Realizing the Circular Carbon Economy: *Opportunities within Agricultural Landscapes*

Credit:iStockphoto.com/fotoVoyager

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Union of Concerned Scientists

Opportunities within Agricultural Landscapes

1 acre →

What Practice (s)?

How Much?

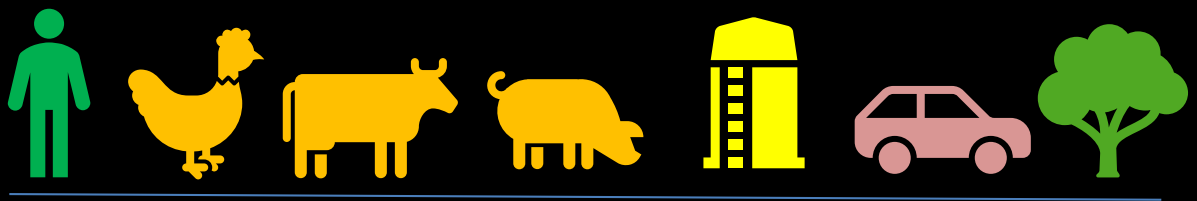
Where?

To what end?

?

Credit:iStockphoto.com/fotoVoyager

Why look at agricultural landscapes for circular carbon solutions?



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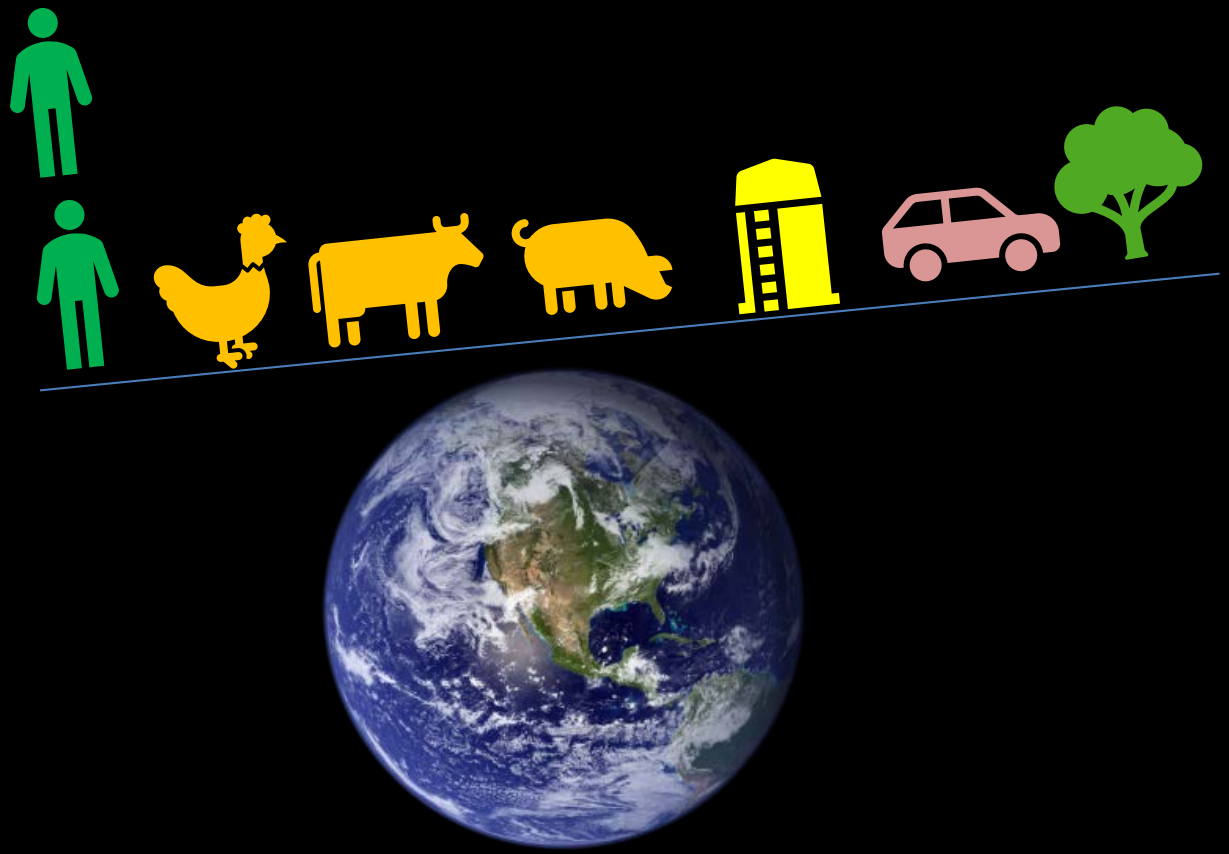
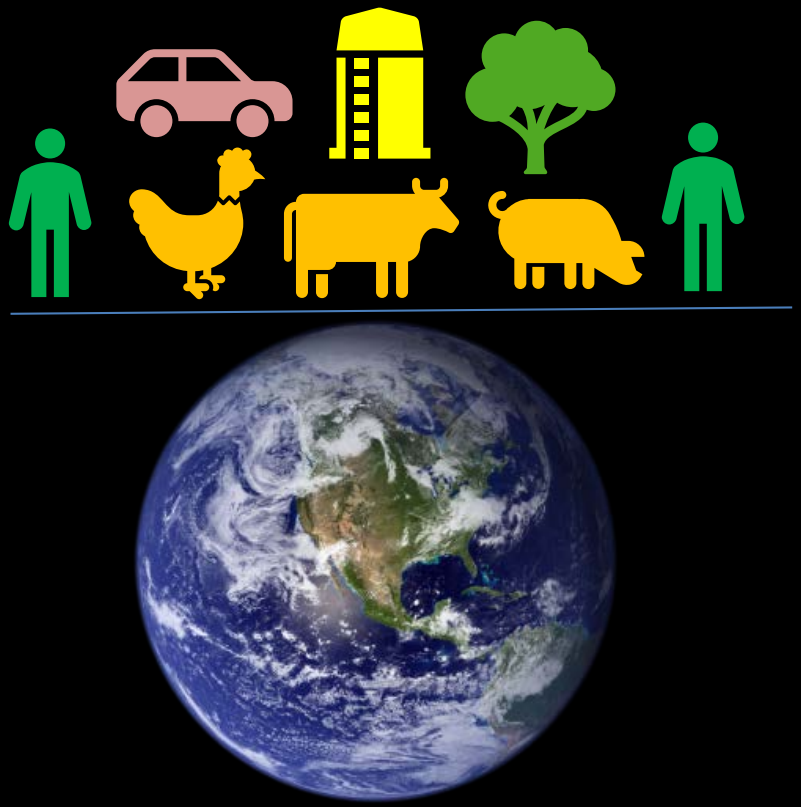


Why look at agricultural landscapes for circular carbon solutions?



More products & services out of less land

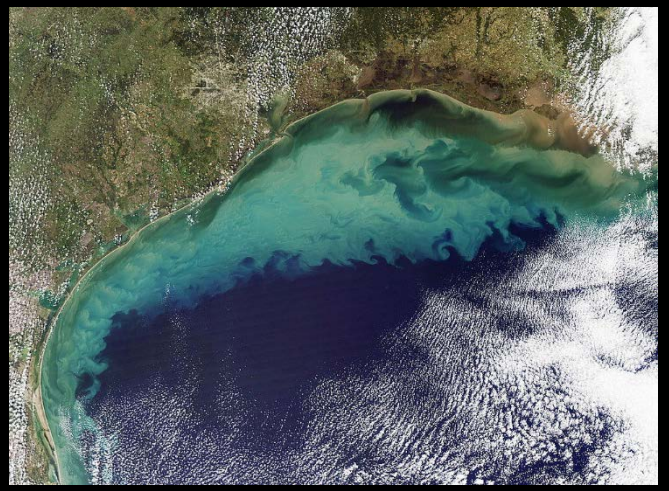
Credit: A Price

Credit: Larry Lamsa/CC 2.0 (Flickr)

Climate change puts new demands on our farm & food system

Credit: USDA

Credit: elena volkova/iStock



Credit: NASA

Credit: USDA,/Scott Bauer

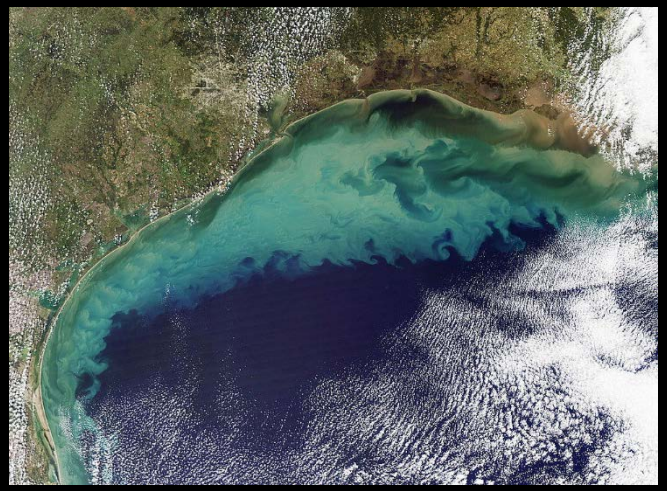
USAID/J. Hyman, Land O'Lakes/CC (Flickr)

Don Becker/USGS

But maybe land management & a landscape perspective can help…

Credit: USDA

Credit: elena volkova/iStock



Credit: NASA

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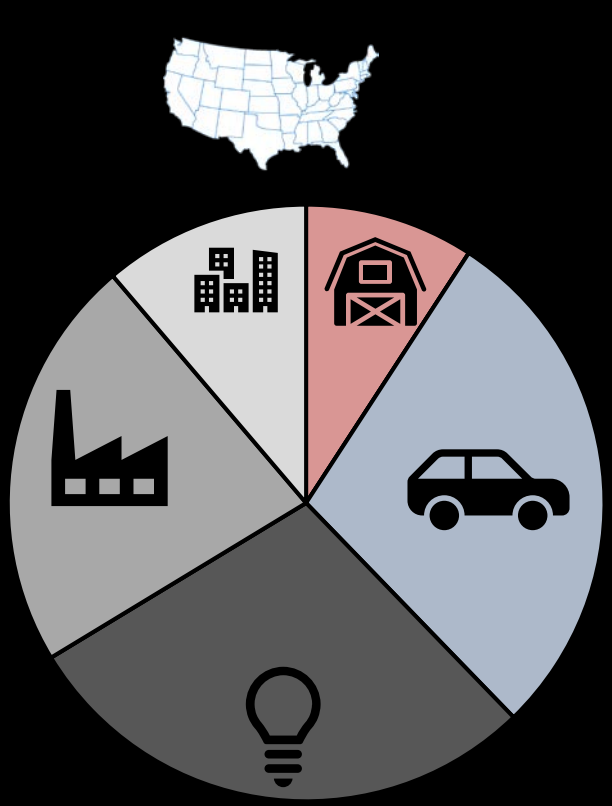
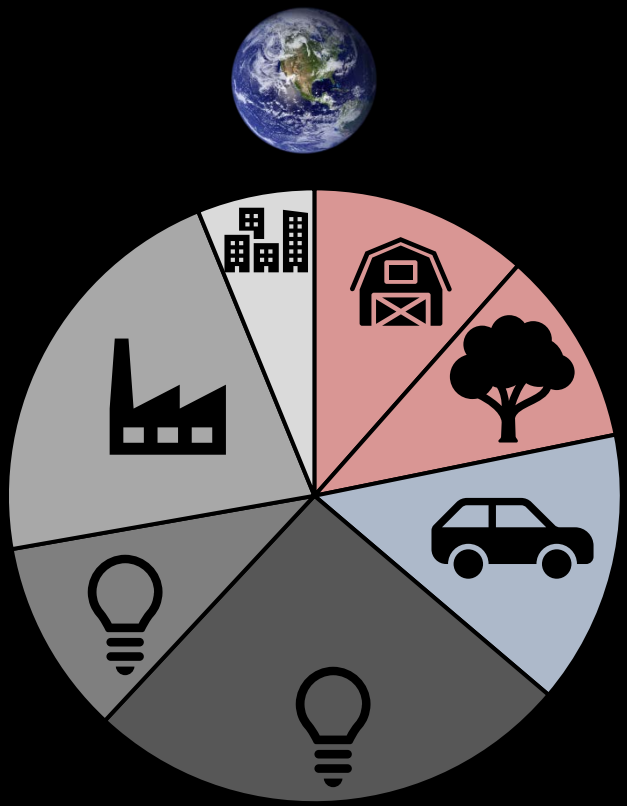
Don Becker/USGS

Opportunity to reduce emissions from agriculture

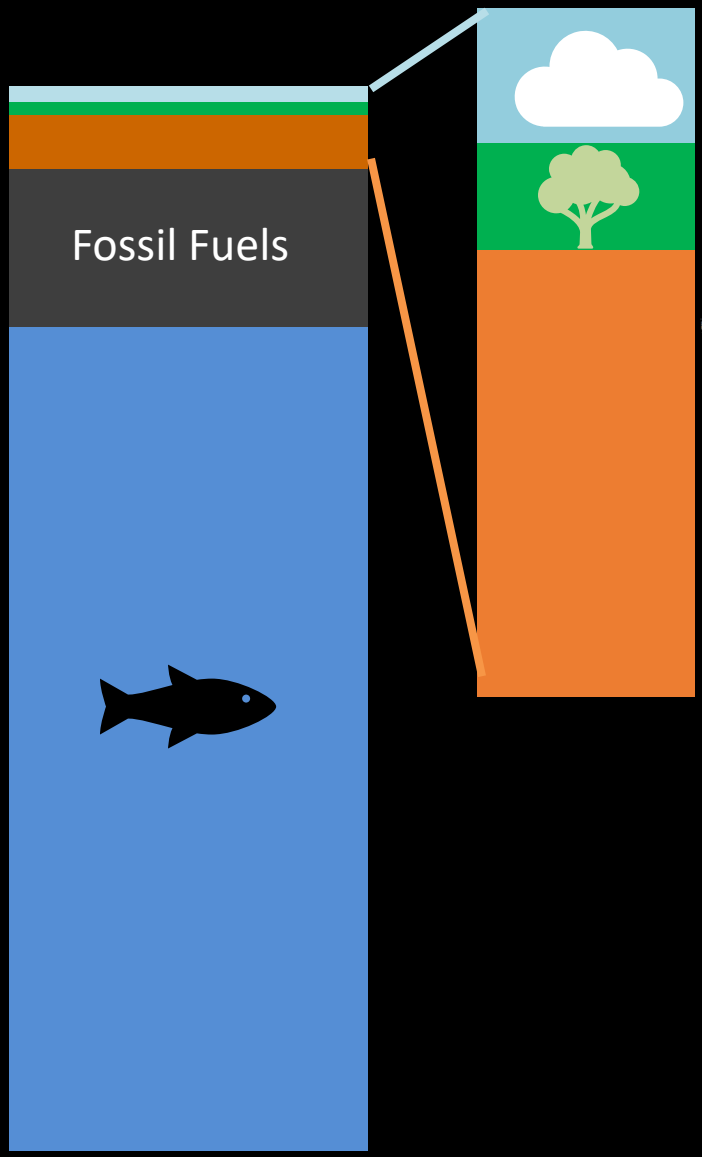


Source: EPA 2016

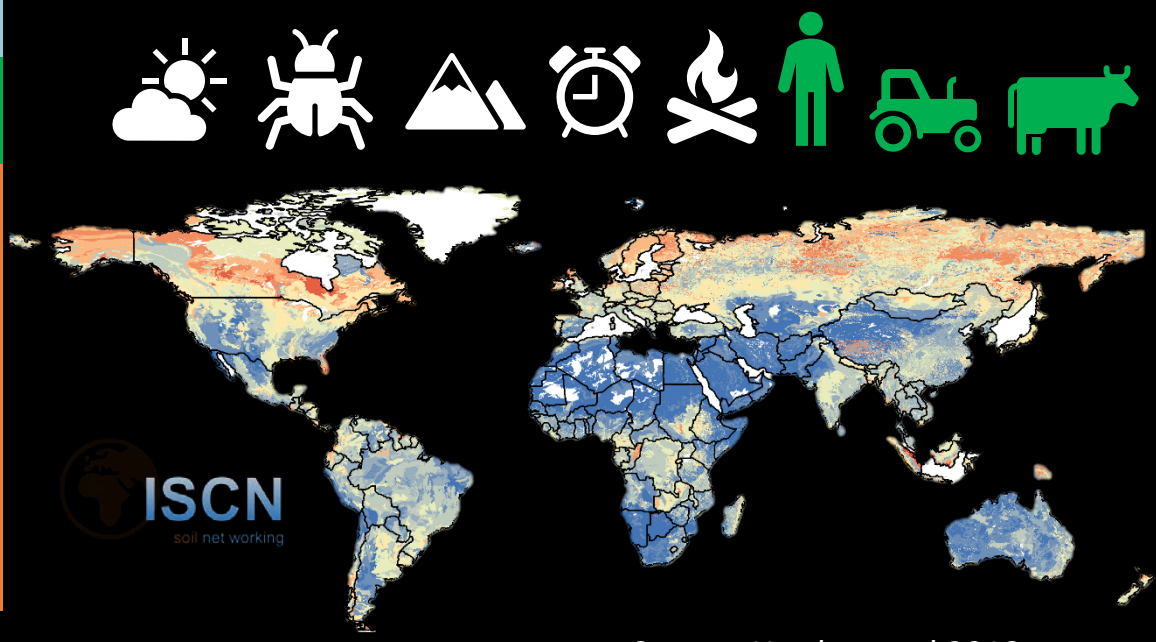


Source: IPCC 2014; Tubiello et al. 2015

Opportunity to increase carbon sequestration



Source: Adapted based on Lal 2010



Source: Harden et al 2018

What practices?

Cropland:
0.3-0.5 Mg C/ha/y

No-Till

Cover Crops

Crop Rotation

Grassland, grazing land:
0.04-0.2 Mg C/ha/y

Grazing Management

Perennials

- Land set-asides
- Water management
- Restore degraded lands
- Manage rice
- Restore histosols

Forest land:
0.1-0.4 Mg C/ha/y

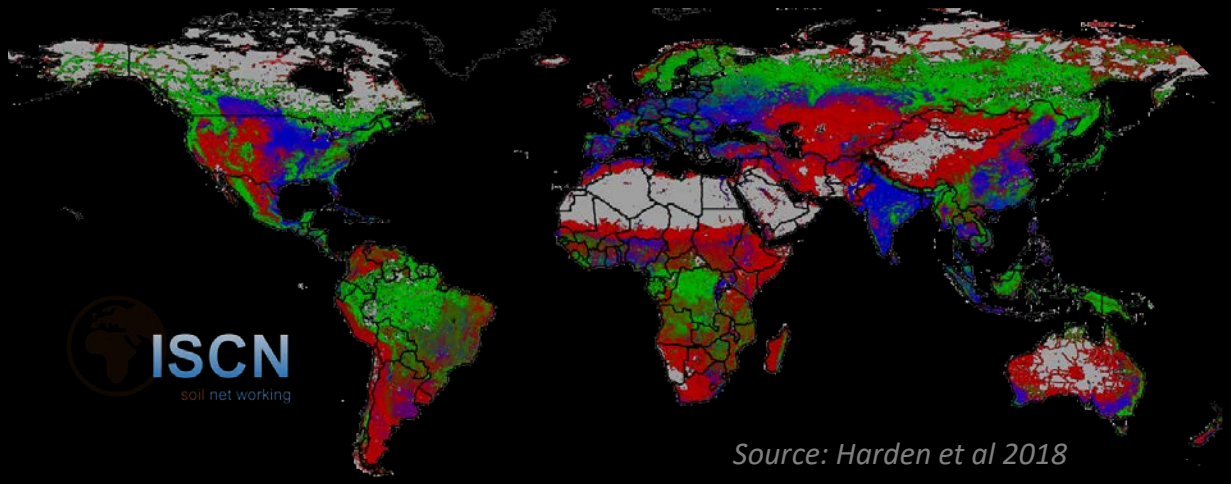
Sources: Chambers et al. 2016, Paustian et al. 2016
Photo credits: A Basche; A Price; T Schultz; T Carter/Savanna Institute

CO_2 > N_2O, CH_4, CO_2

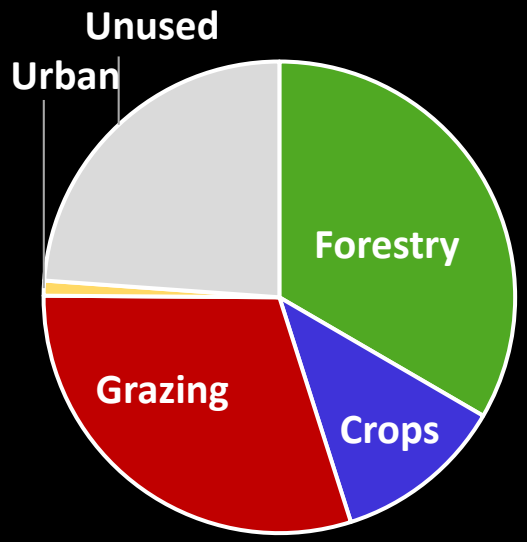
For climate mitigation, NET sinks are key

Photo credits: A Price; T Schultz

On a large scale, how much & where?

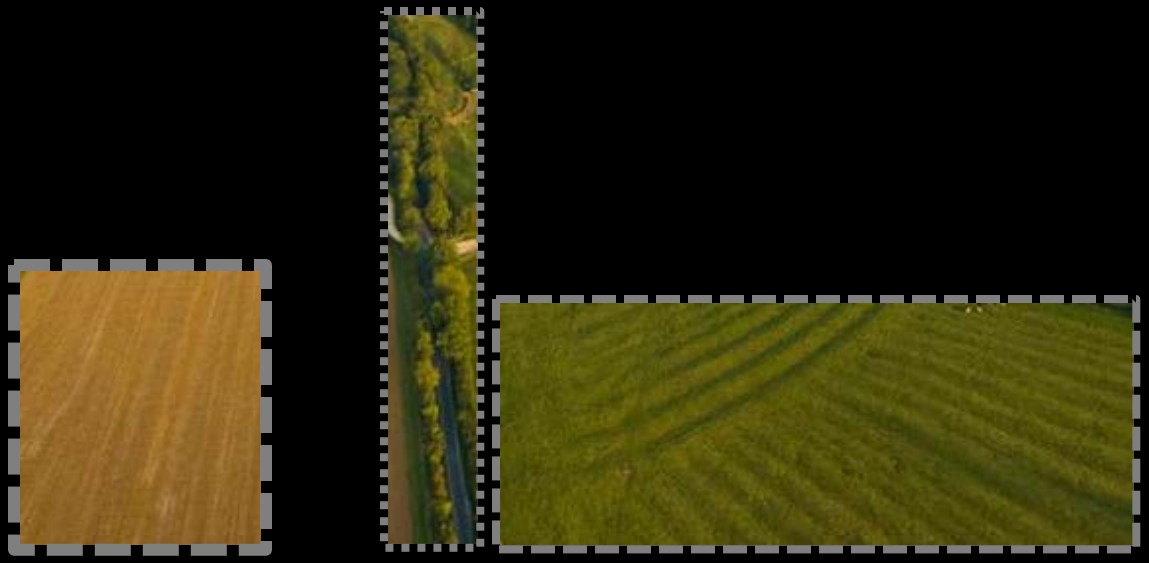


Source: Harden et al 2018



Acre by acre, how much…?

CO_2



Credit:iStockphoto.com/fotoVoyager

How much… & where?

Credit:iStockphoto.com/fotoVoyager

Targeted location -> different outcomes?

Credit: Jason Johnson/public domain (Flickr)

Credit: Edwin Remsberg/USDA-SARE

Synergies from mixed-land use?



Credit: Tobias Carter/Savanna Institute

Subfield opportunities?

Credit: Organic Seed Alliance

Screenshot from: http://www.efcsystems.com/index.php/agronomicplanningandsustainability/

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1 acre →

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In addition to climate mitigation, we need practices that help with climate adaptation

Credit: USDA

Don Becker/USGS

Potential for spongier soils

Cropland:
0.3-0.5 Mg C/ha/y

+5%

No-Till

+16%

Cover Crops

+32%

Crop Rotation

Grassland, grazing land:
0.04-0.2 Mg C/ha/y

+59%

Grazing Management

+68%

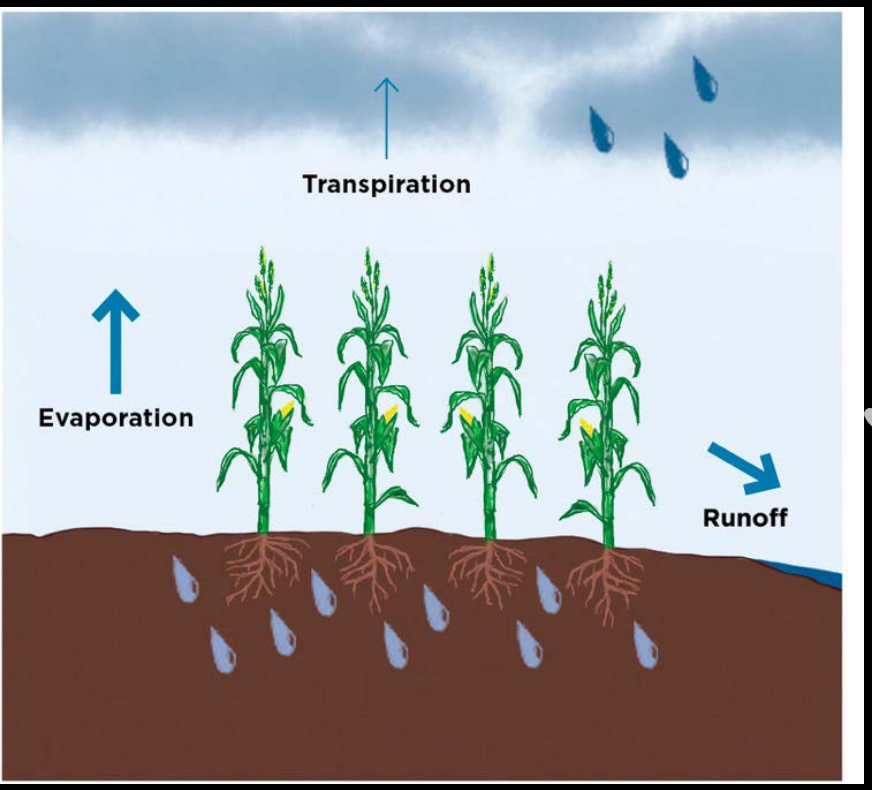
Perennials

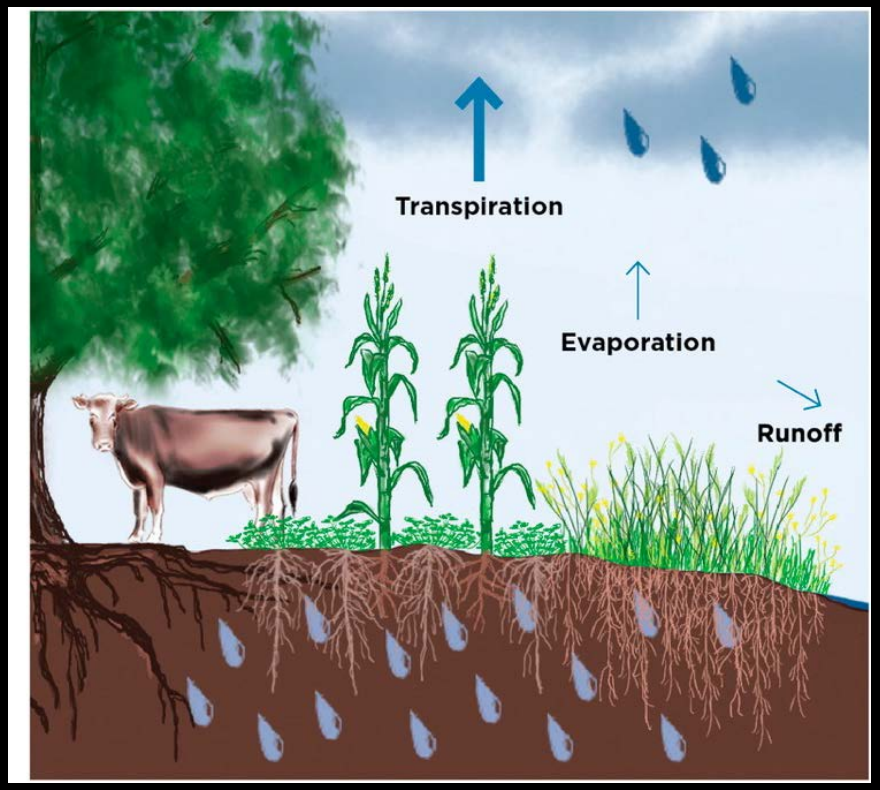
Forest land:
0.1-0.4 Mg C/ha/y

Source: Chambers et al. 2016; UCS/Basche 2017
Photo credits: A Basche; A Price; Tom Schultz; Tobias Carter/Savanna Institute

Landscapes for spongier soils

16% greater water use
20% lower flood frequency





Credit:UCS/Basche 2017

Prairie strips protect Iowan farms & water

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About

STRIPS stands for Science-based Trials of Rowcrops Integrated with Prairie Strips. The project is composed of a team of scientists, educators, and extension specialists who have chosen to work together on the use of **prairie strips** as a farmland conservation practice. We strive to more fully understand the assembly, management, function, and value of prairie strips; to communicate our results to diverse audiences; and to assist others with the implementation of prairie strips on farm fields. Our initial research site is located at Neal Smith National Wildlife Refuge near Prairie City, Iowa. We are now implementing and maintaining research and demonstration sites across the Midwest, including on private commercial farms.

Credit: STRIPS; Screenshot from https://www.nrem.iastate.edu/research/STRIPS/content/about-strips

Crop rotations boost yields & profits

Credit: Tom Schultz

Lentils save a family farm

Credit: Liz Carlisle

“Waste” boosts drought-stricken grass

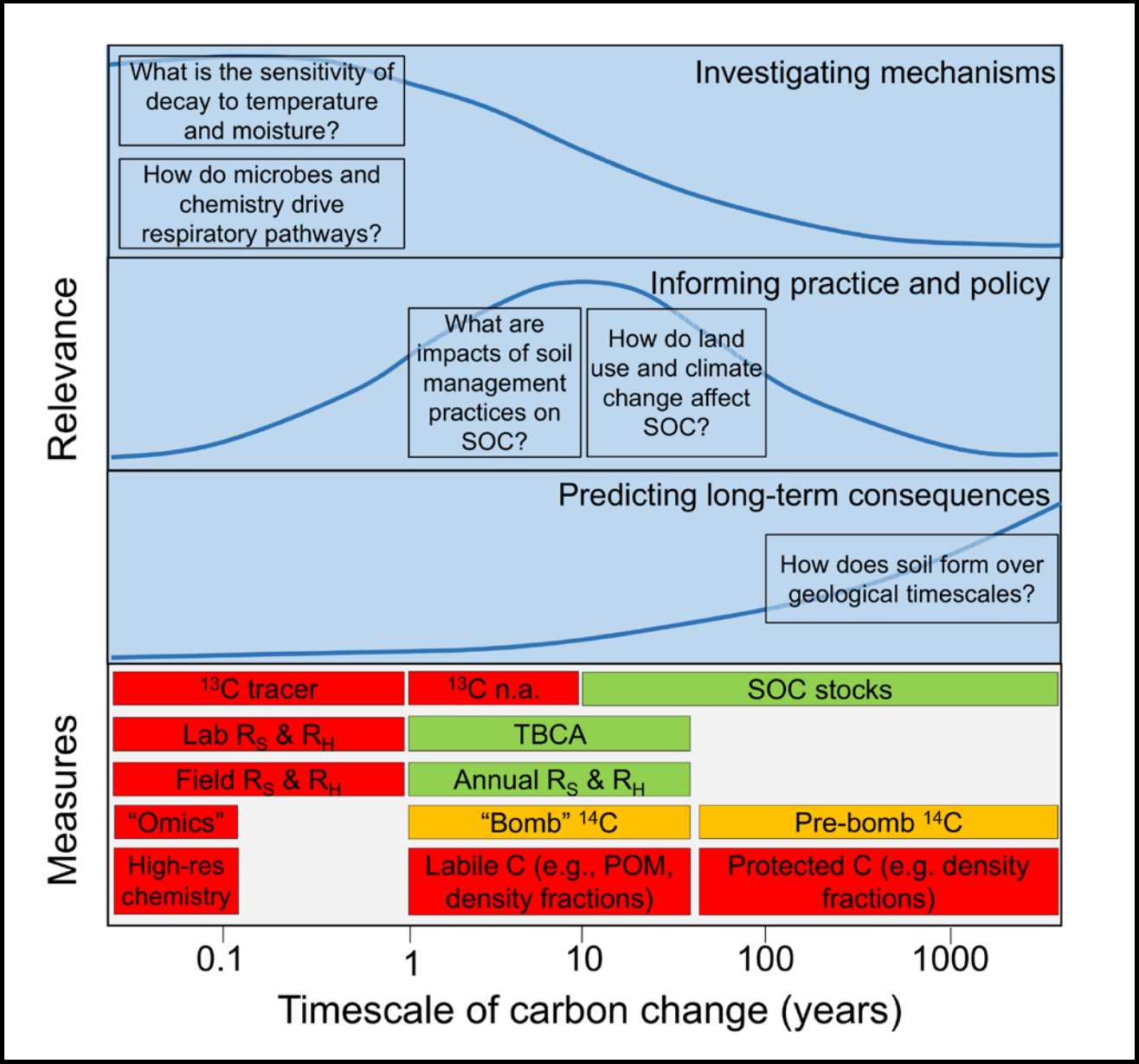
Credit: J Wick/MCP

Challenges & uncertainties

- **Valuing ecosystem services**
- **Net GHG accounting**
- **C sequestration rates & saturation**
- **Measuring carbon change**

Credit: USDA

For soil C, research questions, needs & measurements vary.



Source: Harden et al 2018

Invest in research, education & extension

Credits: Organic Seed Alliance; Tracy Robillard/NRCS Oregon

- Tools & training
- Interdisciplinary, systems-level research
- Agroecology, Economics, Human health, Equity

Agroecology as a framework for landscape management

Credit: Preston Keres, USDA

Thank You

Credit:iStockphoto.com/fotoVoyager