

LCA, Renewable Fuels and modeling: Some thoughts related to FASOM

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Plan of presentation

Will cover a few LCA aspects of FASOM

1. Major developments that affect LCA results.
2. Nature of greenhouse gas accounting in FASOM and way it differs from traditional LCA.
3. Data sources and reliance on other models
4. The divergence of LCA results in international land use accounting
5. Challenges to land use modeling and biofuels
6. Plans for model improvement

Recent FASOM Modeling Developments

- Land-use class disaggregation
 - Cropland (from to forest, cropland pasture)
 - CropLand_Pasture (from to forest, cropland)
 - Rangeland
 - Pasture (from to forest)
 - CRP (to cropland)
 - Forest_Pasture
- Crop expansion
 - (Winter, spring barley, double crop soybeans, canola, miscanthus, energy sorghum)
- N₂O updates
 - Unifications with DAYCENT
- Expanded fertilization possibilities
 - 115%, N inhibitor

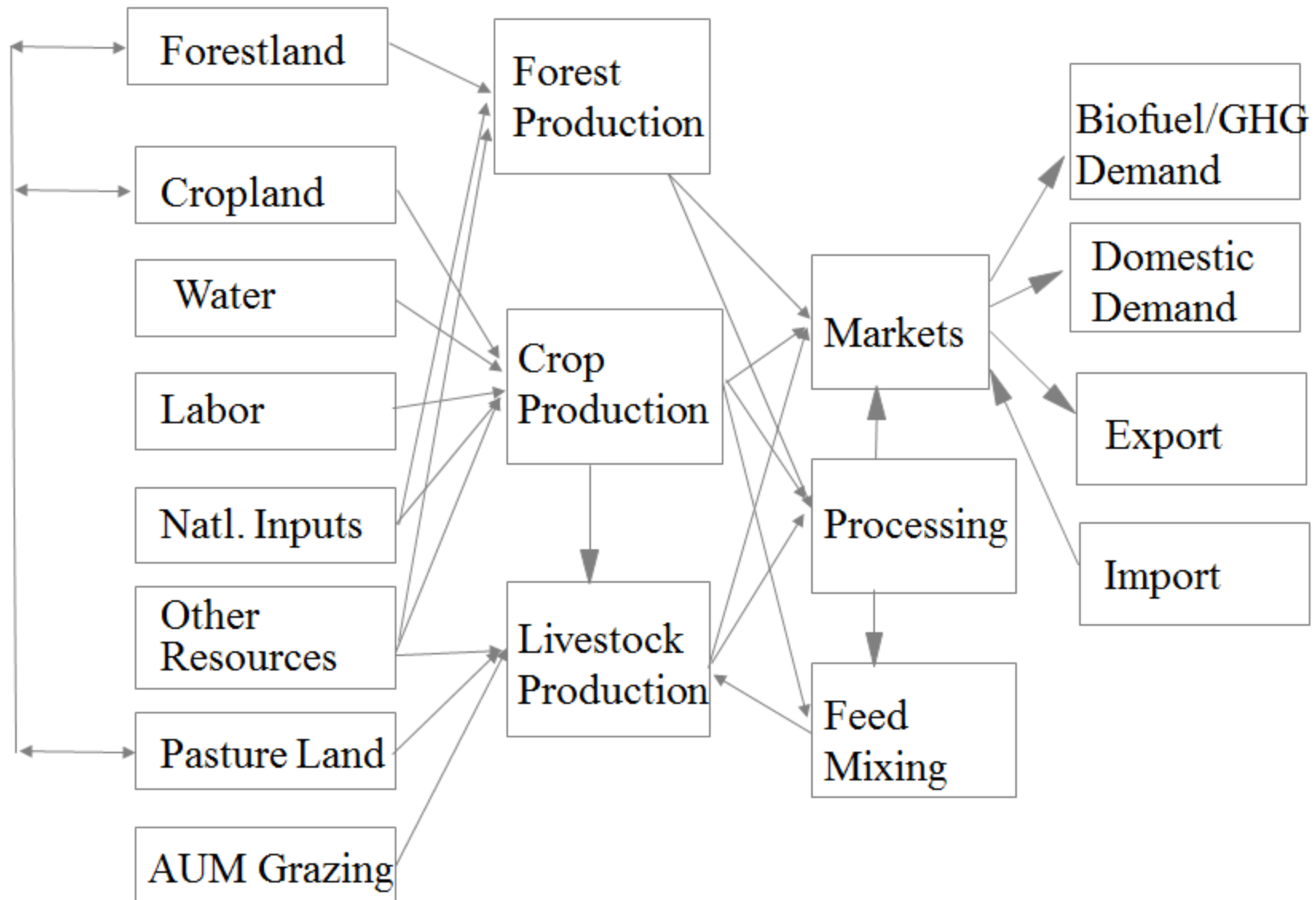
Recent FASOM Modeling Developments

- Transactions costs, storage
 - Months of storage, fixed and variable cost
 - Longer for residues (10 months)
 - Shorter for energy crops (6-8)
 - Low for forest wood
 - Two stage transport for cofiring
 - Costs of assembly, uncertainty, other transactions
- Unification with global GLOBBIOM.

FASOM GHG Accounting and differences from LCA

- FASOM is not a LCA model
- In one small part FASOM contains LCA type of information
- But it is not a total accounting in any one place
 - Input GHG content under purchased inputs
 - Farm production by 63 regions (input use)
 - Hauling in processing variables
 - Also processing GHG emissions
 - Many categories (next page)
- When solved all is added together

Basic Modeling -- FASOMGHG



FASOM GHG Accounting and differences from LCA

In forest

Forest_SoilSequest_FI

Forest_SoilSequest_OP

Forest_AfforestSoil_OP

Forest_LitterUnder_FI

Forest_LitterUnder_OP

Forest_AfforLitter_OP

Forest_ContinueTree_FI

Forest_ContinueTree_OP

Forest_AfforestTree_OP

Forest products

Forest_USpvtProduct

Forest_USExport

Forest_USFuelResidue

Carbon_For_Fuel

Forest_USpubProduct

Forest_USImport

Forest_USresidProduct

Forest_CANProduct

Forest_USFuelWood

Forest_CANresidProduct

Dev land

Dev_Land_from_Ag

Dev_Land_from_Forest

Ag soil

AgSoil_CropSequest_Initial

AgSoil_PastureSequest

AgSoil_CropSequest_Till

AgSoil_CropChange

Ag production

Carbon_AgFuel

Carbon_Pest

Carbon_Dryg

Carbon_Irrg

Carbon_Fert

FASOM GHG Accounting and differences from LCA

Bioenergy

Carb_Ethl_Offset	Carb_Ethl_Haul	Carb_Ethl_Process
Carb_CEth_Offset	Carb_CEth_Haul	Carb_CEth_Process
Carb_CEth_Residue_Offset	Carb_CEth_Res_Haul	Carb_CEth_Resdue_Process
Carb_BioElec_Offset	Carb_BioElec_Haul	Carb_BioElec_Process
Carb_BioElec_Residue_Offset	Carb_BioElec_Res_Haul	Carb_BioEl_Res_Proc
Carb_Biodiesel_Offset	Carb_Biodiesel_Haul	Carb_Biodiesel_Process

Animals

Methane_Liquidmangement	Methane_EntericFerm	Methane_Manure
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Crops

Methane_RiceCult	Methane_AgResid_Burn
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Processing

Methane_BioElec	Methane_Biodiesel	Methane_Ethl
Methane_CEth		

FASOM GHG Accounting and differences from LCA

Animals

NitrousOxide_Manure

Bioenergy processing

NitrousOxide_BioElec

NitrousOxide_Biodiesel

NitrousOxide_Ethl

NitrousOxide_CEth

Fertilization, legumes, crop residues, histosol

NitrOx_Cropland_Direct

NitrOxide_Cropland_Volat

NitrOxide_Crop_Leach

NitrOx_Cropland_Sludge

NitrousOxide_Nfixing

NitrousOxide_CropResid

NitrOx_Crop_Histosol

NitrOx_Crop_Resid_Burn

Pasture

NitrOx_Pasture_Direct

NitrOx_Pasture_Volat

NitrOxide_Past_Leach

Data Sources including Models

- State crop budgets
- GREET
- EPA
- USDA Agricultural Statistics
- EPIC
- DAYCENT
- EPA GHG Inventory
- ARMS survey
- USDA Livestock budgets

Divergence

Results critically depend on assumptions

To model Brazil well need

- Southern land (corn and soy and pasture)
- More northern land (soy and pasture)
- Rainforest land (pasture and rainforest)
- Transport costs

Challenges

What to do about new stuff

Butanol and plug in fuels

Cellulosic ethanol

Pyrolysis

Energy crops

- miscanthus, energy sorghum.
jatropha

Challenges

Technological change

Storage

Transactions costs

Energy price as quantity is large

Land classes

Marginal lands and feedstocks

Plans for improvement

More feedstocks

Marginal lands

Better storage and transactions costs

International expansion and dynamics

Two stage processing and retrofits

Climate change and crop mix