

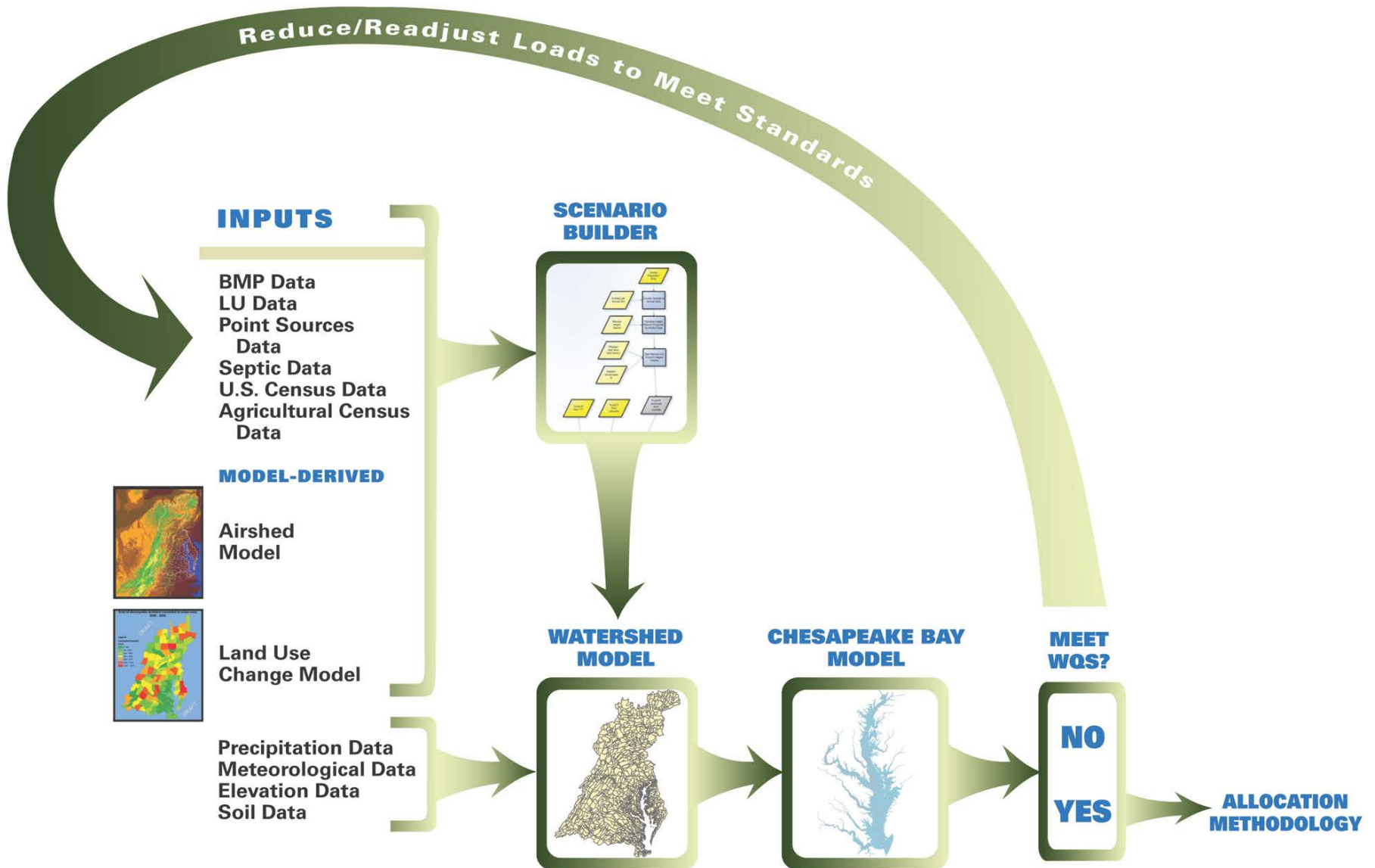
# Measuring the Impacts of Dairy and Beef

Chesapeake Bay Program Agricultural Workgroup's  
Building a Better Bay Model Workshop  
05/23/2013

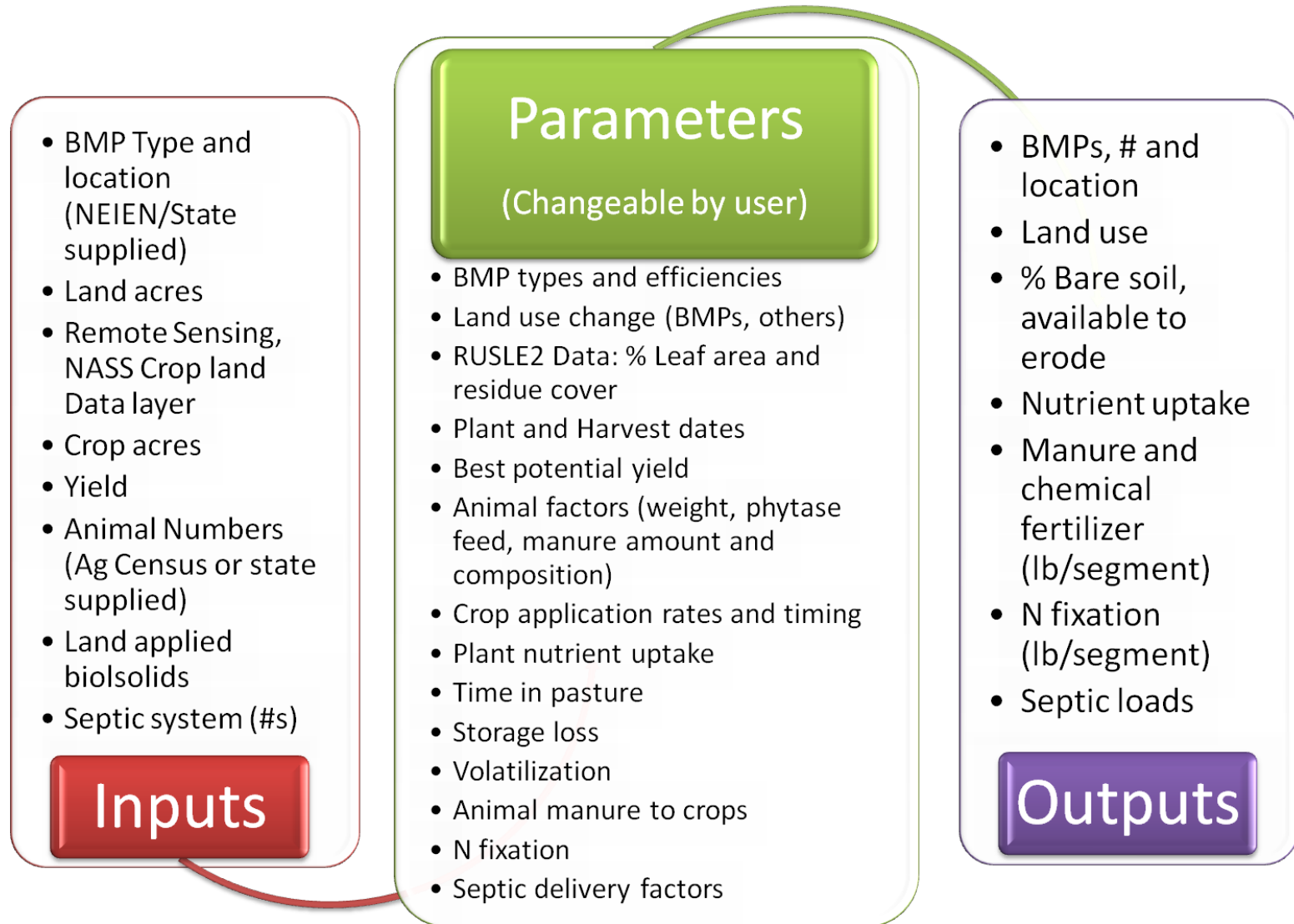
Gary Shenk  
Chesapeake Bay Program's Integrated Analysis  
Coordinator

Photos and graphics courtesy of USDA Image Gallery and CBP

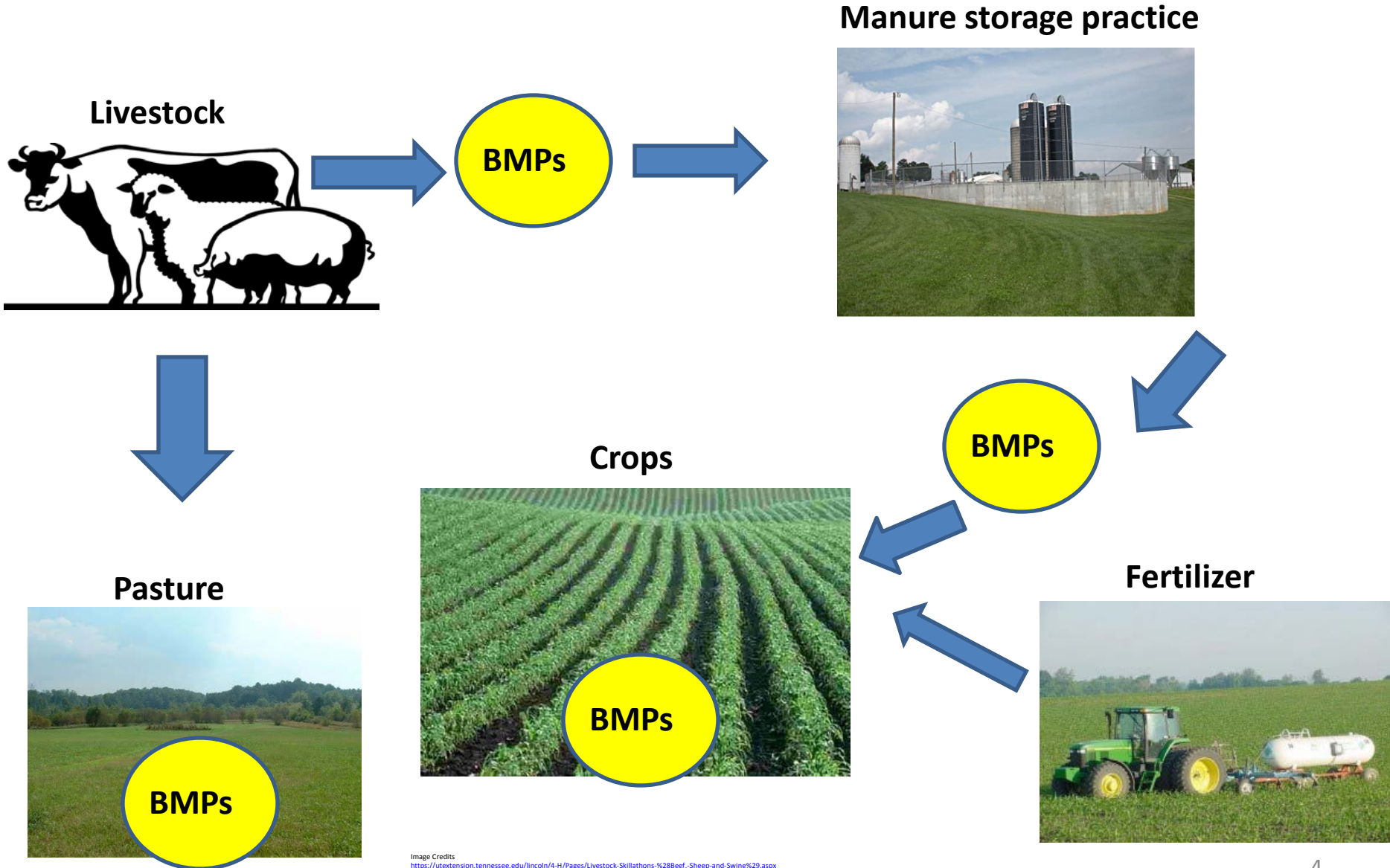
# Chesapeake Bay Program Modeling Tools



# Scenario Builder Data Inputs and Outputs



# Scenario Builder



# Nutrient Generation by Cattle

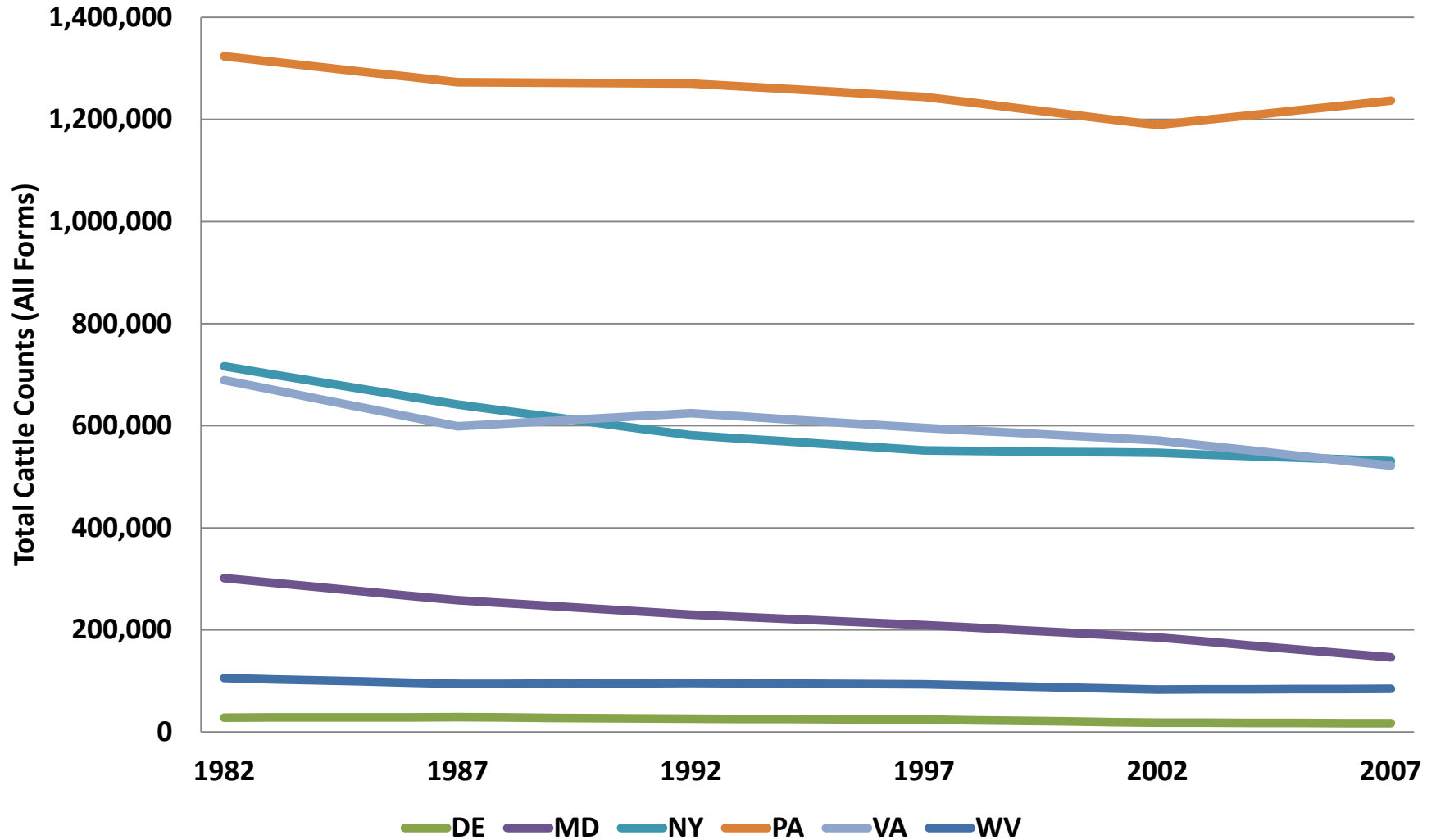
**Number of  
Cattle in  
County**

- Lbs Live Weight of Cattle
- Lbs Manure Produced/Cattle/Day
- Days of Manure Production
- Lbs of Nutrient Species/lb of Manure
- Feed Management Reductions to Nutrients
- Moisture Content
- Ammonia Volatilization Rate
- Ammonia Emissions Reductions
- Storage and Handling Loss
- Animal Waste Management Practices
- Manure Transport

**Lbs  
Phosphorus**

**Lbs  
Nitrogen**

# Inventoried Cattle Counts Through Time



# Census of Agriculture Inventory Data

- The guide to the USDA's 2012 Census of Agriculture directs producers to report "inventories of all beef and dairy cattle and calves on this operation on December 31, 2012..."

SECTION 13 CATTLE AND CALVES			
1. Did you or anyone else have any cattle or calves, including dairy cattle, on this operation in 2012?			
<p><u>INCLUDE</u></p> <ul style="list-style-type: none"> <li>cattle on this operation</li> <li>cattle on public or industrial property under a grazing permit</li> <li>cattle on land used rent free by this operation</li> <li>cattle grown or fed on this operation for others on a custom or contract basis</li> </ul>	<p><u>EXCLUDE</u></p> <ul style="list-style-type: none"> <li>cattle grown or fed by someone else on a custom or contract basis</li> </ul>		
1201 1 <input type="checkbox"/> Yes - Complete this section	3 <input type="checkbox"/> No - Go to SECTION 14		
<b>DECEMBER 31, 2012 INVENTORY</b>			
2. Of the total number of cattle and calves on hand, how many were –			
a. Beef cows? Include beef heifers that had calved. Exclude heifers that had not calved, steers, calves, and bulls. . . . . 0804	None <input type="checkbox"/> <table border="1"><tr><td>Number on this operation December 31, 2012</td></tr><tr><td></td></tr></table>	Number on this operation December 31, 2012	
Number on this operation December 31, 2012			
b. Milk cows kept for production of milk? Include dry milk cows and milk heifers that had calved. . . . . 0805	<input type="checkbox"/> <table border="1"><tr><td></td></tr></table>		
c. Other cattle? Include heifers that had not calved, steers, calves, and bulls. . . . . 1206	<input type="checkbox"/> <table border="1"><tr><td></td></tr></table>		
d. <b>TOTAL</b> cattle and calves on hand December 31, 2012. Add items 2a, 2b and 2c. . . . . 0803	<input type="checkbox"/> <table border="1"><tr><td></td></tr></table>		
<b>CATTLE AND CALVES SOLD OR MOVED FROM THIS OPERATION</b>			
3. Of the cattle and calves sold or moved from this operation during 2012, how many were –			
a. Calves sold or moved in 2012 weighing less than 500 pounds? . . . . . 0808	None <input type="checkbox"/> <table border="1"><tr><td>Number sold or moved in 2012</td></tr><tr><td></td></tr></table>	Number sold or moved in 2012	
Number sold or moved in 2012			

# Kellogg et. al (2000) and ASAE (2003)

- Average Lbs Manure Excreted/AU/Day
  - Average Lbs Live Weight
  - Average Lbs Solids Excreted/AU/Day
  - Average Lbs Total Phosphorus Excreted/AU/Day
  - Average Lbs Total Nitrogen Excreted/AU/Day
  - Average Lbs Ammonia Excreted/AU/Day
- 
- ASAE. 2003. Manure Production and Characteristics In ASAE Standards. D384.1. St. Joseph, MI. pp. 683-685
  - Kellogg, R.L. et al., 2000. Manure nutrients relative to the capacity of cropland and pastureland to assimilate nutrients: Spatial and temporal trends for the United States. Proceedings of the Water Environment Federation, 2000 (16), 19-157.



# Cattle Manure Nutrient Concentration Data

<b>Bird Type</b>	<b>Lbs manure/day/AU</b>	<b>Lbs TN/lb manure</b>	<b>Lbs TP/lb Manure</b>
<b>Beef</b>	<b>58</b>	<b>0.0059</b>	<b>0.0016</b>
<b>Dairy</b>	<b>86</b>	<b>0.0052</b>	<b>0.0011</b>
<b>Other Cattle</b>	<b>64.39</b>	<b>0.0037</b>	<b>0.0010</b>

# Cattle and Pasture BMPs

## Cattle BMPs

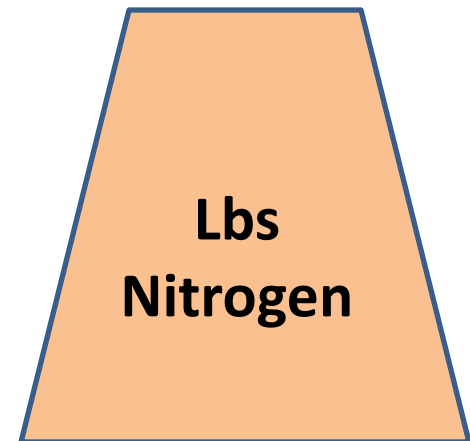
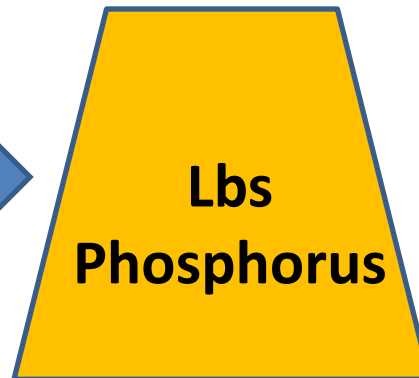
- Dairy Precision Feeding
- Lagoon Covers
- Mortality Composting
- Animal Waste Management Systems
- Barnyard Runoff Control
- Loafing Lot Management
- Dairy Manure Injection (Interim; applied to crop land uses)

## Pasture BMPs

- Off-Stream Watering
- Stream Access Control
- Prescribed Grazing
- Precision Intensive Rotational Grazing
- Streamside Forest Buffers
- Streamside Grass Buffers
- Streamside Wetland Restoration

# Generating the Bins

- 1) Convert Inventory to Animal Units (1,000 lbs)
- 2) Multiply AU by Lbs Manure/Day
- 3) Multiply Total Lbs Manure/Day by Nutrient Species



# Direct Excretion on Pasture

- Cattle often deposit manure directly in the pasture, especially on smaller operations.
- States defined the percent of days each month spent on pasture for each growth region.
- All manure produced on these days is deposited directly on the pasture land use and is NOT available for crops.
- A subset of pasture land is considered “degraded riparian pasture.” Direct excretion of manure on this land use occurs at 9 times the rate of regular pasture.



# AFO/CAFO Land Uses

<b>Farm Animal Type</b>	<b>Acres per farm</b>
<b>Cattle and Calves</b>	<b>0.5</b>
<b>Total Hogs and Pigs</b>	<b>0.2</b>
<b>Any Poultry</b>	<b>0.25</b>
<b>Sheep and Lambs</b>	<b>0.1</b>
<b>Milk Goats</b>	<b>0.05</b>
<b>Angora Goats</b>	<b>0.05</b>

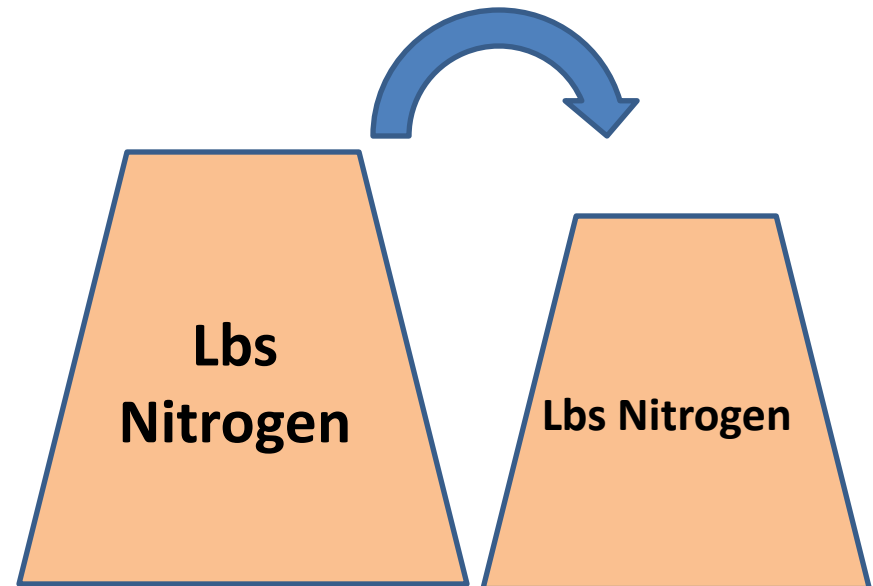
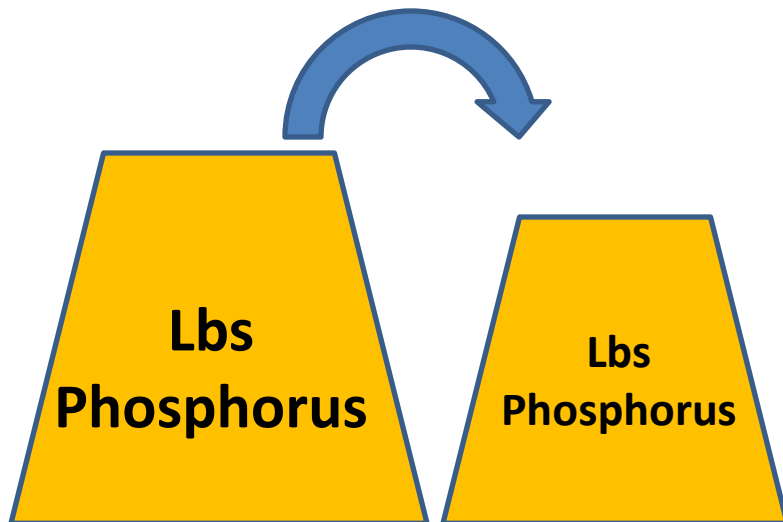
- AFO/CAFO land uses are meant to simulate production areas upon which stored manure can be lost from storage and transportation.
- Acres are not defined by number of animals. Census of Agriculture farm counts by animal type are multiplied by fractions in table to achieve animal production area acreages.

# Reducing the Nutrient Piles

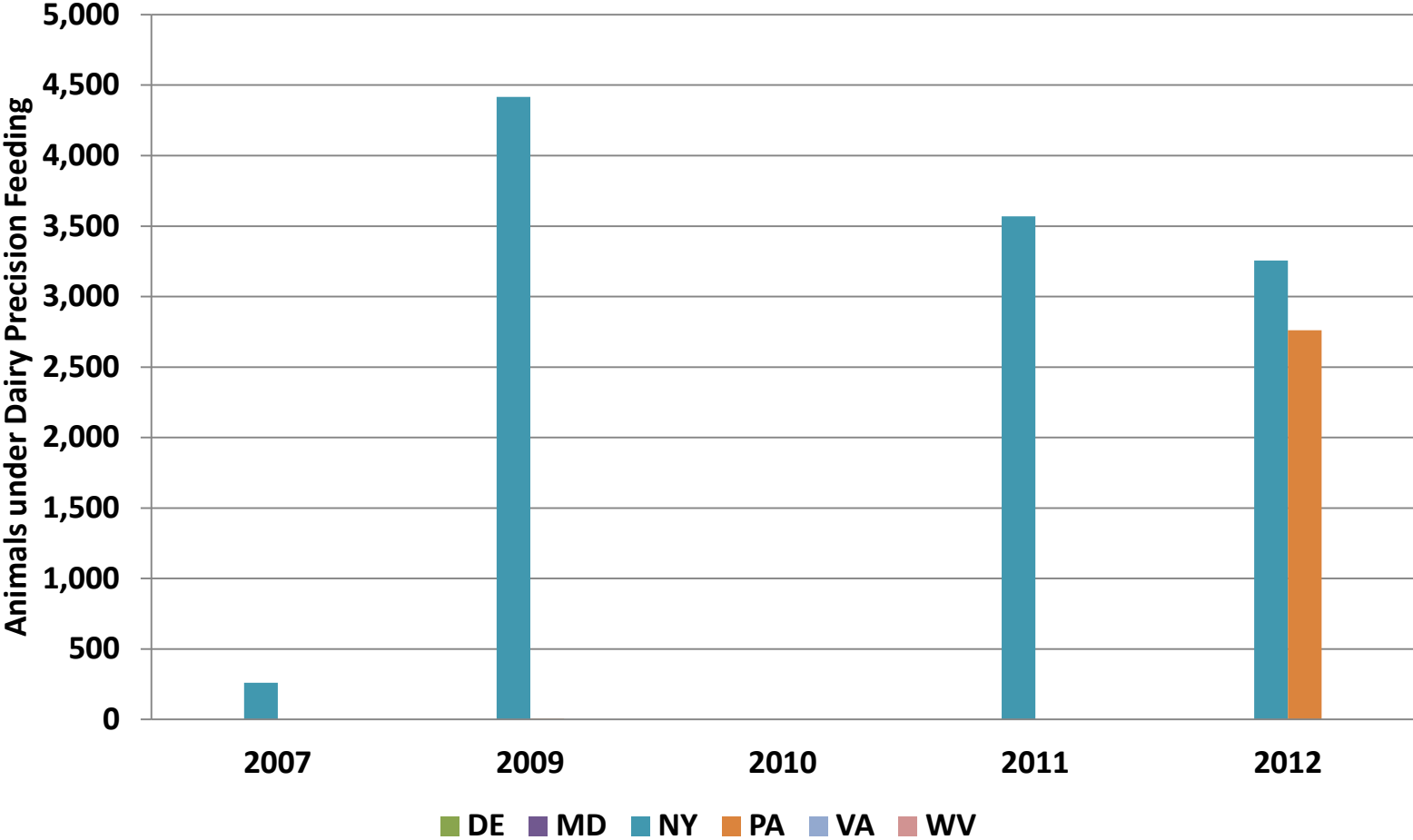
- Nutrients generated are reduced through the Dairy Precision Feed BMP. This BMP reduces 24% of N and 25% of P in manure.
- Nutrient piles are also altered through natural ammonia volatilization and lagoon covers.

Dairy Precision Feeding, Natural Ammonia Volatilization and Lagoon Covers

Dairy Precision Feed

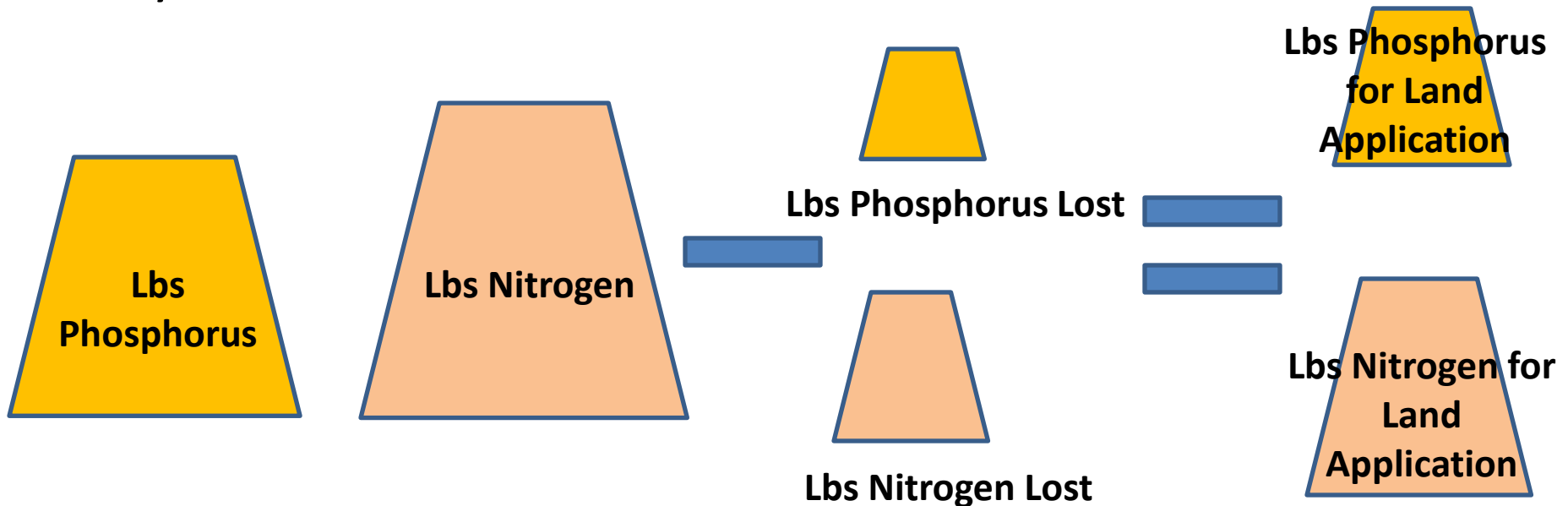


# Dairy Precision Feed Reductions By State



# Storage and Handling Loss

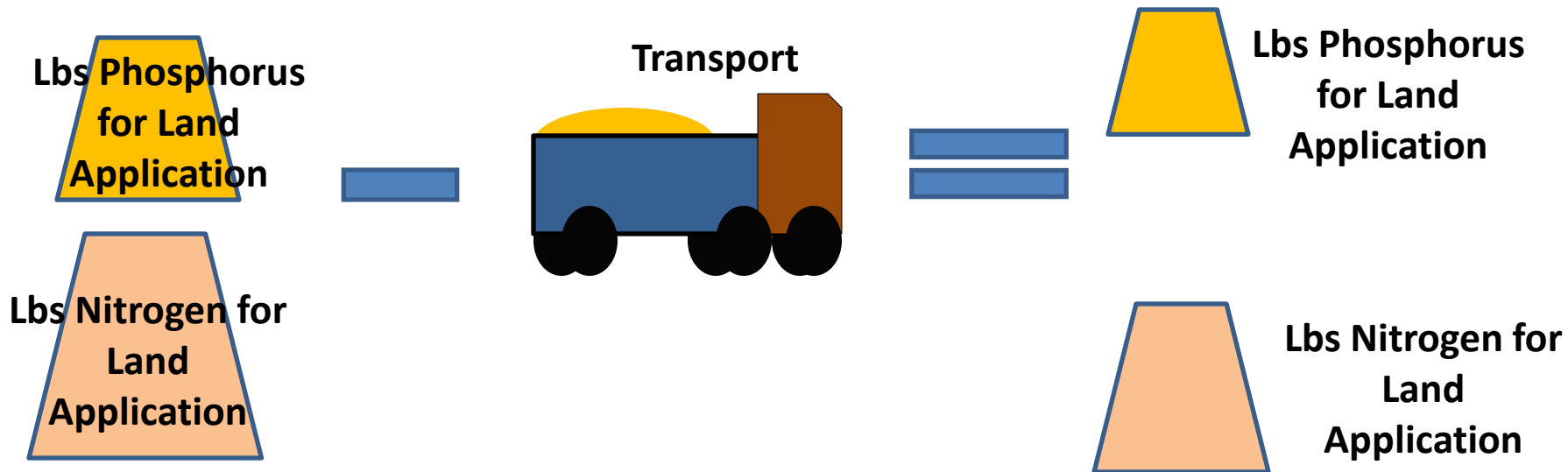
- All cattle manure piles are assumed to have a 20% loss of manure to the barnyard/production area.
- This becomes the load to the AFO/CAFO land use.
- Loafing lot management, barnyard runoff control, mortality composting and animal waste management systems reduce the amount of manure lost to this land.



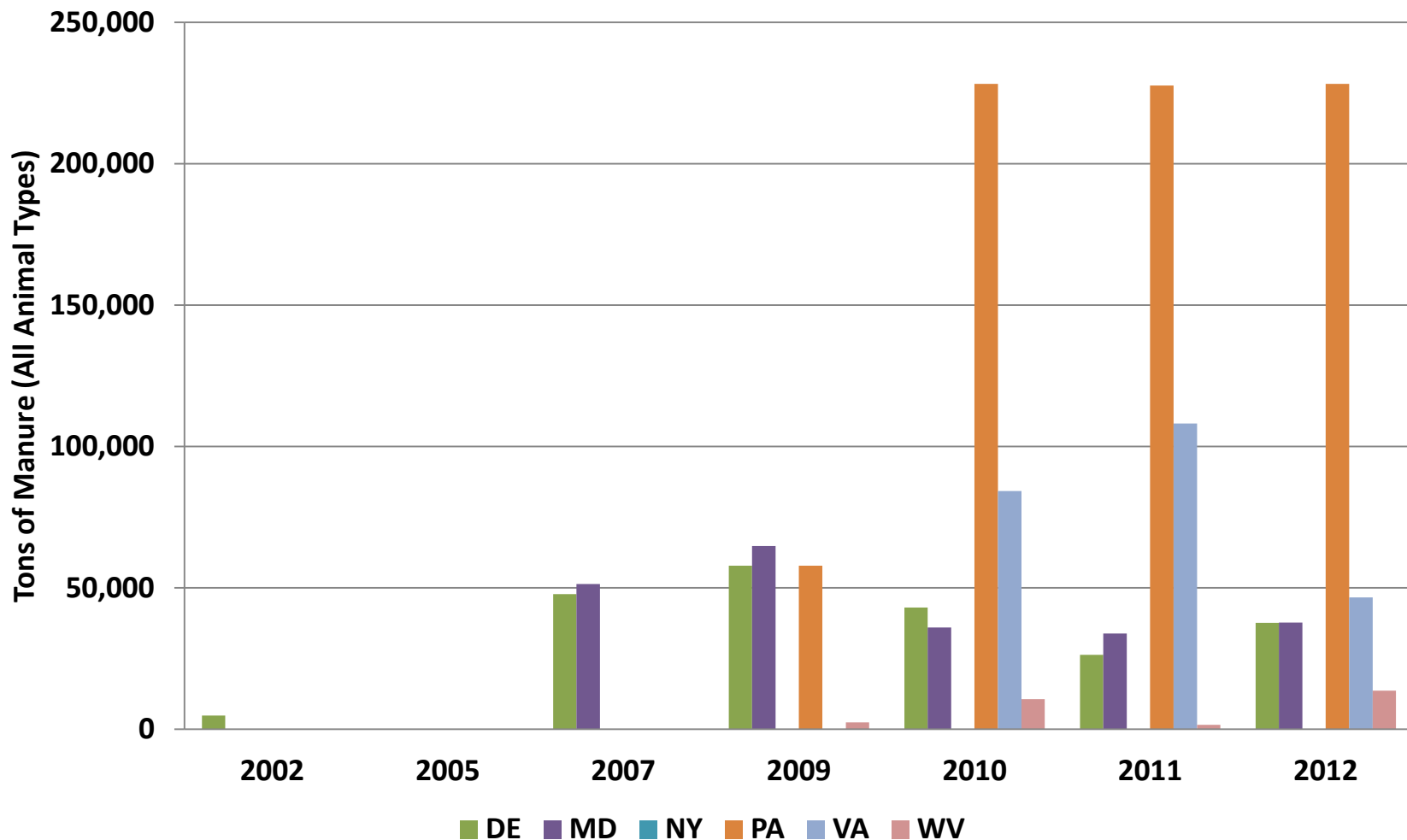


# Manure Transport

- Manure generated in a county is assumed to be available for crops in that county and nowhere else.
- Manure Transport reduces the manure available for crops in one county by shipping it to another county.

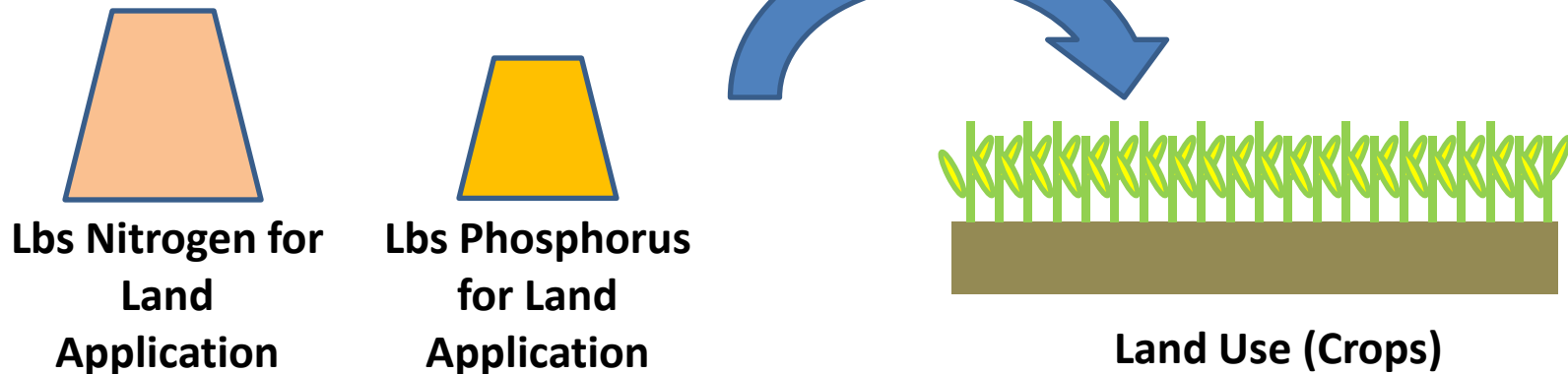


# Manure Transport Through Time For All Animals



# Distributing the Manure

- Nutrient Types include biosolids, manure and fertilizer.
- Manure has nutrients not available for plant need.
- Fertilizer is assumed to be 100% available for plant need
- Order by Nutrient Source
  1. Fertilizer (to fulfill inorganic need as defined by agronomic guides per crop)
  2. Direct excretion
  3. Biosolids (to NM land first if available)
  4. CAFO Manure (to NM land first if available)
  5. AFO manure
  6. Fertilizer (to supplement remaining need)
  7. Disposal sequence



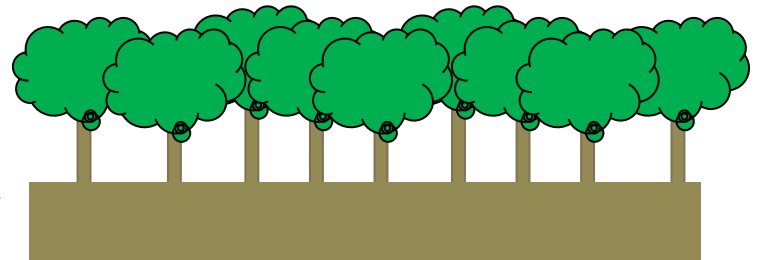
# Pasture Land Use Change BMPs

- Stream Access Control with Fencing
- Streamside Grass Buffers
- Streamside Forest Buffers
- Streamside Wetland Restoration

Each of these BMPs convert degraded riparian pasture into a land use with lower nutrient export rate.



**Degraded Riparian Pasture**



**Forest**

# Efficiency BMPs

- Off-Stream Watering
- Prescribed Grazing
- Precision-Intensive Rotational Grazing
- Dairy Manure Injection (can go on any land use)

Each of these BMPs reduce the amount of nutrients and sediment running off of pasture lands. Dairy manure injection reduces runoff from croplands rather than pastures.

