Agriculture Census Projections

Chesapeake Bay Watershed

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Background

- CAST-19 : 2017 Agricultural Census data incorporated into the land use, and animal numbers.
- Under/Over projecting few crop categories. one example is Full season soybeans
- CAST-21 : Investigate alternatives to the current methods for forecasting agricultural land uses and animals and propose options for Partnership consideration.
- Current schedule calls for all updates to CAST-21 to be finalized Sept 2021 and changes to projection methods are requested by March 2021

Historical Data

- Projections use data recommended by Ag Modeling for Phase 6 Watershed Model (CAST) and approved through Agriculture Workgroup, Water Quality GIT, etc.
- 1982 through 2012 NASS Ag Census information
  - 2017 with 4 projections methods.
  - 2017 Ag Census data

- For crops, projections are by Land use at the county scale. Land use categories are then proportioned to individual Crop types according to latest Census of Agriculture.
- For broilers, turkeys, pullets, and hogs, use annual Census production numbers by state. State numbers are then proportioned to individual counties according to latest Census of Agriculture
- All other animals, use 5-year Census inventory numbers by County

Projection Methods

- Linear regression: Linear trend forecasting is used to impose a line of best fit to time series historical data.
- Linear regression + Applying the trend to recent census year.
- Double exponential smoothing(Alpha=0.8 beta=0.2). This is current algorithm we use in CAST 19

$$Ft = a^* At\text{-}1 + (1- a) * (Ft\text{-}1 + Tt\text{-}1)$$

$$Tt = b^* (At\text{-}1\text{-}Ft\text{-}1) + (1- b) * Tt\text{-}1$$

$$AFt = Ft + Tt$$

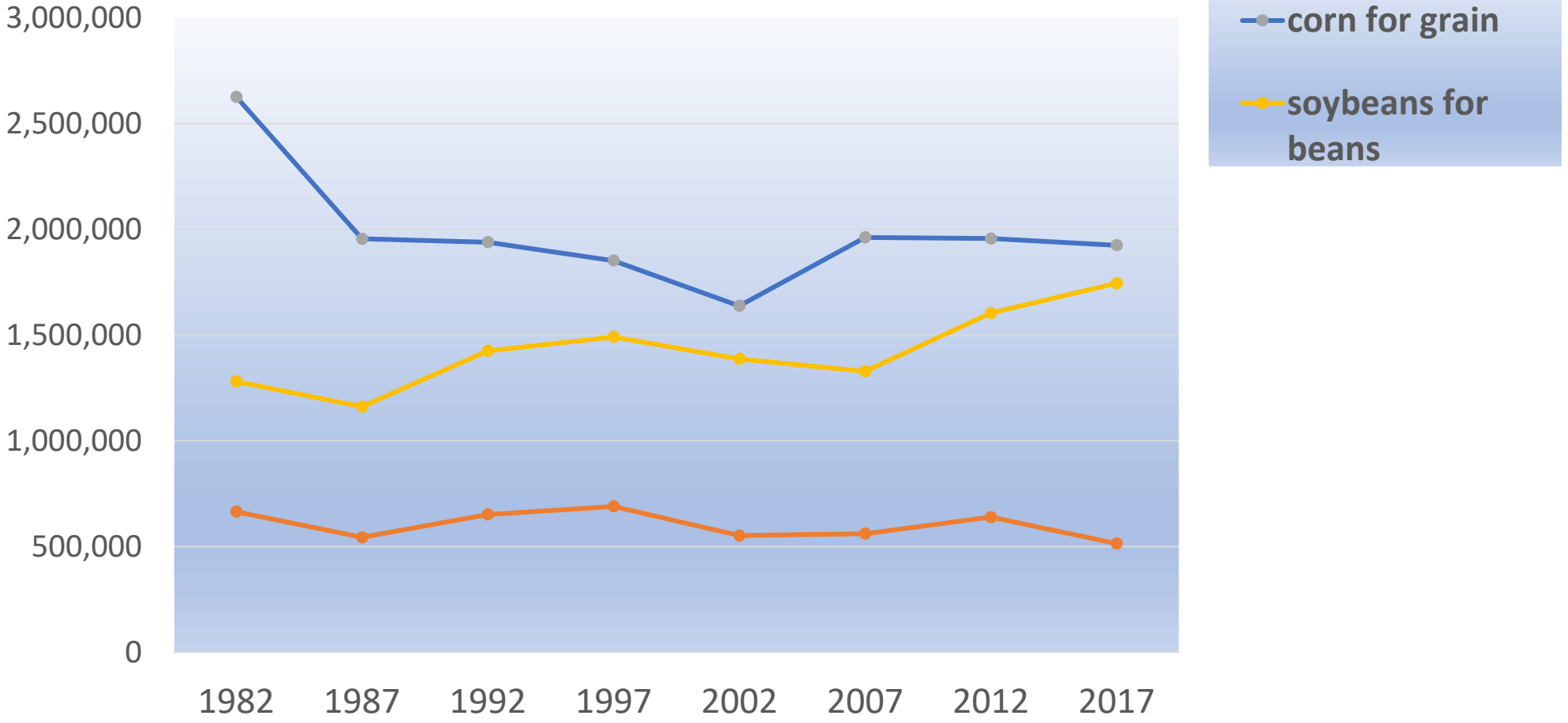
- At = Actual county value as reported by Ag Census
- Ft = Unadjusted forecast (before trend)
- Tt = Estimated trend
- AFt = Trend-adjusted forecast
- *a*= Alpha value is the weight placed upon the most recent Ag Census value
- *b*= Beta value is the weight placed upon the long-term trend in Ag Census values

- Double exponential smoothing (Alpha=0.9 and beta=0.1). Gives even more weightage to recent census years.

Methodology

- Animal and Crop data at available geographic scale from 1982-2012 are projected to 2017 using 4 different projection methods mentioned above and compared with 2017 Ag census information from NASS.
- A Rank for each Crop/Animal category for each method at a Bay Wide(can drill down to State or County) scale is determined based on absolute % difference from the real 2017 Ag Census data.
- Method with least Rank is considered the best among four available to predict 2017 based on the History available.
- This result will be used for projecting data beyond 2017.

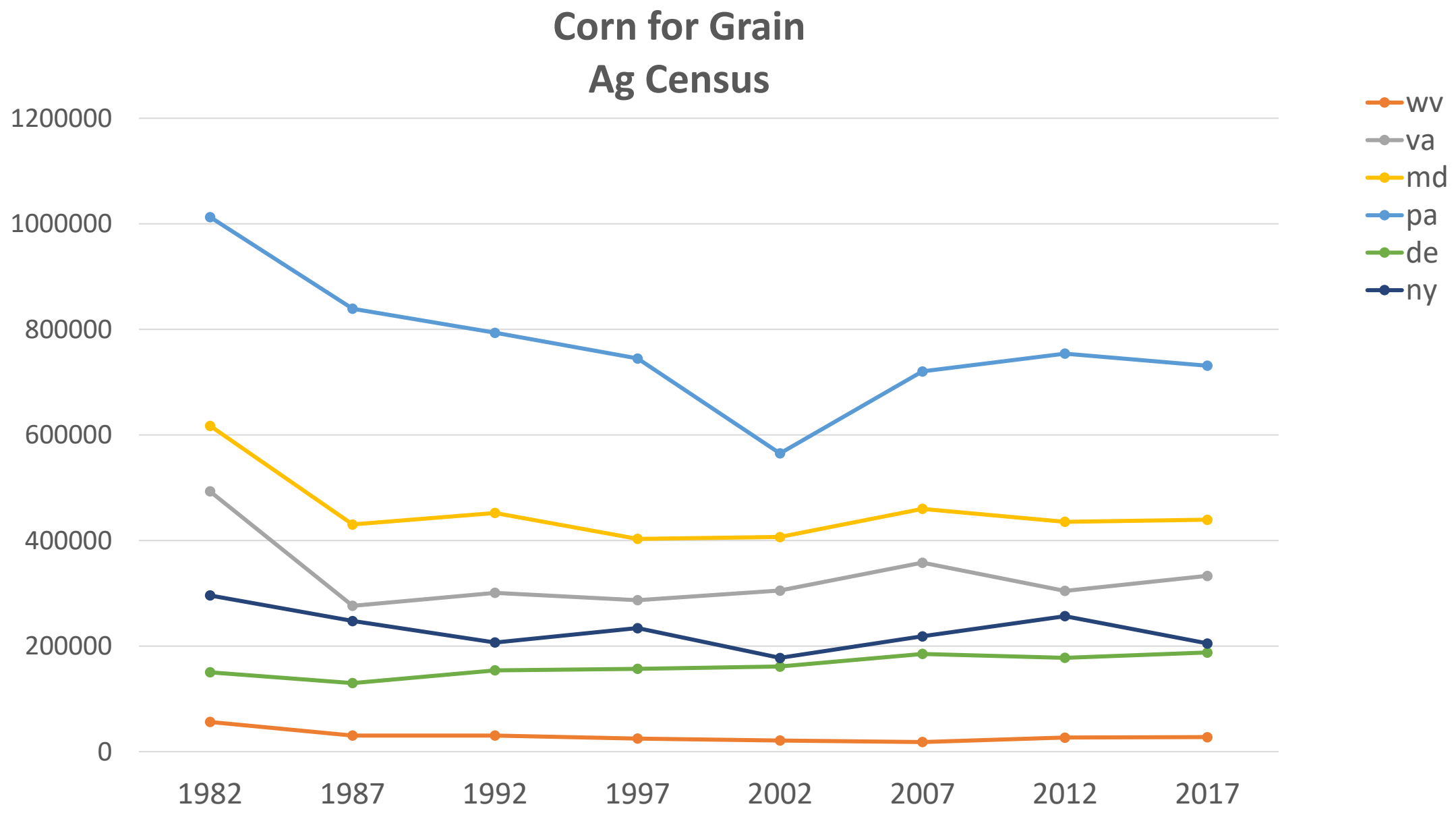
Ag Census History
Bay Wide



Corn for Grain Bay Wide				
ProjectionMethod	2017 Ag Census	2017 Projected	% Difference	Rank
LinearProjection	1,924,881	1,671,956	13.14	4
LinearProjection_Method2	1,924,881	1,875,514	2.56	1
DES-0802	1,924,881	1,807,299	6.11	2
DES-0901	1,924,881	1,766,142	8.25	3

Soy Beans Bay Wide				
Projection Method	2017 Ag Census	2017 Projected	% Difference	Rank
LinearProjection	1,744,873	1,566,056	10.25	4
LinearProjection_Method2	1,744,873	1,650,180	5.43	1
DES-0802	1,744,873	1,621,050	7.10	3
DES-0901	1,744,873	1,647,056	5.61	2

Wheat for Grain Bay Wide				
Projection Method	2017 Ag Census	2017 Projected	% Difference	Rank
LinearProjection	513,622	531,774	3.53	1
LinearProjection_Method2	513,622	599,978	16.81	4
DES-0802	513,622	580,066	12.94	2
DES-0901	513,622	589,933	14.86	3


Corn for Grain
Ag Census
1200000
1000000
800000
600000
400000
200000
0
1982
1987
1992
1997
2002
2007
2012
2017
wv
va
md
pa
de
ny

Corn for Grain WV				
Projection Method	2017 Ag Census	2017 Projected	% Difference	Rank
LinearProjection	27,679	13,685	50.56	4
LinearProjection_Method2	27,679	22,514	18.66	1
DES-0802	27,679	18,584	32.86	2
DES-0901	27,679	17,773	35.79	3

Corn for Grain VA				
Projection Method	2017 Ag Census	2017 Projected	% Difference	Rank
LinearProjection	333,188	283,286	14.98	2
LinearProjection_Method2	333,188	291,099	12.63	1
DES-0802	333,188	277,281	16.78	3
DES-0901	333,188	261,288	21.58	4

Corn for Grain MD				
Projection Method	2017 Ag Census	2017 Projected	% Difference	Rank
LinearProjection	439,538	382,565	12.96	4
LinearProjection_Method2	439,538	418,074	4.88	1
DES-0802	439,538	400,619	8.85	2
DES-0901	439,538	387,136	11.92	3

Corn for Grain NY				
Projection Method	2017 Ag Census	2017 Projected	% Difference	Rank
LinearProjection	205,160	204,860	0.15	1
LinearProjection_Method2	205,160	249,562	21.64	4
DES-0802	205,160	239,535	16.76	3
DES-0901	205,160	238,500	16.25	2

Corn for Grain DE				
Projection Method	2017 Ag Census	2017 Projected	% Difference	Rank
LinearProjection	187,963	188,666	0.37	1
LinearProjection_Method2	187,963	184,822	1.67	3
DES-0802	187,963	185,138	1.50	2
DES-0901	187,963	183,481	2.38	4

Corn for Grain PA				
Projection Method	2017 Ag Census	2017 Projected	% Difference	Rank
LinearProjection	731,353	598,894	18.11	4
LinearProjection_Method2	731,353	709,444	3.00	1
DES-0802	731,353	686,143	6.18	2
DES-0901	731,353	677,964	7.30	3

Recommended Paths Forward

- There is no single projection method that works for all states, all land and animal categories. It is important to continue with the partnership decision to use one method across states and across animals and land use types.
- Investigate new projection algorithms and/or means of determining accuracy of projection – as recommended by the AgWG.
- Do analysis for major crops/animals rather than each land use and animal type. Best method for these major crops/animals would apply to the less prevalent categories.