Chesapeake Bay Program
Science. Restoration. Partnership.

Submerged Aquatic Vegetation Outcome

Management Strategy

2015–2025, v.2

I. Introduction

Submerged aquatic vegetation (SAV), or underwater grasses, provide significant benefits to aquatic life and serve critical functions in the Chesapeake Bay ecosystem. Underwater grasses provide food, habitat, and nursery grounds for a number of commercially and ecologically important finfish and shellfish, such as striped bass and blue crabs. They reduce wave energy, which reduces shoreline erosion and also promotes the settlement of suspended solids, improving water clarity. Through photosynthesis, underwater grasses act as a carbon sink by taking in carbon dioxide. This contributes to the reduction of greenhouse gas emissions and therefore ultimately reduces the potential for climate change impacts. Likewise, underwater grasses also produce oxygen, which helps sustain other aquatic life. Increasing the abundance of underwater grasses in the Bay and its rivers will dramatically improve the entire Bay ecosystem.

II. Goal, Outcome and Baseline

This management strategy identifies approaches for achieving the following goal and outcome:

Vital Habitats Goal

Restore, enhance and protect a network of land and water habitats to support fish and wildlife, and to afford other public benefits, including water quality, recreational uses and scenic value across the watershed.

Submerged Aquatic Vegetation (SAV) Outcome

Sustain and increase the habitat benefits of SAV (underwater grasses) in the Chesapeake Bay. Achieve and sustain the ultimate outcome of 185,000 acres of SAV Bay-wide necessary for a restored Bay. Progress toward this ultimate outcome will be measured against a target of 90,000 acres by 2017 and 130,000 acres by 2025.

This outcome was derived by the Chesapeake Bay Program's SAV Workgroup and is based on observed historical SAV abundance and distribution throughout the Bay and its rivers.

Baseline and CurrentCondition

The Bay Program's SAV Workgroup has reviewed the historic record and photographic evidence from the 1930s to present and determined that the Bay has historically supported at least 185,000 acres of SAV. The most critical component for restoring SAV is to achieve the Water Quality Goal (reduce pollutants to achieve the water quality necessary to support the aquatic living resources of the Bay and its tributaries and to protect human health). In most cases, as water clarity improves, SAV will reestablish without the need for planting. However, as the Water Quality Outcomes are met there will be places where water clarity is sufficient but there is no longer a seed source for natural recolonization of SAV. Therefore, the workgroup supports efforts to plant or seed SAV each year in areas of the Bay deemed likely for success. This restoration effort is intended to stimulate natural SAV bed growth to aid in reaching the baywide abundance goal of 185,000 acres. Actively restoring SAV each year will provide future seed sources and improve physical conditions for further SAV recruitment. Additionally, continuous seed bank restoration and planting will encourage the expansion of SAV propagule production facilities, increase expertise among restoration practitioners, and provide opportunities for citizen and student engagement.

SAV constitutes one of the most important biological communities in estuaries. SAV has historically contributed to the high primary and secondary productivity of the Bay, but increased nutrient and sediment inputs in the watershed from World War II onward caused baywide declines in the 1960s and 1970s. Hurricane Agnes in 1972 further stressed the resource. SAV has recovered somewhat since that time in accompaniment with improved watershed nutrient management, but not to historic levels.

Since 1976, the workgroup has served the larger Bay community by providing technical expertise and applied research findings to resource managers in an effort to inform the restoration and protection agenda. Please refer to the Chesapeake Bay Program's site (https://www.chesapeakeprogress.com/abundant-life/sav) for the current status of SAV abundance.

III. Participating Partners

Team Lead: Vital Habitats Goal Team

Workgroup Lead: Submerged Aquatic Vegetation Workgroup

- SAV Workgroup chair
  - Prepare biennial workplan and management strategy
- SAV Workgroup
  - *Implement* **Strategy to Accelerate the Protection and Restoration of Submerged Aquatic Vegetation in the Chesapeake Bay, the biennial workplan, and the SAV management strategy**
  - *Produce and publish* **Submerged Aquatic Vegetation Habitat Requirements and Restoration: A Third Technical Synthesis**

Opportunities for Cross-Goal Team Collaboration:

- Fisheries Goal Team
- Water Quality Goal Team
- Black Duck Action Team (Habitat Goal Team)
- Maintain Healthy Watersheds Goal Team

Participating agencies **(Signatories in bold)**

Level of Participation: High:

- **Maryland Department of Natural Resources**
  - Chairs SAV Workgroup and coordinates SAV Workgroup efforts
  - Conducts SAV monitoring and research, collaborates with CBP partners to conduct research
  - Financially supports baywide SAV Survey
  - Utilizes SAV data for project reviews requiring permits and/or mitigation when those projects impact SAV habitat.
- Virginia Department of Environmental Quality
  - Financially supports baywide SAV Survey
  - Utilizes SAV data for permits required for mitigation if a project impacts existing SAV beds or historic SAV presence.
  - Additionally uses SAV data for project planning and to evaluate the value and function of shallow water habitats.
- **D.C.'s District Department of the Environment**
  - Conducts SAV research
- **U.S Environmental Protection Agency**
  - Financially supports baywide SAV Survey and SAV research projects
- U.S. Army Corps of Engineers
  - Utilizes SAV data for permits required for mitigation if a project impacts existing SAV beds or historic SAV presence.
  - Uses SAV data for project planning and to evaluate the value and function of shallow water habitats.

- **Virginia Institute of Marine Sciences**
  - Conducts and financially supports baywide SAV survey
  - Conducts SAV research
- University of Maryland/University of Maryland Center for Environmental Science (UMCES)
  - Conducts SAV research
- Smithsonian Environmental Research Center
  - Conducts SAV research
- St. Mary's College
  - Conducts SAV research
- Old Dominion University
  - Conducts SAV research

Level of Participation: Medium:

- U.S. Fish and Wildlife Service
- U.S. Geological Survey
  - Conducts surveys
- National Oceanic and Atmospheric Administration
- Baltimore County (past participant in surveys)

Likely Participating Jurisdictions:

- **Maryland**
- **Virginia**
- **Washington, D.C.**

Likely Participating Federal Partners:

- Fish and Wildlife Service
- National Oceanic and Atmospheric Administration
- U.S. Geological Survey
- U.S. Army Corps of Engineers

Local Engagement

Non-profit groups, such as the Chesapeake Bay Foundation, have been historically involved in education and outreach regarding SAV, as well as active SAV restoration projects in partnership with schools and state and local agencies. However, funding cutbacks and historic difficulty in achieving long-term success in direct restoration resulted in a decreased focus on implementation. As water clarity improves, focus will return to active restoration efforts. Other non-profits, such as local watershed organizations and Riverkeepers, are also playing an active role in the SAV Workgroup and contributing to SAV restoration efforts as well as education and outreach.

IV. Factors Influencing Success

Many factors, both natural and anthropogenic in origin, with wide-ranging levels of importance and management potential, influence the attainment of SAV goals. A thorough understanding of these factors is essential to promote natural recovery of SAV and SAV restoration success.

1. Habitat Conditions

High-quality habitat conditions are vital to the success of SAV recovery and restoration efforts. Good quality habitat conditions for SAV are defined by shallow water (2 meters or less) with sufficient water quality and appropriate salinity for the species being targeted for restoration. For example, eelgrass grows in the high-salinity waters of the lower Bay, while sago pondweed prefers the brackish waters of the mid-Bay. Most important, water clarity is necessary for productive SAV habitat. Water clarity varies primarily as a function of precipitation (as it affects run-off and consequently sediment and nutrient pollution entering the Bay). Additionally, bottom disturbance and herbivory by waterfowl may limit the success of active restoration efforts. While these factors are difficult to control directly, the workgroup supports targeted restoration projects in areas of the Bay with suitable habitat conditions and a likelihood for success.

Additionally, the Bay is considered at high-risk for sea level rise and increased water temperatures from climate change, which will influence SAV habitat conditions. Climate change and sea level have little management potential at the local scale. The SAV Workgroup, however, advocates for management approaches that alleviate the impact from some climate stressors (i.e. minimize shoreline hardening/modification to allow inland migration of SAV as water levels increase). Also, heat-tolerant, lower-light tolerant, and canopy-forming SAV species can be used in restoration efforts if it is anticipated that impacts associated with climate change will affect a particular restoration site.

2. Human Impacts

Anthropogenic activities, including dredging, propeller scarring, fishing and aquaculture practices, as well as the introduction of invasive species and marine debris, can cause direct physical disturbance to SAV. Indirect impacts from localized water quality degradation associated with activities such as shoreline alteration, sedimentation from changes in land use, or in-water activities like clam dredging, also influence the health of SAV beds. Additionally, public perception of SAV affects its health: during periods of SAV recovery and high abundance, some members of the public perceive it as a nuisance and consequently take measures to deter its growth or directly remove it. Human activities can be managed through education, outreach, and regulation.

3. Protection of Existing and Recovering SAV

Effective and enforceable regulations are necessary to adequately protect SAV. The adequate protection of existing and recovering SAV is necessary to reach the 185,000-acre baywide SAV restoration goal. As new threats and conflicts (e.g. oyster aquaculture, climate change impacts, SAV harvesting) emerge simultaneously with recovering SAV populations (from improvements in water clarity resulting from improved watershed nutrient management plans), the efficacy of existing regulations may diminish.

4. SAV Restoration and Science

There are a number of reasons to actively restore SAV, but active restoration of SAV by planting whole plants or seeds is a multi-step, labor-intensive, and expensive venture, and success is based on a number of factors, including appropriate site selection. Ecosystem modeling can aid in the site-selection process and can be advantageous for a number of habitat restoration applications, but the current version of the Chesapeake Bay Shallow Water model does not work well for SAV because of limited nearshore habitat quality and bathymetry data. As such, SAV restoration planning in the Bay also involves extensive site-visits and habitat suitability determination that contributes to the overall effort involved.

Additionally, limited information is available regarding the habitat requirements of seedlings as compared to mature SAV populations. Evidence does suggest, however, that SAV seedlings require better water clarity than mature plants, so SAV restoration in areas that otherwise meet SAV habitat requirements will not necessarily be successful. Also to consider regarding restoration science is the role that genetics play. It has only been recently recognized that a plant's genetic adaptation to a certain habitat or set of conditions may be an important factor for restoration success. As such, past SAV planting and seeding efforts in the Bay saw limited success. As water quality has improved with improved watershed nutrient and sediment management plans, however, small-scale efforts to actively restore SAV have been more successful.

Unfortunately, even in ideal habitat conditions with reduced human impacts, the limited availability of source seeds, plants, and propagules (from laboratories, nurseries, and wild collection), as well as the minimal availability of funding for restoration projects and restoration science research, has limited the SAV Workgroup and its partner's ability to implement expansive SAV restoration projects.

5. SAV Monitoring

Annual baywide SAV monitoring is essential to reaching the 185,000 acre SAV restoration goal. Annual monitoring data allow for adaptive management of SAV throughout the Bay should it become necessary, and it is the only way to show with certainty that efforts to protect and restore it are effective. The protection of existing SAV is, likewise, only possible with monitoring and distribution data, and is a priority management strategy for increasing and sustaining the habitat benefits of SAV in the Chesapeake Bay. For example, the annual SAV survey shows when activities like propeller dredging, clamming, aquaculture, and shoreline or near-shore development are negatively impacting SAV. In response, management and enforcement agencies are able to react in a relatively timely manner before extensive damage can be done. Additionally, long-term annual monitoring data facilitate trends analyses and synthesis work and reveal additional research needs.

V. Current Efforts and Gaps

While there are numerous factors influencing the success of SAV recovery and restoration throughout the Bay, extensive efforts are being made to address those factors and to identify what additional efforts and actions are necessary to reach the 185,000 acre SAV restoration goal.

1. **Habitat Conditions**

   Successful recovery and restoration of SAV in the Bay are dependent upon improved water clarity conditions. Water clarity improvements are being made by meeting pollutant allocations set by the Chesapeake Bay TMDL, and through the work of the Water Quality and Maintain Healthy Watersheds Goal Implementation Teams.

   In 2015, an estimated 92,315 acres of SAV were present in the Bay based on imagery collected and maps created from the annual SAV survey. SAV coverage increased from 97,668 acres in 2016 to an estimated 104,843 acres in 2017. Currently, SAV in the Chesapeake Bay is achieving 57 percent of the 185,000-acre goal. Recent increases in SAV may be attributed to the Chesapeake Bay TMDL and concurrent improvements in water clarity.

2. **Human Impacts**

   Regardless of the multiple ecosystem services that SAV provides, the consequences of the loss of those services in exchange for other uses, such as aquaculture or living shorelines, is not thoroughly understood and anthropogenic activities continue to directly and indirectly impact SAV recovery throughout the Bay. In an effort to educate the public about the benefits of SAV, in an attempt to reduce conflict and improve the public's perception of SAV, the SAV Workgroup works with the CBP communications team on annual press releases of SAV acreage and goal-attainment and produces SAV-related web content throughout the year.

3. **Protection of Existing SAV**

   All Bay states have regulations in place that protect existing SAV but it is unclear if those regulations will adequately protect SAV as it recovers throughout the Bay.

4. **SAV Restoration and Science**

   CBP Partner scientists and others in the region are currently conducting research in the fields of SAV biology, ecology, genetics, restoration, and regarding the impacts of climate change on SAV, but because limited funding is available for SAV research, extensive gaps in our knowledge base remain. Additionally, although research is being conducted, it is not immediately available to the public or SAV workgroup members, so is not always considered when making research-related or management decisions.

5. **SAV Monitoring**

   Because of the importance of collecting long-term SAV monitoring data for management purposes and because of the citizen outreach opportunities it provides, SAV Workgroup members engage in a variety of SAV monitoring activities annually. These activities include the baywide SAV survey, which is chronically under-funded.

VI. Management Approaches

The Partnership will work together to carry out the following actions and strategies to achieve the SAV outcome. These approaches seek to address the factors affecting our ability to meet the goal and the gaps identified above.

The following four strategies have been identified as critical to the success of SAV restoration goals.

1. **Support Efforts to Restore Water Clarity in the Chesapeake Bay**
   In order to meet current and future SAV restoration goals, it is essential to meet water clarity standards in areas and at depths that are designated by Maryland, Virginia, and the District of Columbia for the application of those criteria (i.e., SAV shallow water use). The water clarity standards reflect the light requirements that are necessary for the growth and maintenance of SAV populations throughout the shallow waters of the Chesapeake Bay and its tidal tributaries. This strategy is being implemented by meeting pollutant allocations set by the Chesapeake Bay TMDL and through the work of multiple Chesapeake Bay Program groups, including the Water Quality Goal Implementation Team and the Healthy Watersheds Goal Implementation Team.

2. **Protect Existing Submerged Aquatic Vegetation in the Chesapeake Bay**
   Protect existing SAV by supporting efforts to characterize threats and develop protection measures, establish protection area criteria, minimize the effects of invasive species, evaluate SAV protection laws and regulations, and increase understanding of the potential effects of sea-level rise and other climate-change impacts on SAV populations. Protecting existing SAV beds will also help ensure continued seed and propagule sources for natural recovery.

3. **Restore Submerged AquaticVegetation in the Chesapeake Bay**
   Support efforts to restore SAV where possible, targeting sites with suitable water quality and high potential to benefit living resources.

4. **Enhance Research, Citizen Involvement, and Education and Outreach in the Chesapeake Bay Watershed**

   Support research that advances our understanding of SAV restoration, recovery, and resilience and track advancements in knowledge of SAV biology, ecology, genetics, and the effects of climate change. Expand efforts to educate the public about the critical importance of SAV, and include citizen scientists and volunteers in SAV monitoring efforts.

VII. Monitoring Progress

Monitoring programs are critical to understanding year to year fluctuations in living resource distribution and abundance. SAV distribution is assessed using annual aerial surveys, and abundance acreage is derived from photographs taken during the aerial survey. Continued annual baywide monitoring is the top funding priority for SAV resource management as it provides information vital to managing water quality. The most recent SAV distribution data and survey-related information are available at the Virginia Institute of Marine Science website.

VIII. Assessing Progress

In 2017, there were an estimated 104,843 acres of SAV in the Chesapeake Bay, achieving 57 percent of the 185,000-acre goal.

Increased resources and capacity for SAV and water clarity restoration are required to hasten progress toward this goal. Please refer to the Chesapeake Bay Program Underwater Bay Grass Abundance site (http://www.chesapeakebay.net/indicators/indicator/bay_grass_abundance_baywide) for the current status of bay grass abundance by segment, and areas where the most progress needs to be made.

Lessons Learned

1. Fiscal –

   Funding for the annual baywide SAV survey has become increasingly unstable for the last several years. As such, the SAV Workgroup is working to both streamline the survey to decrease costs and find new, more permanent funding sources. Without funding, monitoring products (e.g. SAV maps and acreage numbers for each Chesapeake Bay segment) that managers depend on will not be available or will be reduced in ways that make regulatory changes necessary. A new action in the 2018-2020 SAV Workplan reflects the SAV Workgroup's partnership with the CBP Budget and Finance Workgroup and the subsequent development of a financing strategy report with recommendations and guidance for creating a sustainable funding source.

2. Policy –

   As SAV recovers in areas throughout the Bay, there are increasing instances of shallow water use conflicts and current regulations may not be sufficient to protect SAV to the extent necessary to reach our 185,000 acres SAV-restoration goal. A new action in the 2018-2020 SAV Workplan reflects the efforts of an SAV Goal Implementation Team funded project to review current SAV statutes and regulations and make recommendations for increased protection where necessary.

3. "Less is more" approach -

   Many of the actions in the 2016-2018 SAV Workplan were being conducted by workgroup members and partners but were not actions that the CBP or SAV Workgroup funded or had actual control over (ie. academic research projects). Consequently, in the 2018-2020 Workplan and updated SAV Management Strategy, the language was changed from phrases like "the SAV Workgroup is doing this" to "the SAV Workgroup is tracking this" or "the SAV Workgroup supports efforts to do this."

IX. Adaptive Management

The partnership will use the following approaches to ensure adaptive management:
The SAV Workgroup will meet each year to track progress toward the 185,000- acre goal, as well as share progress and discuss any new challenges or opportunities. The workgroup will use this time to review performance assessment information and adjust management strategies if appropriate. As new issues are identified, the workgroup will collectively develop strategies to overcome barriers to restoration, as well as identify trends, priority areas, and research needs.

X. Biennial Workplan

Biennial workplans for each management strategy will be revised every 2 years. It will include the following information:

- Each key action
- Timeline for the action
- Expected outcome
- Partners responsible for each action
- Estimated resources