

# The Carbon Bank beneath Our Feet

Carbon Storage in Rangeland Soils

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# Introduction

Currently: Post-doctoral research ecologist for the Southern Plains Climate Hub at the USDA-ARS Grazinglands Research Lab

Previously: BS in Biology at University of New Mexico; PhD in Ecology from the University of Wyoming



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# Outline

What are rangelands?

Rangeland carbon sequestration: process

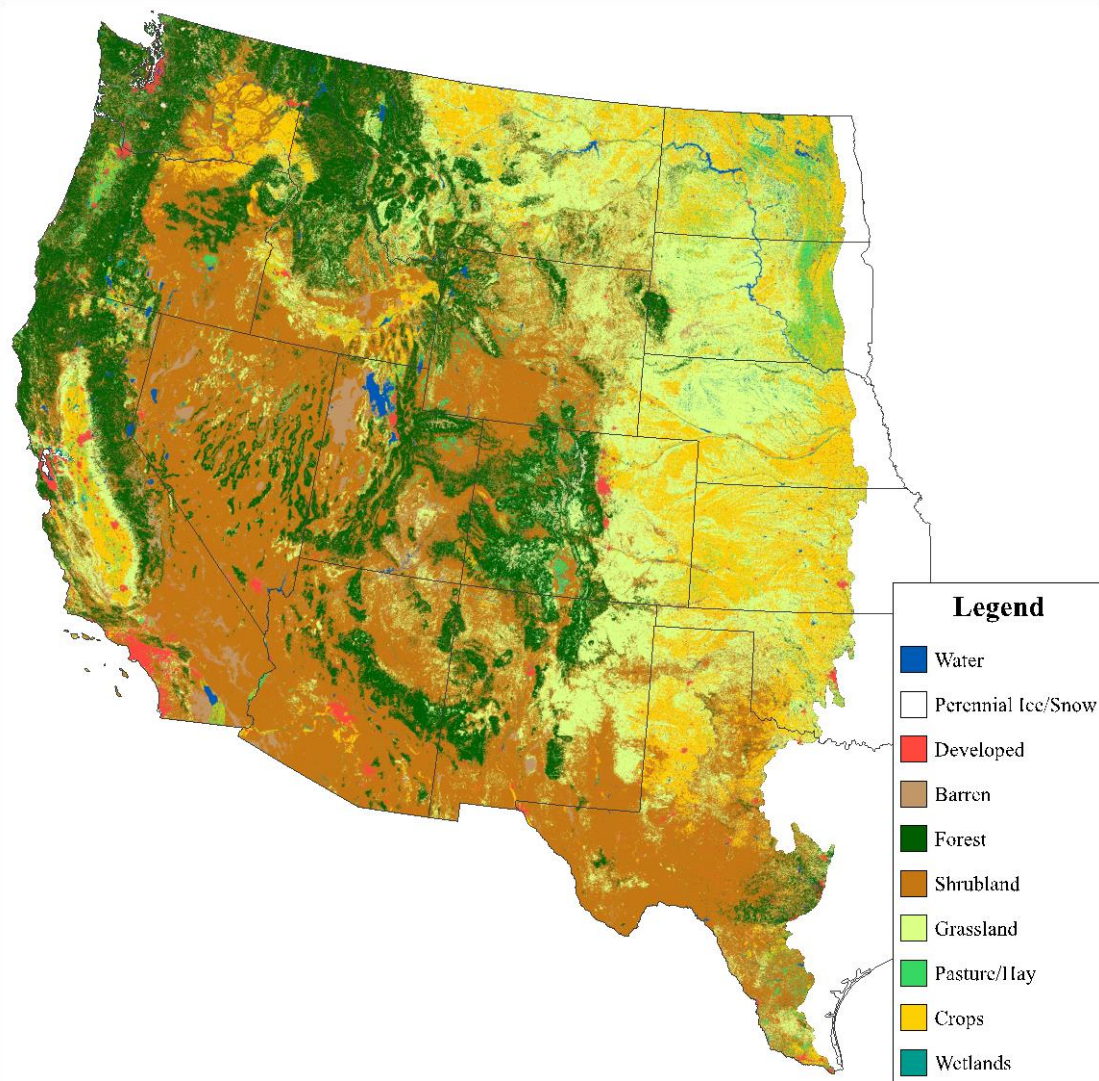
Rangeland carbon sequestration: challenges

Putting rangeland carbon to work

Conclusion

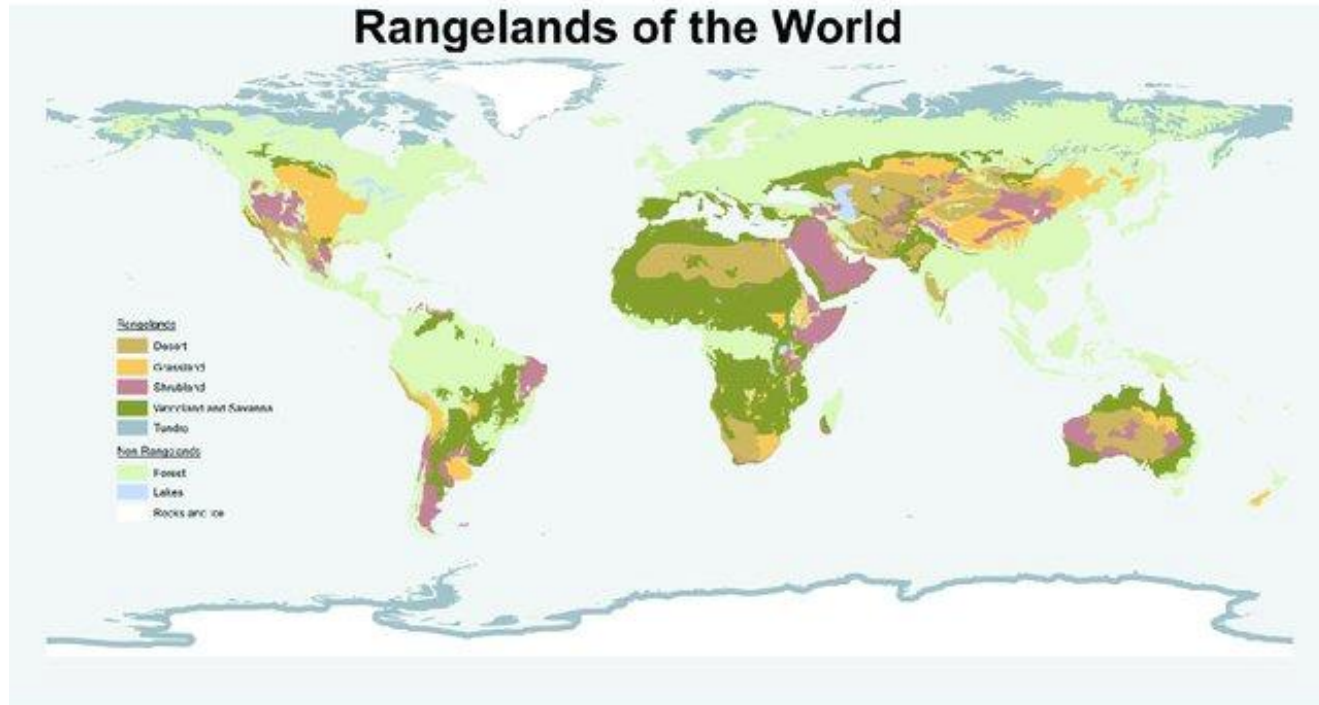
# What are rangelands?





# Rangelands...

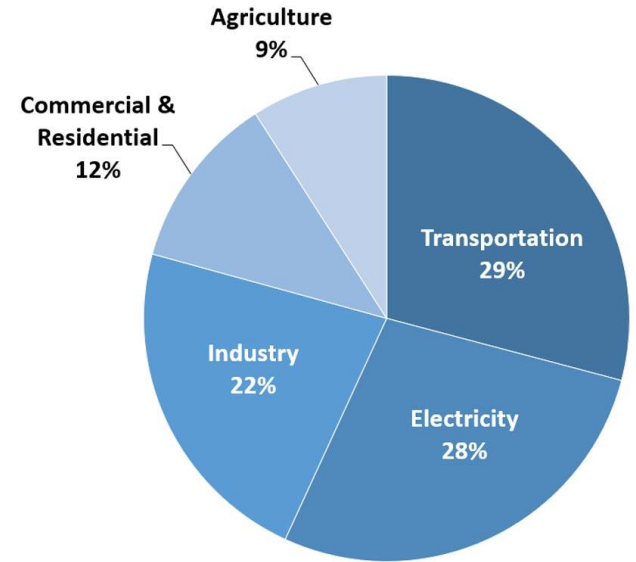
- ...occupy about 50% of the world's land surface



# Rangelands...

- ...occupy about 50% of the world's land surface
- ...sequester about 0.5 Pg of carbon per year
  - To compare, transportation produced about 1.86 Pg of CO<sub>2</sub> or CO<sub>2</sub> equivalents in 2018 in the United States, equal to 29% of total US carbon emissions

## Total U.S. Greenhouse Gas Emissions by Economic Sector in 2017



U.S. Environmental Protection Agency (2019). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2017

# Rangelands...

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- ...sequester about 0.5 Pg of carbon per year<sup>1</sup>
  - To compare, transportation produced about 1.86 Pg of CO<sub>2</sub> or CO<sub>2</sub> equivalents in 2018 in the United States<sup>2</sup>, equal to 29% of total US carbon emissions
- ...store more than 10% of carbon associated with living things on land, and 10-30% of organic carbon in soil





# Takeaways

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- ☆ Disturbance is the primary cause of loss of carbon from rangelands

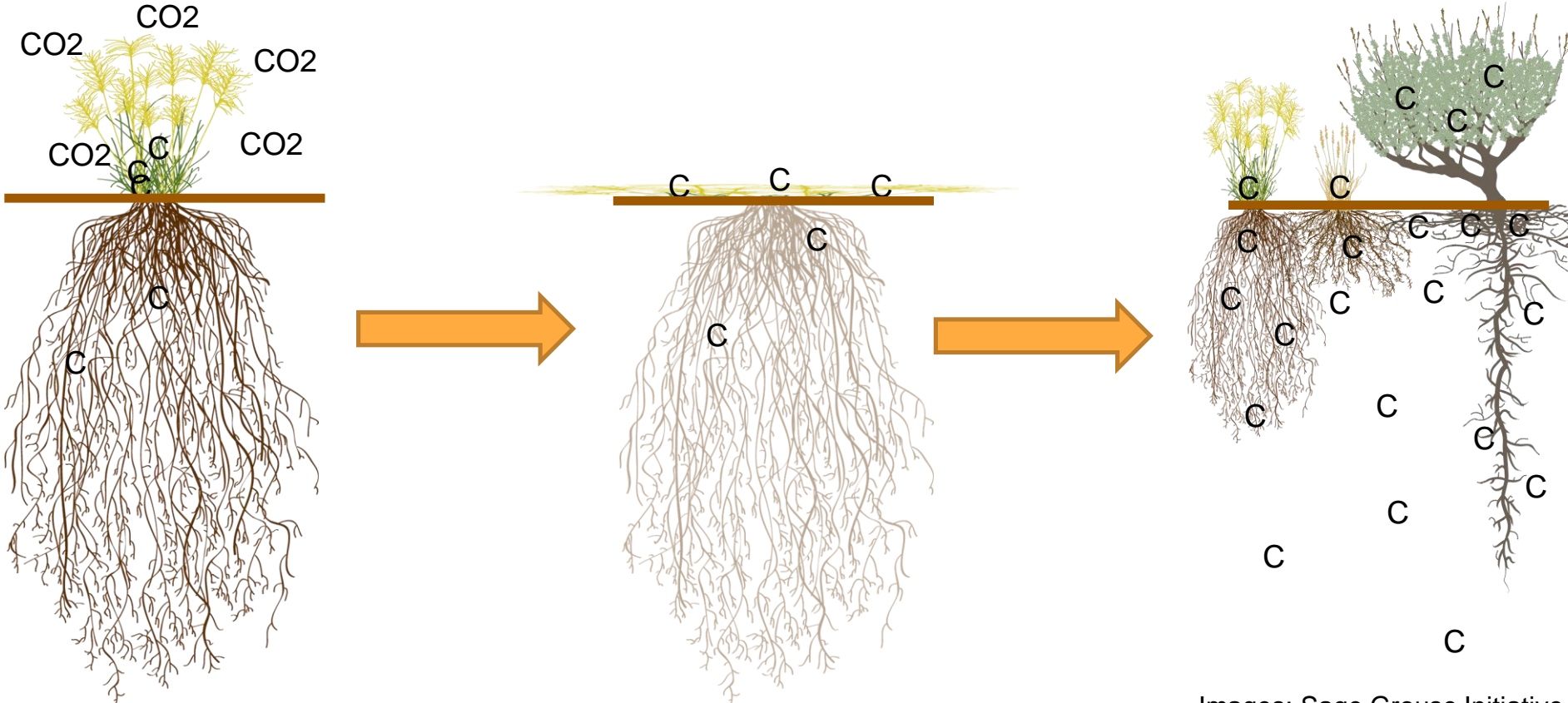
# Takeaways

- ☆ Without interference, rangeland soil gains *and* loses carbon very slowly
- ☆ Disturbance is the primary cause of loss of carbon from rangelands
- ☆ It is easier to preserve existing soil carbon than rebuild it once it is lost

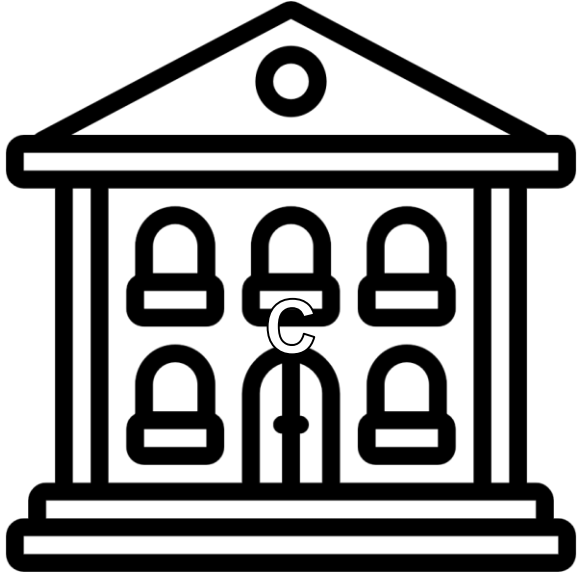
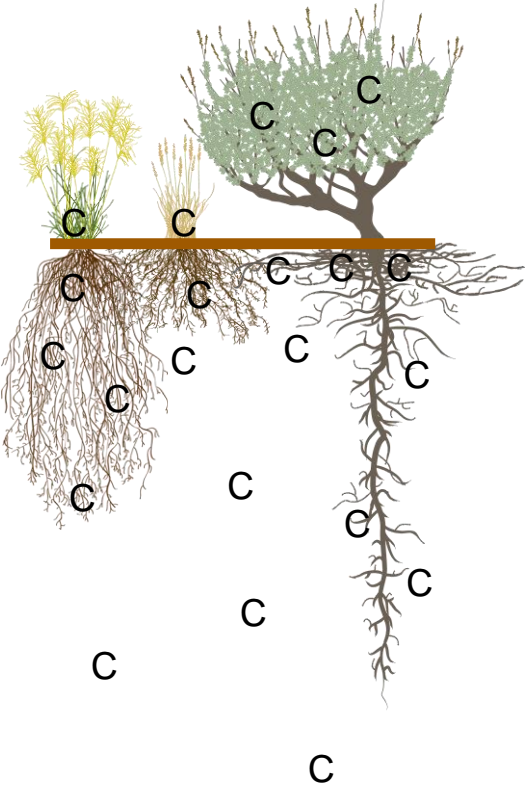
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# Rangeland Carbon Sequestration



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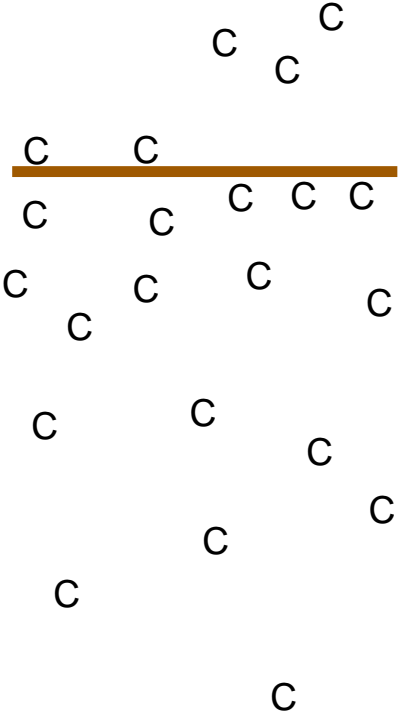


10 years  
C

100 years  
C

1000 years  
(or more)  
C

# Rangeland Carbon Sequestration



# Rangeland carbon sequestration challenges

- Not all rangelands can sequester carbon at the same rate; some are very slow





# Rangeland carbon sequestration challenges

- Remaining reserves of coal, oil, and natural gas frequently underlie rangelands



# Rangeland carbon sequestration challenges

- Degradation due to invasive species



# Putting Rangeland Carbon to Work

**Marin Carbon Project**  
California

**Carbon Offset Development**

Comanche Nation, Oklahoma

Pe'Sla Lands of the Black Hills, South Dakota

Wind River Reservation, Wyoming

Santa Ana Pueblo, New Mexico

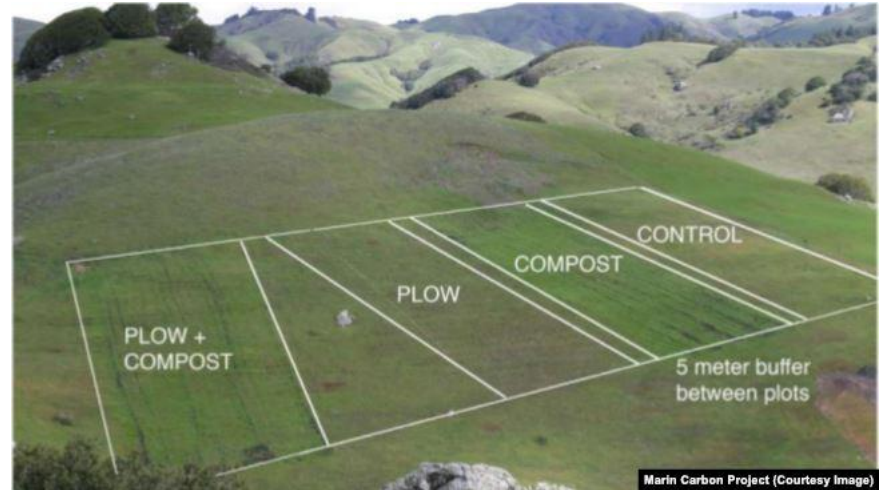
***Cienega* Restoration on Pitchfork Ranch**

New Mexico

# Marin Carbon Project



Photo: Becca Ryals



Marin Carbon Project (Courtesy Image)

Photo: Marin Carbon Project

# Marin Carbon Project

Adding compost to rangelands in Marin Co., CA resulted in:

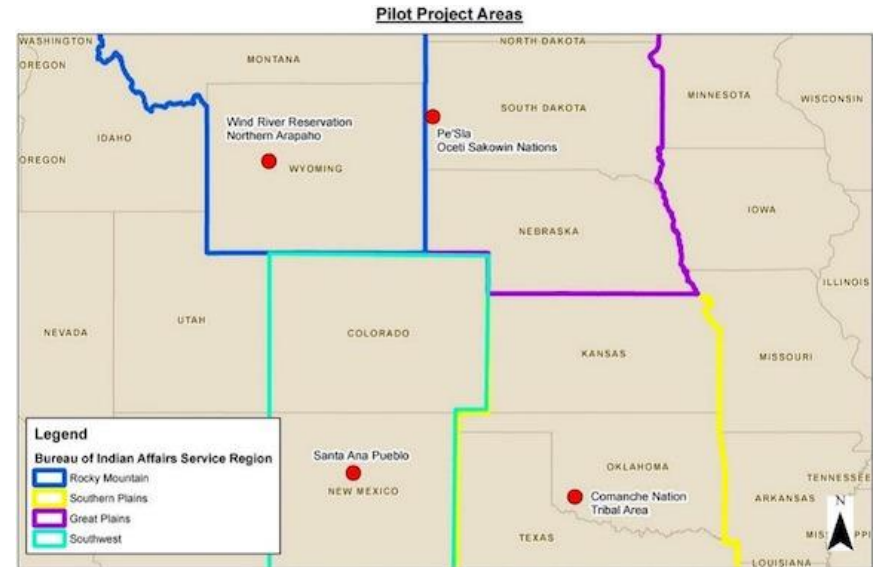
- 50-70% increase in grass production
- 20% increase in soil organic matter

for up to 3 years following compost application



Photo: Marin Carbon Project

# Carbon Offset Development



Photos: National Indian Carbon Coalition

# Carbon Offset Development

- Developed by the National Indian Carbon Coalition using Conservation Innovation Grant funding from USDA
- Explored potential for generation of carbon offsets on tribal land through improvement and conservation of rangeland



Photo: Angus M Thuermer Jr., WyoFile

# *Cienega* Restoration on Pitchfork Ranch



Photos: Pitchfork Ranch



# *Cienega* Restoration on Pitchfork Ranch

Improving carbon sequestration using various practices resulted in:

- Clearer, cleaner water
- Increased plant production
- Increased wildlife habitat



Photo: Avery McGaha, High Country News

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# Sources

1: Derner & Schuman 2007

2: <https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions>