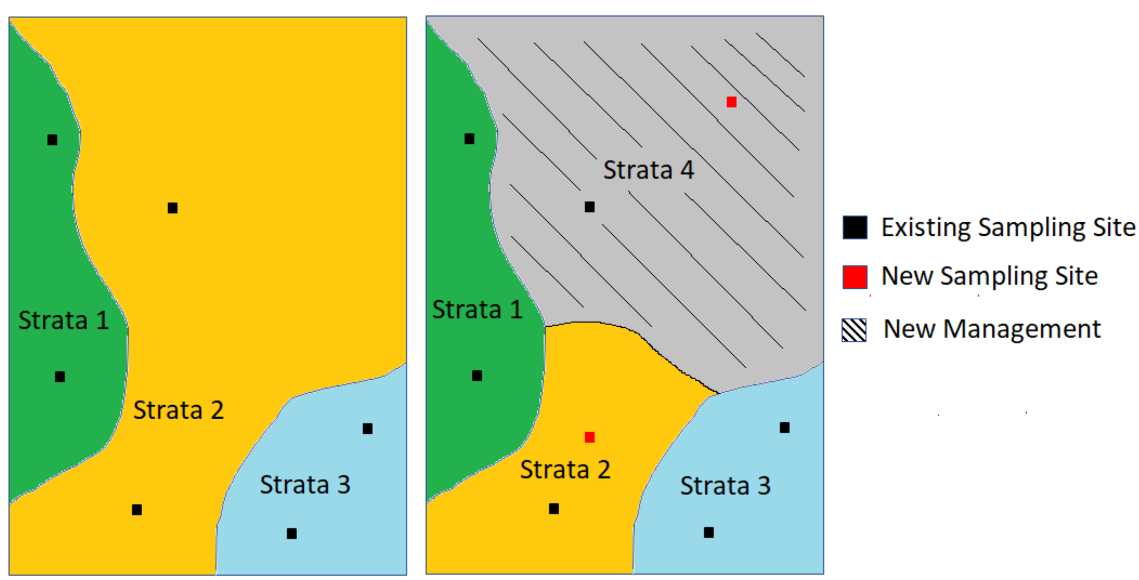
Documentation

An electronic file must be made available which identifies the Project Area, strata, and central sampling locations. The bounds of strata within the Project Area must be recorded using a GPS cellular application (e.g., GPX Tracker for iPhone or Android) or a GPS device. The recorded strata must be included in the electronic file containing the boundaries of the Project Area.

Flexibility Mechanisms

Changes to Strata

This methodology allows for changes to the strata between sampling events due to changes in land management or sampling data showing negligible variation between strata. If a strata established in a previous sampling event becomes subdivided and subject to different land management practices which could lead to different levels of SOC accumulation, then new strata and sampling sites must be established in accordance with the required sampling intensity.



Multiple strata established in a previous sampling event may also be combined in later sampling events if there is negligible variation between the strata. This mechanism is meant to encourage more intensive sampling in baseline measurements, ensuring a more accurate accounting of initial variability within the pasture. Based on the bulk density and SOC measurements, the RGP Practitioner may document a case for combining multiple strata into one for future sampling events. The RGP Developer will ultimately decide if there is negligible variation between the bulk density and SOC measurements and approve the combination of strata. Future sampling events may reduce the number of sample locations in compliance with the sampling intensity requirements of this methodology. The sampling locations that are retained must represent the upper and lower bounds of SOC as measured in previous sampling events of the newly combined strata.

Resources

Bulk Density Sampling Methods

Sharpened pipe and hammer

- Measuring Soil Carbon Change, pg. 27

Sampling Kit

- Bulk Density Test

Labs

North Carolina State University

- Email: eats-laboratory@ncsu.edu
- Telephone: 919-513-1297
- Cost for total organic carbon analysis: $7.60 per sample
- Fees:
    - Grinding Room Usage Fee – $5.30 per hour
    - Instrument Usage Fee – $12.00 per hour
    - Sample Handling Fee – $0.20 per sample
- Submission form: https://eats.wordpress.ncsu.edu/files/2020/04/2020-EATS-Request-Form-Locked.pdf

University of Georgia

- Telephone: 706-542-5350
- Cost for total organic carbon analysis: $15 per sample
- Submission form: http://aesl.ces.uga.edu/forms/soil.pdf?18-0430