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**NY Pollution Discharge Elimination Permits for CAFOs,  
Management Adjustments and the Environment**

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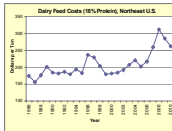
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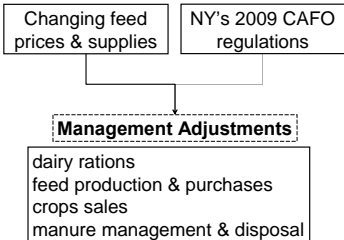
## Introduction

- NY's 2009 CAFO regulations may exacerbate pressure on dairy farm operating margins
- NY's Pollution Discharge Elimination for CAFO
  - Set manure application rates consistent with Cornell's nutrient recommendations
  - Prohibits application where soil P is excessive
  - Limits application where soil P test is high
- Reduced opportunities for manure application will increase off-farm disposal costs
- Feed costs are below 2008 record high, but remain well above historic levels
- NY dairy producers look for cheaper feeds
  - Existing DDGS supplies in Western NY
  - More to come if second plant reopens
  - New CME Group's DDG contract may help manage feed cost risk



## Objectives and Contribution

Examine linkages among dairy management adjustments & environmental quality in response to:



### Measured Outcomes

- Change in farm income
- Change in land use
- Change in manure spreading and disposal
- Distinguish value of land for production from its value as site for manure disposal
- Change in environmental quality, as measured by change in P runoff

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## A Three-county Study Region in Western New York

- A concentration of Dairy CAFOs
- A major portion of the Genesee River Watershed, draining into Lake Ontario
- Finger Lakes to the east natural barrier to transport manure for disposal



Some Regional Data		
	Total	Ave./farm
No. Dairy CAFOs	111	
No. Dairy Cows	80,354	724
Cropland in CAFOs (ac.)	157,495	1,419
Other Cropland* (ac.)	237,780	2,142

\* Regional cropland not controlled by CAFOs  
Sufficient for manure disposal, location unknown

## Analytical Approach

A regional mathematical programming model that:

Maximizes expected income over variable costs for dairy CAFOs

Key Components of the Model:

### Livestock:

- Rations: lactating cow, dry cow, replacement heifers (CPM-Dairy program, Cornell & U of Penn)
- Forage bases: 60/40 & 40/60 corn silage/hay crop silage
- DDGS products: 8% and 12% fat
- Milk and manure production (incl. levels of N & P) differ by ration

### Crops (with rotation restrictions):

- Alfalfa, orchardgrass, corn silage, corn grain (grow, buy, sell)
- Manure must be applied to cropland or disposed of off-site
- Different manure disposal costs to reflect different average distance to site

### Cropland assigned to three land classes based on

- Soil capability class
- Soil characteristics & silage yields (4.9, 5.3, and 5.9 t/acre, DM)

From survey data: 10%, 65%, & 25% high, medium, & low quality land, respectively

- CAFO Regulations: Apply N&P from manure/purchased fertilizer based on soil test P (STP)

- From county soil P test data: 7%, 53%, & 40% of cropland in HP, MP, & LP, respectively



Soil test P (STP lbs/ac.)

If STP ≥ 40—High P (HP)

Corn No Manure  
Alfalfa No P fert.

If 9 ≤ STP < 40—Medium P (MP)

Corn Manure allowed, application  
Alfalfa P-based at ½ crop removal

If STP < 9—Low P (LP)

Corn Manure or N fert. allowed, application N-based  
Alfalfa Manure or P fert. allowed at P crop removal

## Empirical Results

### Base Scenario

- 2005-09 average prices
- DDGS rations available
- All manure spread on farm
- Can exceed N&P requirement

### Policy Scenario

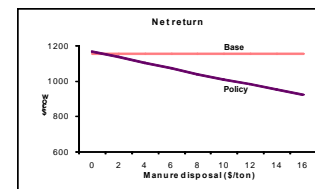
- 2005-09 average prices
- DDGS rations available
- CAFO rules for manure spreading
- Model alternative disposal costs

**Dairy Rations:** For both scenarios rations for dairy cows include 10% DDGS & 8% DDGS for dry cows & replacements

**Manure Production:** 29.3 t/cow (include dry cow and replacement)

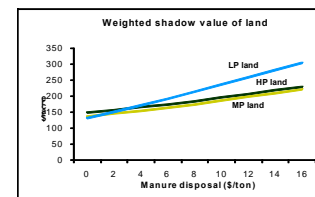
**Off-site disposal:** Base = 0.0 t/cow Policy = 15.5 t/cow (53% of total)

- Net Return:** Initial drop (<10%) due to increased disposal cost
- Higher disposal cost (e.g., greater travel distance), 20% drop
  - Corn acres fall by 20%; manure is spread on increased alfalfa acres



### Shadow value of land under policy:

- Land has value for crops & for manure disposal
- As off-site disposal costs rise, value of land with no restrictions on manure application (LP) rises relative to other groups.

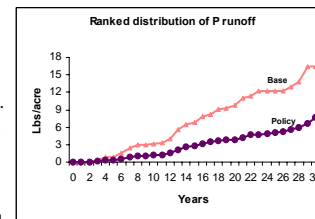


**Environmental quality:** P runoff ( $RO_p$ ) based on corn land using Vada, et al. (*J. Environ. Qual.* 2009) & differ by soils & weather

**Ave. runoff :** Base = 7.2 lbs/ac.  
Policy = 2.9 lbs/ac.

**Safety-first:** Drop in threshold runoff exceeded 10% of the time

**Base**  $P\{RO_p > 13.8 \text{ lbs/ac.}\} = 0.1$   
**Policy**  $P\{RO_p > 6.0 \text{ lbs/ac.}\} = 0.1$



## Implications & Conclusions

- Policy requires off-site disposal of half the manure
- Net revenue sensitive to availability of nearby land suitable for disposal
- CAFO land with low soil P has enhanced value for crop production and waste disposal
- Off-site disposal may require additional oversight to realize/ensure environmental improvements from CAFO permits