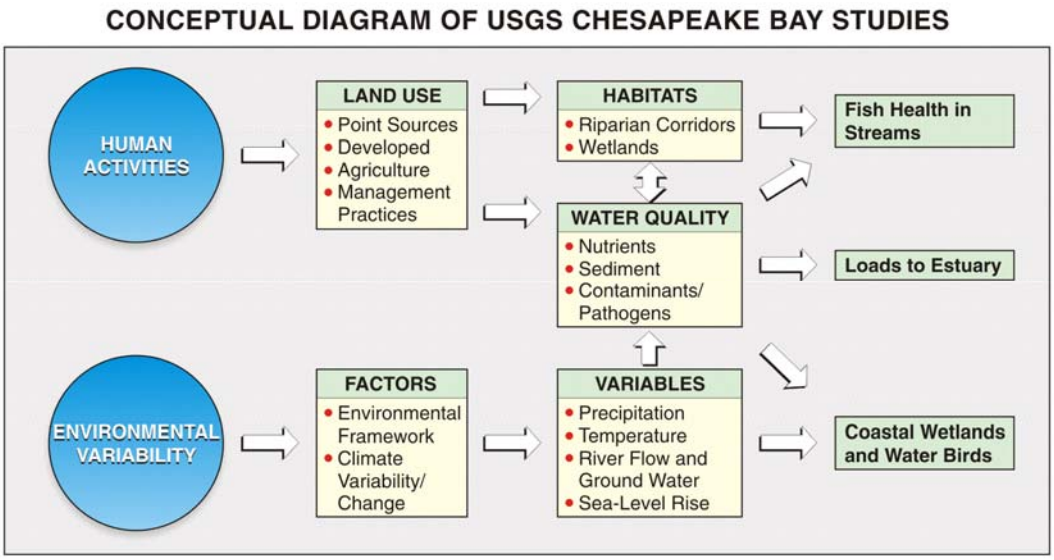
Selected 2008 Accomplishments of USGS Chesapeake Bay Studies

The mission of the USGS Chesapeake Bay studies is to provide integrated science for effective ecosystem conservation and restoration with and emphasis on the following synthesis topics during 2007-2012:

- Better define the landscape processes affecting water quality.
- Monitor and assess changes in human activities, water quality, and habitats.
- Understand the factors affecting the health of fish and wildlife.
- Assess and forecast the impacts of climate and land-use change.
- Synthesize science and provide decision-support tools to enhance ecosystem management.

These topics address multiple goals of the USGS Science Strategy and many of the technical needs of the Chesapeake Bay Program (CBP). A conceptual diagram showing the relation between the synthesis topics is shown below.

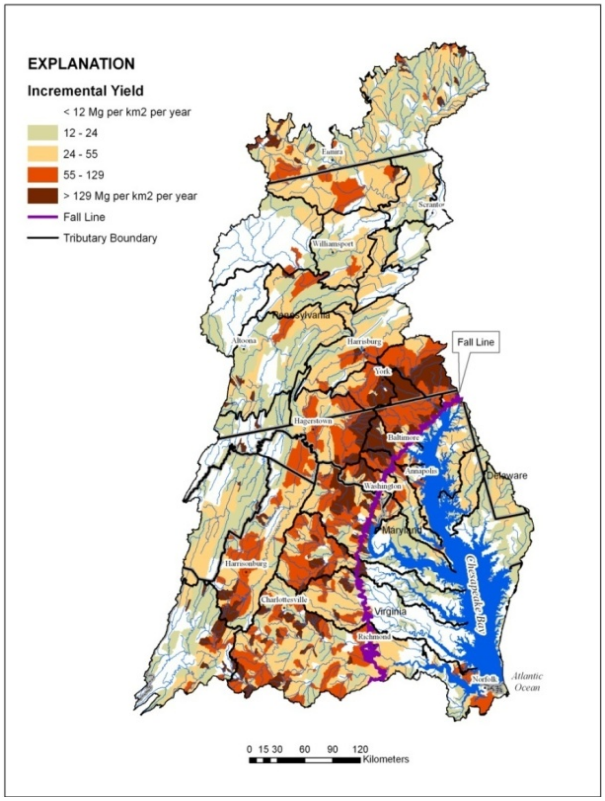


Selected accomplishments of Chesapeake Bay studies in 2008 include:

- The Nations' first regional sediment SPARROW model.
- Quantified sources, transport, and storage of sediment and associate nutrients in selected environmental settings.
- Direct ground-water discharge and nitrogen to the Bay.
- Trends and new techniques of changes in nutrients and sediment.
- Improved land-use analysis to explain changes in water quality and forests.
- Extent and potential causes of intersex conditions and fish kills in the Potomac basin.
- Factors affecting relative sea-level rise.
- Land-change model to forecast conditions over the next 20 years.
- COAST: A decision support tool to identify watersheds to enhance conservation actions.
- USGS Circular 1316: "Synthesis of USGS Findings for the Chesapeake Bay Ecosystem and Implications for Environmental Management".

Nations' first regional sediment SPARROW completed.

A sediment SPARROW model of the Chesapeake Bay watershed, which is the first regional sediment SPARROW model for the Nation, was completed. A journal article about the model was approved by the USGS and has been submitted to the Journal of the American Water Resources Association for publication. The initial model results (shown below) were communicated to multiple audiences, and will be useful in targeting the types and locations of conservation practices reduce sediment to the Bay and its streams. Contacts: John Brakebill and Scott Ator



Quantifying the sources, transport, and storage of sediment and associated nutrients.

A comprehensive report on sediment sources, transport, and storage was approved and will be released in 2009. The report summarizes new research techniques to "fingerprint" sediment sources in different environmental settings and other selected results on the sources, transport, and storage of sediment in the Bay watershed. Research in local watersheds in different environmental settings was planned and initiated. Future work will include measurements of sediment and nutrient sources, transport, and trapping in riparian ecosystems in selected watersheds in the Piedmont and Coastal Plain. Contacts: Allen Gellis and Greg Noe.

Quantifying direct ground-water discharge of nitrogen to the Bay.

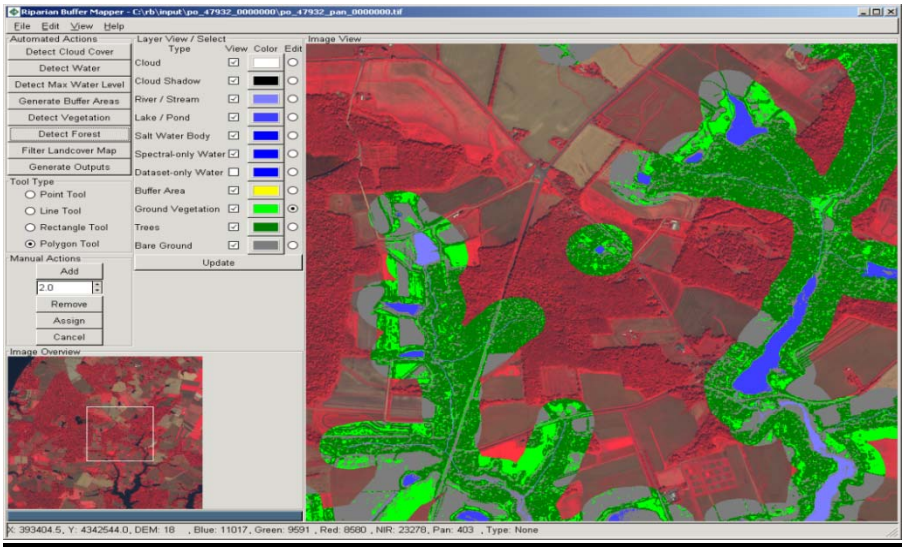
An initial version of the Delmarva ground-water model was completed and will be used to estimate direct ground-water discharge to the upper part of Chesapeake Bay. Geologic mapping in central Bay area improved the understanding of the hydrologic framework and its relation to direct ground-water discharge and improve the associated model. Information from field studies of direct ground-water discharge in smaller areas, including the Corsica watershed, was analyzed to help identify the local-scale factors affecting ground-water discharge. Contacts: Ward Sanford and John Bratton.

Trends and new techniques of changes in nutrients and sediment.

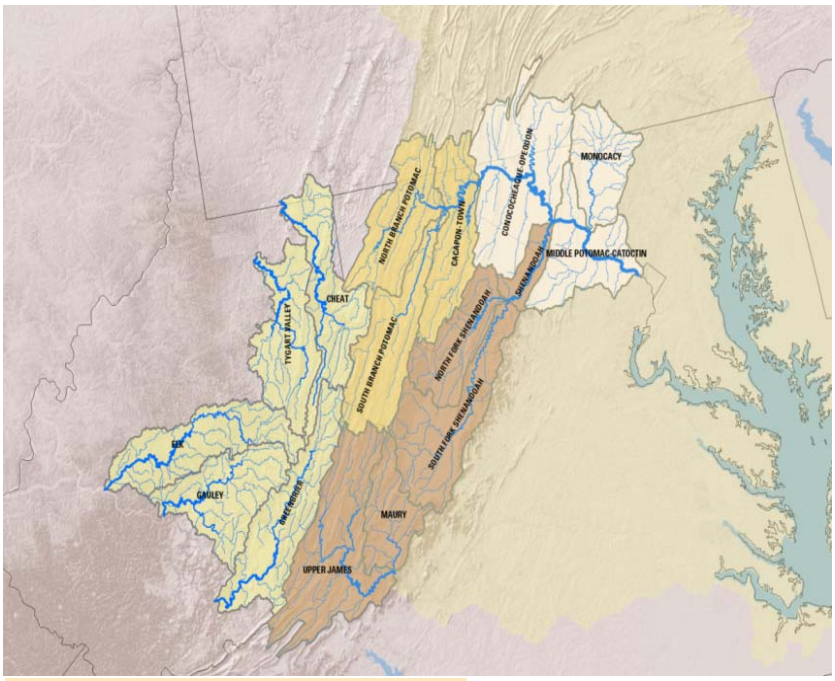
The USGS updated trends of nutrients and sediment at major sites within the Bay watershed and developed a Web site to more easily access the information. The results are used to document water-quality response to both land-use change and implementation of management actions in the Bay watershed. The USGS is working to develop enhanced techniques to display and evaluate water-quality changes over different time periods (ranging from changes over several years to changes over several decades). Contacts: Joel Blomquist and Mike Langland.

Improved land-cover analysis to explain changes in water quality and forests.

The USGS worked with the CBP office to develop new techniques to analyze land-cover change for the Chesapeake Bay watershed from 1984 through 2006. The analysis, in conjunction with more detailed land-use information, will allow for a more comprehensive evaluation of the effect of land-use and land-cover change on changes in water quality trends and forests in selected watersheds. Additionally, high resolution land-cover information was tested to document riparian forest change. A semi-automated tool for mapping forest buffers from high-resolution imagery, RBMapper, has been developed to help prioritize reforestation areas in the Bay watershed (see below). Contacts: Peter Claggett and Fred Irani.



Extent and Potential Causes of Fish Kills and Intersex Conditions in the Potomac Basin.
The USGS first discovered intersex conditions in fish in 2004 as part of research addressing fish kills in the Potomac watershed. The prevalence of fish kills and intersex conditions is shown below as part of a landscape analysis to better understand the causes and potential relation between intersex conditions and fish kills. The USGS and other investigators are finding that no one infectious agent is responsible for the fish kills—the pathology results show signs of a variety of infectious agents (such as parasites and endocrine-disrupting chemicals). The USGS is analyzing emerging contaminants in both water and fish as part of its fish-health assessments. Contacts: Vicki Blazer and Dana Kolpin.



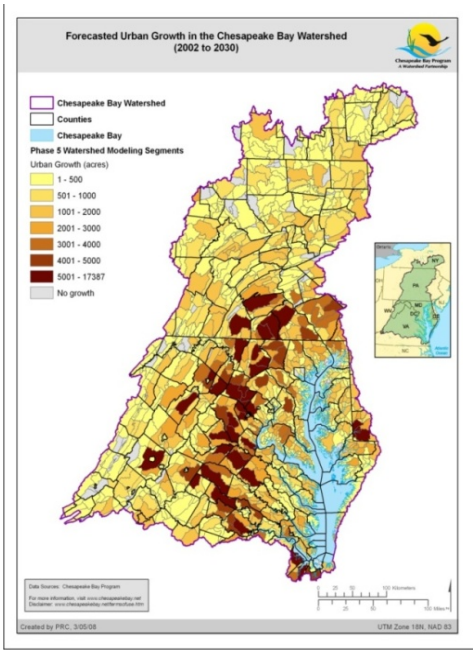
Study basins

- low intersex / no fish kills
- low intersex / fish kills
- high intersex / fish kills
- high intersex / no fish kills

Causes of Relative Sea-Level Rise
The USGS has analyzed relative sea-level changes in the Bay coastal area to better understand the cause and forecast potential future conditions. Preliminary results indicate that land subsidence due to long-term response to previous glacial periods (know as glacioisostatic adjustment) is a factor contributing to relative sea-level rise. This implies that land subsidence, not global warming, is a primary factor contributing to relative sea-level rise in the Bay area. A journal article of the findings is being prepared. Contact: Milan Pavich.

Land-Change Model to Forecast Conditions over the Next 20 Years.

Forecasting land-use change and its impact on water quality and habitat will be accomplished by using the Chesapeake Bay Land Change Model (CBLCM). The change model will be used to assess alternative future scenarios of land-use change (an example is shown below) and will be a prototype for the USGS to develop other land-change models in the United States. The USGS is also beginning a 3-year project in 2009 to address the combined impacts of land-use change and climate variability on streamflow and water quality in the Bay watershed. The results will help managers improve the management strategies needed to reduce nutrient and sediment loads to the Bay. Contact: Peter Claggett.



Chesapeake Bay Synthesis Report

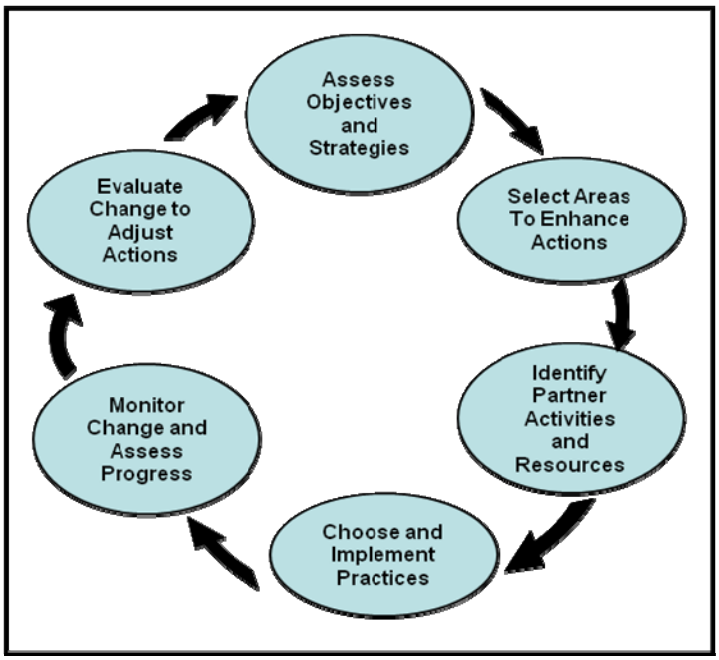
The USGS released Circular 1316: "Synthesis of U.S. Geological Survey Science for the Chesapeake Bay Ecosystem and Implications for Environmental Management." The report summarized USGS science about the multiple factors affecting the degradation of the Chesapeake Bay ecosystem and provided summaries of:

- Population growth and land-use change;
- Nutrient distribution, transport, and changes in the watershed;
- Sediment sources and transport in the watershed and estuary;
- Pesticide occurrence in the watershed and contaminant impacts on wildlife;
- Climate change and its impact on water quality and habitat;
- Estuary habitats (submerged aquatic vegetation and wetlands);
- Factors affecting fish health; and
- Changes in food and habitats of water birds.

The USGS plans a similar report to summarize findings from 2007-2012 as well as supporting journal articles and USGS reports. Contact: Scott Phillips

COAST: A Decision-Support Tool to Identify Watersheds to Enhance Ecosystem Management

The USGS and the CBP office developed an initial version of the Chesapeake Online Adaptive Support Toolkit (COAST). COAST provides access to selected USGS and CBP findings using an adaptive-management framework (see below). The USGS and USEPA interacted with NRCS to use COAST to select priority watersheds to enhance conservation practices. The NRCS is using the process to select additional watersheds in which to focus funds from the 2008 Farm Bill to improve water quality and habitat conditions. Contacts: Scott Phillips Cassandra Mullinix, and Paul Hearn.



For more information on these accomplishments and USGS Chesapeake Bay activities see:

http://chesapeake.usgs.gov/

Or Contact Scott Phillips (swphilli@usgs.gov)