Environmental Impacts of Biofuel Cropping Systems: Introduction

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Richard Pouyat

(USDA Forest Service, Baltimore Ecosystem Studies)

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- Dale Brockway (Research Ecologist, USDA Forest Service, Southern Research Station)
- Richard Cruse (Iowa State University)
- Virginia Dale (Oak Ridge National Laboratory)
- Karl Glasener (Director of Science Policy, American Society of Agronomy, Crop Science Society of America, Soil Science Society of America)
- Dennis Ojima (The H. John Heinz III Center for Science, Economics, and the Environment)
- Tim Rials (Director, Sun Grant Initiative, Southeastern Regional Center)
- Philip Robertson (Michigan State University, W.K. Kellogg Biological Station)

Steering Committee

- John Sheehan (Vice President, Strategy and Sustainable Development, LiveFuels, Inc.)
- Linda Wallace (Professor, Botany/Microbiology, GLCH, University of Oklahoma)
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Biofuel Sponsors

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- Gordon and Betty Moore Foundation
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- Natural Resources Defense Council
- Union of Concerned Scientists
- USDA-Agricultural Research Service
- USDA-CSREES

Biofuel Sponsors

- USDA-Forest Service
- US Department of Energy
- US Environmental Protection Agency
- Western Governors' Association
- Woodrow Wilson International Center for Scholars

Key Environmental Issues

- Net Greenhouse Gas impact of cropping system
- Implications of biofuels on agriculture land use
  - Crop switching
  - Expansion of agriculture
  - Use of Conservation Reserve Program (CRP) land
- Environmental "leakage" effects at regional and global scales
  - Cutting of forests for biofuel crops
- Conservation and biodiversity
  - CRP land

Key Environmental Issues

- Food vs. Fuel argument
  - Reduce food for third world countries
  - Mexico Tortilla Example
    - Enhanced agriculture clearing
  - Improve agriculture in developing countries
    - Fertilizing in Malawi

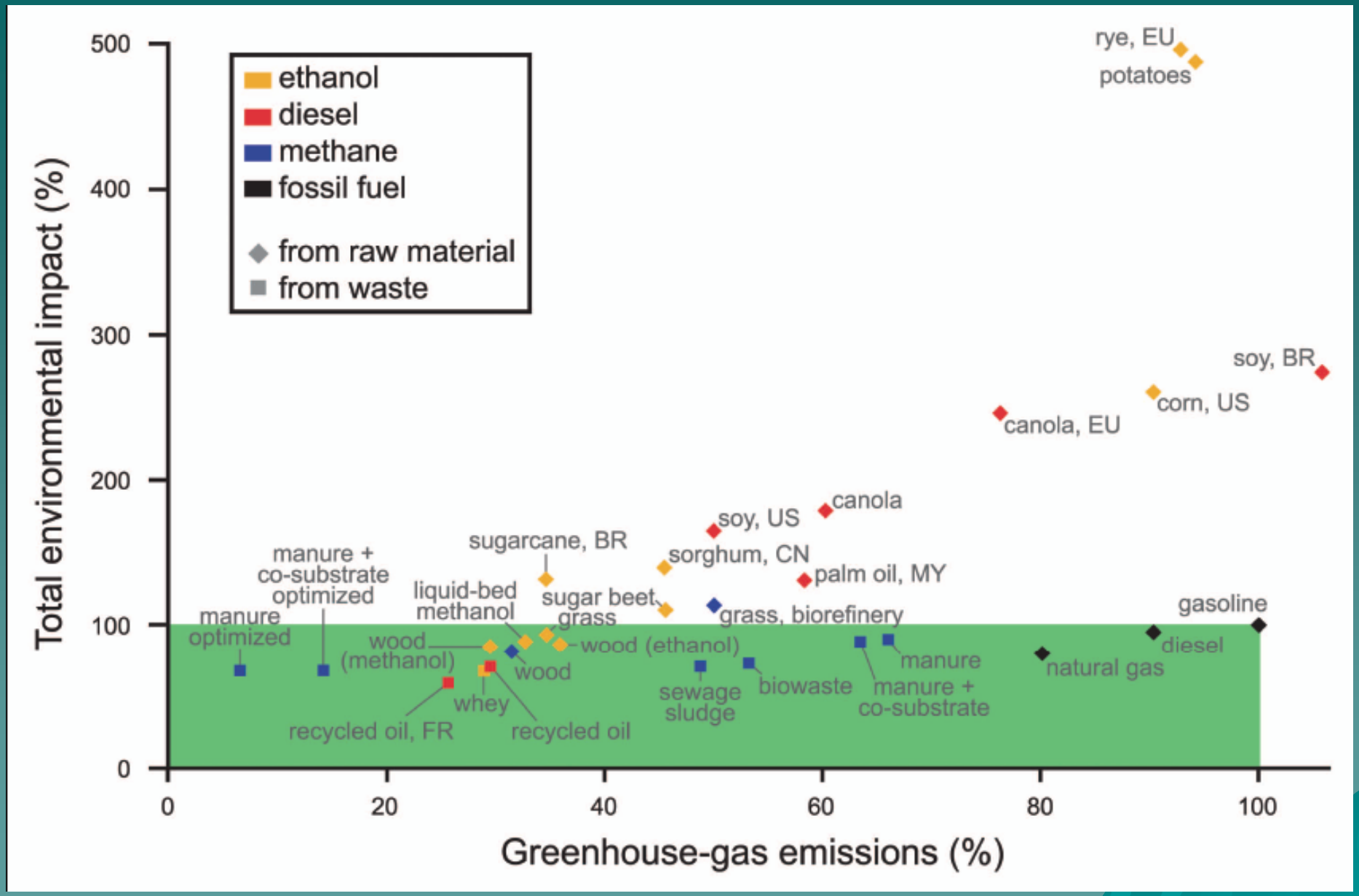
Outline

- What are the potential biofuel cropping systems?
- Potential impacts of land use changes
  - Plowing of CRP land
- List of talks
- Summary

Biofuel Cropping Systems

- Oil Crops (Rapeseed, Canola)
- Corn-Soybean – (CT, NT)
- Perennial Grass
  - Switchgrass
  - Reed Canary
  - Low Input System
- Corn-Soybean – ALFALFA (CT, NT)
- Hybrid Poplar

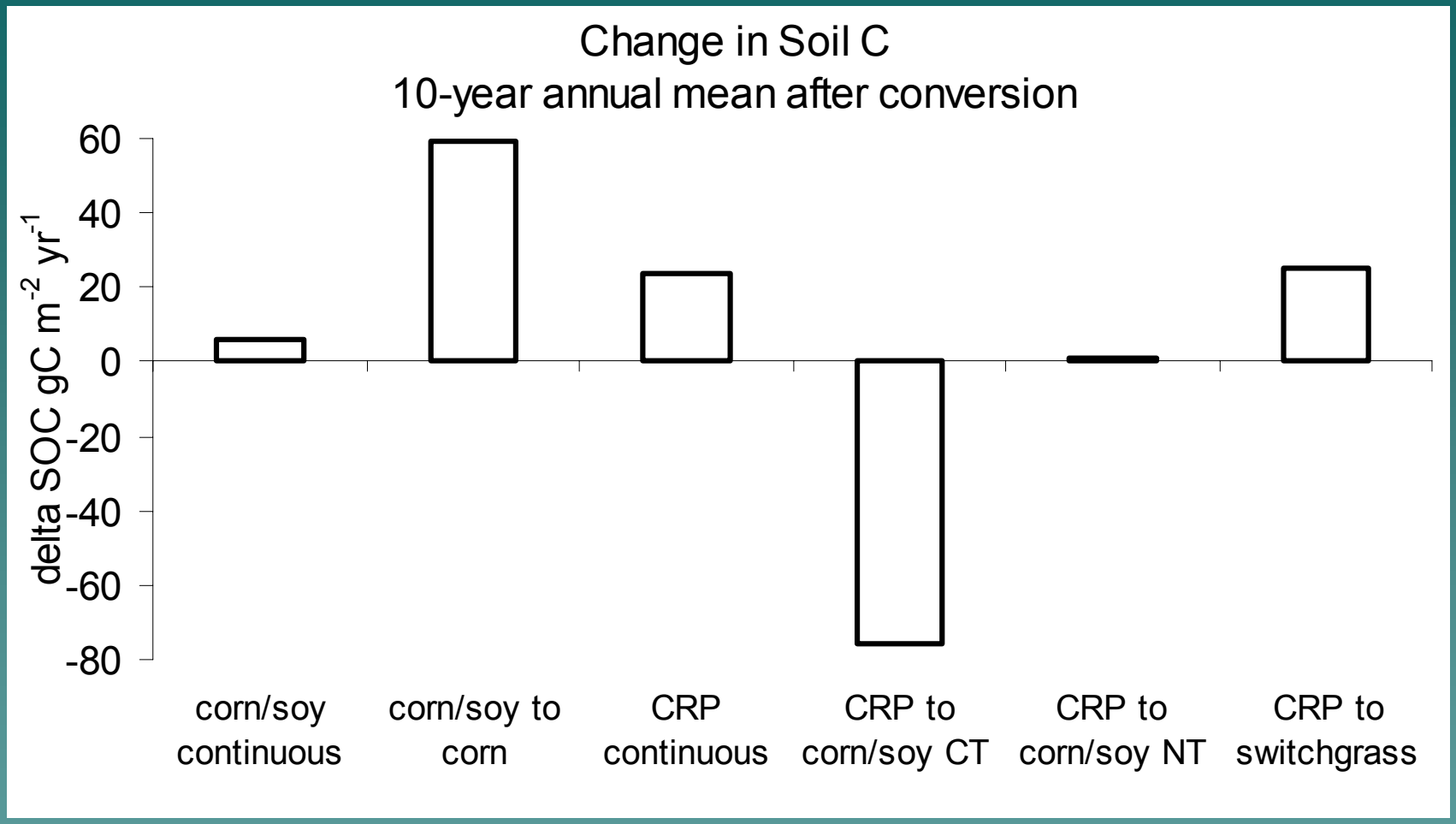
Environment vs. Greenhouse Gas Reduction

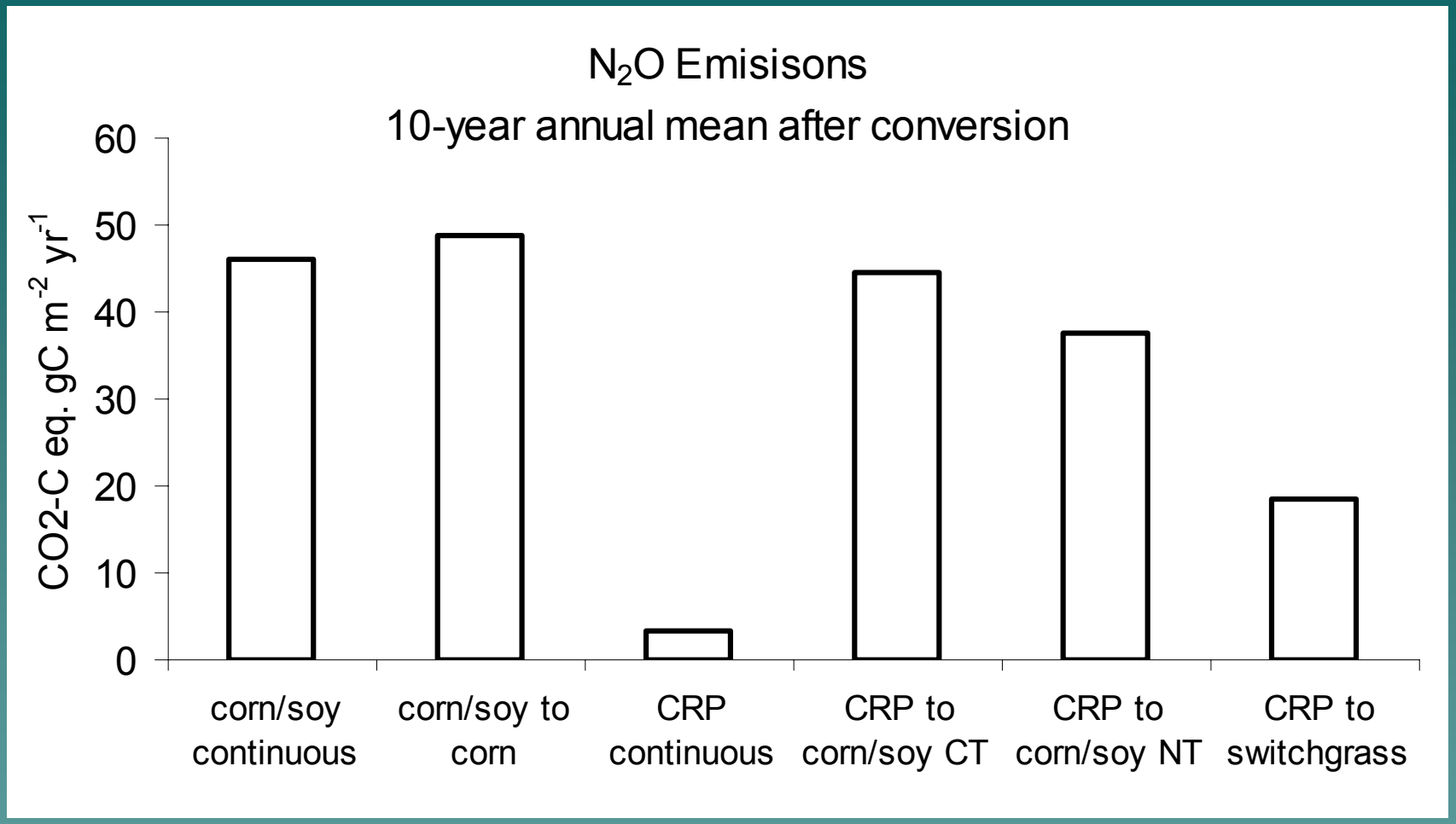


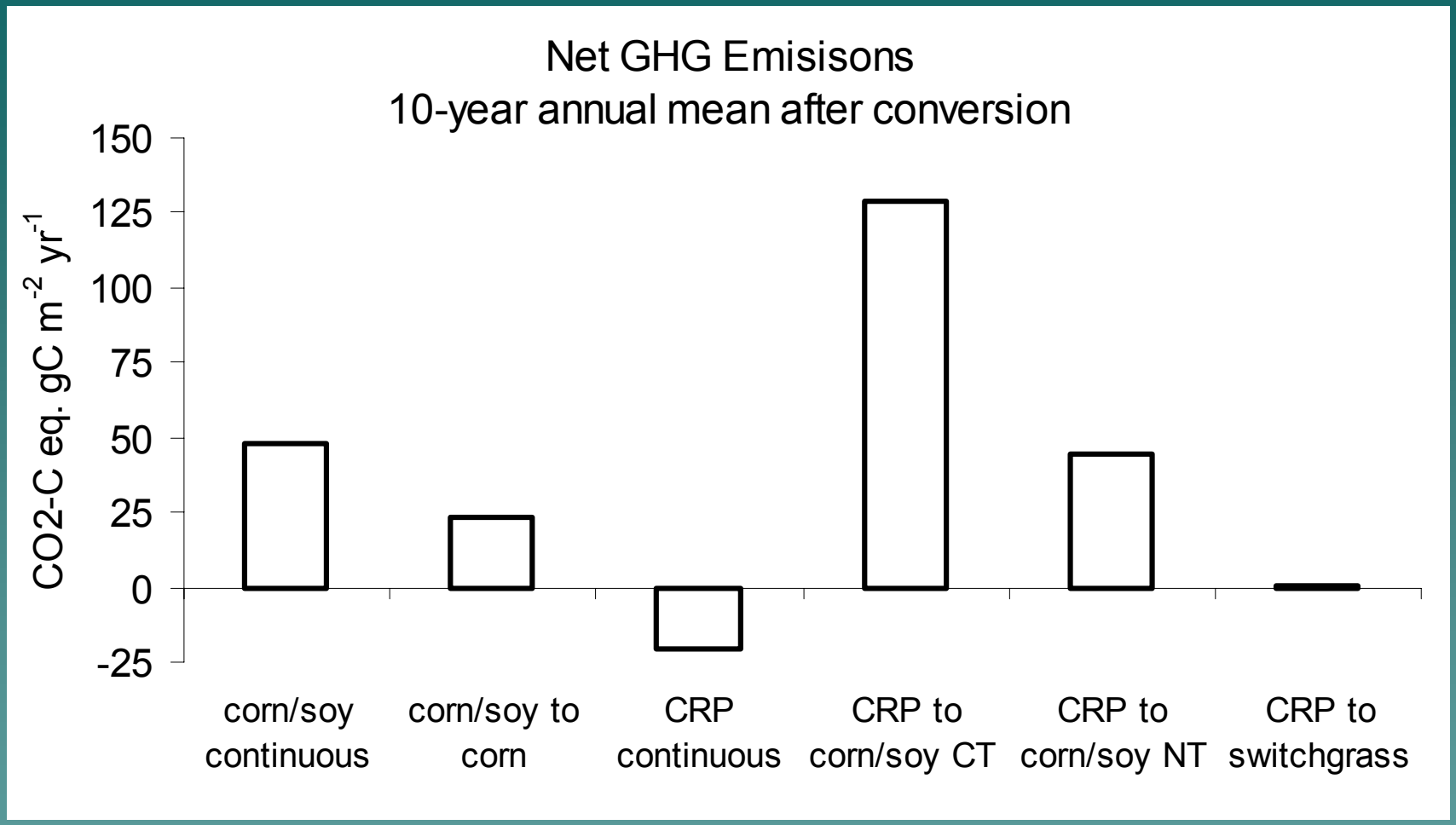
R. Zah *et al.*, *Ökobilanz von Energieprodukten: Ökologische Bewertung von Biotreibstoffen* (Empa, St. Gallen, Switzerland, 2007)

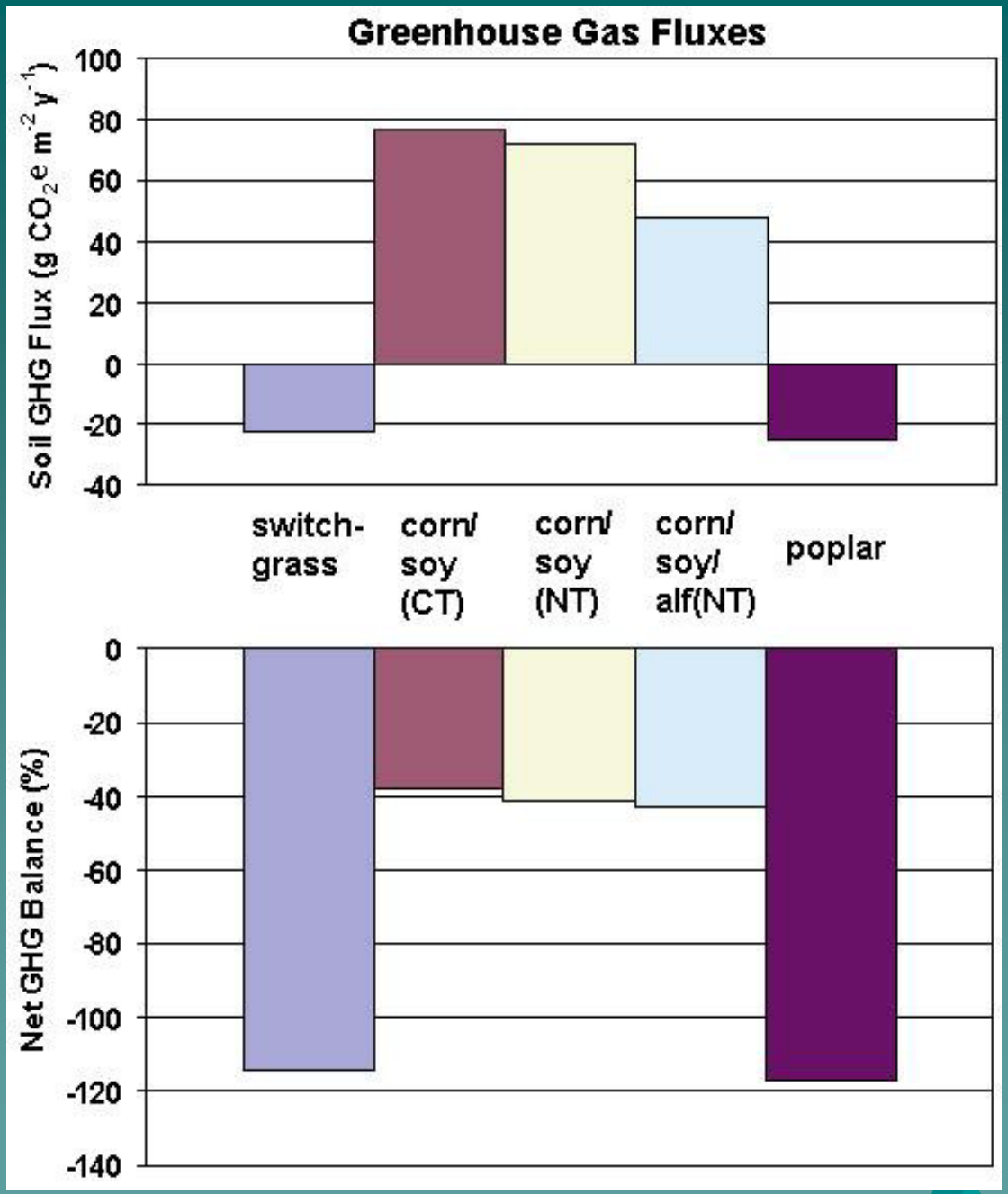
Expansion of Agriculture in the U.S.

- Conservation Reserve Program Lands (CRP)
- Native Grasslands
- Reduction in other crops (i.e. soybean)

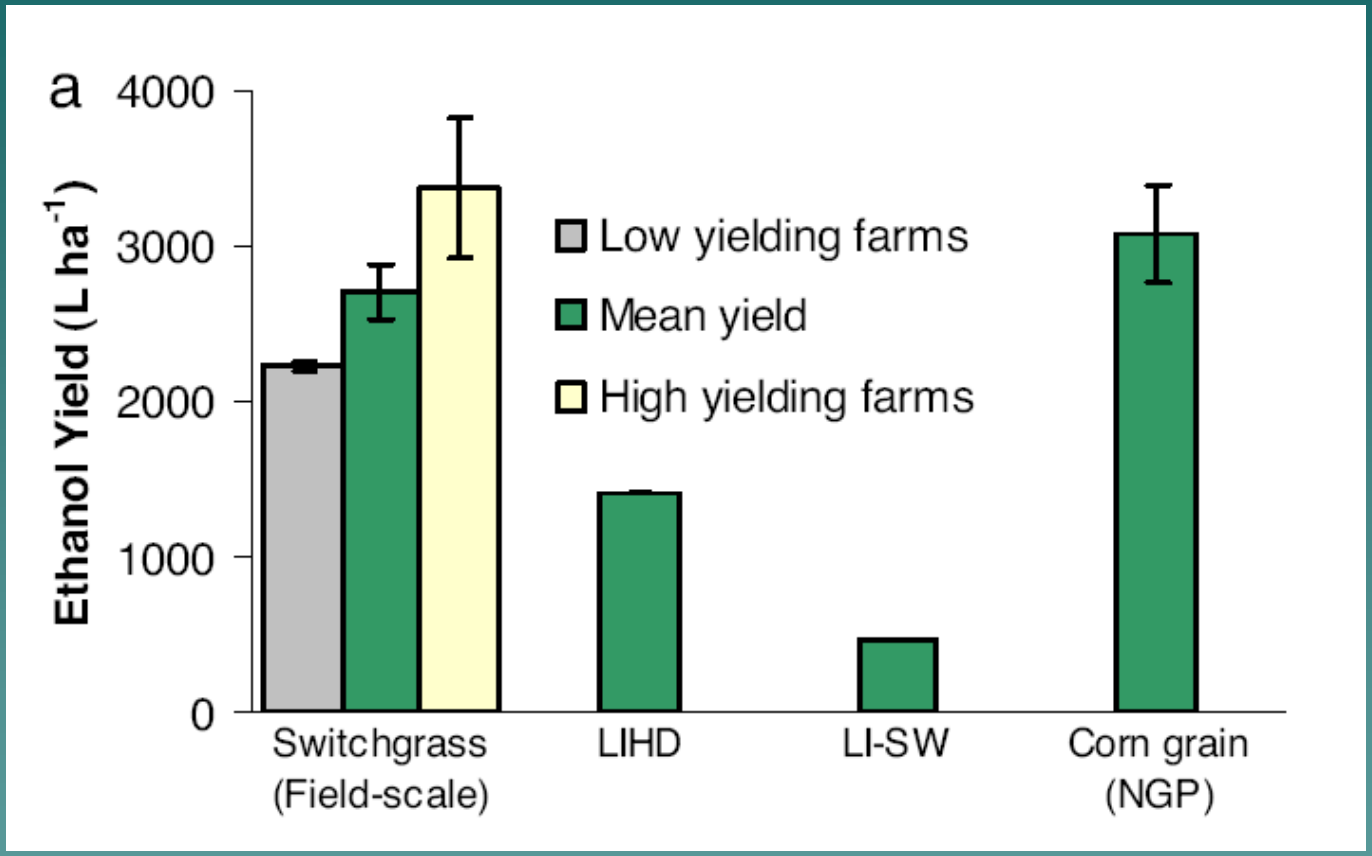

Change in Soil C
10-year annual mean after conversion
delta SOC gC m-2 yr-1
60
40
20
0
-20
-40
-60
-80
corn/soy continuous
corn/soy to corn
CRP continuous
CRP to corn/soy CT
CRP to corn/soy NT
CRP to switchgrass


N_2O Emisisons
10-year annual mean after conversion
CO2-C eq. gC m^{-2} yr^{-1}
60
50
40
30
20
10
0
corn/soy continuous
corn/soy to corn
CRP continuous
CRP to corn/soy CT
CRP to corn/soy NT
CRP to switchgrass


Net GHG Emisisons
10-year annual mean after conversion
CO2-C eq. gC m-2 yr-1
150
125
100
75
50
25
0
-25
corn/soy continuous
corn/soy to corn
CRP continuous
CRP to corn/soy CT
CRP to corn/soy NT
CRP to switchgrass



Adler, P.R., S.J. Del Grosso, and W.J. Parton. 2007. Life cycle assessment of net greenhouse gas flux for bioenergy cropping systems. Ecol. Appl. 17(3):675–691.



Schmer, M.R., K.P. Vogel, R.B. Mitchell, and R.K. Perrin. 2008. Net energy of cellulosic ethanol from switchgrass. PNAS 105: 464-469.

Sustainable Development

Defining Sustainable Biofuels – or "It isn't Easy Being Green"

John Sheehan
LiveFuels, Inc.

Private Sector Perspective

Field to Fuel – Developing Sustainable Biorefineries

Robin Jenkins

Dupont Central Research and Development Experiment Station

Socioeconomic Perspective

Biofuels and Water Quality in the Midwest: Corn vs. Switchgrass as Feedstocks

Cathy Kling
Iowa State University

Biogeochemistry

The Biogeochemistry of Bioenergy Landscapes: Clean Water, Clear Air, & Climate Mitigation vs. Business as Usual

Philip Robertson
Michigan State University

Landscape Dynamics

Interactions Between Biofuel Choices and Landscape Dynamics and Land Use

Virginia Dale
Oak Ridge National Laboratory

Keynote Address

Environmental and Ecological Dimensions of Biofuels

Jose Goldemberg
Global Energy Assessment Council &
Universidade de Sao Paulo, Brasil

Conservation & Biodiversity

Biofuels and Biodiversity

John Wiens
The Nature Conservancy

Agriculture & Grasslands

Production of Biofuels Feedstock on Agriculture Land and Grasslands

Rob Mitchell
Wally Wilhelm
U.S. Department of Agriculture,
Agricultural Research Service

Rangelands

Are Rangeland Biofuel Feedstocks Ecologically Sustainable?

Rob Mitchell
Linda Wallace
University of Oklahoma

Forests

Sustainable Biofuels and Bioproducts from Our Forests

Marilyn Buford
U.S. Department of Agriculture Forest Service

Secondary Feedstocks

Municipal Solid Waste as Supplemental Feedstocks

Donna Perla
U.S. Environmental Protection Agency

Ecology Synthesis

A Global-Scale Biofuels Program and its Environmental Consequences

Jerry Melillo
The Ecosystems Center,
Marine Biological Laboratory

Decision Making Synthesis

The Rush to Biofuels and Ecological Perspectives in the Policy Process

Otto Doering
Purdue University

Summary

- ESA is working on getting environmental information on biofuel cropping systems readily available
- A set of synthesis papers will be written as a result of this meeting
- Recommendations for new biofuel environmental impact research