



*2021 Coastal Habitat Protection Plan:  
Priority Habitat Issue – Submerged Aquatic Vegetation Protection and  
Restoration with a Focus on Water Quality*

*DEPARTMENT OF ENVIRONMENTAL QUALITY*

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# *Submerged Aquatic Vegetation (SAV) in North Carolina*

Habitat Protection and Restoration

## What is the story with SAV in North Carolina?

- Why is it important?
- What is the history?
- What happened?
- How much do we want?
- How do we get there?
  - Recommended Actions



Photo credit: Martha's Vineyard Gazette



# *Submerged Aquatic Vegetation (SAV) in North Carolina*

## Habitat Protection and Restoration

### Why is SAV important?

- Provides habitat for animals
- Stabilizes sediment and shoreline
- Reduces wave energy
- Improves water quality and clarity
- Sequesters carbon
- Increases coastal community and ecosystem resilience



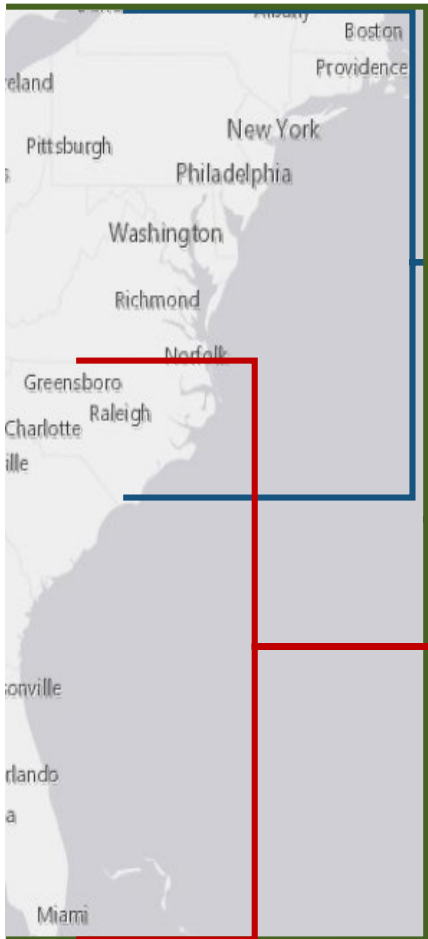
Photo Credit: Jay Fleming/Getty Images



# Types of SAV in North Carolina

High salinity (>10 ppt)  
“seagrasses”

Low salinity ( $\leq 10$  ppt)  
freshwater grasses



**Eel Grass**  
*Zostera marina*



**Shoal Grass**  
*Halodule wrightii*



**Widgeon Grass**  
*Ruppia maritima*

**Wild Celery**  
*Vallisneria Americana*



Photo Credit: USGS

**Sago Pondweed**  
*Stuckenia pectinata*



Photo Credit: UPL Aquatics

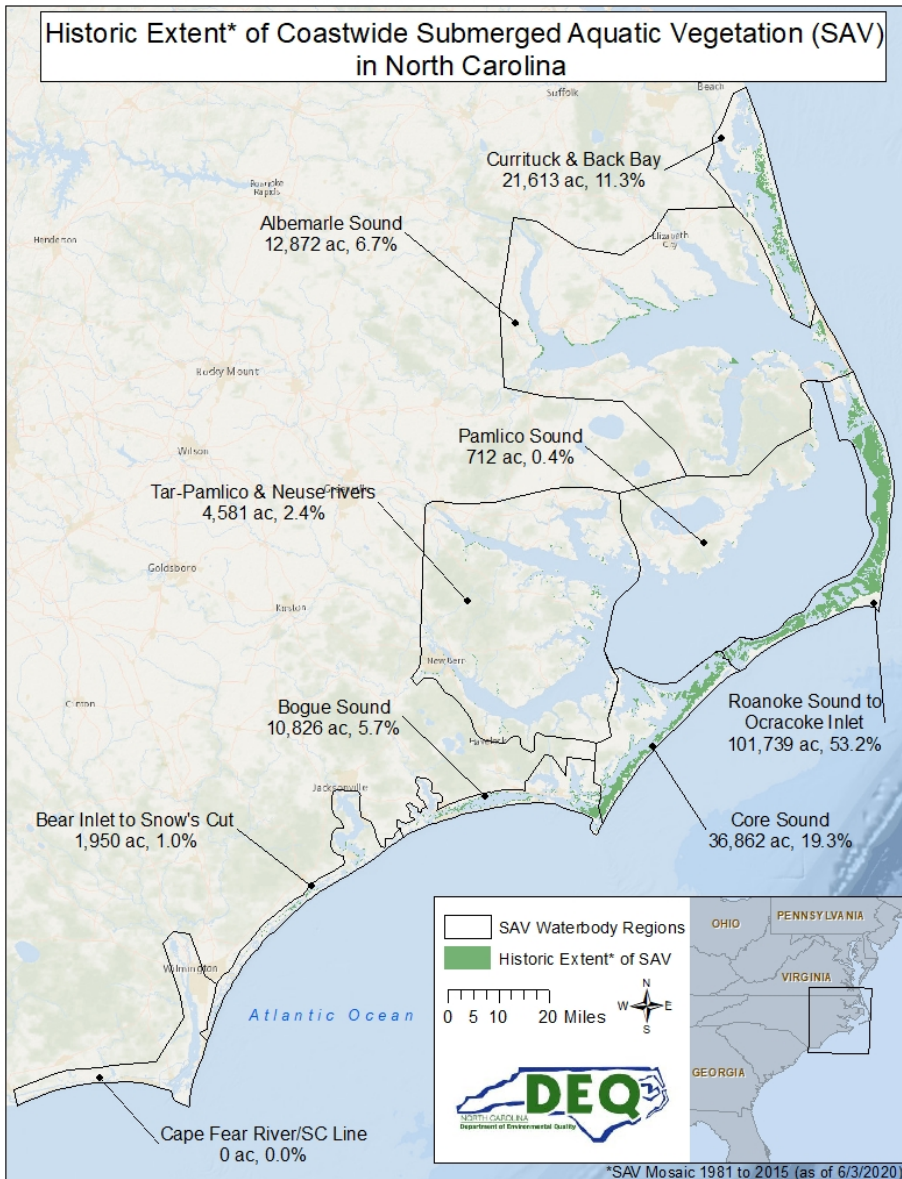
**Eurasian watermilfoil**  
*Myriophyllum spicatum*



Photo Credit: MSAPMS

And many more  
(freshwater grasses)...

# What is the history of SAV in North Carolina?



Salinity Zone	SAV Region Name	Historic Extent* (ac)	Percent of Historical Extent* (%)
Low	Currituck Sound and Back Bay	21,613	11.3
Low	Albemarle Sound	12,872	6.7
Low	Tar-Pamlico & Neuse rivers	4,581	2.4
High	Pamlico Sound	712	0.4
High	Roanoke Sound to Ocracoke Inlet	101,739	53.2
High	Core Sound	36,862	19.3
High	Bogue Sound	10,826	5.7
High	Bear Inlet to Snow's Cut	1,950	1.0
High/Low	Cape Fear River to SC line	0	0.0
<b>Total</b>		<b>191,155</b>	<b>100.0</b>

\*SAV Mosaic 1981 to 2015 (as of 6/3/2020)

Online Map: <https://arcg.is/08bSij0>

# APNEP Indicator Report: Extent of Submerged Aquatic Vegetation, High-Salinity Estuarine Waters (SAV Monitoring & Assessment Team, in review)



North Zone = - 5.98%

Central Zone = - 2.67%

South Zone = - 10.38%

# Submerged Aquatic Vegetation (SAV) in North Carolina

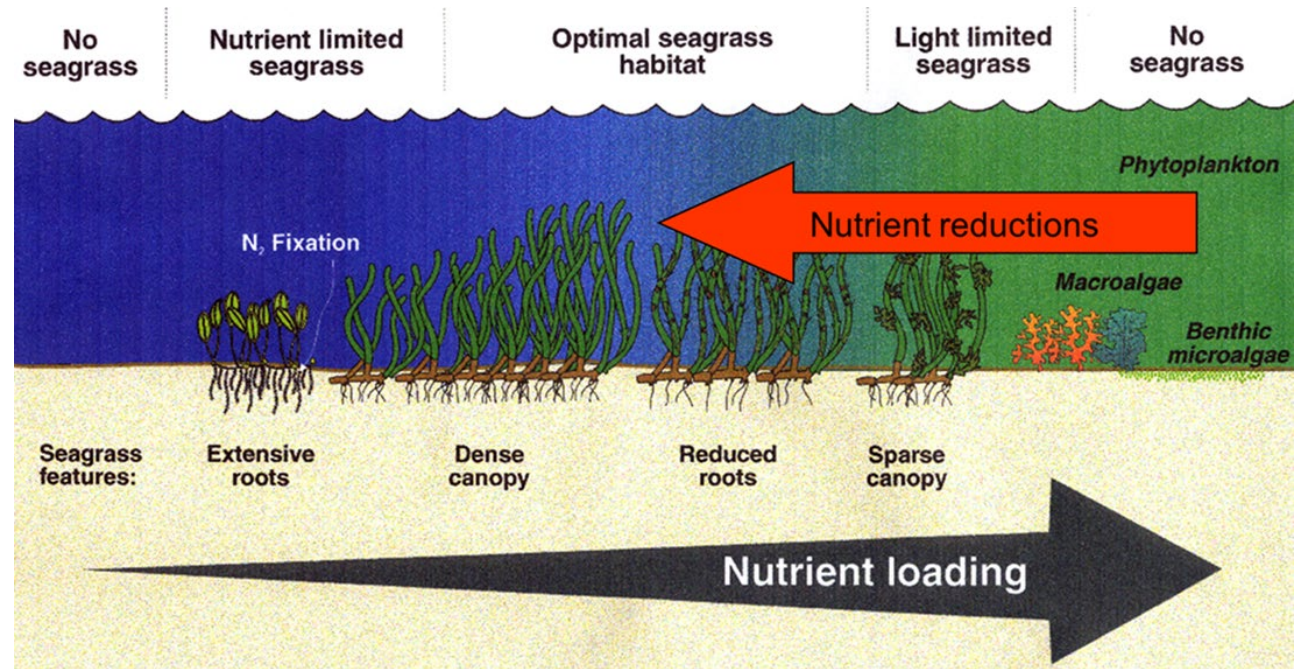
## Habitat Protection and Restoration

### What happened to the SAV?

- Water quality!!!
  - ↑ nutrients = algal blooms ☹️
  - ↓ water clarity



Photo Credit: DWR



# Submerged Aquatic Vegetation (SAV) in North Carolina

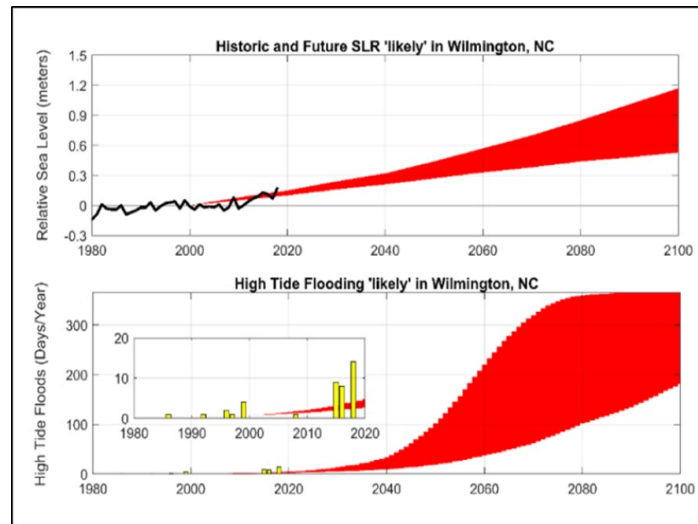
## Habitat Protection and Restoration

### And also...

- Direct physical disturbance
  - Dredging, docks/marinas, fishing gear, mariculture, & prop scarring
- Climate change
- Chemical controls
- Pathogens



Photo credit: FL FWCC.



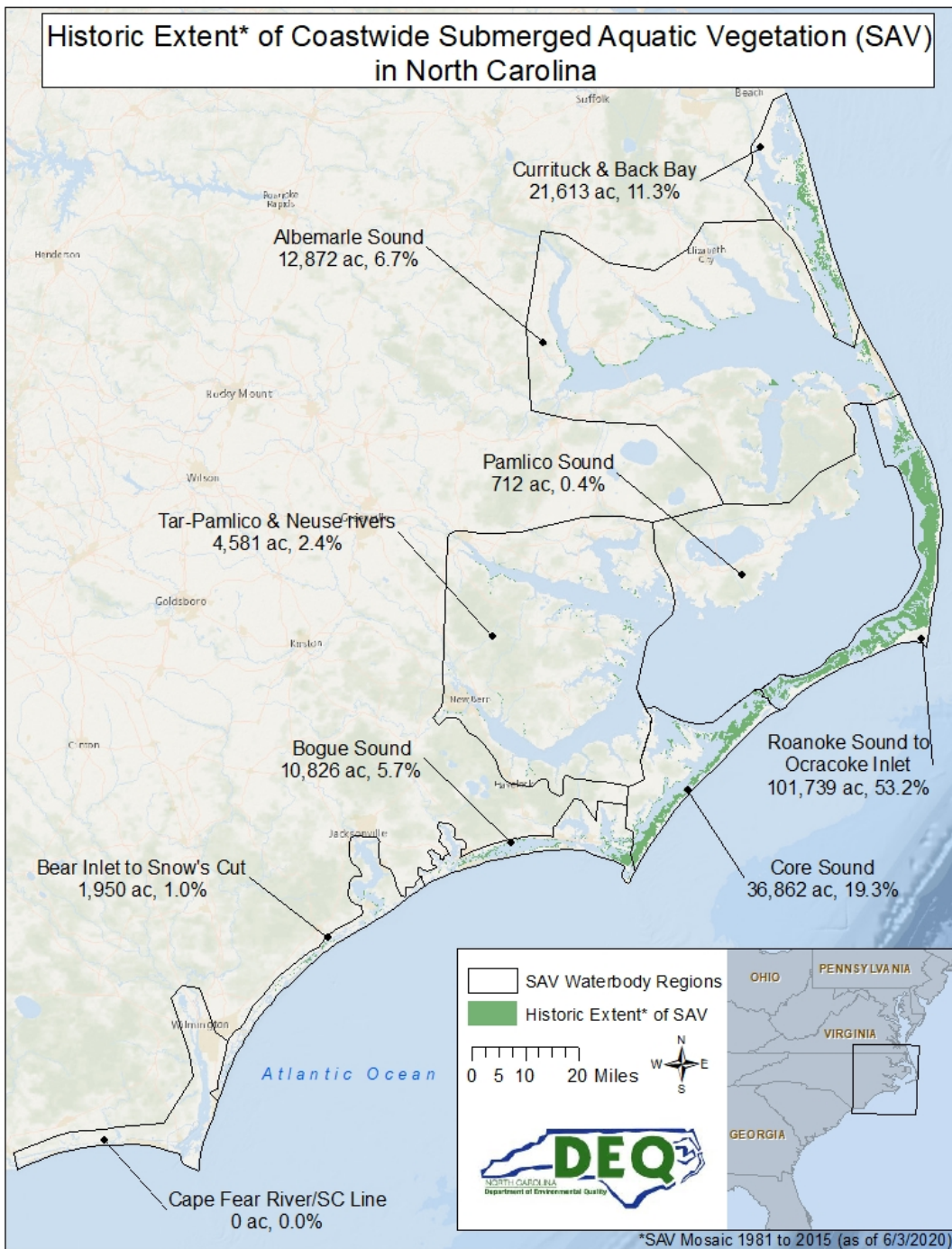
Kunkel et al. 2020



Photo credit: A&B Aquatics







How much SAV do we want in North Carolina?

As much as we have had in the past!

**191,155 acres**

Online Map: <https://arcg.is/08bSij0>

# *Submerged Aquatic Vegetation (SAV) in North Carolina*

Habitat Protection and Restoration

## How do we reach our SAV acreage goal?



Photo Credit: APNEP

- Support water quality improvement efforts
- Enhance SAV research and monitoring
- Improve collaboration
- Protect and restore



# Set SAV Acreage Goals



Determine Percent Light Needed  
(PAR attenuation)



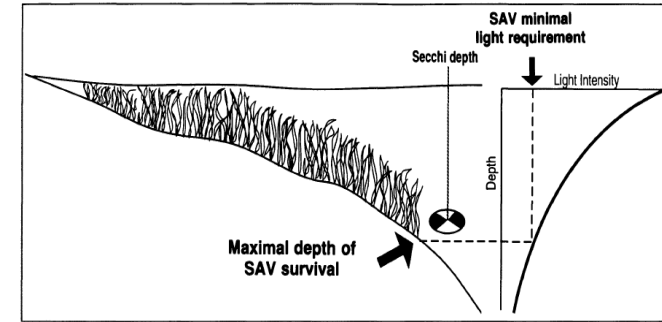
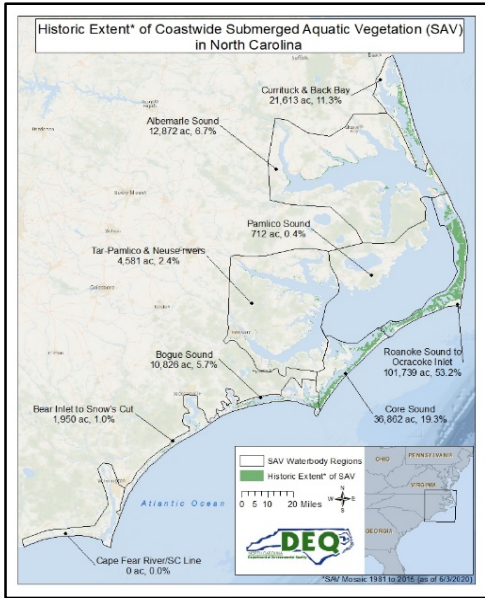
Set chlorophyll *a* concentration target  
(optical model)



Set nutrient load/concentration targets  
(interim nutrient criteria)



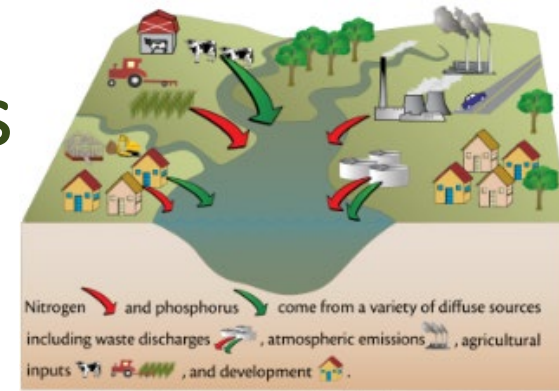
Determine contributions by source/location in watershed



Dennison et al. 1993



Photo Credit: DWR



Lane et al. 2007

# Recommended Actions

## Protection and restoration of SAV through water quality improvements

1. By 2021, commit to protecting and restoring SAV to reach an interim goal of 191,155 acres coastwide based on the known historical extent of SAV in NC (1981-2015), with specific targets by SAV waterbody regions for the purpose of assessing and reporting progress.
2. By 2021, based on known SAV requirements for growth and reproduction, adopt a light penetration target of 22% to the deep edge of SAV for high salinity SAV waterbody regions and a light penetration target of 13% to the deep edge for low SAV waterbody regions.

# Recommended Actions

## Protection and restoration of SAV through water quality improvements

3. By 2021, adopt scientifically based chlorophyll *a* targets for high salinity SAV waterbody regions based on SAV requirements for growth and reproduction.
4. By 2021, adopt scientifically based chlorophyll *a* targets for low SAV waterbody regions based on SAV requirements for growth and reproduction.
5. By 2021, investigate and determine quantitative linkages between chlorophyll *a* concentrations, nutrient loads, and sources throughout the SAV waterbody regions.

# Recommended Actions

## Protection and restoration of SAV through water quality improvements

6. By 20XX, through the NCPD, develop scientifically defensible nutrient criteria to protect or restore ~12,900 acres of low salinity SAV habitat in the Albemarle Sound SAV waterbody region and related designated uses, and begin adoption of nutrient criteria into water quality standards through the rule making process.
7. By 2021, work with DMS and DWR, watershed planners, and the local governments to develop watershed restoration plans that protect, restore or replicate natural hydrology through natural and nature-based solutions in order to maintain healthy SAV, good water quality, healthy fish habitats, and additional co-benefits at a local watershed level.

# Recommended Actions

## Protection and restoration of SAV through water quality improvements

8. Within SAV waterbody regions, work with DWR, DEMLR, and Soil and Water Conservation to increase the use of BMPs for that region within five years.
9. Cultivate and organize the leadership, partnerships, and pathways that are necessary to develop progressively refined, effective and efficient strategies for protecting and restoring SAV and associated water quality.
10. Continue to protect SAV from fishing activity disturbances by participating in the development of Fisheries Management Plans and from development activity disturbances through the review of CAMA permit applications.

# Recommended Actions

## Protection and restoration of SAV through water quality improvements

11. Continue to promote the protection and restoration of floodplains, wetlands, and all coastal habitats through restoration planning with consideration to climate change and community resilience.
12. Use local, state, and federal pathways to develop policies that encourage and incentivize the conservation and restoration of SAV.
13. In conjunction with the recommended actions of the CHPP 2021 Environmental Rule Compliance to Protect Habitat issue paper, improve enforcement of existing regulations that pertain to protecting water quality and preventing habitat loss.



# Recommended Actions

## Monitoring Needs

1. By 20XX, using the best available technologies, implement a full scale mapping and monitoring assessment program, conduct coastwide SAV mapping at regular intervals (>5 yrs apart) in order to quantitatively evaluate SAV distribution and abundance in NC over time, provide scientific basis for future protection and restoration goals, and support recommended water quality actions.
2. By 20XX, establish coastwide sentinel sites with annual monitoring and reporting requirements, including species composition, biomass and distribution, to assess impacts and changes over time, providing a scientific basis for future projections of impacts including those due to climate change.

# Recommended Actions

## Monitoring Needs

3. By 20XX, expand the DWR ambient water quality monitoring to include additional stations and water quality parameters such as CDOM, especially in Pamlico and Albemarle sounds, and integrate with other existing water quality data sources, including DMF programs and others.

## Research Needs

1. By 20XX, acquire necessary data and develop a hydrodynamic model for Albemarle and Pamlico sounds to determine, under normal and high rainfall conditions, the loading and sources of nutrients and sediments and their effect on water quality and SAV.

# Recommended Actions

## Research Needs

3. By 20XX, obtain more accurate estuarine bathymetry data to inform future SAV protection and restoration goals.
4. Continue to investigate the impacts of agricultural practices on water quality and assess changes in land use to recommend best management practices that would benefit the water quality in the surrounding watershed.

## Education, Outreach, and Citizen Science

1. By 20XX, develop public education and stewardship programs with social marketing campaigns to increase the public awareness of SAV and its importance as fish habitat with numerous co-benefits, and the commitment to SAV conservation.

# Recommended Actions

## Education, Outreach, and Citizen Science

2. Work with local governments and NGOs to develop ways to incorporate voluntary monitoring of water quality and SAV through the use of citizen groups, coalitions, river keepers, etc.
3. Incorporate SAV protection and restoration into the economic development strategy for NC.

## Funding

1. Obtain adequate funding to implement the SAV recommended actions.



Photo Credit: John Carroll

# Questions!