

The Chesapeake Online Adaptive Support Toolkit (COAST)

A suite of web-based tools for improved management of the Chesapeake Bay ecosystem

What is COAST?

COAST is an integrated framework of information and web-based tools that allows managers to employ an adaptive-management approach for coordinating, implementing, and assessing management actions and ecosystem change. COAST will support the Chesapeake Action Plan (CAP) (USEPA, 2008), which will enhance management, coordination, and accountability of Chesapeake Bay Program (CBP) partner activities to restore and protect the Chesapeake Bay and its watershed. The initial version of COAST will focus on aspects of the CBP water-quality goal and help managers address questions such as:

- Where are the areas in the Bay watershed where management actions have the greatest potential to reduce nutrient and sediment loads to the Bay?
- What are the existing partner activities and resources that can be better aligned in an area?
- What is the optimal suite of actions to provide the greatest reduction of loads at the lowest cost?
- What are changes in water quality and progress toward management objectives?
- What are the factors affecting water-quality change and the implications for adjusting strategies and management actions?

To help address these questions, COAST provides improved access to diverse information and integrates results from different models and monitoring programs using an adaptive-management framework (fig 1):

1. Assess objectives and strategies.
2. Select areas to enhance implementation of water-quality practices.
3. Identify partner activities and resources.
4. Choose and implement practices to improve water quality.
5. Monitor change and assess progress toward improving water quality.
6. Evaluate change to adjust actions.

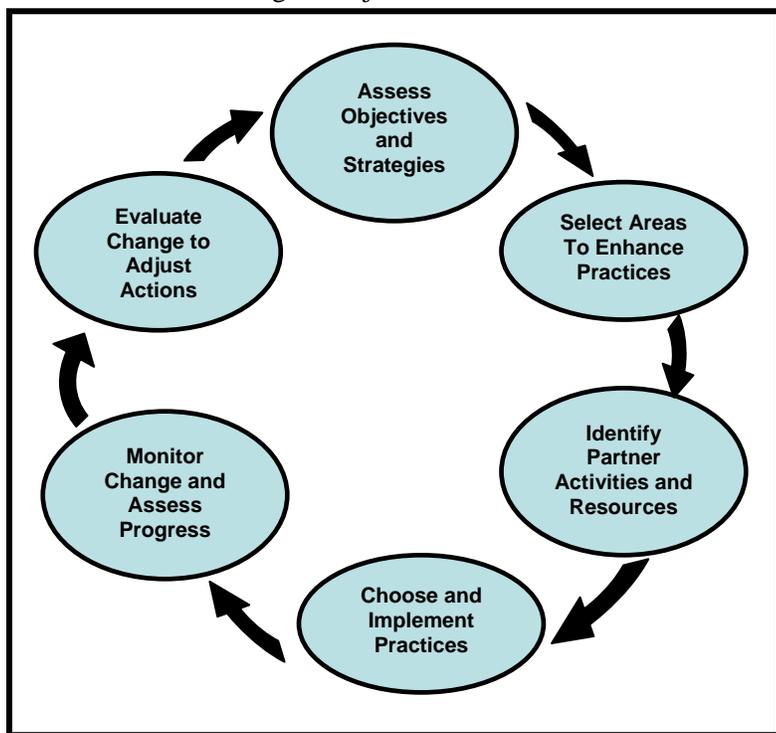


Figure 1- Adaptive management cycle for COAST.

The framework for COAST emphasizes a structured decision-making process and provides the opportunity for improved management as more is learned about the ecosystem over time. The framework is based on adaptive-management principles being used by the CBP, which include both business (Kaplan and Norton, 2008) and ecosystem applications (Williams and others, 2007).

Who are the Users of COAST?

The initial version of COAST will be used most frequently by the CBP Federal, State, and non-governmental partners who implement management actions and provide grants to meet the CBP water-quality goal. As more information becomes available at local scales, COAST should become more useful for local governments and watershed groups. Future versions of COAST may support other goals of the CAP (such as habitats, healthy watersheds, and fisheries), so there could be a larger and more varied group of users.

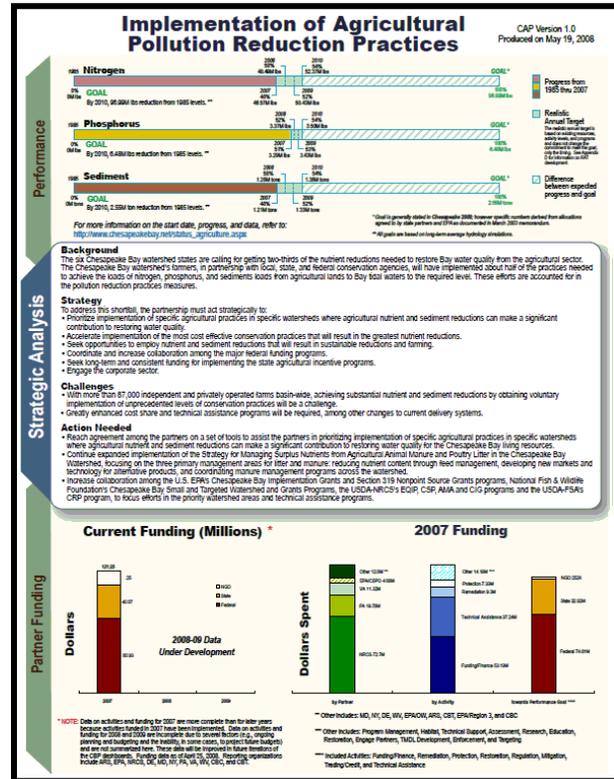
What are the Major Components of Version 1.0 of COAST?

(1) Assess Objectives and Strategies to Improve Water Quality

The “objectives and strategies” component provides users with information about the objectives of the CBP water-quality goal and restoration and protection strategies to achieve that goal. COAST will provide access to:

1. Summaries (“dashboards”) of key information on the goal, performance objectives, and strategies (fig. 2);
2. The CAP strategic framework that identifies implementation strategies the CBP partners will pursue to meet the water-quality goal; and
3. State tributary-specific strategies for reducing nutrients and sediment in each jurisdiction to meet the water-quality goal.

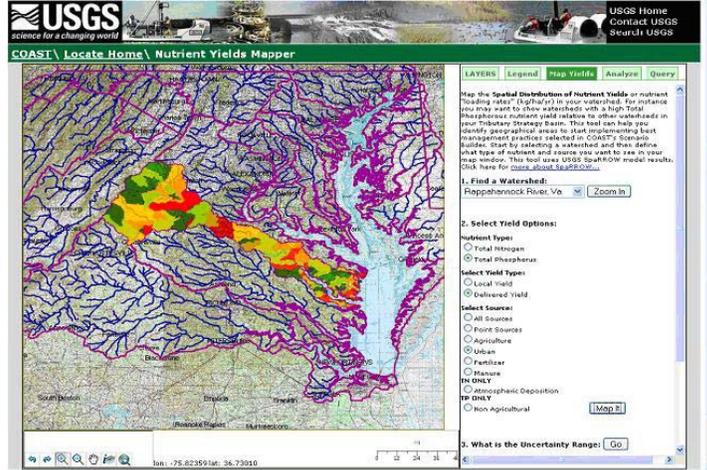
Figure 2 - Dashboards are high-level summaries of key information, developed for managers by the CBP to help better implement and assess program resources.



(2) Select Areas to Enhance Water-Quality Practices

The “select areas” component of COAST provides CBP partners with information on the geographic areas that provide the greatest opportunities to restore and protect water quality in the Bay. Managers can use this information in conjunction with additional information on local water-quality problems to select areas that will benefit both the Bay and help improve local streams. Version 1.0 will focus on mapping nutrient yields related to several CAP “source sectors,” including developed lands, agricultural lands, point-source discharges, and atmospheric deposition. The data used for identifying areas with high nutrient yields in the different “source sectors” are based on SPARROW (SPATIally Referenced Regressions On Watershed attributes) model results (fig. 3) and other information such as impaired waters listings. Information to identify areas for water-quality protection is based mostly on the CBP Resource Lands Assessment, Protected Forest Lands, and outputs from the CBP-USGS land-cover change model.

Figure 3- The prototype Nutrient Yields Mapper (NYM) utilizes statistically sorted data from the USGS SPARROW model (Brakebill and Preston, 2004) to display areas within selected watersheds that exhibit higher than average nitrogen and phosphorus (P) runoff. The map to the right shows the results of a query for a map of total P for the Rappahannock River watershed (highest P yields are designated by red color, lowest by pale green).



Chesapeake Action Plan

ACTIVITY CATEGORIES

Welcome EPA user!

Below, you will find a list of activities for your organization. The activities are organized by pillar and topic area. For additional assistance, click on the Reporting Guidance link at the top right of the screen.

To view existing activities and associated funding information, or add new activities and funding information, then select a Topic Area from the respective dropdown list.

Pillar 1: Restoring Healthy Waters (10 Topic Areas)			
Wastewater Treatment (15 Activities [2008])			
		Topic Area	Activity Category
View/Modify	1	Wastewater Treatment	Monitoring
View/Modify	2	Wastewater Treatment	Assessment
View/Modify	3	Wastewater Treatment	Program Management
View/Modify	4	Wastewater Treatment	Information Management
Pillar 2: Restoring Healthy Habitats (3 Topic Areas)			
Pillar 3: Ecosystem-Based Fisheries Management (7 Topic Areas)			
Pillar 4: Maintaining Healthy Watersheds (3 Topic Areas)			
Pillar 5: Fostering Chesapeake Stewardship (6 Topic Areas)			
Pillar 6: Partnership, Leadership & Management (3 Topic Areas)			

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(3) Identify Partners Activities and Resources

The “identify partner activities and resources” component allows users to learn more about current efforts in geographic areas or source sectors of interest to enhance coordination for implementing management actions. The primary tool for this component will be the CBP activity integration plan, which is designed to be a comprehensive catalogue of CBP partner activities (fig. 4). The catalogue provides information on the activities being implemented, lead partner and cooperating partners, amount and source of funding, and location of each activity.

Figure 4 – The CBP Activity Integration Plan System is a web-based tool that allows CBP partners to view each other’s activities across the watershed with details on where the activity is occurring, how much funding the activity has received, and which partners are involved.

(4) Choose and Implement Practices Needed to Improve Water Quality

The “choose and implement practices” component allows users to identify an optimal suite of practices to improve water quality. The initial version of COAST will provide summaries of management actions and CBP watershed model outputs to assess alternative management scenarios to help select the optimal set of management practices to reduce nutrients. In the future, a web-based interface with the CBP watershed model will be added to this component of COAST to allow testing of different nutrient and sediment scenarios (fig. 5). The interface will enable users to better understand the impact of land-use change, the types and locations of management actions, and help define the factors that reduce loading to the land and reduce water quality impacts.

This interface tool will allow users to explore different scenarios by controlling multiple inputs and variables including:

- Best management practices (BMPs) location, type, and efficiencies.
- Animal population locations and numbers.
- Land use using the CBP-specified 25 land-use categories.
- Crop management parameters, such as fertilizer application rates and tillage practices.

In the future, information on the cost effectiveness of different management actions will be added to this COAST component to help users assess the costs associated with different management scenarios. COAST will also include links to other models and information as they become available.



Figure 5 – The CBP watershed model will have an interface to simulate scenarios of different management actions to reduce nutrients and sediment into the Bay. This will help choose the optimal suite of practices to implement in selected areas.

(5) Monitor change and assess progress.

This component of COAST provides access to monitoring results and environmental indicators to help users assess changes in management actions and water quality and evaluate progress toward restoration objectives. The primary sources of information will be the CBP nontidal and estuarine water-quality monitoring networks and the CBP environmental indicators. Tools are being developed to improve access to results from monitoring programs, such as the water-quality results for the nontidal stations (fig. 5). COAST will provide access to the CBP indicators related to implementation of practices, changes in watershed quality, and estuary water-quality conditions to help assess progress toward implementation and water-quality goals.

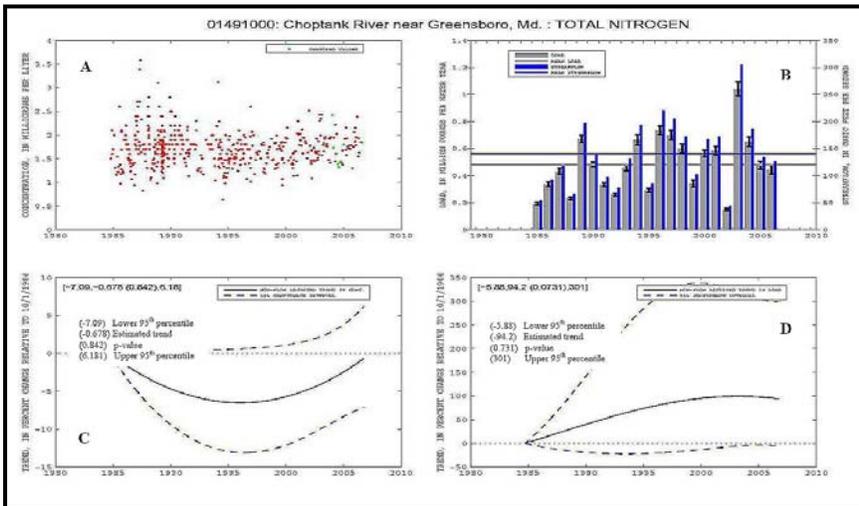


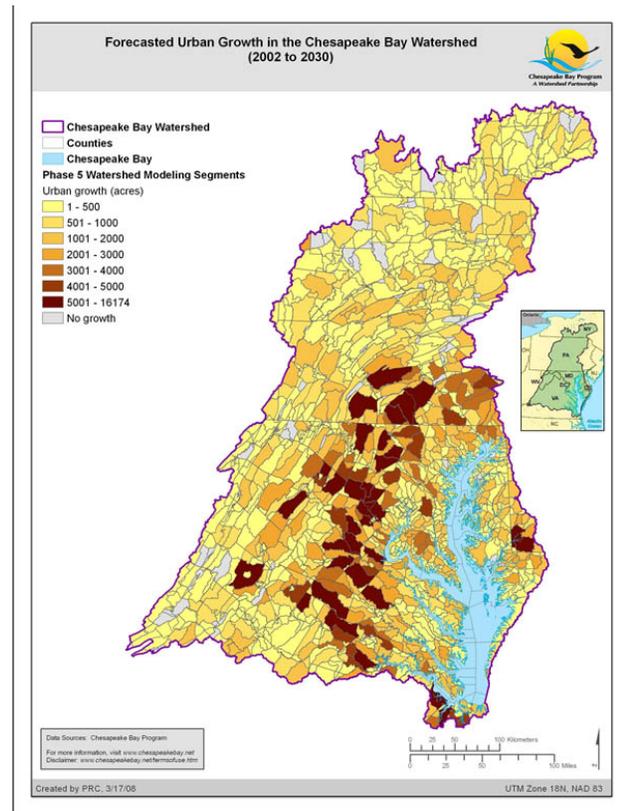
Figure 5 – This figure shows an example of the monitoring trends data that will be retrievable through COAST. The four-panel plot shows trends for total nitrogen at a monitoring station on the Choptank River for the period 1985-2007. Upper left (A) shows the "raw" sample concentration data, upper right (B) shows annual and mean loads and streamflow, lower left (C) shows the continuous non-flow-adjusted trend in

concentration, and lower right (D) shows the continuous non-flow-adjusted trend in load (from Langland and others, 2007).

(6) Evaluate change to adjust actions.

This component will provide a process and information to help decision makers evaluate the factors affecting implementation of management practices and water-quality change to adjust practices and strategies in the future. These factors include land-use and population change (fig. 6), changes in nutrient and sediment sources, implementation of management actions, and information about lag time between management actions and ecosystem response.

Figure 6 – The map to the right shows forecasted urban growth in the Chesapeake Bay watershed from 2002 to 2030. Interpretive maps like this one will help planners anticipate changes in their water quality caused by regional trends in land-cover change.



How is COAST Being Developed?

The COAST is being developed and implemented through a partnership between the U.S. Geological Survey (USGS) and the CBP Office. Test cases to assess the types of decision-support tools, information, and methods of presentation that will be most useful to decision-makers are being conducted. Test cases move the theory of adaptive management into real-world applications by allowing the COAST developers to interact with small groups of decision-makers to determine the best mix of existing information and models to improve their management decisions.

The COAST team began with an agricultural test case because agriculture is the largest source sector contributing nutrients to the Bay. The objectives of the agricultural test case are:

1. To demonstrate at a watershed-wide and state scale how COAST can be used to prioritize where to direct resources, to identify the optimal agricultural nutrient conservation activities, and to determine how to assess their effectiveness.
2. To demonstrate to states and counties how COAST can be used as a starting point from which to engage in a more locally driven analysis to identify and coordinate opportunities for achieving further nutrient reductions in priority agricultural areas.

Version 1.0 of COAST will be updated based on the outcomes of these test cases. The COAST Team is setting up similar test cases for urban and developed lands and forested areas for FY2009; the results of these test cases will be used to update subsequent versions of COAST. In the future, additional test cases will be developed to evaluate how COAST can evolve to better support other CAP goals related to fisheries, habitat, watersheds, and other aspects of water quality (such as contaminants).

What is the Schedule for COAST?

FY2009:

- Refine components of COAST based on test cases and release Version 1.0. (Fall 2008).
- Conduct additional testing with other user groups and refine applications for water-quality restoration and protection components.
- Include information for sediment (SPARROW model results and other information).

- Provide links to selected state and local information and tools.

Long-Term Tasks

- Annually revise COAST with updated monitoring results and environmental indicators.
- Integrate CBP watershed model interface to improve optimization of actions.
- Integrate new model results (such as more recent SPARROW model results).
- Develop tools to estimate costs of different management scenarios.
- Plan, decide, and implement enhancements to COAST to support other aspects (living resources, habitat, and land use) of the CAP (2009-2011).

What are the Challenges and Opportunities? The process of utilizing adaptive-management approaches in the CBP is difficult due to the number of CAP goals (fisheries, habitat, water quality, watersheds, stewardship, and leadership) and the number of partners involved in the effort. Additional models and monitoring would be needed to quantitatively assess the processes and effectiveness of management practices related to watersheds, habitat, and living resources in the 64,299-square-mile Chesapeake Bay watershed. Furthermore, the complex network of Federal, State and local agencies who will be responsible for implementing efforts to meet these goals makes designing a single system, such as COAST, very challenging. The CBP will employ a phased approach to determine the best use of adaptive-management principles for restoring and protecting the Nation’s largest estuary.

Who are the COAST Contacts?

For further information, contact: Scott Phillips, USGS, (swphilli@usgs.gov) or Kelly Shenk, USEPA (shenk.kelly@epa.gov). The current COAST Team is:

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