AgWG Ad Hoc CAST Issues

January 21, 2021

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 • 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 • Return Feb/March 2021 for decision
Task 3: Investigate 2012-2017 Ag Census change for fallow/idle acres TODAY	• AgWG Sept 17; NASS consulted; no new information; No further action; TASK COMPLETED? decision Jan AgWG
Task 4: Investigate use of latest landcover & LiDAR imagery to better define changes in total ag (& other land use) acres TODAY	• Oct 15 AgWG: P. Claggett, USGS & J. Czawlytko, Chesapeake Conservancy; seeking feedback Jan AgWG; Feb 2021 for decision
Task 5: Investigate alternatives for double-crop acre estimates	• Oct 15 AgWG; NASS consulted- no new information; No further action; TASK COMPLETED? Decision Feb AgWG
Task 6: Consider supplemental NM for soybeans	• In process • Dec Ad Hoc; Jan Ad Hoc; Feb Ad Hoc
Task 7: QA/QC'd historic & current layer pop. data for Hillandale Farms (PA)	• In process • Feb Ad Hoc- general discussion
Task 8: Build-in Verification Ad Hoc Team products	• In process

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

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

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

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)

~~Heavy Use Area Protection- NRCS 561 (NY?)~~

BMP Effectiveness/Modeling

Winter Crop (NY/PA)

Manure Transport / Manure Treatment Technologies (PA)

Animal Data

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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:

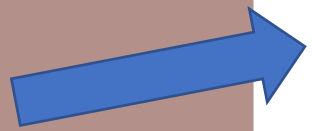
- Provide data all the way back through 1985.

  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

- Feb Ad Hoc:
  - Hillandale (Task 8) Discussion
  - Updates NM on Soybeans
- Feb AgWG:
  - Decision Landcover/ LiDAR Data (Task 4)
  - Decision Double Crop methods (Task 5)
- March AgWG
  - Decision Forecasting Ag Trends (Task 2)

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)** **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**) • *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]

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.

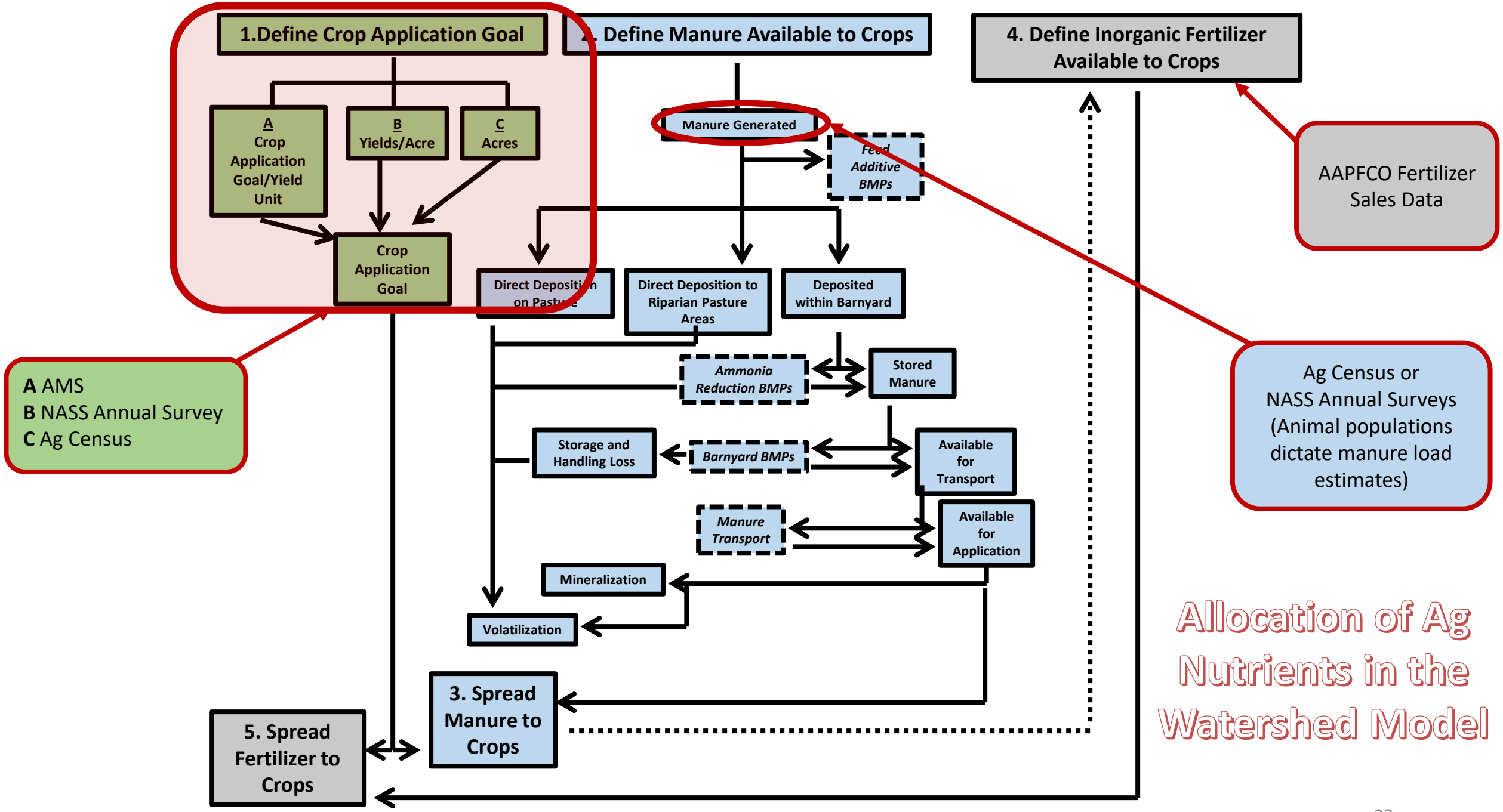
Comments on CAST-19: Soybean nitrogen application_Resolution (p.3)

- 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

Additional Concerns- MD

Animal Populations: explore other estimating options

- ❑Improve livestock (dairy, equine, beef) population estimates
  - ❑Reduction goals for some counties unattainable due to inaccurate population assumptions (i.e. poultry mortality, waste management).

Crop Production Acres: improve annual estimates

- ❑MD's Nutrient Management Annual Implementation Report (AIR)
- ❑other means (USDA-FSA crop reporting)

Fertilizer sales and use data

- ❑Better understanding via state chemist

Additional Concerns- NY

Animal Populations: explore other estimating options

- ❑Over-estimation for counties partially within the watershed

Cover Crops:

- ❑Additional category Commodity Cover Crops with Manure (not inorganic fertilizer).
  - ❑Encourage/credit cover cropping in forage-based dairy cropping systems

Nutrient Management on Pasture:

- ❑Credit options and/or inorganic fertilizer rates

Additional Concerns - PA

Dairy Precision Feeding:

- ❑ Revisit the criteria for measurement of implementation

Rotational/Prescribed Grazing:

- ❑ Revisit the criteria for determining implementation

Cover Crops:

- ❑ Revisit the criteria for crediting commodity cover crop (harvested, nutrients applied)

Manure Transport / Manure Treatment Technologies:

- ❑ Revisit the requirement to apply NM to offset an assumed “backfill” of inorganic application
  - ❑ Assumption does not adequately reflect current practice

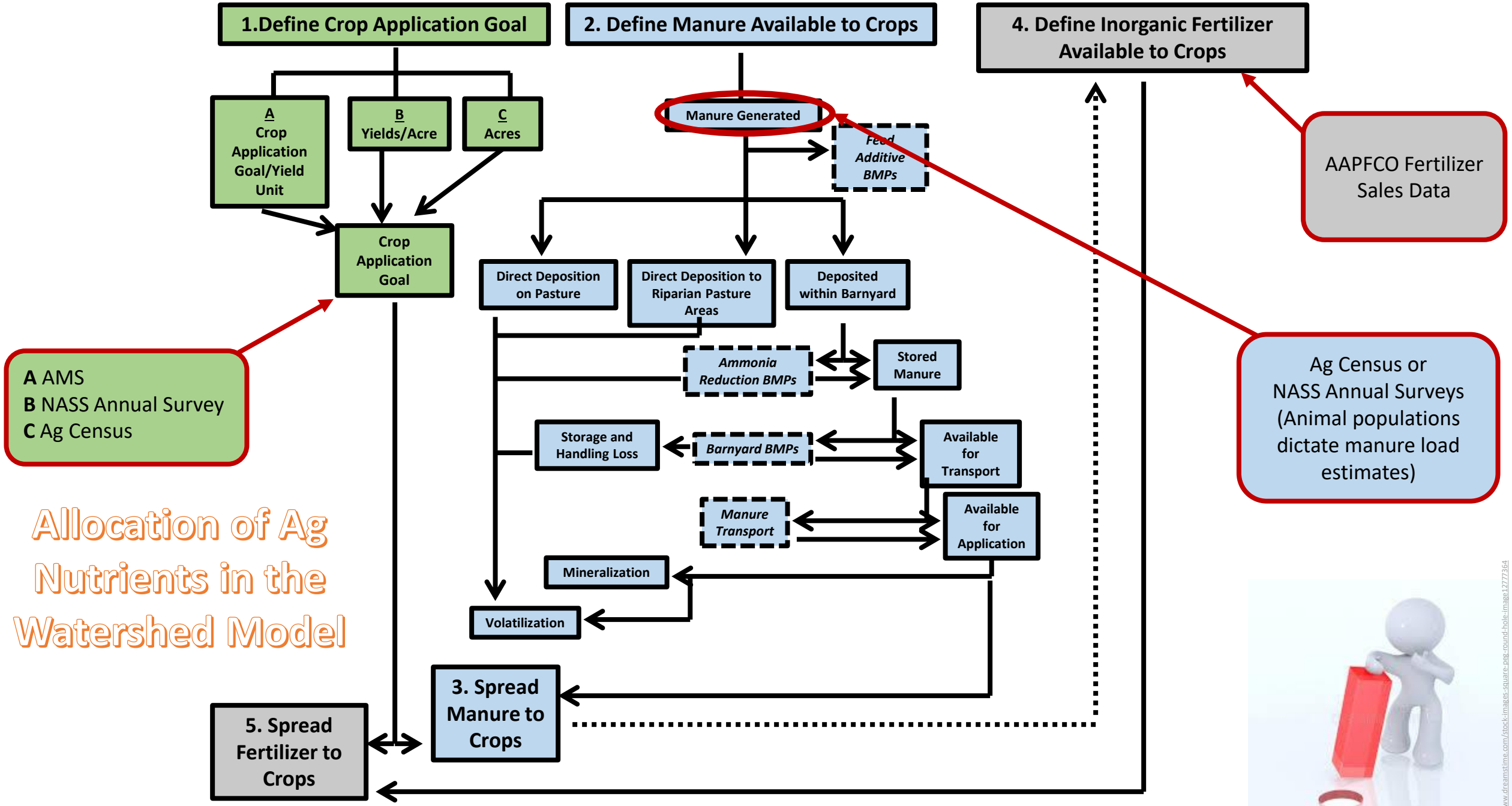
Heavy Use Area Protection (NRCS 561):

- ❑ HUAP is not currently credited
- ❑ HUAP should be synonymous to Loafing Lot Management BMP

Nutrient Management on Pasture:

- ❑ Crediting NM on pasture/non-cropland acres

Allocation of Ag Nutrients in the Watershed Model

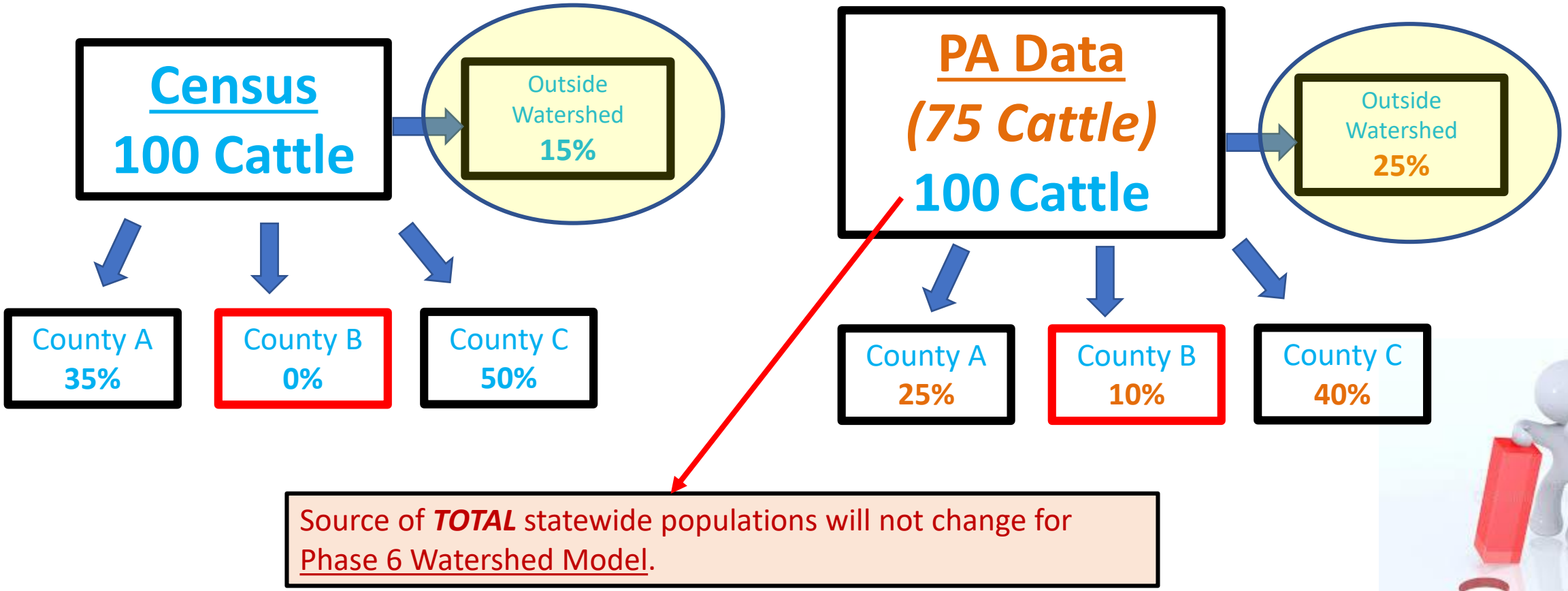


AMS= Agricultural Modeling Subcommittee

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.