

Turning Research into Practice



Cornell University's Agricultural & Forestry Research and Institutional Actions



Cornell University



University Profile

- Land-grant university with international presence
- Recognized leader in Education, Research and Outreach
- 20,000 students taught by 3,000 faculty
- 319,000 metric ton CO₂-e footprint
- College of Life Science and Agriculture manages >14,000 acres of forest and farmland

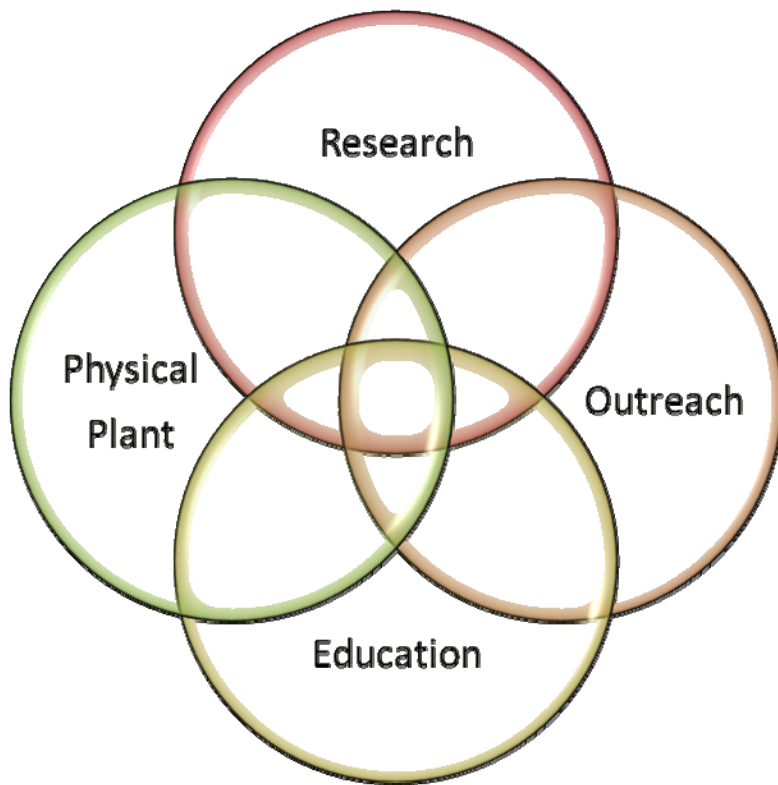
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Linked Missions in Sustainability



- Atkinson Center for A Sustainable Future
- 11 Undergraduate & Graduate Colleges
- Cornell Cooperative Extension
- Office of Energy & Sustainability

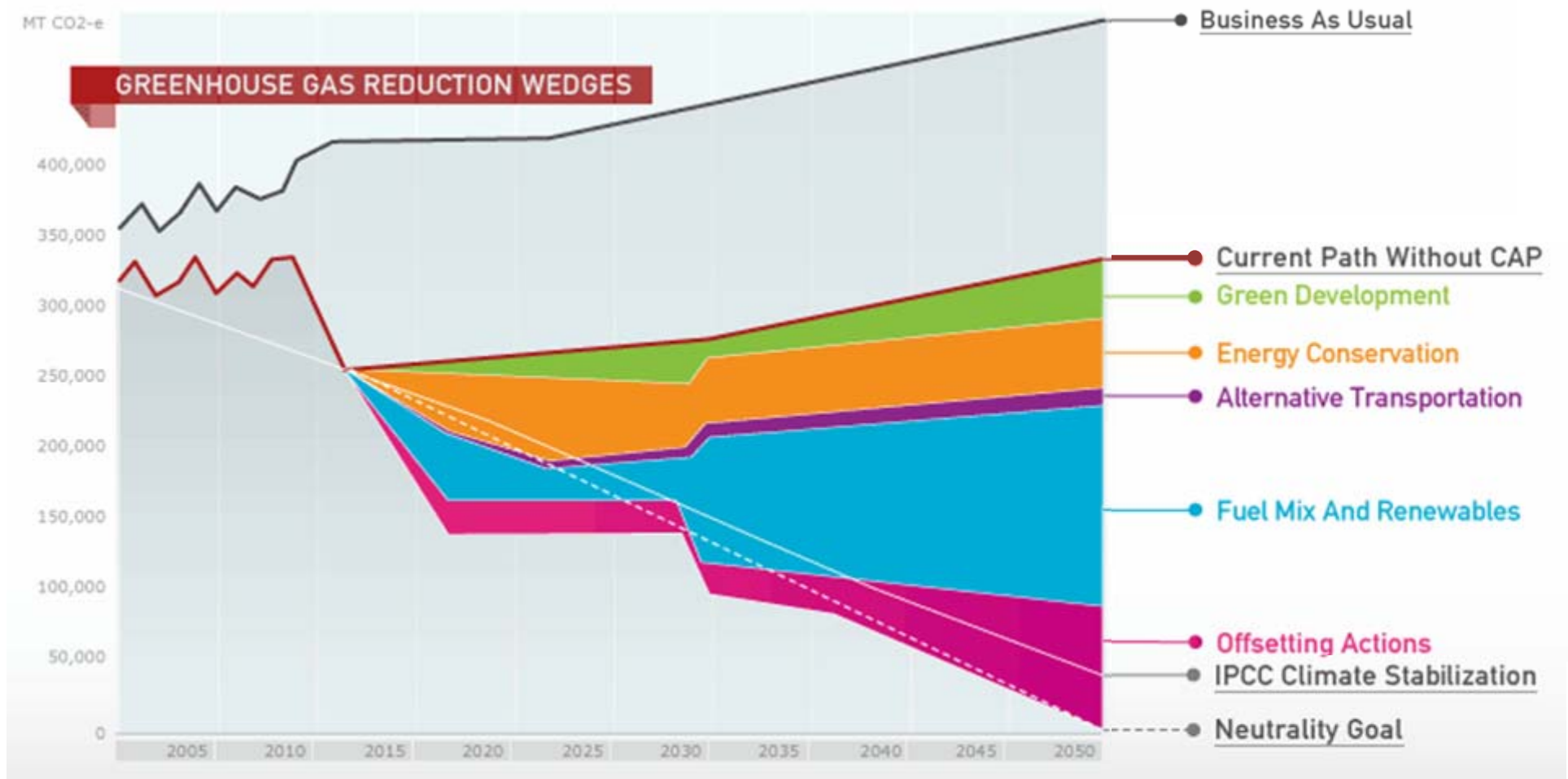
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Climate Action Plan Portfolio



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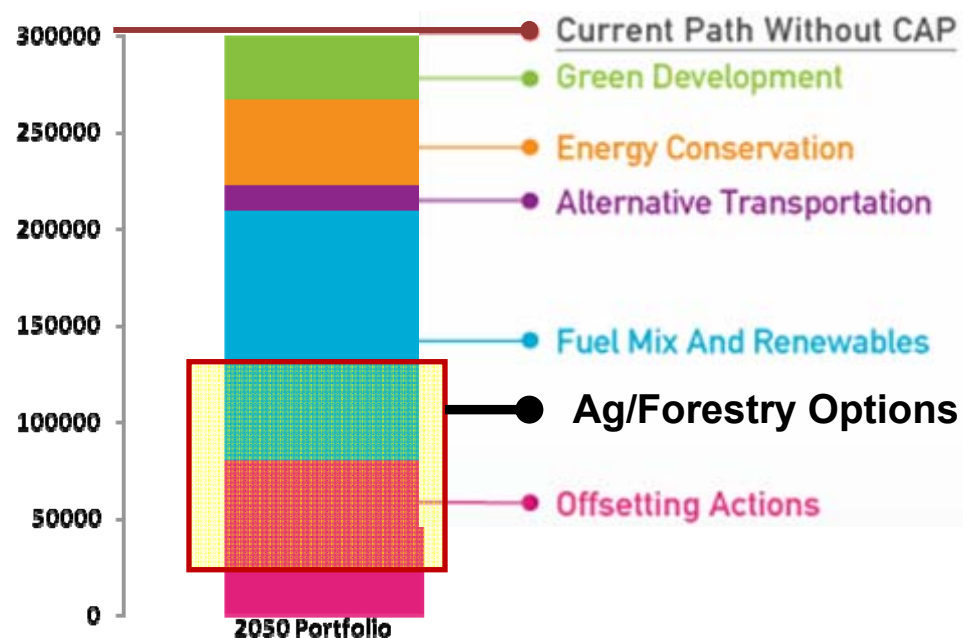


Climate Action Plan Portfolio

Agricultural & Forestry Options

	Mitigation Potential (Tons/yr)	% of 2050 Portfolio	Savings (Cost) \$/Ton
Afforestation	3,600	1.2%	\$(6.90)
Forest Management	15,000	5.0%	\$(1.35)
Biochar	3,800	1.3%	\$(0.48)
Soil Tillage	400	0.1%	\$(0.48)
CURBI	8,700	2.9%	\$88.00
Biomass Gasification*	60,000	20.0%	\$35.00
Methane Digester	1,500	0.5%	\$(75.41)
Total Ag & Forestry	79,490	26%	

* Alternate heating option to deep hot rock geothermal





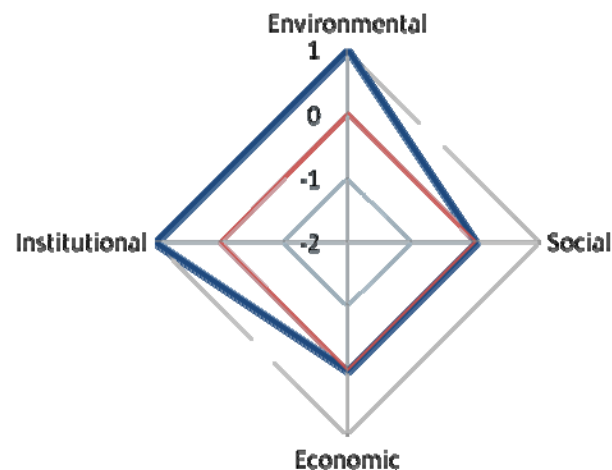
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Conservation Soil Tillage

- CO₂ sequestration rate = 0.4 tons/acre/year
- Currently practiced on 900 acres
- Potential short term expansion planed to 2000 acres.





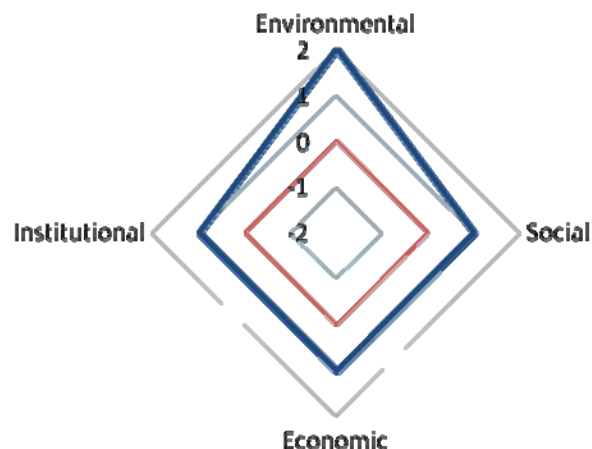
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Afforestation & Forest Management

- 1000 acres idle pasture/cropland available for planting
 - 3.8 tons CO₂ /acre/yr
- Existing 6,636 acres of forest could sequester an additional 0.9 tons CO₂ /acre/yr

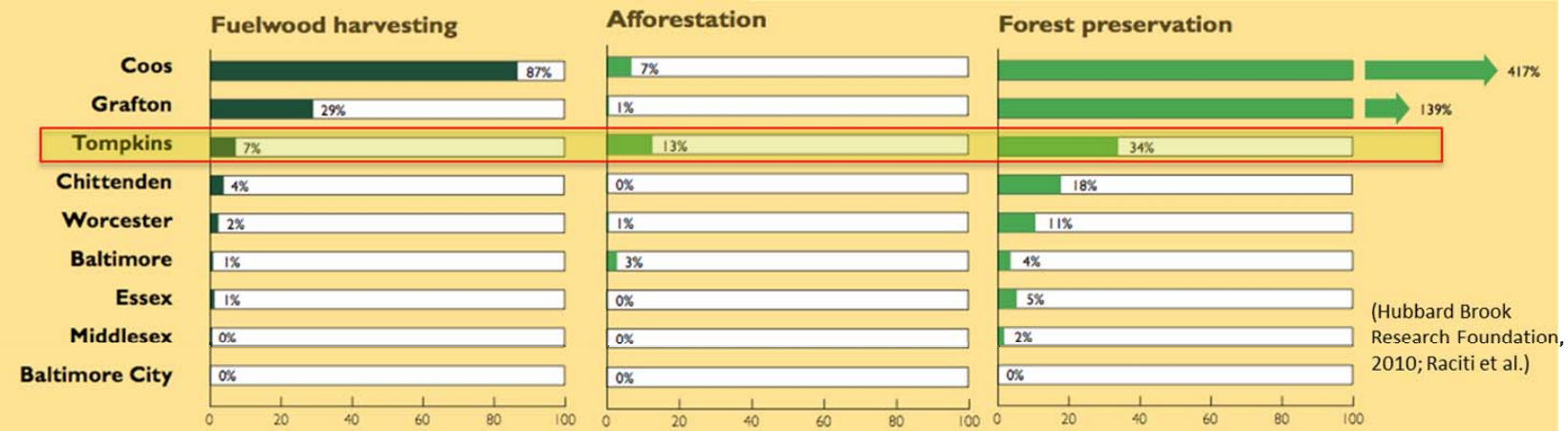
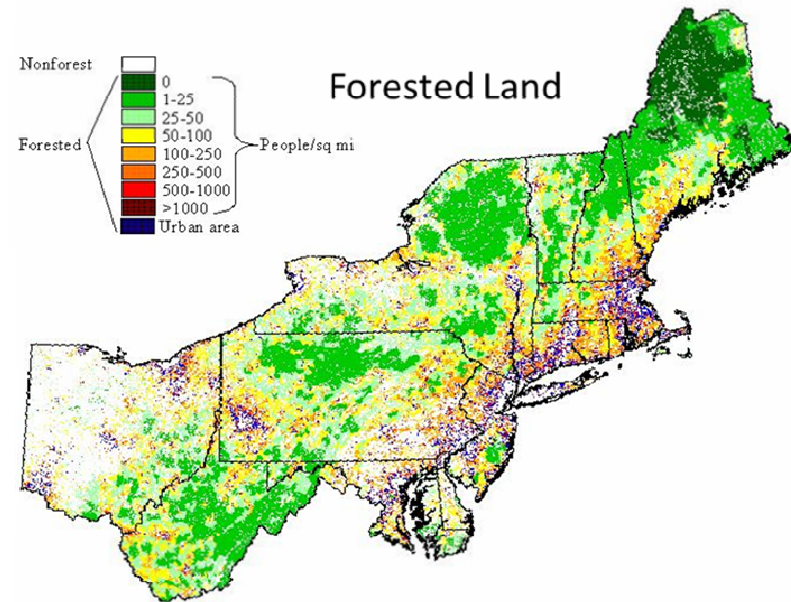
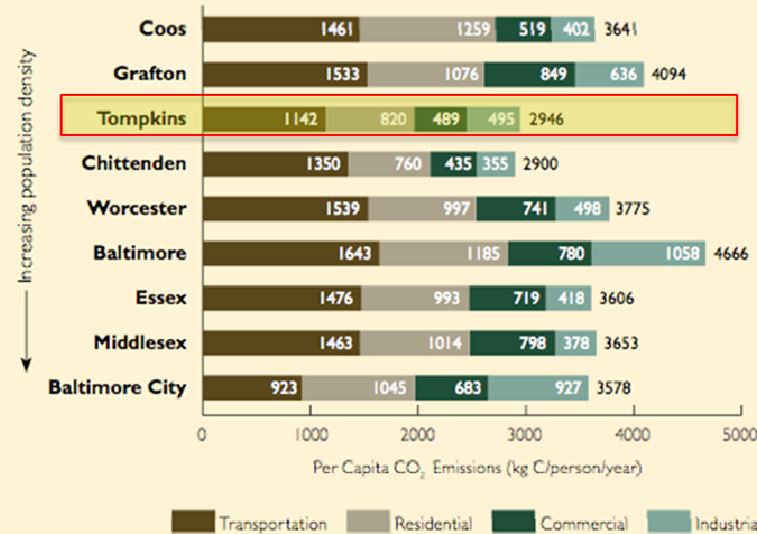




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Beyond Cornell

Carbon Dioxide Emissions by County



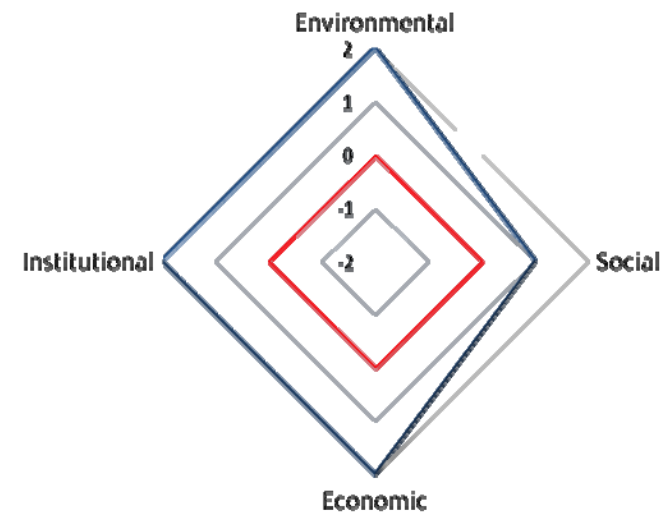
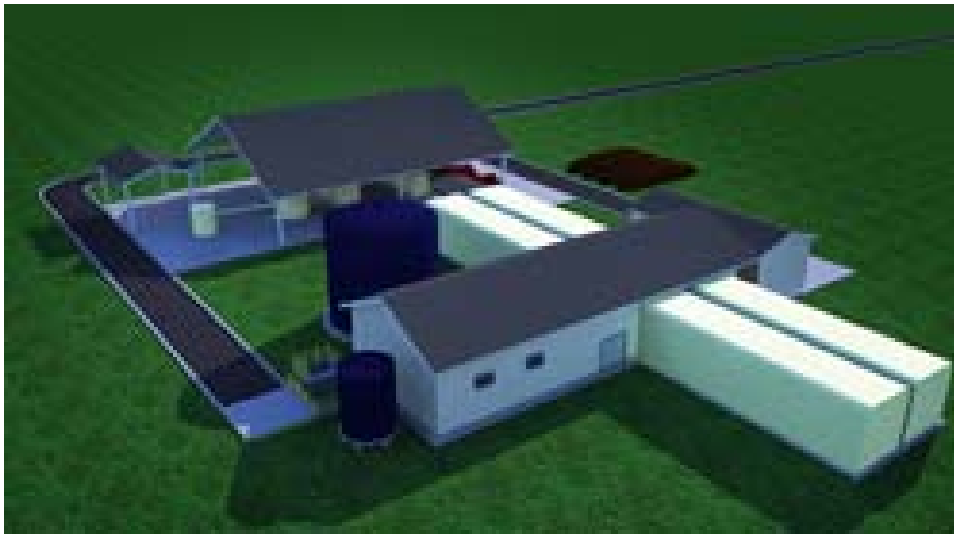
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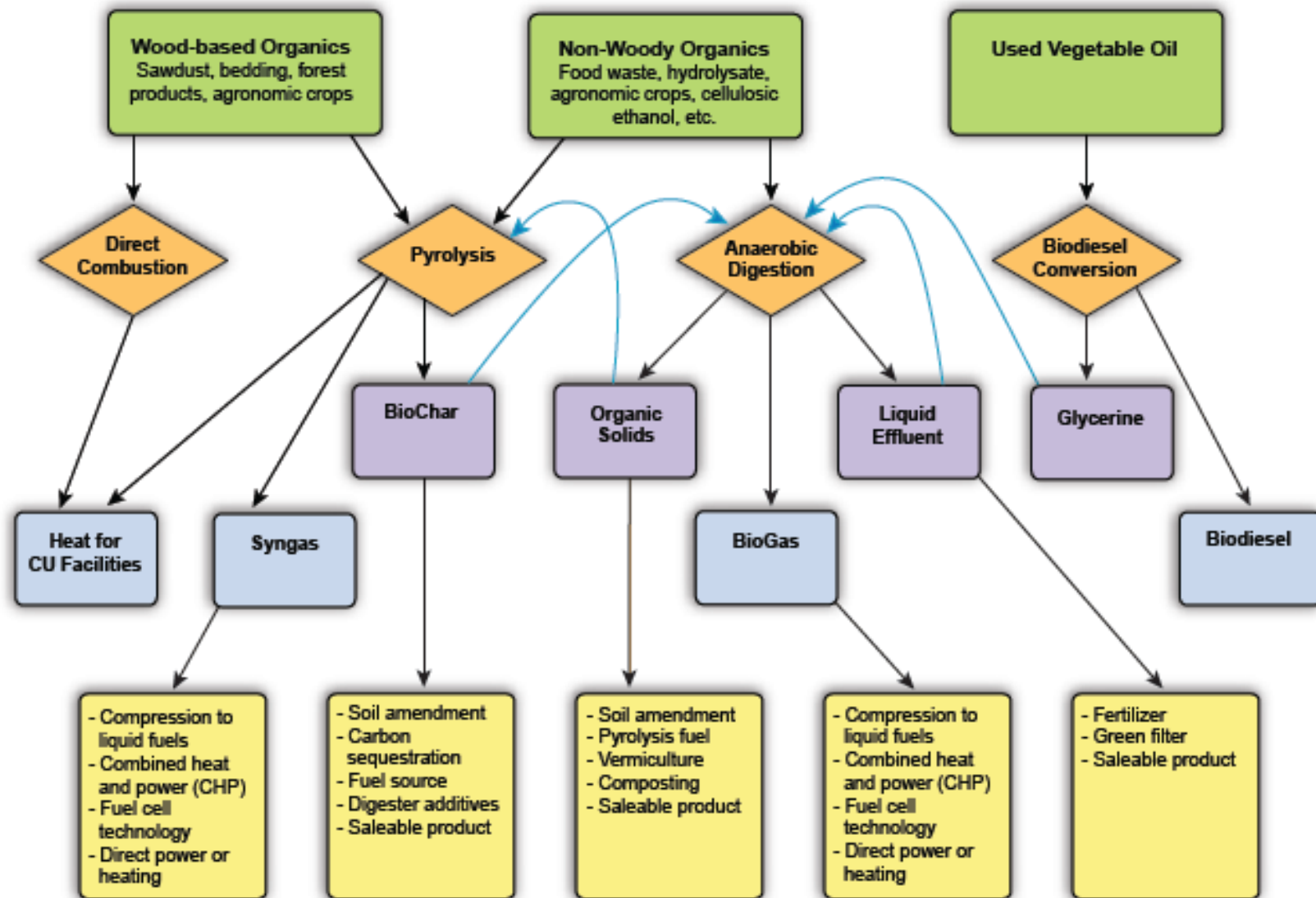
Cornell Renewable Bioenergy Initiative



Mitigation Potential: 9,000 Tons CO₂ (3% of projected 2050 campus footprint)
Energy Recovery resulting in \$88/Ton CO₂ savings, with waste stream reduction
Research, Education and Demonstration Opportunity

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CURBI Operating Chart





OFFSETTING ACTIONS SUMMARY

	APPROX ANNUAL GHG REDUCTION		ACTION STARTS	NEXT STEPS	FINANCIAL
	Metric Tons (CO ₂ Equivalent)	Percent of 2050 Footprint			
defined mission-linked offsets	23,000	7%	near-term	generate project plan	costs money
undefined mission-linked offsets	61,000	19%	long-term	define in future	costs money
community offsets	3,000	1%	mid-term	develop protocol with community	costs money
TOTAL	87,000	27%			



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Agricultural Carbon Management for Climate Change Mitigation

Johannes Lehmann

Department of Crop and Soil Sciences

*David R. Atkinson Center for a Sustainable
Future*

Sam Bosco

Department of Horticulture

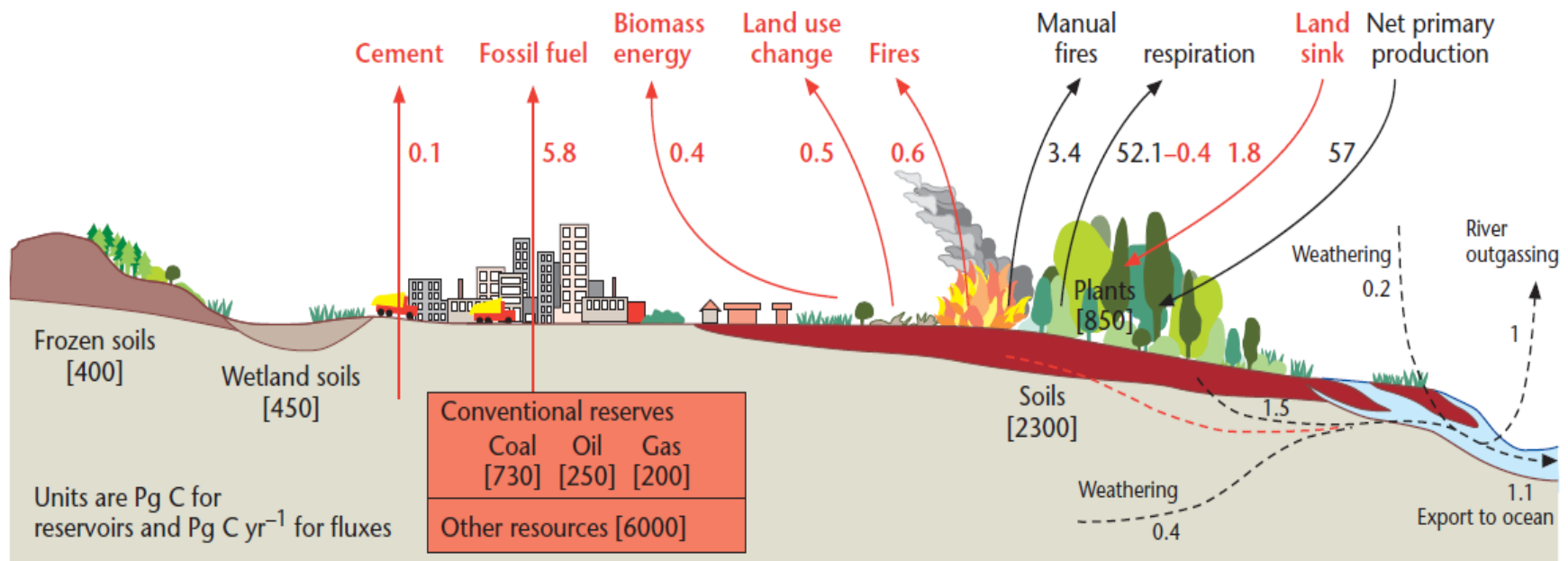
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More organic carbon in soils than in all plants and the atmosphere combined

Every 14 years, all carbon in the atmosphere is taken up by plants and recycled through soil



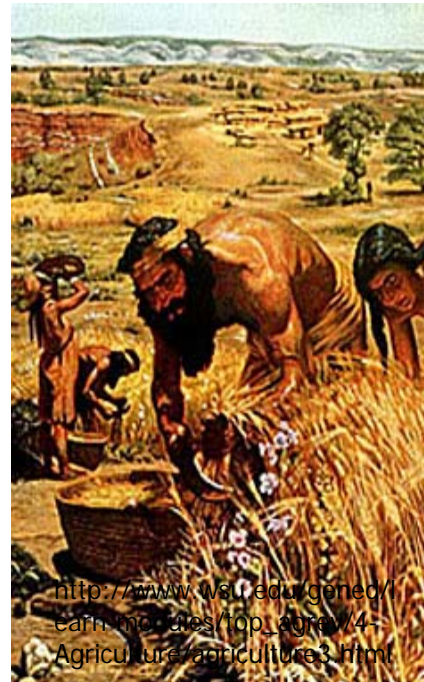
Sabine, 2005, *Encyclopedia of Life Science*



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Carbon in Agricultural Soil

**Some soils have lost 20 to 80 tons OC/ha
Historic losses of 44 to 537 Gt of OC through agriculture**



Lal, 2004, Science

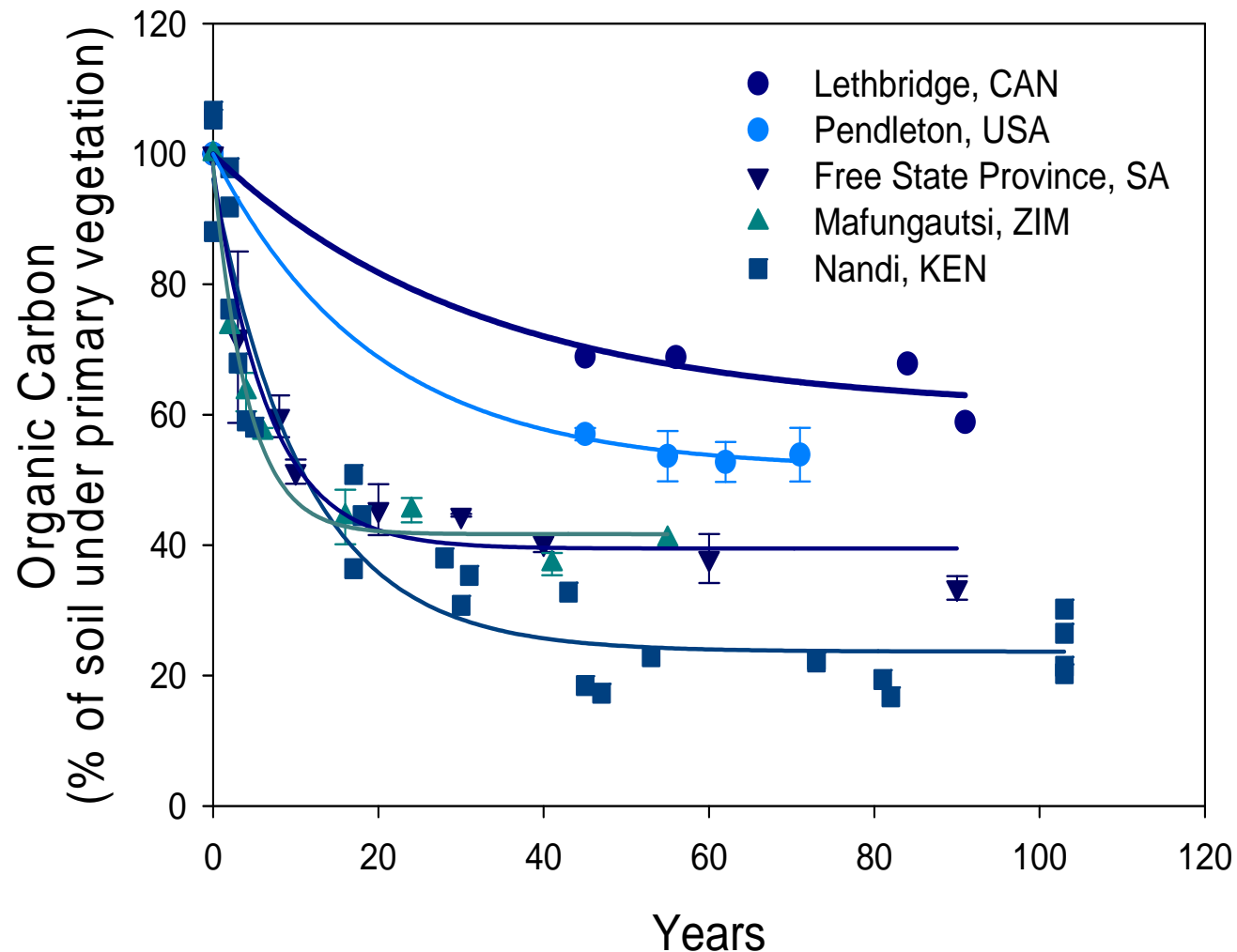
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Soil Carbon Loss and Restoration

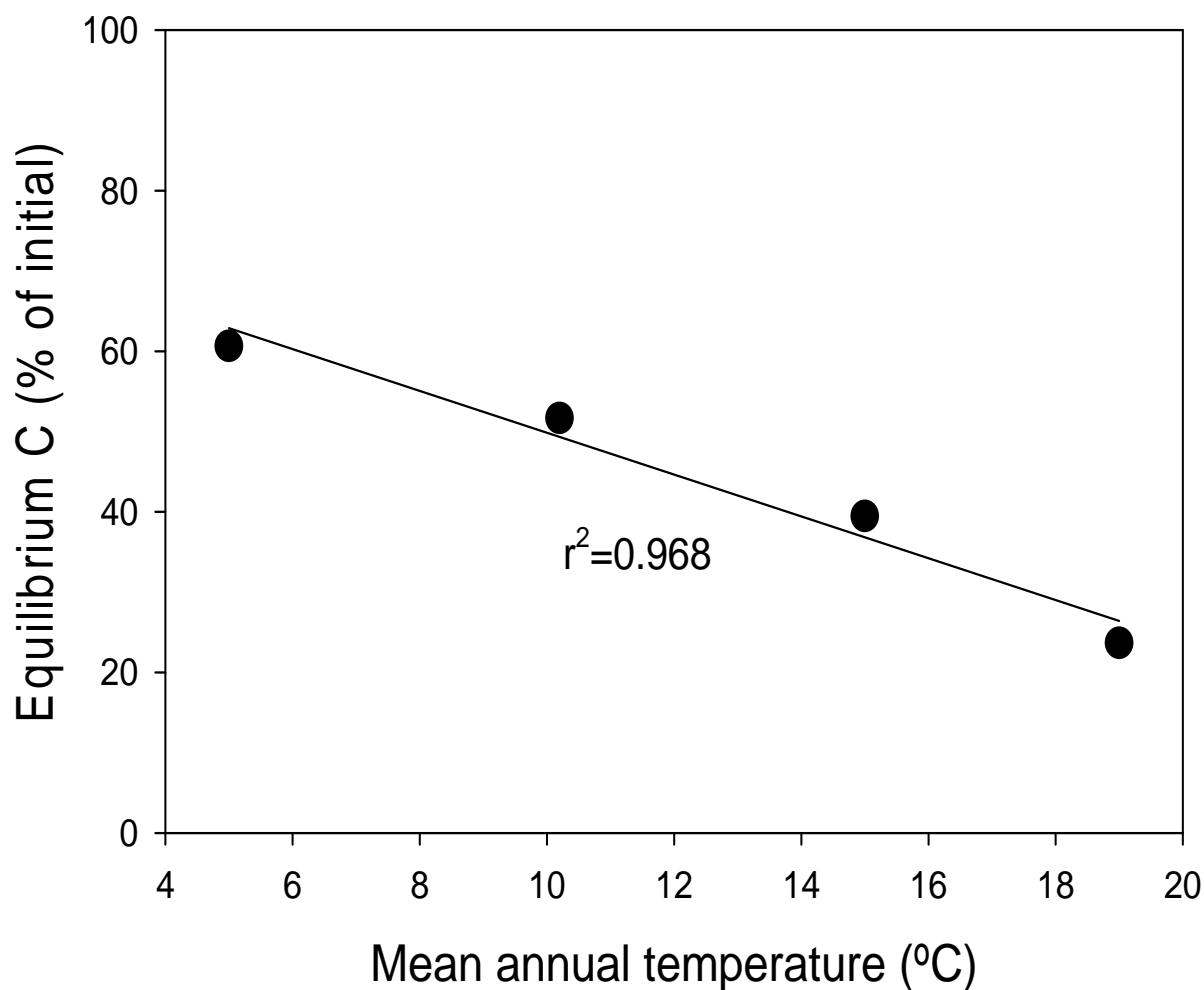


Compiled from Rasmussen et al., 1998, Science; Lobe et al., 2001, EJSS;
Zingore et al., 2005, EJSS; Kinyangi, 2006;
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Soil Carbon Loss and Restoration



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Carbon Sequestration in Agricultural Soil

Assessment:

Measurement-based?

Practice-based?

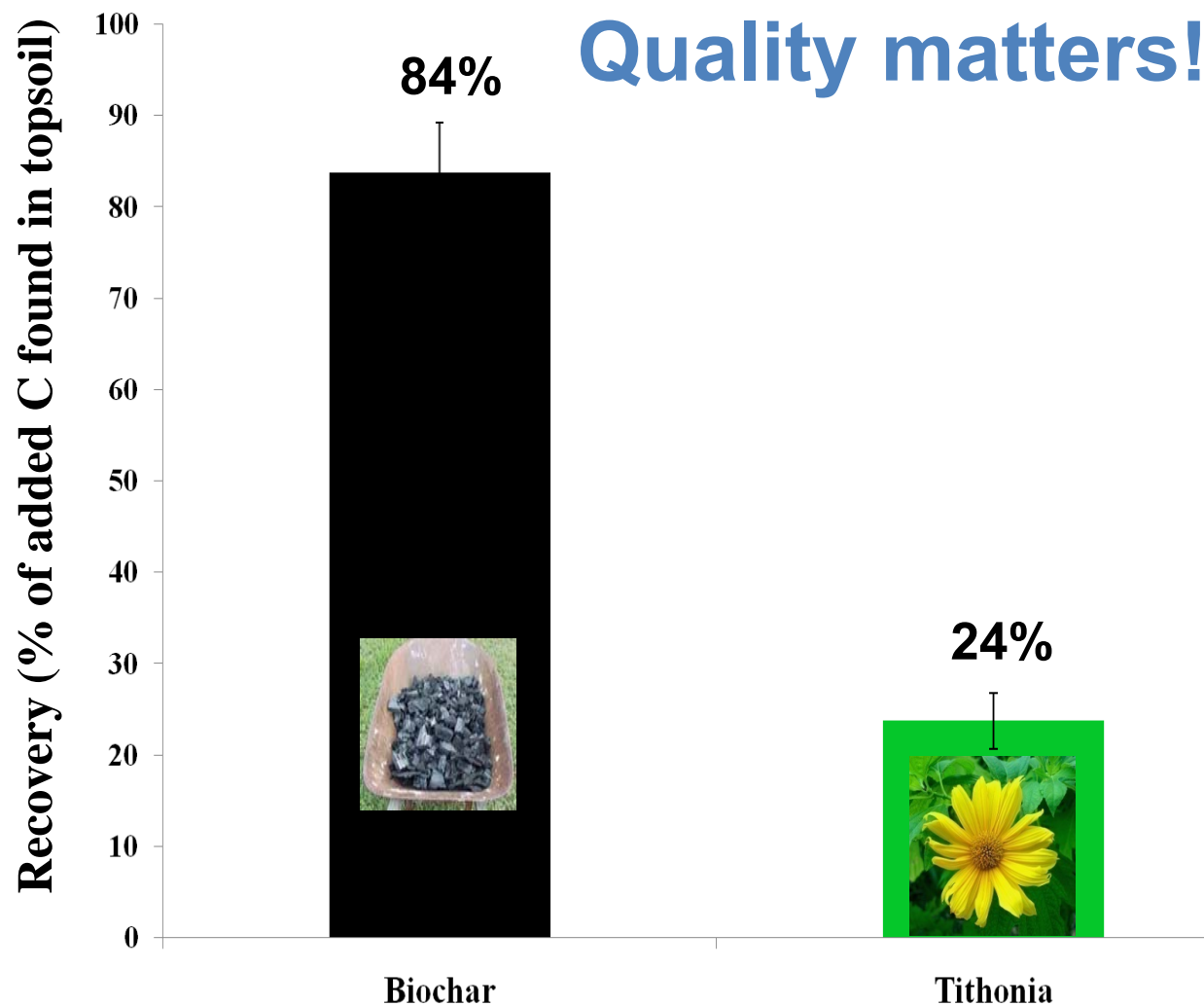
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Organic Matter Additions



12 t C/ha/yr
After two
years
(n=3)

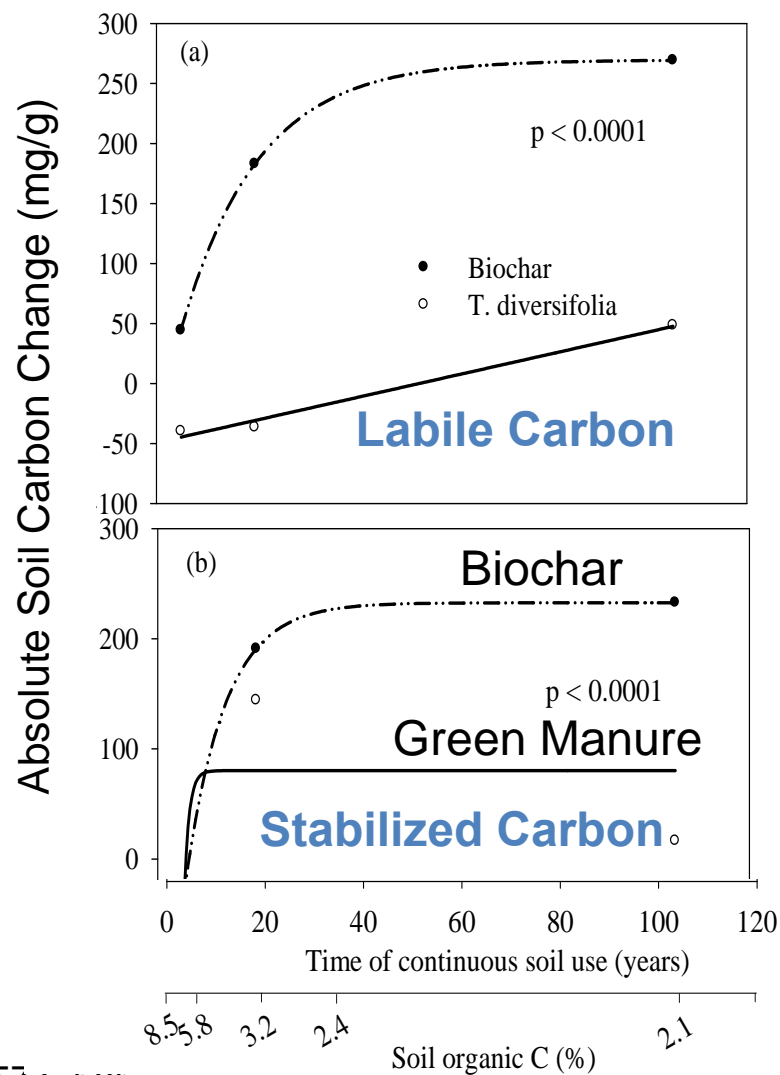
Kimetu et al., 2010, AJSR 48, 577–585

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Organic Matter Additions



Kimetu et al., 2010, AJSR 48, 571-585

(n=3 for regressions)

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Conservation Agriculture in Zambia



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Conservation Tillage in NY State



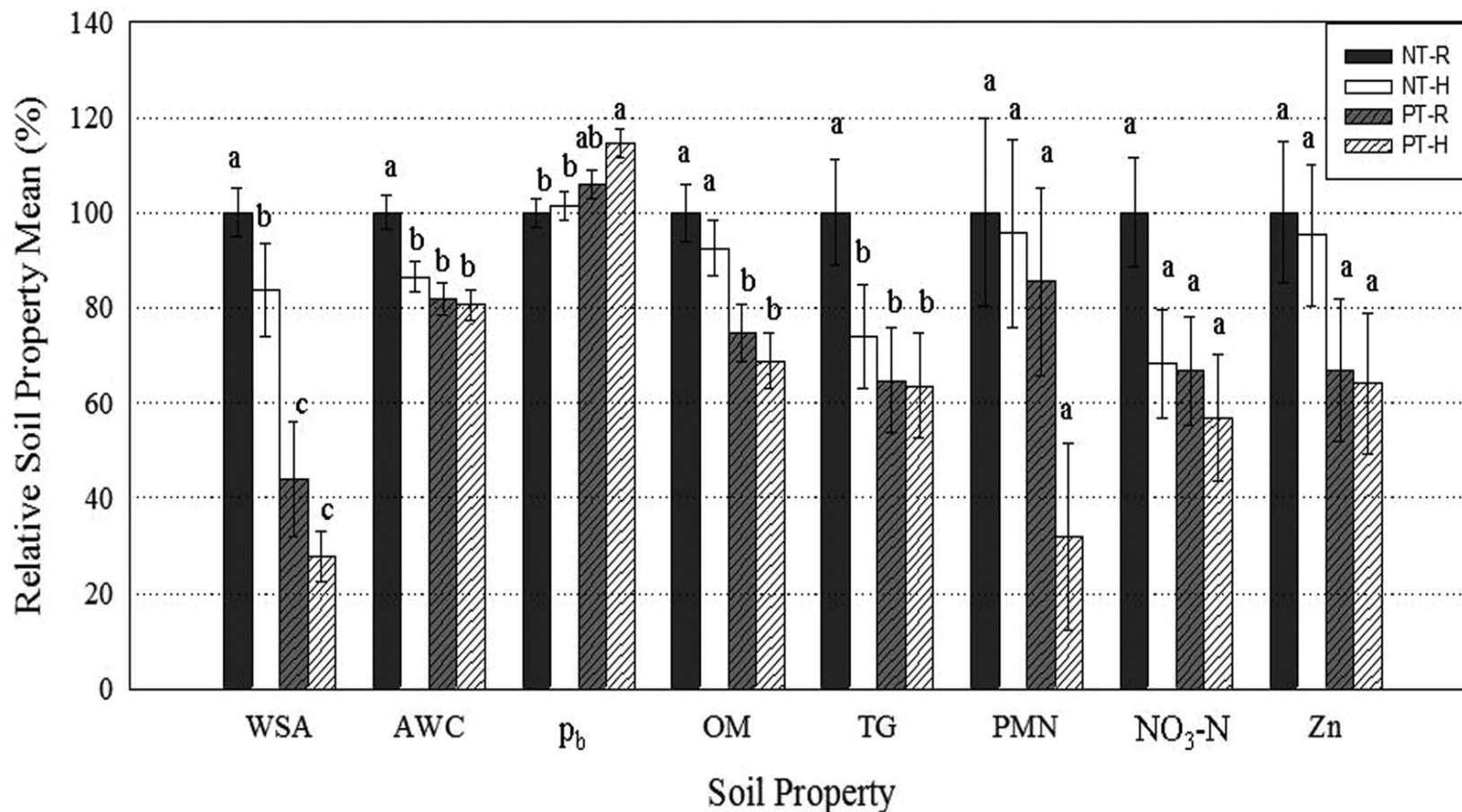
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Conservation Tillage in NY State



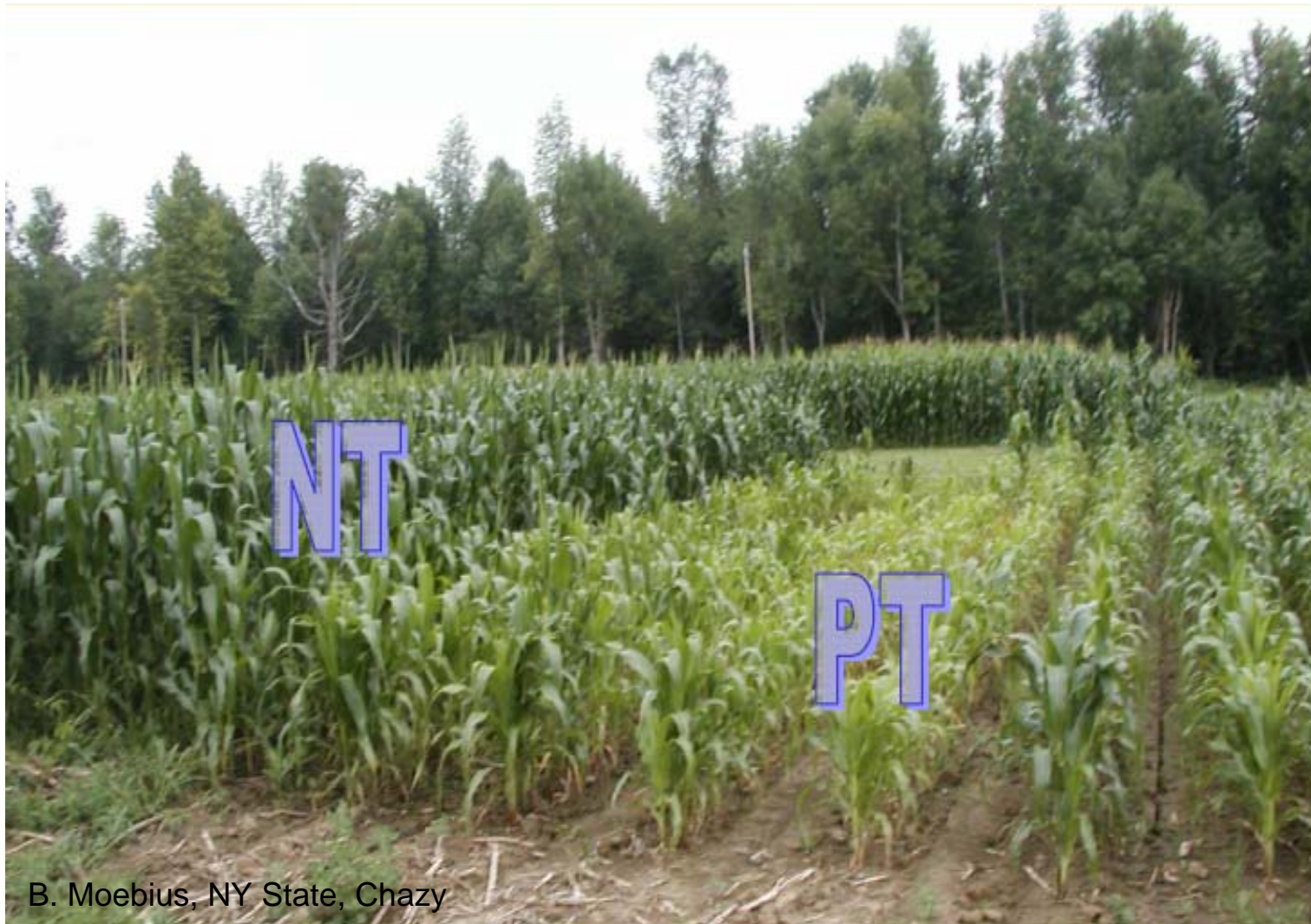
Moebius et al., 2008, SSSAJ 72:960-969

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Soil Carbon Feedback



B. Moebius, NY State, Chazy

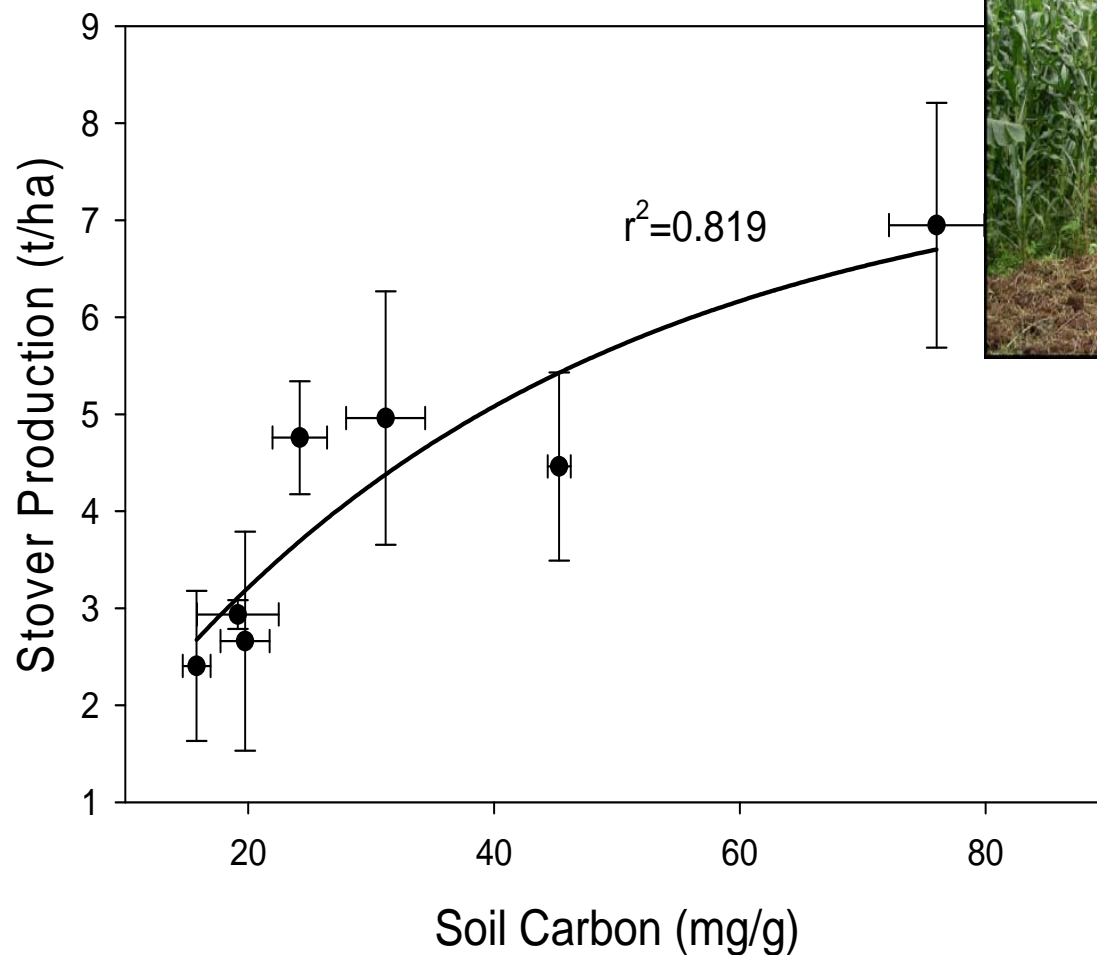
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Soil Carbon Feedback



*Chronosequence,
Western Kenya*

(n=2-4; means and SE)

Compiled from Solomon et al., 2007, GCB; Ngoze et al., 2008, GCB;

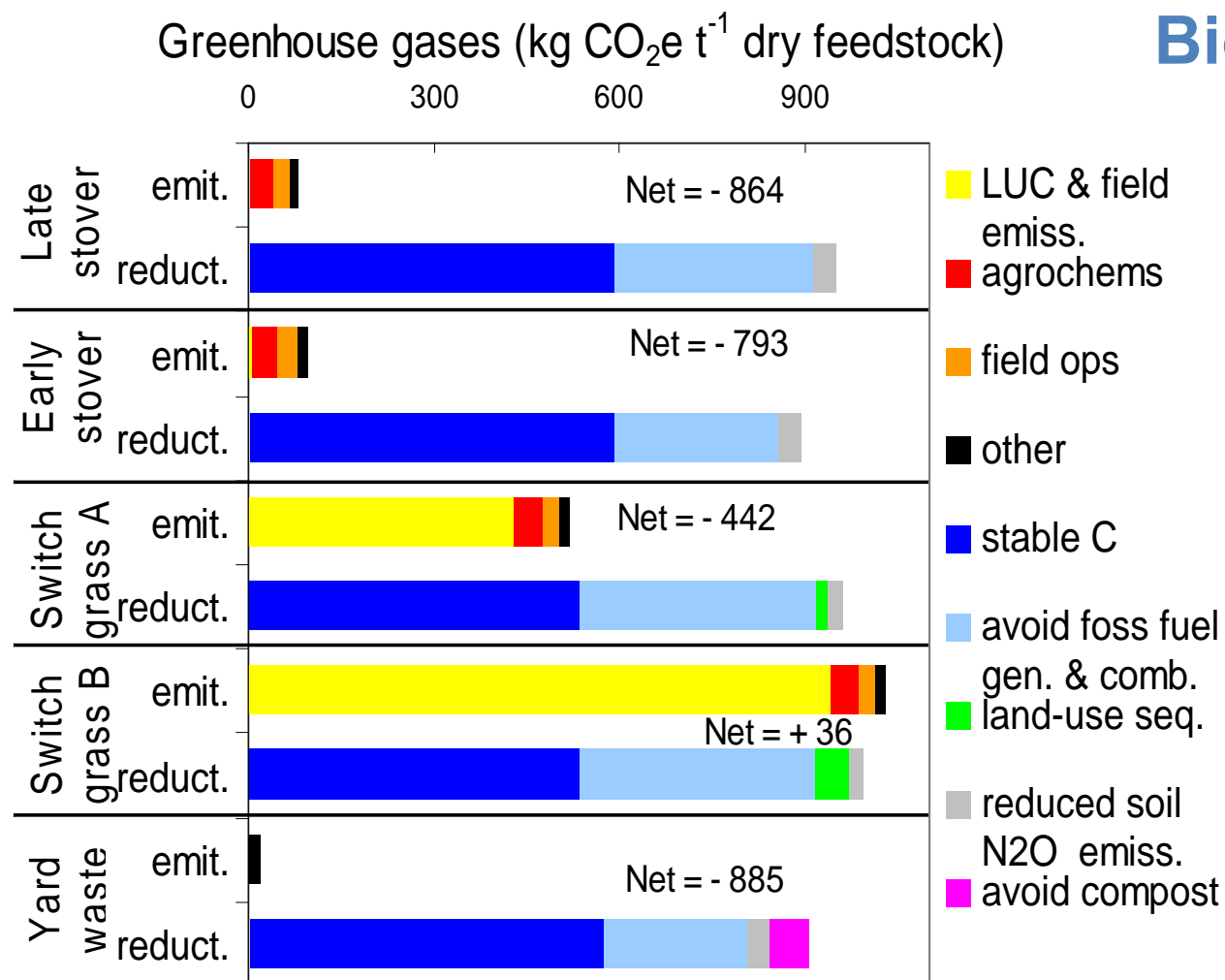
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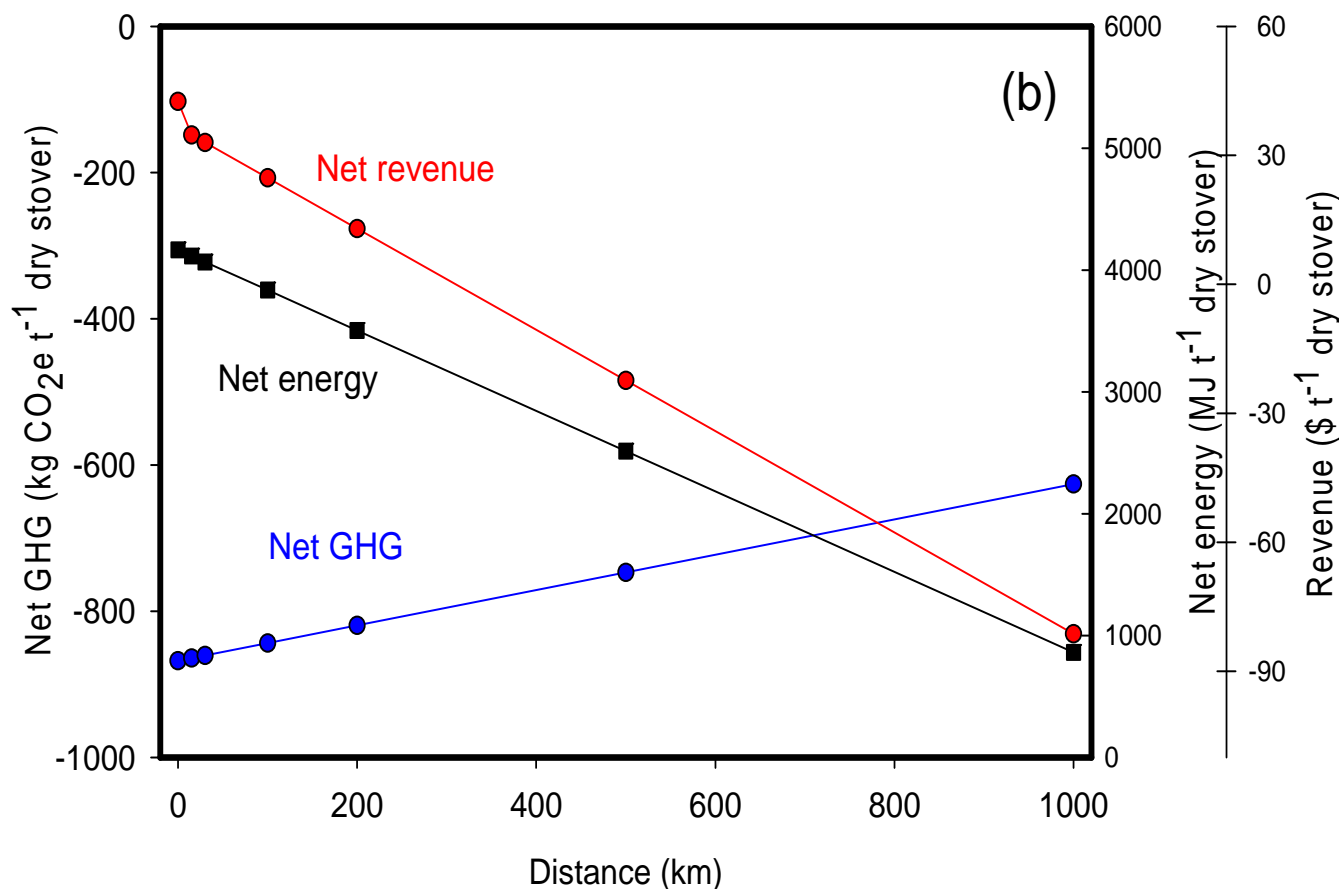
Systems Analysis: Life Cycle Assessment

Biochar Systems



Roberts et al, 2010, *Environmental Science and Technology* 44, 827–833

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Late stover, high C price
Slow pyrolysis
(1-10 tons/hr capacity)

Roberts et al, 2010, *Environmental Science and Technology* 44, 827–833
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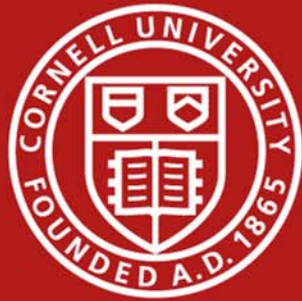


Measurement-based?

Practice-based possible, but:

- Must include soil/climate information**
- Must recognize system-accounting**
(Combination between measurement/practice-based)

Predictable variability \neq uncertainty!



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David R. Atkinson Center
for a Sustainable Future



President Skorton's
Climate Commitment

Cornell's Climate
Action Plan



ACSF
Leadership
Team

350+
Faculty
engaged
with ACSF

Atkinson Center for a
Sustainable Future (ACSF)

Academic
Venture Fund

Opportunity
Support

Strategic Faculty
Cluster Hiring

**Engaging all Colleges
of Cornell**

Topical Lunches
build teams

Symposia and
Workshops