

Chesapeake Bay Program Partnership Updates Modeling Tool

The Chesapeake Assessment Scenario Tool (CAST) is updated every two years following the Chesapeake Bay Program (CBP) Partnership decision to incorporate updated data and revised methods. By consistently accommodating new science and information used in the model, we get a better understanding of how our management actions and changing environmental conditions may be impacting water quality and living resources across the Chesapeake Bay watershed. The new version of CAST includes updates which affect predicted loads in all scenarios and years. This includes your own scenarios, scenarios shared with you, and public scenarios.

Errors and Omissions

There were data errors and omissions identified during the review of CAST 2021 that have been raised and discussed with the CBP partnership. Agricultural fertilizer sales data had been inaccurate in CAST-19 and was corrected in the review version of CAST-21 prior to the initial review period of November 1 to December 1, 2020. It was also found that some data was not updated from the National Agricultural Statistics Service (NASS) Surveys, affecting broilers and crop yields. The extent of errors was identified and conveyed to the partnership, and new procedures were put in place to prevent these errors and omissions in the future.

Effect on Targets and Goals

The data omissions did not affect 2025 Planning Targets for nutrients and sediment, the jurisdictions' Phase III Watershed Implementation Plans (WIPs), Climate Change targets, or the Conowingo WIP. The data omissions affect the model's measure of where we are currently with respect to these goals.

Changes Impacting Loads

Agricultural and urban fertilizer sales data

- Agricultural and urban fertilizer sales data are updated to include data reported to American Plant Food Control Officials (AAPFCO) through 2016, the most recent year available. The CAST-19 error in agricultural fertilizer for two years (2013 and 2014) was corrected and new 2015 and 2016 fertilizer data were included in CAST-21. The addition follows protocols for two-year updates to the model and affects nutrient inputs to agricultural lands from 2016 forward. The exclusion of some fertilizer sales data in CAST-19 meant that nutrient applications to the land and resultant loads were artificially low.
- Farm fertilizer sales data indicate an increase in fertilizer use over time for most states. This update is one of two primary causes of higher agricultural loads in CAST-21 compared to CAST-19 – the other being crop yields. Watershed-wide, the new fertilizer use information as well as other scheduled changes to the model data like accommodation of new high-resolution landcover data, resulted in a 4.3 million pound higher nitrogen load and a 500 thousand pound lower phosphorus load in CAST-21 compared to CAST-19.
- Two additional years of urban fertilizer sales data produce new turfgrass fertilizer application rates from 2013 to 2025. The effect on application rates and loads through time and between model versions depends on the jurisdiction.

Broiler populations *(available in the CAST-21-review version of 2/18/2022)*

- The latest version of CAST-21 includes one year (2020) of broiler population data that were missing in the earlier release. The information comes from the annual NASS survey. Also, there is a correction for New York, which does not have broilers as part of the annual NASS survey.
- The effect of the one additional year of broiler data on nutrient application rates and loads is minimal. Watershed-wide, loads are 25 thousand pounds and 1 thousand pounds higher for nitrogen and phosphorus, respectively, in CAST-21 than CAST-19.

Crop yields *(available in CAST-21 review version of 2/18/2022)*

- Six major crops were missing most recent crop yield data from annual surveys (2017-2020 period) in the original release of CAST-21. They were not zeroed out for these years but were held constant at the last year of hard data or were projected depending on the relevant rule. The missing crops were corn, grain and silage, soybeans, alfalfa hay, barley, and oats.
- The addition affects crop nutrient application rates and loads for 2017 forward for the six crops. The partnership's decision rules for incorporating these data affect projections from 2013 for all crop types.
- In addition to crop yields, nutrient application rates are affected by 1) the available amounts of manure nutrients and inorganic fertilizer, 2) the types and acres of crops, and 3) the nutrient needs of those crops – information that changes yearly through new data or projections.
- Watershed-wide, the new crop yield information produces a 2.0 million pounds higher nitrogen load and 40-thousand-pound lower phosphorus load in CAST-21 compared to CAST-19.

General Updates

With the development of annual Progress model scenarios, jurisdictions can introduce new records of implemented BMPs for historic years, not just new implementation over the past year. The effects of this update are lower loads in CAST-21 than CAST-19 by 1.2 million pounds and 140 thousand pounds for nitrogen and phosphorus, respectively. The revised BMP history not only modifies loads from the land, but nutrient applications to crops as well as acres of land uses – for particular BMPs.

Other information was accommodated with CAST-21 through partnership guidance and scheduled introductions. This includes new information for 1) the total acres in agricultural, 2) the split between permitted and non-permitted animals, 3) the amount of biosolids applied to crops, 4) areas under new construction, 5) wastewater discharges, 6) reductions in sewer overflows, 7) the number of septic systems, 8) the extent of sewer service areas, 9) forest harvest acres, and 10) the time period for crediting tree BMPs.

The table below quantifies the changes in nitrogen and phosphorus loads between CAST-19 and CAST-21 by jurisdiction with the best estimates of the contribution from each of the major changes.

Changes in Nutrient Loads Between CAST-19 and CAST-21 by Jurisdiction*

Nitrogen								
Jurisdiction	Source	New Fertilizer Data + General Updates (M lbs)	Additional Broiler Data (M lbs)	Additional Yield Data (M lbs)	New State-Reported BMP History (M lbs)	Total CAST19:CAST21 Load Difference (M lbs)	Total CAST19:CAST21 Load Difference (%)	
NY	AllSources	0.697	0.000	-0.042	0.013	0.668	5.0%	
PA	AllSources	1.772	0.124	0.868	-0.268	2.496	2.4%	
MD	AllSources	1.017	-0.016	0.482	-0.230	1.253	2.6%	
VA	AllSources	0.566	-0.015	0.434	-0.540	0.445	0.8%	
WV	AllSources	-0.153	-0.016	-0.005	-0.002	-0.175	-2.2%	
DE	AllSources	0.374	-0.052	0.220	-0.136	0.407	5.9%	
DC	AllSources	-0.002	0.000	0.000	0.000	-0.002	-0.2%	
CBW	AllSources	4.273	0.025	1.957	-1.163	5.091	2.1%	

Phosphorus								
Jurisdiction	Source	New Fertilizer Data + General Updates (M lbs)	Additional Broiler Data (M lbs)	Additional Yield Data (M lbs)	New State-Reported BMP History (M lbs)	Total CAST19:CAST21 Loads Difference (M lbs)	Total CAST19:CAST21 Load Difference (%)	
NY	AllSources	0.004	0.000	-0.002	0.001	0.003	0%	
PA	AllSources	-0.027	0.004	-0.014	-0.018	-0.054	-1%	
MD	AllSources	-0.392	0.000	-0.014	-0.047	-0.454	-12%	
VA	AllSources	-0.159	0.001	-0.004	-0.085	-0.249	-4%	
WV	AllSources	0.067	0.000	0.000	-0.001	0.065	15%	
DE	AllSources	0.013	-0.004	-0.001	0.009	0.017	14%	
DC	AllSources	-0.003	0.000	0.000	0.000	-0.004	-6%	
CBW	AllSources	-0.498	0.001	-0.036	-0.142	-0.675	-5%	

*Positive numbers indicate higher loads in CAST-21 than CAST-19

*Loads do not include possible changes in reported wastewater discharges between models

BMPs Now Available for Annual Reporting

- With the introduction of CAST-21, there are new opportunities or methods for crediting BMPs related to urban stream restoration, agricultural ditch management, abandoned mine land reclamation, and wetland creation and rehabilitation. In addition, there is an extension of credit durations for tree and forest planting, and riparian forest buffers.

You can learn more about the detailed changes between CAST versions at

<https://cast.chesapeakebay.net/Documentation/ModelDocumentation>.