



# Agroforestry Extension for the PNW

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and Natural Resources*

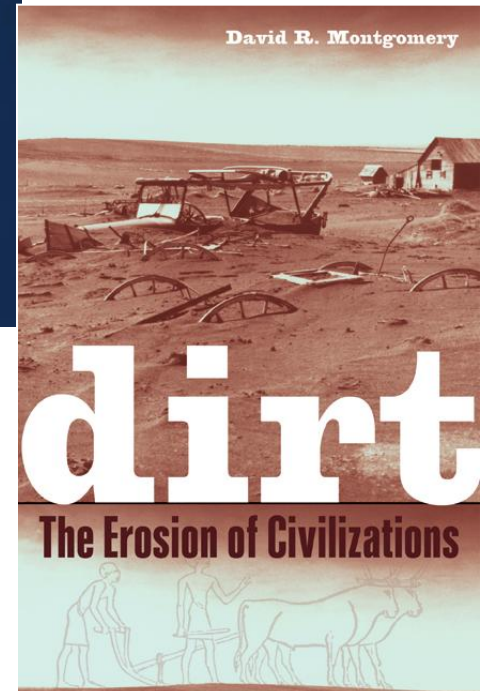
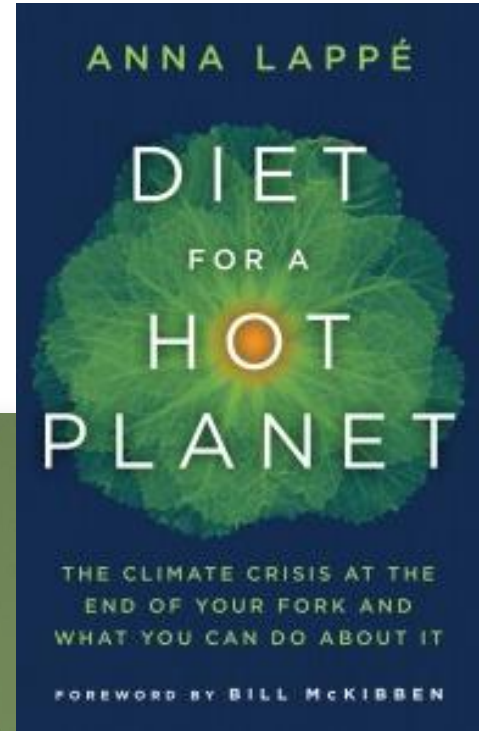
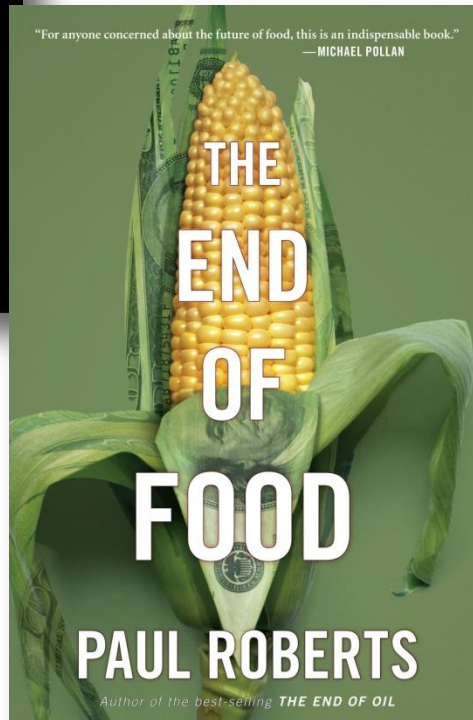
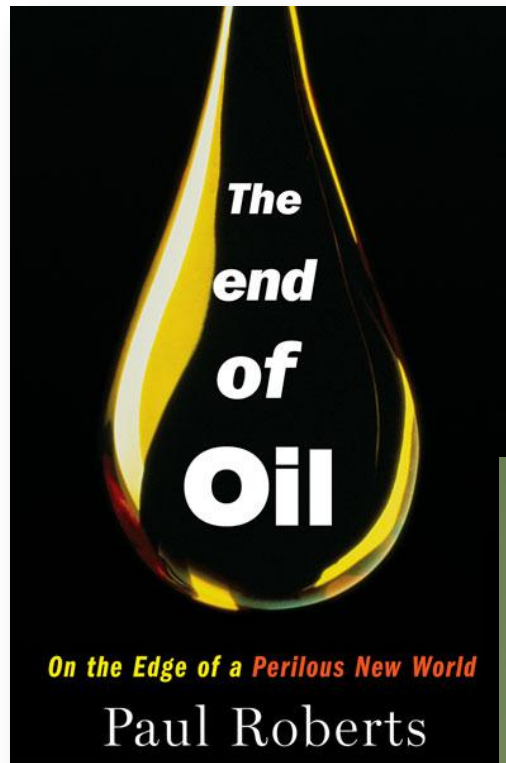
**Goal: Discuss the status of sustainable agriculture in the PNW and the role that trees on the farm can play in sustainable agriculture, with particular emphasis on carbon storage.**

1. Global Grant Challenges related to agriculture and forestry
2. A quick snapshot of PNW agriculture and the manifestation of these challenges
3. Targeted high-impact strategies for integrating trees into PNW ag systems
4. An angle for agroforestry integration not often considered ...

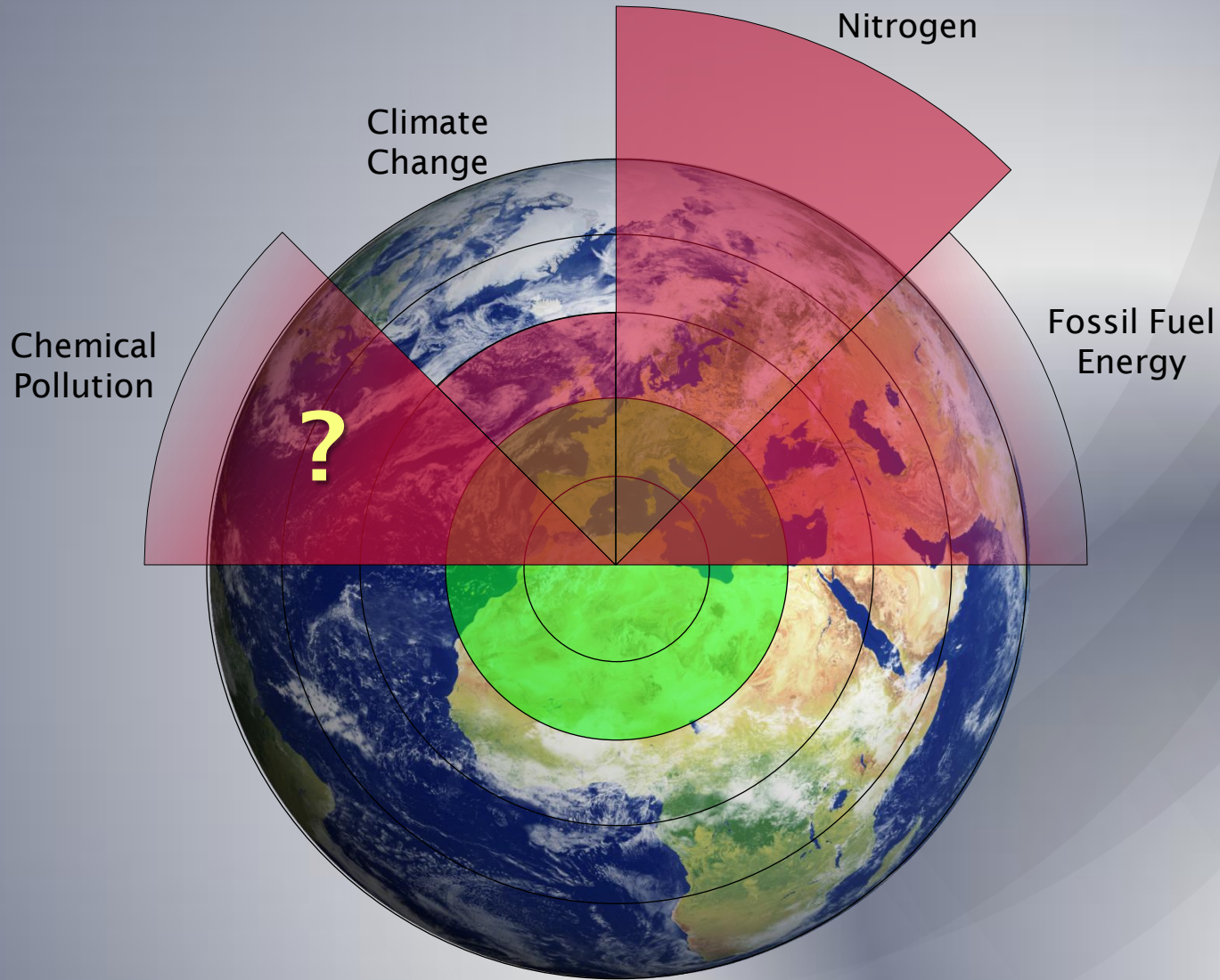


**CLIMATE  
FRIENDLY FARMING™**

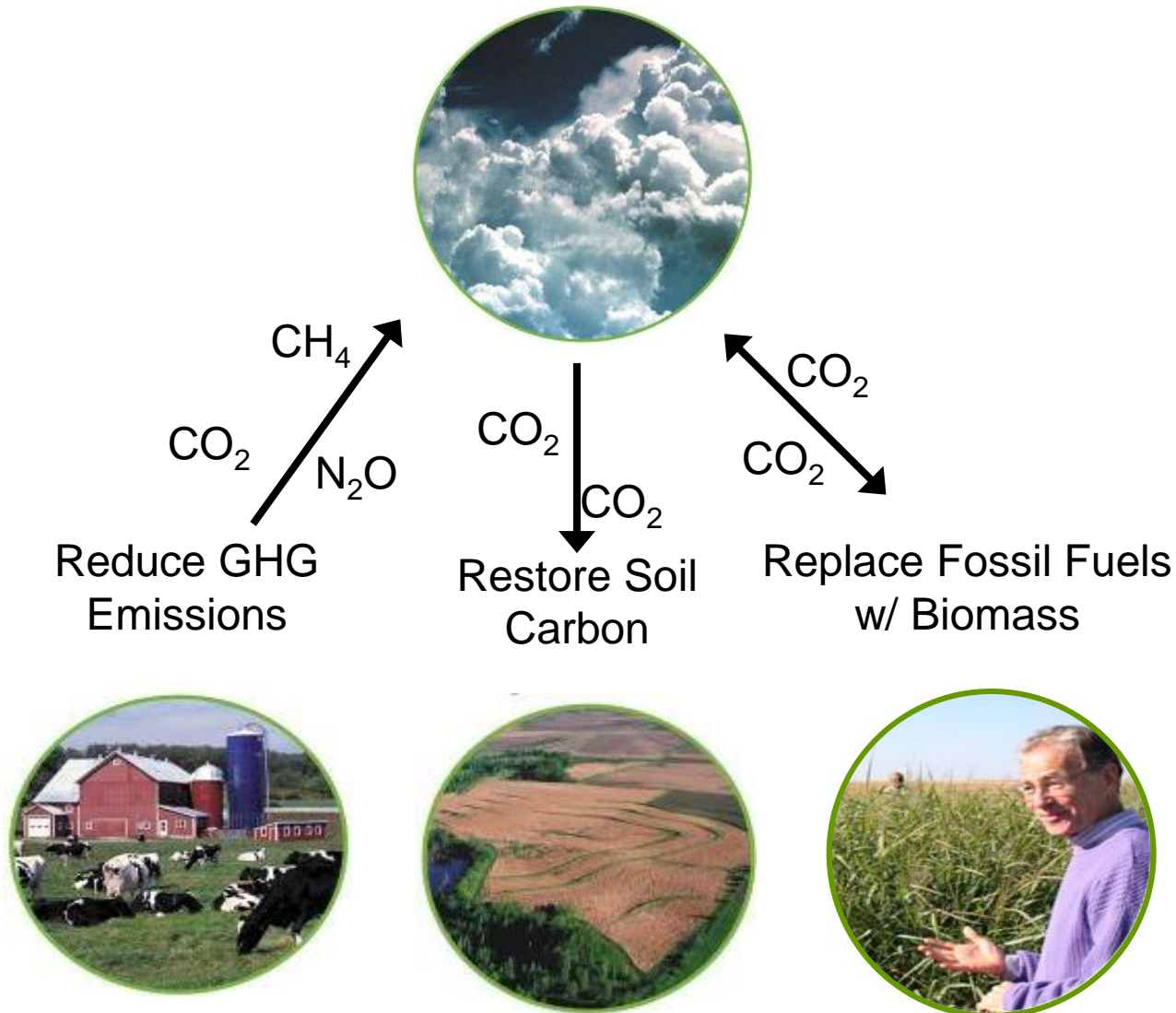
# Global Grand Challenges Facing 21<sup>st</sup> Century Agriculture



# Beyond the Boundary

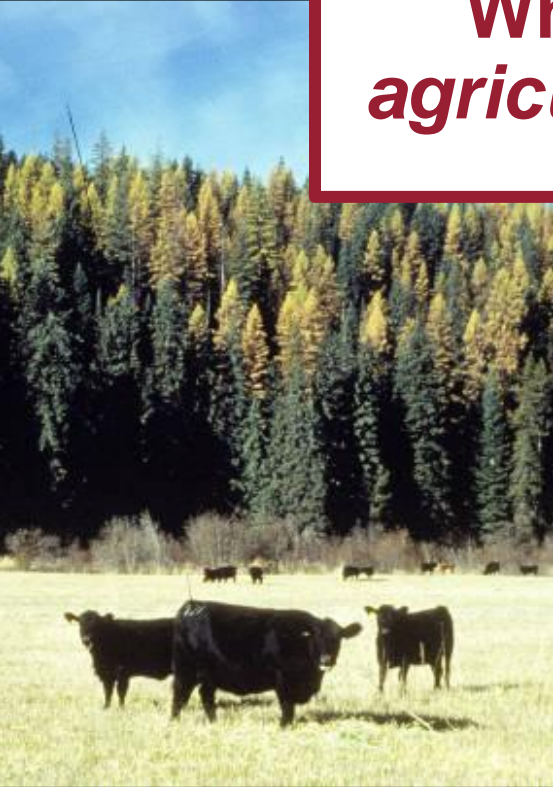


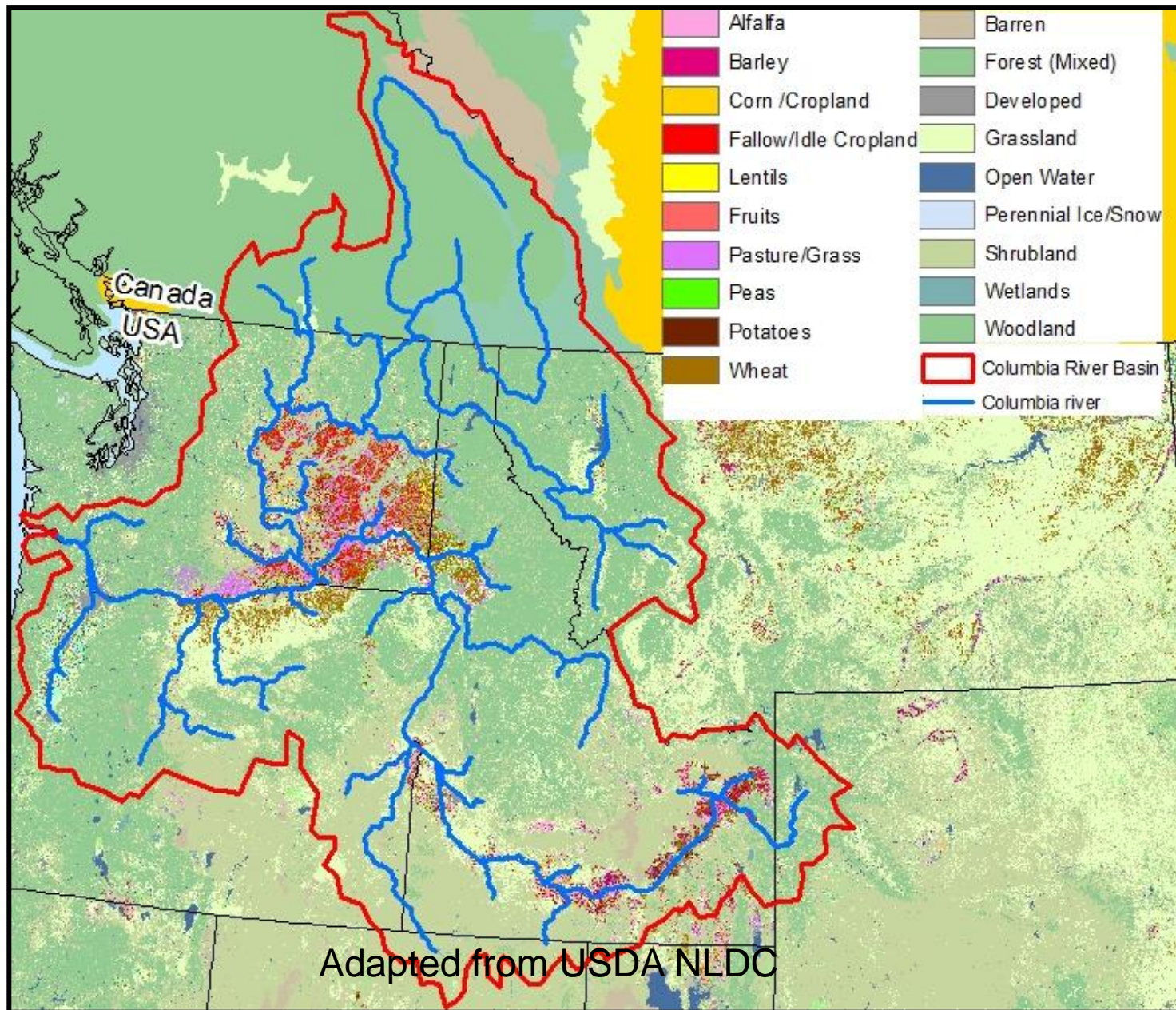
# Climate Friendly Farming™



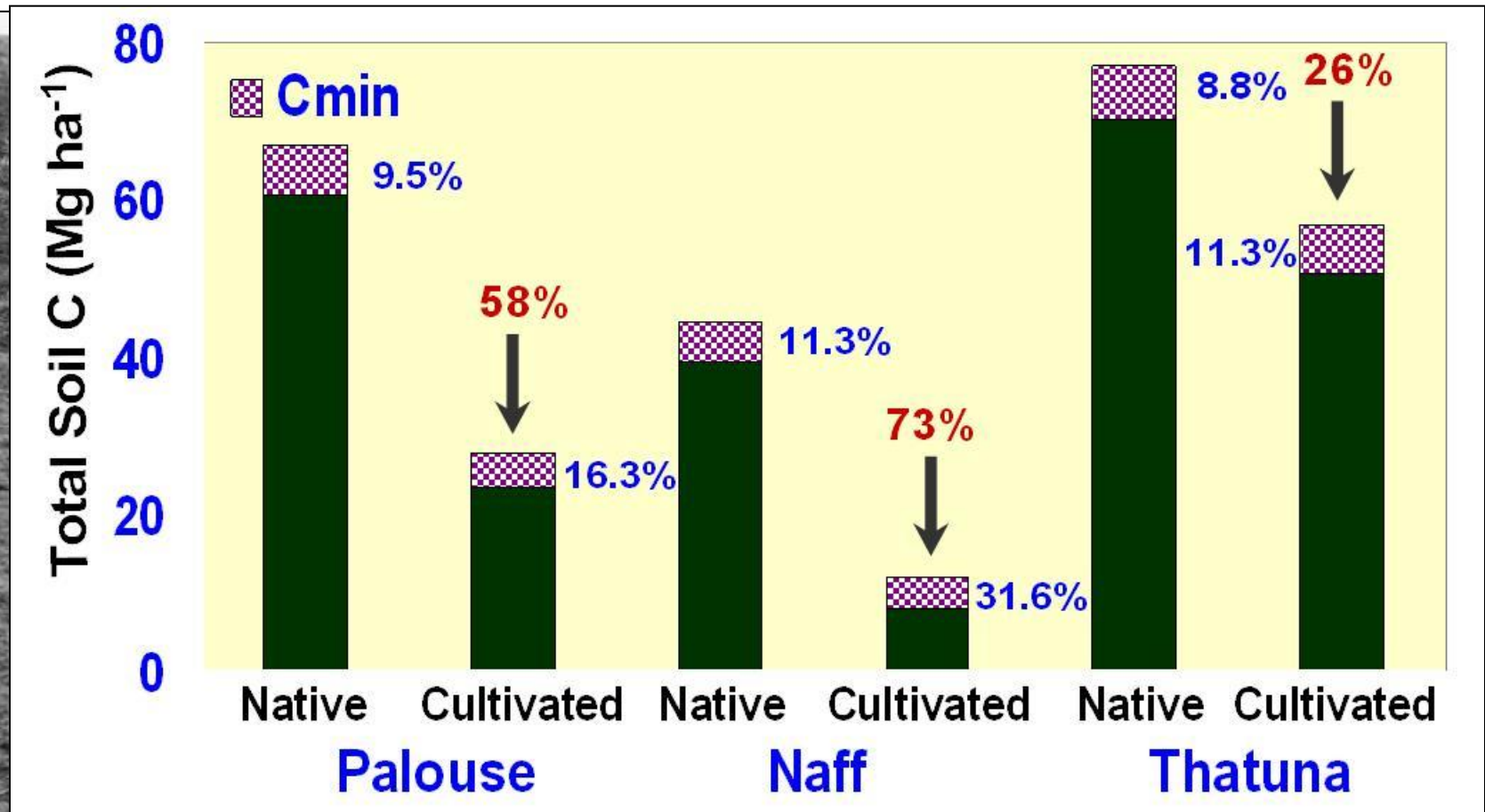


**What does our regional  
*agriculture system* look like?**





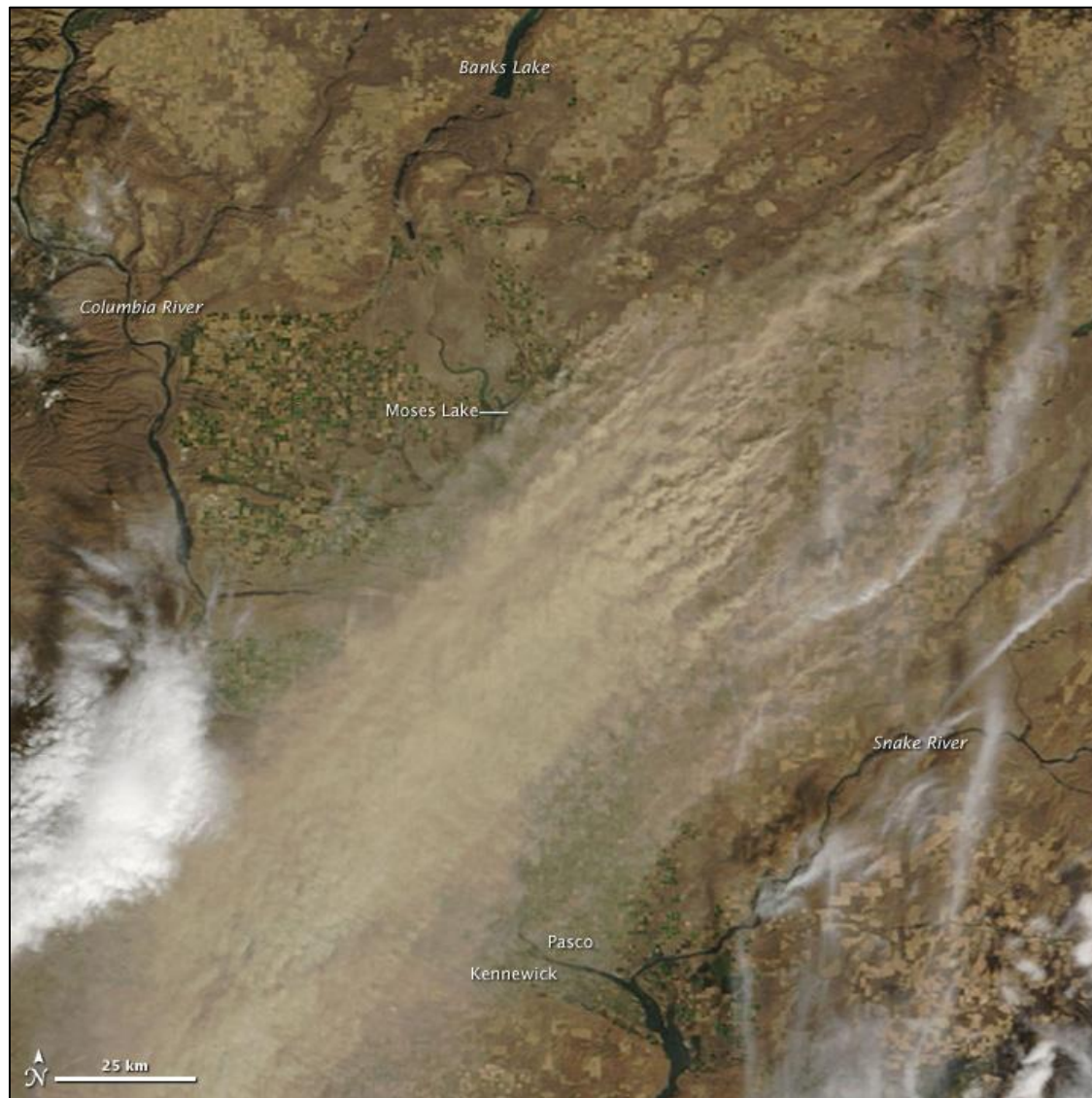
# Historical Carbon Loss from Agricultural Soils



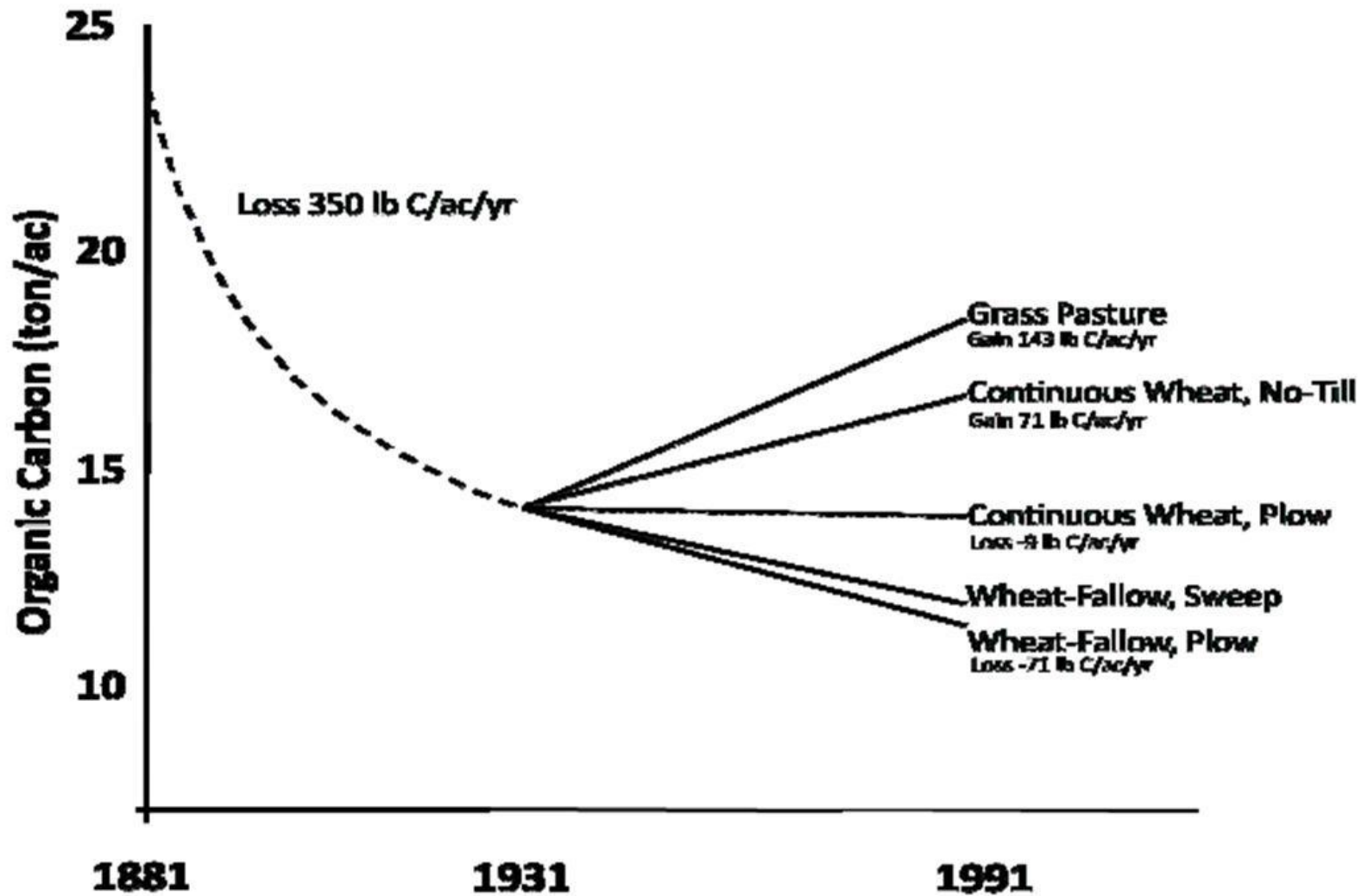
Difference in total soil organic C between native and cultivated soils by soil type near Pullman, WA (0-20 cm).

Portions of these data were published by Purakayastha et al. 2008; Yorgey et al. 2010





## Long-term Soil Carbon Trends w/ Mitigation



# The importance of perennial plants for soils



*Photo used courtesy of the Land Institute, Salinas, KS*



# Pushing the envelope of C Sequestration

<b>Cropping Method</b>	<b>Global Warming Potential (lbs CO<sub>2</sub> equiv / acre / year)</b>
<b>Conventional</b>	1014.6
<b>No-till</b>	124.6
<b>Organic</b>	364.9
<b>Early Successional</b>	-1877.9

Kellogg Biological Station (Michigan) LTER <http://lter.kbs.msu.edu/>



## **Snow Fences, Wind Breaks: Reducing Wind and Water Erosion**



**Significant \$\$\$ saved for snow removal**

# Trees for biocontrol habitat enhancement, an under-explored opportunity?



# Forage trees as a climate change resiliency strategy for livestock production?



# The down-side of integrating trees and agriculture: Someone will have to pay ...

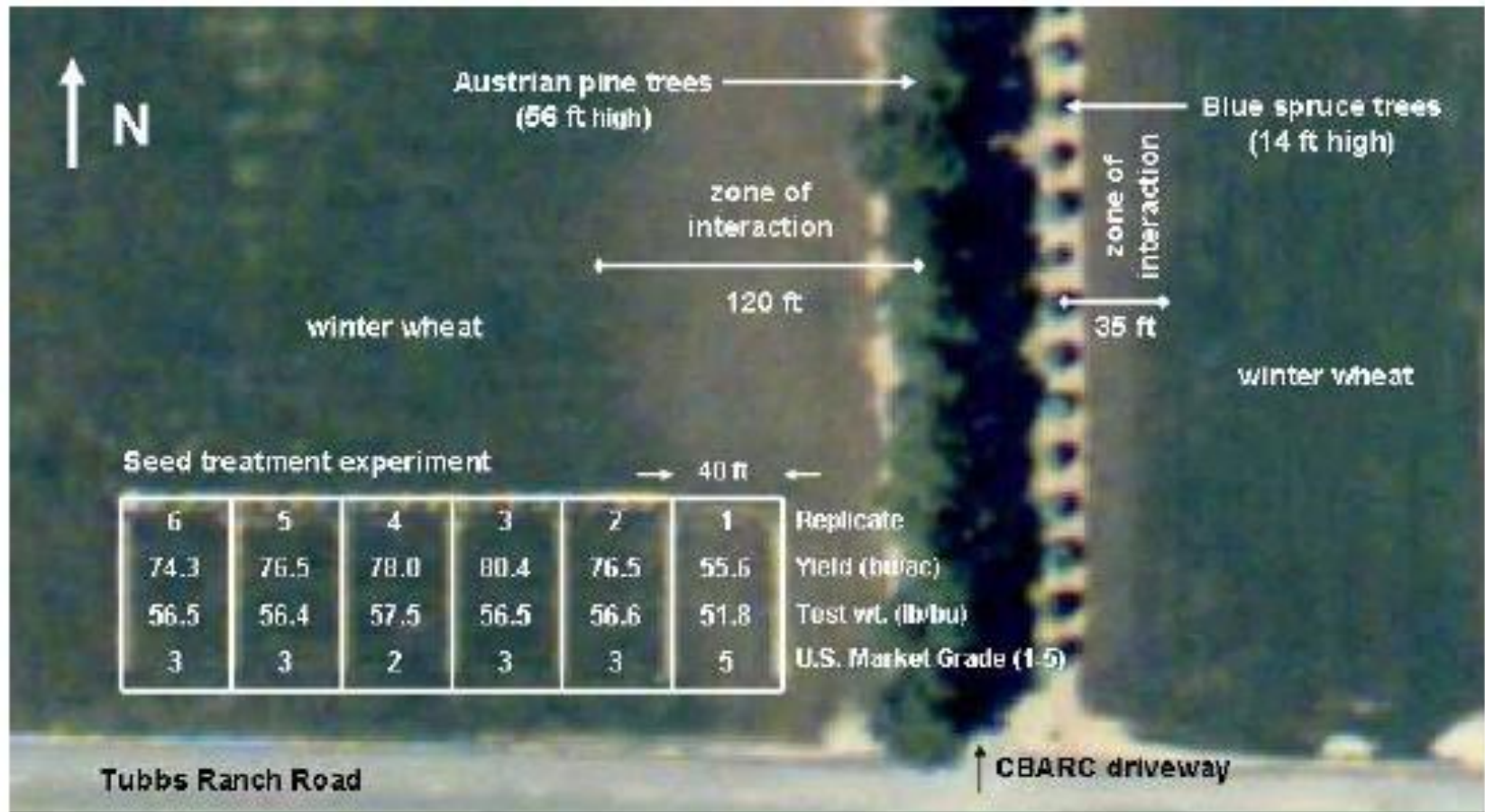


Figure 1. Aerial photograph of the visually apparent tree-crop interaction for winter wheat crops growing adjacent to two rows of trees (each row with a different height) at the Columbia Basin Agricultural Research Center (CBARC) near Pendleton on June 12, 2003. The boxed diagram highlights an experimental area (55 x 240 ft.) composed of six replicates of 11 seed treatment variables growing in 5 x 40-ft. plots oriented in the east-west direction.



# Bioenergy Development: Inter-cropping Switchgrass and Hybrid Poplar



Figure 3. Switchgrass inter-planting on June 9&12, 2011.



Figure 4. Drill rows through poplar harvest debris.



Figure 5. Drill rows through poplar harvest debris. Note N-immobilization.



August, 2011

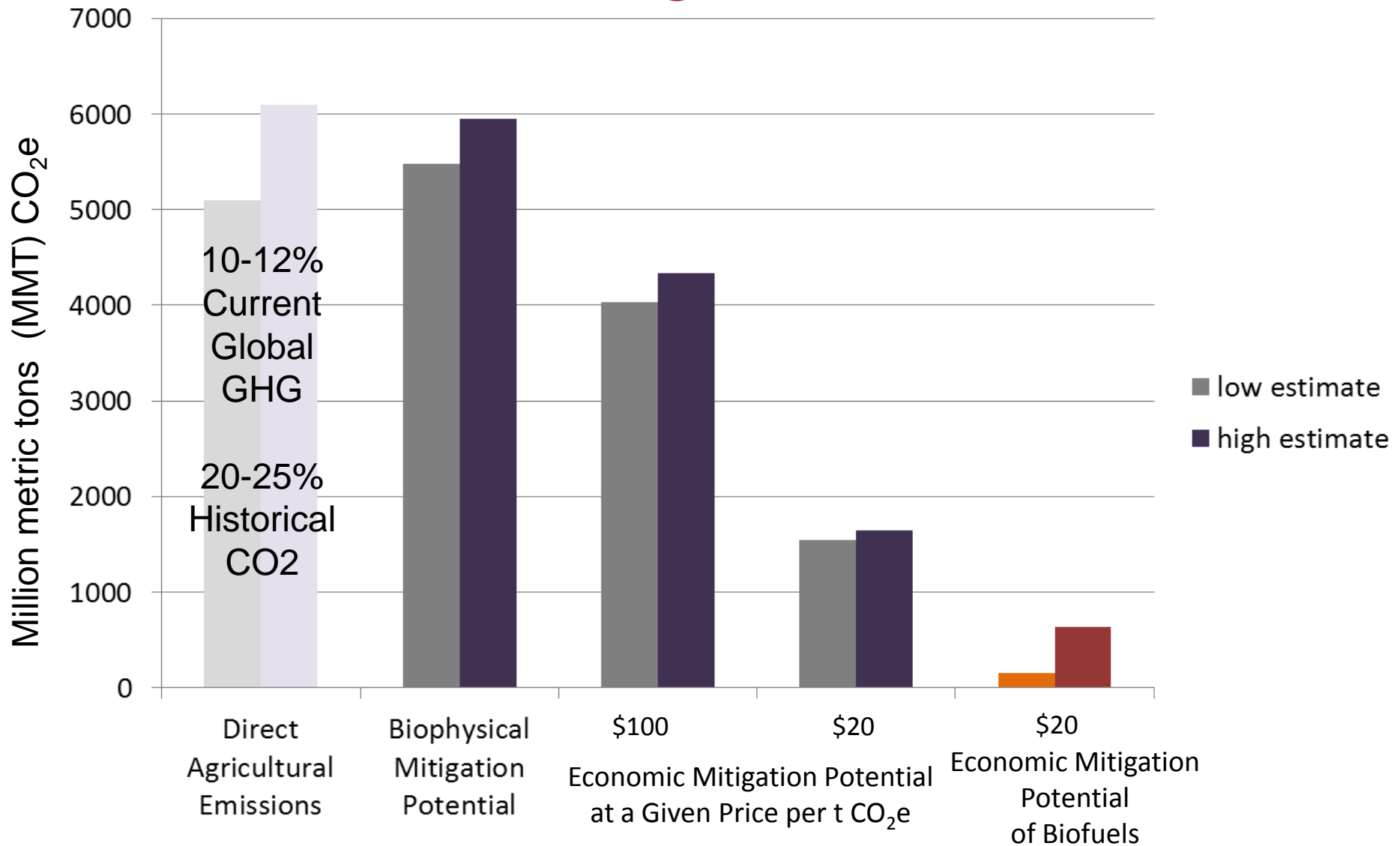


Tree Monitoring & Growth



GHG sampling began in July, 2011

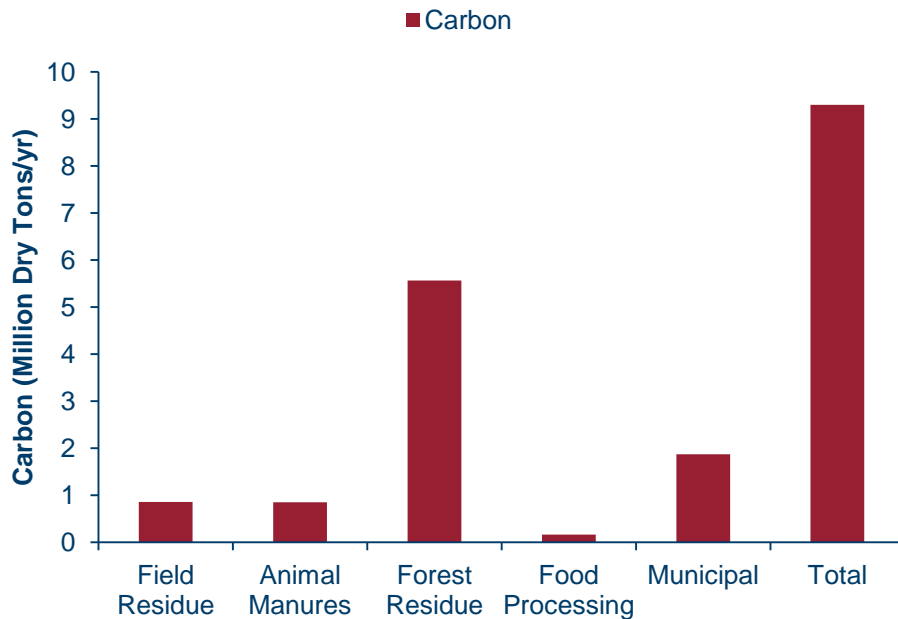
# Estimated Global Economic Mitigation Potentials from Agriculture & Biofuels



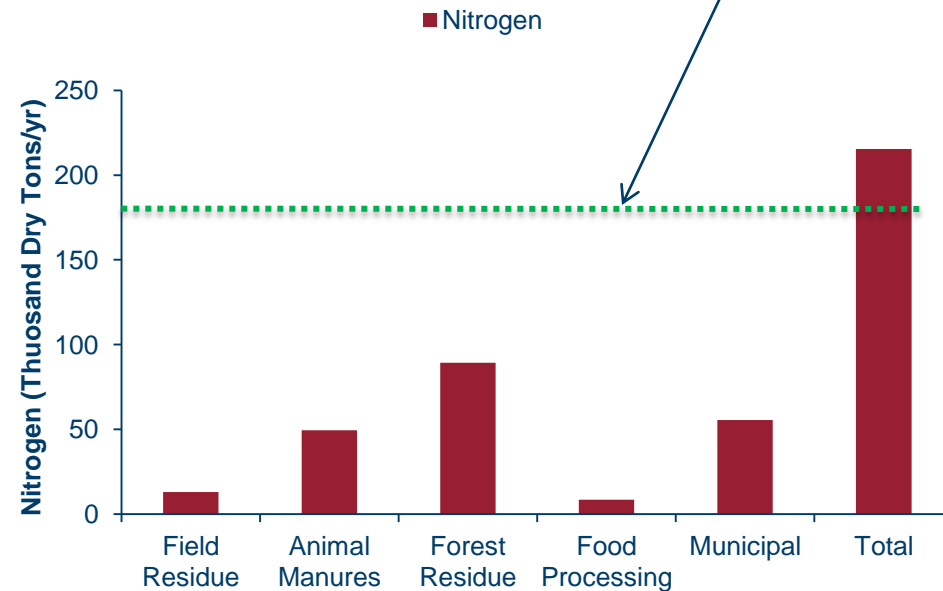
Smith et al. 2008, IPCC 2007

# A new cluster of specialty forest products? Connecting trees and agriculture through soil amendments

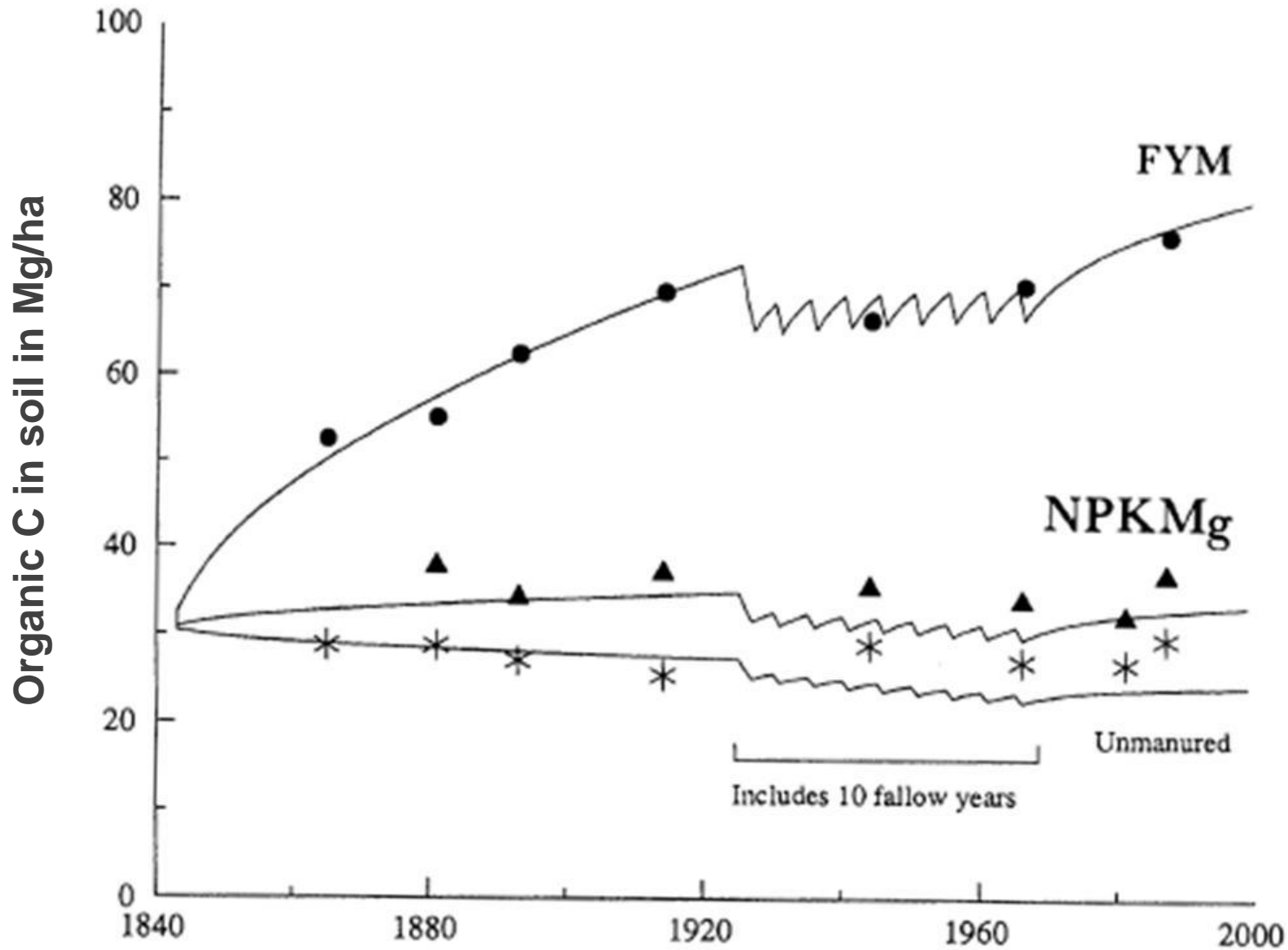
Removing 20% of total C annually ~10% of Washington's Net CO<sub>2</sub>



176,000 MT of synthetic N fertilizer inputs in 2001



# Soil Carbon *Can Be* Increased Significantly Using Residual Organic Residuals



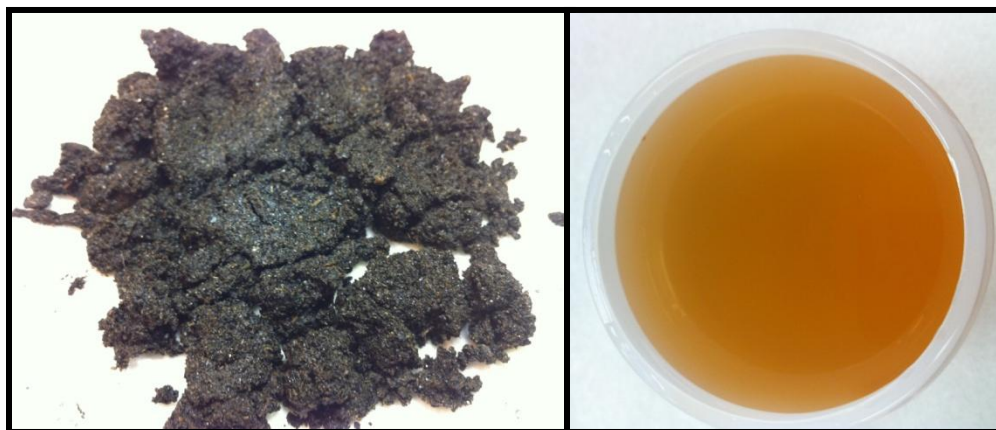
# Current Generation organic Amendments

- Composts, biosolids, manures, etc.:
- Recovered C, N, other nutrients, microbial activity, etc.
- Agronomically expensive to purchase and land apply

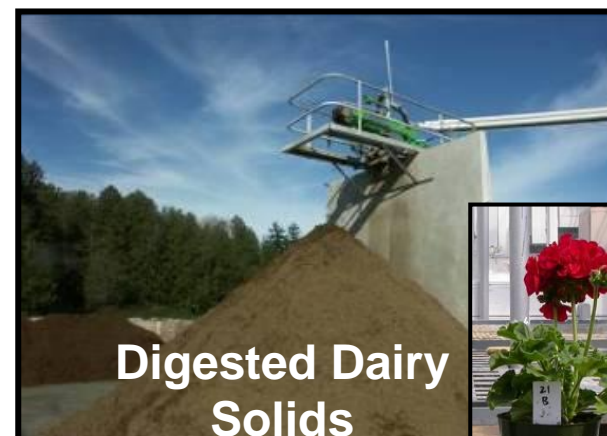


# Next Generation organic Amendments

- Precise, multi-functional amendments derived through bioenergy systems
- All the benefits of 1<sup>st</sup> Gen Amendments in a “*drop-in fertilizer*”
- High impact agronomic and environmental benefits



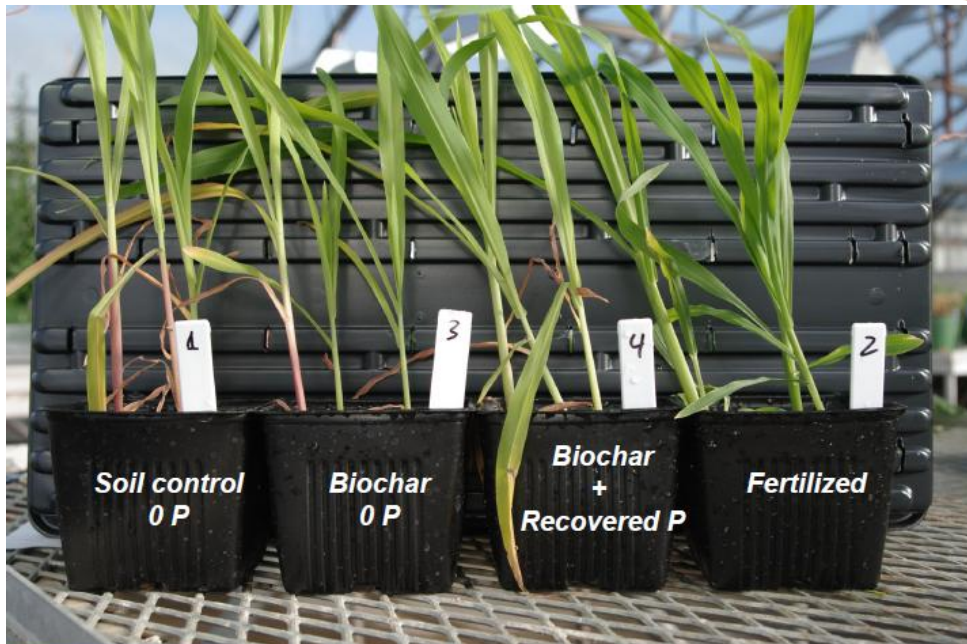
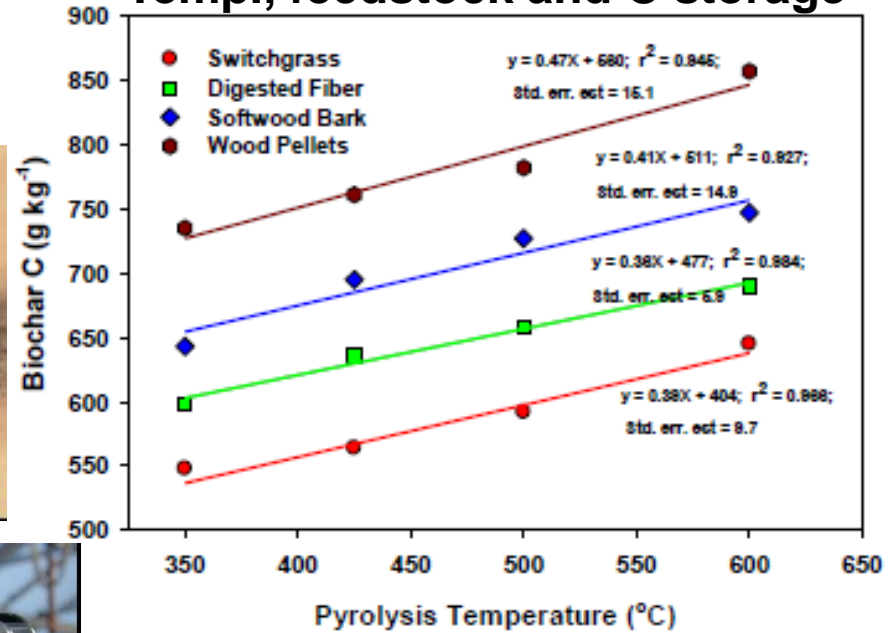
Biomass Derived Fertilizers



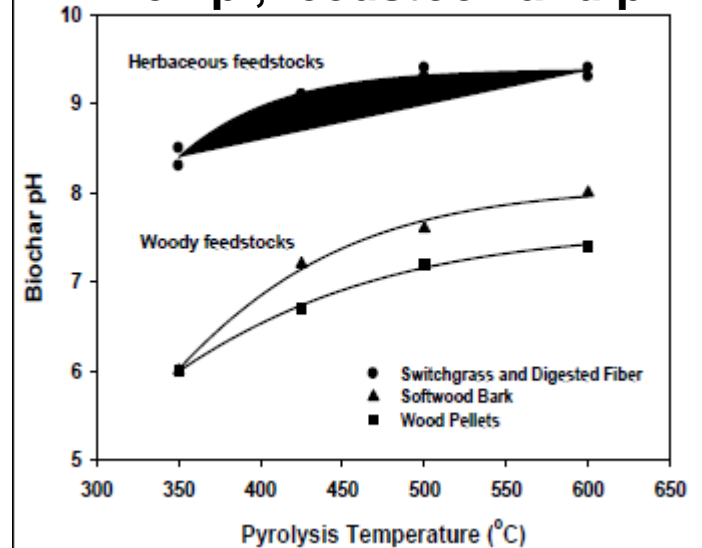
# Woody biochar as an agricultural soil amendment



## Temp., feedstock and C storage



## Temp., feedstock and pH



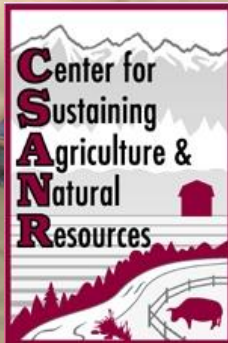
Acknowledgments: Hal Collins, USDA ARS

# Center for Sustaining Agriculture & Natural Resources

*Science in Action to Improve the Sustainability of  
Agriculture, Natural Resources and Food Systems*

- Organic and Biologically Intensive Ag
- Small Farms / Beginning Farmer Education
- Climate Change Mitigation & Adaptation
- Biomass Energy and Products
- Local & Regional Food Systems
- Environmental & Food Footprints
- Water Quantity and Quality

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# Transforming PNW Agriculture



Biofumigation



Compost Technology & Use

Carpenter-Boggs



Next Generation Organic Soil Amendments



Organic Wheat Variety Release



Parasitoid Biocontrol

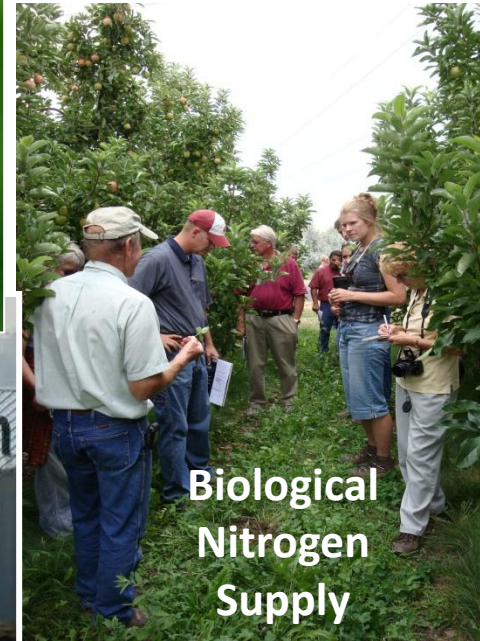
Beers



Sustainable Ag Policy



Biodigesters & BioFertilizers

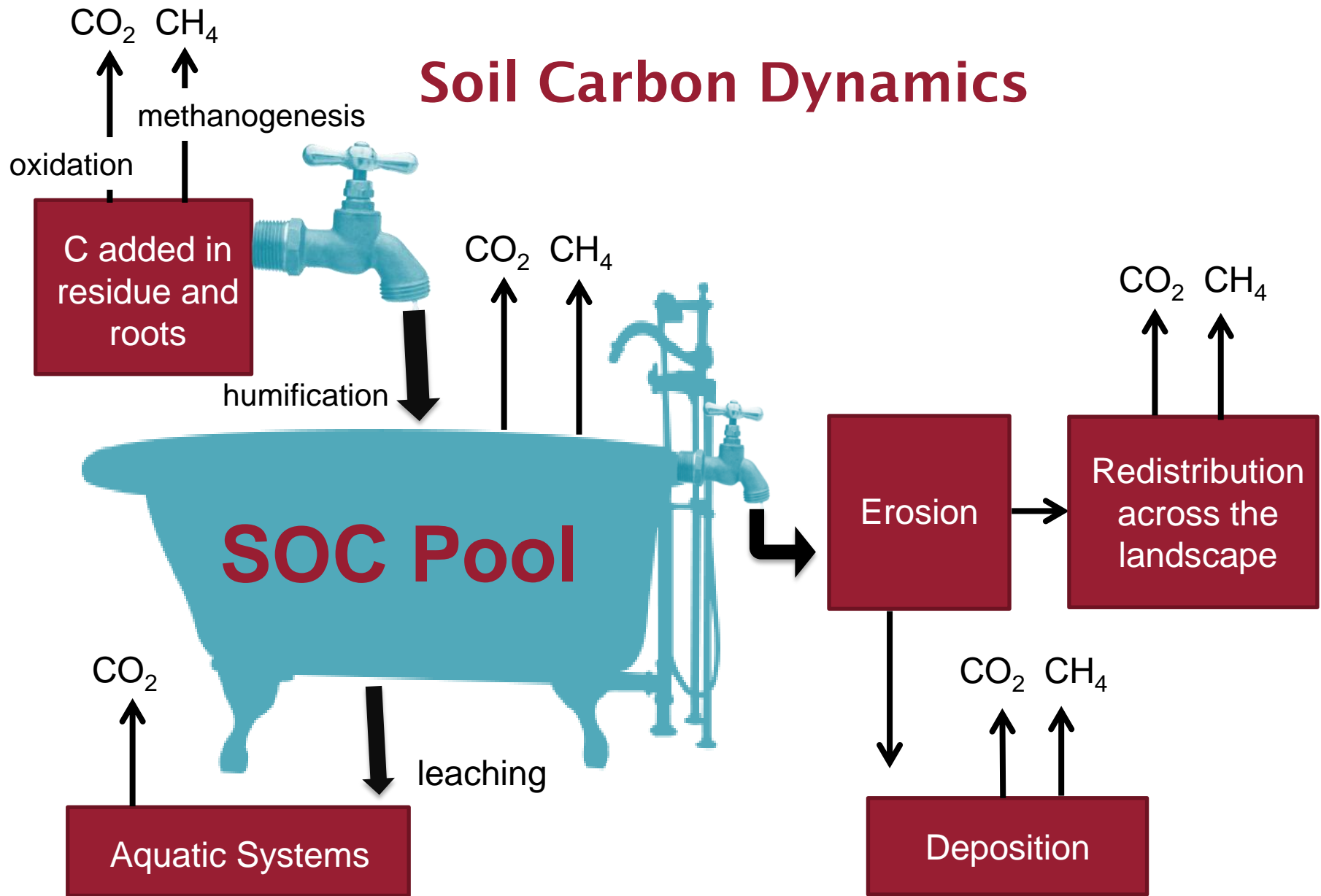


Biological Nitrogen Supply

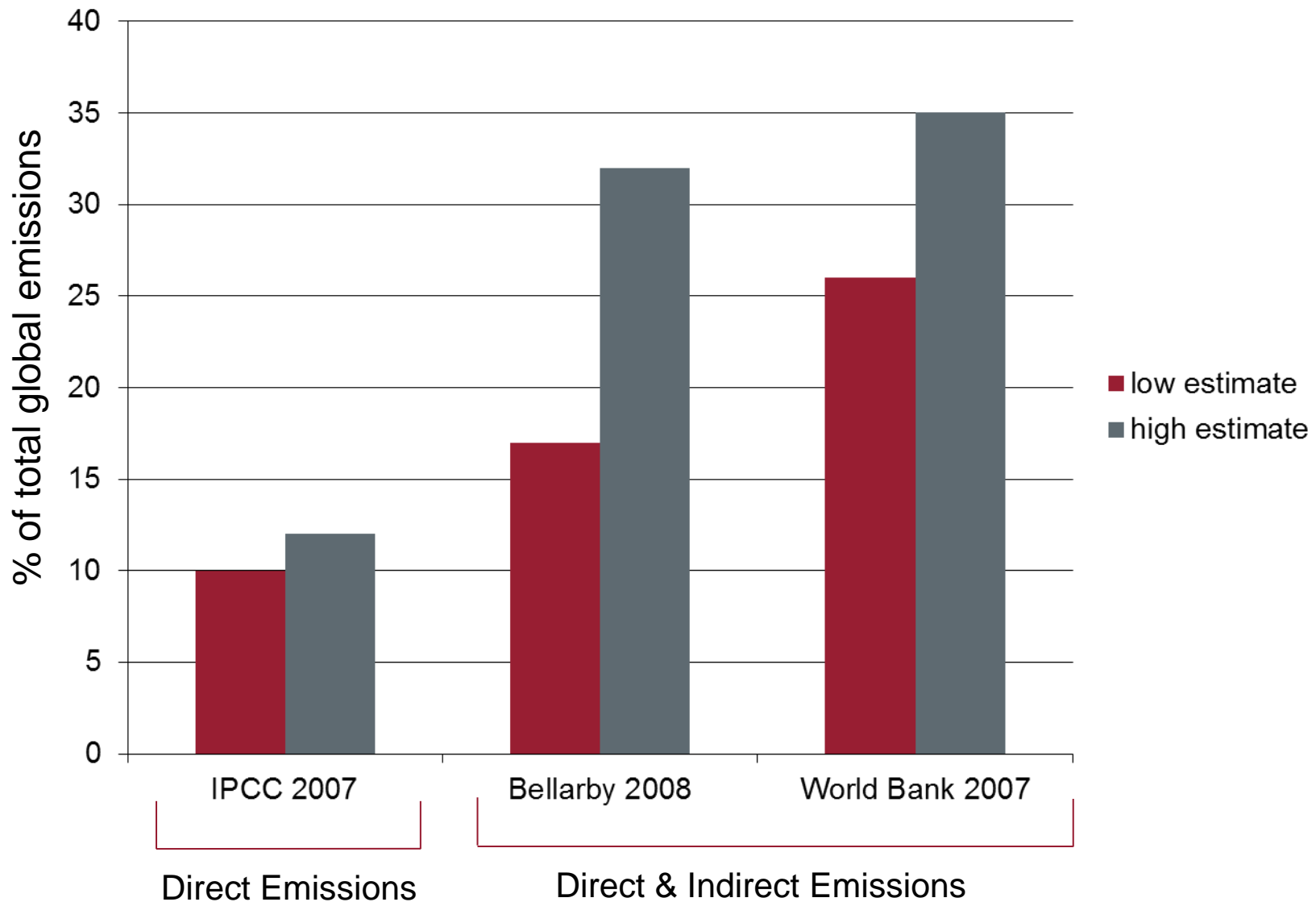
WASHINGTON STATE  
 UNIVERSITY

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# Soil Carbon Dynamics



# Global Inventories that Include Both Direct and Indirect Emissions from Agriculture



IPCC 2007, Bellarby 2008, World Bank 2007