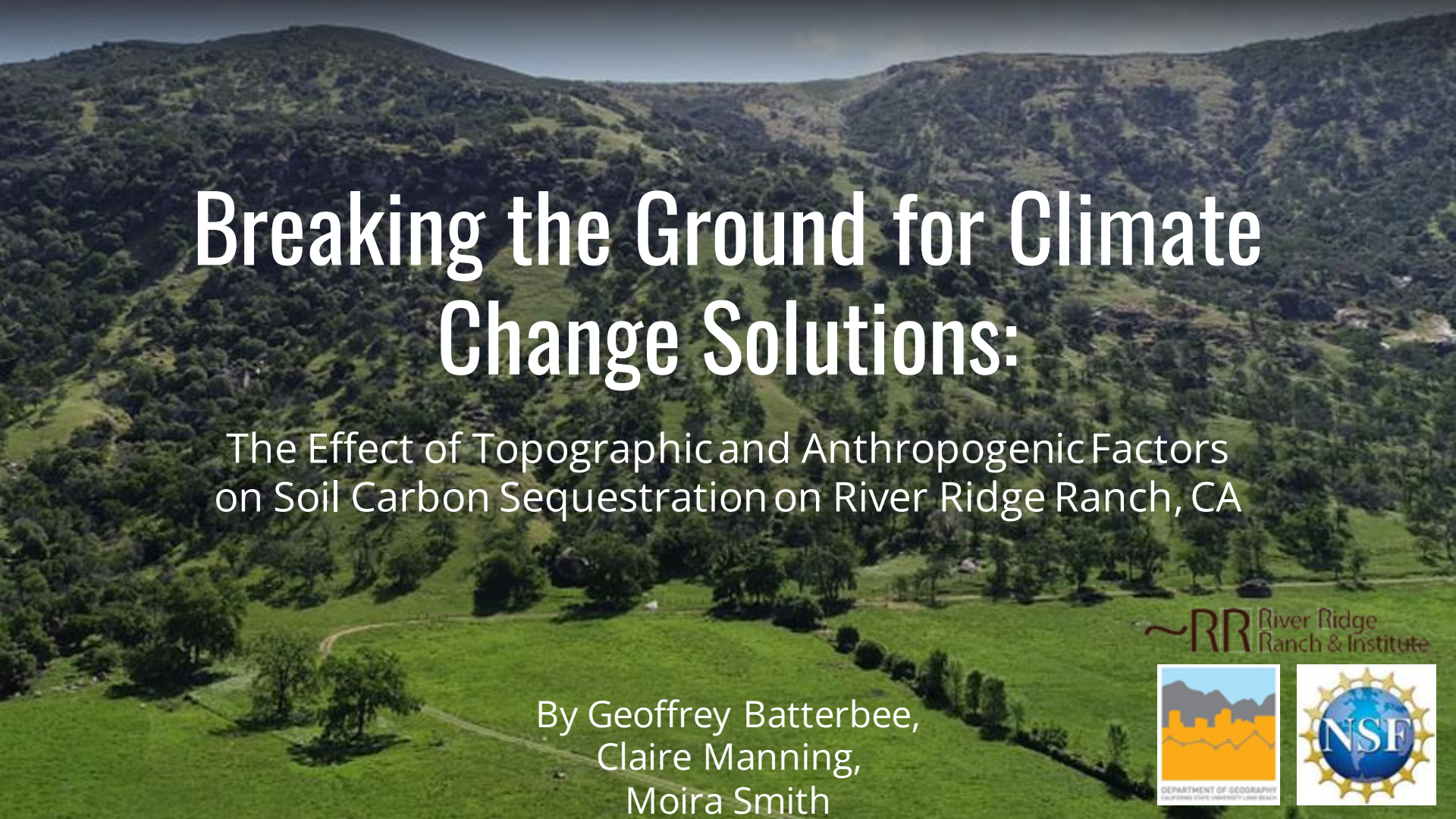

# Breaking the Ground for Climate Change Solutions:

## The Effect of Topographic and Anthropogenic Factors on Soil Carbon Sequestration on River Ridge Ranch, CA

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NSF

# Background

- Climate Change
  - Increase in global temperature
  - Intense storms, sudden shifts in weather patterns

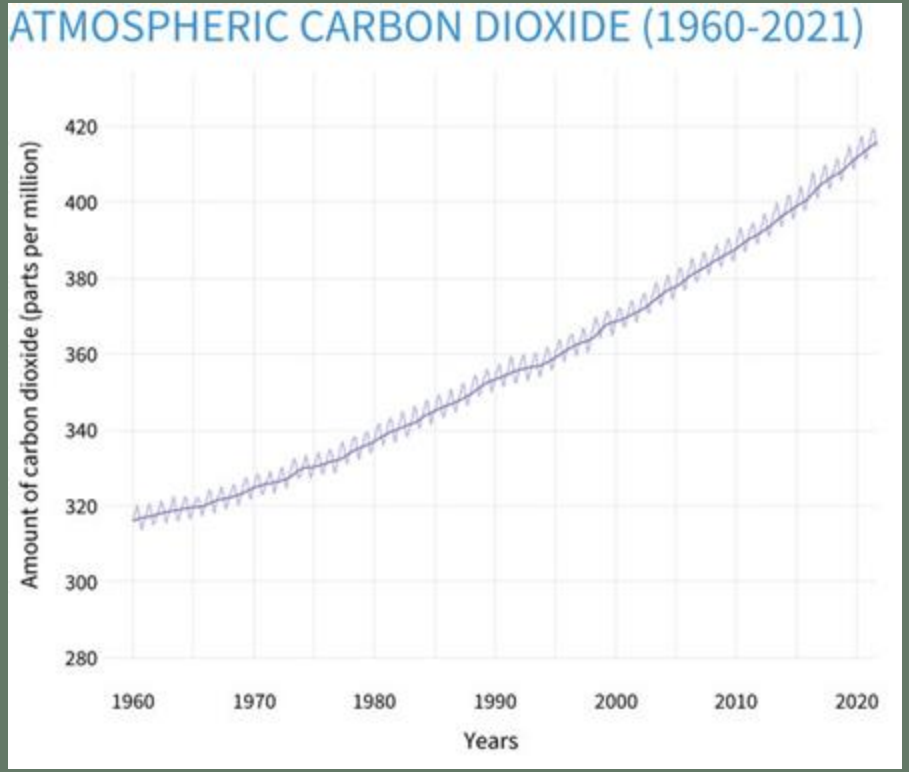



**Figure 1.** Atmospheric carbon dioxide levels measured from Mauna Loa Observatory, Hawaii (*Climate.gov*).

# Background

- Political Climate: difficult to decrease emissions
  - Domestic Partisan Divides
  - International Problems

- Short-term solution?


**Figure 2.** Climate protest in Washington, DC. (*PanMacmillian.com*).

# Carbon Sequestration

**Process of capturing and storing carbon dioxide from the atmosphere**

- oceans, forests, grasslands, **soil**

# Background

- Government incentives → market for carbon offsets
- Net-zero goals
- Growing market for carbon credit

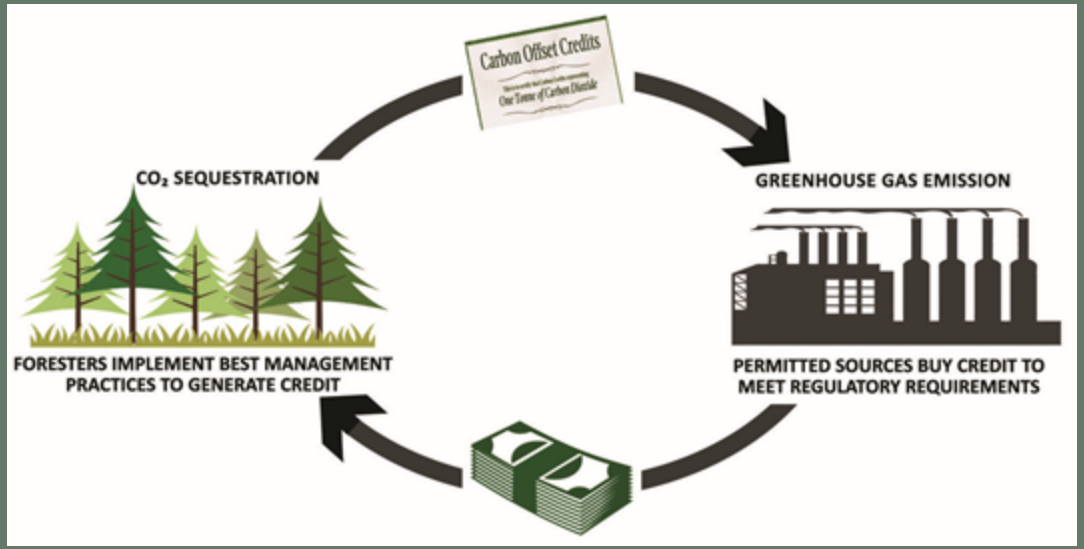



**Figure 3.** Carbon market diagram (*Audubon.org*).

# Project Introduction

- Determining the carbon sequestration capacity of soils given various factors

- Key factors under consideration:
  - Elevation
  - Aspect
  - Grazing
  - Irrigation

**Figure 4.** River Ridge Ranch, Springville, CA.

# SOM and SOC

- SOM- Soil organic matter:  the fraction of soil consisting of decomposing plant and animal biomass
- SOC- soil organic carbon:  a measurable component of soil organic matter
- SOM = ~58% SOC

**Figure 5.** Soil organic  matter.

# Hypothesis/Questions

- Elevation: There will be a difference in SOM and SOC with elevation
- Aspect: SOM and SOC will be higher on northwest and west-facing slopes than on southwest and south-facing slopes
- Grazing: SOM and SOC measurements will be higher in ungrazed areas than in grazed
- Irrigation: SOM and SOC will be higher in irrigated areas than non-irrigated areas

# Key Objectives

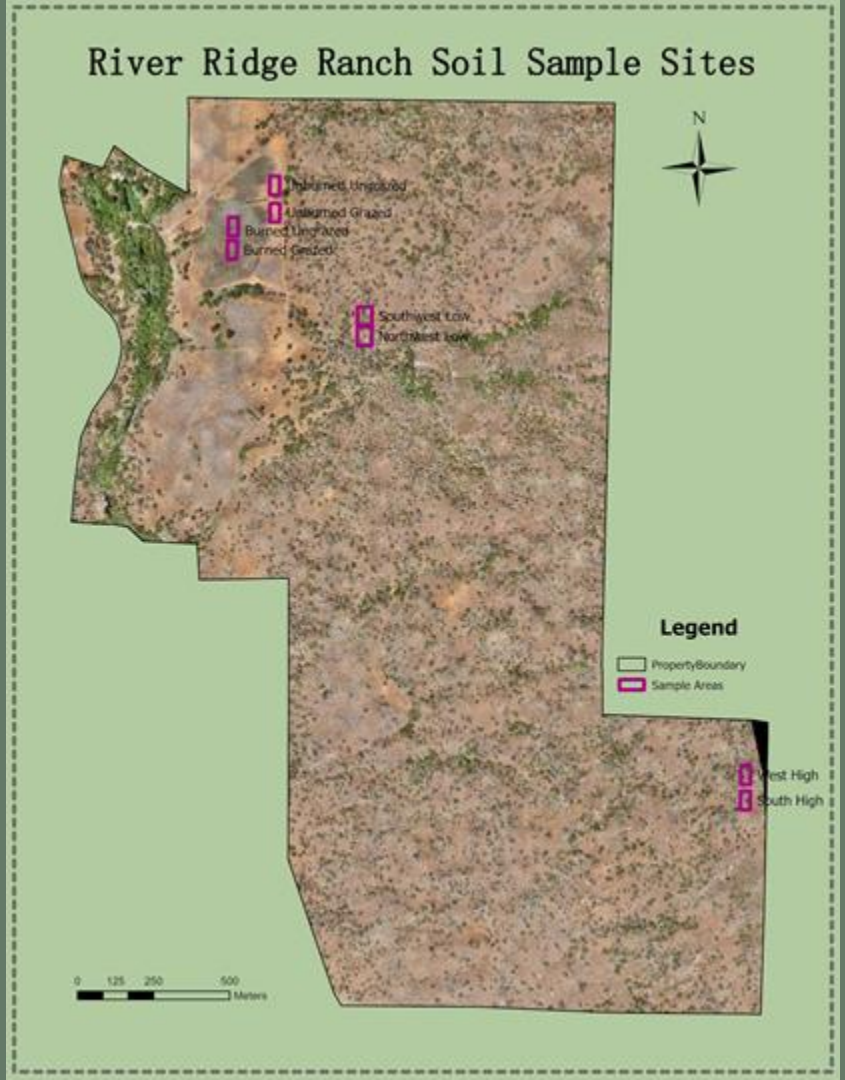
1. Understand the **potential differences** in **soil organic carbon** (SOC)

1. Offer **recommendations** for **improving land management** and **conservation** techniques

1. **Baseline data** for future studies

# Methods: Site Selection

- 4 sites to compare elevation and aspect:
  - Southwest low
  - Northwest low
  - South high
  - West high
- 3 sites to compare grazing and irrigation:
  - Irrigated, grazed
  - Non-irrigated, grazed
  - Non-irrigated, non-grazed



# Methods: Data Collection

- Data collection at 7 different sites within River Ridge Ranch and immediate surroundings (June 2022)
- Within each site, 10 sample plots were taken at equal intervals along a transect

# Methods: Data Collection

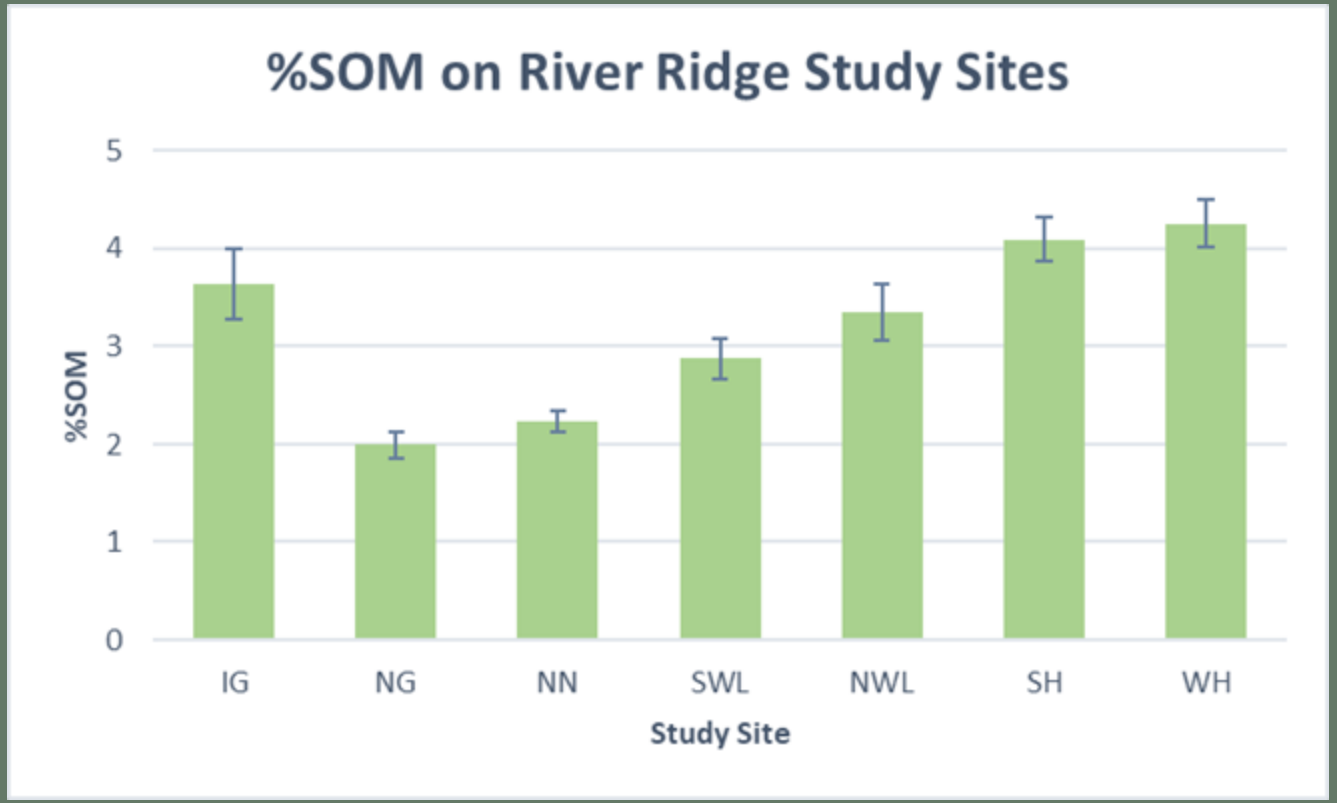
- Soil corer was used to take samples at two depths
  - Top layer (0-10 cm)
  - Bottom layer (10-40 cm)

# Methods: Data Analysis

- Sieved, oven dried, and weighed samples
- Samples placed in the oven at 500°C for four hours to burn the organic matter off
- Samples were weighed again
- Amount of organic matter determined from the difference of weights

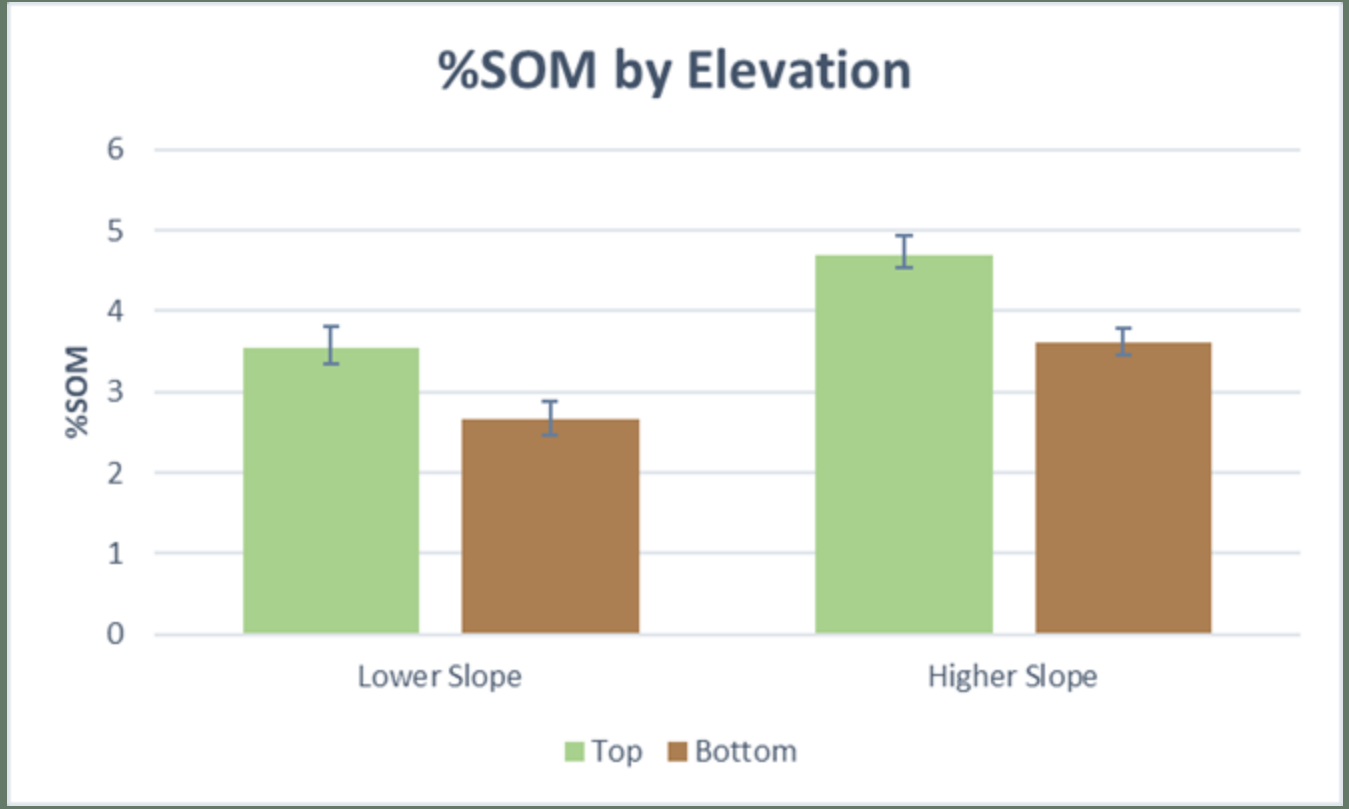
$$\%\ SOM = \frac{initial\ weight - final\ weight}{initial\ weight}$$

# Results

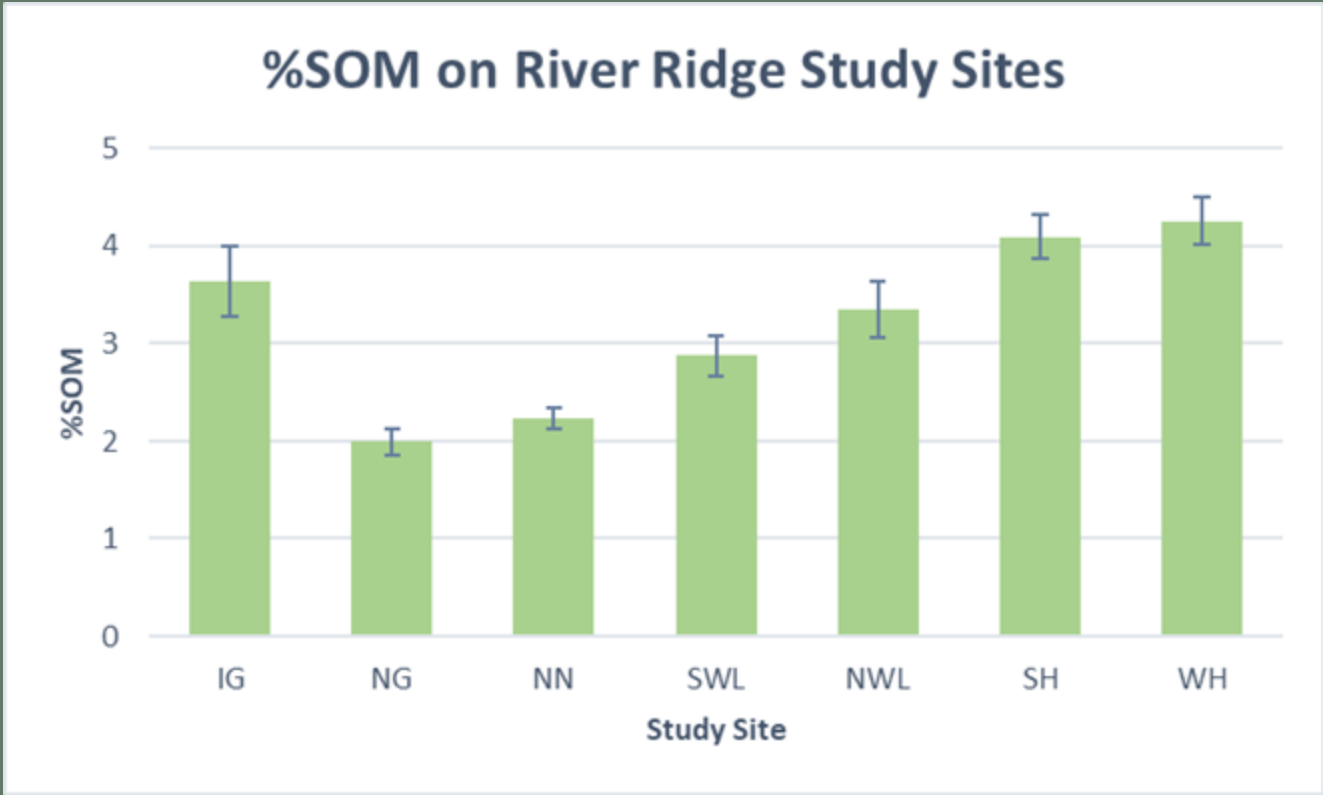



| | | |
|---|---|---|
| **IG** | = | Irrigated Grazed |
| **NG** | = | Non-irrigated Grazed |
| **NN** | = | Non-irrigated Non-Grazed |
| **SWL** | = | Southwest Lower |
| **NWL** | = | Northwest Lower |
| **SH** | = | South High |
| **WH** | = | West High |

# Results


%SOM by Elevation
%SOM
6
5
4
3
2
1
0
Lower Slope
Higher Slope
Top
Bottom

# Results

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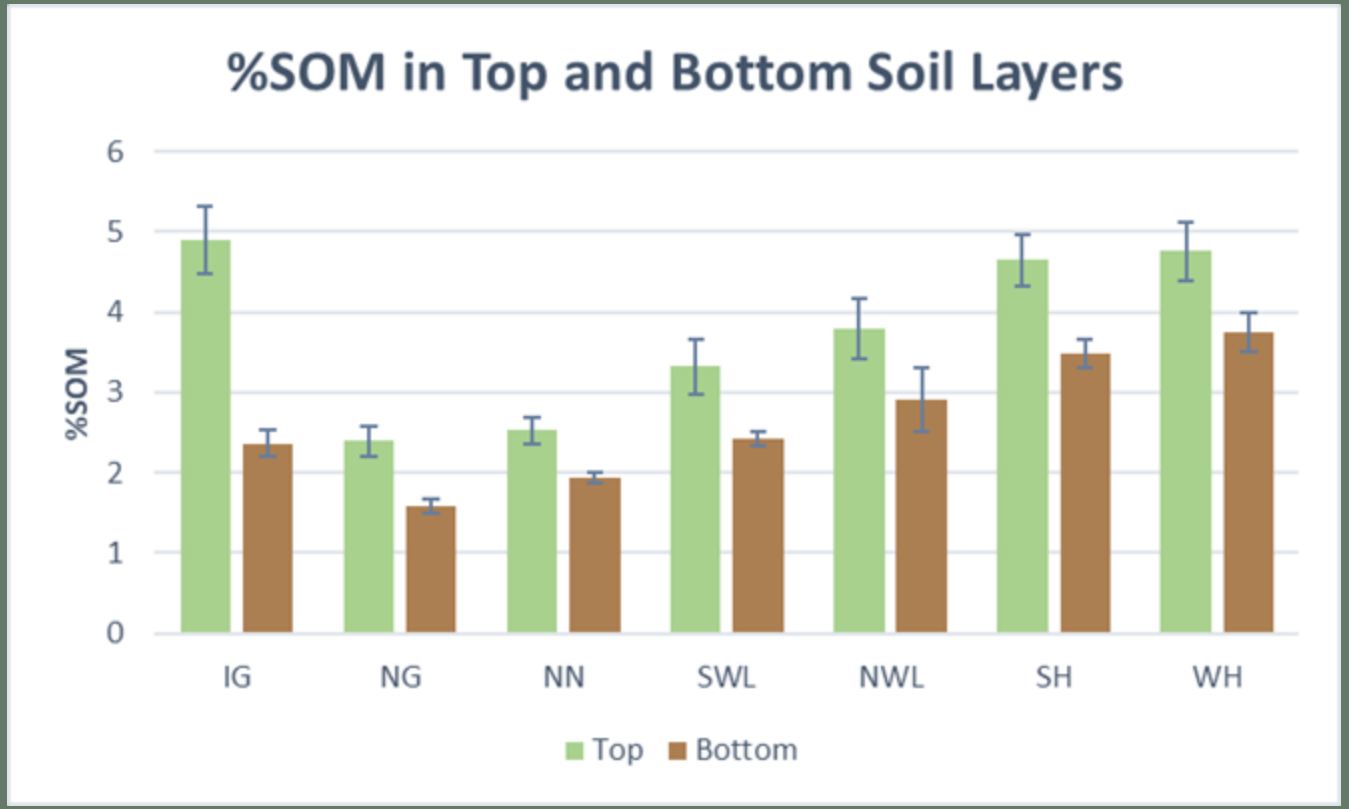


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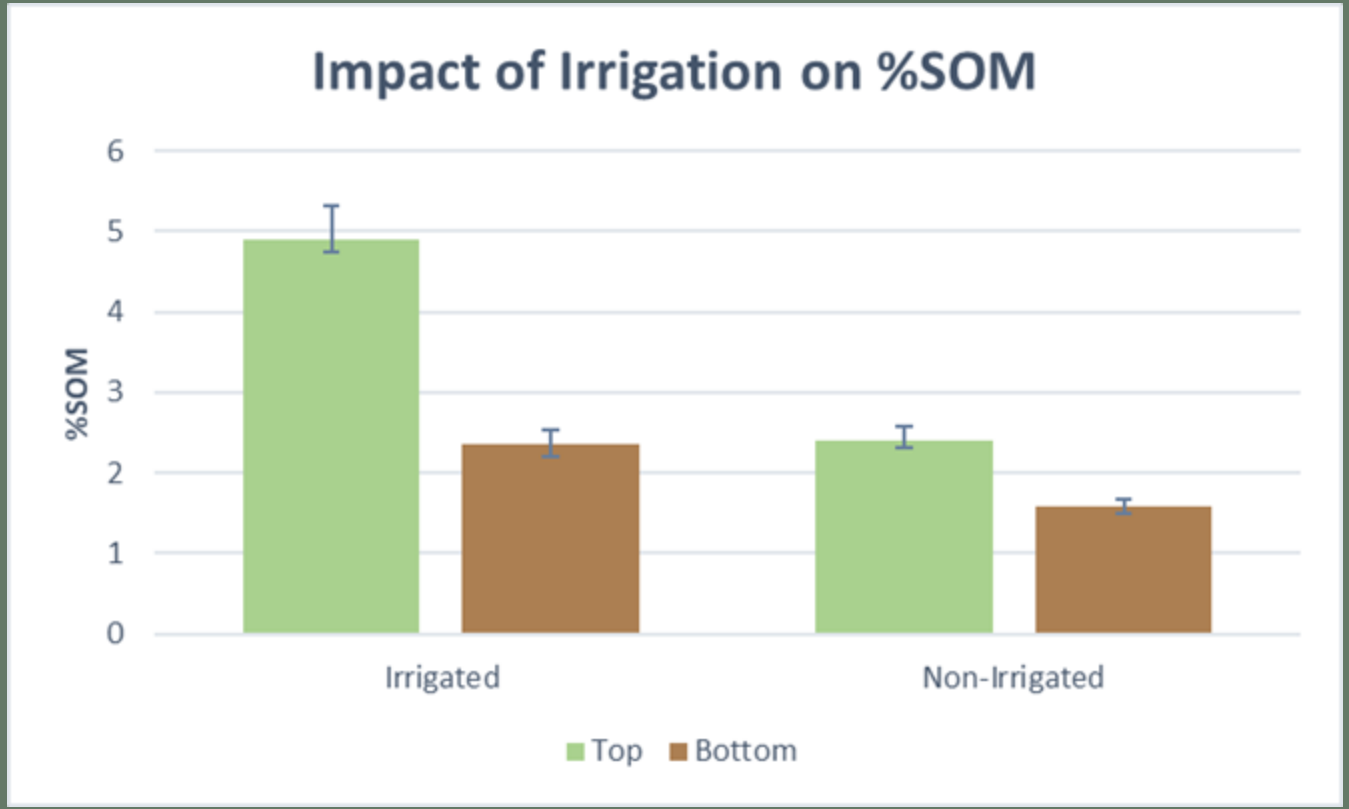
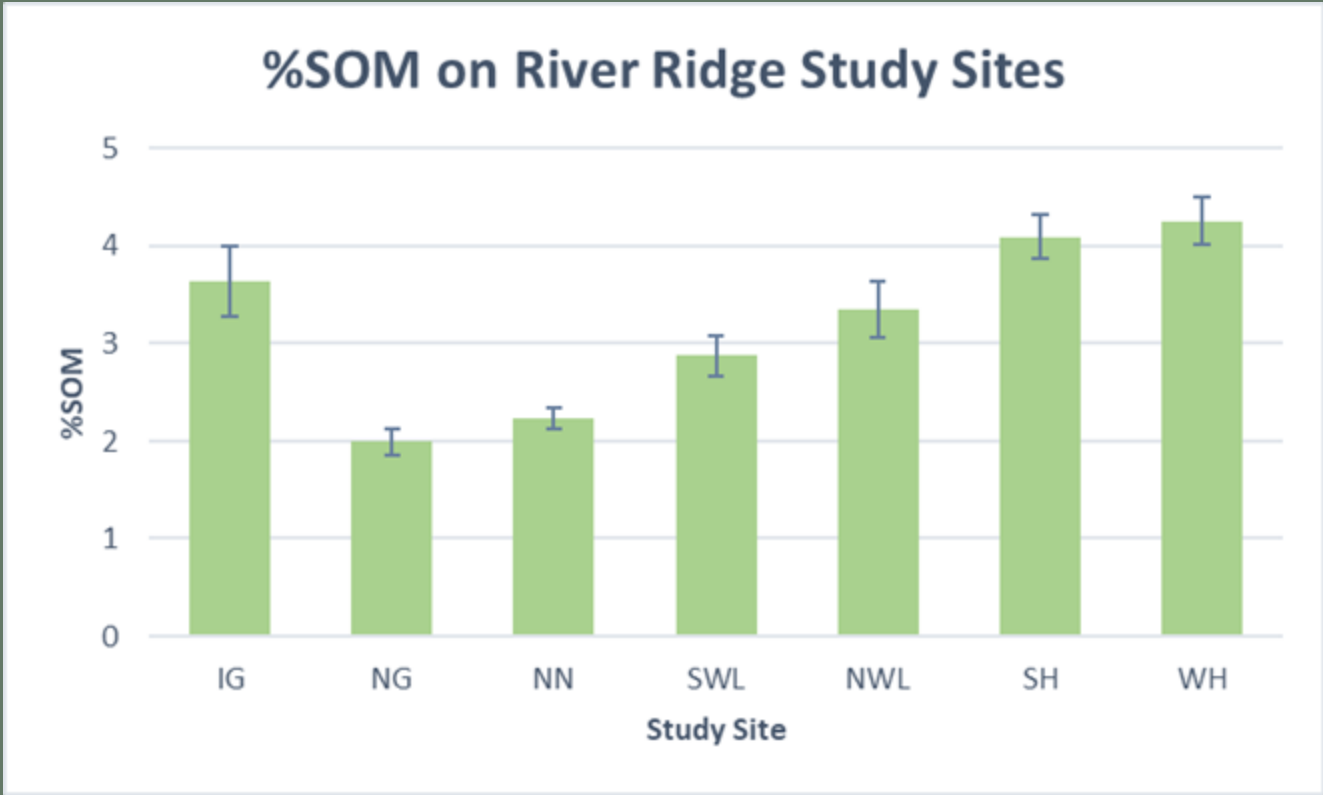
# Results


Impact of Irrigation on %SOM
%SOM
6
5
4
3
2
1
0
Irrigated
Non-Irrigated
Top
Bottom

# Results

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| **NN** | = | Non-irrigated Non-Grazed |
| **SWL** | = | Southwest Lower |
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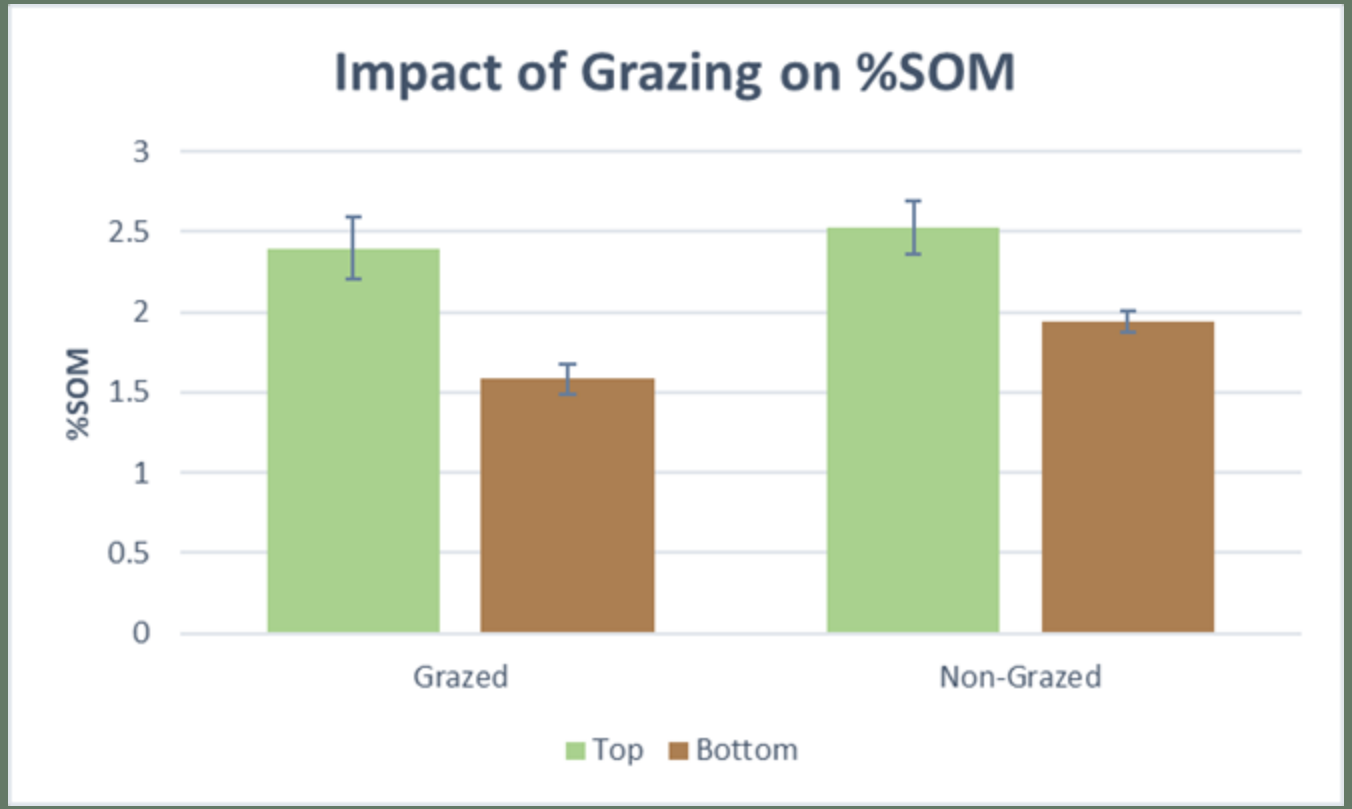
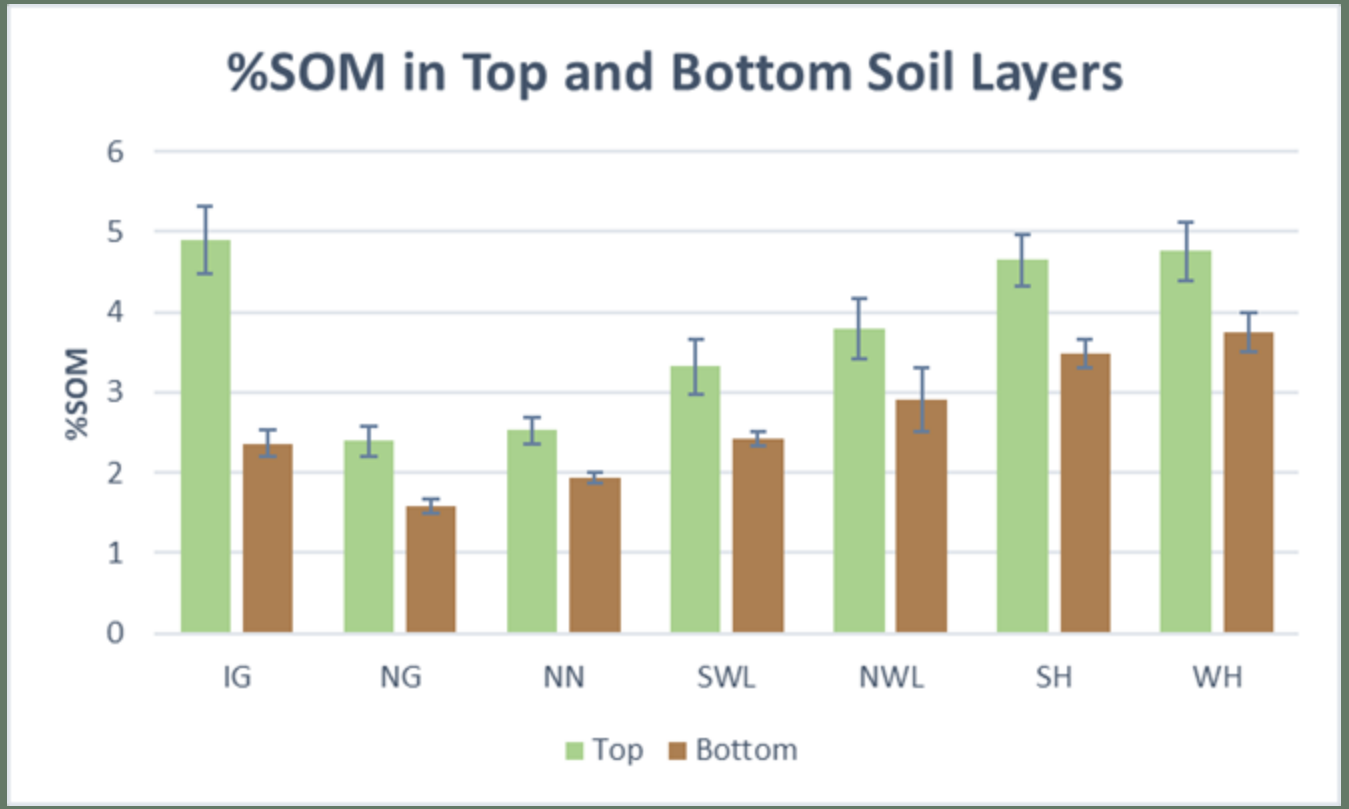
# Results


Impact of Grazing on %SOM
%SOM
3
2.5
2
1.5
1
0.5
0
Grazed
Non-Grazed
Top
Bottom

# Results

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# Implications

- Ranching practices
  - Irrigation
  - Grazing

**Figure 6.** Irrigated land in California. (*Landflip.com*).

**Figure 7.** Grazed land in Nevada. (*FarmandRanch.com*).

# Implications

- Conservation
  - Elevation
  - No development

**Figure 8.** Neighborhood development in LA. *(dreamstime.com)*.

**Figure 9.** View from the top of River Ridge Ranch, CA.

# Carbon Market Implications

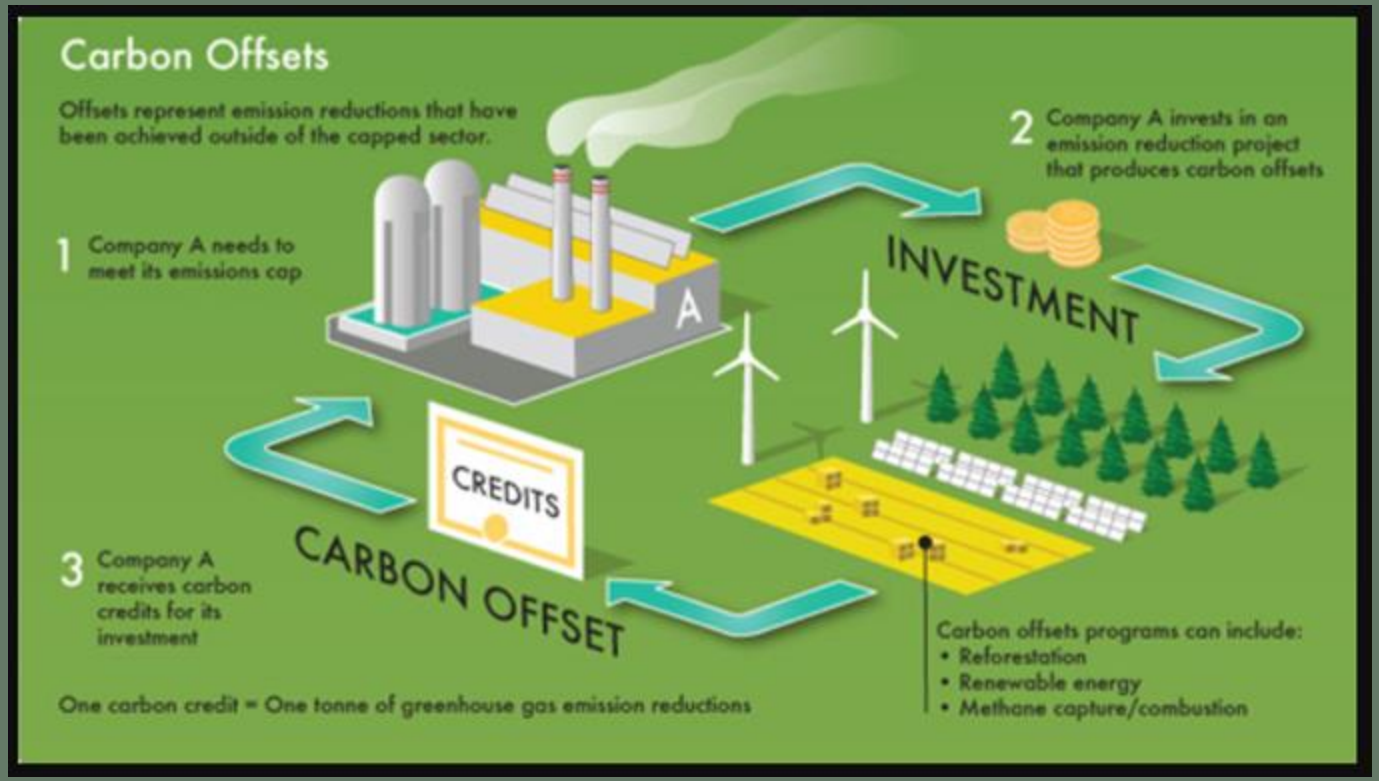


**Figure 10.** Carbon offset schematic.

# Future Research

- Long-term experiment exploring irrigation and grazing
- Does slope angle affect the amount of SOC?
- Baseline for Future Research
  - How does carbon sequestration in the pasture change with the reintroduction of cattle grazing on the ranch?
  - How can we more accurately estimate the total amount of soil carbon on River Ridge Ranch?

# Acknowledgements


- Thank you to Professors Paul Laris, Scott Winslow, Mystyn Mills and the rest of the CSULB Geography Department faculty for guiding us in this project
- Thanks to Gary Adest for his guidance, hospitality, and for offering his ranch as a research site
- To the National Science Foundation for funding the research
- Grad Students Sara Avrit, Mina Nada, and Brendan Schultheis for helping with the project