

Updated ILUC Emission Factor Model

CARB
September 15, 2011

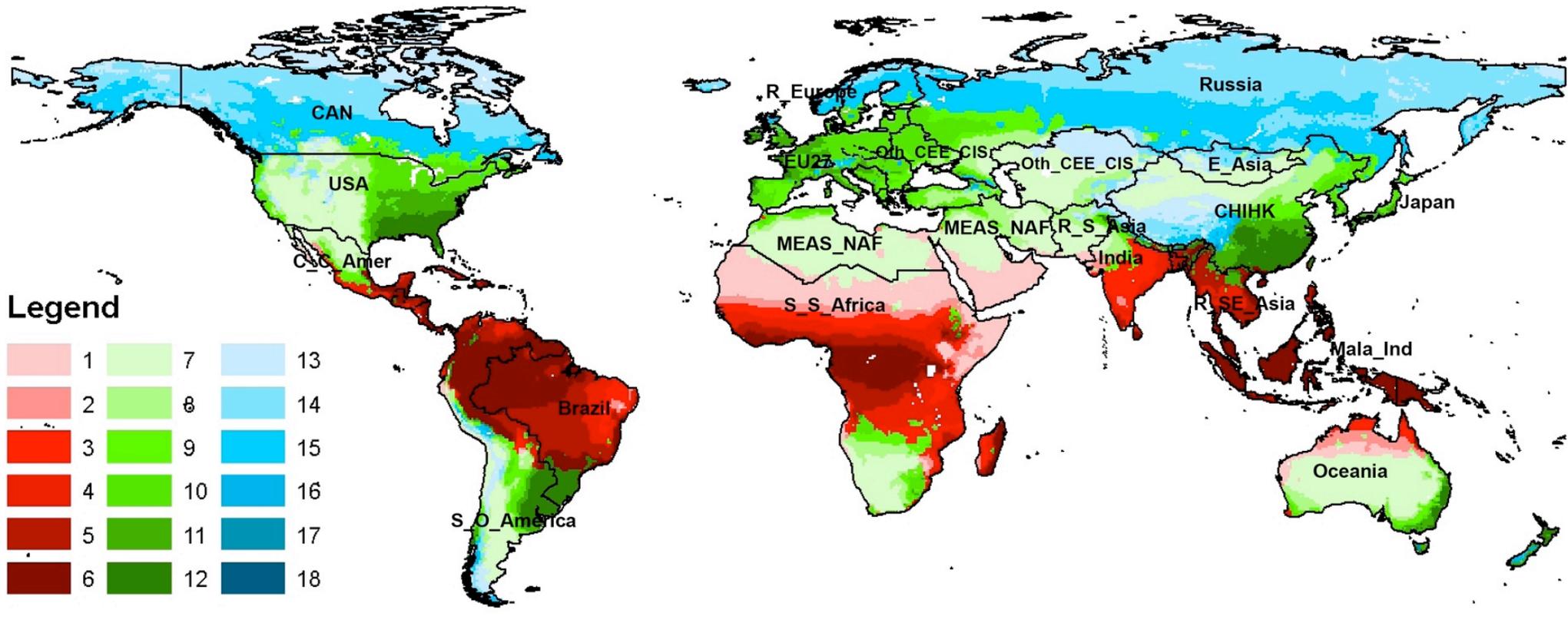
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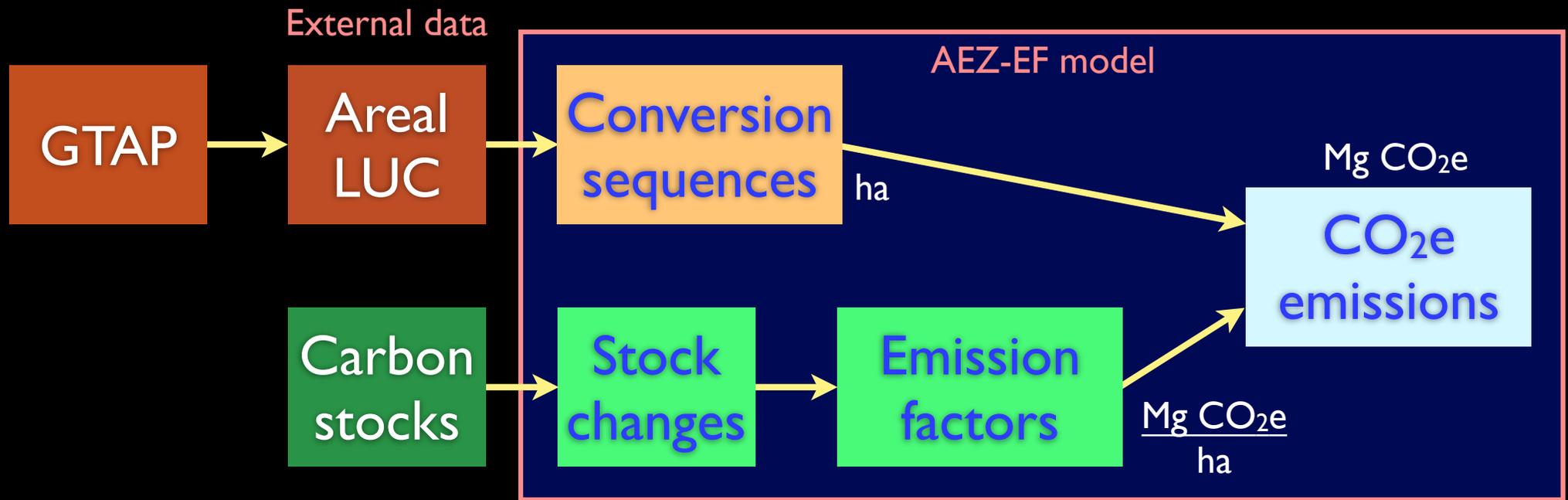
Goals

- More complete emissions accounting
- Tighter interface between economic and carbon accounting sub-models
- Allow the emissions accounting model to be used with any conforming GTAP results (19 regions x 18 AEZs)
- Transparency and clarity of implementation

Carbon by AEZs & Region



Model components



GTAP results: four 18x19 matrices

Changes in livestock pasture (ha)							
	1-USA	2-EU27	3-BRAZIL	4-CAN	5-JAPAN	...	19-Oceania
AEZ 1	0	0	-13	0	0	...	-16
AEZ 2	0	0	-132	0	0	...	-214
AEZ 3	0	0	-802	0	0	...	-67
AEZ 4	0	-2	6	0	0	...	-28
AEZ 5	0	0	-360	0	0	...	-10
AEZ 6	0	0	2,952	0	0	...	-56
AEZ 7	-20,864	0	0	-770	0	...	-4,848
AEZ 8	-6,036	-22	0	-664	0	...	-1,560
AEZ 9	-769	-152	0	-760	-14	...	-857
AEZ 10	-5,028	-2,264	-52	-398	-272	...	-387
...
AEZ 18	0	0	0	0	0	...	0

Similar matrices for forestry, cropland, cropland-pasture

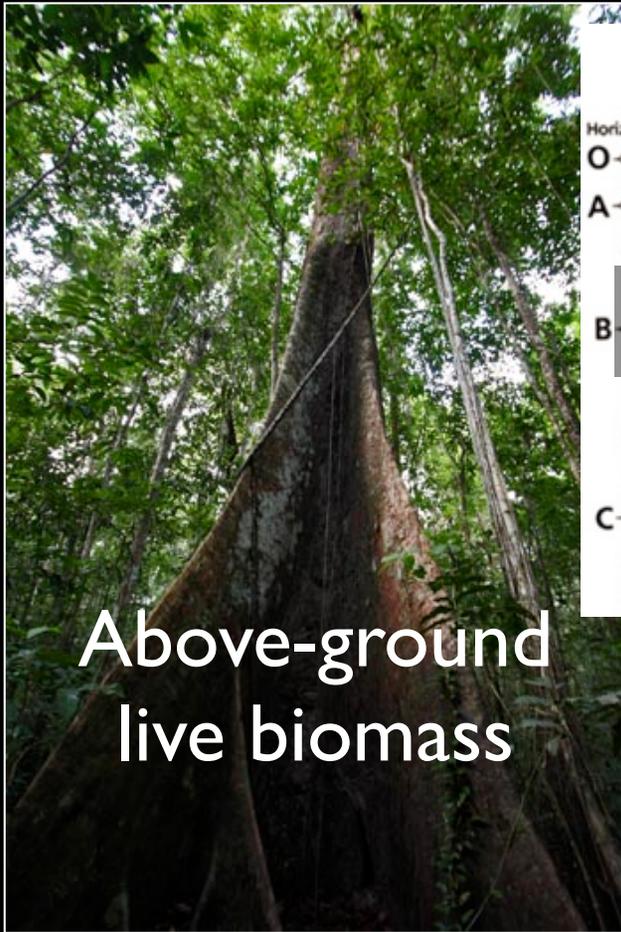
Emission factors for same AEZ-regions

Emissions for pasture-to-cropland conversion (Mg CO ₂ e ha ⁻¹)							
	1-USA	2-EU27	3-BRAZIL	4-CAN	5-JAPAN	...	19-Oceania
AEZ 1	0	0	59	0	0	...	59
AEZ 2	0	0	56	0	0	...	66
AEZ 3	0	0	69	0	0	...	64
AEZ 4	0	144	103	0	0	...	100
AEZ 5	0	0	101	0	0	...	57
AEZ 6	0	0	99	0	0	...	198
AEZ 7	101	0	0	106	0	...	74
AEZ 8	110	92	0	123	0	...	81
AEZ 9	115	107	0	407	390	...	76
AEZ 10	130	376	143	221	344	...	114
...
AEZ 18	0	0	0	0	0	...	0

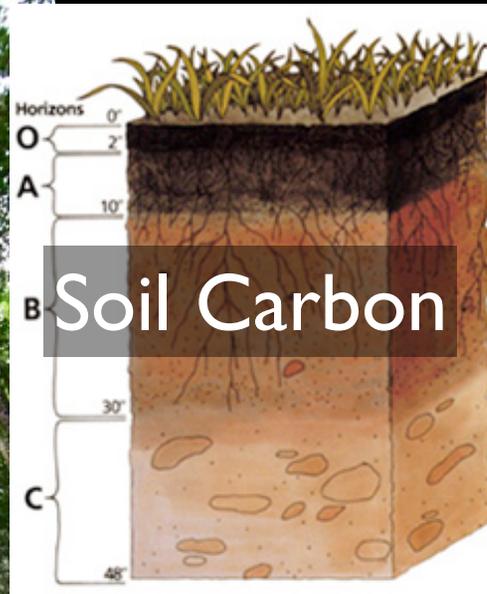
Similar matrices for other conversion sequences

Carbon pools considered

Carbon pools considered

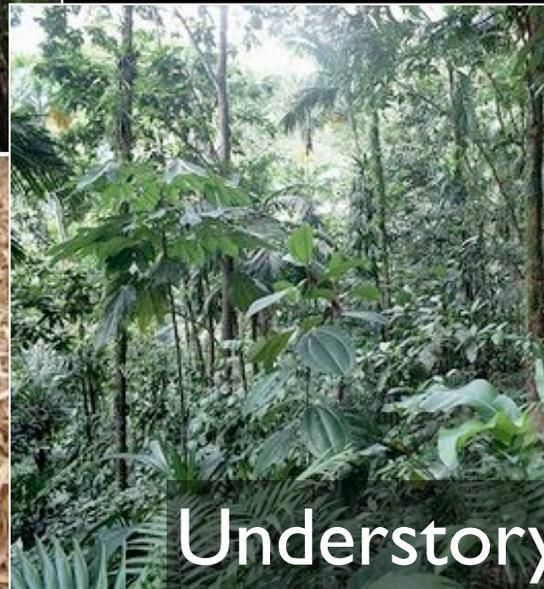
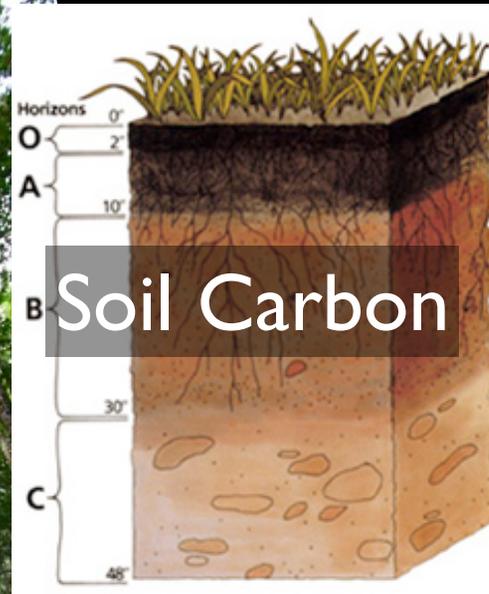


Above-ground
live biomass



Below-ground live biomass
(roots)

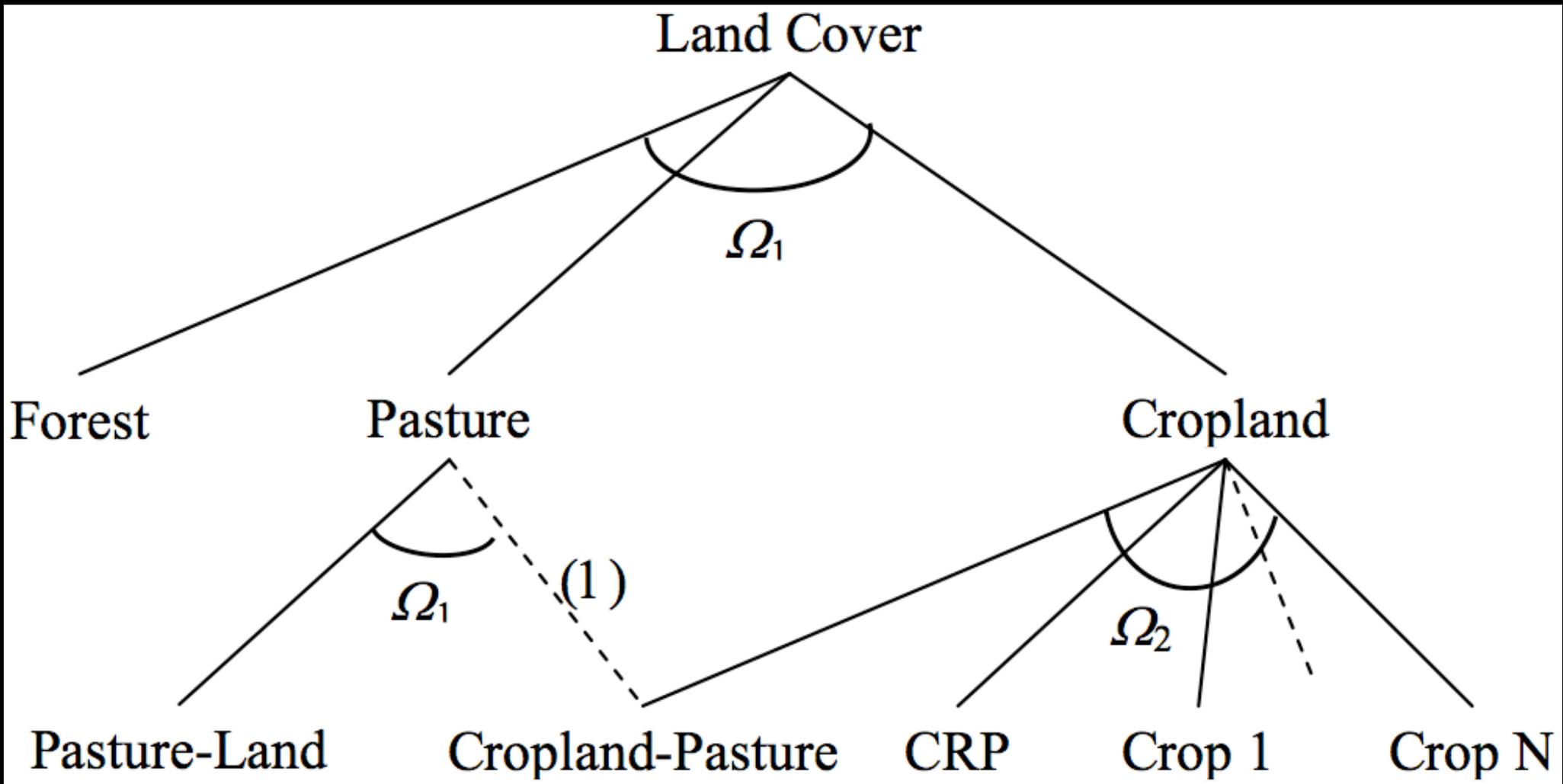
Carbon pools considered



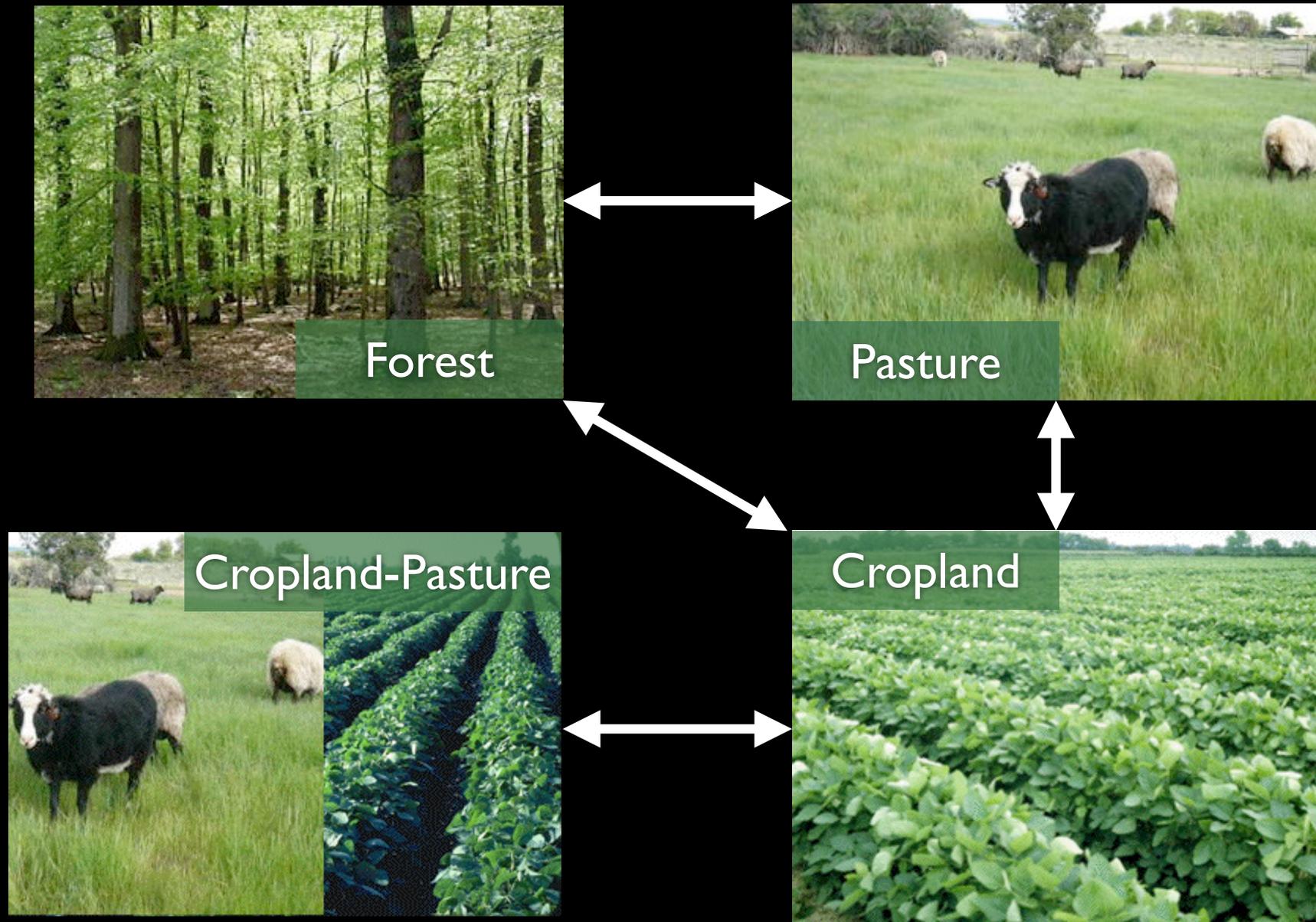
Area changes to sequences

- GTAP reports area changes by land use
- Emissions depend on specific conversion sequence, e.g., forest to cropland, cropland-pasture to cropland, cropland to pasture, ...
- We infer sequences from which land uses show net gains or losses in each AEZ-region

GTAP land cover structure



8 conversion sequences



Conversion sequences

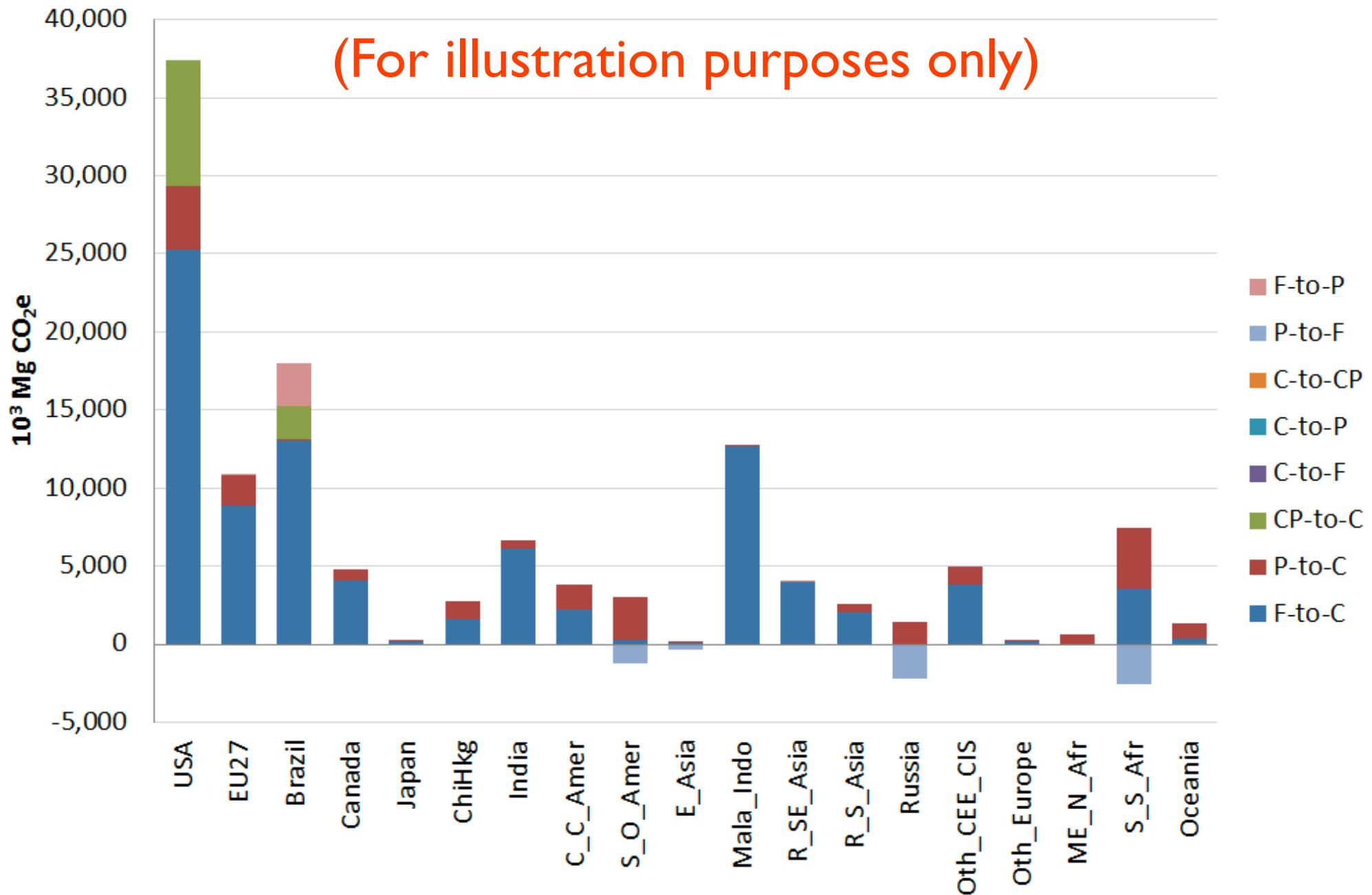
- Cropland-pasture transitions only to/from cropland
- Net changes in cropland, pasture, and forestry are approx. zero in all regions
- One land cover type has different sign than the other two and is a source or sink
- Using net changes underestimates emissions since carbon loss is faster than regrowth

Harvested wood products

- How much forest carbon remains sequestered 30 years after clearing?
 - Fraction of above-ground biomass harvested
 - Fraction of harvested biomass in products
 - Fuelwood, pulp, sawnwood, plywood, ...
 - Fate of each product category over time
- Evaluating new study by UC Davis for AEZ-EF

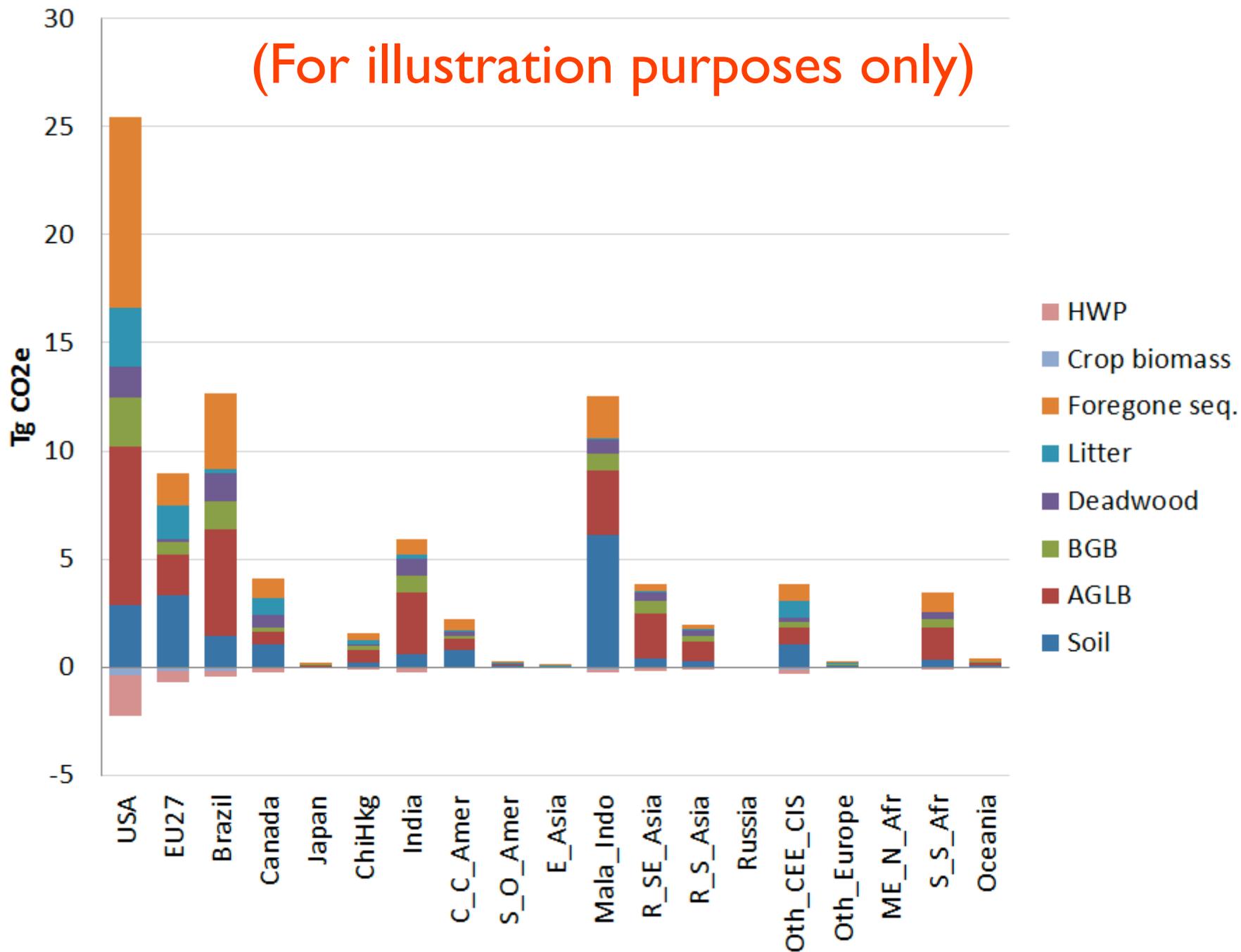
Emissions by sequence and region

(For illustration purposes only)



Forest-to-crop emissions by source

(For illustration purposes only)



Comparison with prior model

	Prior model	New model
Basis	Searchinger et al. 2008	Newly developed
Carbon stocks	Woods Hole data for 10 regions	Gibbs & Yui (2011) data for 203 AEZ-region combinations
What's represented	Landcover types at agricultural frontier	Average C stock in each AEZ-region combination
Soil emissions	25% of top 100 cm	Variable by region; IPCC method (30 cm)
Conversion sequences	Forest and grassland to cropland	8 transitions among forest, pasture, cropland, C-P
Other	-	Non-CO ₂ emissions. Peatland in Indonesia/Malaysia.