AMT Office Hours February

2/14/2025

Tom Butler, EPA

What is on the docket for today?

- Land Use details
- Inorganic agricultural fertilizer

Land Uses: January recap

Proposed decisions:	
Alter the Land Uses in CAST to represent, Managed and Unmanaged Hay as well as Managed and Unmanaged Pasture.	Modify the manure spread algorithm to create a fourth group as proposed by Virginia for Phase 7.

We decided to move forward

- January – decided to move forward with new Land Uses
  - Pending Delaware review

Group 1

- Grain with manure
- Silage with manure
- Managed Other Hay

Group 2

- Small Grains
- Double cropped
- Other crops
- Specialty (high and low)
- Managed Pasture

Group 3

- Other Hay
- Pasture

Group 4

- Soybeans
- Legume Hay

Land Use Details

What is our definition of managed vs unmanaged hay and pasture?

How should the acres of managed vs unmanaged categories be determined/reported?

What should the relative nutrient loading rate be for each of these new Land Uses (Loading Rate Ratio)?

What should the impact of Nutrient Management (NM) be?

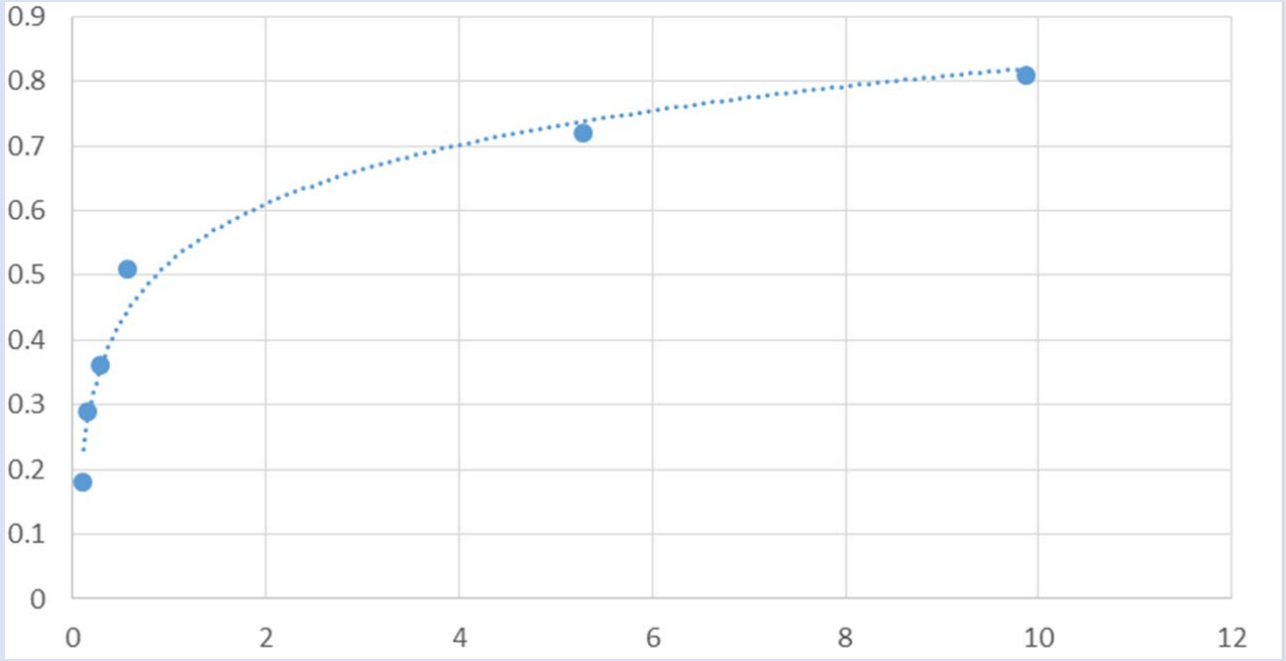
Definitions:

- Clear watershed wide definition
- How do managed and unmanaged lands differ?
  - Nutrient applications the same?
  - What are the defining characteristics?

Acres of managed and unmanaged don’t exist

Historic records of NM?	• Does each state have this ability?
Annual reporting?	• Used for construction acres
Algorithms?	• Used currently for grains with and without manure

Example graph



Loading Rate Ratios:

Chesapeake Bay Average			
Land class	Land Use	Loading Rate Ratio	Loading Rate (pounds per acre per year)
Cropland	Double Cropped Land	0.79	30.9
	Full Season Soybeans	0.71	27.7
	Grain with Manure	1.4	54.7
	Grain without Manure: **Reference land use**	1	39.1
	Other Agronomic Crops	0.45	17.6
	Silage with Manure	1.62	63.3
	Silage without Manure	1.16	45.3
	Small Grains and Grains	0.84	32.8
	Specialty Crop High	1.34	52.4
	Specialty Crop Low	0.31	12.1
Pasture	Ag Open Space	0.43	5.1
	Legume Hay	0.74	8.7
	Other Hay	1.04	12.3
	Pasture: **Reference Land Use**	1	11.8

CAST Ag Land Use Loading

- Land Classes
  - Basic split of ag into Cropland and Pasture

Chesapeake Bay Average			
Land class			
Cropland			
Pasture			

CAST Ag Land Use Loading

- Divided into Land Uses
  - Groups of crops we believe behave similarly.
- Reference Land Uses are determined for each class
  - Foundation for behavior of all other land uses

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Corn for grain without manure has the most area
Control in each study examined

Pasture covers the most area

CAST Ag Land Use Loading

- Loading Rate Ratio
  - Relative loading behavior of Land Uses compared to the refence.

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CAST Ag Land Use Loading

- Loading Rate
  - Pounds/acre/year of nutrients delivered to the water from the land.
  - Modeling workgroups purview
    - Encompass physical transport

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Phase 6 CAST Ag Land Use Loading

Eligible to receive Manure AND Fertilizer
Eligible to receive ONLY fertilizer
Eligible to receive NO nutrients

- 14 Total
- 13 eligible to receive nutrients
  - 11 eligible to receive nutrients from manure
  - 2 eligible to receive nutrients from ONLY fertilizer

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Things to consider:

- **IF** we **change any Land Use**, we need to **change their** associated **Loading Rate**
- **Same** is true if we **create** a new **Land Use**.

Phase 7 CAST Ag Land Uses

- Two new Land Uses
  - Managed Hay
  - Managed Pasture
- Need to think about differences between new Land Uses and existing ones.

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	Managed Hay	?	?
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	Managed Pasture	?	?

Impact of Nutrient Management: Phase 6

Land Use	Non-Nutrient Management Nitrogen Multiplier	Non-Nutrient Management P Multiplier
Full Season Soybeans	1.2	1.5
Grain w/ Manure	1.3	3
Grain w/o Manure	1.2	1.5
Legume Hay	1.2	1
Silage w/ Manure	1.4	3
Silage w/o Manure	1.2	1.5
Small Grains and Grains	1.2	1.5
Small Grains and Soybeans	1.2	1.5
Specialty Crop High	1.3	2
Specialty Crop Low	1.2	2
Other Agronomic Crops	1.1	1.5
Other Hay	1	1
Pasture	1	1

Impact of Nutrient Management: Proposed

Land Use	Non-Nutrient Management Nitrogen Multiplier	Non-Nutrient Management P Multiplier
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Other Agronomic Crops	1.1	1.5
Other Hay	1	1
Pasture	1	1
Managed Hay	1.2	1.5
Managed Pasture	1.2	1.5

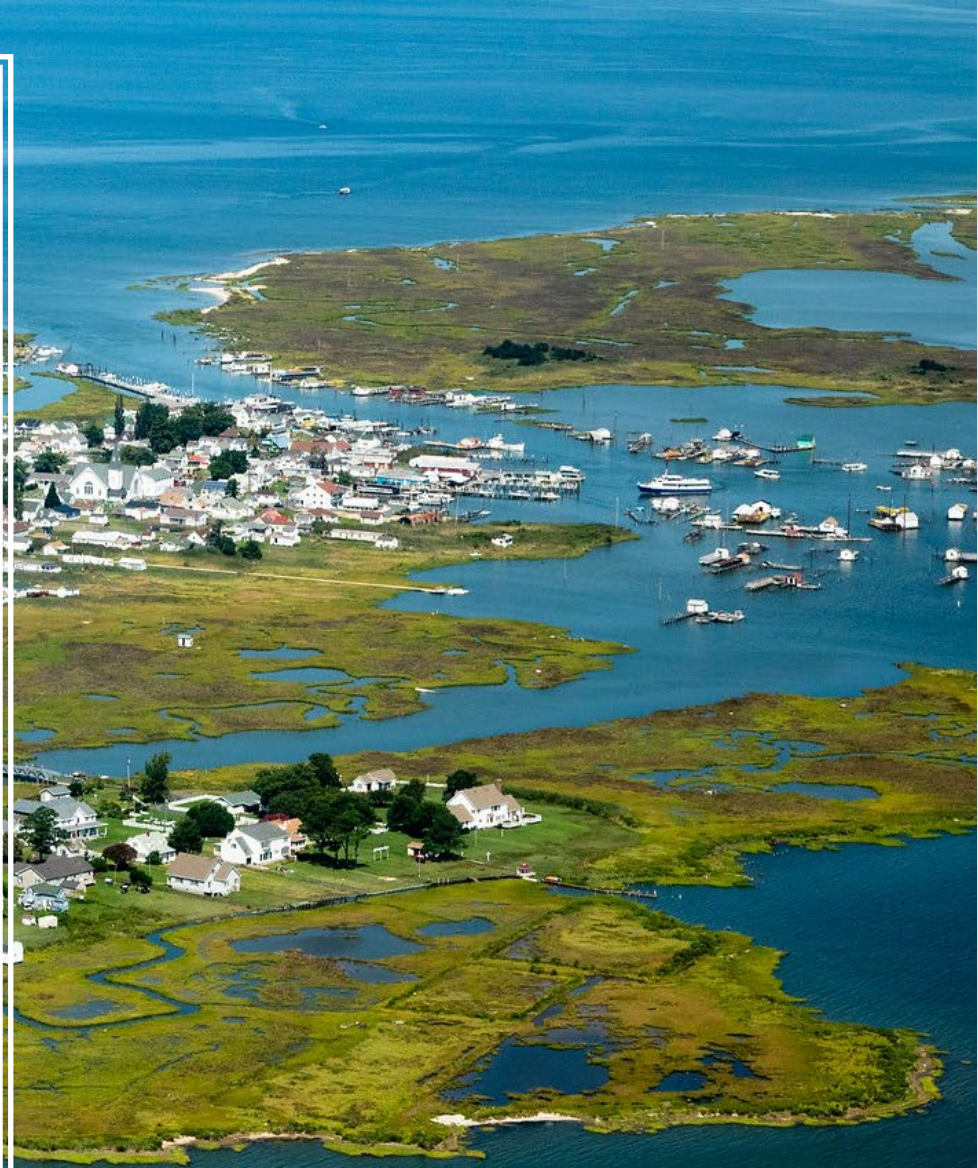
Questions?

Inorganic fertilizer:

Processing Agricultural Fertilizer Data for CAST

Background

- Chemical fertilizer* in the Chesapeake Bay Watershed is a large source of nutrients that leads to low dissolved oxygen and increased chlorophyll *a*.
  - *Inorganic fertilizer available for application to crops
- Modeling chemical fertilizer application rates is important for management decisions.
- Jurisdictions are concerned with the accuracy of chemical fertilizer data used in modeling efforts.



Chesapeake Bay Program

Brief History of Chemical Fertilizer Data

Chemical fertilizers are manufactured and applied differently to urban and agricultural lands.

Urban and agricultural fertilizer applications are treated differently in the model and overseen by different groups

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Regulation/Policy changes	Bay wide farm surveys describing fertilizer applications	Using data from the International Plant Nutrition Institute (CAN)	Utilize Association of American Plant Food Control Officials (AAPFCO) sales data

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In 2023 Moved to utilize data directly from states where available

Working with the Data

Agricultural fertilizer data are summed for the entirety of the six CBW states and redistributed at county-level

- Fertilizer can be transported across state lines after sale
- Calculate a regionwide fertilizer amount by summing all states
- Determine watershed counties' crop application goals with Ag Census and reported nutrient management data
- Distribute regional fertilizer to counties based on crop application goal and available manure and biosolids

Agricultural Fertilizer Data Sources

American Association of Plant Food Control Officials (AAPFCO)

- County-level commercial fertilizer sales (mass of N and P)
- Updated annually but takes time to release (most recent release is for 2017 data)

State departments of agriculture

- County-level commercial fertilizer sales (mass of N and P)
- Updated annually with reduced latency vs AAPFCO

United States Department of Agriculture (USDA) National Agricultural Statistics Service (NASS)

- Census of Agriculture
  - Fertilizer expenditures on 60+ crops produced in the region (US Dollars)
  - Updated every five years (County and State levels)
- Annual Surveys
  - Major crop production and livestock production (State level only)

Land Grant Universities and State Extension Agencies

- Agronomic application rates (fertilizer mass/ crop yield / acre)
- Updates based on the availability of research data

Why AAPFCO data?

- State reported, single data source
- Consistent standard data reporting requirements
- Publicly available data for deriving countywide inorganic fertilizer application
  - When investigating fertilizer inputs for Phase 6, AAPFCO provided full spatial coverage of CB watershed counties, was regularly published (although delayed), and included necessary information (e.g., farm vs. non-farm, nutrient masses) from a single source
- Ag Modeling Subcommittee (AMS) developed a Partnership-approved fertilizer use estimation procedure for agricultural fertilizer in CAST
  - Process utilizes AAPFCO data, NASS datasets, and application rates from states

Organizations Using AAPFCO

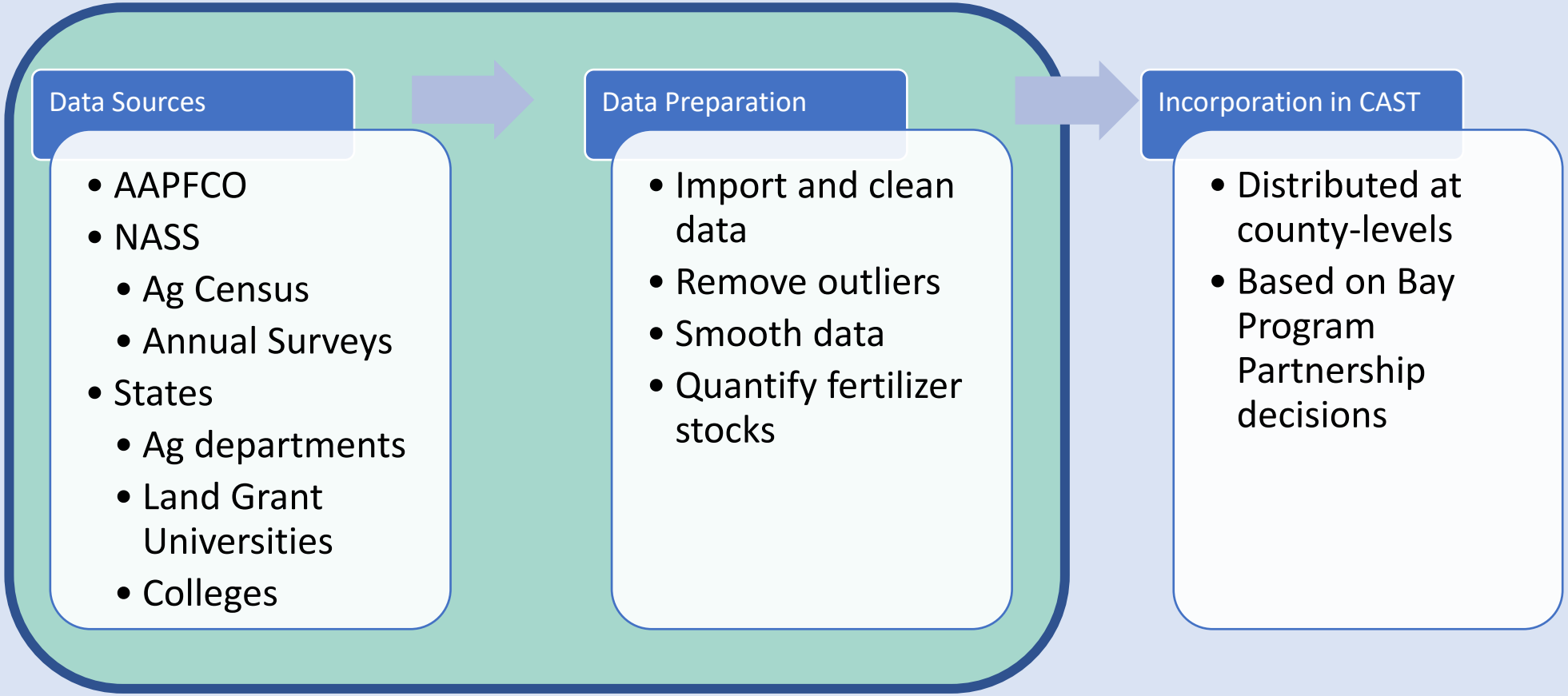
- The Fertilizer Institute and Plant Nutrition (Canada)
  - Nutrient Use Geographic Information System (NuGIS)
- United States Geological Survey (USGS)
  - Spatially Referenced Regression On Watershed (SPARROW) attributes model
  - National Water-Quality Assessment (NAWQA)
  - Develop turfgrass application estimates
- USDA Economic Research Service
  - Fertilizer Use and Price
- USDA Natural Resources Conservation Service (NRCS)
  - Conservation Effects Assessment Project (CEAP)

Why the move to states?

- Same data as AAPFCO
- No middleman
- Reduced latency

Data Processing Steps

Ag Fertilizer Data Processing Overview



1. County Level

AAPFCO/State

1. AAPFCO data are obtained by the Chesapeake Bay Program at the **county level**.
    a. These data contain the annual mass (tons) of fertilizer sold (% TN and P205).

1. County Level

AAPFCO/State

2. State Level

AAPFCO/State

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    a. These data contain the annual mass (tons) of fertilizer sold (% TN and P205)
2. These data are converted to pounds of fertilizer sold then summed at the **state level**.
    a. Outlier removal occurs.
    b. Farm fertilizer fraction is determined.
    c. Smoothing with a 3-year rolling averge.

1. County Level

AAPFCO/State

2. State Level

AAPFCO/State

3. Six State Level

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2. These data are converted to pounds of fertilizer sold then summed at the **state level**.
    a. Outlier removal occurs.
    b. Farm fertilizer fraction is determined.
    c. Smoothing with a 3-year rolling averge.
3. Summed for the **six state level** per year for TN and P205.

Notes on State data *

- The same information is gathered from states as AAPFCO.
- Data after 2016 and up to 2020 were provided directly by states.
  - DE, PA, MD, VA
- Remaining states used the trend of fertilizer increase from those who reported.
  - Trend was applied from last reported data.

4. County Level

Ag Census

4. Ag Census data are obtained by the Chesapeake Bay Program at the **county level**.
    a. These data contain soil amendments expenditures (US Dollars), which include annual fertilizer purchases; Reference point for state fertilizer applications.

4. County Level

Ag Census

5. Six State Level

Ag Census

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5. These data are then summed to the **six state level**.

4. County Level

Ag Census

5. Six State Level

Ag Census

5a. CBW Counties

Ag Census

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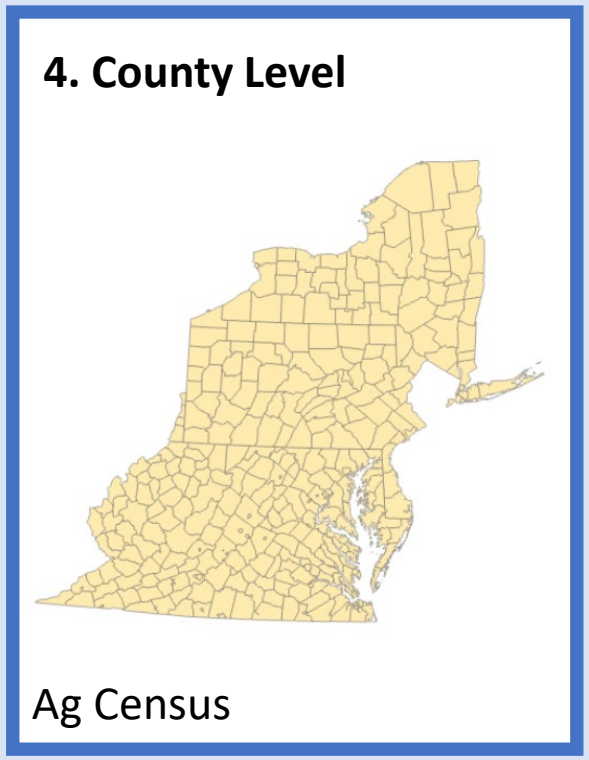
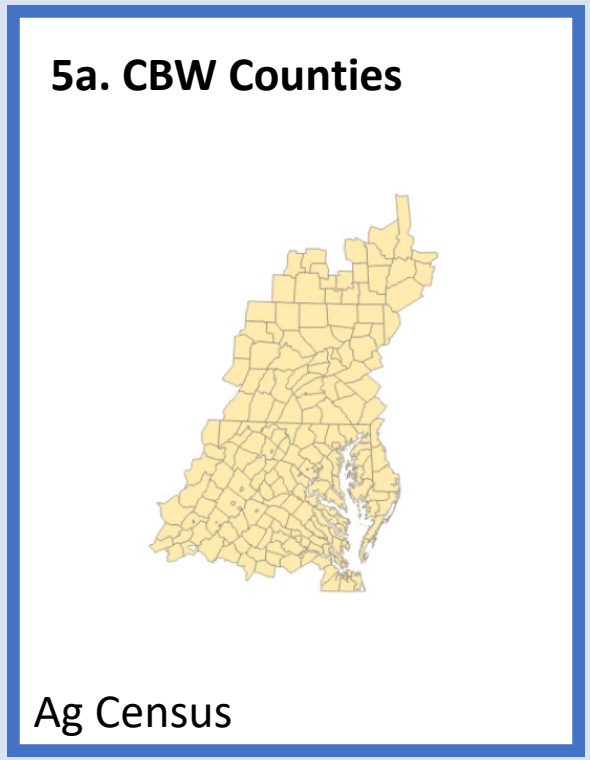
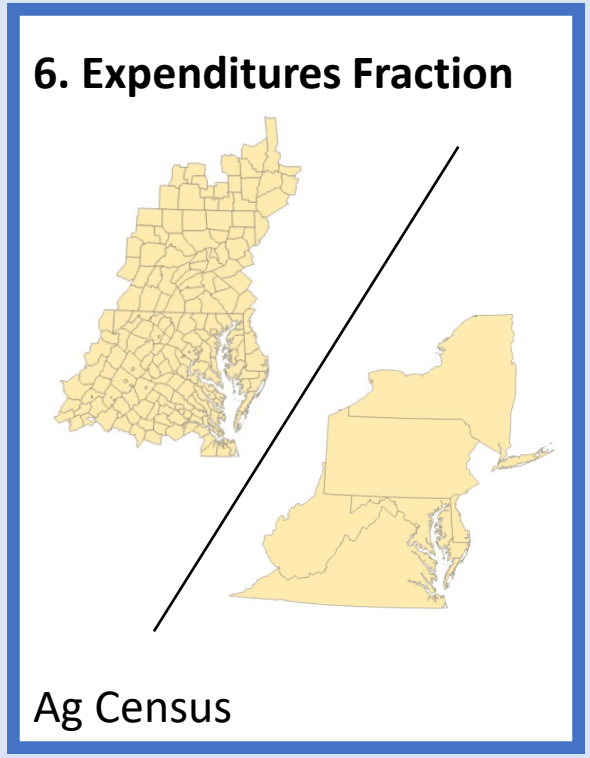
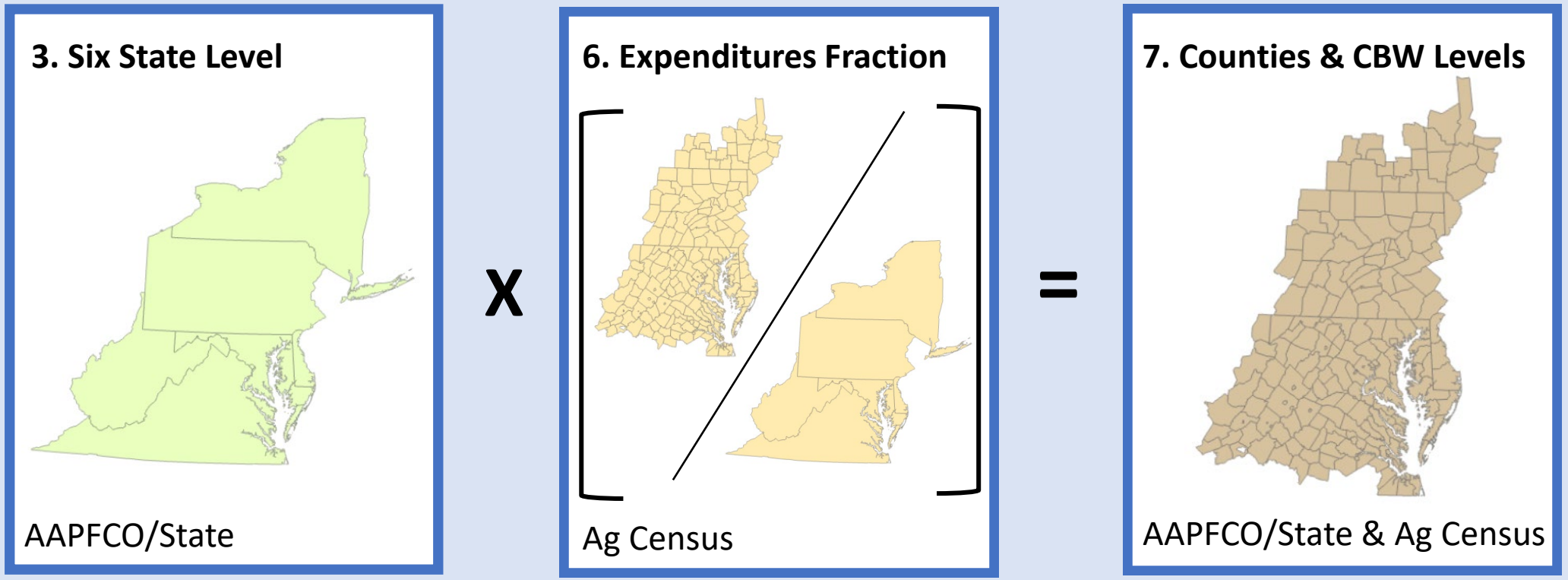
    a. Soil amendment expenditures are summed for **CBW counties**.







4. Ag Census data are obtained by the Chesapeake Bay Program at the **county level**.
    a. These data contain soil amendments expenditures (US Dollars), which include annual fertilizer purchases; Reference point for state fertilizer applications.
5. These data are then summed to the **six-state level**.
    a. Soil amendment expenditures are summed for **CBW counties**.
6. The **expenditures fraction** spent on agricultural fertilizer within the CBW is determined.
    a. Ratio of CBW Counties to the Six-State Level (unitless) per year.



7. Quantify the pounds of agricultural fertilizer used annually in the **CBW**.

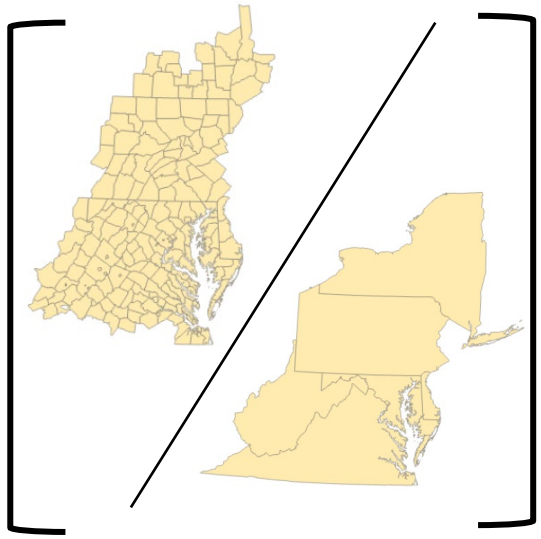
    a. Six state agricultural fertilizer mass (pounds; AAPFCO) is multiplied by the CBW expenditures fraction (unitless; Ag Census).

3. Six State Level

AAPFCO/State

X

6. Expenditures Fraction



Ag Census

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7. Counties & CBW Levels

AAPFCO/State & Ag Census

7. Quantify the pounds of agricultural fertilizer used annually in the **CBW**.

a. Six state agricultural fertilizer mass (pounds; AAPFCO) is multiplied by the CBW expenditures fraction (unitless; Ag Census).

b. Results in annual fertilizer mass *available for application* (pounds of TN and P205 [multiplied by 0.4362 for farm fertilizer]), which is a calculated fertilizer stock for the entirety of CBW **counties.**

Some quick Terminology

- **Expected Application (pounds)**
  - Indicates the amount of nitrogen a crop or set of crops is expected to receive for an entire county. It is calculated for each crop type using this equation: **#acres of crop x yield/acre (NASS Annual data C-23) x *Expected Application Rate**
- **Expected Application Rate (pounds/acre)**
  - The ***Recommended Application Rate** is adjusted for a factor to account for acres **not** under nutrient management
- **Recommended Application (pounds)**
  - Indicates the amount of nitrogen a crop or set of crops is expected to receive for an entire county under 100% nutrient management. It is calculated for each crop type using this equation: #acres of crop x yield/acre x ***Recommended Application Rate**
- **Recommended Application Rate (pounds/acre)**
  - The Nutrient Management Application Goal per Acre supplied by the jurisdictional land grant university (LGU)- it describes the amount of nitrogen needed per yield unit or acre for each crop type and assumes nutrient management is practiced.

Fertilizer application rates were **quantified** by the Chesapeake Bay Program **Ag Workgroup-approved methods** for CBW counties.

a. *Recommended application rates* are provided by state land grant universities in pounds of N or P per yield unit.
    a. Acres under nutrient management have an **application goal** equal to the *recommended application rate.*
    b. Acres not under nutrient management have a higher **application goal** as specified by the Nutrient Management BMP panel.

b. All fertilizer is distributed to counties based on their remaining **application goal** after manure and biosolids are applied.

c. Fertilizer is distributed to crops within counties based on a complex formula developed by the Ag Modeling Subcommittee.

Summary

We need fertilizer data to estimate N and P applications to the land.

We use state and federally reported data sets.

Data are processed to remove outliers, location issues, and timing of use.

Processed data are applied at the county level, based on the reported crop types and yields in addition to applied organic nutrients.

Questions?

Thank you for attending office hours!

We will begin our main meeting at 09:00.