

Symbiosis: Addressing Biomass Production Challenges and Climate Change

Cyd E. Hamilton, PhD
American Association for
Advancement of Science Fellow

Symbiosis Conference,
Cornell University 2013

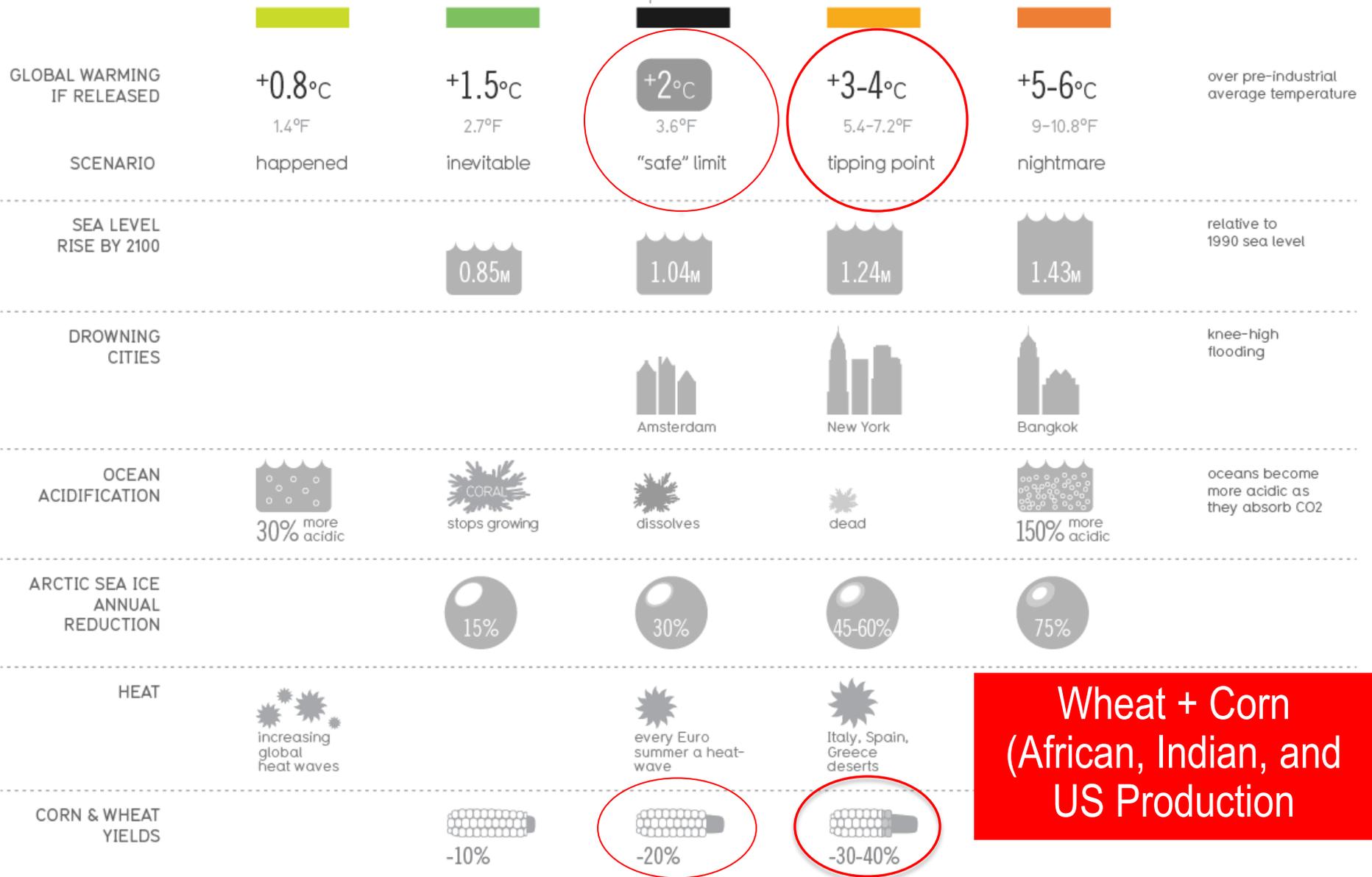
Outline

- Thank you!
 - John Ferrell and Valerie Reed (BETO)
 - James White (Rutgers)
 - Stacey Young (Sentech)
- Background Motivation
- Conference Objectives
 - Two days
 - Long term (Bioenergy Tech. Office Report)
 - Articles e.g., reviews, commentaries
- Plenary Speaker Introduction
 - **John Ferrell** - Department of Energy (DOE), Bioenergy Technologies Office (BETO)
 - **Catherine Ronning** – DOE, Office of Science



Challenges of Climate Change

Data from IPCC 2007 and OECD 2012



**Wheat + Corn
(African, Indian, and US Production)**

A bit about the microbes

1. Benefits

- Abiotic stress tolerance
- Pathogens
- Herbivores

2. Mechanisms

- Alkaloids
- Antioxidants and reactive oxygen species (ROS)

3. Why consider stability

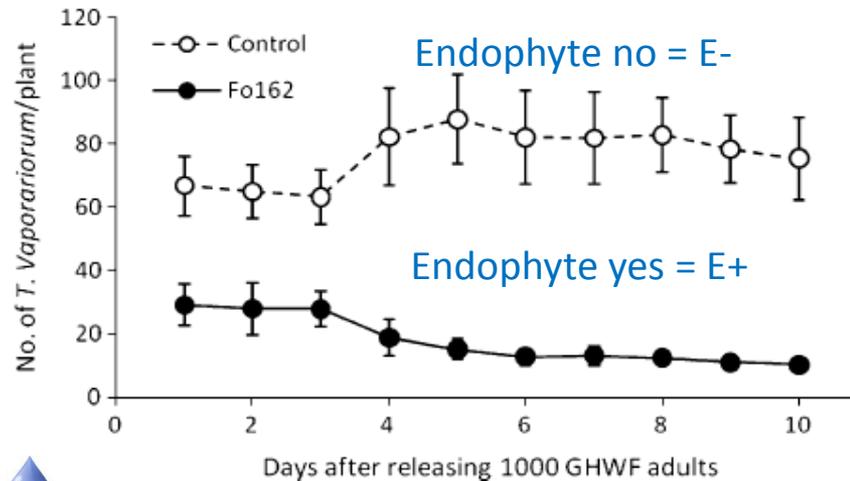
- Ecogenomics, microbiomes, and systems biology

4. Sustainability via reduced:

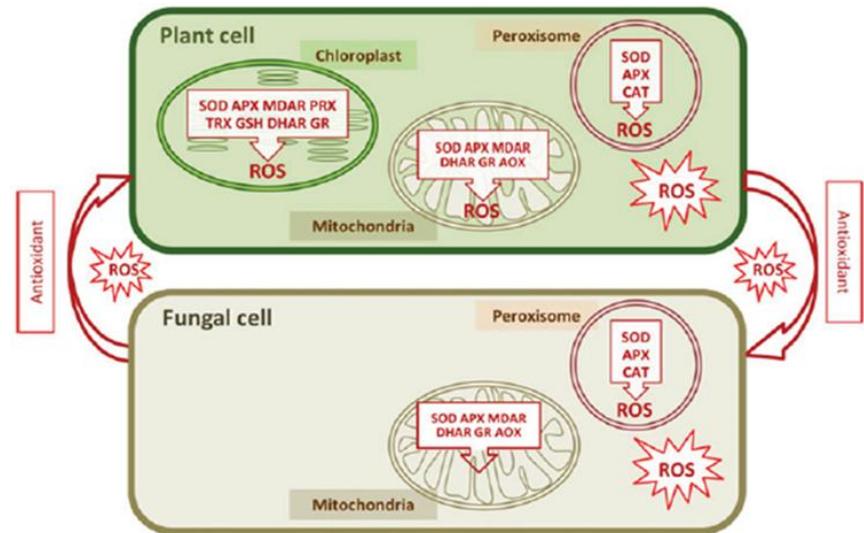
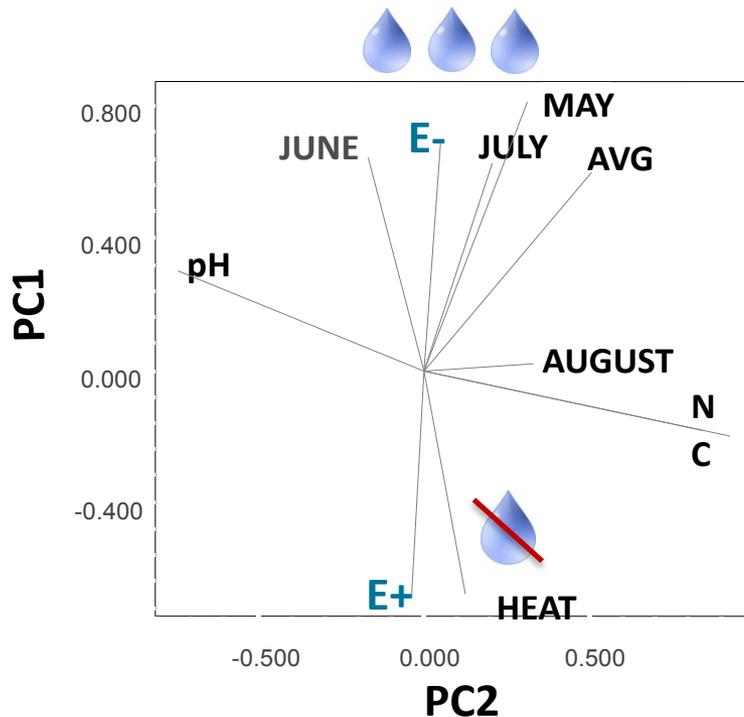
- GHGe
- Water usage
- Chemical applications



Herbivores, Pathogens, Abiotic stress tolerance



Menjivar et al. 2012, *Plant Soil*

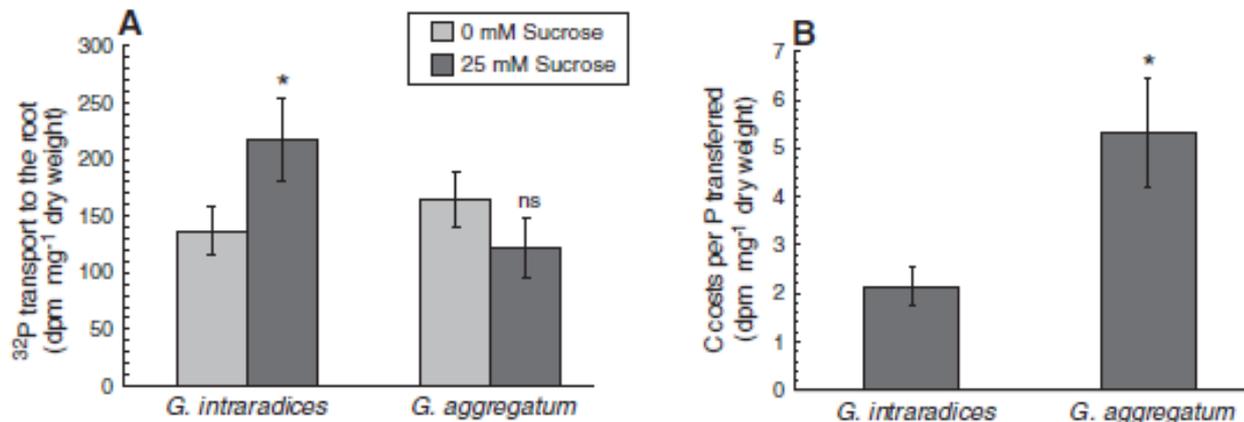


Hamilton et al. 2012, *Fung Div*

Discussion and Report Motivation

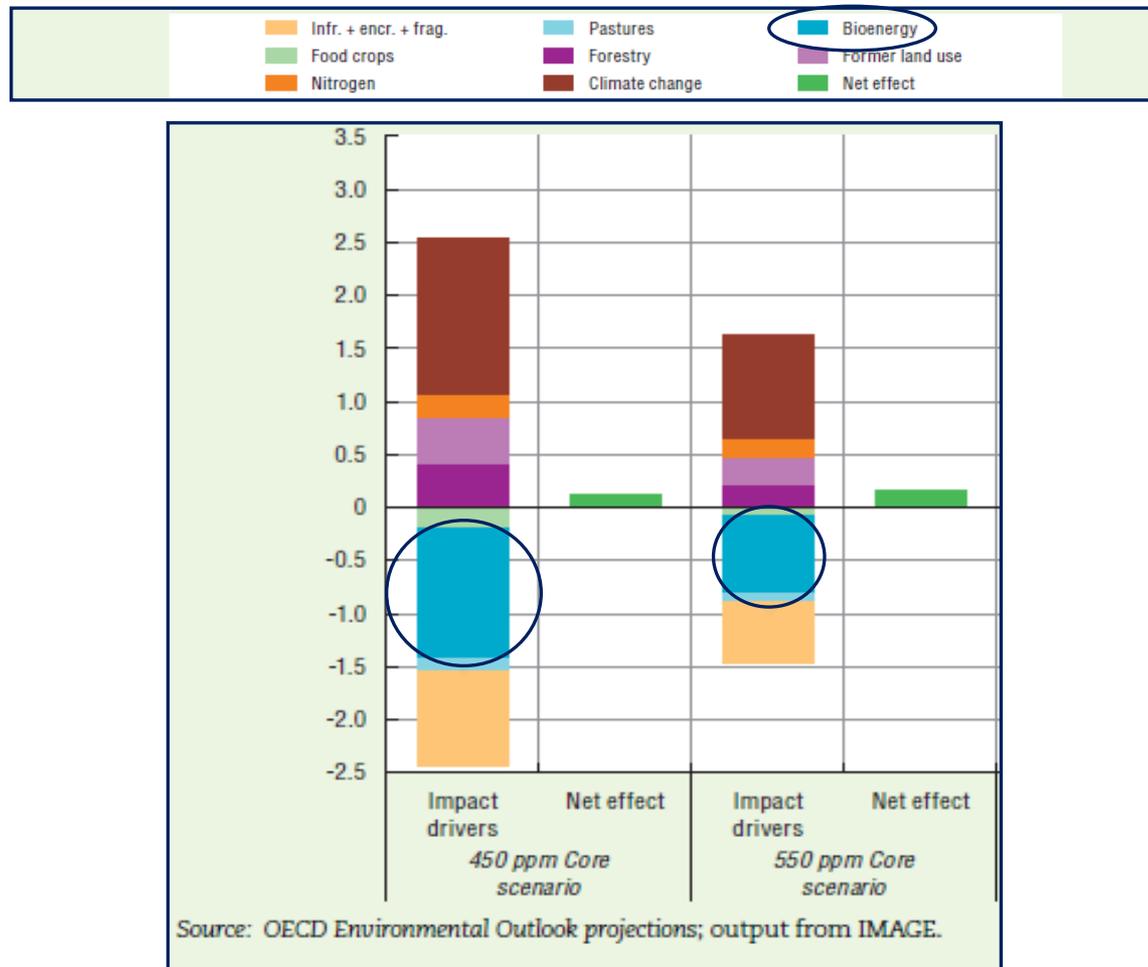
1. Plant characteristics integral to bioenergy crop production and management (practitioners)
2. Systems biology, genomics and modeling – how to produce stable interactions
3. Addressing environmental sustainability of bioenergy crop production
4. Successes and challenges to large scale commercialization of mutualists in bioenergy crop production

DOE, BETO Report on these topics for public distribution



Kiers et al. 2013, *Science*

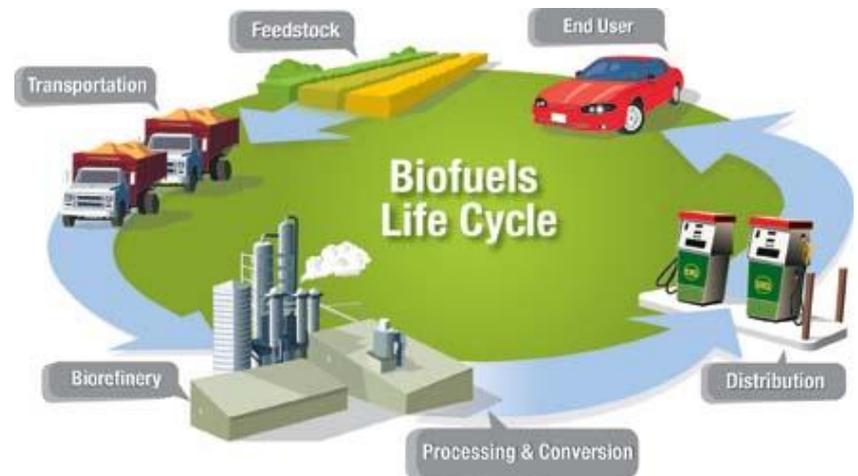
Mitigating biodiversity losses via bioenergy crops



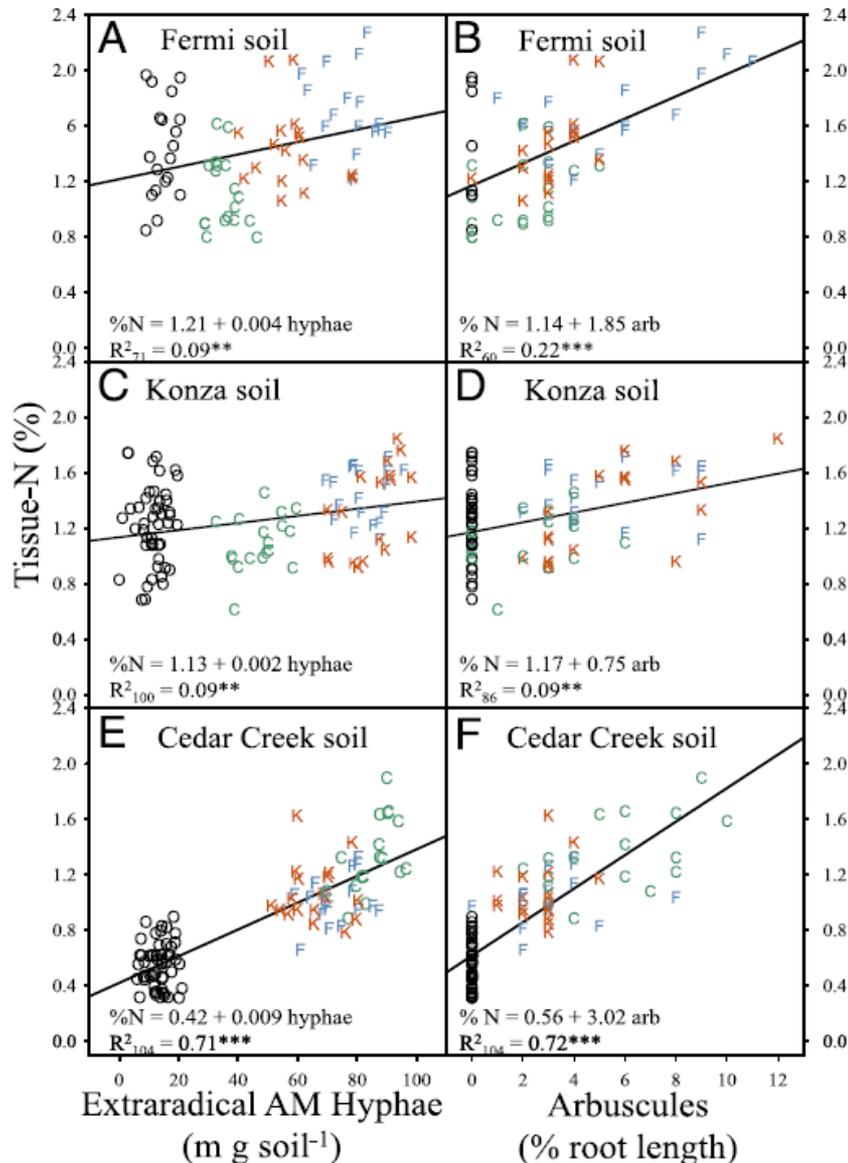
Organization for Economic Cooperation and Development (OECD) Outlook to 2050 (2012)

John Ferrell

- Operations Committee Lead for Biomass R&D Board
- Feedstock Manager
- Foci include feedstock system:
 - Supply
 - Innovative machinery and operations
 - Materials quality
 - Sustainability
 - Economics

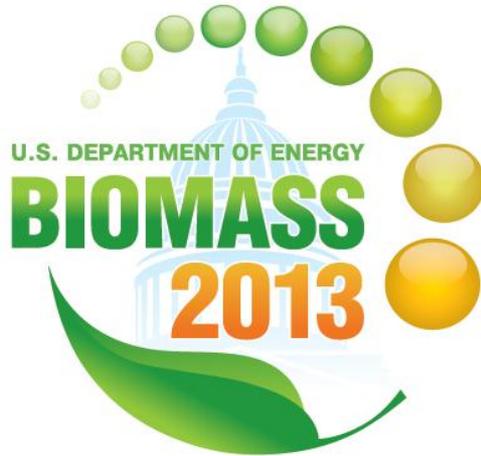


Catherine Ronning, PhD



- DOE, Office of Science (SC)
 - Program Manager in Biological Systems Science Division
 - Joined Biological and Environmental Research in 2009 (Plant Biology and Prog. Mgr.)
 - Member of DOE's Bioenergy Research Centers and Joint Genome Institute Mgmt.
- Previously with J. Craig Venter Institute
 - Microbial EST
 - Genome sequencing

Announcement: BIOMASS 2013 Annual Conference



Biomass 2013: How the Advanced Bioindustry is Reshaping American Energy

July 31-August 1, 2013,

Washington D.C. Convention Center

This year's conference will highlight industry successes and explore current trends and the frontiers of bioenergy.

Agenda Summary

1. Biomass and Competitive Advantages for Manufacturing Clean Energy Products
2. Advancing Alternative Fuels for Military and Aviation Sector
3. Natural Gas and Biomass Liquids
4. Examining Biomass Sectors Gaining Traction, Breaking Ground and Building
5. Synthetic Biology and the Promise of Biofuels
6. End Use and Fuel Certification
7. Navigating Roadblocks on the Path to Advanced Biofuels Deployment
8. Conventional Refineries and Bio-Oil R&D Tech.

Miscellaneous Information

- **WIFI access:**
 - “Red Rover” wireless
 - open their web browser which will bring up to CIT information page
 - follow the directions, accept the terms and restart devices. Here is a link to the CIT page:
<https://www.it.cornell.edu/services/redrover/howto/rrguest/>
- **Your permission to share power point presentations in post-conference materials**
- **Upcoming BETO Annual Conference**
- **Report Outline – see your folders**
 - Working group summary
 - Working group key findings

Thank you
Questions?

Projected Feedstock Demand

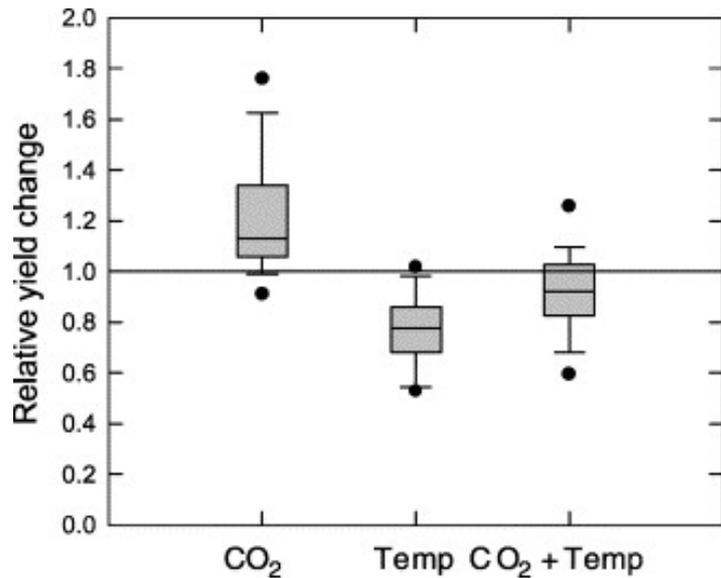
Year	2013	2014	2015	2016	2017	2022	2030
Feedstock Demand mt/y	60	76	102	129	155	325	325
Feedstock Supply mt/y	>52*	>52*	>52*	>52*	191	345	541
EISA (RFS2) mg/y	3000	4000	6000	7000	9000	21 000	21 000

DOE, Biomass MYPP 2012

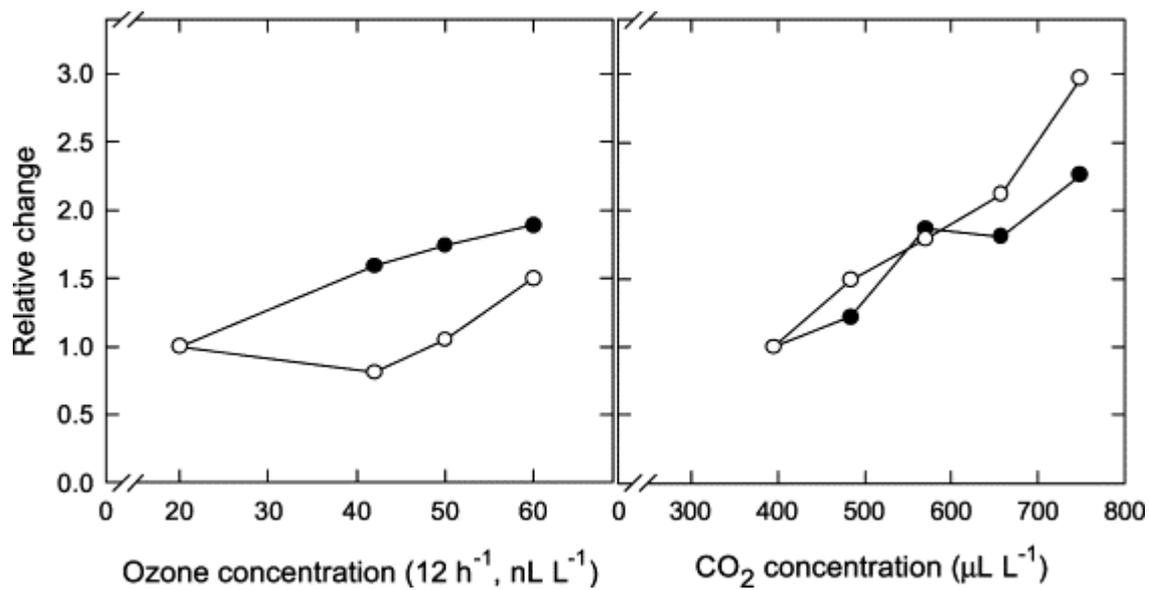
Biomass Type	No Climate Change (mg/y)	Hadley Projections (mg/y)	Canadian Projections (mg/y)
Switchgrass	12 744	12 804	9 011
Poplar + Willow	61	113	275
Crop residues	41	105	3 697
Processing residues	841	663	703
Grain EtOH	15 015	15 015	15 015
Total	28 701	28 701	28 701

Zhang and McCarl 2013, *Econ Res Intl*

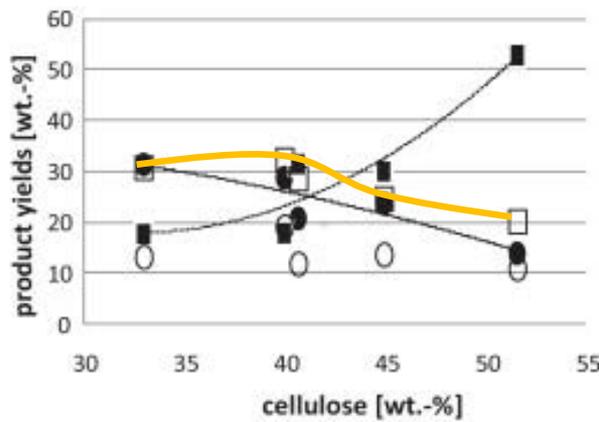
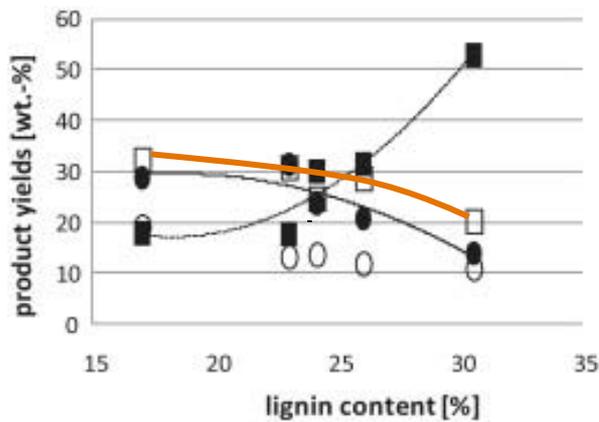
Climate change and yields



Fuhrer et al. 2003, *Ag, Ecosys, Environ*



Heagle et al. 2002, *Enviro Entom*



Tröeger et al. 2013, *J Analyt App Pyrolysis*