Managing Manure To Improve Air and Water Quality

Marc Ribaudo
Economic Research Service

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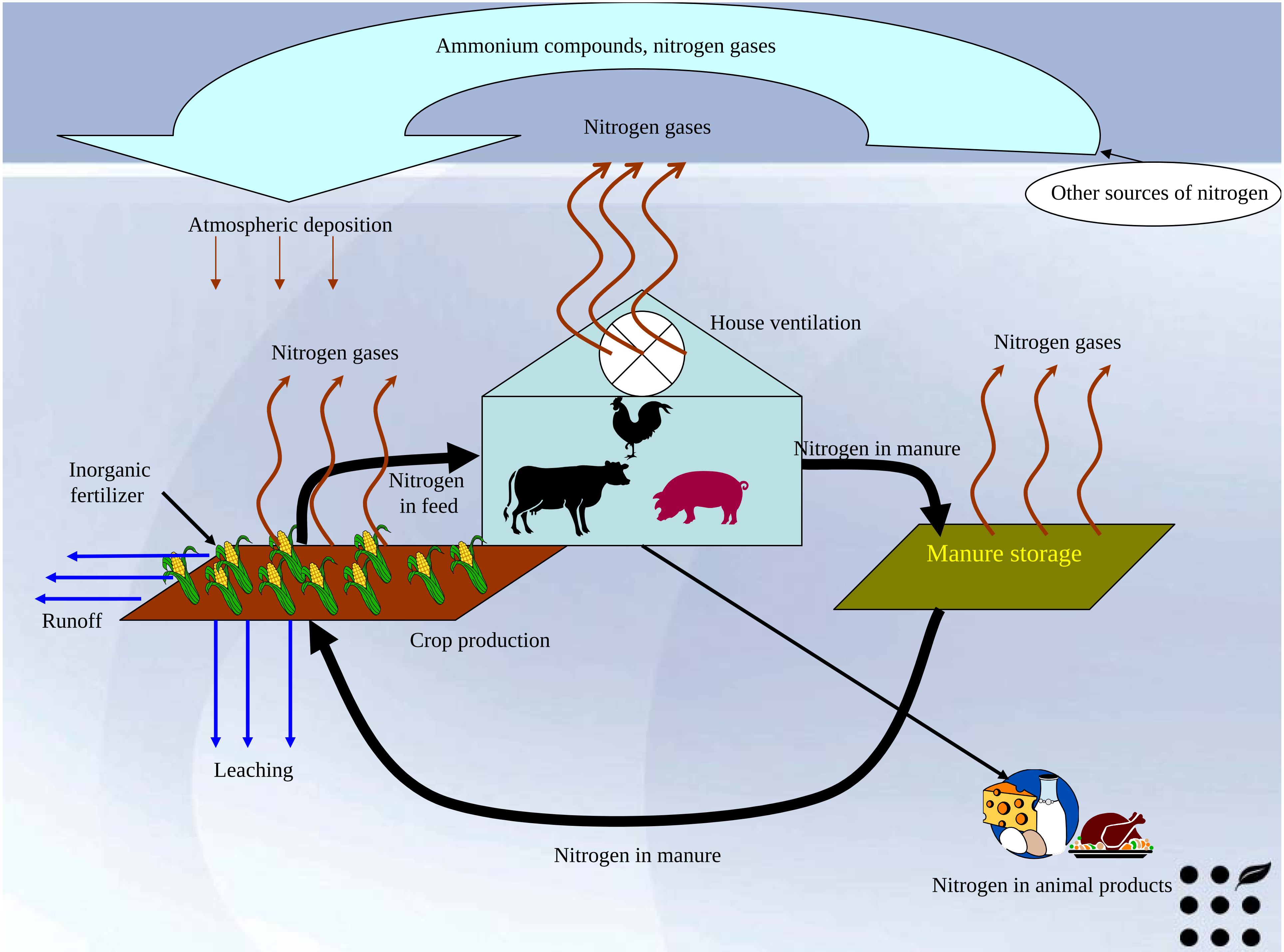
The Issue

- The multi-media (air and water) nature of pollution from animal waste poses challenges to farmers and to resource managers because environmental laws typically take a single-medium view.

- Failure to account for the multi-path nature of animal waste in policy design can lead to unintended consequences in terms of costs to farmers and degradation to environmental quality.

The Application

- The fate of nitrogen from animal feeding operations is a good example
- Nitrogen can follow a number of pathways in different forms
- We focused on ammonia emissions to the atmosphere and nitrate losses to water

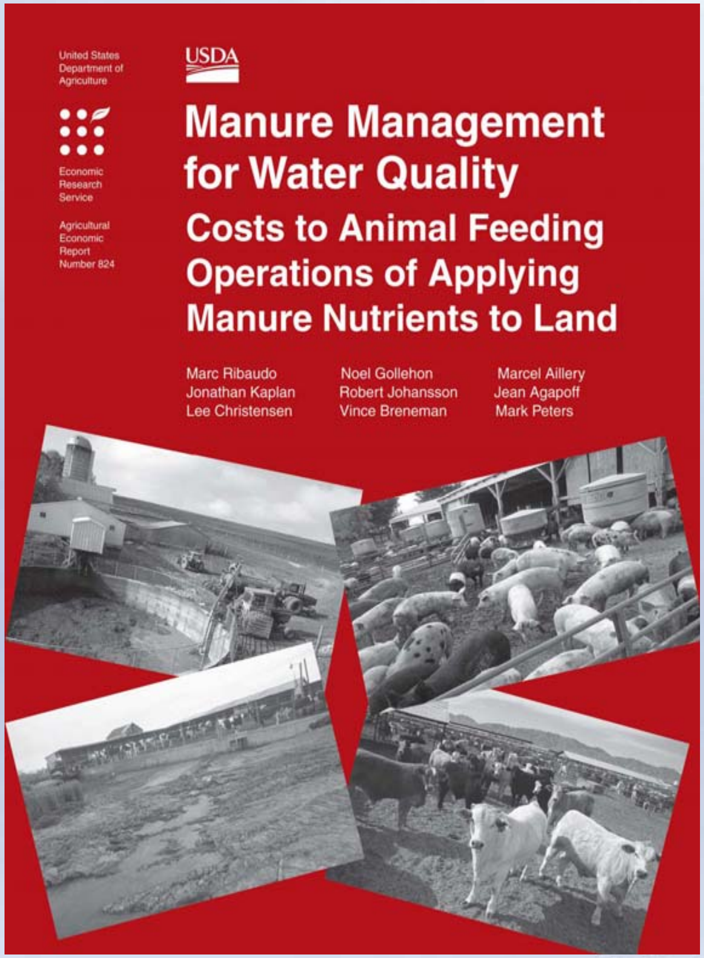

Ammonium compounds, nitrogen gases
Nitrogen gases
Other sources of nitrogen
Atmospheric deposition
House ventilation
Nitrogen gases
Nitrogen gases
Nitrogen in manure
Inorganic fertilizer
Nitrogen in feed
Manure storage
Runoff
Crop production
Leaching
Nitrogen in manure
Nitrogen in animal products

Background

The policy context included the Clean Water Act regulations for concentrated animal feeding operations (CAFOs) promulgated in 2003, and air quality regulations contained in the Clean Air Act and CERCLA.

- CAFOs must have a nutrient management plan
- Clean Air Act restrictions on fine particulates could lead States to restrict ammonia emissions
- CERCLA could require reporting on emissions from animal feeding operations

We assessed the costs of complying with the new land application requirements for CAFOs under the Clean Water Act and found that implementing a nutrient management plan could significantly increase the cost of spreading manure.



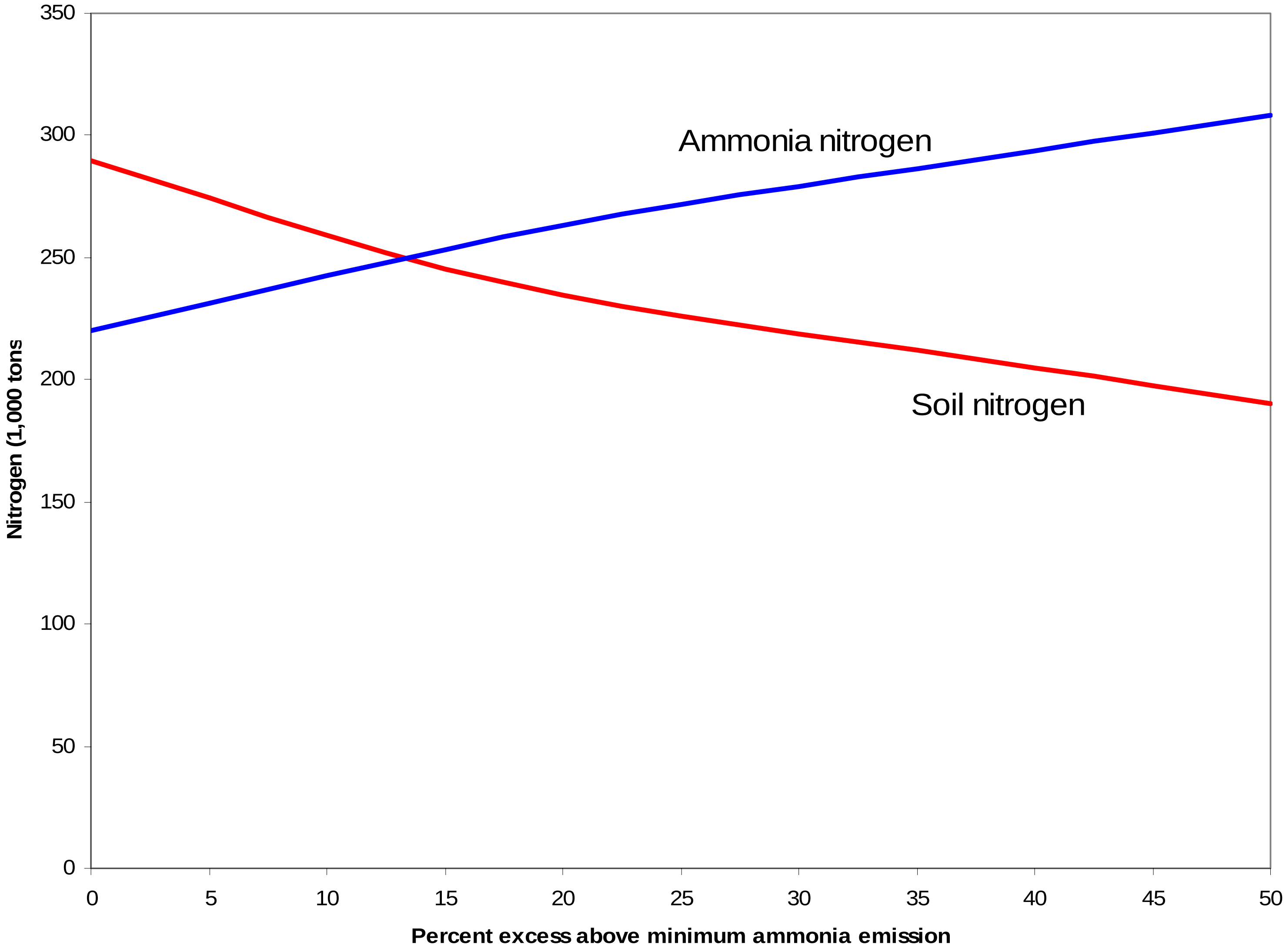
Our new analysis consists of three parts

- Farm level assessment of economic and environmental tradeoffs under coordinated and uncoordinated air and water policies
- National level assessment of the broader impacts, including long-term structural adjustments and impacts on producers and consumer
- Implications of adding air quality regulations to existing Clean Water Act regulations in a region where the land base for spreading manure is relatively limited

Farm-Level Analysis: Focus on Hogs

- Nitrogen application standards had little impact on air emissions, overall
- Reducing ammonia emissions increased excess nitrogen applications to land
- Coordinated policy that reduces both ammonia and excess nitrogen would require a mix of practices different than either of the previous two scenarios

Increasingly stringent ammonia reductions increase the amount of excess nitrogen applied to fields



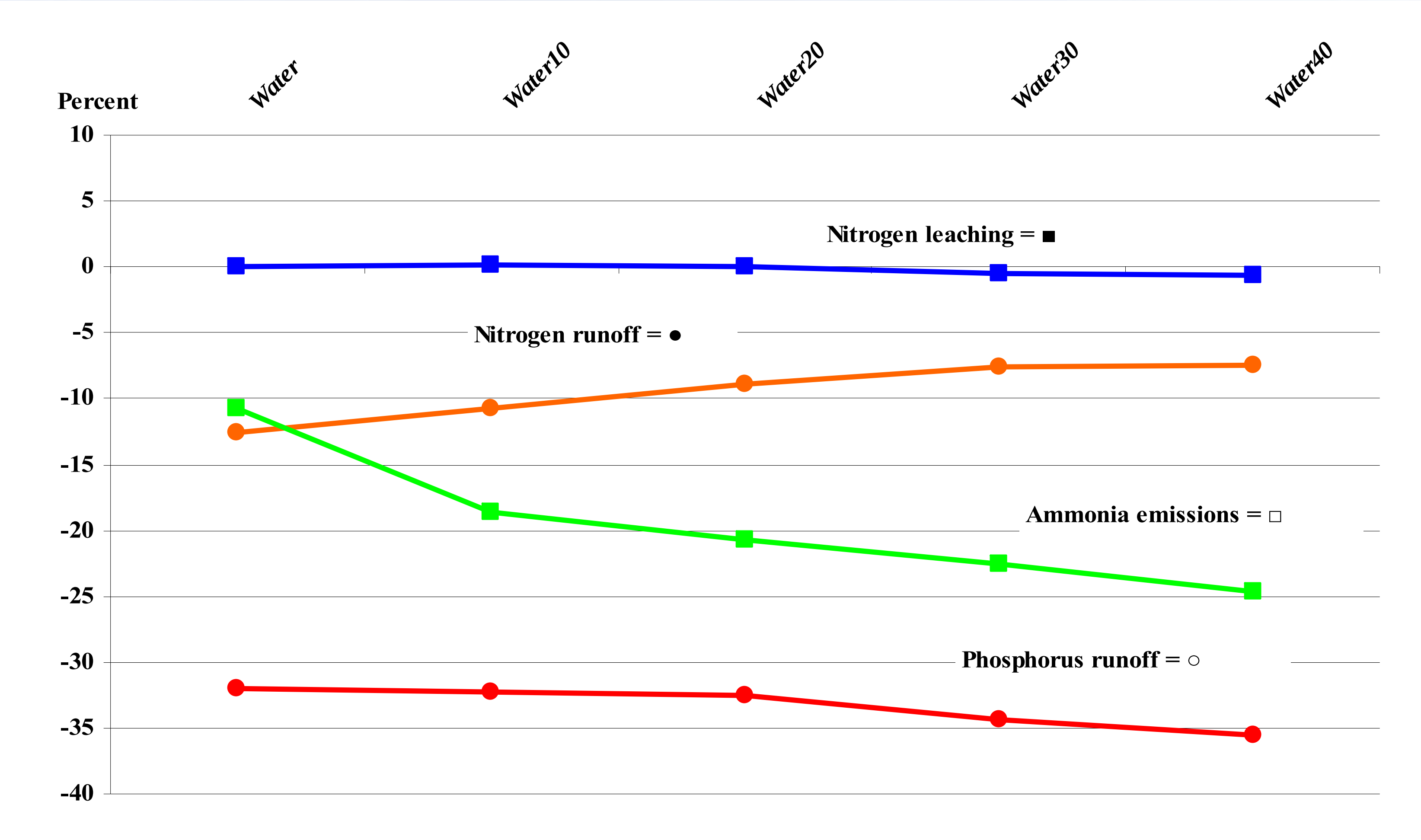
Source: Aillery et al., Economic Research Service, 2005

National Analysis: A Focus on Agricultural Markets

		CAFO+reduce ammonia			
	CAFO	*10%*	*20%*	*30%*	*40%*
	change (million units)				
Nitrogen reductions (lbs. runoff, leaching, and air emissions)	1,169	1,553	1,599	1,653	1,779
Net returns to crop production ($)	449	328	307	267	196
Net returns to livestock production ($)	-897	-700	-724	-566	-268
Consumer surplus ($)	-402	-786	-876	-1,304	-2,053
Returns to agriculture and consumer surplus ($)	-850	-1,158	-1,293	-1,602	-2,125

Source: Aillery et al., Economic Research Service, 2005

Tradeoffs in environmental quality if water and air policies are uncoordinated

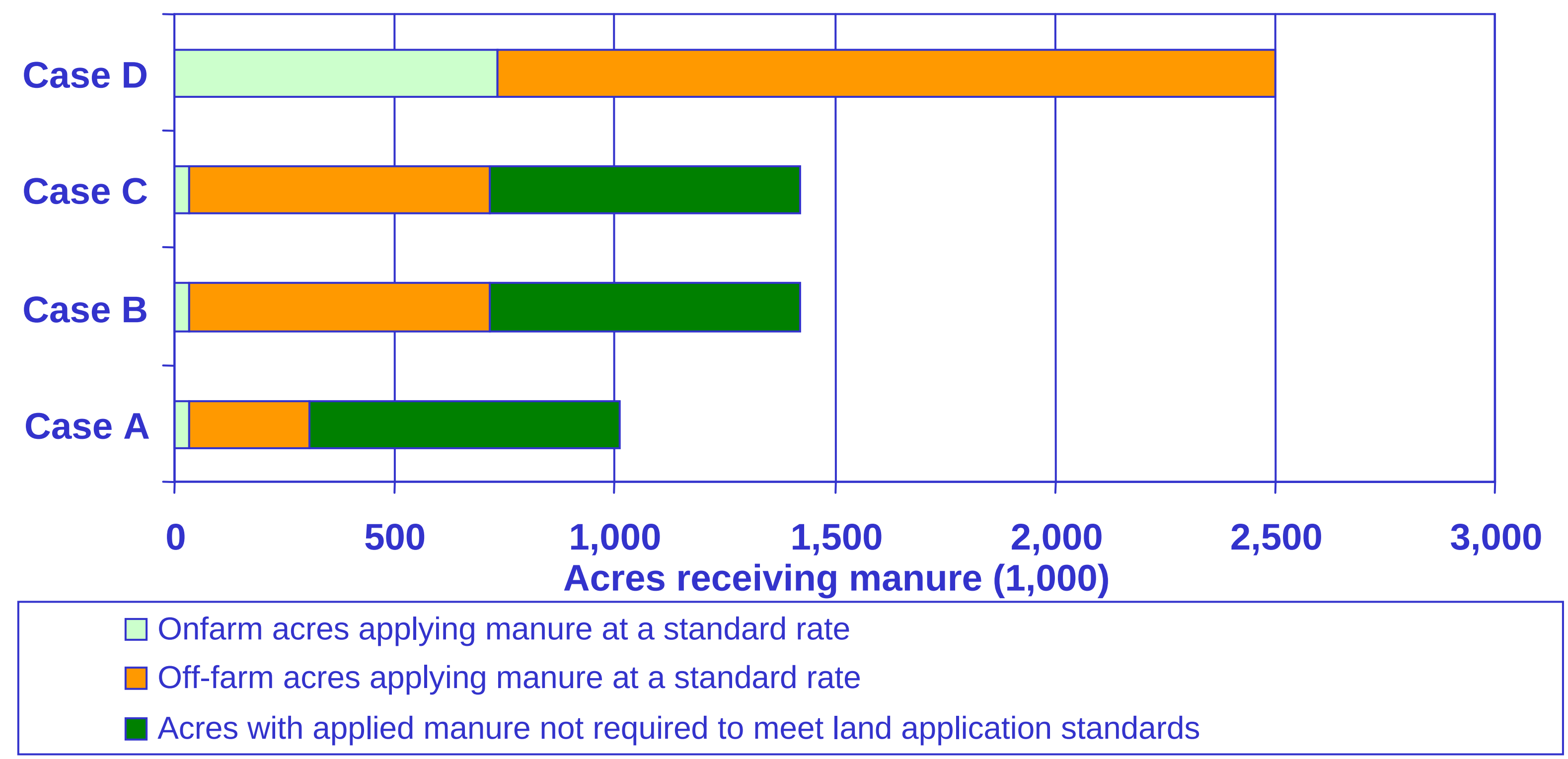


Source: Aillery et al., Economic Research Service, 2005

Regional Analysis: Focus on the Chesapeake Bay Watershed

- Region with high concentration of animals relative to land available for spreading
- Meeting CAFO requirements costly because of competition for land and distance manure must be hauled
- Any change in manure management that increases nutrient content of manure would increase costs of complying with environmental regulations

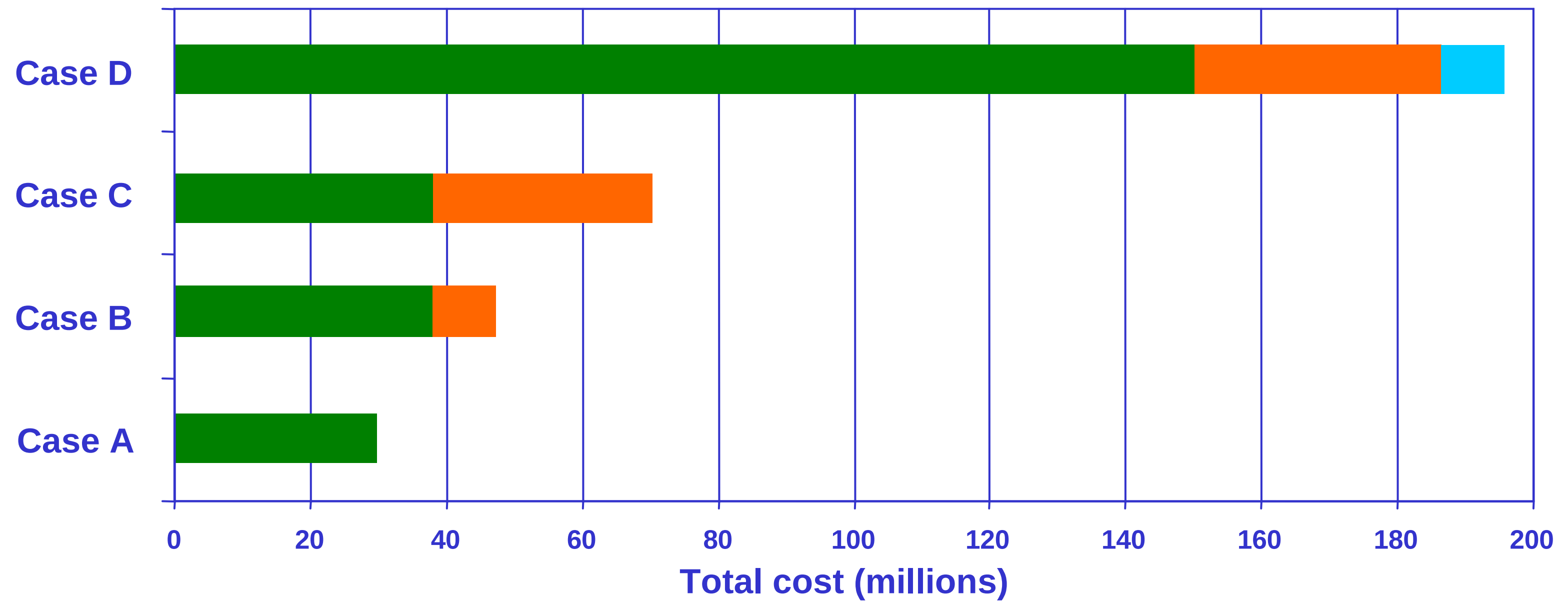
Increased nutrient content of manure requires more land



Case A – CAFOs meet water standards, no ammonia controls
Case B – CAFOs meet water standards, CAFOs adopt ammonia-N controls
Case C – CAFOs meet water standards, All AFOs adopt ammonia-N controls
Case D – All AFOs meet water standards, All AFOs adopt ammonia-N controls

Source: Aillery et al., Economic Research Service, 2005

Cost of meeting nitrogen standard and reducing ammonia emissions



- Costs to meet water-based land application standards (hauling, application, and planning)
- Costs for air emission controls (facility and field)
- Projected costs to manage manure exceeding land application levels

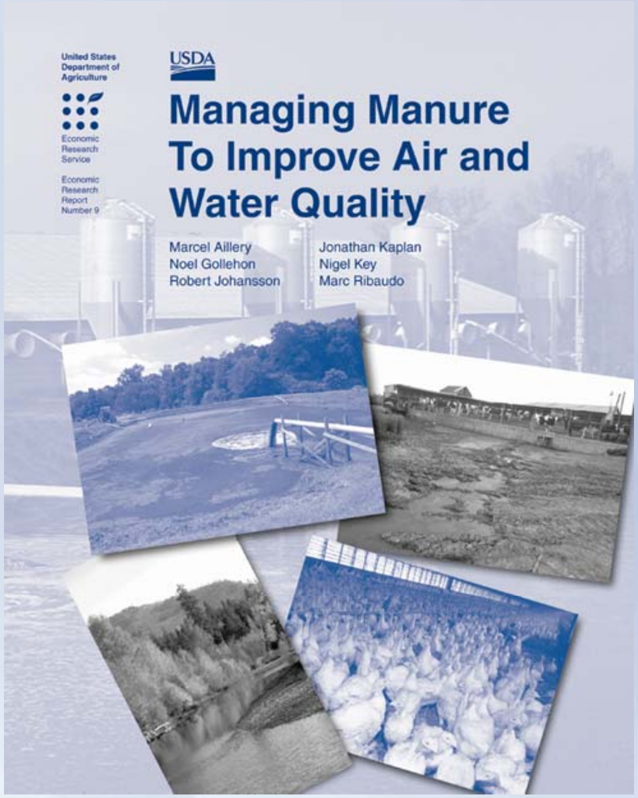
Case A – CAFOs meet water standards, no ammonia controls
Case B – CAFOs meet water standards, CAFOs adopt ammonia-N controls
Case C – All AFOs adopt ammonia-N control, CAFOs meet water standards
Case D – All AFOs adopt ammonia-N controls, all AFOs meet water standards

Source: Aillery et al., Economic Research Service, 2005

Major Findings

- Tradeoffs between air and water are prevalent in manure nitrogen management
- Uncoordinated policies would impose extra costs on farmers
- Unintended consequences of uncoordinated policies can lessen environmental gains
- Other tradeoffs may be important
- Reducing nitrogen at the source could address multiple problems

For Additional Information



Full report can be obtained online at http://www.ers.usda.gov

Or contact Marc Ribaudo at
mribaudo@ers.usda.gov
202-694-5488

Changes in regional production

Region	*Base*	*CAFO*	*CAFO + reduce ammonia*	
			WaterAir10	*WaterAir20*
			million AU	
NE	4.176	-0.004	-0.123	-0.144
LA	7.847	-0.099	-0.302	-0.359
CB	16.874	-0.375	-1.550	-1.725
NP	19.461	-0.848	-0.549	-0.648
AP	14.284	-0.323	-0.164	-0.225
SE	3.871	0.005	0.019	-0.013
DL	3.082	-0.020	-0.120	-0.151
SP	21.224	0.400	0.729	0.880
MN	10.365	0.450	0.651	0.755
PA	7.149	-0.358	-0.262	-0.220
US	108.333	-1.172	-1.671	-1.850

Source: Aillery et al., Economic Research Service, 2005