Biofuels and nutrition

ARB LCFS Expert Working Group

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Food Consumption Subgroup Goals

- The focus of the subgroup will be on comparing and evaluating existing estimates of the effect of substituting crop based biofuel for fossil fuel on world food and fuel prices and food consumption.

- As other subgroups are focused on general reliability and accuracy of economic models used for land use change (LUC) estimation, our attention will be restricted to how food effects are modeled.

- Particular attention will be paid to understanding GTAP simulations.

- As it is unlikely that the subgroup will make significant progress in achieving all of the tasks described below prior to the deadline for the Expert Workgroup to submit a report this fall, much of the subgroup effort will be directed toward detailed recommendations for future work

Subgroup Workplan

- Understanding GTAP simulations of the substitution of crop based biofuel for petroleum based fuel.
  - Using the results from GTAP simulations, we will attempt to gain a better understanding of how and to what extent the model predicts changes in food consumption.
  - the amount by which GTAP simulations predict that non-biofuel agricultural commodity consumption will change.
  - the primary means by which agricultural commodity consumption changes occur in GTAP simulations.
  - the extent to which changes in food consumption disproportionately affect low income populations.
  - the extent to which feedback from changes in petroleum based fuel prices affects changes in agricultural commodity prices and consumption.

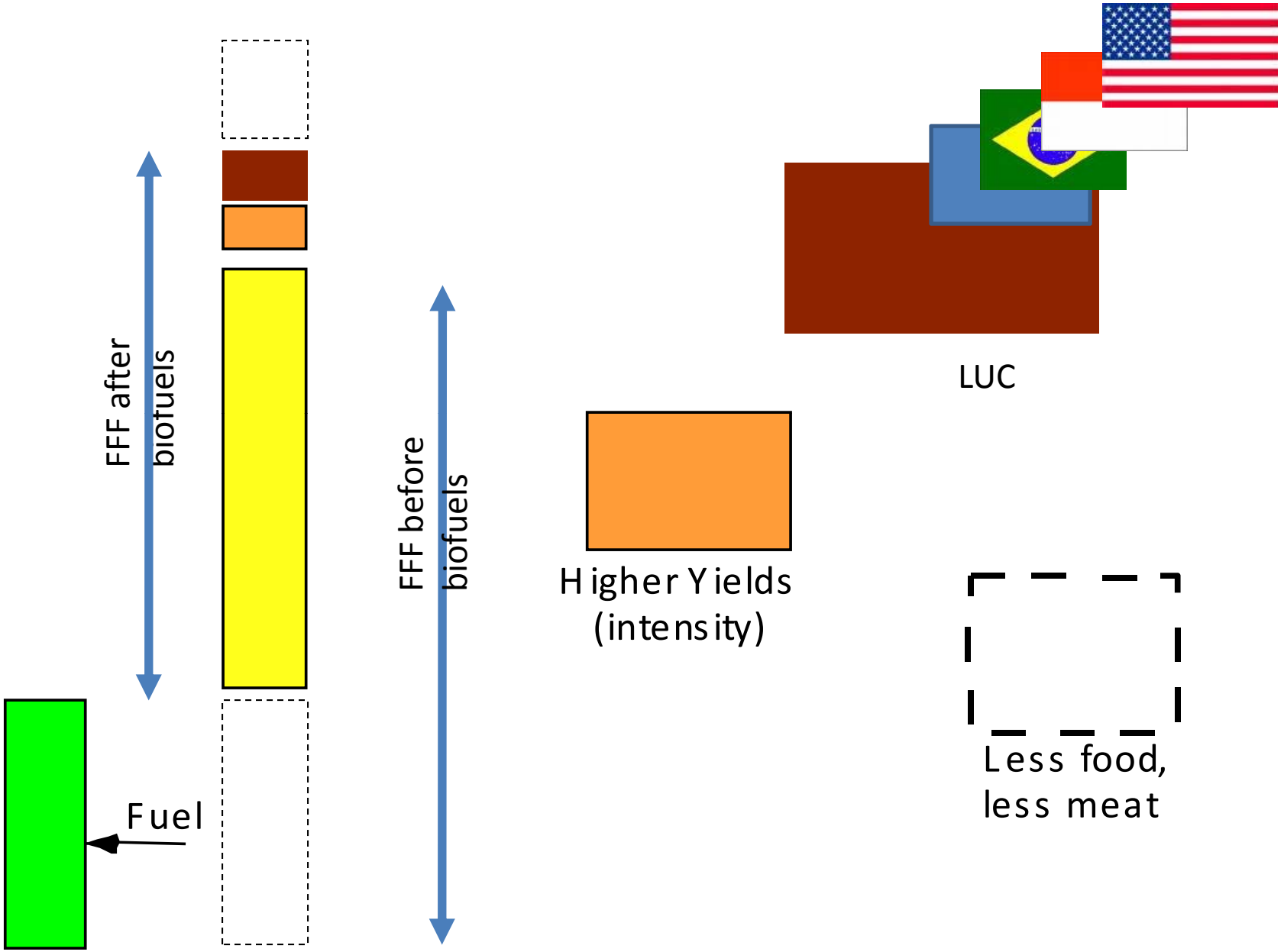
- Model comparison and validation: Compare the results (e.g. agricultural commodity and petroleum based fuel price changes, food consumption changes, etc) from various economic/agricultural models (e.g. GTAP, IMPACT, FAPRI, MIRAGE, others). The JRC report on LUC model comparison may help inform this task.
- Explore possible incorporation of fuel FFF effects into LCFS implementation.

Food Consumption Subgroup Potential Technical Advisors

- IFPRI: Mark Rosegrant and/or Siwa Msangi
- GTAP: Wally Tyner (EWG member)
- FAPRI: Seth Meyer (EWG and Food Consumption subgroup member)
- Rosamond Naylor, Director of the Program on Food Security and the Environment, Stanford University
- C. Ford Runge, Center for International Food and Agricultural Policy, University of Minnesota
- Ronald Trostle, USDA
- JRC: Robert Edwards

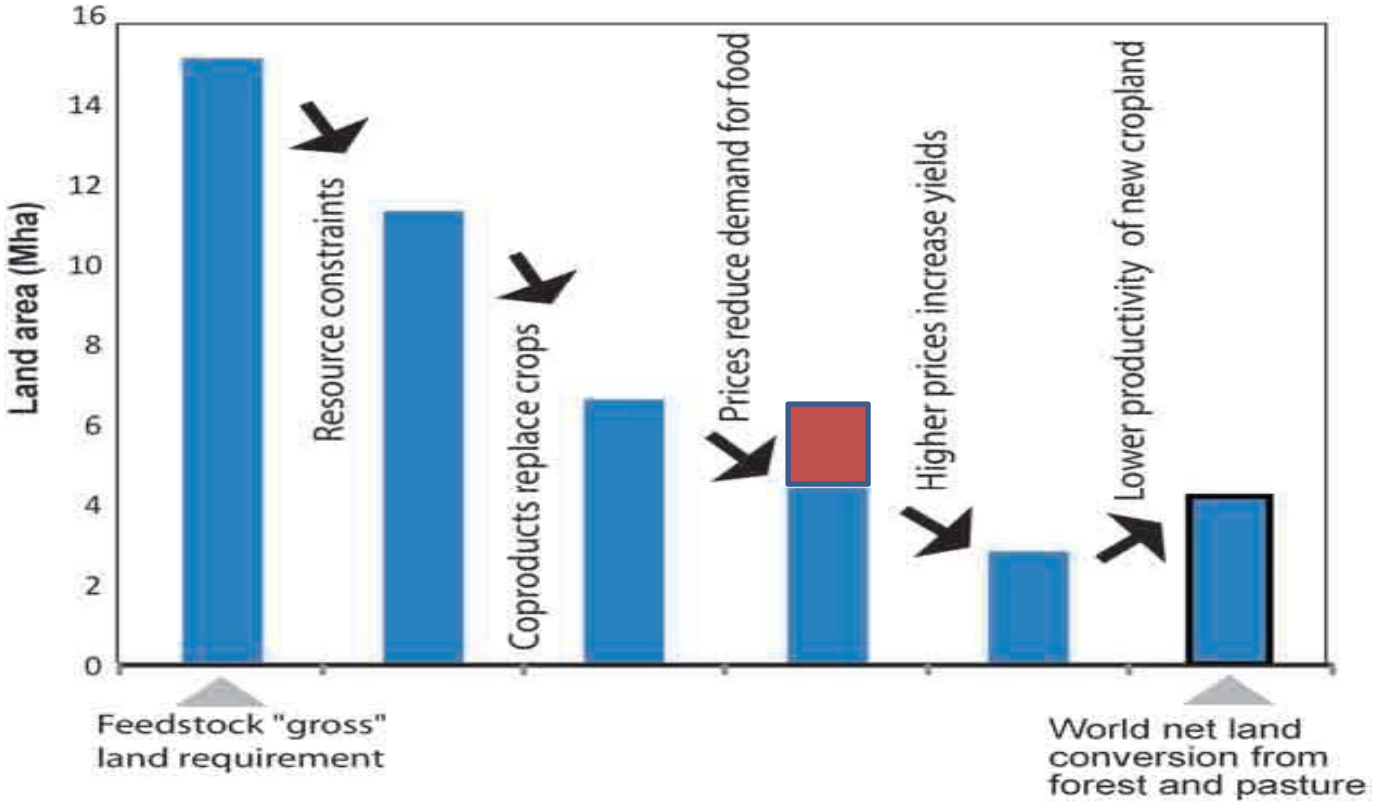
Problem Overview

- First generation biofuel feedstocks (corn, starch) compete with food, feed and fiber (FFF) for land and other inputs
- An increase in the consumption of these feedstocks could causes higher FFF prices, and thus may cause:
  - Diet change (i.e., less meat as fraction of total calories)
  - Reduction in total FFF consumption
- Both of these factors are unequally distributed across populations


FFF after biofuels
FFF before biofuels
Fuel
LUC
Higher Yields (intensity)
Less food, less meat

How big are these responses?

- GTAP estimates food effects and price changes the same way it estimates other product quantity changes.



Recent GTAP results

US and EU mandates

Description	% Change in Prices		% Changes in Outputs	
	USA	EU27	USA	EU27
	Full Effect Experiment			
Coarse grains	12.6	6.5	11.2	-2.7
Oilseeds	11.2	19.1	6.4	32.6
Other crops	6.0	5.8	-2.8	-3.2
Dairy farms	0.6	1.3	-0.3	-0.8
Ruminant	0.8	0.3	-0.2	0.1
Non-ruminant	0.7	-1.9	-0.4	0.5
Total (including trade balances of all commodities)				

From Taheripour et al ND

Food Consumption Category	"Current Policy" Experiment (reduction in food consumption)				Fixed Food Consumption	
	US		Global		US	Global
	Market Price, % change	Consumption Quantity, % change	Global Exports Price, % change	Consumption Quantity, % change, weighted by market values across regions	Market Price, % change	Global Exports Price, % change
Coarse Grains	16.33	-0.9	7.22	-0.35	17.64	8.04
Other Grains	3.7	-0.3	1.73	-0.2	4.46	2.29
Oilseeds	6.22	-0.44	3.27	-0.18	7.18	3.95
Sugarcane	8.64	-0.56	0.91	-0.09	10.44	1.37
Livestock	2.4	-1.24	0.63	-0.23	2.73	0.82
Other Food Products	0.41	-0.3	0.21	-0.18	0.46	0.29
Processed Livestock	0.85	-0.5	0.16	-0.20	0.95	0.21
Other Agriculture	2.71	-1.15	0.69	-0.33	3.24	0.99

(from Hertel et al 2010 SOM)

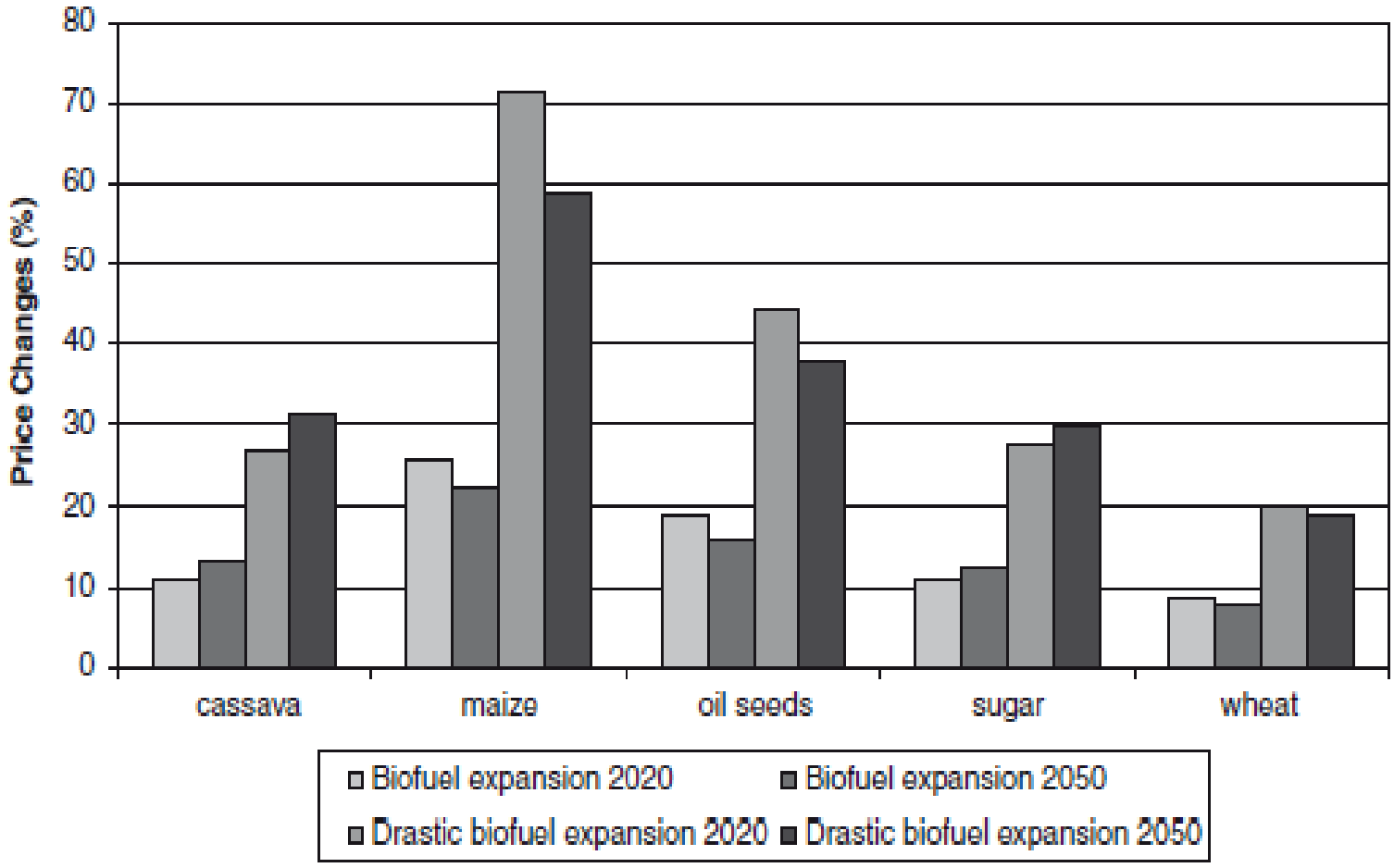
Biofuel impacts on prices

Source	Estimate	Commodity	Time period
World Bank (April 2008)	75 %	global food index	January 2002 – February 2008
IMF (2008?)	70 % 40 %	corn soybeans	? ?
IFPRI (May 2008)	39 % 21-22 %	corn rice & wheat	2000 – 2007 2000 – 2007
OECD-FAO (May 2008)	42 % 34 % 24 %	coarse grains vegetable oils wheat	2008 – 2017 2008 – 2017 2008 – 2017
Collins (June 2008)	25-60 % 23-35 %	corn US retail food	2006 – 2008 2006 – 2008
Glauber (June 2008)	23-31 % 10 % 4-5 %	commodities global food index US retail food	April 2007 – April 2008 April 2007 – April 2008 January – April 2008
CEA (May 2008)	35 % 3 %	corn global food index	March 2007 – March 2008 March 2007 – March 2008

Some relevant findings

- Naylor et al 2007 summarize seven estimates of corn price increases from various volume scenarios ranging from 6% to 65%;
- **Larger biofuel volumes cause greater price increases**
- Estimates of consumption and price effects vary widely
- The 2006-8 food price spike was not **principally** due to biofuels expansion (Baffes & Haniotis 2010)
- Commodity prices are a small fraction of food prices
- Real food prices are generally at historic lows

Biofuel volume affects price



(from Msangi et al 2010)

Motivation

FFF, especially food, effects of biofuel expansion are:

- Considerable
- Politically salient
- Most affect the very poor

The policy conundrum

- LCFS is built on (i) unit estimates of (ii) GHG [g/MJ]
- It is not meaningful to allocate a “fraction of a price increase” to a MJ of fuel in the same way a fraction of LUC can be assigned (total land use discharge/total MJ shock)
- It *might* be possible to assign a food consumption decrease this way, but not in GHG units.
- Should two fuels with different FFF effects be treated differently in the LCFS?

Measuring nutrition effects in CO_2 units

Hertel et al hold food consumption constant and estimate a 50% higher ILUC value.

Is there another way to incorporate FFF effects into LCFS discrimination among fuels?