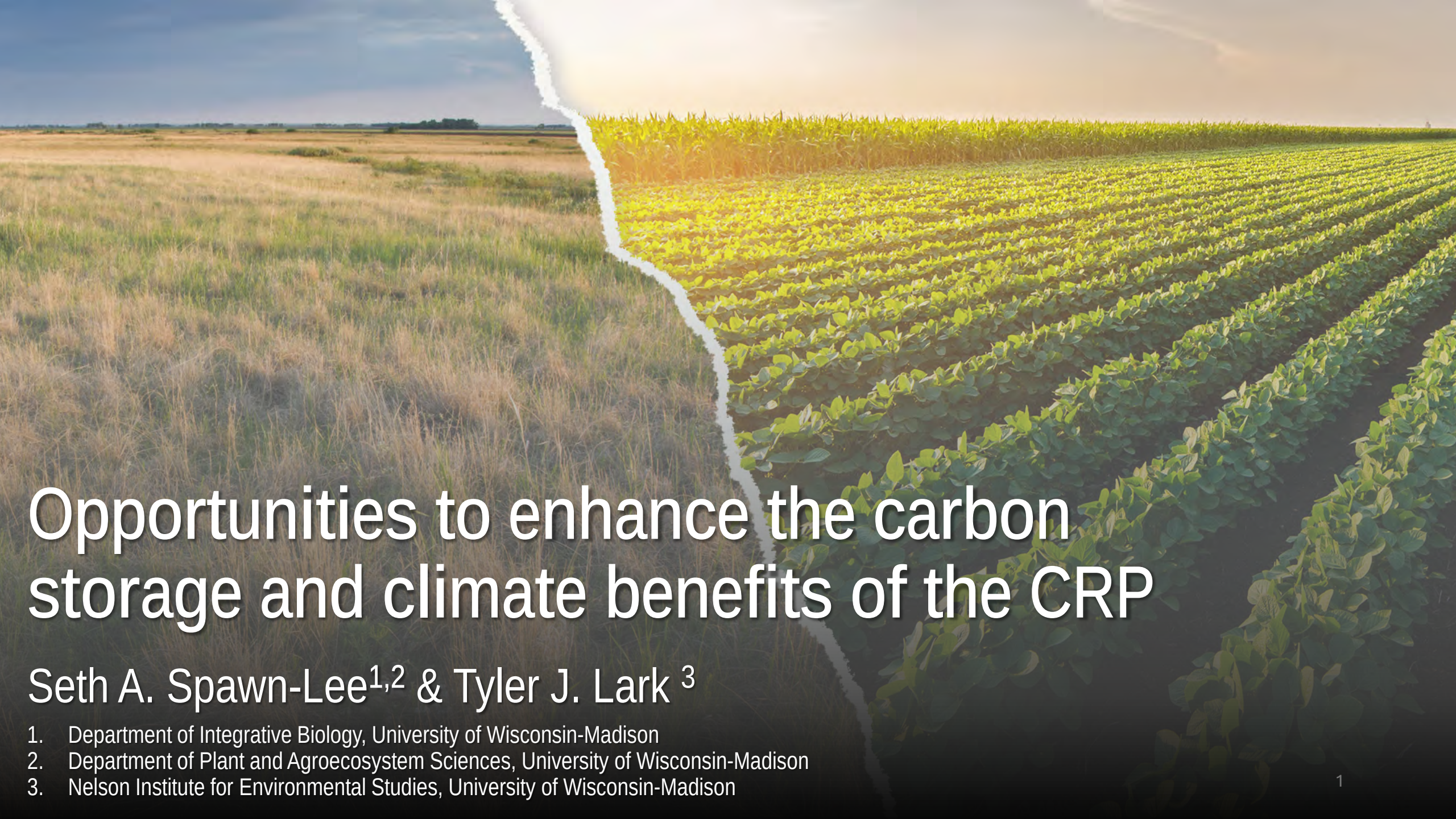

Opportunities to enhance the carbon storage and climate benefits of the CRP

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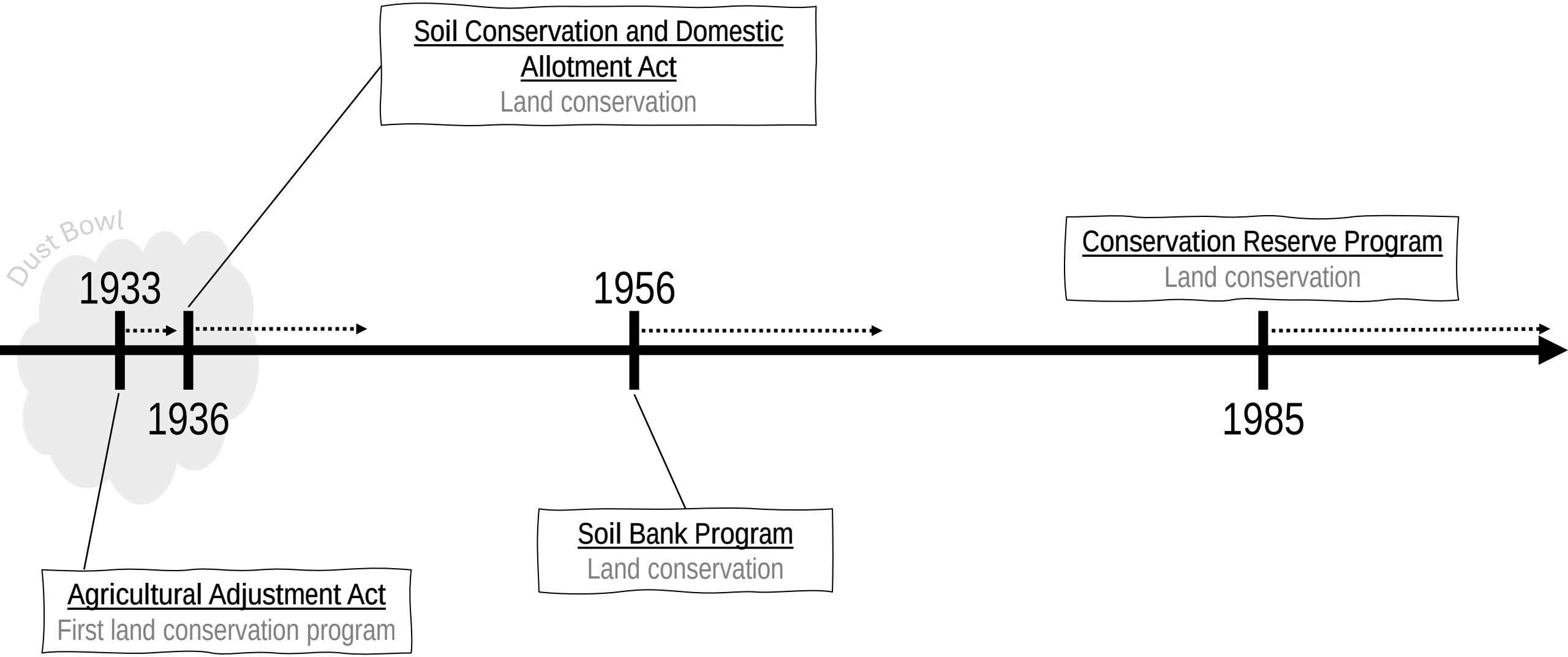
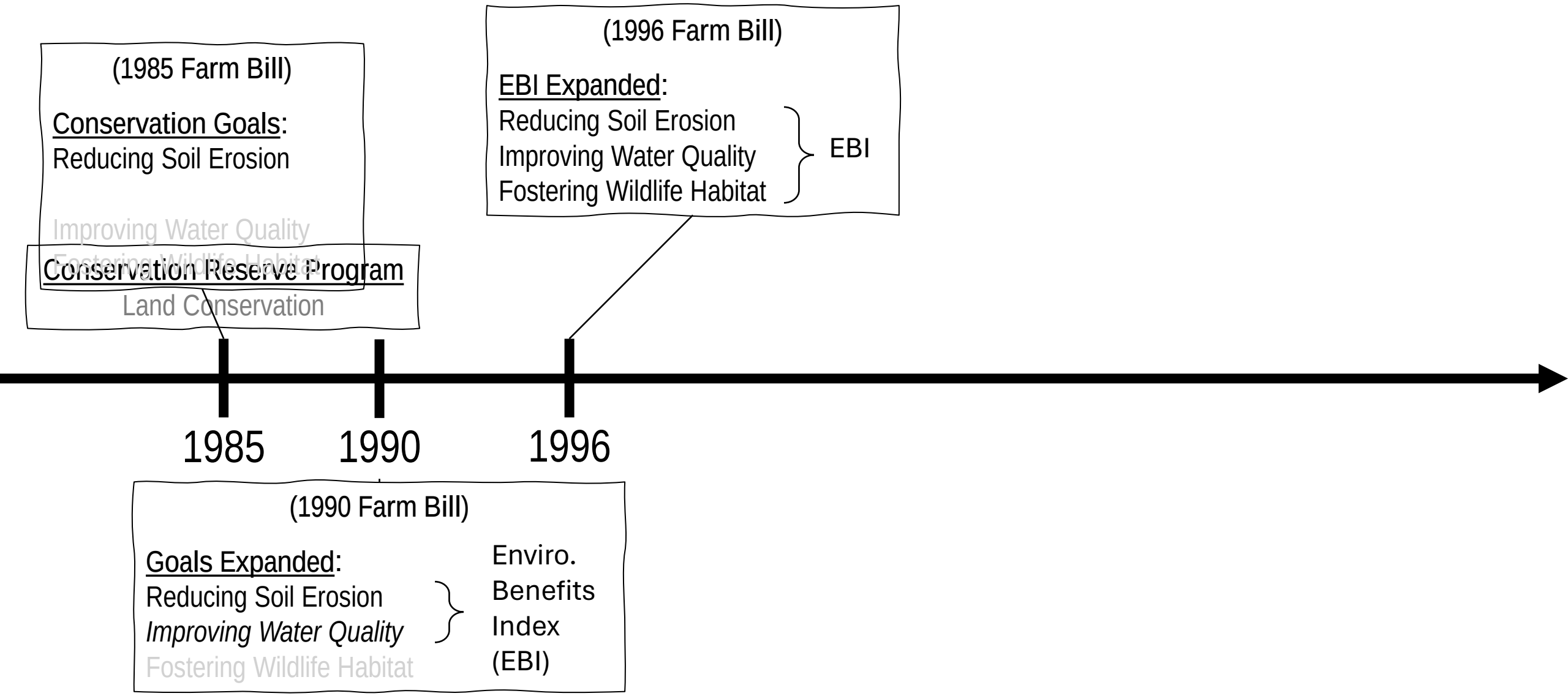
The Conservation Reserve Program (CRP)

- The largest U.S. agricultural land conservation program
  - Administered by the USDA
  - Farmers and/or land-owners offer lands to be retired for 10+ years
    - Receive annual rental payments in exchange for conservation while under contract
    - Typically planted to perennial vegetation throughout contract period
    - Typically, little to no use allowed during the length of the contract

- Born out of a lineage of similar land conservation programs…


Soil Conservation and Domestic Allotment Act
Land conservation
Dust Bowl
1933
1936
1956
Conservation Reserve Program
Land conservation
1985
Agricultural Adjustment Act
First land conservation program
Soil Bank Program
Land conservation


(1985 Farm Bill)
Conservation Goals:
Reducing Soil Erosion
Improving Water Quality
Fostering Wildlife Habitat
Land Conservation
Conservation Reserve Program
(1996 Farm Bill)
EBI Expanded:
Reducing Soil Erosion
Improving Water Quality
Fostering Wildlife Habitat
EBI
1985
1990
1996
(1990 Farm Bill)
Goals Expanded:
Reducing Soil Erosion
Improving Water Quality
Fostering Wildlife Habitat
Enviro. Benefits Index (EBI)

The Environmental Benefits Index (EBI)

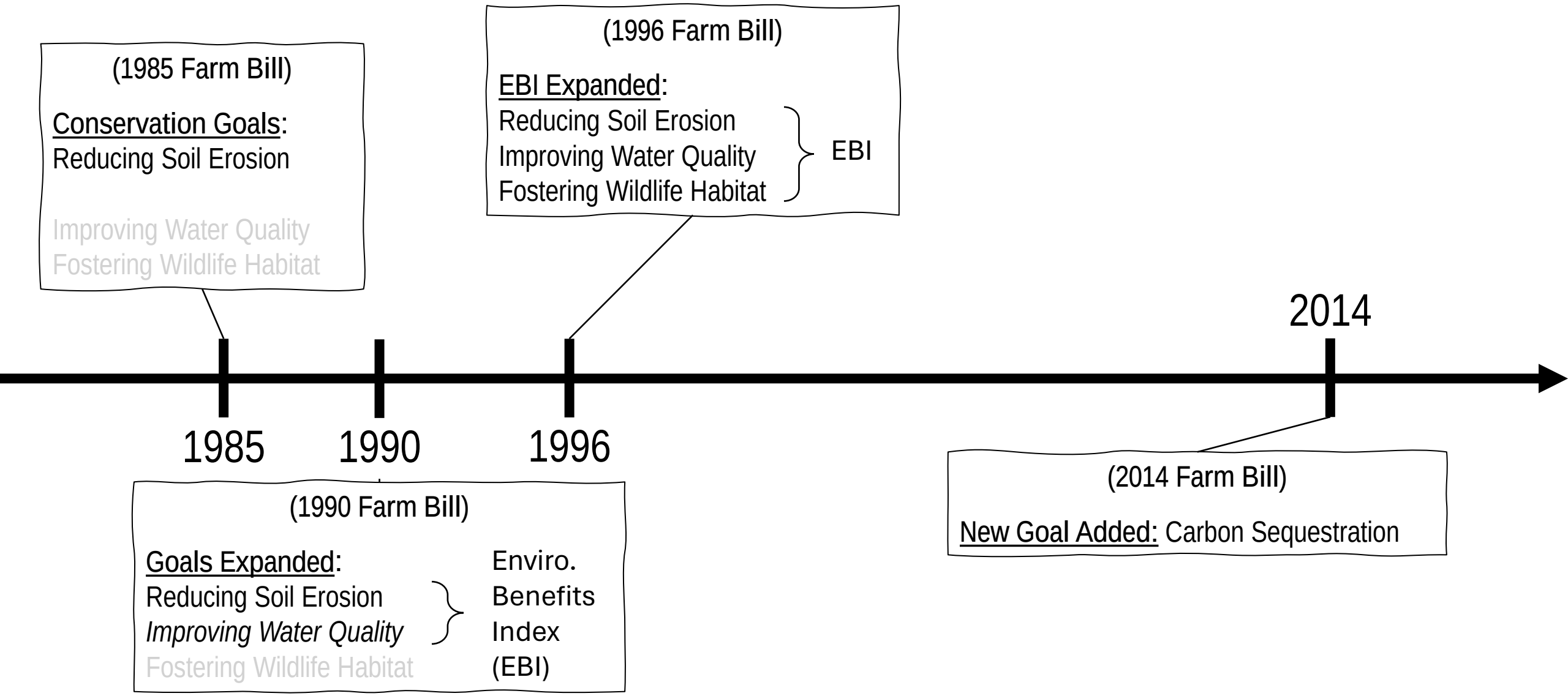
N1: Benefits to **wildlife** (0-100 pts)
N2: Benefits to **water quality** (0-100 pts)
N3: Benefits to **erosion management** (0-100 pts)
N4: **Enduring benefits** (0-50 pts)
N5: Benefits to **air quality** (0-45 pts)
N6: **Cost** (NA pts)

+

EBI

Used to rank and prioritize offered lands in a way that balances program objectives

In that way, very much influences program geographies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EBI Expanded:
Reducing Soil Erosion
Improving Water Quality
Fostering Wildlife Habitat
EBI
2014
1985
1990
1996
(1990 Farm Bill)
Goals Expanded:
Reducing Soil Erosion
Improving Water Quality
Fostering Wildlife Habitat
Enviro. Benefits Index (EBI)
(2014 Farm Bill)
New Goal Added: Carbon Sequestration

New goal: carbon sequestration

N1: Benefits to wildlife (0-100 pts)

N2: Benefits to water quality (0-100 pts)

N3: Benefits to erosion management (0-100 pts)

N4: Enduring benefits (0-50 pts)

N5: Benefits to air quality (0-45 pts)

N6: Cost (NA pts)

+

EBI

Similar schema used to evaluate N4

N5c: "Carbon Sequestration" subfactor

10 pts: Pledge to plant trees

0-5 pts: Pledge to plant grasses

Lands' potential carbon benefits loosely factor into no more than 60 (<15%) of the EBI's >400 available points

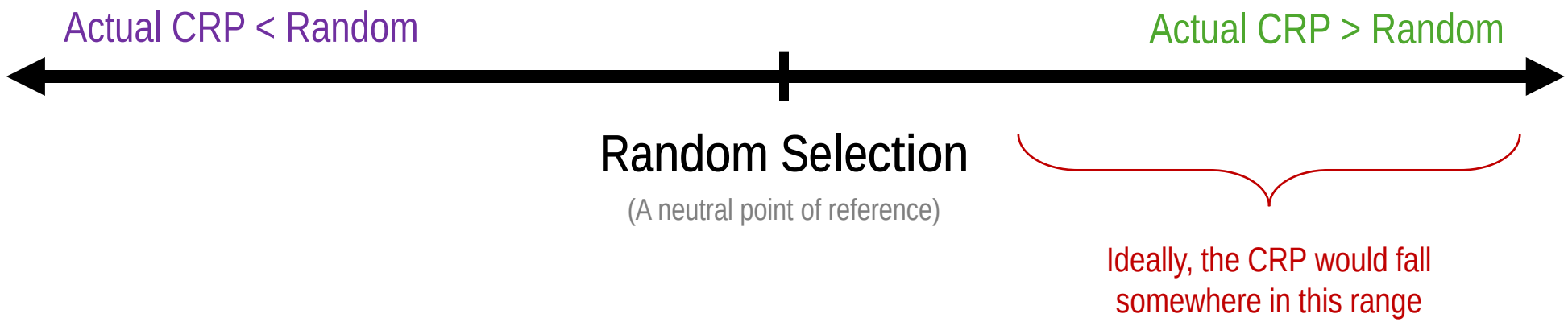
Our Questions:

Is the CRP conserving lands with the greatest potential to store carbon?

How does its performance with respect to carbon, compare to that of its other conservation and cost-efficacy objectives?

General Approach

Compare indices of lands' conservation and carbon (C) storage potentials of all existing enrollments to those of a baseline scenario representing the geography expected if enrollments were instead selected at random from the pool of land with CRP-eligible land use histories.



General Approach (details)

1. Acquire locations of all current CRP enrollments (as of 2020) from the FSA

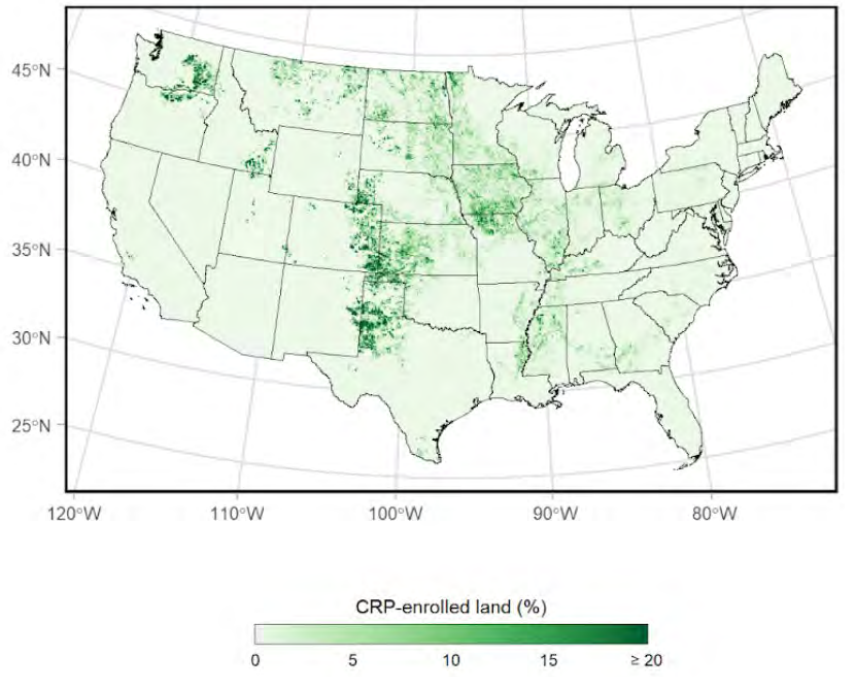
2. Estimate the geog. expected if enrollments were instead chosen at random
   i. Identify lands with a CRP-eligible land use history
   ii. Simulate random selection

3. Model an index of soils' carbon storage potential

4. Sum and compare indices of soils' carbon storage potential and other program goals for both 'actual CRP' and 'random' enrollment geographies.

Geography of actual CRP enrollments

Location data obtained through a Cooperative Research and Development Agreement with FSA

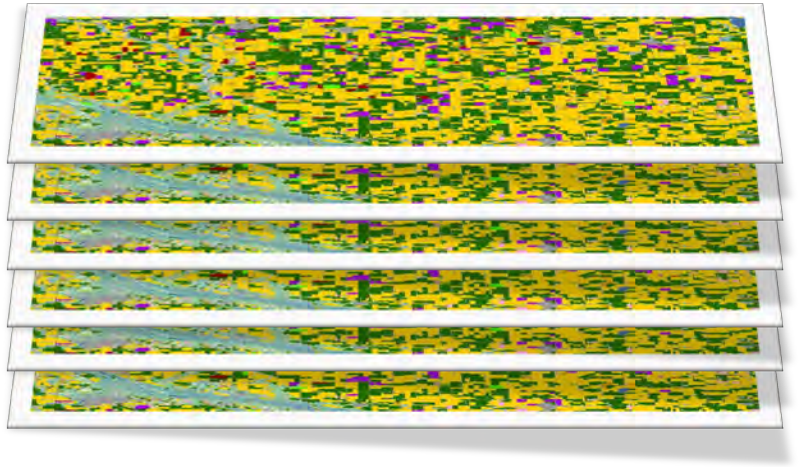


Actual Data Detail

Expected geography of random enrollment

i. Mapping lands with CRP-eligible land use histories

Algorithm…

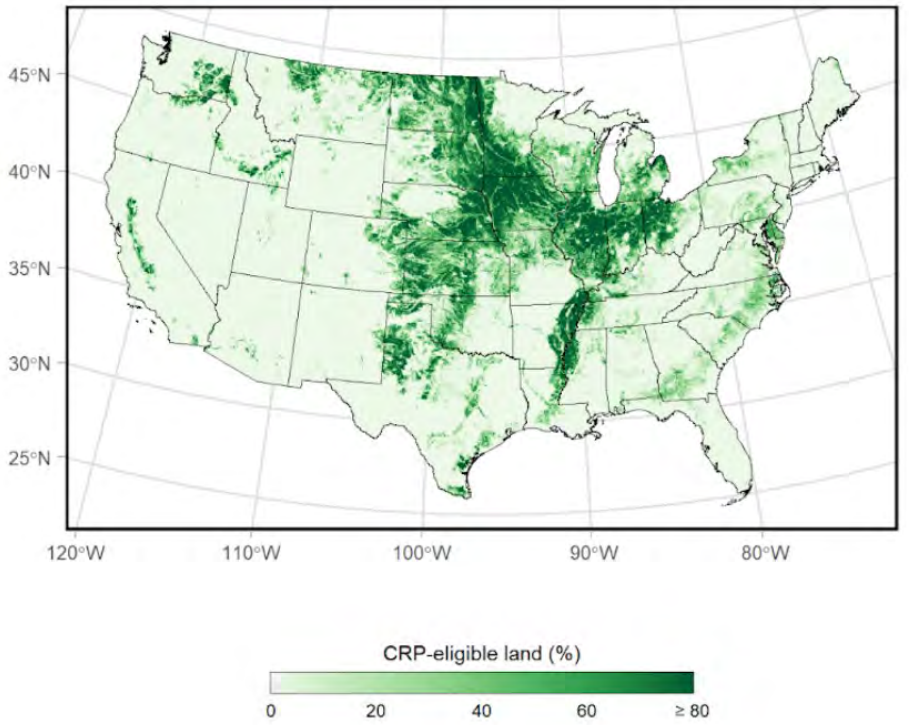


USDA's Cropland Data Layer
Annual U.S. crop-type maps

Expected geography of random enrollment

i. Mapping lands with CRP-eligible land use histories

Algorithm…



Expected geography of random enrollment

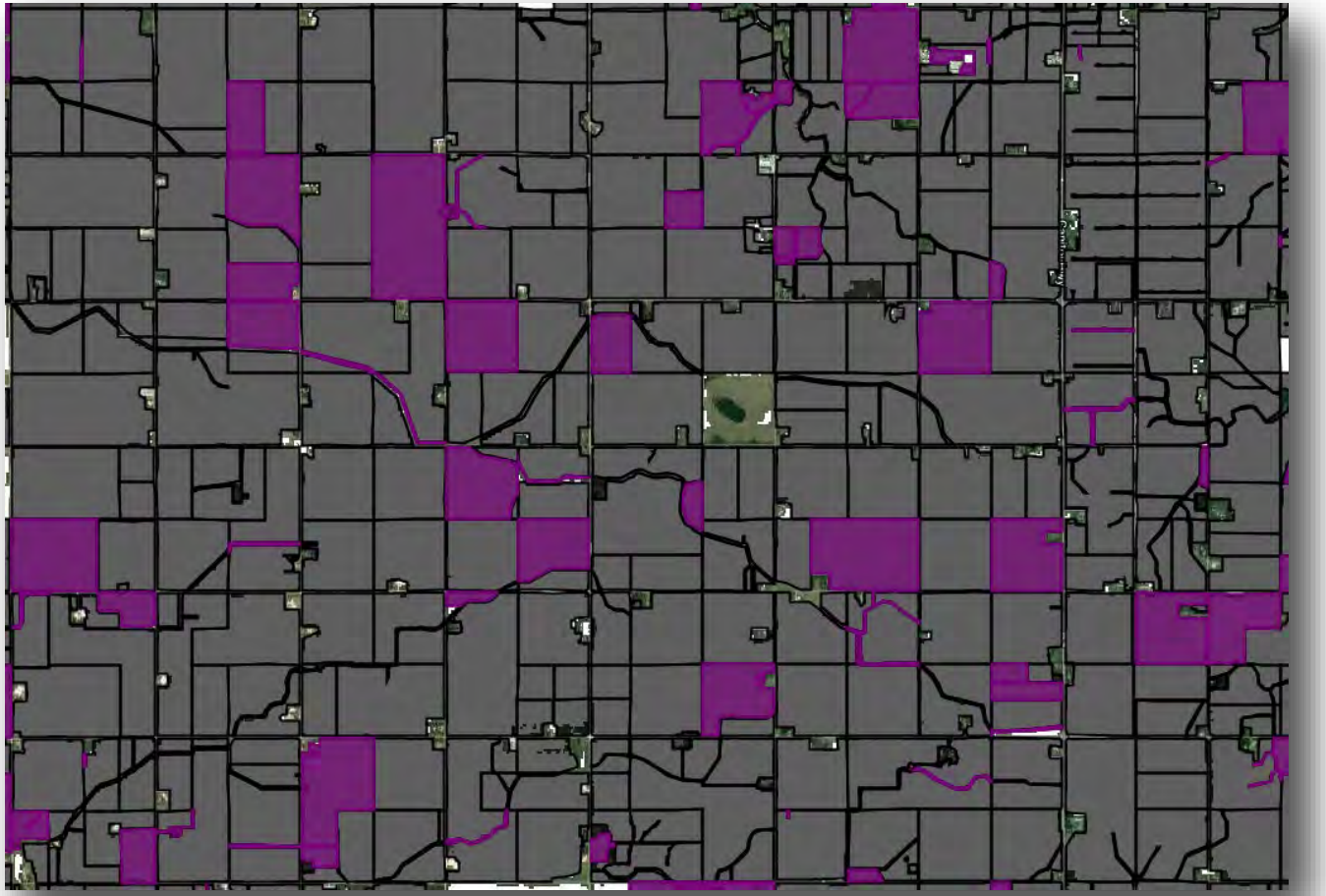
ii. Simulating random enrollment

(22-million acres)

Pixels → Parcels
(33-million)

Random sampling

10 separate samples



Modeling [soil] carbon storage potential index

Most CRP enrollments (> 80%) exist as grasslands where carbon is primarily stored in soils

Particulate Organic Carbon (POC)

- Free moving and accessible
- Can accumulate indefinitely
- Easily decomposed → fast cycling
- Sensitive to disturbance

Mineral Associated Organic Carbon (MAOC)

- Tightly bound to soil minerals (i.e., protected)
- Saturates (i.e., there is a theoretical site-specific maxima)
- Cycles slowly
- Relatively resilient to disturbance

Soil C storage for climate mitigation needs to be abundant and persistent

MAOC

Modeling [soil] carbon storage potential index

$MAOC_{max}$ Model

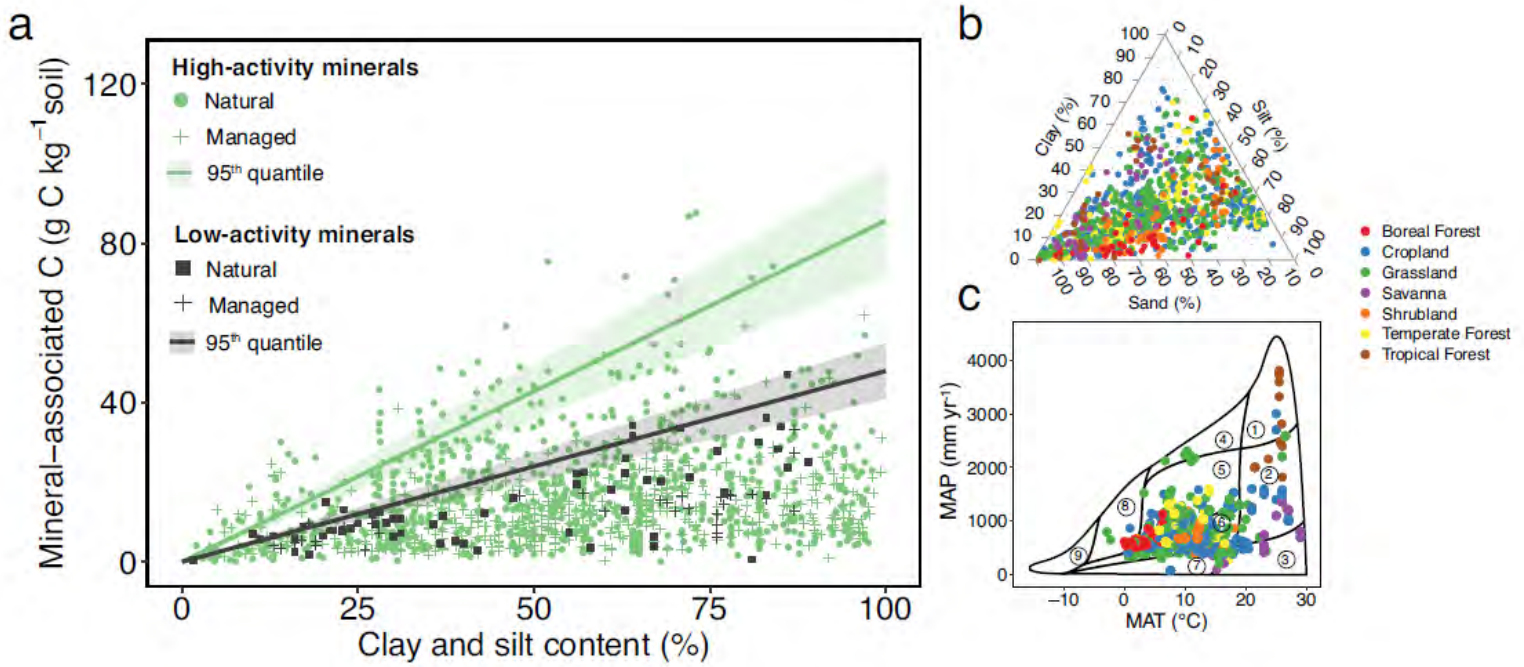

nature COMMUNICATIONS

ARTICLE

Global stocks and capacity of mineral-associated soil organic carbon

Georgiou et al., 2022

Statistical model derived as the maximum slope (95th quantile) relating measured MAOC in 1144 soil cores to soil texture



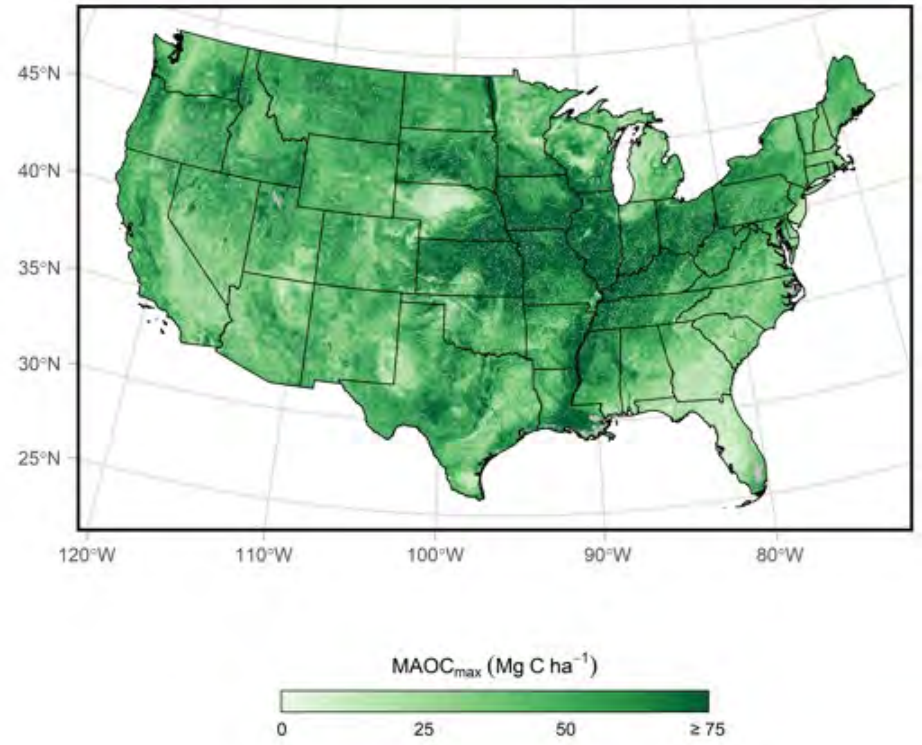
Modeling [soil] carbon storage potential index

$MAOC_{max}$ Model

Georgiou et al., 2022

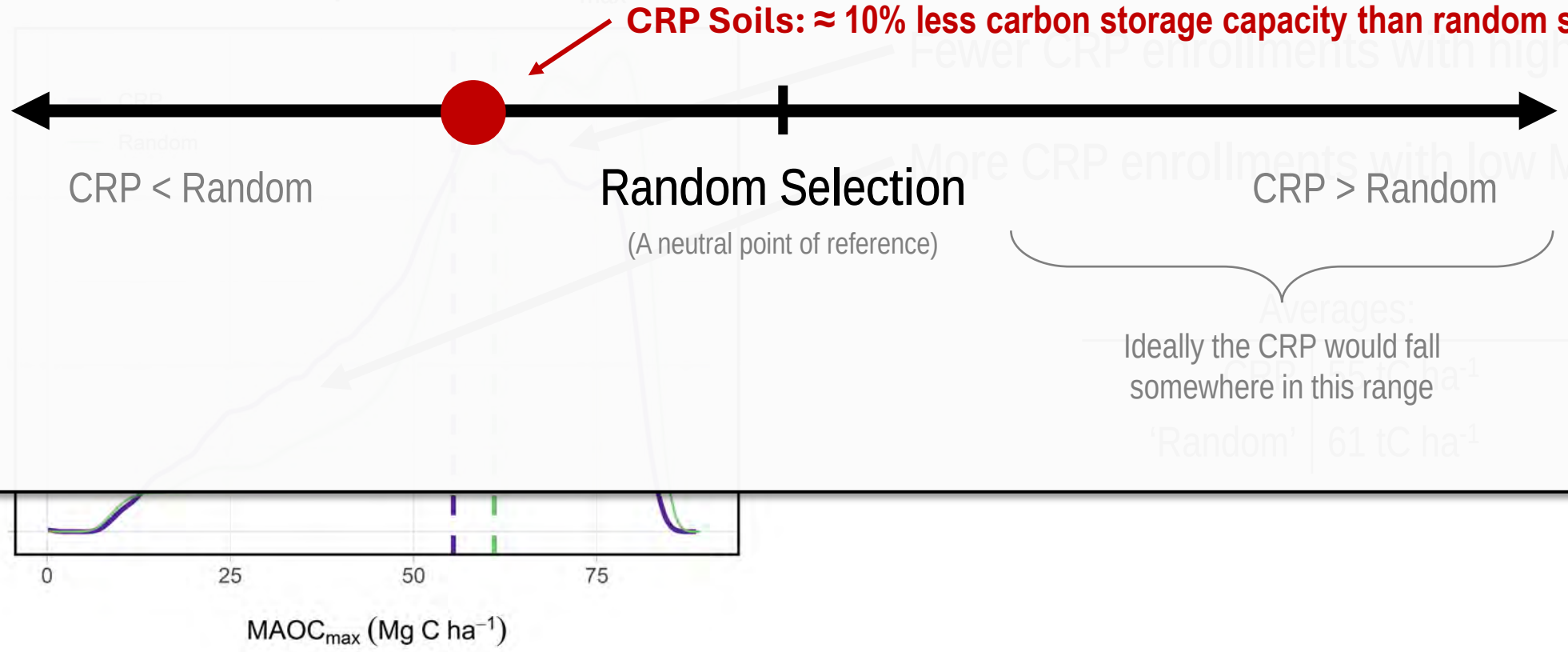
Maps of soil…

- Silt
- Clay
- Order



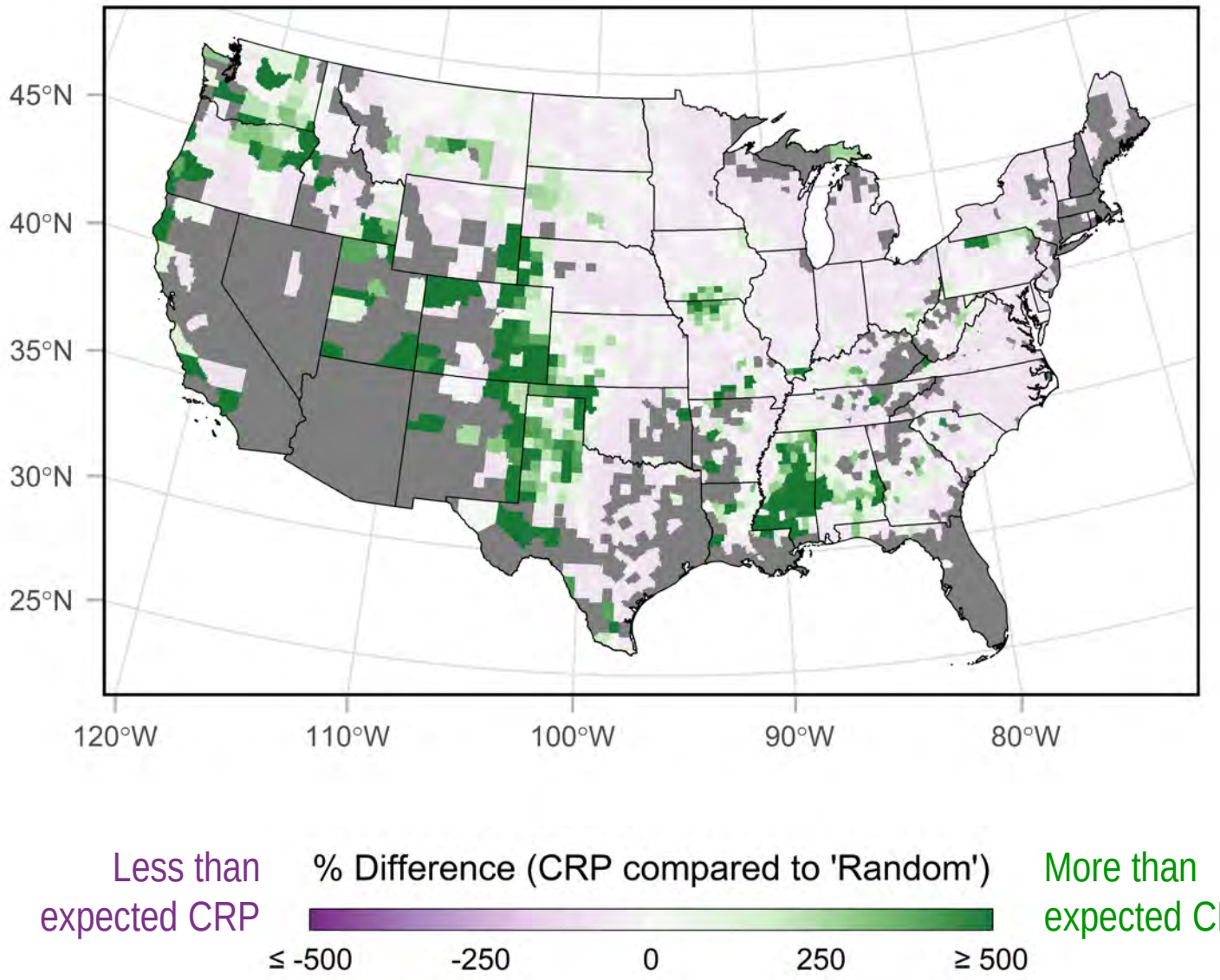
Model predictions represents the biophysically determined maximum amount of MAOC that soils could hold under ideal management conditions

Findings: More CRP soils with low $MAOC_{max}$ and less with high $MAOC_{max}$

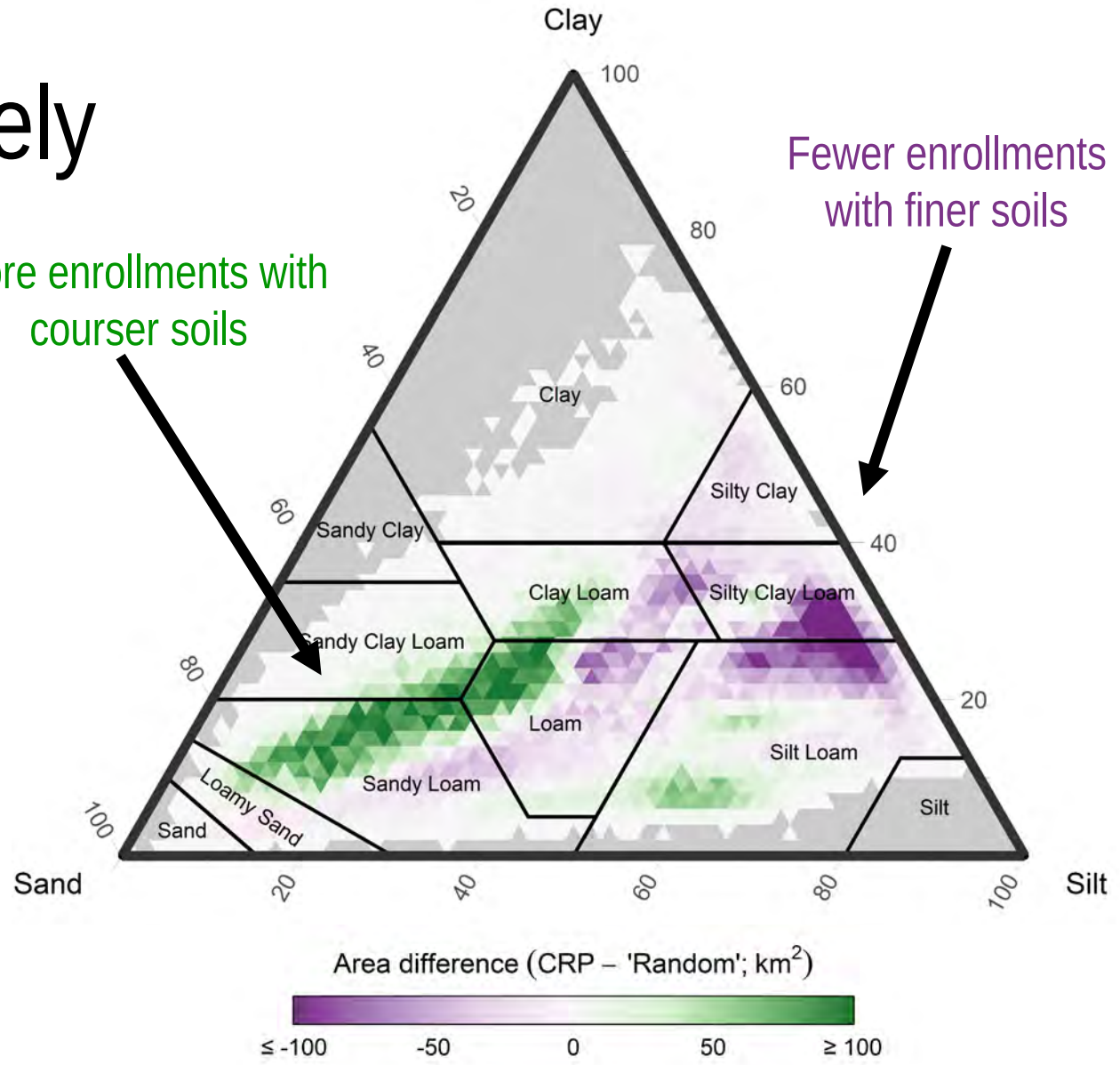


Disproportionate CRP enrollment area in the West (and elsewhere)

$$\%\ diff. = \frac{CRP - Random}{Random} \times 100\%$$

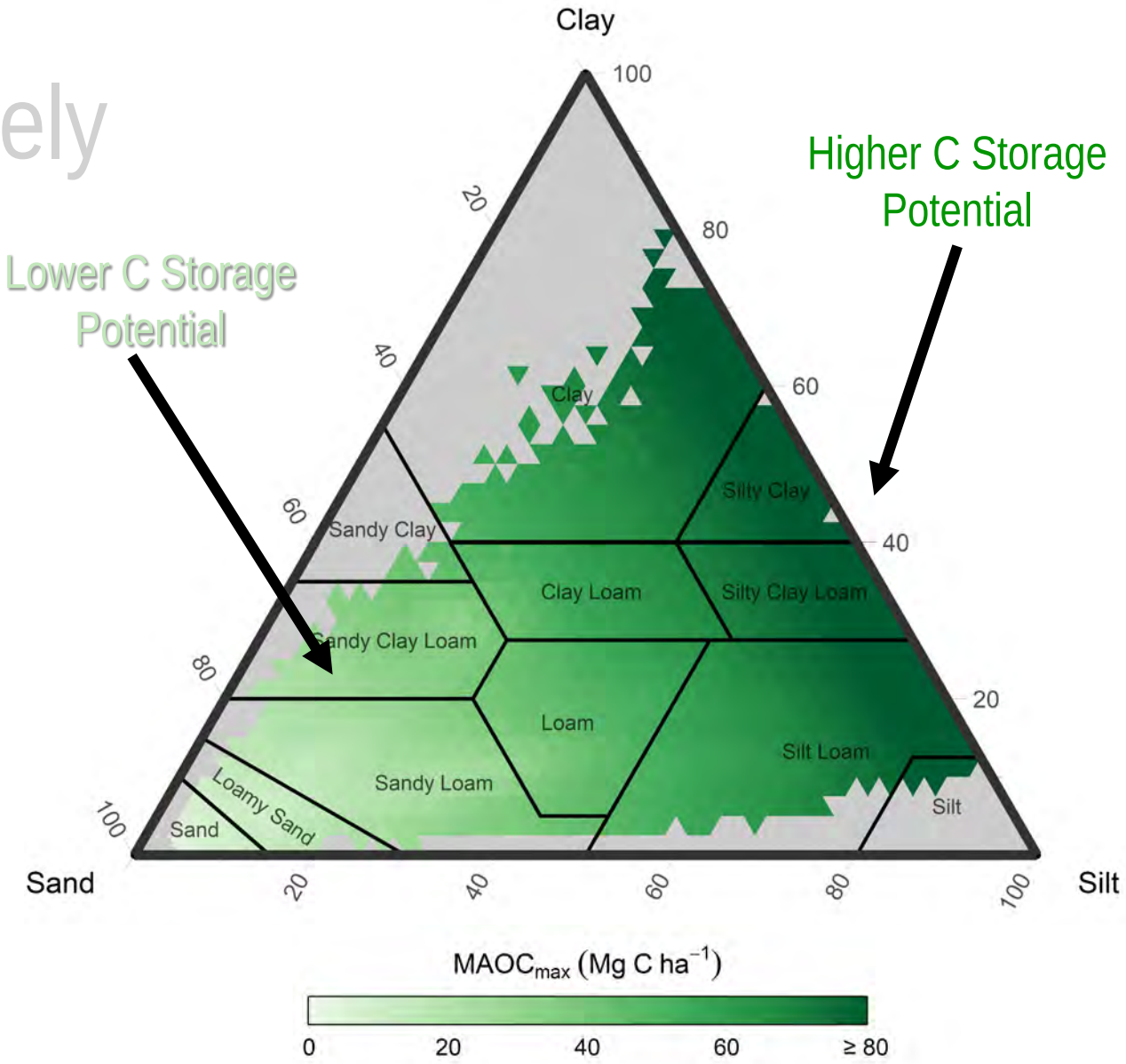


The CRP disproportionately conserves sandier soils



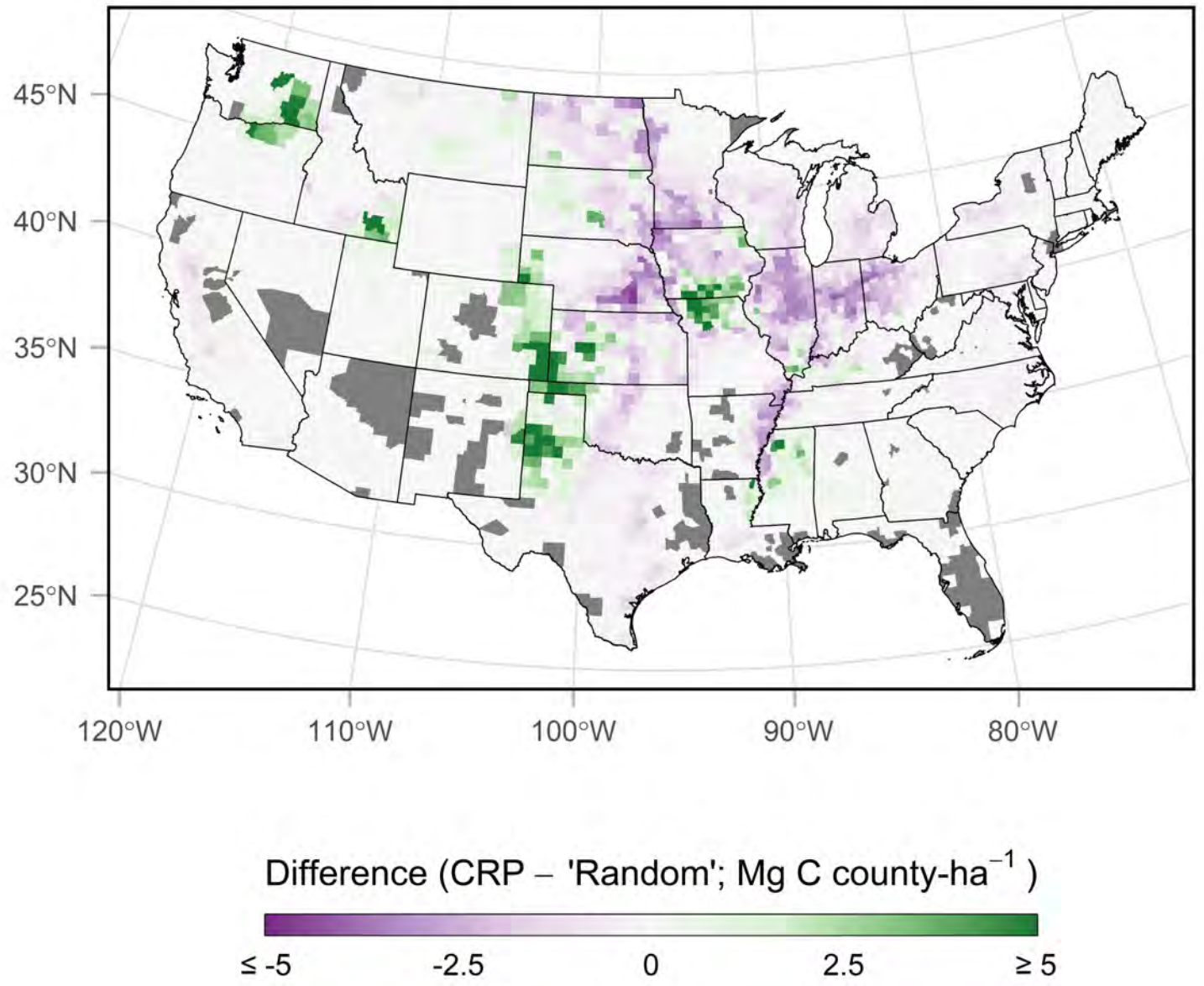
The CRP disproportionately conserves sandier soils

…that have a lower soil carbon storage potential

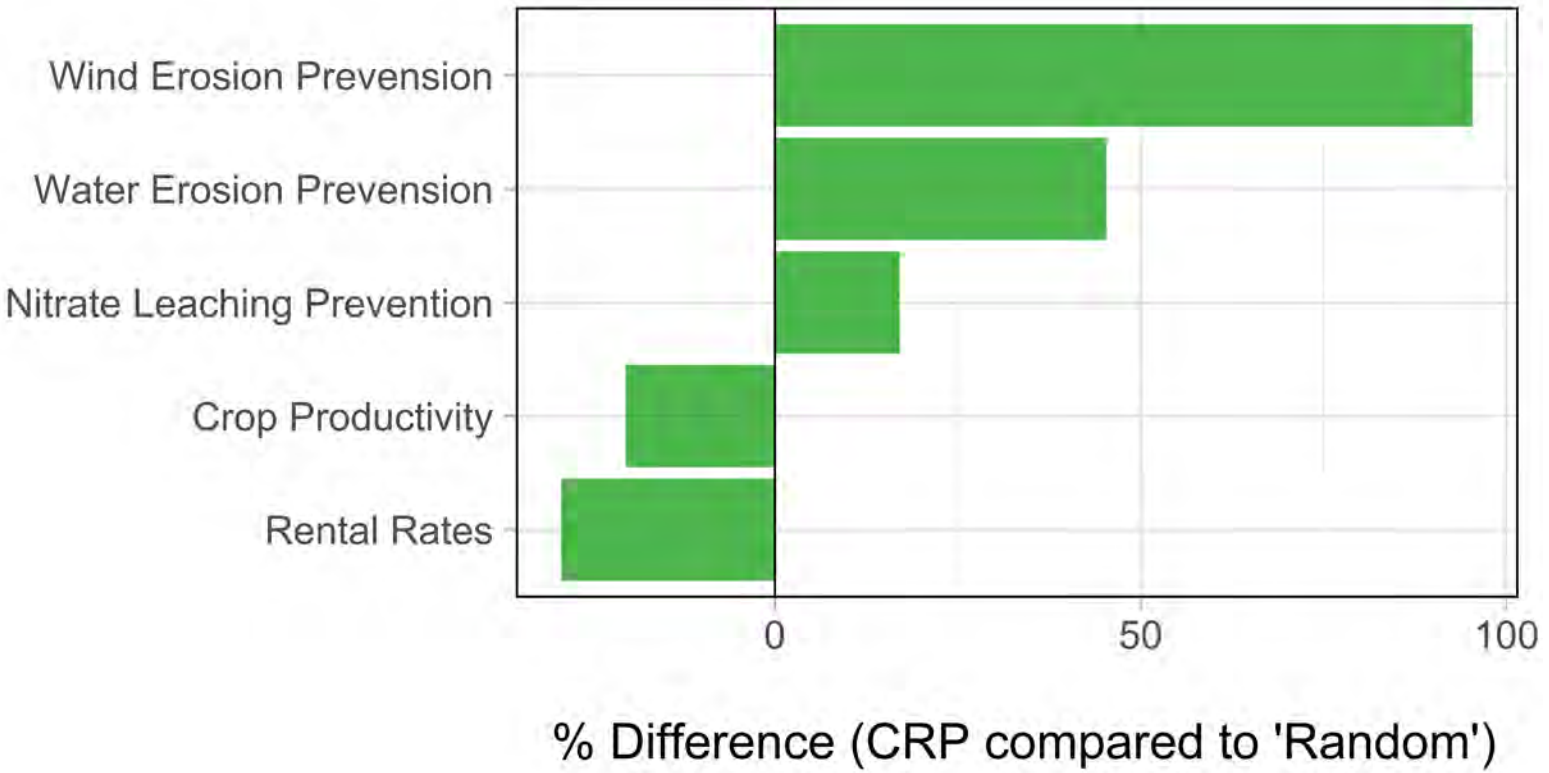


Greater than expected carbon storage potential in the West (and elsewhere)

Less throughout much of the country's most productive agricultural regions



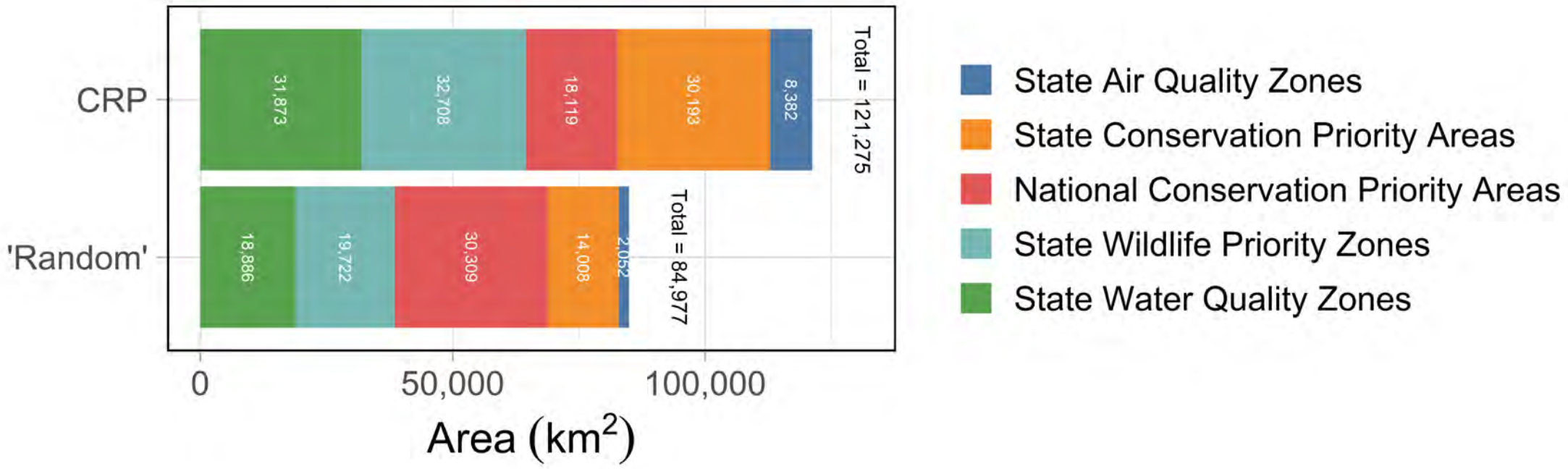
Enrollments make outsized contributions to the CRP's other goals



Outsized contributions to soil retention and water quality goals

Dodges most productive and expensive lands

Enrollments make outsized contributions to the CRP's other goals



Cost-effective conservation

	Annual Rent
Actual CRP Enrollments	$1.77B*
‘Random’ Enrollment	$2.50B

*USDA-reported actual 2020 rent: $1.724B

30% Savings!

Trade-offs…

Soils with a high carbon storage potential are…

- ↑ more productive
- ↑ more expensive to rent
- ↑ Their conservation confers a relatively small water quality benefit

But… [a synergy!]

- ↑ Their conservation contributes more to preventing water erosion

These results are preliminary and do not reflect an official position of the USDA or the U.S. Government.

Conclusions:

The CRP's current geography has a relatively low C storage potential

- Instead favors sandier soils, especially in the southern Great Plains

Its geography is responsive to the indices considered during selection

- Including carbon storage or sequestration metric might improve its carbon efficacy

- *Soil texture could be a simple, effective proxy for C storage potential in the EBI*

Trade-offs might reduce water quality benefits and increase costs

- Synergies may uphold or enhance erosion control benefits

Opportunities to enhance the CRPs climate benefits

- More explicit evaluation of lands carbon storage potential and greater weighting of that evaluation in the EBI might meaningfully enhance the programs' ability to sequester and store carbon

- Allowing some harvest regimes that balance local conservation considerations could meaningfully contribute biomass for bioenergy or other uses, thereby potentially further enhancing the CRP's contributions to climate change mitigation → more on this to come!

Thank you!

PowerPoint Slides and Recording will be available with USDA-FSA online at:
https://www.fsa.usda.gov/programs-and-services/economic-and-policy-analysis/natural-resources-analysis/webinars/index

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