

# The Susquehanna Flats are home to the largest and most diverse submerged aquatic vegetation (SAV) bed in Maryland.

# **Executive Summary**

Although mprovements

The Susquehanna Flats are home to the largest and most diverse SAV bed in Maryland. Although SAV abundance has fluctuated over the decades, it responded to Chesapeake Bay-wide improvements in water quality and exceeded the restoration goal of 12,149 acres for this segment in 2008, 2009 and 2010 before it was negatively impacted by Tropical Storm Lee in 2011. Sediment and nutrient loading from the Susquehanna River pose a risk to the system, but bed size, density and diversity will promote resilience to those stressors. Filamentous green algae and *Lyngbya* has also become a concern in this region as well, but more research is necessary to determine the scope of the problem.





## Goal - Attainable

The goal of 12,149 acres is attainable and was achieved from 2008-2010, following a decade of improving water quality.

## **Historical Coverage**

#### Changing patterns

The Susquehanna Flats once provided premier habitat for both resident and migratory waterfowl because of its dense and diverse abundance of SAV, which was documented in herbarium collections from as early as 1870. Herbarium specimens indicate that redhead grass, sago pondweed, wild celery, common waterweed and hornwort were all present between 1870 and 1900. In the 1950s-1970s, additional data from ground surveys indicate that diversity increased to include milfoil, naiads and muskgrass, with milfoil the dominant plant on the Susquehanna Flats in the late 1960s and early 1970s. Tropical Storm Agnes negatively impacted SAV throughout the Bay in 1972, however, and SAV remained fairly widespread but sparse for the next several decades here. At the onset of the Bay-wide aerial survey in 1984, SAV covered more than 5,000 acres of the Susquehanna Flats, but remained sparsely populated over much of that space. Transplant efforts helped restore native species and SAV has expanded in both distribution and density in recent years following Bay-wide improvements in water quality. The SAV restoration target was exceeded in 2008, 2009 and 2010, but in 2011, Tropical Storm Lee reduced SAV cover on the Susquehanna Flats by nearly half again. Recovery has been rapid since then, and in 2016, more than a dozen species were documented on the Susquehanna Flats, including wild celery, water stargrass, hornwort, milfoil, hydrilla, muskgrass and several species each of naiads and pondweeds.

#### **Key Events**

#### Tropical Storms Agnes and Lee

SAV was experiencing a general decline in abundance throughout the Bay in the 1960s and early 1970s when the region was hit by Tropical Storm Agnes in 1972. Agnes caused an extreme runoff event that resulted in the loss of most remaining SAV in the upper Bay. Following the resurgence of SAV in the region, Tropical Storm Lee led to another dramatic decline of SAV in September 2011. The impact from Tropical Storm Lee was compounded by an inundation of sediment, nutrients and debris spilling over from behind the Conowingo Dam that caused excessive turbidity, burial and scour of the plants on the Susquehanna Flats. Recovery, however, has been rapid in the years since.

#### Vulnerability/Resilience

#### Conowingo Dam and turbidity; resilience from bed size, density and diversity

SAV on the Susquehanna Flats will remain vulnerable to sediment and nutrient influx from the Susquehanna River and Conowingo Dam, but the size, density and diversity of species on the bed itself makes it a highly resilient system. The plants on the outer rim of the main central bed appear to serve as guardians of the plants at the bed's interior. The outer rim is composed of dense, bushy species, frequently observed with an abundance of epiphytes and sediment attached to the leaf blades. This indicates that those plants are efficiently filtering the water column, reducing the prevalence of turbidity over the interior of the bed. Thanks to the protection provided by the outer bed plants, that central population persists during extreme weather events and high flows and facilitates recovery in the years following.

#### Expansion of filamentous green algae and Lyngbya

Several species of filamentous green algae as well as *Lyngbya*, an invasive cyanobacteria that thrives in warm, nutrient-rich water, have become prevalent components of the Susquehanna Flats SAV bed in recent years. These nuisance species grow on the substrate and also loosely attach to SAV blades, but as they decompose, they form dense, floating mats on the surface of the water, shading the SAV below. In other regions of the world, *Lyngbya* has been known to decrease SAV density, but it has not been found to negatively impact SAV on the Susquehanna Flats to date. Some species of *Lyngbya* produce toxins that cause dermatitis, but additional research is needed to determine which species of *Lyngbya* are present on the Susquehanna Flats.

#### **Management Implications**

#### Sediment and nutrient reductions; filamentous green algae and Lyngbya

There are two major issues that will influence the continued abundance and diversity of SAV in this region: sediment and nutrient loading, and the expansion of *Lyngbya* and filamentous green algae. All efforts should be made to reduce sediment and nutrient loading from the Susquehanna River to ensure SAV persistence in this region. A reduction in nutrient loading would likely also decrease the prevalence of *Lyngbya* and filamentous green algae. More research is needed to determine if these nusiance species will impact SAV abundance and density in the long term, and if the species present are those that produce toxins and/or have other ecosystem impacts.

#### References

Stevenson and Confer 1978; Bailey et al. 1978; Orth and Moore 1983, 1984; Dennison et al. 1993; Moore et al. 2000, 2004; Kemp et al. 2005; Orth et al. 2010a, 2017; Patrick and Weller 2015; Gurbisz et al. 2016, 2017; Lefcheck et al. 2018 www.vims.edu/bio/sav/SegmentAreaChart.htm (abundance data) www.vims.edu/bio/sav/maps.html (species information) www.eyesonthebay.org (Maryland water quality data)