# AgWG Ad Hoc CAST Issues

February 18, 2021

# **Task 3:** Investigate 2012-2017 Ag Census change for fallow/idle acres

**Please send any objections WITH suggested modifications to the language below to Loretta Collins (lcollins@chesapeakebay.net) and Gary Felton (gfelton@umd.edu) by COB Thursday, February 4th.**

**No objections received**

**Decision:**

- The AgWG reached consensus regarding CAST-21 Workplan Task 3: Investigate 2012-2017 Ag Census change for fallow/idle acres, recognizing that the 5-year census indicates a significant increase in fallow & idle acres within some counties in the Chesapeake Bay watershed.
- The AgWG acknowledges that investigation has not provided evidence to indicate that the 2017 Ag Census data is or is not reflective of on-the-ground change, therefore cannot recommend adjustment to CAST-21 model inputs at this time.
- The AgWG has exhausted its available resources to investigate this issue, but this decision does not preclude interested parties from pursuing further lines of inquiry and bringing information back to the workgroup for review.

# CAST-21 Workplan (Working Draft)

**Approved data and method changes need to be finalized through the WQGIT by Sept. 1, 2021**

Questions/ Comments?

| KEY ACTION | STATUS |
|---|---|
| **Task 1:** Updates to data & methods that typically occur every 2 years. | • On-going<br>• In process: "Rules of the Road" document for data submissions |
| **Task 2:** Investigate alternative forecasting methods for ag land uses & animals | • Nov 19 AgWG: CBPO presentation on 4 methods of forecasting<br>Feb AgWG; March for decision |
| **Task 3:** Investigate 2012-2017 Ag Census change for fallow/idle acres | • AgWG Sept 17; NASS consulted; no new information; No further action; See Jan AgWG decision |
| **Task 4:** Investigate use of latest landcover & LiDAR imagery to better define changes in total ag (& other land use) acres | • Oct 15 AgWG: P. Claggett, USGS & J. Czawlytko, Chesapeake Conservancy; seeking feedback<br>Jan AgWG; Feb AgWG, March for decision |
| **Task 5:** Investigate alternatives for double-crop acre estimates | • Oct 15 AgWG; NASS consulted- no new information; No further action; TASK COMPLETED? March for decision |
| **Task 6:** Consider supplemental NM for soybeans | • In process<br>• Dec Ad Hoc; Jan Ad Hoc; Mar Ad Hoc |
| **Task 7:** QA/QC'd historic & current layer pop. data for Hillandale Farms (PA) | • In process<br>• Feb Ad Hoc- general discussion |
| **Task 8:** Build-in Verification Ad Hoc Team products | • In process |

TODAY

TODAY

# What is Driving N Load Concerns?

No consensus in Ad Hoc yet…

## Agricultural Loading Rates?

## Ag Census (i.e., Source Of Crop Data) ?

## NM BMP Recommendations?

- Changing an Approved Expert Panel Recommendation Must Follow Science (BMP Protocol)
  - Protocol for the Development, Review, and Approval of Loading and Effectiveness Estimates for Nutrient and Sediment Controls in the Chesapeake Bay Watershed Model

# Agricultural Loading Rates

Based on Available Literature & Best Professional Judgement

"N losses from soybeans are only somewhat lower than corn, because N fixation inputs (which are poorly characterized) are apparently substituting for fertilizer inputs." (p.11 )

Ag Loading Rate Review Steering Committee: Agricultural Loading Rates

# Census of Agriculture

## Concern Regarding Accuracy of Ag Census Crop Acres

- Spatially Distributed Land Use from the Land Cover/Land Use Data Team Starting With the CAST-21 Could Mitigate Concern

## Method of Modeling Double-Crop Soybeans Approved by CBP Partnership

- Determined Sound by USDA-NASS

CAST-21 Workplan TASK 3

# NM Expert Panel Recommendations

# Land Use: Full-Season Soybeans

On Soybeans NM Controls for P (*not N*)

Land Grant Universities Do Not Recommend N Application (Via Fertilizer or Manure)

"Core" NM BMP → **N & P**

- Applies to Crop Application Goal (What is Applied to Crop)

Supplemental NM BMPs → **P only**

**General Thinking**

- Timing & Placement of Excess N Irrelevant (Still Subject to Loss)
- Rate? Excess N Reduced *is Still Excess N* Subject to Loss…
- Fraction of Applied N Tiny Compared to Residual N From Fixation
- Applies to Total Soybean Load
  - Total Load is Primarily Residual N From Fixation

# Next Step NM on Soybeans

(Jan Ad Hoc)

**ACTION:** PA will work on gathering information to better understand what real-world soybean management looks like. Other jurisdictions are encouraged to do the same.

**ACTION:** Clarify with CBPO how the simulation of how N assumptions are handled in the model (e.g. reduction of N fixation in the model with applied N).

## Animal Data

Animal Populations: explore other estimating options (MD/NY; Task 1)

## Crop Production/Acres

Crop Production Acres: improve annual estimates (MD; Task 1)

## Nutrient Applications/Assumptions

Fertilizer Sales and Use Data (MD; Task 1)

## BMP Tracking & Reporting

Dairy Precision Feeding (PA)

## BMP Effectiveness/Modeling

Winter Crop (NY/PA)

Manure Transport / Manure Treatment Technologies (PA)

CBPO looking into use of NASS Annual Dairy Surveys

## Animal Data

Animal Populations: explore other estimating options (MD/NY; Task 1)

## Crop Production/Acres

Crop Production Acres: improve annual estimates (MD; Task 1)

Future Updates on Industry-Related Initiatives

## Nutrient Applications/Assumptions

Fertilizer Sales and Use Data (MD; Task 1)

Working with MD State Chemist. Further Updates to Come.

# Improving Ag Data? (TASK 1)

## Crop Acreage Data

Crop Application Goal

Alternative methods to account for fitting Ag Census data to CBP needs?

- Adjusting methods for estimating crop acres (e.g. double crops)

Alternative/supplemental data sets

- Other data sets at the state or federal level?

## Animal Population Data

Additional NASS Annual Survey Data may be available to inform population trends between census years (incorporated every two years)

- Dairy, Beef Cattle, Layers, Swine…

Direct from industry data can inform animal population ***trends*** between census years.

- Requires careful cooperation
- Legal, privacy assurances

Manure Generated

## Other Data Issues (new data incorporation every 2 years)

Soil P data

- Gary Shenk Sept 2018 presentation to AgWG on data set incorporated into the CBWM
- **Additional soil P data is welcome and encouraged (NY & WV have made inquiries)**

Manure Nutrient Concentration Data

- Changes in management may result in changes in nutrient concentrations
- **Additional manure concentration data is welcome and encouraged**

Fertilizer Data

- More accurate allocation of fertilizer within the CBW?
  - **Jurisdictions working with state chemists**

4. Define Inorganic Fertilizer Available to Crops

**CRITICAL CONCEPT:**

To maintain integrity of CBWM there are two options for new data sets:

- Provide data all the way back through 1985.

  OR
- Use the **trend** in new data sets for the years available.

**CBWM= Chesapeake Bay Watershed Model**

# BMP Tracking & Reporting

Dairy Precision Feeding (PA)

PA Team Making Progress.

Target Date June 2021 for Report Back to the AgWG.

# BMP Effectiveness/Modeling

Winter Crop (NY/PA/MD)

Manure Transport / Manure Treatment Technologies (PA/MD)

Continue Discussion Based on Today's Presentation.

Future Discussion with Modelers


- March Ad Hoc:
  - Discussion NM on Soybeans
  - Clarification “Winter Crop” BMP Ask
- March AgWG
  - Decision Forecasting Ag Trends (Task 2)
  - Decision Landcover/ LiDAR Data (Task 4)
  - Decision Double Crop Methods (Task 5)
- June
  - Update from Dairy Precision Feeding Group

| BMP Concern | CBP BMP Effectiveness Source | Next Steps |
|---|---|---|
| **Dairy Precision Feeding (PA)** | Definitions and reductions approved by the WQGIT in **2009** | **PA Action Team** |
| **Rotational/Prescribed Grazing (PA)** | Definitions and benefits were reviewed and approved by the Agriculture Workgroup and WQGIT in **2010** | **RESOLVED** |
| **Heavy Use Area Protection-NRCS 561 (PA)** | Loafing Lot Management definitions and reductions approved by the Chesapeake Bay Program's Nutrient Subcommittee in **2003**. | **RESOLVED** |
| **Nutrient Management on Pasture (NY/PA)** | Nutrient Management Practices for use in the Phase 6.0 Chesapeake Bay Program Watershed Model (**2016**) | **RESOLVED** |
| **Commodity Cover Crops (NY/PA)** | Cover Crops Practices for use in Phase 6 of the Chesapeake Bay Watershed Model (**2016**) | **EP Chair discussion with AgWG (Dec 2020)**<br>**Charlie White, Penn State @ AgWG Jan 2021** |
| **Manure Transport / Manure Treatment Technologies (PA)** | • *Manure Treatment Technologies*: Recommendations from the Manure Treatment Technologies Expert Panel to the CBP's WQGIT to define Manure Treatment Technologies as a Best Management Practice (**2016**)<br>• *Manure Transport*: definition and benefits have remained in use **since review and approval by the CBP partnership's source sector workgroups for tributary strategy development**. | **Work with MWG** |


[Protocol for the Development, Review, and Approval of Loading and Effectiveness Estimates for Nutrient and Sediment Controls in the Chesapeake Bay Watershed Model]

# N Application on Soybeans

- **Soybeans** - The nutrient management expert panel did not consider that the Nutrient Management BMP could be applied to full season soybeans' nitrogen load. That should be reevaluated since there is a minimal amount of nitrogen applied to the full season soybean crop.

From Water Quality GIT Presentation to Management Board 7/9/20

# Application Goal Multipliers

| Land Use | Non NM N Multiplier | NM N Multiplier | Non NM P Multiplier | NM P Multiplier |
|---|---|---|---|---|
| **Full Season Soybeans** | **1.2** | **1.0** | 1.5 | 1.0 |
| Grain with Manure | 1.3 | 1.0 | 3 | 1.0 |
| Grain without Manure | 1.2 | 1.0 | 1.5 | 1.0 |
| Legume Hay | 1.2 | 1.0 | 1 | 1.0 |
| Silage with Manure | 1.4 | 1.0 | 3 | 1.0 |
| Silage without Manure | 1.2 | 1.0 | 1.5 | 1.0 |
| Small Grains and Grains | 1.2 | 1.0 | 1.5 | 1.0 |
| Small Grains and Soybeans | 1.2 | 1.0 | 1.5 | 1.0 |
| Specialty Crop High | 1.3 | 1.0 | 2 | 1.0 |
| Specialty Crop Low | 1.2 | 1.0 | 2 | 1.0 |
| Other Agronomic Crops | 1.1 | 1.0 | 1.5 | 1.0 |
| Other Hay | 1 | 1.0 | 1 | 1.0 |
| Pasture | 1 | 1.0 | 1 | 1.0 |

Data provided by Phase 6.0 Nutrient Management Expert Panel

Full Season Soybeans:
40 bu/ac @ 100 ac

Core NM:
40 bu/ac x 0.12 lbs N/bu x 1.0 x 100 ac =
**480 lbs N applied**
40 bu/ac x 0.33 lbs P/bu x 1.0 x 100 ac =
**1,320 lbs P applied**

Non NM:
40 bu/ac x 0.12 lbs N/ac x 1.2 x 100 ac =
**570 lbs N applied**
40 bu/ac x 0.33 lbs P/bu x 1.5 x 100 ac =
**1,980 lbs P applied**

**CRITICAL CONCEPT:**
*Multipliers* are applied to Crop Application Goal

# NM Supplemental Percent Reductions
## (Only after Core NM is applied)

| Land Use | Nutrient Management BMP | | | Nutrient Management BMP | | |
|---|---|---|---|---|---|---|
| | N Rate Supplemental | N Placement Supplemental | N Timing Supplemental | P Rate Supplemental | P Placement Supplemental | P Timing Supplemental |
| Full Season Soybeans | 0% | 0% | 0% | 5% | 10% | 1% |
| Grain w/ Manure | 15% | 5% | 10% | 10% | 20% | 20% |
| Grain w/o Manure | 5% | 3% | 5% | 5% | 10% | 1% |
| Legume Hay | 0% | 0% | 0% | 1% | 10% | 1% |
| Silage w/ Manure | 15% | 5% | 10% | 10% | 20% | 20% |
| Silage w/o Manure | 5% | 3% | 5% | 5% | 10% | 1% |
| Small Grains and Grains | 5% | 3% | 10% | 5% | 10% | 1% |
| Small Grains and Soybeans | 5% | 3% | 10% | 5% | 10% | 1% |
| Specialty Crop High | 15% | 5% | 5% | 5% | 10% | 1% |
| Specialty Crop Low | 5% | 3% | 5% | 5% | 10% | 1% |
| Other Agronomic Crops | 5% | 3% | 5% | 5% | 10% | 1% |
| Other Hay | 0% | 3% | 5% | 0% | 10% | 1% |
| Pasture | 0% | 0% | 0% | 0% | 0% | 0% |

Data provided by Phase 6.0 Nutrient Management Expert Panel

**CRITICAL CONCEPT:**
*Supplemental NM is* applied to Edge of Stream Delivery

# Comments on CAST-19: Soybean nitrogen application (p.2)

- With the increase in full-season soybeans and decrease in double cropped soybeans in CAST-19, the  N application rates were examined. Chris Brosch-DDA, Jill Whitcomb-PA-DEP; James Martin-VA-DEQ

# Comments on CAST-19: Soybean nitrogen application→Response (p.3)

- N applications on soybeans depend on whether the soybeans are full season or double cropped.
- Double-cropped receive 0 N applications.
- Full season have a N crop need of 0.12 lb./bu (5.70 lbs./ac)
  - watershed-wide avg
    - 2.23 inorganic lbs./acre applied
    - 1.35 organic lbs./acre applied
- The University of Maryland, Penn State, and Virginia Tech nutrient management guidelines recommend zero N on full-season or double-cropped soybeans.

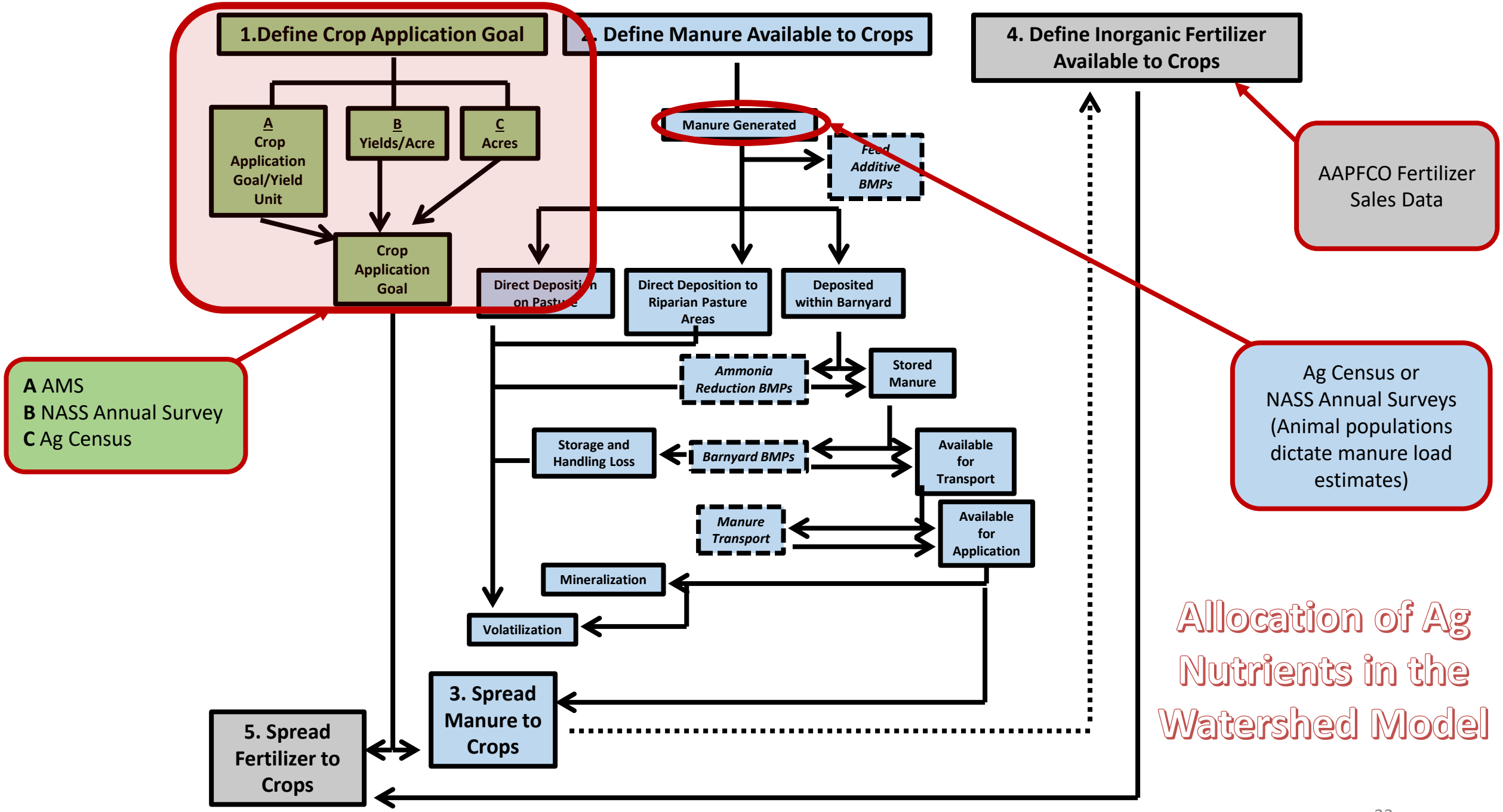
# Comments on CAST-19: Soybean nitrogen application_Resolution (p.3)

- A comparative analysis of changing full-season soybeans to corn and the resulting nitrogen loads was provided to PA-DEP.

- The soybean N application and N fixation assumed for Lancaster County and the average in the rest of PA's watershed were provided to Jill Whitcomb, PA-DEP.

- The CBP will provide to Jill Whitcomb, PA-DEP, and other states the peer reviewed research and other sources that document nutrient runoff/leaching rates from legumes, and how it is applied in the modeling tools (e.g., is it a constant throughout the year or is there a difference in seasonality, is there a difference depending on what crop preceded/followed, etc.) by the May 25, 2020 WQGIT.

- The AgWG will be asked to consider establishing a group to evaluate nutrient management BMPs for nitrogen on full season soybeans. [see Workplan Task 6]






AMS= Agricultural Modeling Subcommittee

# Crop Application Goal on Major Crops

Crop Application Goal

*lbs of N/Year = State-Supplied lbs of N/Application Goal Yield Unit/Year X Yield/Year X 1.1**

| Crop | DoubleCrop | Nutrient | Yield Unit | DE_1 | MD_1 | NY_1 | PA_1 | VA_1 | WV_1 |
|---|---|---|---|---|---|---|---|---|---|
| Alfalfa Hay Harvested Area | N | TN | dry tons | 1 | 1 | 1 | 1 | 1 | 1 |
| Alfalfa Hay Harvested Area | N | TP | dry tons | 5 | 5 | 5 | 6 | 5 | 5 |
| Corn for Grain Harvested Area | N | TN | bushels | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Corn for Grain Harvested Area | N | TP | bushels | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 |
| Corn for Grain Harvested Area | Y | TN | bushels | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Corn for Grain Harvested Area | Y | TP | bushels | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 |
| Wheat for Grain Harvested Area | N | TP | bushels | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 |
| Wheat for Grain Harvested Area | N | TN | bushels | 1.25 | 1.25 | 1 | 1 | 1.25 | 1.25 |
| Wheat for Grain Harvested Area | Y | TP | bushels | 0.465 | 0.465 | 0.465 | 0.465 | 0.465 | 0.465 |
| Wheat for Grain Harvested Area | Y | TN | bushels | 1.25 | 1.25 | 1 | 1 | 1.25 | 1.25 |
| Pastureland and rangeland other than cropland and woodland pastured Area | N | TN | acres | 15 | 15 | 15 | 15 | 15 | 15 |
| Pastureland and rangeland other than cropland and woodland pastured Area | N | TP | acres | 4 | 4 | 4 | 4 | 4 | 4 |
| **Soybeans for beans Harvested Area** | **N** | **TN** | **bushels** | **0.12** | **0.12** | **0.12** | **0.12** | **0.12** | **0.12** |
| **Soybeans for beans Harvested Area** | **N** | **TP** | **bushels** | **0.33** | **0.33** | **0.33** | **0.33** | **0.33** | **0.33** |
| **Soybeans for beans Harvested Area** | **Y** | **TN** | **bushels** | **0** | **0** | **0** | **0** | **0** | **0** |
| **Soybeans for beans Harvested Area** | **Y** | **TP** | **bushels** | **0** | **0** | **0** | **0** | **0** | **0** |

Data provided by states after consultation with nutrient management program staff.

Chesapeake Bay Program Phase 6 Beta 3 Watershed Model Webinar
July 11, 2016

*AMS elected to multiply yearly yield by 1.1 assuming farmers are optimistic, and average yields are often under-estimated.

**CRITICAL CONTEXT:**
"Crop Application Goal" assumes Core NM is in place

Full Season Beans receive
**0.12 lb N/bu**
&
0.33 lb P/bu

Double Crop Beans
**0 lb N/bu**
&
0 lb P/bu

***NM on full season beans is controlling/managing for phosphorus!***

# Concern:

Nutrient management on full-season soybeans?
**YES**: "core NM"
NO: "supplemental NM" for N rate, placement & timing
Why? NM on soybeans is controlling for P…
N application not NM (soybeans don't need N)

*Given the same acreage…*
A shift from double-crop to full-season soybeans can result in an increase in attributed N load (primary driver is N fixation).

*Without supplemental NM for N…*
Jurisdictions stuck with "uncontrollable load."

**CRITICAL CONCEPT:**
N load attributed to soybean acres includes estimated leaching/runoff of residual N based on scientific literature review.

Ag Loading Rate Review Steering Committee
Agricultural Loading Rates

*Model Assumption*

Full Season (under Core NM):
Assume 40 bu/ac @ 100 ac

40 bu/ac x 0.12 lbs N/bu x 1.0 x 100 ac =

**480 lbs N applied**

Double-Crop
Assume 25 bu/ac @ 100 ac

25 bu/ac x 0 lbs N/bu x 1.0 x 100 ac

**0 lbs N applied (on beans)**
**N applied to sm grain**

# Soybean Crop Application Goal

**Full Season Soybeans**

- 0.12 lbs N/bu (~5.7 lbs N/ac)
- CBW Average: (~3.58 lb/N ac)
- UME, Penn State, VT recommend zero N application

**Double Cropped Soybeans**

- Zero N applications
- UME, Penn State, VT recommend zero N application

Assumption: "Nitrogen application is not recommended for soybean production, however, **use of commercially available fertilizer formulations may result in application of up to 50 lb N / acre when fertilizer formulation and application rate is determined by crop P2O5, K2O, S, or other nutrient needs**. Organic waste nitrogen application to full-season soybean is not recommended because it is an agronomically inefficient use of applied nutrients. Organic wastes should only be applied to small grain - double-crop soybean rotations at rates and timings to supply the recommended nitrogen rate to the small grain crop." – UME SFM-1

# Allocation of Ag Nutrients in the Watershed Model

1.Define Crop Application Goal

2. Define Manure Available to Crops

4. Define Inorganic Fertilizer Available to Crops

A Crop Application Goal/Yield Unit

B Yields/Acre

C Acres

Crop Application Goal

Manure Generated

*Feed Additive BMPs*

Direct Deposition on Pasture

Direct Deposition to Riparian Pasture Areas

Deposited within Barnyard

*Ammonia Reduction BMPs*

Stored Manure

Storage and Handling Loss

*Barnyard BMPs*

Available for Transport

*Manure Transport*

Available for Application

Mineralization

Volatilization

3. Spread Manure to Crops

5. Spread Fertilizer to Crops

AAPFCO Fertilizer Sales Data

Ag Census or NASS Annual Surveys (Animal populations dictate manure load estimates)

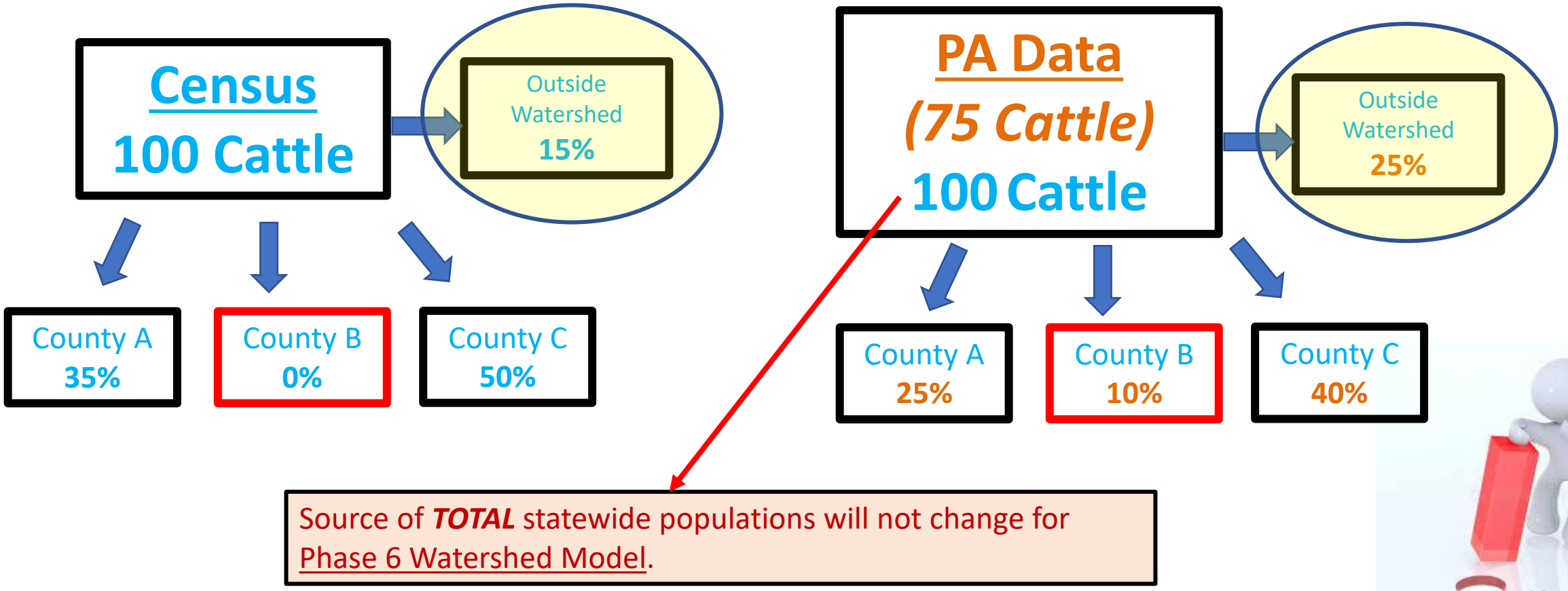
**A** AMS
**B** NASS Annual Survey
**C** Ag Census

AMS= Agricultural Modeling Subcommittee

CRITICAL CONCEPT

# Source for ***distribution*** of statewide populations can change.

Example: Pennsylvania provides fraction of cattle in every county for the year 2019, and these fractions are used to distribute TOTAL statewide cattle populations from the Census of Agriculture.




Source of ***TOTAL*** statewide populations will not change for Phase 6 Watershed Model.