Hillandale Population Methodology for Incorporation into CAST

August 19, 2021, AgWG Meeting

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The Problem

- **Hillandale Farms, Inc.**
  - CAFO layer facilities in Adams & York Counties are not accounted for in CAST.
  - Hillandale Farms is the largest CAFO in PA.

- **How do we know this?**
  - 2017 Ag (5-year) Census data does not indicate farm counts or population data that would indicate CAFOs of this size at the county or state scales.

- **The solution?**
  1) Collect data from all available sources
  2) Develop a methodology to incorporate the Hillandale Layer population into the Adams and York County datasets.

Topic of July's WTWG Meeting

Topic of August's WTWG Meeting

The Challenge

- Collecting **reliable sources of data** that we can access on a recurring basis per the CAST schedule, preferably at no cost.
- **Determining if industry data is an acceptable** alternative to the Ag Census.
- **Setting a precedent** for incorporating new or more accurate sources of data for animal populations in the future.

Update from the WTG

- **Consensus to include the Hillandale Data into CAST-21 was not reached due to:**
  - Not having confirmation from the AgWG that **facility data can be used to supplement the Ag Census.**
  - Not having **sufficient time to review** the information.
  - Not having **identified other gaps in CAST's animal populations** due to potentially other large operations missing from the Ag Census.

Review of what was Presented to the WTWG

What dataset would we be introducing?

- The Hillandale Layer population would be **added to the existing Layer population in CAST.**
  - The Hillandale Layers **WOULD NOT** be replacing the existing CAST layer population.

- How many birds?
  - **Adams County in 2017:** 4,630,608
  - **York County in 2017:** 1,229,125

- Why?
  - This population is not represented in the Ag Census.
  - **Adams Ag Census 2017:** 210,832 (192 Farms)
  - **York Ag Census 2017:** 274,531 (343 Farms)

- What data source is used?
  - Inventory Numbers provided by the Hillandale Operation.
    - Two data points per year (inventory at the start and end of the year) from 1995 to 2021.
  - Validity verified by comparing to the CAFO permits and NMPs.

Available Layer Population Data Sources

1. 2017 NASS (National Agricultural Statistics Survey) **Census of Agriculture**
2. **NASS Annual Statistical Survey**
3. Hillandale Farms **Facility Layer Inventory Data**
4. Nutrient Management Plans **(NMPs)**
5. **CAFO** (Concentrated Animal Feeding Operation) Permits
6. Pennsylvania Manure Management Plans **(MMPs)**

Reviewed Ag Census and NASS Survey to **determine Hillandale Layer population was not present.**

Facility Layer Inventory Data used **to derive Change Product** that will be processed with existing CAST layer population.

NMPs and CAFO permits used to **cross check facility numbers.**

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Fully Incorporating the Hillandale data could be a **Two Step Process**

Presented to the WTWG

1. Change product for Phase 6

– 1995 to Present

2. Included in the calibration of Phase 7

-1984 to Present

How do we currently incorporate layer data into CAST?

- Layer Population (Total Inventory) at State/County scale are taken from the NASS (5-year) Ag Census from 1982- 2017.
- Estimates are calculated for D Counties.
  - Counties for which inventory data is published **ONLY** as part of state-wide total to protect privacy.
- Linear Interpolation is used to calculate data for in between years based on the reported Ag Census years.
- Ratio for CAFO/AFO, submitted by states, is used to determine the number of Confined/Non-Confined Animal population, which in turn derives the Feeding Space Land Use.

New Data (i.e. the Hillandale Data) would be incorporated into a two-year update as a Change Product using the same process.

The Change Product Methodology

- As a **"Change Product"** or year-to-year change.
- What is a "Change Product"?

Year	Actual (Absolute) Population Provided by Operation	Change Product (Amount incorporated into CAST)
1995	100	0
1996	200	100
1997	100	0
1999	400	300
2000	500	400

What is the Change Product methodology based on?

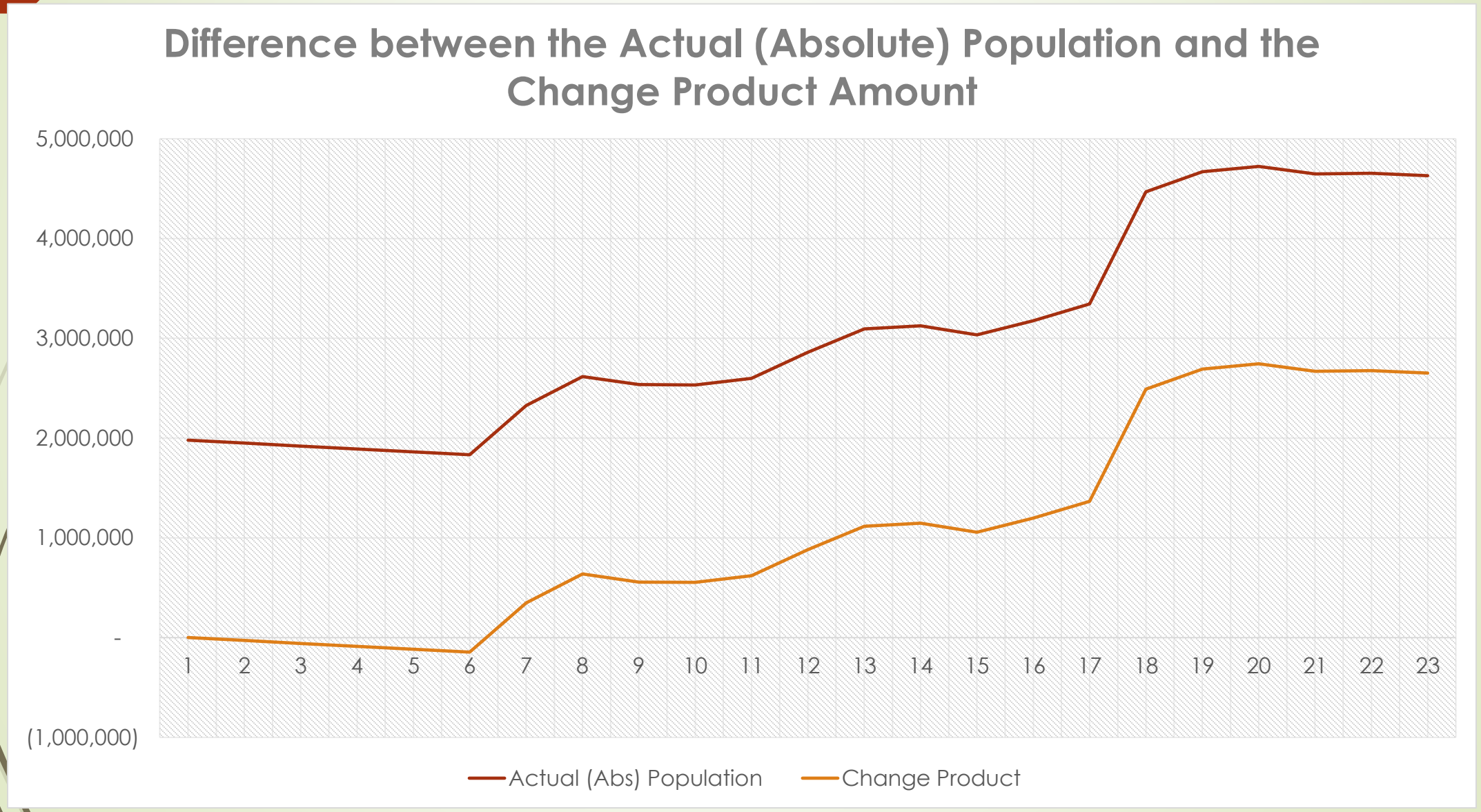
The Principle of Relative Change (Section 12.4.1 of the CAST Model Documentation)

- Process to incorporate changes, or new data sources judged more accurate than the data already used in P6, into the watershed model during a two-year milestone period.
- ***Same method*** *as used with introducing: 1) high-resolution landcover/land use data, 2) annual revisions to BMP history to reflect changes in implementation*

- **Two Rules to Maintain Integrity of the TMDL Calculation and the Planning Targets:**
  1) 1995 remains unchanged
  2) The trend (change product) is used rather than the absolute number.

  - Relative Change = **The Principle** for incorporating new sources of more accurate data during a two-year milestone period
  - Change Product = **Application of the Principle** of Relative Change within the watershed model
- *Relative change* allows us to incorporate changes that more accurately **represent changes between 1995 and any future scenario**, hence the "change product".

Visual Explanation of Relative Change



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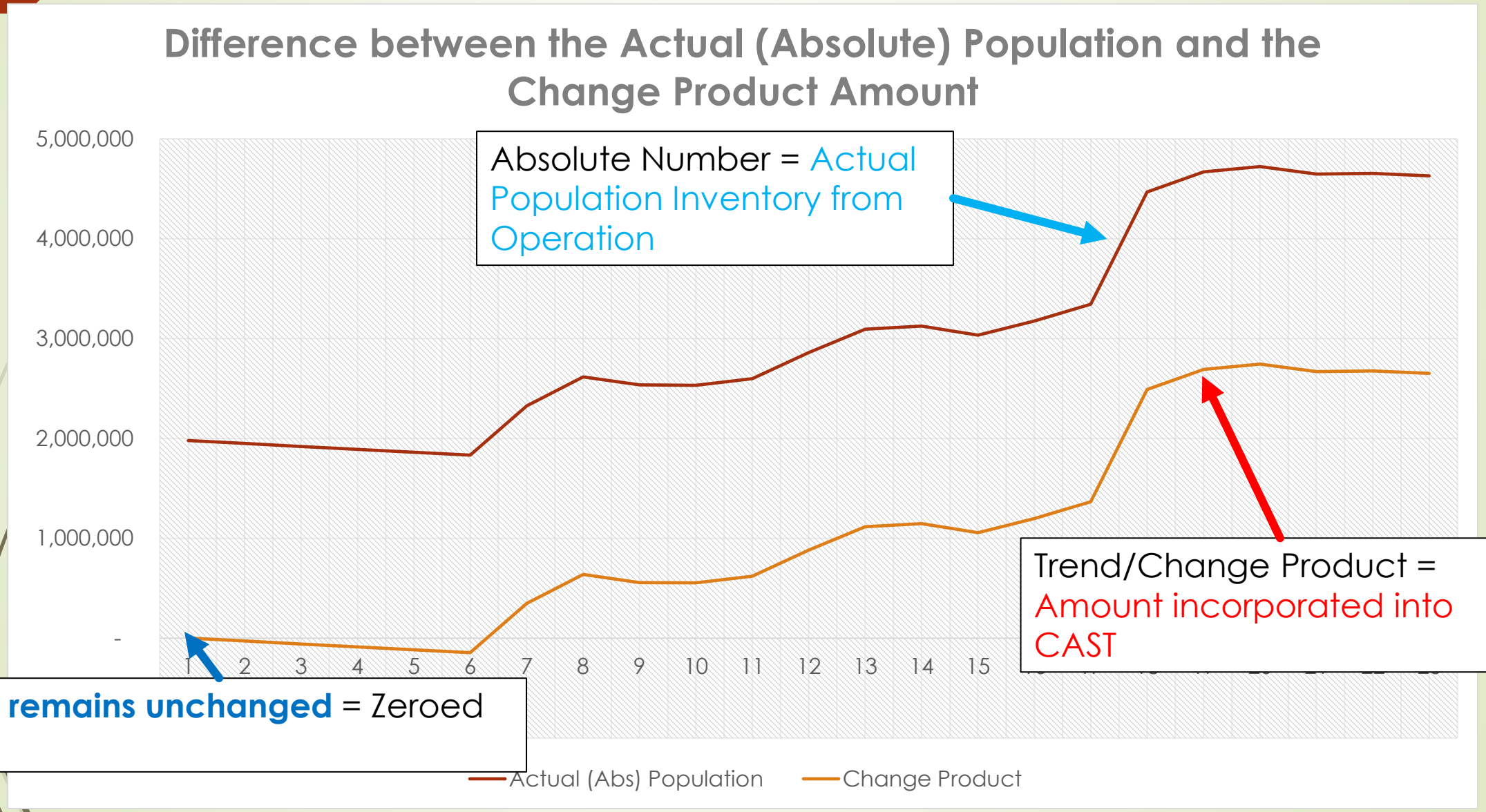

Summary of What was Outlined for the WTWG

- The Hillandale Layer Population Data **WOULD NOT** replace the existing layer population in CAST that is based on the Ag Census.
- The Hillandale Layer Population data would be incorporated into CAST (added to the existing CAST layer population) **as a Change Product per the Principle of Relative Change.**
- The Hillandale Layer Population data would **be processed in the same way** CAST layer population data is currently processed.
- The incorporation of Hillandale Layers as a Change Product **would impact loads** across the watershed.

What do we need from the AgWG (in partnership with other applicable workgroups)?

- **To discuss and determine which data sources are acceptable alternatives or supplements to the Ag Census.**
  - For Hillandale, this data would supplement the Ag Census within CAST.
- **Is facility data an acceptable supplement or alternative to the Ag Census?**
- How do we identify gaps in our existing animal populations that are present due using only the Ag Census as a basis for animal populations in the model?
- Once gaps are identified, how do we fill them?

Slides for Reference

Will this impact the TMDL?

- *Relative change* enables us to maintain consistency with the TMDL critical period (water quality attainment from 1993-1995).
  - **All versions of P6 CAST must return to same results for the 1995 scenario.**
  - **Why?** A Change in load in 1995 would change the relationship between 1995 and the planning target which are *calculated as the change in 1995 load necessary to meet WQ standards.*

  Reminder: The watershed model = a tool to estimate changes in load from 1995 onwards due to management actions
    - The purpose is to represent changes actually occuring in the watershed.

- *Relative change* allows us to incorporate changes that more accurately **represent changes between 1995 and any future scenario**, hence the "change product".
  - "Best available data" = best available data on **the changes in** land use, BMPs, animal populations, etc.

Estimation of how loads could be impacted with the addition of the Hillandale Layer Change Product

- Scenarios were run using a **draft version** of CAST, CAST-19 with the CAST-21 land use (that has been provided to date) up to 2017.

- **Which scenarios were run?**

  2017 Progress **with and without** the Hillandale Layer Population.

Summary of Estimated EOT Load Change – *EOT Load % Change between 2017 Progress without the Hillandale Population and 2017 Progress with the Hillandale Population*

Table 1. Estimated EOT Load % Increase between 2017 Progress without the Hillandale Population and 2017 Progress with the Hillandale Population

State	EOT N (lbs N)	EOT P (lbs P)	EOT S (lbs S)
Delaware	0.10%	0.05%	-
District of Columbia	-	-	-
Maryland	0.04%	0.03%	-
New York	0.04%	0.08%	-
Pennsylvania	0.14%	0.45%	0.003%
Virginia	0.02%	0.02%	-
West Virginia	0.02%	0.02%	-

(Positive percentages represent an increase in loads.
Load change = 2017 Progress with Hillandale Population – 2017 Progress without Hillandale Population)

Summary of Estimated Load Change (lbs nutrient)

Table 2. Estimated EOT Load Increase between 2017 Progress without the Hillandale Population and 2017 Progress with the Hillandale Population			
State	**EOT N (lbs N)**	**EOT P (lbs P)**	**EOT S (lbs S)**
Delaware	6,910	63	-
District of Columbia	-	-	-
Maryland	23,470	1,065	-
New York	6,238	554	-
Pennsylvania	157,485	17,701	73,789
Virginia	13,024	1,144	-
West Virginia	1,452	109	-

(Positive numbers represent an increase in loads.

Load change = 2017 Progress with Hillandale Population – 2017 Progress without Hillandale Population)

Most Heavily Impacted Areas (Load Increase > 5,000 lbs N EOT)

Table 3. The Estimated EOT Load % Increase between 2017 Progress without the Hillandale Population and 2017 Progress with the Hillandale Population

Geography	EOT N Change	EOT P Change	EOT S Change
Adams, PA	4%	15%	-
Franklin, PA	0.1%	-	-
Lancaster, PA	0.1%	-	-
Sussex, DE	0.2%	-	-
York, PA	0.8%	7%	-

(Positive percentages represent an increase in loads.
Load change = 2017 Progress with Hillandale Population – 2017 Progress without Hillandale Population)

Important Model Processes to Understand

How are inorganic fertilizer nutrients distributed and applied across the watershed?

- **Fertilizer nutrient applications are distributed across the CB watershed from a watershed-wide amount to meet each crop's need.**
- Generally, application rates depend on relative crop "need" defined by past nutrient applications., past nutrient applications.
- Implementation of Nutrient Management (Core) may influence the crop need in each county.

How are manure nutrients distributed and applied to cropland?

- **Manure nutrients are applied to counties where they are generated unless manure transport is indicated in the scenario.**
- Generally, application rates in each county depend on relative crop "need".
- Where manure nutrients are land applied, inorganic fertilizer nutrients will decrease.

How will the land use distribution be impacted?

- **Land use will only be impacted within Adams and York counties.**
- The permitted feeding space will increase. Land use in the natural and developed sector will decrease to account for the increase in feeding space within the Agriculture sector.