Expanding Biofuel Production:
Sustainability and the Transition to Advanced Biofuels

The Environment and Health (Panel Discussion)

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Cellulosic production systems offer significant promise for improving the environmental performance of intensive agriculture - but it won't "just happen"

Elements of Biofuel Sustainability

- Economic
  - ✓Profitable

- Environmental
  - ✓Carbon negative (climate stabilizing)
  - ✓Nutrient, water conservative
  - ✓Biodiversity benefits
  - ✓Human health impacts

- Social Systems
  - ✓Food, energy security
  - ✓Rural vitality

A diversity of production systems

High Diversity

Restored prairie

Early successional

Short-rotation trees

Native grasses

Switchgrass

Miscanthus

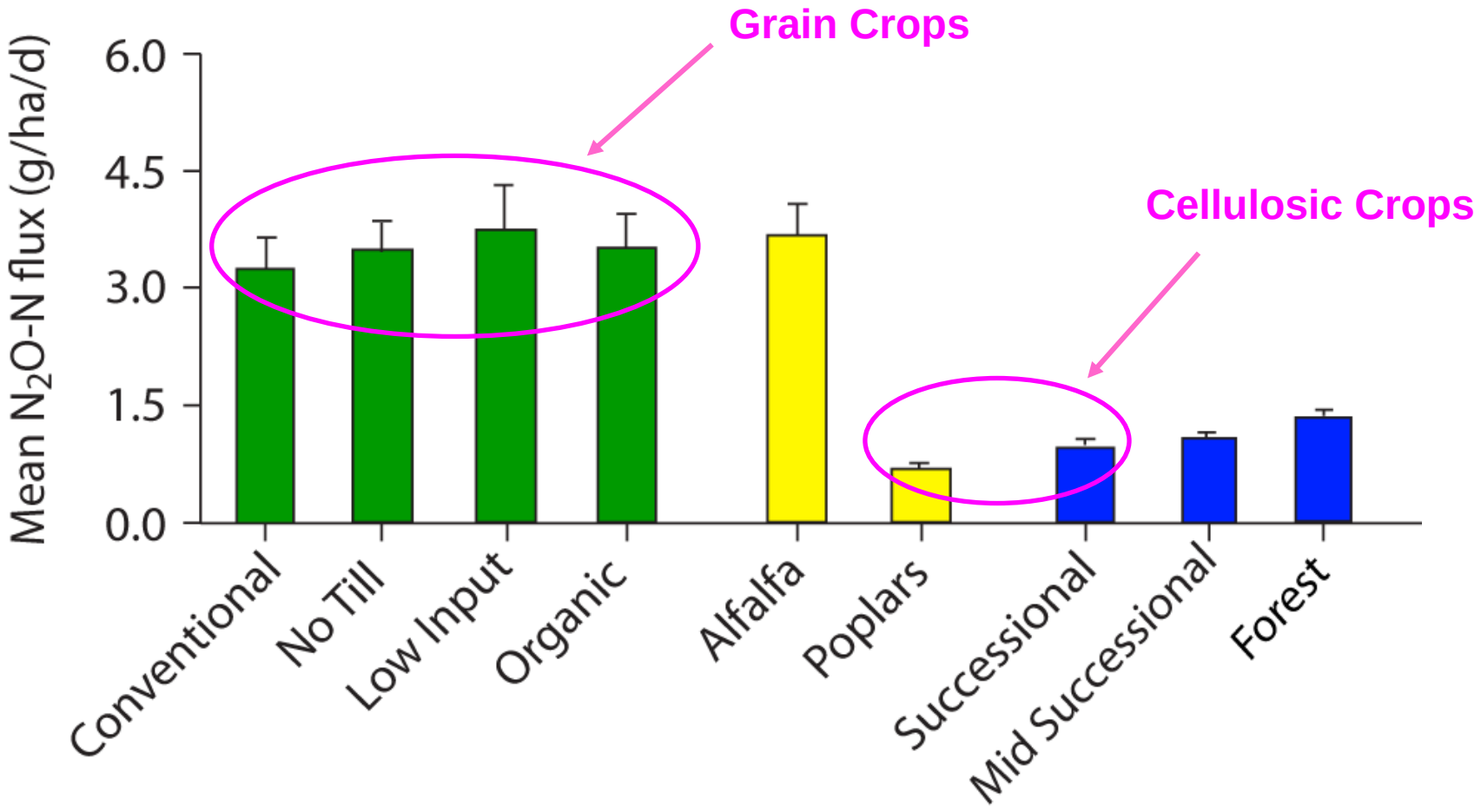
Corn-Soybean-Canola

Corn

Low Diversity

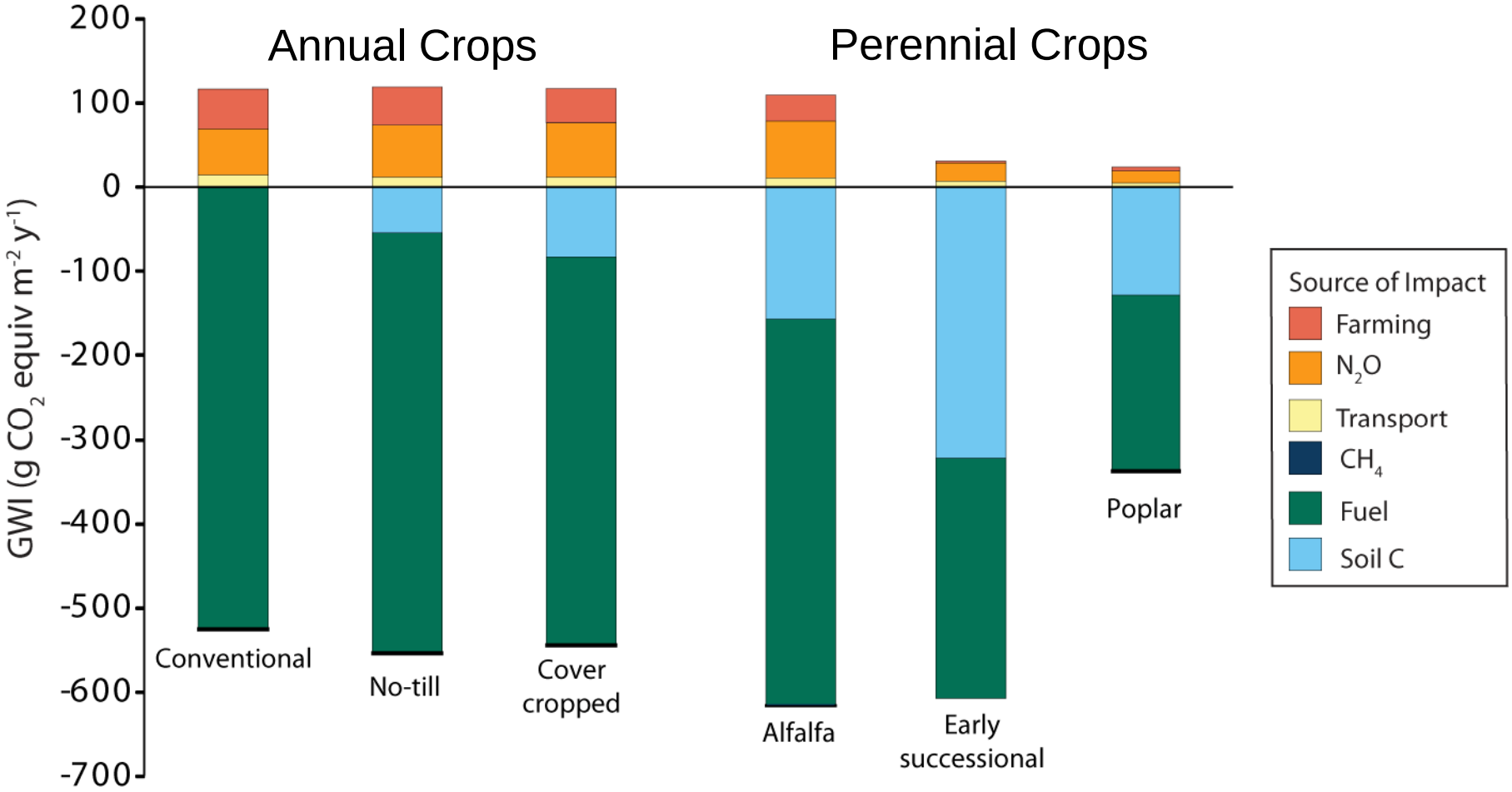
environmental performance?

Nitrous Oxide Fluxes at KBS (1992-2007)



Source: Robertson et al. 2000 *Science*; Grandy et al. 2006 *JEQ; and in prep.*

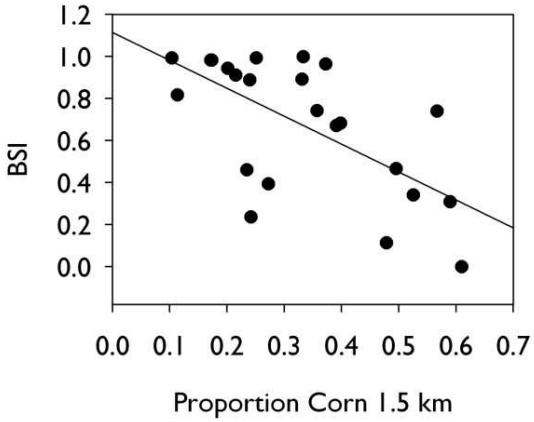
Global Warming Impact – KBS Field Crops



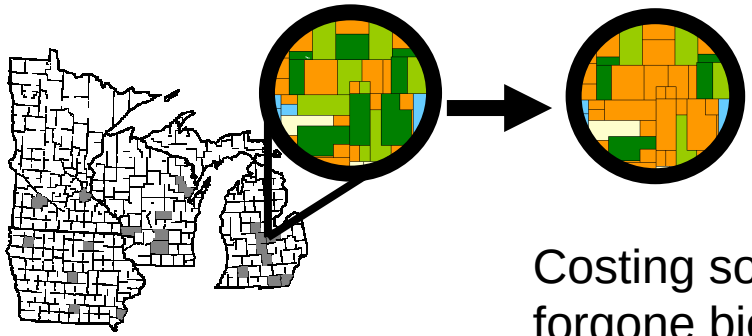
Biodiversity Services

Increasing corn for biofuel production reduces biocontrol services in agricultural landscapes

Predators save soybean farmers \$13-79 acre^{-1} yr $^{-1}$ in reduced pesticide applications and yield loss



Increased corn in the landscape reduces key predators and biocontrol services in soybean



Costing soybean producers \$58 – \$671 M yr $^{-1}$ in forgone biocontrol services

(based on actual 2006-07 increase in corn in MI, MN, IA, WI)

Landis et al. 2008 PNAS 105:20552.

Conclusions

General hypothesis

- Diverse perennial systems promote the delivery of ecosystem services related to environmental performance (e.g. climate stabilization & biodiversity) – and productivity?

But not all cellulosic cropping systems are created equal

- Choice of crops (e.g. annual vs. perennial, native vs. exotic, invasive vs. non-invasive, landscape diversity)
- Management practices (e.g. residue return, harvest timing and intensity, fertilization rate, irrigation)
- Location (prior crop history)