Modeling the Chesapeake Bay Watershed

The Chesapeake Bay Program uses state-of-the-art science and monitoring data to replicate conditions of the Chesapeake Bay watershed. This information is then used by decision-makers at the federal, state and local levels to determine how best to restore and protect local waterways, and ultimately, the Chesapeake Bay. By combining sophisticated modeling data and real-world monitoring data, we gain a comprehensive view of the Chesapeake ecosystem—from the depths of the Bay to the upper reaches of the watershed.

The suite of computer modeling tools developed by the Chesapeake Bay Program divides the 64,000-square-mile watershed into thousands of smaller segments, and helps us understand the impact of pollution-reducing policies and practices at the regional and local level. The most significant value of the suite of modeling tools is the ability to predict how the Chesapeake Bay will respond to future conditions such as pollutant loads, land use changes and climate change.

What is included in the Chesapeake Bay Program's suite of modeling tools?

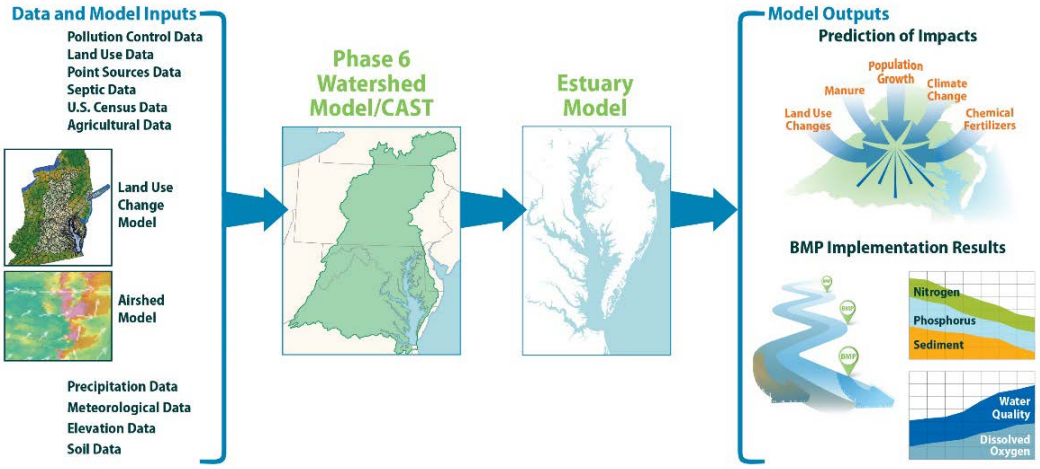
The Chesapeake Bay Program has a suite of four computer models that includes:

- **Airshed Model:** estimates the amount of nitrogen deposited onto the land and water by vehicles, power plants and other emission sources
- **Land Use Change Model:** predicts the impacts that urban population and development will have on sewer and septic systems
- **Phase 6 Watershed Model:** estimates the amount of nitrogen, phosphorus and sediment reaching the Chesapeake Bay
- **Estuary Model:** examines the effects that pollution loads have on water quality

State and local governments, planners, nonprofit organizations and others can use these models to test scenarios and simulations of possible actions in order to determine how much pollution is entering their local waterways, where it is coming from, how their actions will have an impact and much more before committing time and resources.

How do the models work together?

Step 1. Data from the Land Use Change Model, Airshed Model and other data such as human and farm animal populations, rainfall, septic systems and elevation are input in the Phase 6 Watershed Model.



Step 2. Results of Phase 6 Watershed Model are then input into the Estuary Model.

Step 3. The model results predict the types of impacts, which enables planners to choose conservation practices that can best filter pollutants and improve water quality.

How has the Chesapeake Bay Suite of Modeling Tools improved over time?

The development and ongoing improvement of the suite of modeling tools is a highly collaborative process involving many partners, stakeholders and experts. Since its inception, the suite of modeling tools has undergone extensive peer review by federal, state and academic modeling experts and scientists.

The newest version of the suite is known as Phase 6. Its simplified structure makes it easier to use. The Phase 6 Suite of Modeling Tools includes expanded and improved data about:

- The sources and amount of nutrients entering the water;
- The latest, cutting-edge high-resolution land cover data from satellites; and
- New and updated information about the efficiencies of pollution-reducing best management practices.

Aerial imagery of Denton, Maryland, is overlaid with data from the Chesapeake Bay High Resolution Land Cover Project. The data, newly included in the Watershed Model, delivers 900 times more information than existing data, showing land cover such as tree canopy (represented in dark green), buildings (represented in red) and roads (represented in black). (Image courtesy of the Chesapeake Conservancy)

The Phase 6 Suite of Modeling Tools can also simulate the environmental impacts of population growth, climate change and sediment build-up behind the Conowingo Dam (on the Susquehanna River in Maryland), which helps decision makers explore options for addressing these factors.

How can I use the Chesapeake Bay Suite of Modeling Tools?

The suite of modeling tools can be accessed online for free through the Chesapeake Assessment Scenario Tool (CAST). CAST allows local communities to run model simulations for various situations (or scenarios) that are relevant to their locality. The modeling results can help states, local governments and others identify which pollution prevention strategies and conservation practices make the most sense, given their available resources.

CAST helps local planners better understand which pollution control practices can provide the greatest reduction in nitrogen, phosphorus and sediment loads—and how much various implementation options might cost. Plus, CAST can indicate which practices would be most successful in different geographic areas, and how water quality and land use patterns might change as a result. Based on scenario outputs, planners can refine their choices.

Learn more about using CAST by viewing the Watershed Academy webinar at https://www.epa.gov/watershedacademy/using-cast-develop-implementation-plans-meet-loading-targets-chesapeake-bay.

Use the Chesapeake Assessment Scenario Tool at

cast.chesapeakebay.net

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