


Data Needs for Regional Environmental Policy Modeling and Analysis



Enhancing REAP



What is REAP?

- Regional Environment and Agriculture Policy model
 - Formerly known as USMP
 - Non-linear programming formulation
 - Explicitly models crop rotation and tillage choice
- Long and illustrious history at ERS
- Calibrated to USDA Baseline
 - And NRI cropping history (1994-1997)
 - And ARMS (tillage and input use)



Model Framework

Changing Economic Incentives

- Returns (tax, subsidy, etc)
- Resource constraints
- Environmental constraints
- Others

▲ Livestock Choices

▲ Cropping Choices

- Rotations
- Tillage
- Fertilizers
- Pesticides
- Region (soils & climate)
- Erodibility

▲ Economic outputs

- production
- returns
- others

▲ Ex post environmental

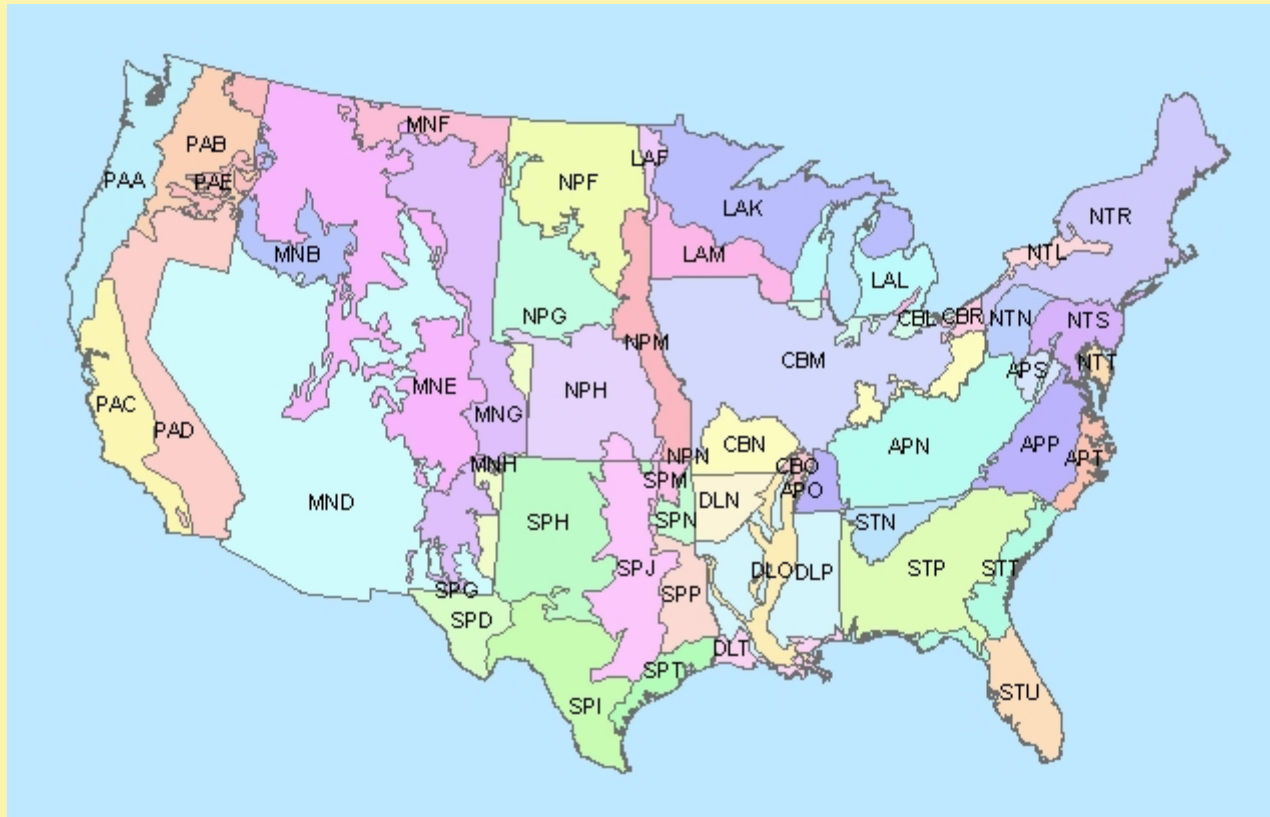
- N-runoff
- Pesticide TPU
- Value of N runoff
- others

▲ Environmental outputs

- Nitrogen use and balance
- Pesticide use and fate
- others



REAP Regions





Production Environment

Inputs		Outputs		
<u>Regional</u>	<u>National</u>	<u>Livestock</u>	<u>Crops</u> <u>Processed</u>	
cropland	nitrogen fertilizer	fed beef for slaughter	corn soybean meal	
pasture land	potassium fertilizer	nonfed beef for slaughter	soybeans soybean oil	
	potash fertilizer	beef calves for slaughter	sorghum livestock feed mixes	
	lime	beef feeder yearlings	barley dairy feed supplements	
	other variable costs	beef feeder calves	oats swine feed supplements	
	public grazing land	cull beef cows	wheat fed beef	
	custom farming operations	cull dairy cows	cotton nonfed beef	
	chemicals	cull dairy calves	rice veal	
	seed	milk	silage pork	
	interest on operating capital	hogs for slaughter	hay broilers	
	machinery and equipment repair	cull sows for slaughter		turkeys
	veterinary and medical costs	feeder pigs		eggs
	marketing and storage	other livestock		butter
	ownership costs			american cheese
	labor and management costs			other cheese
	land taxes and rent			ice cream
	general farm overhead			nonfat dry milk
	irrigation water application			manufacturing milk
	energy costs			ethanol
	insurance			corn syrup



Environmental Indicators

Soil Erosion	Wind
	Sheet & Rill
Nitrate & Phosphorus	Amount Applied
	Leached to groundwater
	Lost in sediment
	Lost in solution
	Lost to atmosphere (N only)
Pesticides	Amount Applied
	Leached to groundwater
	Lost In sediment
	Lost to surface runoff
Manure	Amount generated
Greenhouse gases	Carbon equivalent



REAP Policy Sphere

- How will environmental consequences of agri-environmental policies OR “anticipated” production/input shocks be distributed regionally?
- How can agri-environmental policies be “fine-tuned” to deliver the desired outcome (if possible)?



A Research Question

- How will the “agri-environmental landscape” look following a shock to corn demand from biofuel production?
 - More corn acres/total acres
 - More intensive land management practices
 - Higher prices >> higher cost for livestock
 - More utilization of DDGS
 - Fewer CRP acres
 - Further pressure on urban/rural interface



What would be nice is...

- More detailed information on who is doing the switching to corn
- And who is doing the switching in/out of CRP
- The missing link right now is switchgrass and its potential to transform the scene
 - Yield and input requirements for “dedicated energy crops”



Where is REAP going?

- Mathematical structure very general
 - Could be implemented at watershed or county level
- Each region exemplifies a “typical farm”
 - Could be expanded (with effort) to model farm typologies (income, ownership, size)
- More detailed interaction with upstream/downstream actors
 - Biofuels: Biofuel Plant locations, CAFO locations
 - Climate Change: Energy utilization



Wish list

- Sub-regional biodiversity measures
 - Habitat-oriented
 - Species-oriented
 - Links to land use change
- Better livestock data
 - Link diet to “output” of livestock
- Water, water everywhere (except for in REAP)
- 2002 (2007!?!) NRI
- Transportation costs/modes



Happy Modeling!