

Comments on CAST-19

The Water Quality Goal Implementation Team (WQGIT) decided that at the end of the milestone period, the partners will factor in the new information, best management practice (BMP) efficiencies, and data previously approved by the partnership into the present and past history of progress runs (December 14-15, 2015 Face to Face meeting). In 2018, planning began for the transition from CAST-17d to CAST-19. Deadlines were provided to the WQGIT for new data, BMPs, and other changes. The list of updates explaining the effects was presented and approved by the WQGIT at the September 9 and 30, 2019 meetings ([https://www.chesapeakebay.net/channel_files/34001/2019_09_09_wqgit_-_model_changes_and_planning_targets_-_gshenk_\(002\).pdf](https://www.chesapeakebay.net/channel_files/34001/2019_09_09_wqgit_-_model_changes_and_planning_targets_-_gshenk_(002).pdf), https://www.chesapeakebay.net/channel_files/39994/2019_09_30_wqgit_-_cast-2019_-_gshenk.pdf)

A review of CAST-19 was initiated on February 21, 2020 with a request for the WQGIT and the Watershed Technical Workgroup (WTWG) to provide comments. Presentations on the changes between CAST-17d and CAST-19 were made to the WTWG on March 5, 2020 and again on April 2, 2020. Presentations were made to the WQGIT on March 23, 2020 and April 27, 2020. Comments were received from DE, MD, PA, VA, and WV. Meetings were held with each of these states to address their comments. DC and NY did not provide comments. This document is a summary of all comments received and the resolution of each comment.

The updates to CAST include:

1. 2017 Agricultural Census data incorporated into the land use, crop yields, and animal numbers.
2. 2013 – 2015 land use acres, septic systems, sewer service areas, MS4 areas (VA only)
3. Agricultural and urban fertilizer sales data
4. Wastewater year for all states except VA
5. Stream bed and bank loads are now credited by agency
6. Nitrogen fixation rate for “other haylage; grass silage and green chop”
7. Nitrogen fixation inputs for over-winter crops.
8. Projections are for 2018 and beyond. Previously the projected years were 2013 and beyond.
9. Planning BMPs that are now Official
 - Agricultural Stormwater Management
 - Conservation Landscaping Practices
 - Septic Effluent - Advanced
 - Septic Secondary Treatment - Advanced
 - Septic Denitrification - Advanced
10. BMPs submitted, including in the TMDL critical period
11. BMP costs
12. Biofilter credit

The detailed changes between CAST versions is documented on CAST at: <https://cast.chesapeakebay.net/Documentation/ModelDocumentation>. Graphs showing the changes in loads and between the acres and animals in the Agricultural Censuses are available on CAST at: <https://cast.chesapeakebay.net/Shiny/misc/castver/>. The list of comments and the Chesapeake Bay Program’s responses follow.

Comment—Implications in changing loads for planning

Concern was expressed that the increase in nitrogen in CAST-19 would result in the Phase III WIP Planning Targets changing, resulting in a requirement that the Phase III WIPs be updated. There was also a question of how the milestone goals are recalculated for each milestone period, and whether the latest version of CAST would be used for each recalculation.

Jill Whitcomb-PA-DEP; James Martin-VA-DEQ

Response

The 2025 Phase III Planning Targets do not change. The milestone goals do change. The 2009 progress changes since the entire history of BMP implementation is re-run with each new version of CAST. With the 2009 starting point adjustment, the trajectory to the 2025 planning target endpoint shifts. As we get closer to 2025, the effect of the shift is not as much as earlier years since we are closer to the anchored 2025 target. The 70% milestone goal will step up with each cycle (80% in 2021, 90% in 2023).

Resolution

The Chesapeake Bay Program will send jurisdictions communications pieces with full explanations as to why the nitrogen load is higher in CAST-19 than CAST-17d. PA-DEP requested that the percent from nitrogen fixation, inorganic fertilizer, and manure be shown in a visual interpretation by the May 25, 2020 WQGIT. These communication pieces should help translate for stakeholders the implications of additional nitrogen load in their jurisdiction. The pieces will specifically address what jurisdictions should do with this information and why the changes occurred. It was suggested that the CBPO Communications Office help prepare the communication pieces.

Comment—Hay

The acres in the load source Ag Open Space increases while the acres in the load source Hay have decreased in CAST-19 compared to CAST-17d.

Greg Sandi-MDE; Dave Montali-Tetra Tech; William Keeling-VA-DEQ

Response

The 2017 Agricultural Census collapsed three categories of hay that were separate in previous censuses—wild hay, other hay, and small grain hay. The early CAST-19 beta split the acres equally among the three categories.

Resolution

The 2017 hay acres are proportioned according to the percentages in the 2012 census.

Comment—Soybean nitrogen application

With the increase in full-season soybeans and decrease in double cropped soybeans in CAST-19, the nitrogen application rates were examined.

Chris Brosch-DDA, Jill Whitcomb-PA-DEP; James Martin-VA-DEQ

Response

Nitrogen applications on soybeans depend on whether the soybeans are full season or double cropped. Double-cropped soybeans receive zero nitrogen applications. Full season soybeans have a nitrogen crop need of 0.12 lb. per bushel or 5.70 lbs./acre. This results in a watershed-wide average of 2.23 inorganic lbs./acre applied and 1.35 organic lbs./acre applied. The University of Maryland, Penn State, and Virginia Tech nutrient management guidelines recommend zero nitrogen on full-season or double-cropped soybeans. The University of Maryland guidelines (SFM-1) for nutrient applications state:

“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.”

Resolution

A comparative analysis of changing full-season soybeans to corn and the resulting nitrogen loads was provided to PA-DEP. The soybean nitrogen application and nitrogen fixation assumed for Lancaster County and the average in the rest of Pennsylvania’s watershed were provided to Jill Whitcomb, PA-DEP.

The Chesapeake Bay Program 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 Agricultural workgroup will be asked to consider establishing a group to evaluate nutrient management BMPs for nitrogen on full season soybeans.

Comment—Incorporating new data for the Hillandale layer operation

Animal numbers for the Hillandale operation do not appear to be reflected in the Agricultural Census. Pennsylvania asked that these data be included.

Jill Whitcomb—PA-DEP and Pat Thompson—Energy Works

Response

Steps for adding the data to CAST were outlined for Pennsylvania. These steps include verifying the animal numbers using multiple sources of information and seeking Partnership approval for adding these animal counts. The change affects loads in all jurisdictions since the inorganic fertilizer is distributed using a watershed-wide amount.

It was determined that adding the Hillandale animal counts could not be accomplished immediately. The animal numbers will be evaluated for adding to CAST-21.

Comment—Dairy animals

There was initial confusion when looking at the difference between the dairy animal numbers for a single year. CAST-19 shows more dairy animals than CAST-17d.

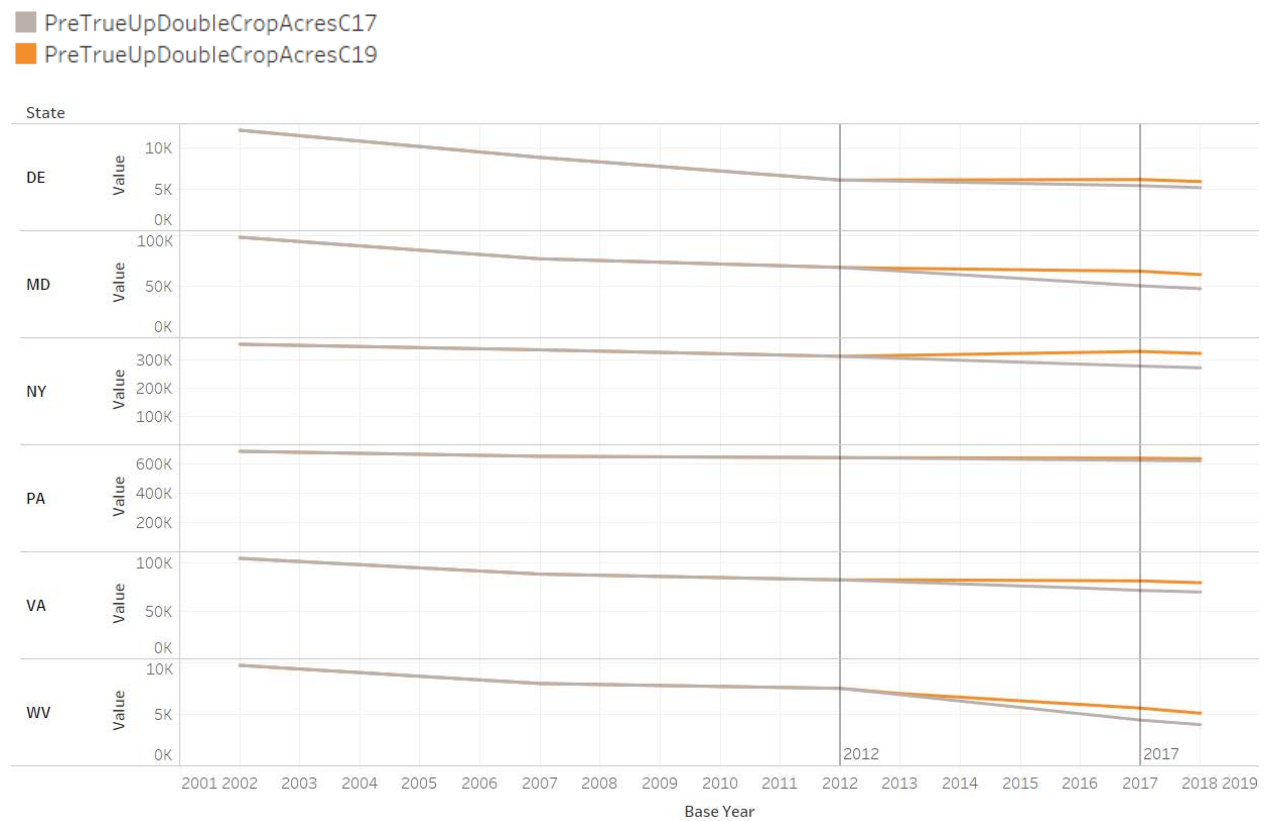
Chris Brosch-DDA, Jill Whitcomb-PA-DEP; James Martin-VA-DEQ

Response

Dairy animals have been decreasing over time. The rate of decrease has been faster than was predicted using the 2017d Agricultural Census. However, these numbers do not reflect an increase in dairy animals in the watershed. Rather, the amounts show that the decreasing trend was not at as high a rate as was projected. The line graph below illustrates that both versions of CAST show a decrease.

Resolution

Data are shown as line graphs so the entire trend of dairy animals over time is clear.



Comment—Developed land acres increasing

States using land policy BMPs noted unexpected increases in developed acres. The land policy BMPs were intended to reduce development in favor of conserving natural lands.

Greg Sandi-MDE; Dave Montali-Tetra Tech

Response

This effect was evident in the WIP scenario for WV, PA, and MD. This comment helped the Chesapeake Bay Program identify an error in the processing of the land policy BMPs used in those states' Phase III WIPs.

Some concerns were expressed that the process used to create the land use using the agricultural census data, construction acres, and harvested forest was causing this result. That process is colloquially referred to as "true-up". The issue was found with the processing of the land policy BMPs, not the aforementioned land use process.

Resolution

The processing of the land policy BMPs is corrected and now the expected effect of conservation is evident

Comment—Methodology for creating the final land use

Virginia asked for documentation and data of exactly how the 2017 Agricultural Census is put together with the mapped land use. This process seems to drive significant changes in some load sources (20+% difference in acres for 2018 not uncommon at state scale).

VA-DEQ, Bill Keeling

Response

Documentation on the land use is in the model documentation posted to CAST at: <https://cast.chesapeakebay.net/Documentation/ModelDocumentation>. The specific information is in Section 5.7. Delving into the effect of the base condition changes, we found that almost the entire increase in load is due to the Agricultural Census crops, not the mapped land use, error rates, or animal numbers. Double cropped land had the largest nitrogen load decrease while full season soybeans had the largest nitrogen load increase. Some of these changes are seen in non-agricultural sectors because of fitting the Agricultural Census acres to the total acres. This is less so in Virginia because of the higher quality land cover and the accompanying error rates.

Comment—Double cropped acres decreasing

The acres of double cropped land decrease in CAST-19 compared to CAST-17d.

Chris Brosch-DDA, Jill Whitcomb-PA-DEP; Dave Montali-Tetra Tech

Response

Available acres for double cropped land are determined using the difference between the Agricultural Census categories of total harvested cropland and the sum of the acres of each crop harvested. The 2017 Agricultural Census shows us that the projections from the 2012 Agricultural Census led to an overestimation of double crop acres used in CAST-17d for 2013 to 2025. The new data from the 2017 Agricultural Census corrects the previous projections. This decrease in double cropped acres is balanced by an increase in grains and full-season soybeans.

Resolution

Line graphs showing the change in the projections used in CAST-17d from the 2012 Agricultural Census compared to the projections in CAST-19 using the 2017 Agricultural Census illustrate the difference in crop acres reported. <https://cast.chesapeakebay.net/Documentation/ModelDocumentation>

Comment—Increased cropland

An explanation of why CAST-19 appears to have more cropland than CAST-17 in West Virginia was requested. There were specific questions about individual crop types.

Dave Montali-Tetra Tech

Response

The Agricultural Census showed an increase in various crops, which is reflected in the CAST-19 land use data. The raw data from Ag Census for 2012 and 2017 was provided. (Spreadsheet: Agcensus_WV_1217_DaveMontali)

Comment—Nutrient applications compared to acres

The pounds of nutrients applied to all agricultural land is different between versions.

Greg Sandi-MDE; Chris Brosch-DDA

Response

In Maryland, the acres of agricultural load sources increase in 2015, 2016, and 2017, resulting in a corresponding increase in nitrogen loads. This agricultural land use pattern was not present in CAST-17d. Comparing the nutrient applications per acre for both versions of CAST with no BMPs shows that the increase in nitrogen applications follows the increase in agricultural acres.

Nutrient applications vary depending on the land use. For agriculture, the crops within the land uses impact the nutrient applications. In Delaware, the shift from crops with lower nitrogen need to crops with higher nitrogen need results in an increase in nitrogen loads. There has also been a shift in the source of nitrogen. Inorganic fertilizer has decreased over time while the manure has increased.

Resolution

Data visualizations were prepared to illustrate the changes in acres for each crop and the resulting nutrient applications.

Comment—Crop need

Virginia asked which new data source is driving the changes in crop need per acre (2018 Progress nutrients applied report shows per acre nitrogen changes ranging from +10% to -15%, only pasture N crop need per acre is unchanged [15lbs N/ac]).

VA-DEQ, Bill Keeling

Response

Crop need will change because the land use changes, affecting the amount of nutrient management credited. Nutrient management is a composite based on the crops in the land use. So even if the land

use acres were the same in 2018 progress between the CAST-17d and CAST-19, the crops that make up that land uses will likely not be in the same proportions.

Comment—BMPs that are credited in the land use

Virginia requested the documentation and data that conclusively demonstrates that the backed-out land use change BMPs through 2017 already are accounted for in the base conditions derived from the 2017 Agricultural Census and 2013 imagery-based land cover.

William Keeling-VA-DEQ

Response

Back out describes the procedures used to account for land use change BMPs that also may be in the land use/land cover data. Documentation is in the model documentation posted to CAST in multiple places. Under the CAST Learning item on the top menu bar, there is User Documentation. If you use the table of contents and skip to reports, then scroll to the Submitted vs. Credited report. That report includes the amount that is not credited. In addition to the Read Me tab with the field names definitions, there are details about the scenarios in the report, land, animal, and manure BMPs. In each of these sheets, the BMPs are listed along with information tied to each BMP. If any of the sheets have no data, it is because there were no BMPs of that type.

More information is available under CAST Learning item on the top menu bar. The section named FAQs includes a description of backout. Using the table of contents, expand General and click on Understanding Results for that description.

There is also the Phase 6 model documentation on the About, Model Documentation page. Download Section 6 and jump to 6.3.1 Load Source Change Practices. There is an explanation of back out there too.

There is a list of all the load source change BMPs located in the Source Data spreadsheet on the tab named Load Source Change BMPs. All those BMPs are backed out if the "from" and "to" load source are not the same.

Comment—BMP crediting differences

Virginia asked what causes submitted BMPs to change in the same scenario between the two models (2009, 2018 and WIP3 all have numerous instances of this in submitted vs credited reports).

VA-DEQ, Bill Keeling

Response

All years are new data pulls from NEIEN. These will not match with official scenarios in CAST-17. A significant difference was found between data submitted for 2019 progress and the prior years of official progress scenarios.

Resolution

Virginia supplied updated BMP data that was used in CAST-19. Some BMPs were inadvertently deleted from the state's BMP Data Warehouse and the updated BMP data included the corrected data. Those

data are now in CAST-19 for all progress years. They were not included in the 2019 progress scenario in CAST-17d.