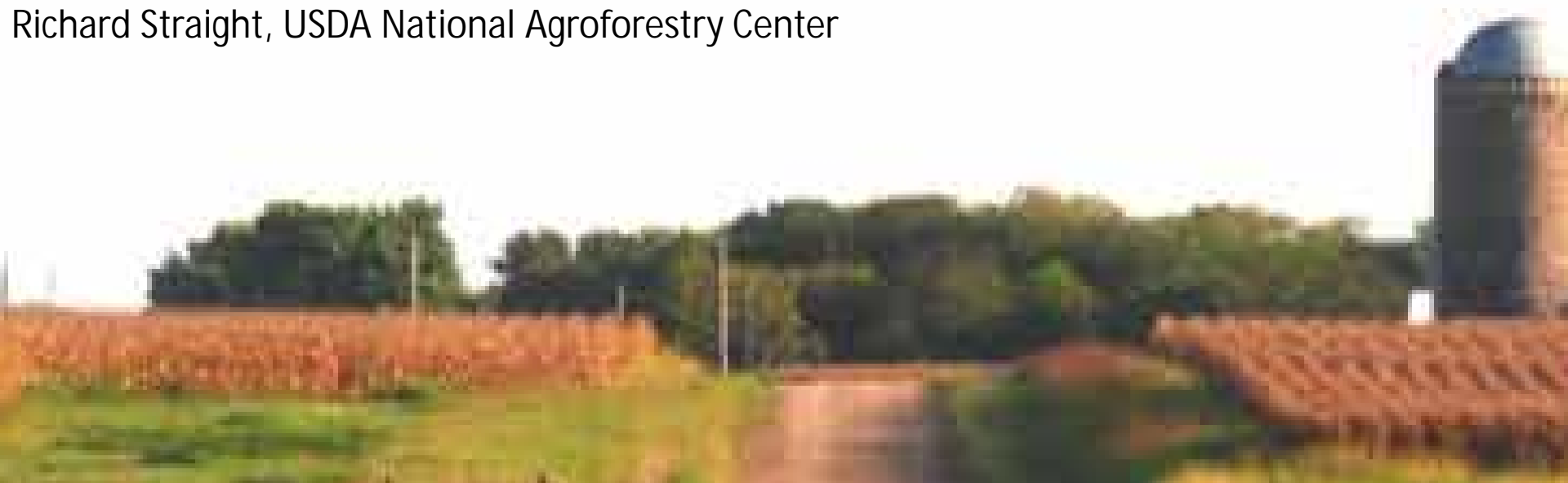


# Kansas Rural Center 2016 Farm & Food Conference

Transforming Our Farms, Our Food & Our Future:  
Building the Road As We Go

## Agroforestry – Tools for Transforming Farms

Richard Straight, USDA National Agroforestry Center



# My Agenda For This Morning

- USDA National Agroforestry Center
- Agroforestry
- Climate Change and Agroforestry
- Biodiversity and Agroforestry
- Cute picture at the end of the presentation

# USDA National Agroforestry Center



- Enhance benefits of agroforestry;
- Accelerate agroforestry adoption.

US Forest Service (Research and Development, and State and Private forestry) and the Natural Resources Conservation Service

# USDA National Agroforestry Center

- Based at the University of Nebraska at Lincoln
- Technology Transfer
  - Technical publications
  - Training and demonstration
  - Regional networks
- Research
  - Models and tools for efficient design



# What is Agroforestry?

Intentional integration of trees with agriculture to:

- Provide environmental, economic and social benefits; and
- Support productive, sustainable farms, ranches, and woodlands;



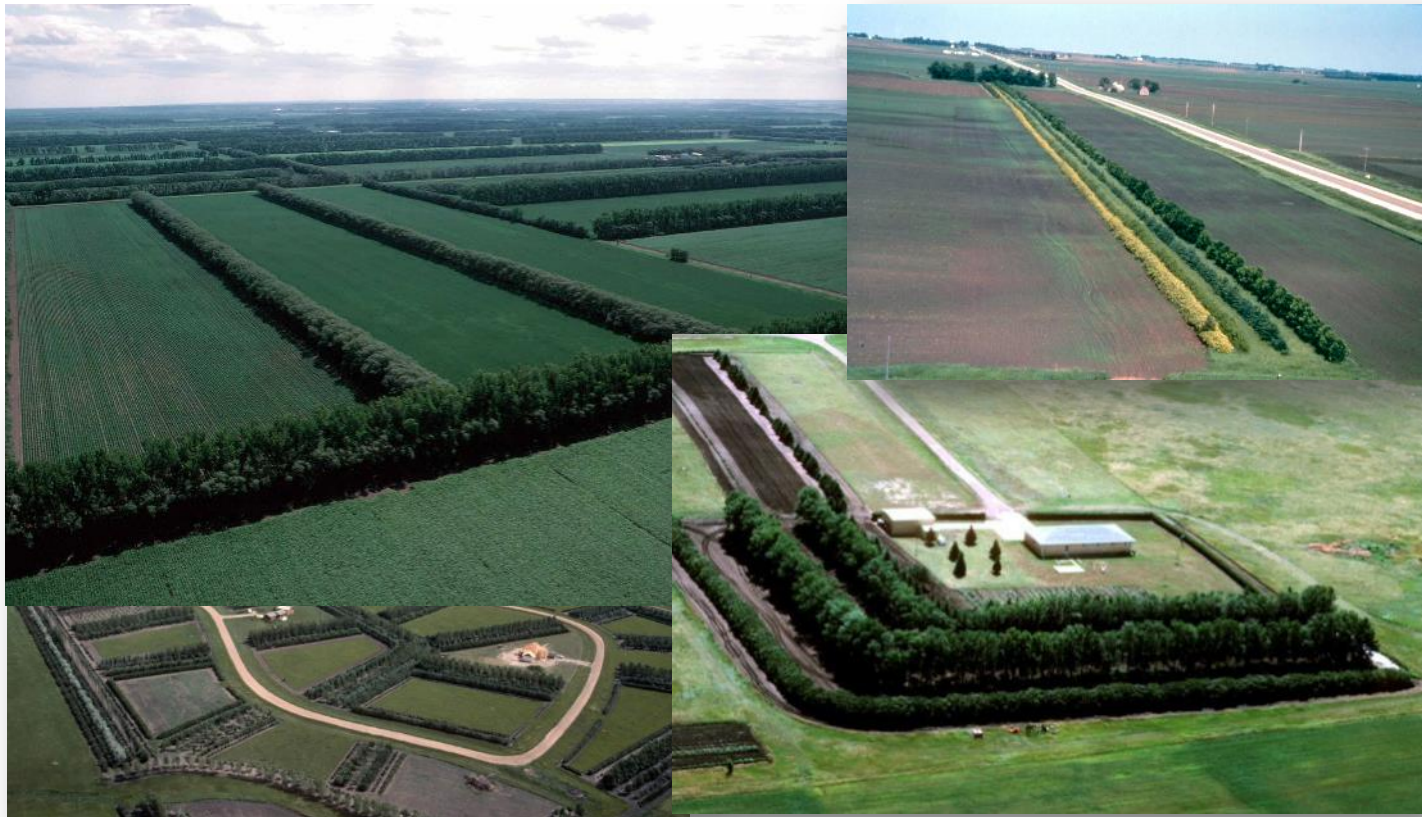
# Most Common Agroforestry Systems (U.S.)

- Windbreaks/Shelterbelts
- Riparian Forest Buffers
- Silvopasture
- Alley Cropping
- Multi-story cropping (Forest Farming)





# Windbreaks



# Riparian Forest buffers





# Silvopasture



# Alley cropping

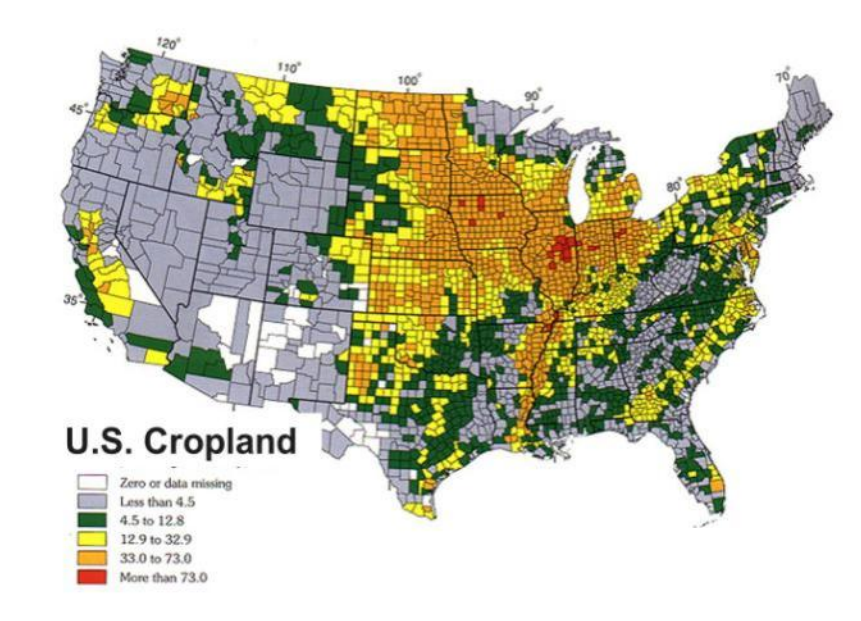
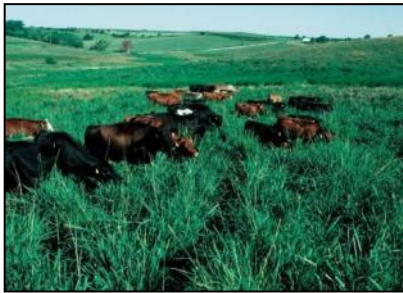




# Forest farming

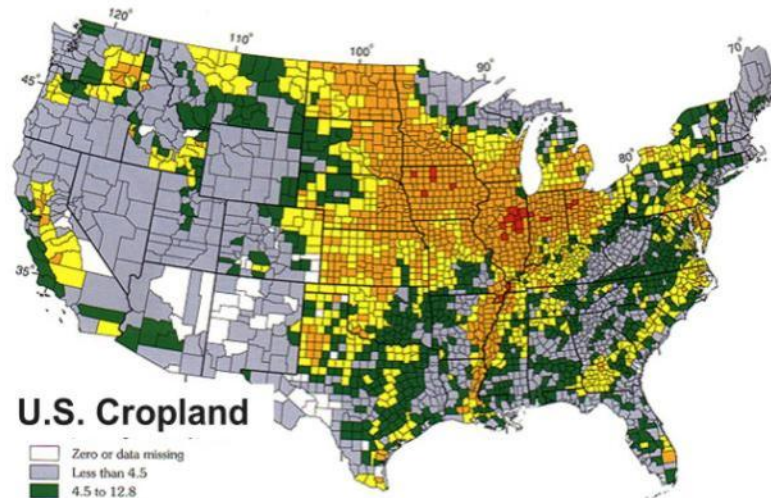
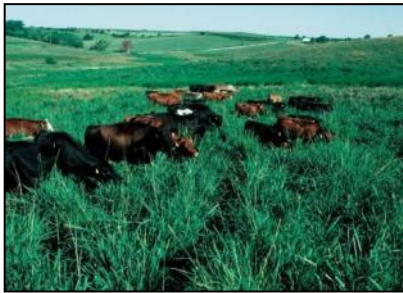






*From agricultural lands:  
We want it all.*



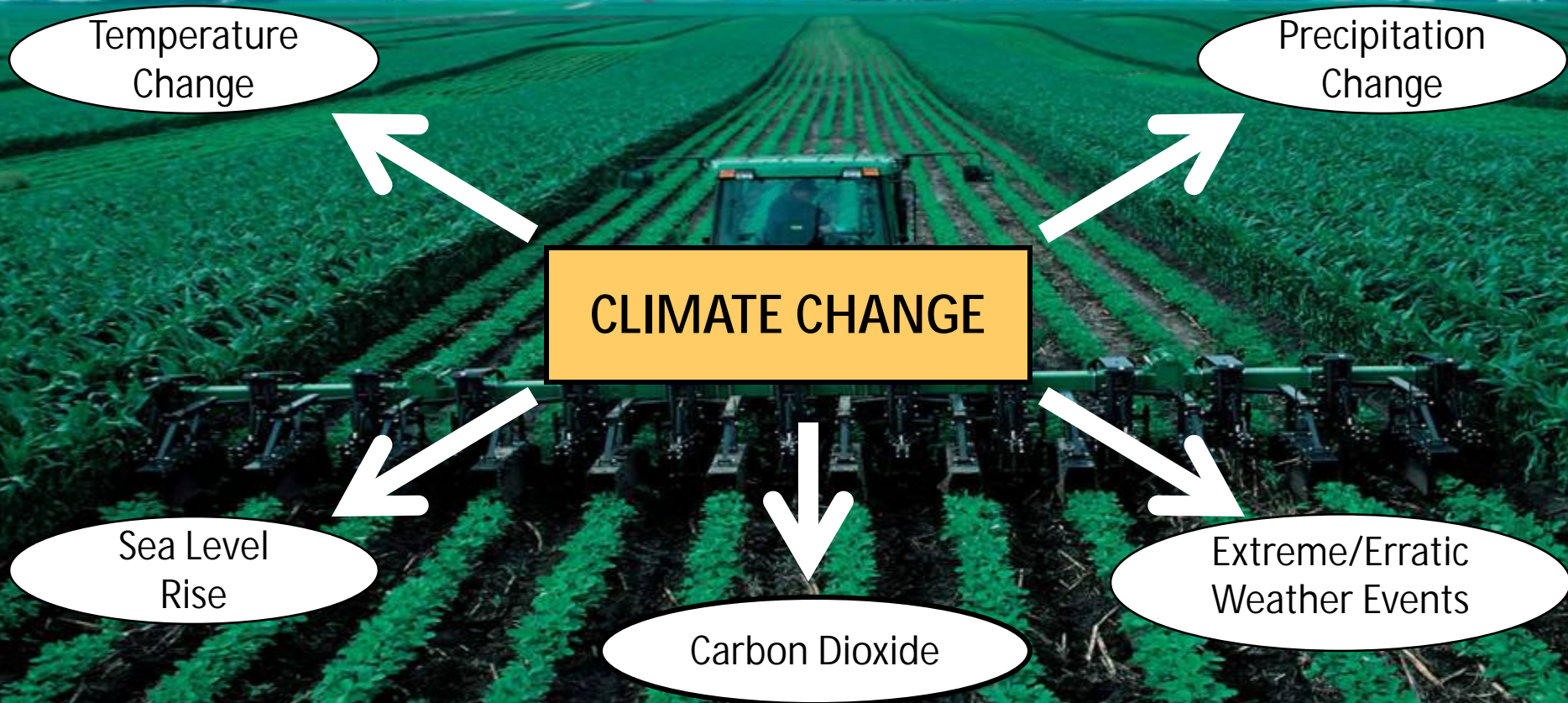


*To provide for a growing population:  
We will want more of it all.*





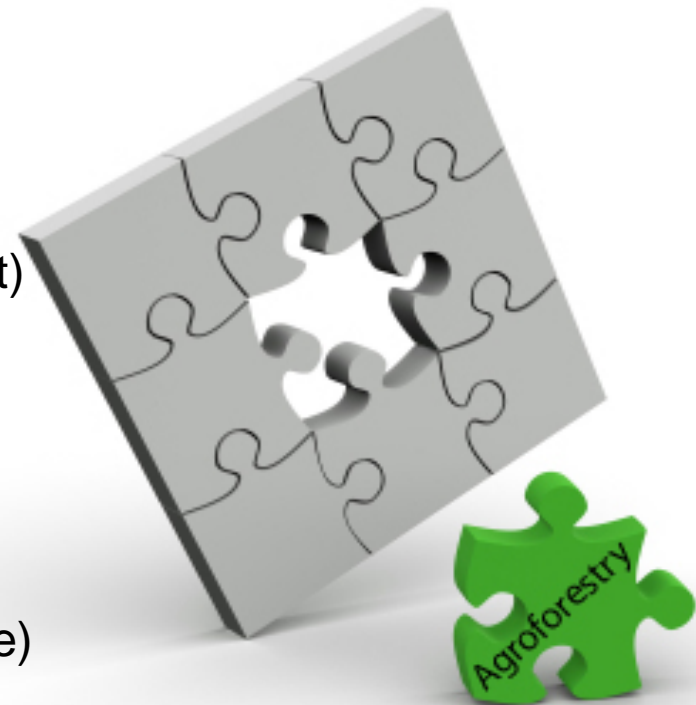
# Realizing Agriculture's Potential?





# Many Actions for Building Climate-Ready Agriculture

- Conservation tillage
- Crop rotations
- Crop species
- Irrigation management
- Fertilization (type, timing, placement)
- Grazing (species, rotations)
- Cover crops
- Perennial crops
- Eliminate fallow
- Converting (i.e., cropland to pasture)



***Agroforestry: providing ReLeaf to Ag***



# Agroforestry: one strategy with multiple services

- 🌿 Diversity of income
  - 🌿 Crop protection & enhancement
  - 🌿 Livestock protection
  - 🌿 Pollinator services
  - 🌿 Biological pest control
  - 🌿 Protection of soil resources
  - 🌿 Water & air quality
  - 🌿 Wildlife habitat
  - 🌿 Recreational opportunities
  - 🌿 Aesthetics
- .....and more.

*....the right trees in the right places for the right jobs.*



# Agroforestry: A 'Leatherman' w/in the 'CC-Integrated' Toolbox for Agriculture

## Mitigation

- 🌿 Sequestering carbon (C)
- 🌿 Reducing GHG emissions



## Adaptation

- 🌿 Reducing threats & enhancing resilience
- 🌿 Facilitating species migration

*....While providing other services*

# Carbon Sequestration Potential – 2 Options

## Mead Farm – Nebraska (50 years)

Option	Ha	%total	MT CO <sub>2</sub>	MT CO <sub>2</sub> /ha/yr
Conservation tillage only	254 No-tillage	100	9,203*	1.17-0.18
			<b>9,203</b>	

\*COMeT-VR (Brenner et al.)

Schoeneberger, Brandle & Zhou

# Carbon Sequestration Potential – 2 Options

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Conservation tillage only	254 No-tillage	100	9,203*	1.17-0.18
			<b>9,203</b>	
Conservation tillage & windbreaks	241 No-tillage	95	8,712*	1.17-0.18
	13 Windbreaks	5	7,416	2.36-17.23
			<b>16,128</b>	

\*COMeT-VR (Brenner et al.)

Schoeneberger, Brandle & Zhou

# COMET Farm - Carbon & Greenhouse Accounting System

The screenshot shows the website for COMET Farm, a Whole Farm and Ranch Carbon and Greenhouse Gas Accounting System. The browser address bar shows the URL [cometfarm.nrel.colostate.edu](http://cometfarm.nrel.colostate.edu). The navigation bar includes the COMET Farm logo, logos for NRCS, USDA, and Colorado State University, and a description of the system. It also features a navigation menu with 'HOME', 'TOOL', 'INFO', and 'HELP', along with a '(Sign in or Register)' link and social media icons for Facebook, Google+, and Twitter.

**What is COMET-Farm?**

COMET-Farm is a whole farm and ranch carbon and greenhouse gas accounting system.

The tool guides you through describing your farm and ranch management practices including alternative future management scenarios. Once complete, a report is generated comparing the carbon changes and greenhouse gas emissions between your current management practices and future scenarios.

[Start Using COMET-Farm](#)

The footer contains seven navigation icons with corresponding text:

- Why should I use COMET-FARM?
- USDA GHG methods
- What information do I need?
- How are my results calculated?
- Is my information safe?
- How do I use COMET-FARM?
- Overview video



# COMET Farm - Carbon & Greenhouse Accounting System

The screenshot displays the COMET Farm web application interface. At the top, the logo for COMET Farm is on the left, followed by logos for NRCS, USDA, and Colorado State. To the right, there is a navigation menu with links for HOME, TOOL, and INFO, and a sign-in/register button. Below the header, the main content area is titled "Step 1 Activities". On the left, there is a "Select a Project" section with a "Create Demo Project" link and a list of existing projects, including "Project 1" with delete and rename options. A "Create New Project" button is located below the project list. On the right, the "Selected Activities for the Current Project:" section shows a list of activity categories for "Project 1". The categories are: "All Categories - Full Accounting", "Cropland, Pasture, Range", "Animal Agriculture", "Agroforestry", and "Forestry". The "Agroforestry" checkbox is checked and circled in blue. A "Define Activities >>" button is located at the bottom of the activity selection area.

COMET Farm | NRCS USDA Colorado State | Whole Farm and Ranch Carbon and Greenhouse Gas Accounting System. ( Sign in or Register ) f g+

HOME TOOL INFO

Step 1  
Activities ▾

**Select a Project** [ Create Demo Project ]  
Existing Projects  
▶ Project 1  
[ delete ] [ rename ]  
**Create New Project**

**Selected Activities for the Current Project:**  
Project 1

- All Categories - Full Accounting
- Cropland, Pasture, Range
- Animal Agriculture
- Agroforestry
- Forestry

**Define Activities >>**

# COMET Farm - Carbon & Greenhouse Accounting System

## How do I use COMET-Farm™?

**1** Choose the main activities to investigate.

- Cropland, Pasture, and Rangeland
- Livestock
- On-Farm Energy

Step 1  
Activities

- All Categories - Full Access
- Cropland, Pasture, and Rangeland
- Livestock

Define Activities

**2** Describe the locations and management practices for the selected activities. Describe future management scenarios to compare with current practices.

[What information will I need to provide?](#)

**3** Run the report.

Choose Scenario	Baseline Actuals	Scenario	Scenario #1 Actuals	Scenario #2 Actuals
Total all periods (Summed CO <sub>2</sub> equivalent/year)	626.4		696.0	776.4
Scenario #1 Actuals	626.4	0.0	69.6	150.0
CO <sub>2</sub> Soil & Biomass Carbon Change (Summed/year)	23.8	0.0	13.2	26.8
Net Emissions (Summed CO <sub>2</sub> equivalent/year)	5.5	0.0	5.3	5.3
CO <sub>2</sub> Emissions (Summed CO <sub>2</sub> equivalent/year)	46.0	0.0	45.7	45.7
Scenario #2 Actuals	626.4	113.6	740.0	766.4
CO <sub>2</sub> Soil & Biomass Carbon Change (Summed/year)	23.8	0.0	13.2	26.8
Net Emissions (Summed CO <sub>2</sub> equivalent/year)	5.5	113.6	5.3	5.3
CO <sub>2</sub> Emissions (Summed CO <sub>2</sub> equivalent/year)	46.0	113.6	45.7	45.7

# Agroforestry: A 'Leatherman' w/in the 'CC-Integrated' Toolbox for Agriculture

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- 🌿 Facilitating species migration

*....While providing other services*

# Agroforestry: Reducing Threats & Enhancing Resiliency in Ag-Lands



Risk management difficult in monocultures and annual-only systems.



Mixing in woody plants offers:

- 🌿 Crop diversification
- 🌿 Structural and functional diversity





# Agroforestry: Reducing Threats & Enhancing Resiliency in Ag-Lands

- 🌿 Microclimate modification
- 🌿 Habitat diversification
- 🌿 Maintenance & protection of natural resource services
- 🌿 Diversified production opportunities



Ø Yield increases due to wind protection (*Kort 1988*)  
(average of 15% in winter wheat, 25% in soybeans, 12% in corn)

Ø Higher grain yields in alley-grown wheat during drought compared to the control. (*Rivest et al. 2013*)

# Microclimate modification: forage



- Ø Air and soil temperatures too cold or too warm for forage growth can be favorably modified by silvopasture systems to create extended production. (*Feldhake 2002; Moreno et al. 2007*)
- Ø Higher levels of CO<sub>2</sub> reduce forage quality. Shading may increase forage quality (increasing protein content while reducing fiber). (*Morgan et al. 2004; Kallenbach et al. 2006*)

# Microclimate modification: livestock



- Ø Livestock shelterbelts increased feed efficiency 13-50% in winter and milk production by 9-76%. (*Hintz 1983*)
- Ø Cattle provided with shade reached their target body weight 20 days earlier than those without shade. (*Mitlöhner et al. 2001*)





# Where Can I Find Climate Change Information?

Related to Farming

# USDA Climate Hubs

- Develop and deliver science-based, region-specific information and technologies
- To agricultural and natural resource managers
- That enable climate-informed decision-making, and
- To provide access to assistance to implement those decisions.

# USDA Climate Hubs



<https://www.climatehubs.oce.usda.gov/>

# Southern Plains Climate Hub

Climate Hubs Partners Tools Regional Assessments Regional Data & Research Educational Materials About Us

Home » Southern Plains Hub

## Welcome to the USDA Southern Plains Climate Hub

The Southern Plains Climate Hub develops and delivers regional, science-based information to partners and producers in Kansas, Oklahoma, and Texas that enables climate-smart decision-making.



May 31st, 2013 Worlds Largest Tornado (2.5) miles Wide EL Reno, OK

Facebook Twitter Email RSS YouTube Flickr

### Southern Plains Hub



### Popular Topics:

- > Southern Plains Regional Vulnerability Assessment - [En Español](#)
- > Southern Plains USDA Building Blocks Report
- > Subscribe to ARS AgResearch

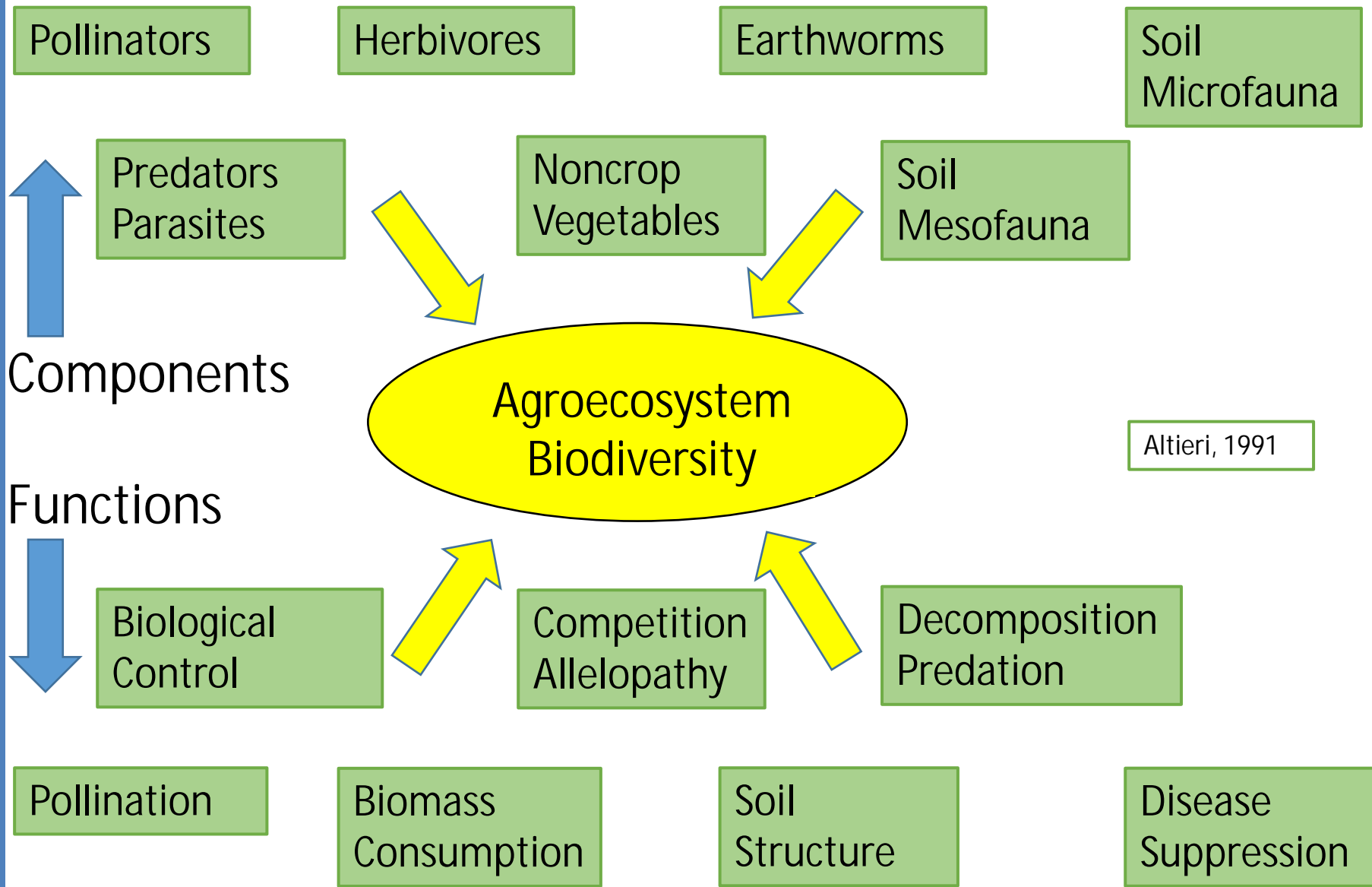


# Biodiversity

- Different Scales
  - field
  - farm
  - watershed
- Intentionally
  - crop rotation
  - variety of crops
  - cover crops
  - windbreaks
  - leaving untilled areas
- Unintentional
  - stuff happens

# Benefits of Encouraging Diversity:

- Improve soil quality
- Support insect, weed and disease control
- Encourage beneficial organisms
- Reduce economic risk



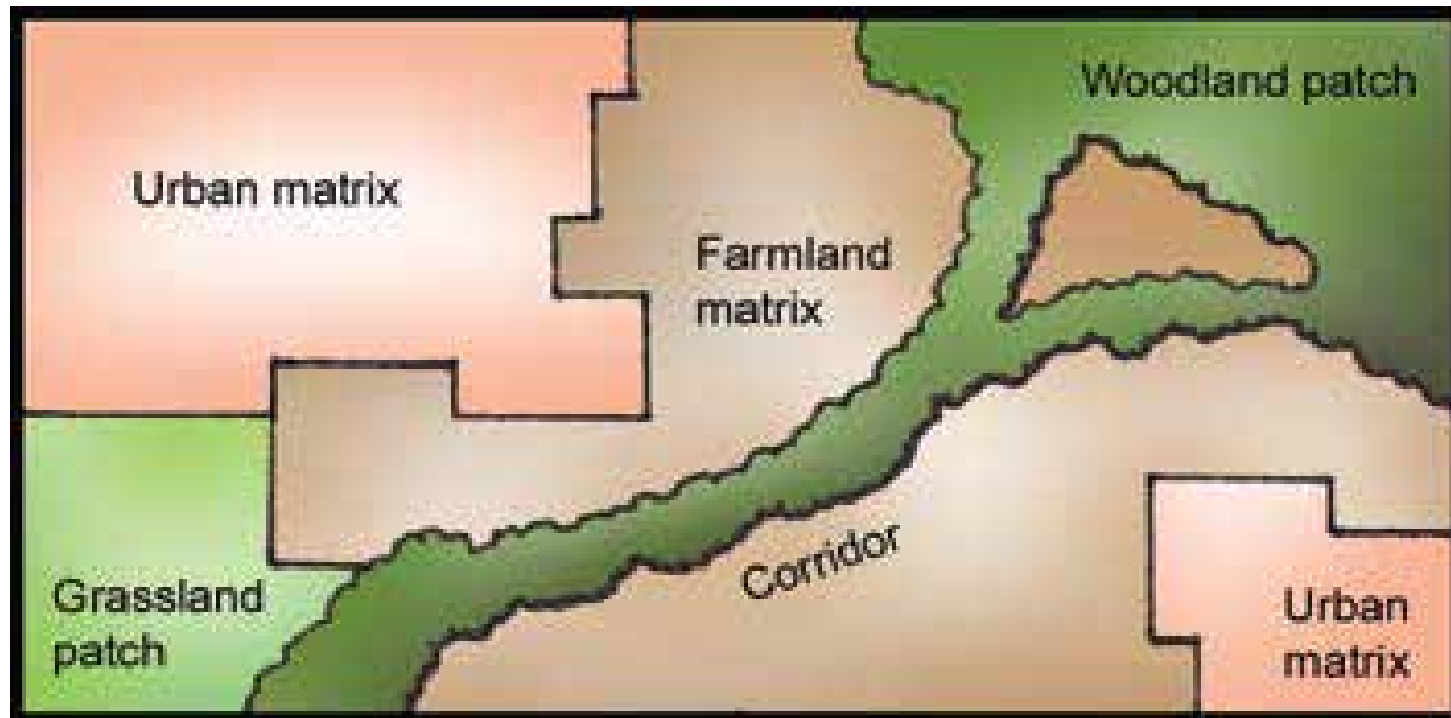
# Habitat diversification



- Ø Agroforestry plantings can provide critical habitat to native pollinators, and
- Ø Natural enemies to crop pests.

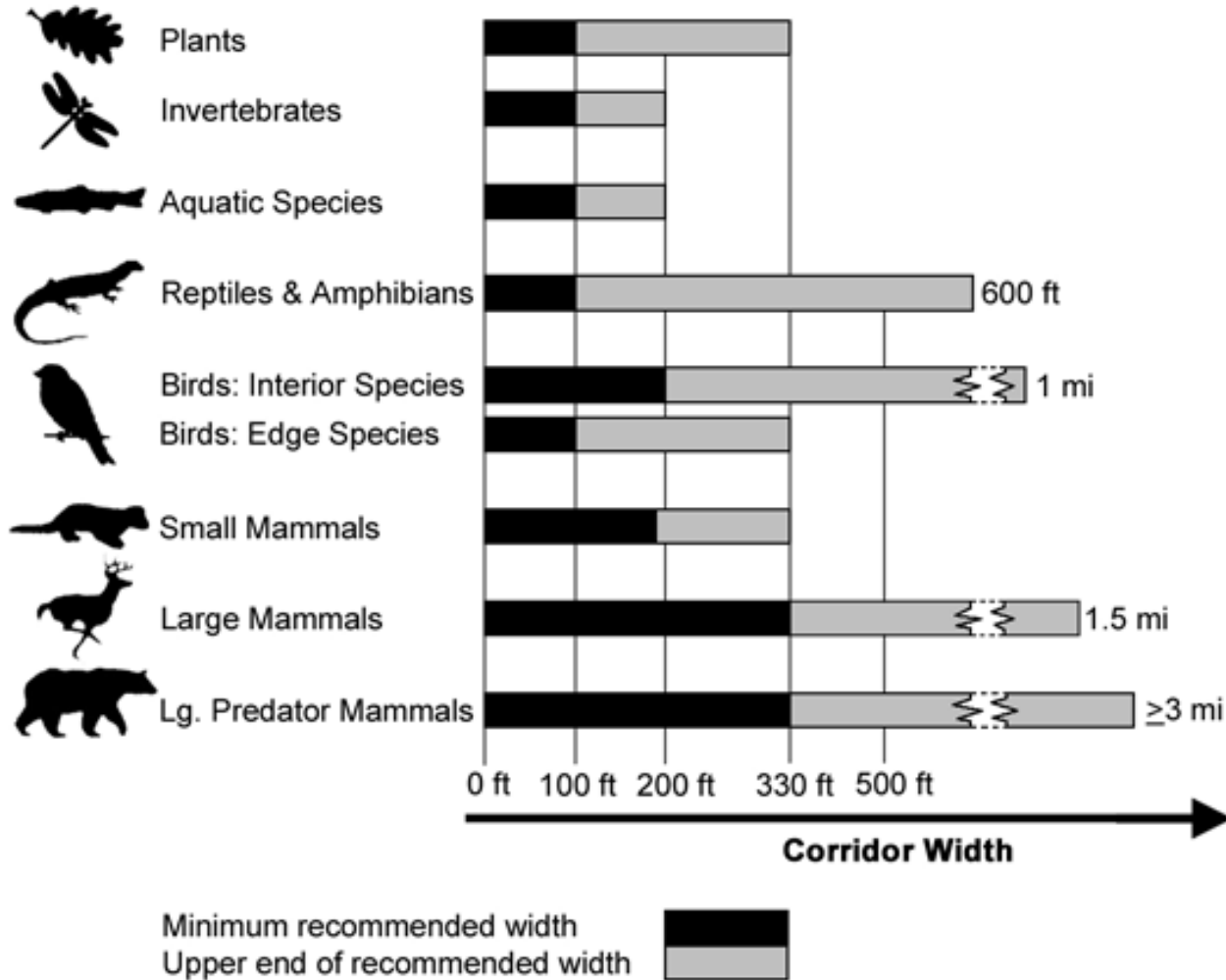


# Many Agroforestry Practices Can Function as Corridors



Critical travel corridors in the highly fragmented ag/urban landscape.

## Corridor Width Summary



Source: Conservation Buffers – Design Guidelines for Buffers, Corridors and Greenways by Gary Bentrup

# Habitat diversification: Connectivity



- Ø Critical habitat for 'every day' survival in-place.
- Ø Critical migration corridors to escape climate change-impaired habitat.
- Ø Critical habitat to escape extreme weather event - FLOODS



# Agroforestry in the Farm Bill

	Alley Cropping	Riparian Forest Buffer	Windbreak	Silvopasture	Forest Farming	Tree Planting
EQIP	F	F	F	F	F	F
CSP	-	S	S	S	S	S
ACEP	-	F,E	-	F,E	F,E	F,E
CRP	F,R	F,R	-	-	-	F,R
CCRP	-	F,I,R	F,I,R	-	-	F,I,R

F = Financial Assistance

S = Stewardship Payments

R = Rental Payment

I = Incentive Payment

E = Easement

\*not all practices or programs are available in all states.

A young child with light hair, wearing an orange and blue plaid shirt, is smiling and holding a light-colored stuffed animal. The child is standing in a field of tall, dry grass. In the background, another person wearing an orange and white striped shirt is partially visible, holding a long, thin object. The scene is bathed in warm, golden light, suggesting late afternoon or early morning.

# Transforming Our Farms, Our Food and Our Future