Scientific and Technical Needs for Fulfilling *Chesapeake 2000* Goals: Priority Needs

2004 Update

Prepared by the Scientific and Technical Advisory Committee
Chesapeake Bay Program

Overarching Theme for STAC's Priority Needs in Support of C2K

A common theme among these priority research needs in support of the ***Chesapeake 2000*** *(C2K)* agreement is a focus on increased understanding of *ecological linkages.* Although there is currently good scientific understanding of many of the individual components of the Bay ecosystem, we will need a deeper and more quantitative knowledge of spatial, temporal and functional linkages among system components to achieve the goals outlined in the *C2K.*

Ecological linkages occur across space and over time via exchanges and transport of water, nutrients, sediments and organisms. Important examples are linkages: 1) among watershed habitats; 2) between watershed and stream; 3) between stream and estuary; and 4) among vital estuarine habitats including wetlands, submerged aquatic vegetation, oyster reefs and open waters. Behavior of the Chesapeake Bay system is also influenced by linkages of nutrients, sediments, and species across watershed and estuary boundaries. Key functional linkages occur via both the trophic interactions that sustain populations of valuable fish and their prey and the biogeochemical processes that regulate water and sediment quality needed for healthy populations of living resources in the Bay. The consequences of these linkages may be readily apparent or emerge only after a period of time. They may dissipate quickly, persist for some time, or create irreversible changes in the watershed, stream, or the estuary.

STAC provides the following recommendations for scientific and technical undertakings that could substantively improve our chances of achieving the ambitious goals outlined in the *C2K* agreement.

Recommendations for Living Resources

<u>Oysters</u>

1. Develop understanding of the ecology of oyster reefs and beds to facilitate restoration and appropriate valuation.
2. Conduct the research required to evaluate potential risks and benefits of introducing a non-native oyster to Chesapeake Bay.
3. Advance husbandry technologies and management strategies in support of commercial fishery.

<u>Exotic Species</u>

1. Develop a fundamental understanding of the relationship between organism supply and invasion success.
2. Improve tracking of sources, establishment, and spread of exotic species.

<u>Fisheries and Fish Management</u>

1. Develop effective monitoring of distribution and abundance of fish resources, and distribution and quantity of harvest activities.
2. Advance knowledge of predator-prey relationships and species-habitat relationships to facilitate multi-species and ecosystem-based fisheries management.

Recommendations for Vital Habitat Protection and Restoration

SAV and Wetland Preservation and Restoration

1. Develop a fundamental understanding of the relationship between landscape pattern and ecosystem function with respect to critical plant communities (SAV and wetlands) and human alteration of the landscape.

Terrestrial Systems: Watersheds and Forests

1. Develop a fundamental understanding of the relationship between landscape pattern and ecosystem function with respect to forests and human alteration of the landscape.

Recommendations for Water Quality Protection and Restoration

Controlling Inputs from Watershed and Air

1. Continue development of low cost, robust, effective technologies for pollutant reduction.
2. Improve understanding of lag time between BMP implementation and measurable improvements.
3. Undertake long-term targeted studies of the impacts of BMPs on sediment, nutrient, and contaminant movement through the watershed to the Bay.

Watershed and Estuarine Monitoring

1. Perform strategic monitoring to validate the model and maintain the land use, atmospheric, and water quality monitoring programs for a period of sufficient length to distinguish longer-term trends, with the objective of improving estimates of uncertainties and variances in atmospheric deposition and impacts on water quality.
2. Improve sediment monitoring to identify sources, and determine impacts on water clarity.
3. Improve monitoring methodologies.

Predictive Modeling of Inputs, Transport, and Ecological Responses

1. Couple existing predictive models and monitoring observations to improve development and refinement of models.
2. Develop a comprehensive sediment transport modeling capability for the watershed and its estuary, supported and informed by appropriate research on processes and patterns.
3. Encourage the development and/or implementation of alternative and innovative modeling approaches.
4. Determine the forces driving land use changes, best management practice implementation, and economic sustainability of resource-dependent activities.

Ecosystem Responses to Input Reductions

1. Investigate nutrient equivalency.
2. Determine the relationships between inputs and living resources.

Recommendations for Sustainable Development and Landscape Management

Modeling and Analytical Tools

1. Make a wide variety of analytical tools and techniques readily accessible to facilitate widespread application of Environmentally Sensitive Site Design (ESSD) and Low Impact Development (LID) practices.

Stormwater Management

1. Improve design and siting of best management practices to control nutrients, sediments, bacteria and toxics, and to approximate predevelopment hydrology.

Stream Corridor Protection

1. Develop economical and cost-effective approaches to protection of biological integrity in streams.