Agriculture Workgroup Meeting
May 17, 2018

Poultry Industry Data Collection
## For the Phase 6.0 Watershed Model

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Looking Back – Phase 5 Models
Defining Poultry Populations and Nutrient Generation

Current Method to Model Poultry Populations within the Watershed

- Based on the 5 year Ag Census data.

- Most recent census in 2007.

- For 2007, the population, P, is the census number.

- Apply an escalation factor, f, to estimate subsequent years.

- $P(i+1) = f * P(i)$, where

    $f \sim 1.01$

Delaware-Chickens
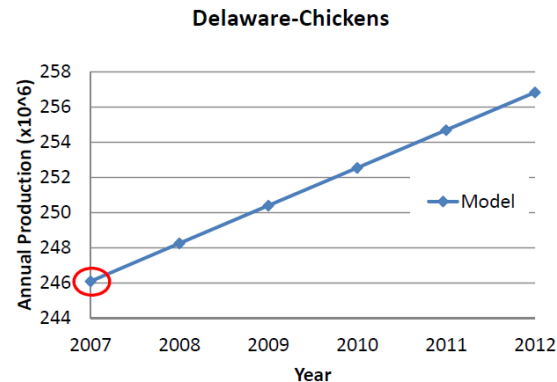
Potential Data Sources for Population Estimates
(Birds per year)

Delaware

| Year	Census	NASS Placements*	NASS Production	NASS Slaughter
2012	?	215,987,000	Not Yet	309,147,000
2011	?	223,589,000	217,800,000	302,305,000
2010	?	243,035,000	235,000,000	304,471,000
2009	?	243,572,000	231,700,000	296,595,000
2008	?	245,505,000	242,900,000	304,657,000
2007	246,098,878	257,973,000	245,800,000	306,875,000

* Includes an early mortality factor
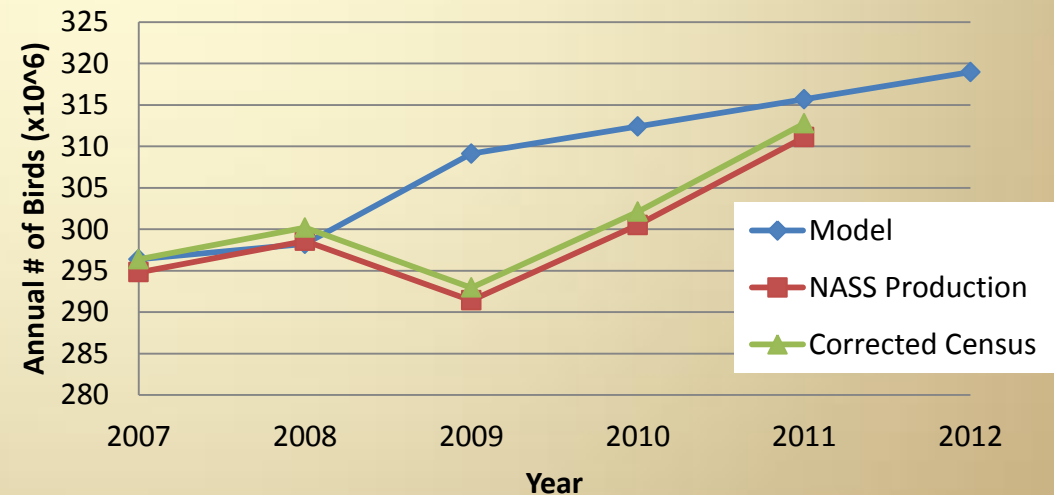
- NASS has recommended using the *Production* data.

Looking Back – Phase 5 Models
Defining Poultry Populations and Nutrient Generation

Delaware-Chickens
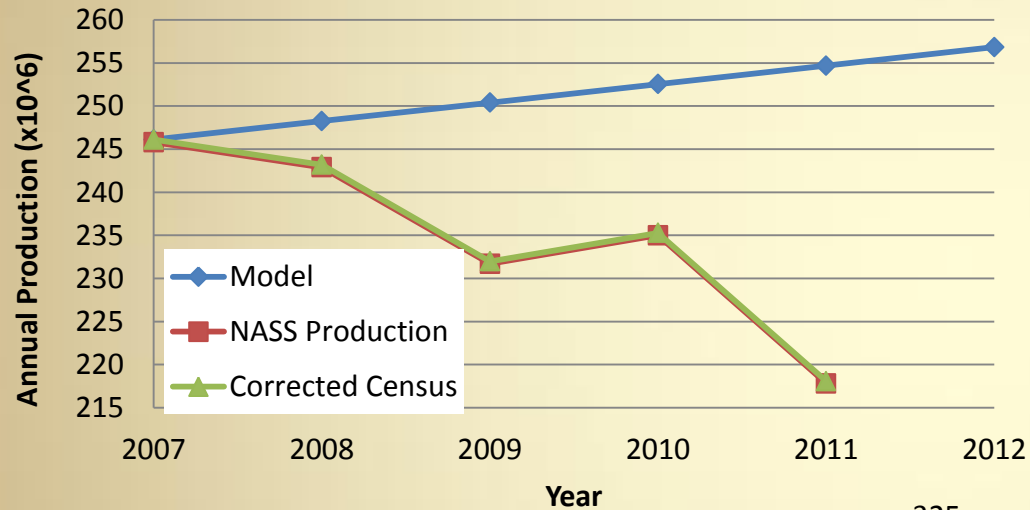
Maryland-Chickens

Looking Back – Phase 5 Models
Defining Poultry Populations and Nutrient Generation

Turkeys, Farms and numbers sold				
	2007 NASS Population	Assuming 1%per year growth	2012 NASS Population	Difference
	Birds	Birds	Birds	Birds
Maryland	739,398	777,114	154,404	622,710 Additional
Pennsylvania	10,927,070	11,484,460	8,507,490	2,976,970 Additional
Virginia	18,434,065	19,374,387	18,223,608	1,150,779 Additional
West Virginia	3,690,527	3,878,780	4,889,115	1,010,335 Fewer
Total	33,791,060	35,514,741	31,774,617	3,740,124 Additional

Manure Generation = 18,000 lbs./ 1000 bird x 3,740,124/1000 = 67,322,232 lbs. or 33,661 tons

Over-estimated Nutrients:

Total Nitrogen: 72.2 lbs./ton x 33,661 tons = 2,430, 332 tons

P2O5: 60.6 lbs./ton x 33,661 tons = 2,039,863 tons

Looking Back – Phase 5 Models
Defining Poultry Populations and Nutrient Generation

- **2011 - Agriculture Workgroup (AgWG) Determined Need for Poultry Litter Subcommittee (PLS) to review poultry nutrient generation modeling assumptions in Phase 5.3.2 Watershed Model**

  - **Charged PLS with:**

    - **Collect data that better reflects modern N and P concentrations**

    - **Develop poultry litter generation quantities for each species**

    - **Develop alternate methods to estimate poultry population numbers across the watershed**

    - **"The PLS recommends a new approach for modeling nutrient generation from poultry based on state-specific litter data, rather than litter estimates taken from the 2003 ASABE Standard"**

Looking Back – Phase 5 Models
Defining Poultry Populations and Nutrient Generation

PLS Panel Membership -

Panelist	Jurisdiction	Affiliation
Jim Glancey	Delaware	University of Delaware (Panel Chair)
Mark Davis	Delaware	Delaware Department of Agriculture
Tom Basden	West Virginia	West Virginia University
Bill Brown	Delaware	University of Delaware
Mark Dubin	Maryland	University of Maryland (Panel Coordinator)
Glenn Carpenter	USDA	USDA-NRCS
Frank Coale	Maryland	University of Maryland
Jason Dalrymple	West Virginia	West Virginia Department of Agriculture
Doug Goodlander	Pennsylvania	Pennsylvania Department of Environmental Protection
Bobby Long	Virginia	Virginia Department of Conservation and Recreation
Jennifer Nelson	Maryland	USDA-NRCS (former)
Jerry Ours	West Virginia	West Virginia Department of Agriculture
Paul Patterson	Pennsylvania	Penn State
Jim Pease	Virginia	Virginia Tech
Royden Powell	Maryland	Maryland Department of Agriculture
Tim Sexton	Virginia	Virginia Department of Conservation and Recreation
Kelly Shenk	EPA	EPA Region III
Trish Steinhilber	Maryland	University of Maryland
Jennifer Timmons	Maryland	University of Maryland
Jennifer Weld	Pennsylvania	Penn State
Hank Zygmunt	Pennsylvania	Resource Dynamics
Jon Moyle	Maryland	University of Maryland
John Rhoderick	Maryland	Maryland Department of Agriculture

Looking Back – Phase 5 Models
Defining Poultry Populations and Nutrient Generation

- **Agriculture Workgroup's Poultry Litter Subcommittee (PLS)**

  "Nitrogen and Phosphorus concentration based on 2003 ASAE
  Standard - Values based on studies performed from late 1980's to early 1990's"

Case Study: Sussex County, Delaware

	EPA/ASAE Approach	units
Bird Inventory	43,620,576	#of birds on any given day (2007 Census)
Animal Unit Definition	455	#of birds per 1000 lbs of animal mass
Total Animal Unit Inventory	95,869	animal units on any given day
Manure Production	85	lbs of manure per animal unit per day
Total Manure Produced	1,487,174	tons wet excretion per year
Nitrogen Concentration	0.0129	lbs TKN per lb of manure
Phosphorous Concentration	0.0035	lbs Total P per lb of manure
Total Nitrogen Produced	38,491,563	lbs Total N per year
Total Nitrogen Not Volatized	35,332,221	lbs Total N per year
Total Phosphorous Produced	10,497,699	lbs Total P per year
Total Phosphorous Produced with 16% phytase credit	8,818,067	lbs Total P per year

	UD/DDA/UMD Approach	units
No of Birds	43,620,576	#of birds
No of Flocks per Year	4.8	flock per year
Total Number of Birds Produced	209,378,765	birds per year
Manure Production	1.25	tons per 1000 birds
Total Manure Produced	261,723	tons per year
Nitrogen Concentration	56.80	lbs Total N per ton
Phosphorous Concentration	19.50	lbs Total P per ton
Total Nitrogen Produced	14,839,720	lbs Total N per year
Total Phosphorous Produced	5,103,607	lbs Total P per year

Potential Nutrient overestimation (Sussex County Delaware)

20,000,000 lbs. Nitrogen

3,700,000 lbs. of Phosphorus

Looking Back – Phase 6 Model
Defining Poultry Populations and Nutrient Generation

- **PLS – Agricultural Modeling Subcommittee (AMS) Recommendations for Future Data Submissions**

  - "On a semi-regular basis (perhaps at the beginning of each Milestone period - 2 years - or more or less frequently) estimates for poultry litter nutrient production should be updated in the Watershed Model to represent how values have changed since the calibration of the new model

  - Reported values should be

    - mass of litter produced;

    - litter dry solids content;

    - litter nutrient concentrations."

Looking Back – Phase 6 Model
Defining Poultry Populations and Nutrient Generation

- **PLS - AMS Recommendations for Future Data Submissions**

  - **"Where possible, future data collection efforts should also focus on the correlation of these key parameters at the <u>farm level</u>, to quantify the effects and extent of various litter management scenarios**

  - **A dataset for broilers, for example, might include for each record**

    - **the volume of litter removed (including total cleanout & removal of crust between flocks) in a cleanout period,**

    - **the number of flocks and number of birds produced during that cleanout period and their finish weight,**

    - **and a manure analyses showing the N, P and moisture content of that litter**

  "This would allow the states to determine the amount of N and P produced per bird on a farm level, which can then be aggregated into an average."

Looking Back – Phase 6 Model
Defining Poultry Populations and Nutrient Generation

- **PLS - AMS Recommendations for Future Data Submissions**

"The AMS recommends that raw sample data for each parameter be submitted to the Bay Program using standardized templates.

This would allow the Partnership to conduct more thorough statistical analyses of the data which in turn would result in better litter estimates for the modeling tools.

Ultimately, the Partnership will need to determine both the method and frequency of collecting and updating these values."

Looking Back – Phase 6 Model
Defining Poultry Populations and Nutrient Generation

Estimating Turkey Populations and Nutrient Generation

Why?

- **More birds processed than grown in Virginia, so annual NASS data not fully reliable. Birds processed in Virginia originate from PA, VA, WV, NC, TN.**

- **Ag Census data only gets ~ 23% return on producer mailings. Does not properly estimate production numbers or distribution.**

- **ASABE as excreted nutrient values combined with other sources of production data resulted in poor estimates of litter nutrients generated.**

- **Phase 5.3.2 CBWM did not accurately reflect Phosphorus reductions over time.**

- **House litter management practices widely variable amongst producers.**

- **Production categories of total turkey population was unknown.**

Looking Back – Phase 6 Model
Defining Poultry Populations and Nutrient Generation

Estimating Turkey Populations and Nutrient Generation

Established Protocol as per PLS - AMS recommendations

- VT worked with Integrators to obtain as much production information as possible to identify growers, and confirm information obtained from growers (QA/QC).

- VA Staff assisted VT interns in contacting growers to interview. VT Interns obtained litter analysis history from VA data base, and obtained new samples and litter analysis.

- VT Interns had pre-determined questions to ask growers. Specific records to check and data to collect.

- VT Interns followed standard operating procedures (SOP) in collecting litter samples for analysis, e.g. ASTM protocols, bio-security

Looking Back – Phase 6 Model
Defining Poultry Populations and Nutrient Generation

Estimating Turkey Populations and Nutrient Generation

Established Process as per VT Institutional Review Board (IRB) scientific requirements

- Data collected on standard forms transferred to spread sheets daily. Collected data checked for data entry errors weekly or more frequently if needed (QA/QC).

- Sampling protocols and biosecurity procedures monitored closely.

- Collected information minus grower personal info (identifier number), sent to PI(s) weekly.

- Samples split between laboratories when requested to determine laboratory consistency (QA/QC). Splitting method follows ASTM procedures.

- Regular meetings and conference calls with coordinator, interns and PI on progress and things learned, issues, etc.
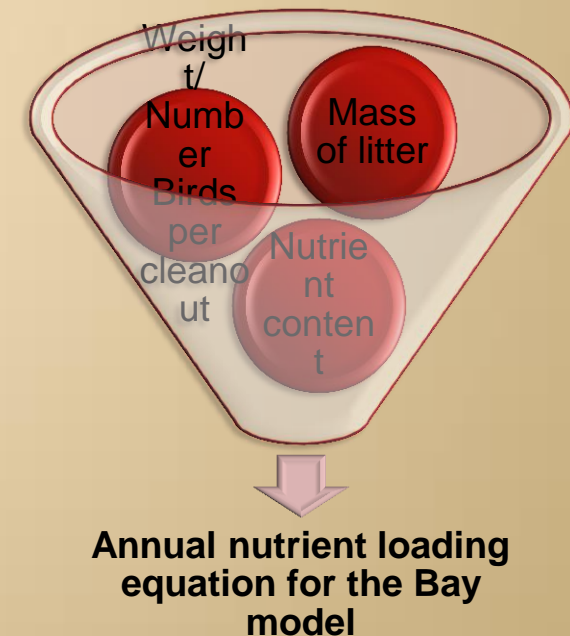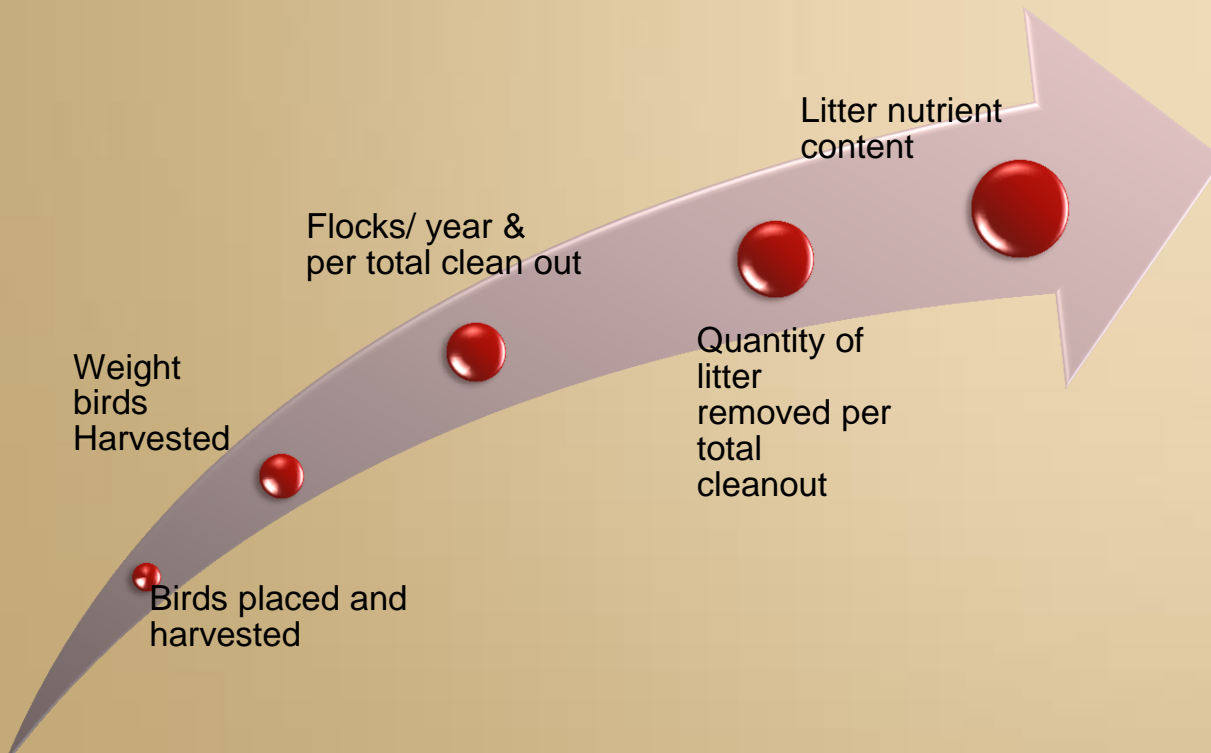
Looking Back – Phase 6 Model
Defining Poultry Populations and Nutrient Generation

Turkey Data Gathering and Management Process

- Identified production and bird types
- Collected farm level & historical nutrient data
- Processed & analyzed data (statistics)

Estimate litter generation rate and nutrient content by production and bird type

Litter nutrient content

Flocks/ year & per total clean out

Weight birds Harvested

Quantity of litter removed per total cleanout

Birds placed and harvested

Weight/ Number Birds per cleanout

Mass of litter

Nutrient content

Annual nutrient loading equation for the Bay model

Looking Back – Phase 6 Model
Defining Poultry Populations and Nutrient Generation

Production and Bird Types	Litter generated per bird	Litter generated per lb. of bird
1 Stage Hen	8.45 ± 3.85 [A,B]	0.52 ± 0.24 [A,B]
2 Stage Hen	10.99 ± 4.75 [A,B]	0.68 ± 0.30 [A]
2 Stage Heavy Hen	7.39 ± 2.45 [B]	0.35 ± 0.14 [B,C]
Finisher Heavy Hen	8.95 ± 3.32 [A,B]	0.38 ± 0.14 [B,C]
1 Stage Heavy Tom	9.65 ± 2.16 [A,B]	0.24± 0.05 [C]
2 Stage Heavy Tom	11.73 ± 7.45 [A,B]	0.29 ± 0.18 [C]
Finisher Heavy Tom	12.82 ± 5.80 [A]	0.31 ± 0.14 [C]
Brooder/Poult	-	-
Breeder	-	-

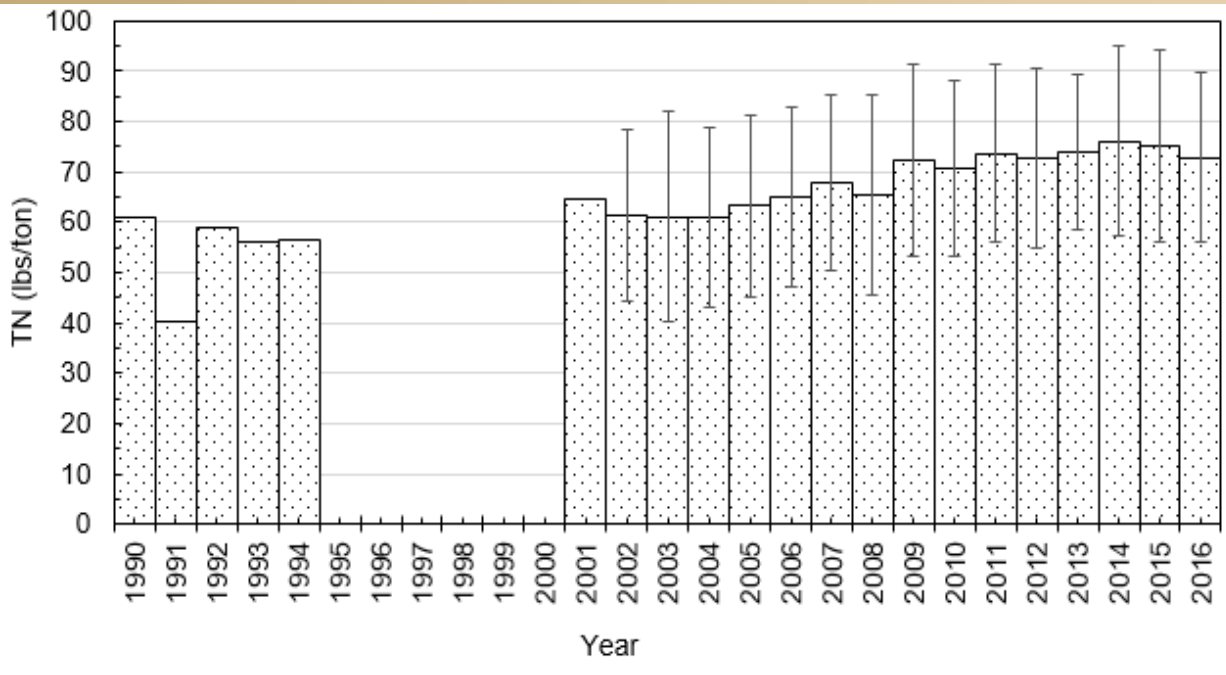**Turkey Litter Generation Rates**

Litter generation rates per bird are about 48 to 77 % less than ASABE 2005 tabulated values.
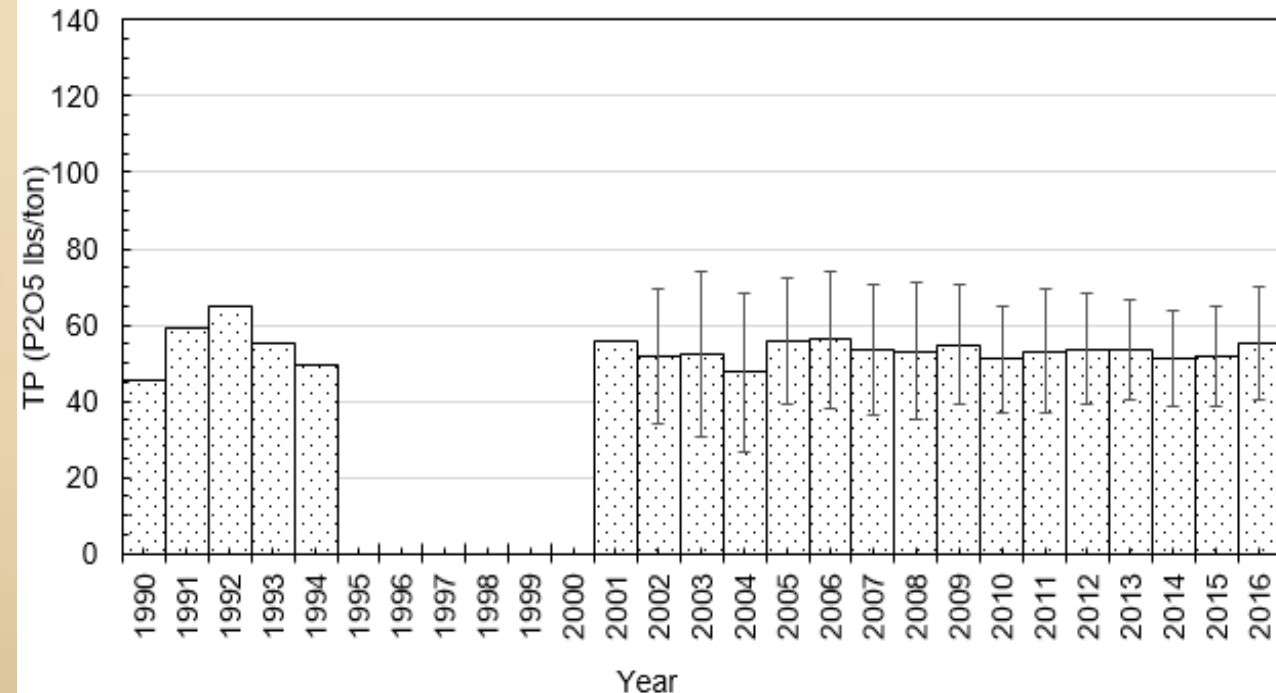
Total nitrogen and phosphorus concentrations in turkey litter 1990 to 2016.

Since 2000:

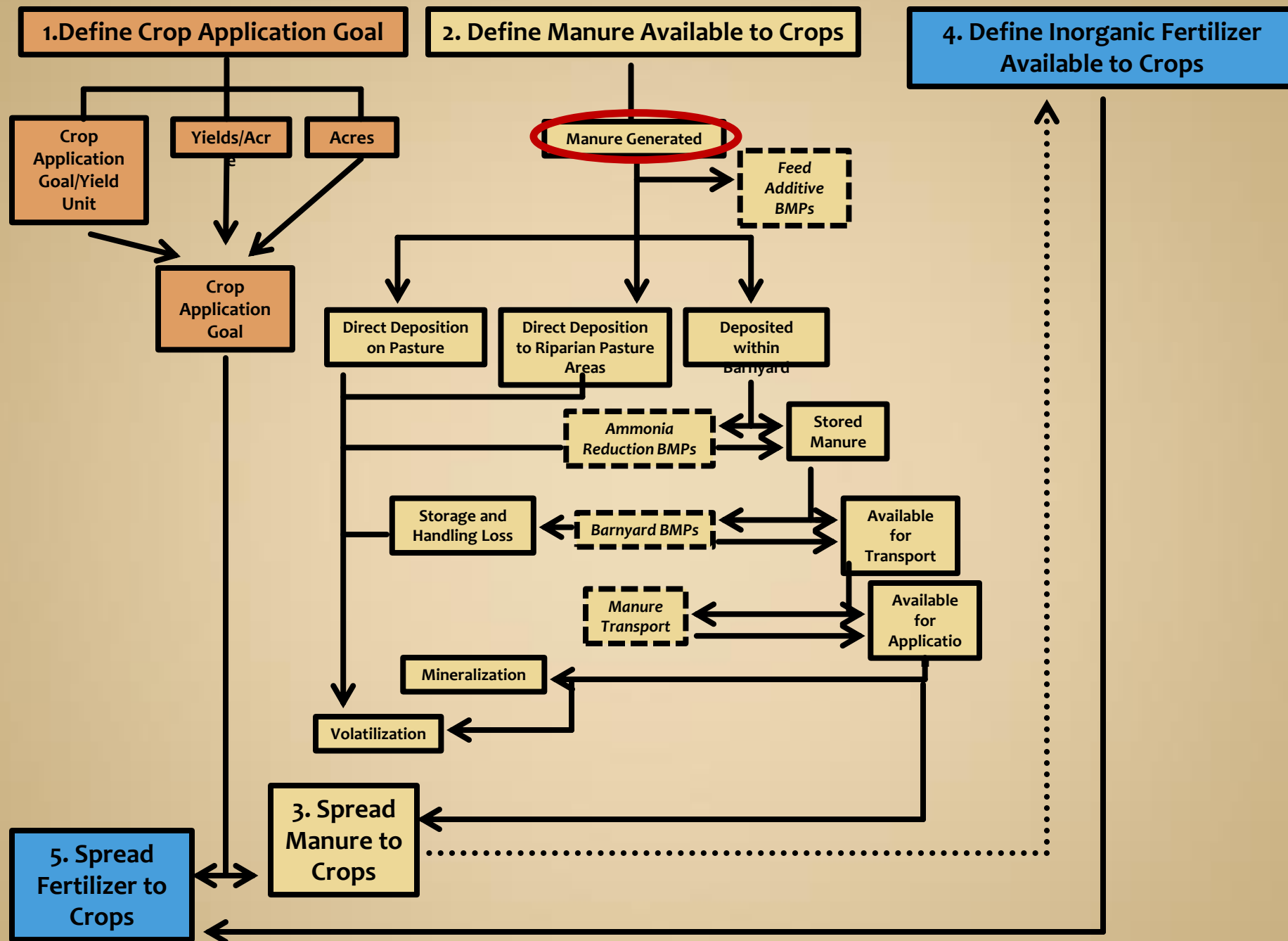- **TAN:TN is 0.21**

- **TN:TP is 1.37 (P is expressed as P2O5)**

Looking Back
Defining Poultry Populations and Nutrient Generation

Turkey litter generation and TN and TP concentrations for calculating annual nutrient loading.

Production and Bird Type	LGB (lbs/bird)	TN (lbs/ton)	TP (lbs/ton)
1SH	9.05	74.64	59.19
2SH	9.05	82.57	66.29
2SHH	9.05	82.57	69.36
FHH	9.05	74.64	66.29
1SHT	11.67	89.09	79.26
2SHT	11.67	82.57	69.36
FHT	11.67	82.57	59.19
BRE	tbd	63.91	79.26
B/P	tbd	63.91	41.62

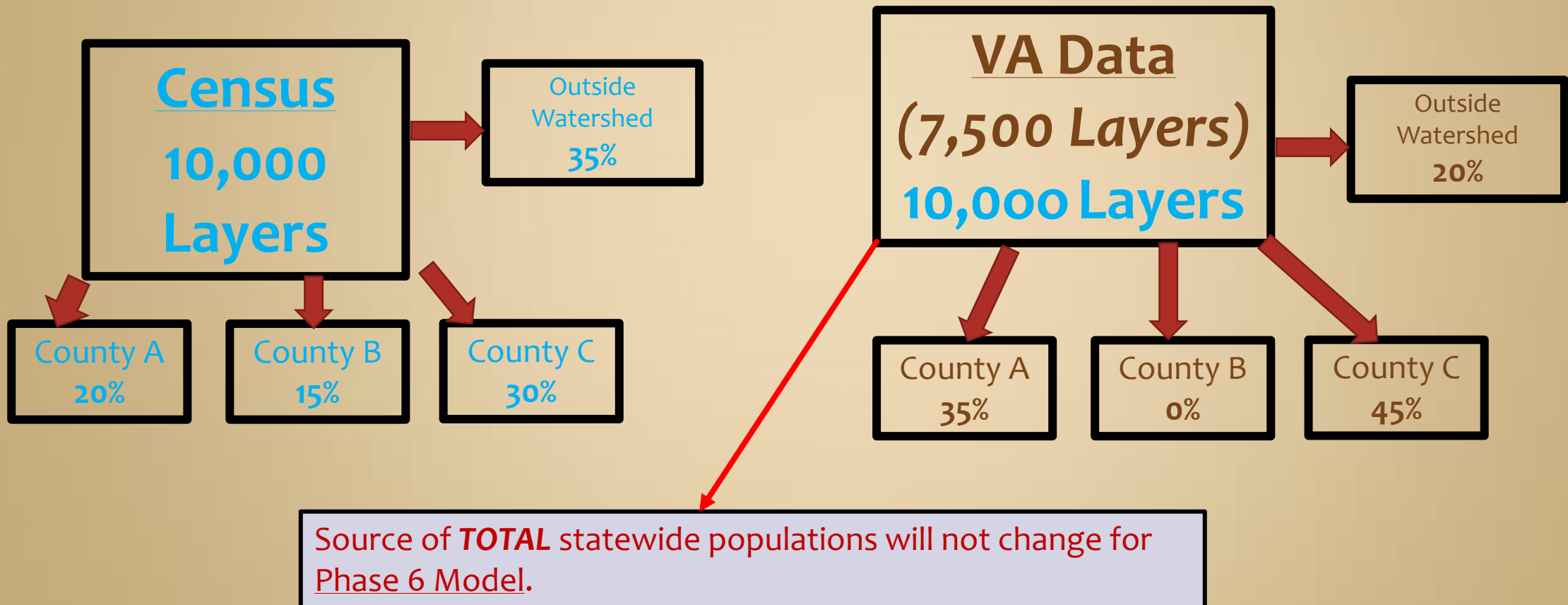# Manure Generation – Phase 6 Model Animal Populations

Animal Type	Population Source
Swine	Census of Agriculture (Inventory and Sales)
Layers and Pullets	Census of Agriculture (Inventory and Sales)
Broilers and Turkeys	NASS Annual Poultry Production Survey
All Other Livestock	Census of Agriculture (Inventory)

Distribution of TOTAL statewide populations down to counties, regardless of population source, based upon Census of Agriculture distribution to counties*

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

- Source for ***distribution*** of statewide populations can change.
  - Example: Virginia provides fraction of layers in every county for the year 2019, and these fractions are used to distribute TOTAL statewide layer populations from the Census of Agriculture.

Source for *distribution* of statewide populations can change.

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

Census 10,000 Layers

Outside Watershed 35%

County A 20%

County B 15%

County C 30%

VA Data (7,500 Layers) 10,000 Layers

Outside Watershed 20%

County A 35%

County B 0%

County C 45%

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

Manure Generation – Nutrient Concentration

Data Currently Used in the Phase 6.0 Model

Animal TypeZ	Manure Source	Lbs Dry Manure/Animal/Yr	Lbs TN/Lb Dry Manure	LbsTP/Lb Dry Manure
Beef	Use Beef - Cow (confinement) from ASAE 2005 for manure values	5,475.00	0.028788	0.006467
Dairy	Use Lactating Cow, Dry Cow and Heifer from ASAE 2005 for manure values	4,404.33	0.042221	0.006764
Other Cattle	Estimated based upon weighted average combination of Beef and Dairy from Census of Agriculture	1,605.07	0.035504	0.006616
Horses	Use average of Horse- Sedentary and Horse - Intense Exercise from ASAE 2005 for manure values	3,102.50	0.031672	0.005941
Hogs for Breeding	Swine Characterization Report;	220.62	.294653	Varies
Hogs for Slaughter	Swine Characterization Report;	97.09	0.106841	Varies
Sheep and Lambs	Use ASAE 2003 for manure values	240.9	0.038182	0.007909
Goats	Use ASAE 2003 for manure values	680.91	0.034615	0.008462
Pullets	PLS Report; See Appendix A	12.95	Varies	Varies
Layers	PLS Report; See Appendix A	17.89	Varies	Varies
Broilers	PLS Report; See Appendix A	Varies	Varies	Varies
Turkeys	Turkey Characterization Report;	7.62	Varies	Varies

3-year trends (up or down) can be applied to existing values in this table.

(requires 3 consecutive years of data)

Data must be collected in a similar fashion as was done for:
- Poultry Litter Subcommittee report
- Swine Characterization Study
- Turkey Characterization Study

Looking Ahead – Phase 6 Model
Poultry Industry Data Collection

Proposed future project would follow the recommendations of the PLS - AMS

- Data collected on a "semi-regular basis."

- Data collected at the farm level.

- Population collected at the county level as required by the model.

- Data collected on farm will correlate litter nutrient concentration to bird size and various litter management scenarios.

- Data collection effort has the ability to fill data gaps for pullets, layers & turkeys.

- Data collection effort will provide latest market trends of the industry.

Looking Ahead – Phase 6 Model
Poultry Industry Data Collection

Project would follow the recommendations of the PLS - AMS

- Data will allow states to determine amount of N & P produced per bird on a farm level.

- Data will provide states with the ability to directly estimate litter nutrient generation rather than project future values from past production data

- Data collection has verified QA/QC protocol.

- Data will be protected from FOIA requests.

- Provides additional opportunity to collect data on Best Management Practices

- Integrators have signaled their willingness to participate.

- Industry has committed significant monetary capitol to assist with funding.

- Reinforces industry's commitment to identify and implement solutions.

Timeline for 2020 Updates to Phase 6 Model

April 30, 2019

Deadline for Submitting Data for Ag Workgroup Consideration

May 1-July 31, 2019

Review Process Begins

- CBPO will collect and analyze data, and/or characterization studies

August 2019

Review Process Concludes

- Ag Workgroup reviews findings and recommends changes if needed

October 2019

CBPO will release **revised agricultural model data**

- Planned Revisions:
  - Fertilizer sales post-2012
  - 2017 Census of Agriculture
  - Annual NASS crop yields for major crops
  - Annual NASS population for turkeys and broilers
- *Potential* Revisions (reliant on relevant data collection and submission)
  - Populations: County-specific percent population for any livestock (e.g., 80% of DE broilers in 2019 are in Sussex County)
  - Nutrient Generation and Concentrations: 3 year + trends (up or down) for any livestock. Analysis must follow Poultry Litter Subcommittee Report format

Timeline for Updates into the future

Next Opportunity to Submit Additional Data – 2021

- **3 years would be required - (2018 – 2021)**

- **Would historical records exist?**
  - **On-farm Population (county level.)**
  - **Farm production information.**
    - **Manure management techniques.**
    - **Manure generation data.**
    - **Manure nutrient concentration data.**

- **Would the Poultry Companies be willing?**

Questions?