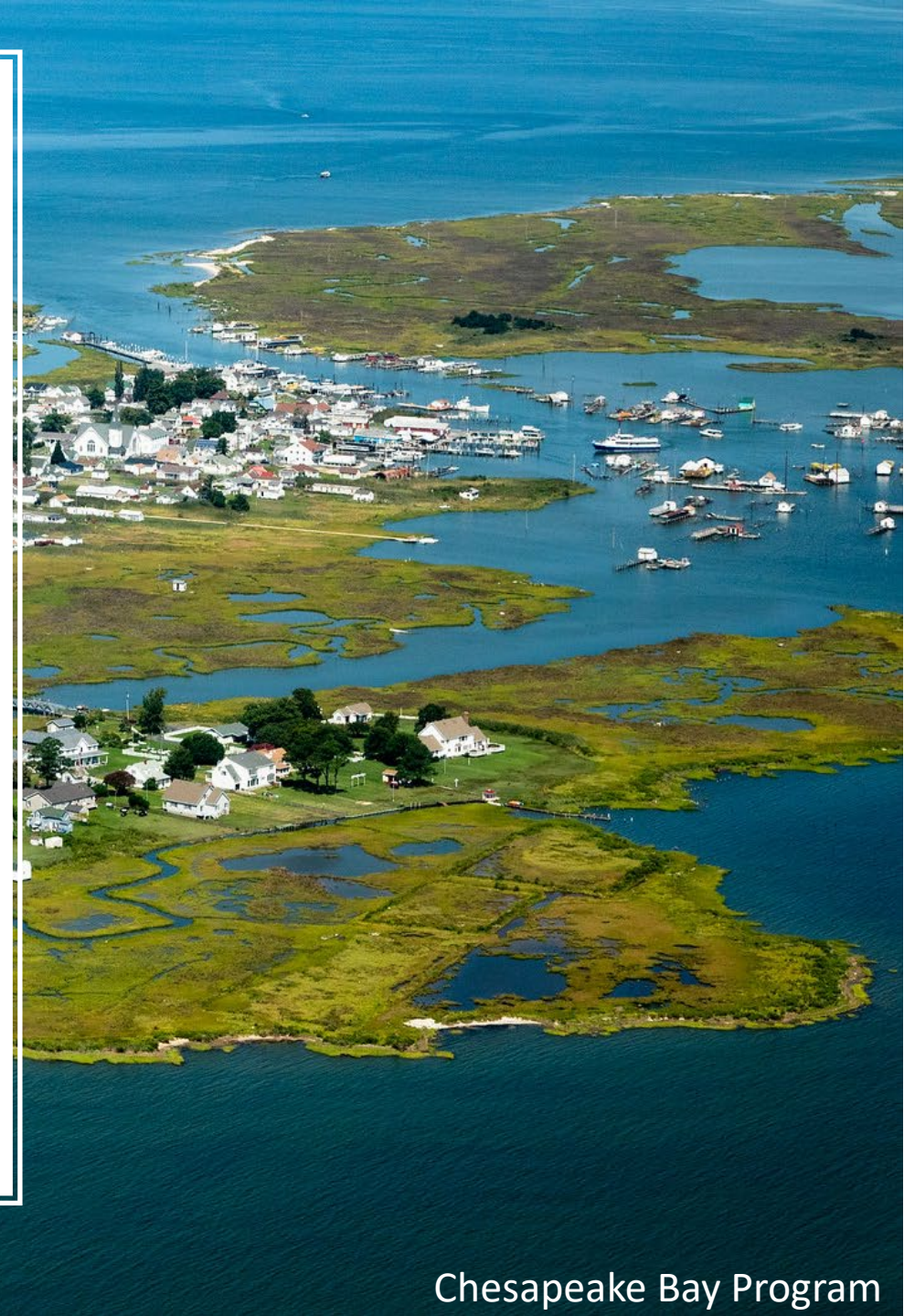




Processing Agricultural Fertilizer Data for CAST

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.



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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Workshops were held in 2007 & 2013 examining alternative chemical fertilizer model inputs. Suggestions included:

Regulation/Policy changes

Bay wide farm surveys describing
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Using data from the International Plant
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In 2017 the Partnership utilized AAPFCO data (with additional data streams) in the model.

Best dataset available in 2017

Single, consistent data source across the watershed

Data originate from state regulatory reports

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)
- 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

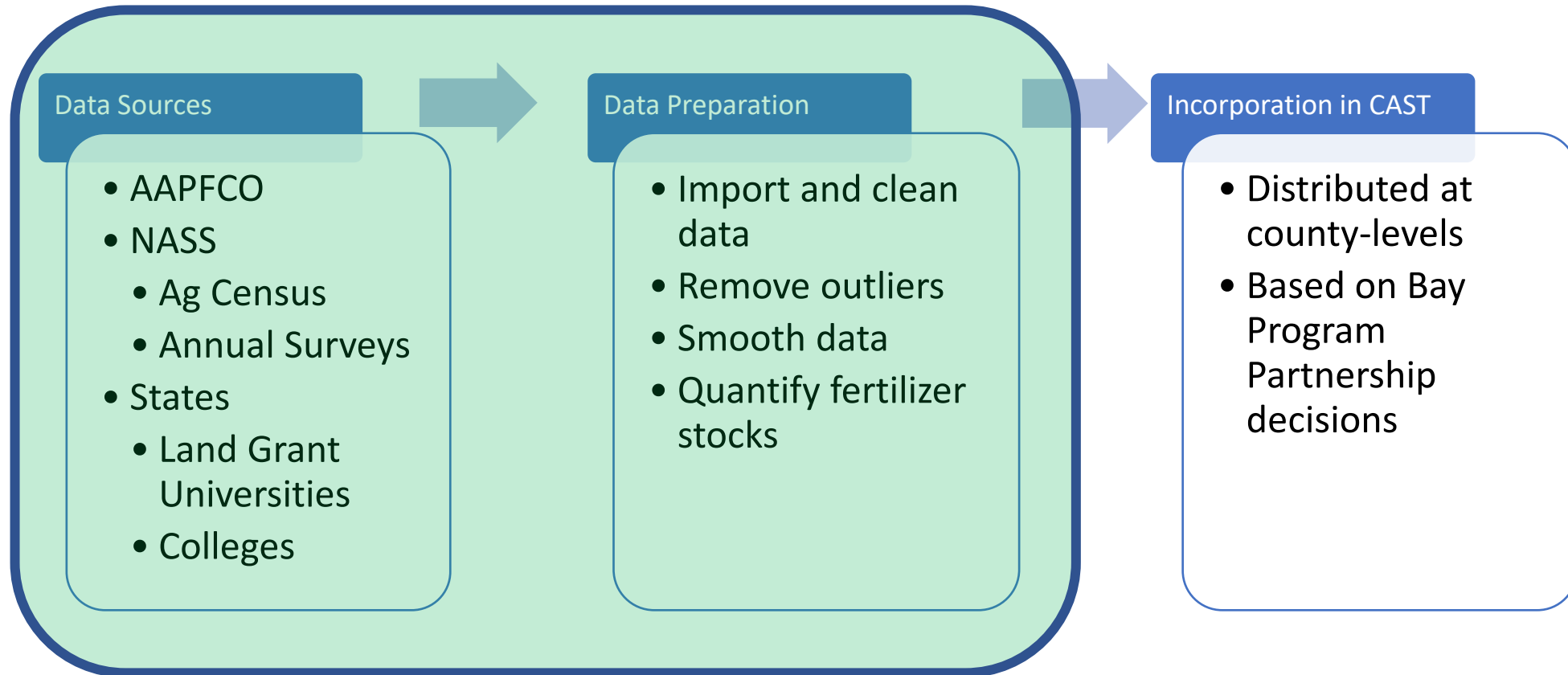
Organizations Using AAPFCO

- 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)

An aerial photograph of a rural landscape featuring a complex mosaic of agricultural fields in various shades of green and brown. Several farm buildings, including barns and houses, are scattered throughout the scene. A road runs diagonally across the lower left portion of the image. The overall scene is captured from a high angle, showing the intricate patterns of the land use.

Data Processing Steps

Ag Fertilizer Data Processing Overview



1. County Level



AAPFCO

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

2. State Level



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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 average.

1. County Level



AAPFCO

2. State Level



AAPFCO

3. Six State Level



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 - c. Smoothing with a 3-year rolling average.
3. Summed for the **six state level** per year for TN and P205.

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



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4. County Level



Ag Census

5. Six State Level



Ag Census

5a. CBW Counties



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5. These data are then summed to the **six state level**.
 - a. Soil amendment expenditures are summed for **CBW counties**.

4. County Level



Ag Census

5. Six-State Level



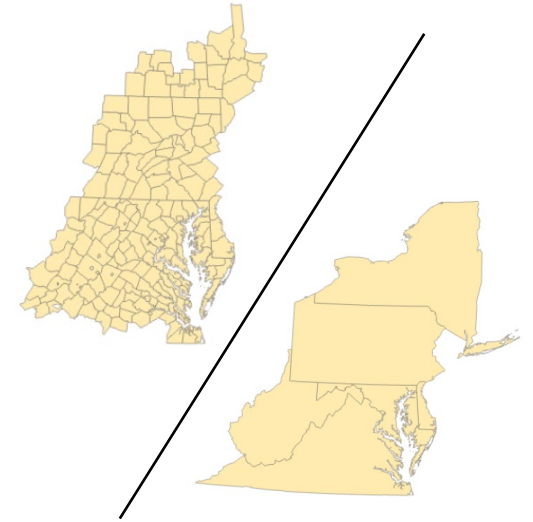
Ag Census

5a. CBW Counties



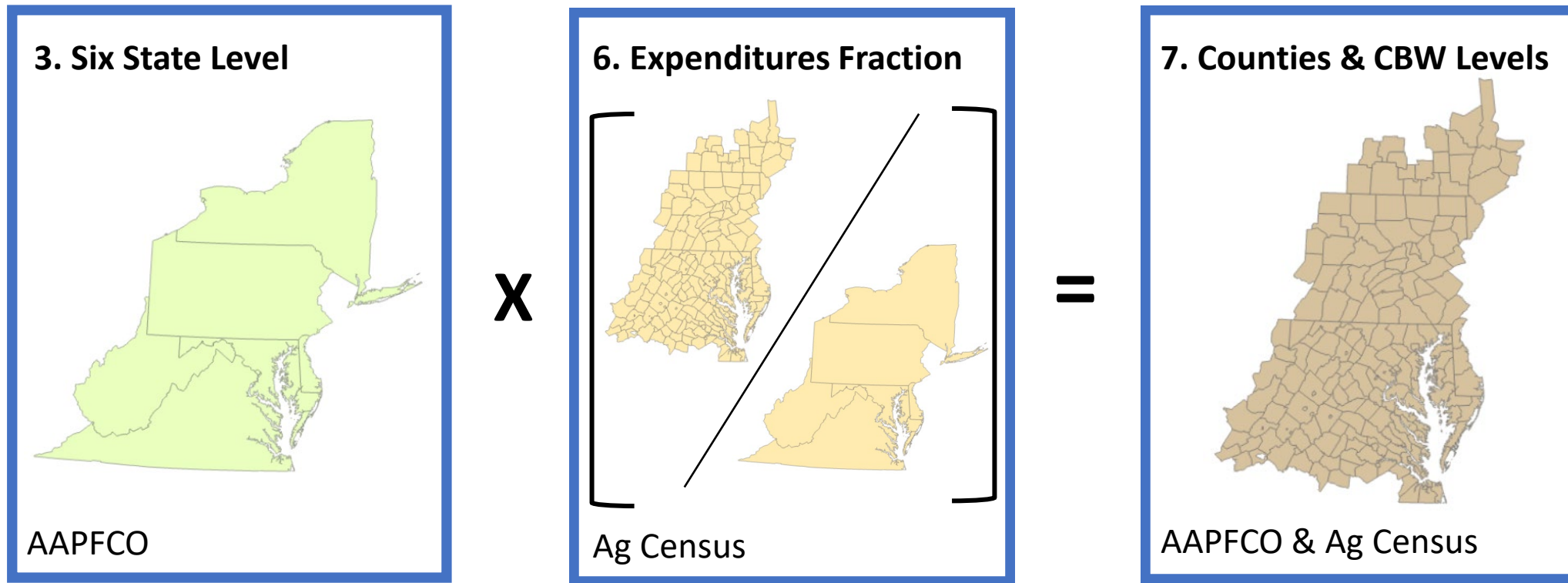
Ag Census

6. Expenditures Fraction



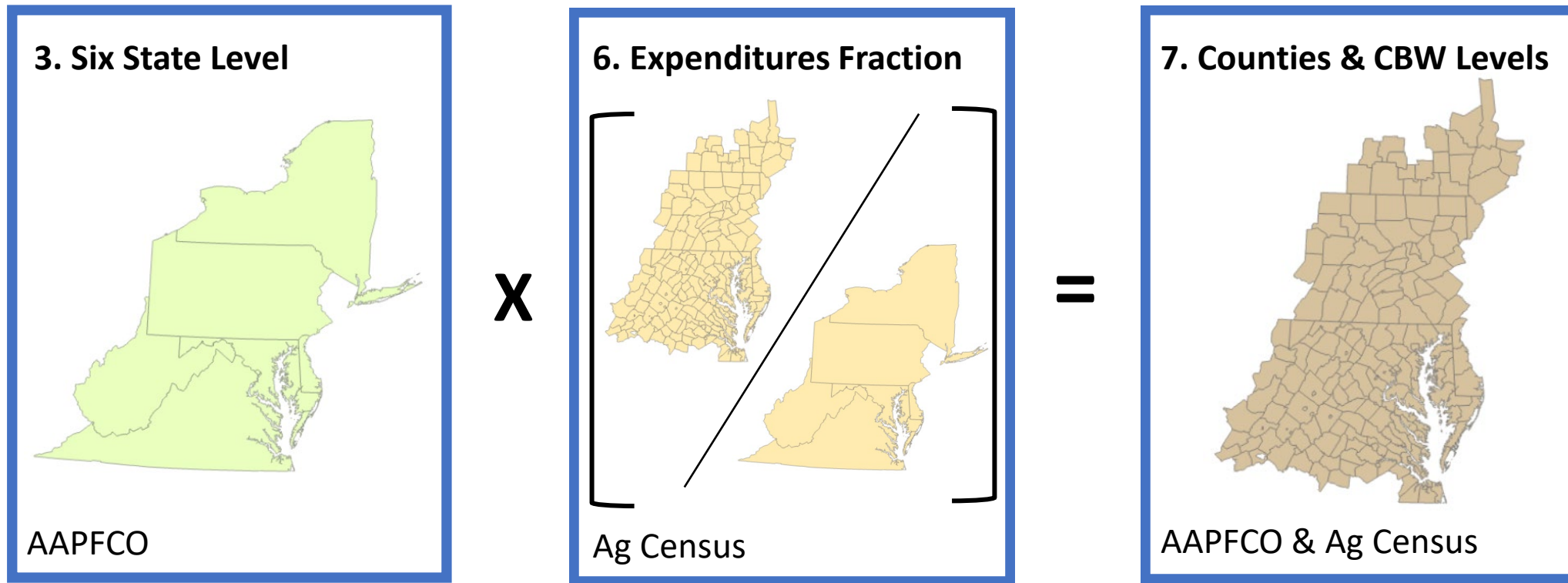
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4. Ag Census data are obtained by the Chesapeake Bay Program at the **county level**.
 - a. These data contain soil amendments expenditures (US Dollars), which include annual fertilizer purchases; Reference point for state fertilizer applications.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



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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**.

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- b. All fertilizer is distributed to counties based on their remaining **application goal** *after* manure and biosolids nutrients are applied.
- c. Fertilizer is distributed to available crops within counties based on a set of distribution curves 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.

An aerial photograph of a rural landscape featuring a patchwork of green and brown agricultural fields, winding roads, and several farm buildings. The scene is captured from a high angle, showing the intricate patterns of the land. The word "Questions?" is overlaid in white text on the left side of the image.

Questions?