ASCENT Project 01

Alternative Jet Fuel Supply Chain Analysis - CORSIA Fuels Support

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Objective:

- Provide data and modeling practices to **estimate ILUC values for alternative SAF pathways**
- Develop required economic analysis to **assess economic feasibility and profitability of SAF pathways**

Project Benefits:

- Improve ILUC estimation method for SAF pathways
- Develop methodologies to calculate direct land use change (DLUC) emissions
- Improve emissions factor databases and modeling approach

Research Approach:

Sustainable aviation fuels (SAFs) are essential in achieving carbon-neutral growth in aviation

Biomass-based SAFs may induce global land use changes and associated carbon stock

CORSIA Life Cycle Analysis (LCA) has two components: **Core LCA** and **ILUC**

- Use GTAP-BIO model to **assess induced land use change (ILUC) emissions**
- Use PE models for **economic feasibility analysis**
- Use Techno-Economic Analysis to study supply chain from feedstock production to aviation fuel

Major Accomplishments (to date):

Provide required data and modeling practices to **estimate ILUC values for alternative SAF pathways** and **developed required land use analyses** to support the Fuels Task Group (FTG) activities and goals.

Future Work / Schedule:

- Further improve the GTAP-BIO model to assess ILUC values for new pathways and new regions
- Develop policy analyses to support SAF production

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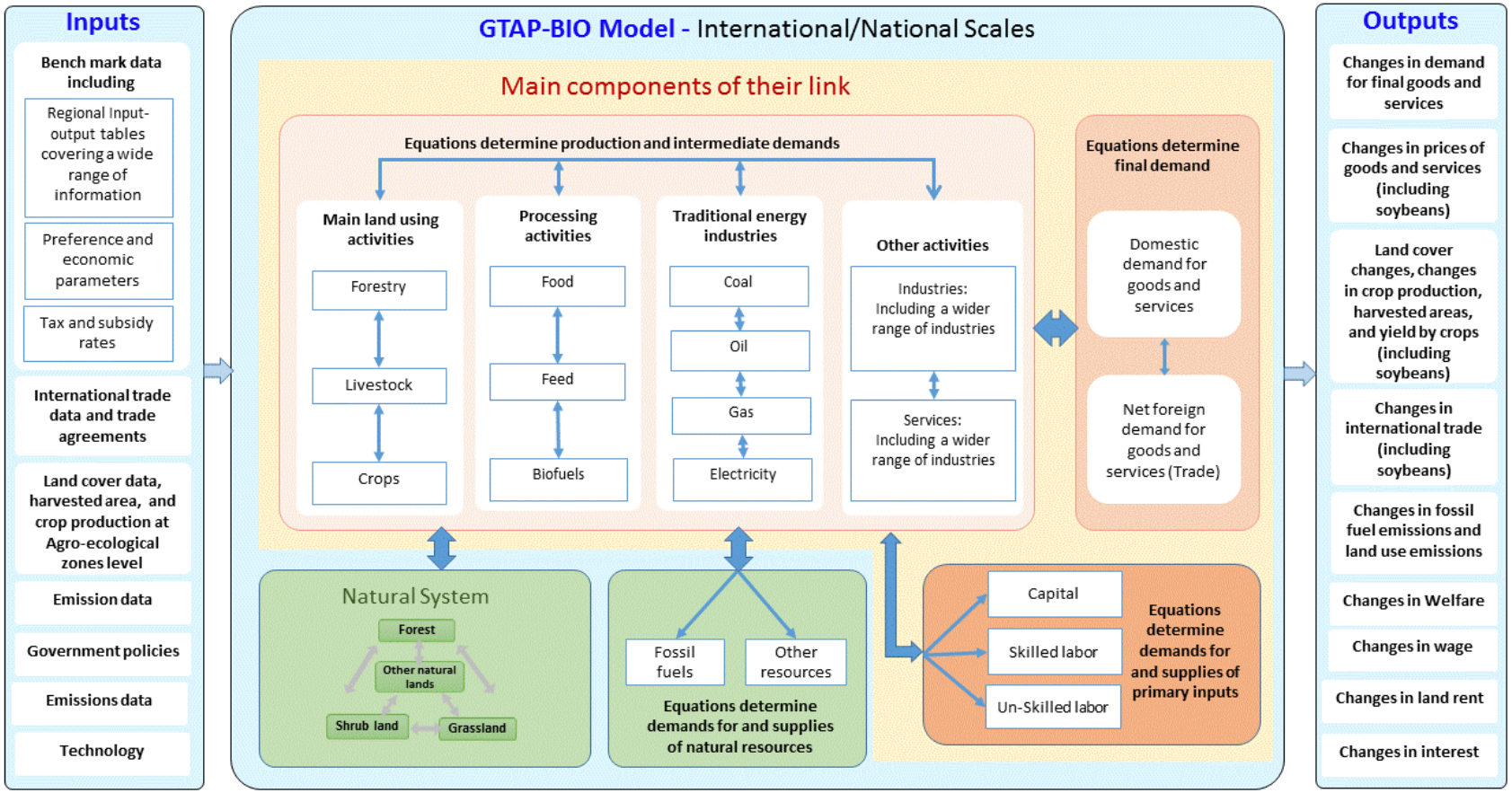
Estimating induced land use change emissions for sustainable aviation biofuel pathways

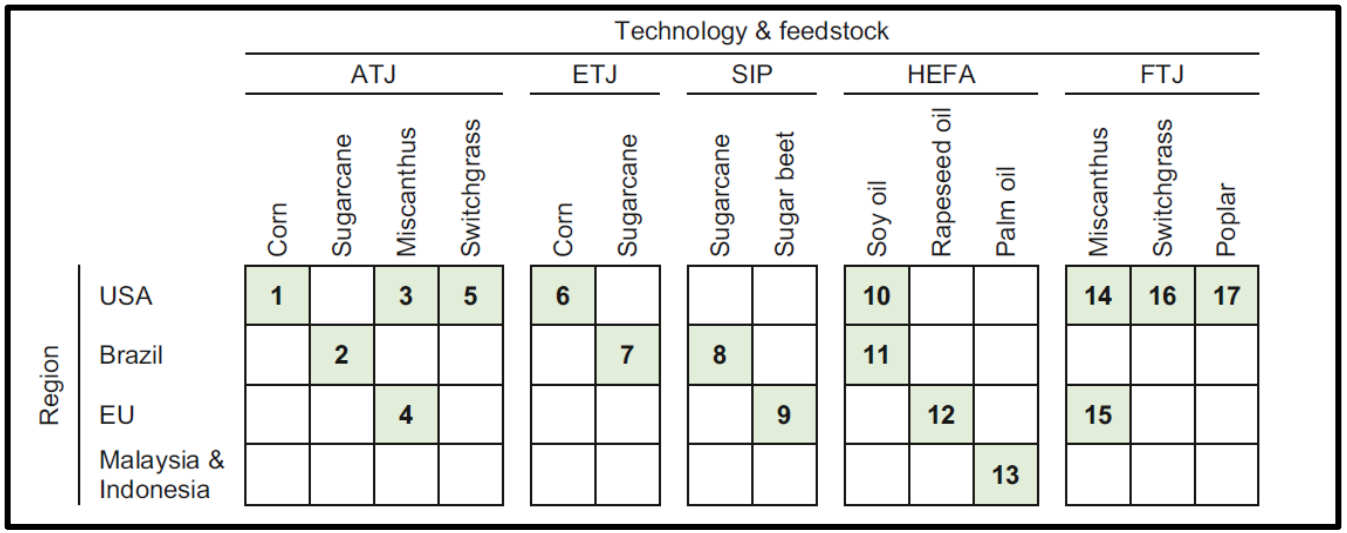
Zhao X., Taheripour F., Malina R. Staple M, Tyner E.
Science of the Total Environment, 119 (2021) 146238

- CORSIA uses two models to determine ILUC values for SAF pathways: **GTAP-BIO**, **GLOBIOM**
- This presentation introduces GTAP-BIO and its estimated ILUC values for SAF pathways

Structure of GTAP-BIO model



Examined SAF pathways and implemented shock sizes in CAPE11

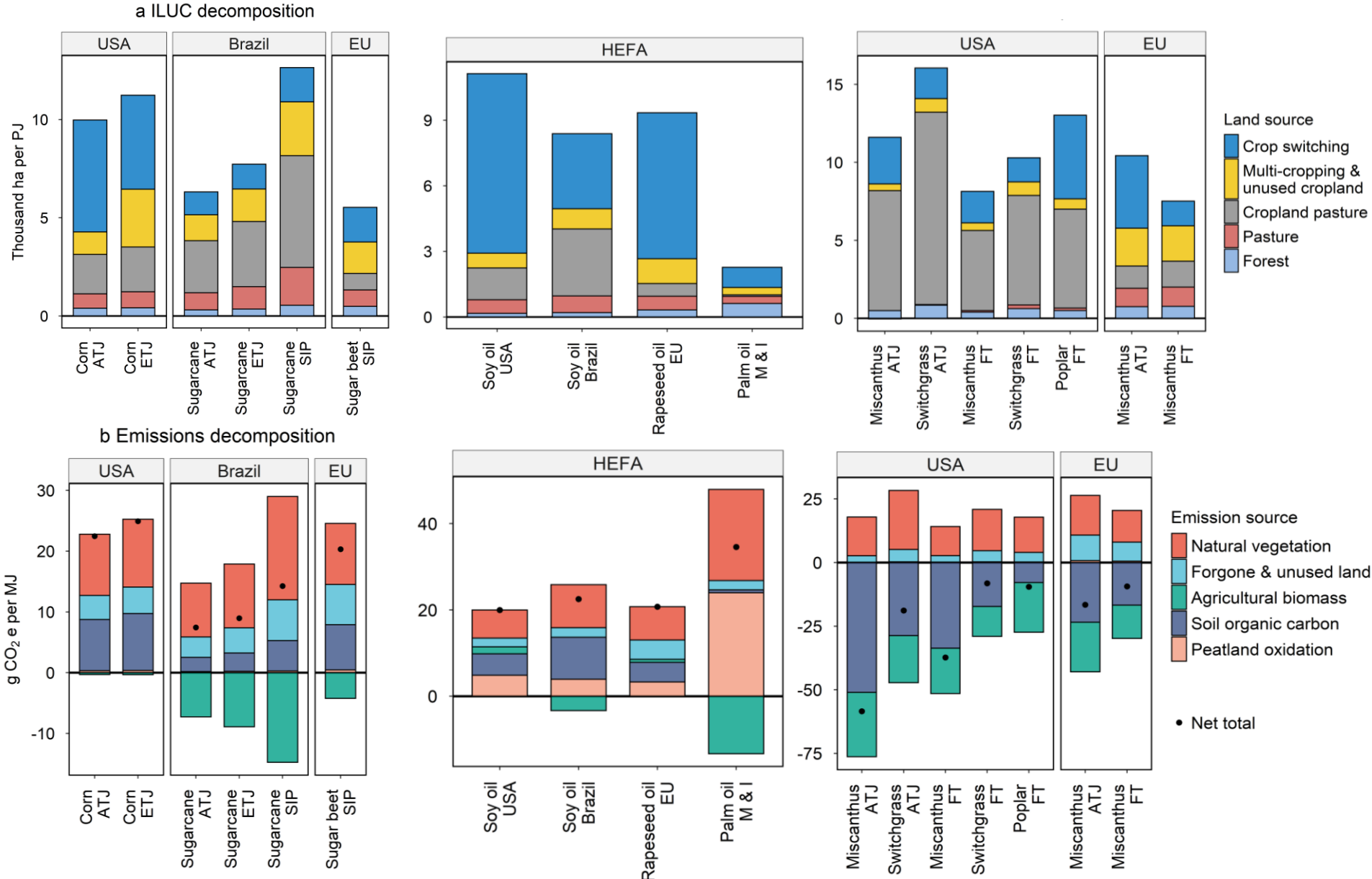


Implemented shock size in PJ for sustainable aviation fuel pathways

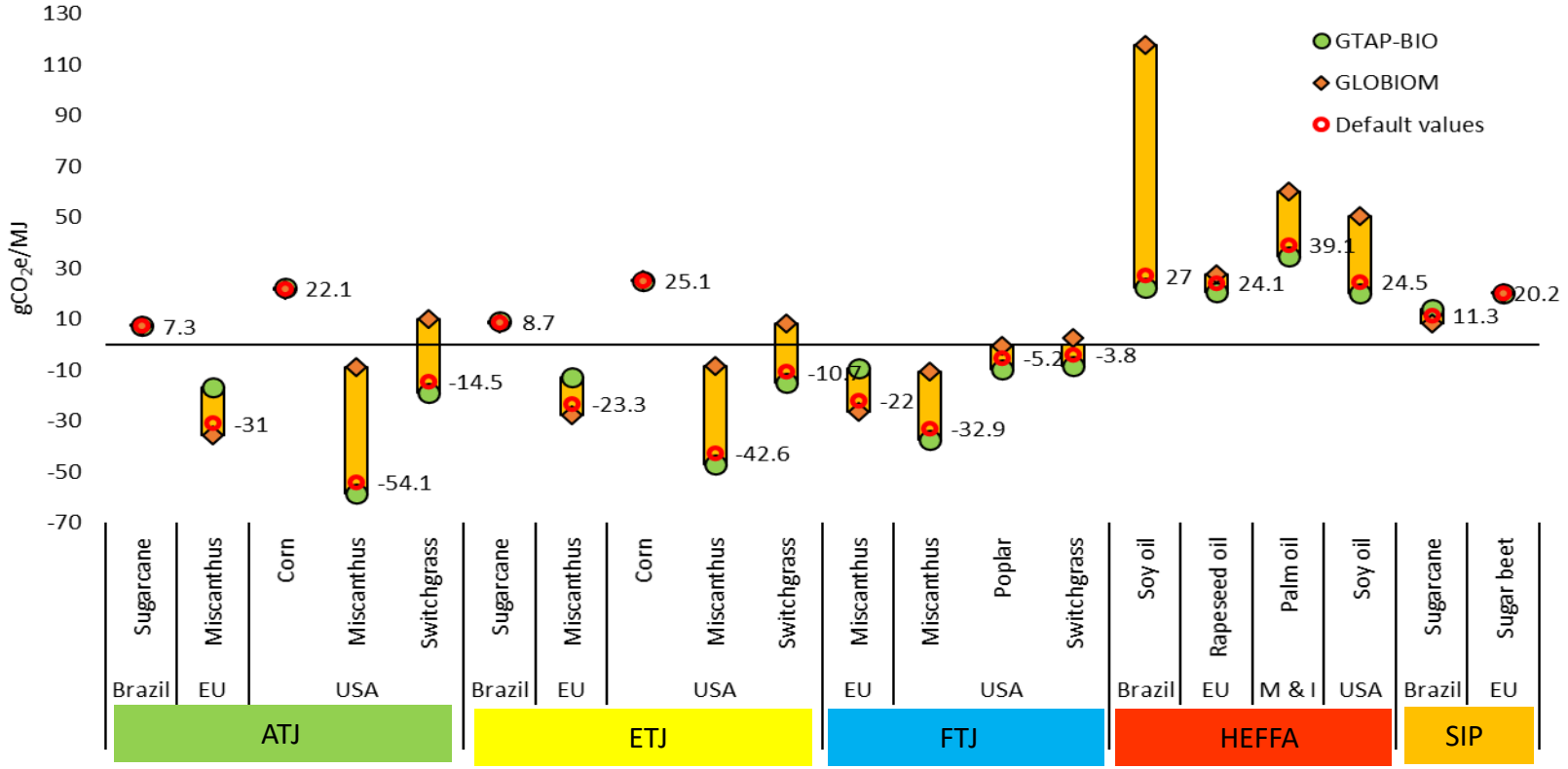
Region	Feedstock	SAF	Fuel coproduct	Total	Region	Feedstock	SAF	Fuel coproduct	Total
USA	Soy oil	57	171	228	Brazil	Soy oil	44	132	177
	Corn	104	0	104		Sugarcane	104	0	104
	Corn	104	32	136		Sugarcane	104	14	118
	Miscanthus	69	208	277		Sugarcane	104	65	169
	Miscanthus	69	0	69		Rapeseed oil	65	195	260
	Switchgrass	69	208	277	EU	Miscanthus	52	156	208
	Switchgrass	69	0	69		Miscanthus	52	0	52
	Poplar	69	208	277		Sugar beet	78	0	78
Mal.-Ind.	Palm oil	52	156	208					

Note: 1 Petajoule (PJ) = 1 billion Megajoules (MJ) and 1 PJ = 0.008 Billion Gallons Gasoline Equivalent (BGGE)

Estimated land use changes for SAF pathways in CAPE11



Estimated ILUC values for SAF pathways in CAPE11



Work in progress on ILUC

- Pathways using dedicated energy crops based on ETJ technologies,
- Pathways using second oil crops: carinata, camelina, pennycress, jatropha,
- Estimating global ILUC values for unexamined regions,
- A major model improvement is in progress to update the GTAP-BIO data base and assess ILUC values for more disaggregated geographical regions.