Growing Wild Celery to SAVe our Wetlands: A Grassroot Collaborative
Final Report
2024-2025

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SAVy Restorations

Project Summary:

Wild celery (Vallisneria americana) is a critically important part of the native submerged aquatic vegetation (SAV) community. In low salinity estuaries, native SAV provides essential habitat for aquatic organisms, is an important food source for migratory waterfowl, removes excess nutrients, reduces turbidity, protects shorelines from erosion, and lessens the frequency and severity of flooding. Like the forests, these plants produce oxygen and sequester carbon dioxide. Due to invasive species, increased sedimentation, and decrease in water quality, wild celery populations have declined or disappeared throughout the Eastern United States. The goal of this project was to restore wild celery to Back Bay by involving Middle School and High School students in the growing and planting process and utilizing novel propagation and transplanting techniques developed by Dr. Sara Sweeten.

Environmental outreach and STEM learning were key elements of this project. The Atlantic Wildfowl Heritage Museum, in collaboration with its partners, provided curriculum, teacher development, and technical assistance for the selected Virginia Beach and Chesapeake Schools to implement a hands-on educational program around the wild celery restoration project. This wild celery restoration program became a portal to enhance and improve interdisciplinary methods of teaching science, technology, engineering, and math (STEM) relative to inquiry-based learning that support education outcomes and standards. At the highest and most effective level, this educational initiative created a "need to know" in the mind of students pushing them to seek information that connected concepts, fostered critical thinking, and nurtured their "sense of wonder" about the earth and the many other organisms who have no voice.

The project was divided into three phases: teacher training, student education and transplanting, final planting of the wild celery and the creation of the video.

Phase 1:

The project began in the summer of 2024, with an overnight immersive teacher training at Back Bay NWR and False Cape State Park. Ten (10) teachers from Virginia Beach and Chesapeake public schools attended the workshop. During the workshop, the Atlantic Wildfowl Heritage Museum partnered with the Fish and Wildlife Service (Back Bay NWR), VA Department of Wildlife Resources, Virginia Department of Conservation Resources (False Cape State Park) and Savy Restorations and Mud Puddle Science LLC. During the two-day workshop the teachers had the following hands-on experiences:

- Hiked on Back Bay National Wildlife Refuge boardwalk to view freshwater marshes
- Learned about the Albemarle/Pamlico Sounds and APNEPs role in protecting this watershed
- Electroshocked fished in the Bay to learn about species that use the Bay as a nursery
- Seined in the Bay to learn what macro invertebrates lived in and around the SAV
- Hiked to the beach
- Visited False Cape Visitors Center
- Hiked to Wash Woods to learn more about the culture and history of the area

- Learned about the Wildfowling Culture and Hunt Clubs in the area and the importance of Wild Celery as a food source for the waterfowl
- Painted wooden decoys
- Tasted local crabs
- Kayaked in the bay and observed SAV up close
- Learned about the biology of Wild Celery and the research and projects that Dr. Sweeten has done in the area
- Rode the tram along the dikes learning about the mission of BBNWR and False Cape State Park

After the Bay to Cape Adventure, we had the teachers do reflections and compete post-workshop questionnaires. We then laid out the plans for the project and invited the teachers to join in the growing and planting of wild celery over the upcoming school year. Three schools signed on: Virginia Beach Middle School and Princess Anne Middle School in Virginia Beach and Indian River High School in Chesapeake.

Phase 2:

In October, Dr. Sweeten and Jody Ullmann visited each of the schools to assess the type of growing container they could accommodate, the best number of plants for them to grow, the number of classes and students they wanted involved, the lighting and other equipment needed, and the best time of year to get started. Each school's needs and wants were different, so we decided to try growing the plants in three distinct situations. Princess Anne MS had a greenhouse, so we set them up with soft sided pools in the greenhouse and used natural lighting. Virginia Beach Middle School has limited space, so we set them up with two metal cattle troughs inside the school near the classrooms and added overhead light. Indian River HS also had limited space and could not accommodate the equipment inside the school, so we set up a large metal cattle trough in the outside courtyard of the school. These three distinctive setups involved the students in helping Dr. Sweeten work out the best practices for growing wild celery with schools, an added bonus for the project.

Before plants were given to the students, Dr. Sweeten went to each group of students and gave a presentation on the biology, history and importance of SAVs and especially wild celery. She then introduced the project and the procedures that they would follow in the transplanting and growing of the wild celery shoots. Groups of students were given aluminum trays, substrate and shoots and were told to plant the shoots either in clumps or spread apart in the trays. After filling the trays, they were then submerged into either the pools or the cattle troughs, depending on the school.

Virginia Beach MS opted to transplant their wild celery in November with 90 students setting up 34 trays of plants, some in clumps and some dispersed throughout the planting medium. They opted also to experiment with the lighting by having one trough with 8 hours of light and the other with 12 hours of light.

The other two schools opted to do their transplanting in February. 192 Life Science students at Princess Anne MS transplanted wild celery shoots into 42 trays in their greenhouse pools. 200 Indian River HS students transplanted 17 trays and installed them in their outdoor trough

The students monitored the growth of the plants and reported any problems to Dr. Sweeten. Water quality kits were purchased and distributed to the schools. The students measured pH, nitrates, nitrites, and ammonia.

Phase 3:

Dr. Sweeten and I met with local agencies to determine the best place to plant the wild celery. Due to some difficulties getting permission to plant on both the Wildlife Refuge and the State Park, we got permission from Mark Johnson, a private land owner on Back Bay, to plant off his dock. Horn Point Kayak Launch became our staging area for the planting. With the help of volunteers, a cage was built off the end of the dock. This cage defined the planting area and gave protection to the young plants from predation while they became established.

Due to differences in the size of the classes, the bus availability, and school's policies, each of the schools chose how many and which students would be involved in the field transplanting trips. Virginia Beach MS and Indian River HS both decided to bring only a select group of students on only 1 day. Princess Anne opted to take full classes on multiple days. In all, we worked with a total of 152 Middle and High School students and 19 adults over a span of 5 days to plant approximately 950 plants.

When the students arrived at Horn Point Kayak Launch, they were given an introduction by either Rachel Harrington of False Cape State Park or Erica Ryder of Back Bay NWR. This introduction covered the A/P watershed, wind-driven tides, the history of the area, the importance of this project and the procedure for the day. The students were then divided into 3 teams. One team seined off the kayak launch, one group went for a nature hike and scavenger hunt along the inlet and the last group walked to Mark's property to assist Dr. Sweeten in planting the wild celery inside the constructed cage. Any students that wanted to don waders and help carry the trays to Dr. Sweeten were allowed to do so, if the school's policy and the teachers granted permission. Almost every student took the opportunity (148 of the 152 students) to put on waders and get into Back Bay. Each group rotated through all 3 stations.

After the planting was done, a survey was sent out to all the teachers to give to their students to assess how well the project covered the scope of work, as set out in the grant, and what changes the project brought about in the students that participated in the project. The results of the survey were tabulated and analyzed.

About a month later, a team from the Atlantic Wildfowl Heritage Museum visited the site to assess the growth of the wild celery plants. When transplanted into the cage, the plants were 8-12" tall. They were pleased to see the plants had at least tripled in size and were easily visible just under the surface of the water.

All of the video footage and photographs taken during the three phases were given to a videographer to edit into a video about the project. This video will be shown at the museum as part of their exhibits, as well as being placed on the website.

Project Scope of Work:

1. Provide a hands-on environmental education training opportunity in the VA Southern Watershed/Albemarle Sound watershed for Middle and High School Teachers and their students that includes water quality, aquatic vegetation, and coastal habitats.
2. Expose these teachers to activities, speakers and field experiences that would help broaden their understanding of the watershed; the flora and fauna, the history and cultural history and the threats it now faces.
3. Guide the teachers and students as they grow out wild celery shoots and plant them in the VA Southern Watershed/Albemarle Sound watershed.

Results and Discussion:

Although Dr. Sweeten had grown and planted Wild Celery in this area in the past, this was the first time she had ever worked with schools growing out the plants. As a pilot program, we learned much over the months as we tested new equipment, new planting techniques, tried different teaching methods and worked with 2 different grade levels and school districts.

We had difficulty getting teachers to sign up for the workshop in the summer. We originally limited it to teachers in Virginia Beach, but ended up opening it up to Chesapeake teachers as well. Ten teachers participated in the training sessions. Those that participated said that they were happy that they did because it gave them a chance to explore the watershed from the water as they kayaked in Back Bay and then to take the time to see it up close through hikes in Back Bay NWR and False Cape State Park.

We saw changes in attitudes through the teachers' reflections after the summer workshop. For example, Valerie from Princess Anne Middle School wrote: "I do not particularly embrace nature. I am deathly afraid of snakes and of ticks. However, this experience has opened my eyes to activities I have never done or given much thought to… am glad that I came on this adventure.

Many of these teachers had never been to this part of their watershed nor had taught much about the watershed. Through the workshop, the teachers received a broad perspective of not only the natural history, but also the culture and history of this area. They learned about research in SAVs and restoration projects that are happening in their watershed. Sarah, a Life Science teacher wrote in her reflection "What a wonderful experience to be part of this program. It was great spending time with experts within the various fields. Going forward I plan to continue to teach and promote awareness about the Albemarle/Pamlico Sound. I plan to stay in contact with the rangers at Back Bay and False Cape and plan field trips with my students."

On the first day of the summer workshop, we had the teachers fill out a pre-assessment and at the end, we had them fill out a reflection and a short post-assessment. The most telling result of the assessments was the difference between the answers to the question "On a scale of 1-10, what was your comfort level teaching about watersheds and especially the AP Watershed before the training?" and the question "On a scale of 1-10, now what is your comfort level

teaching about the watersheds, especially the AP Watershed now that you have completed the experience?" Since all of the teachers were teaching either Life Science, Oceanography or Biology, we were surprised to see that 45% went up 3 or more points and all went up at least 1 point on the scale.

We also asked questions about SAvs, including questions about what they are, their link to the economic and cultural history and their importance to the environment. 70% of the teachers had little to no idea what SAVs were, what their role was in the environment or anything about the wildfowling culture of the area before they attended the summer workshop. While all answered the questions correctly and completely after the workshop.

Both of these are a testament to the power of experiential learning. And the importance of having these kinds of workshops available for teachers.

After the project was over, we surveyed the teachers. We asked them how well the project integrates with the SOLs and their curriculum. All of them agreed that the project integrated into the curriculum and was compatible with some of the SOLs. When asked "What skills do you think your students acquired?", many of them stated not only the obvious ones like observation and knowledge of plant propagation, but also skills such as patience, critical thinking, and personal responsibility. These are highlighted in the "Virginia Beach Compass to 2030 Plan" as skills that are essential for students to learn in order to be ready for a successful future outside of school.

We also surveyed the students that participated in the project. 135 students responded to the survey. When asked "Would you be interested in helping and doing this project again next year if you had the opportunity?", they all answered with a resounding YES, with several asking to be signed up NOW.

Some of the comments we got from students were:

"By participating in this project, I was able to feel like I was doing my part in helping restore the ecosystem's health somewhat. This also showed me what more I can do to help. It also taught me what things we should be doing to not harm the environment and how it's not okay to."

"I got to participate in growing the ecosystem and I liked that when I go back, I can see the progress."

"It helped me become more of a citizen because it changed the way I thought about little things and how they affect my surroundings. It also caused me to think how we need much work on our home since we are the ones that will affect it."

"I felt good because I was bringing a native species back to were (sic)it is supposed to go"

You can go to https://docs.google.com/spreadsheets/d/1zYJhdJmdDW6yX7p76Ef_QecmXStj4yw2ThDfylMzsgk/edit?gid=1411369261#gid=1411369261 to view the entire survey.

One of the challenges encountered during this period was a change in administration at both the Atlantic Wildfowl Heritage Museum and APNEP. Shortly after the summer workshop, Emily

Bodsford, the Museum Director, departed from her position, which has not yet been filled. In addition, the primary APNEP staff member with whom we had been coordinating also left their role, requiring a period of adjustment to determine appropriate points of contact for grant-related matters.

Aimee Rhodes, President of the Back Bay Guild, t/a Atlantic Wildfowl Heritage Museum, has since been designated as the representative responsible for overseeing and advancing the APNEP grant moving forward.

In-Kind Services and Volunteer Hours:

US Fish and Wildlife Service- Back Bay NWR

- Erica Ryder gave many hours in planning the summer workshop
- Lead hikes at the refuge
- Provided space for the first day of the workshop
- Gave a presentation about the importance of SAVs in Back Bay
- Free access to the refuge and Tram transport ($250)

Virginia Department of Conservation and Recreation- False Cape State Park

- Rachel Harrington gave many hours in planning the summer workshop
- Lead hikes at FCSP ($75)
- Allowed us to use the Wash Woods lodge for free for 2 days ($754)
- Gave multiple presentations and hikes during the second day of the workshop

Department of Wildlife Resources

- Chad Boyce did electroshock demonstration

The Atlantic Wildfowl Heritage Museum

- Provided wooden decoys for participants to paint

Private Landowner/Volunteers

- Mark Johnson
    - Approximately 20 nights of free lodging for Dr. Sweeten
    - Allowed us to use his property for:
        - Equipment prep
        - Cage location
        - Allow students to access the bay from his property

CCMP Goals, Outcomes, Objectives and Actions Addressed:

1) Foster watershed stewardship

1.1: Communicate the importance of stewardship and offer opportunities for volunteering to further APNEP's mission.

When we were at Back Bay NWR and False Cape State Park, the rangers talked to the teachers about opportunities to do stewardship projects that help repair erosion, restore damaged habitats, increase pollinators, and help to keep our waters clean.

Students in local middle and high schools had the opportunity to grow and plant wild celery in Back Bay in order to further restoration efforts in this area.
Results: The project directly added approximately 100 sq. ft. of wild celery. These plants act as a "founder colony" that will then go on to help propagate more wild celery starting a positive feedback loop, helping to boost biodiversity and ensuring a healthy population of SAVs for the future. In addition, the students learned the importance of being good stewards, vital team building skills, and essential skills needed in a career in restoration.

1.2: Provide and Promote opportunities for outdoor experiences that connect individuals with the Albemarle-Pamlico ecosystem.
This program gave teachers first-hand knowledge of the watershed that they will now convey to their students through activities, field work, and direct instruction. Having their own first-hand immersive experience will make the lessons they develop and their teaching so much richer and more authentic. Being able to see the submerged aquatic vegetation and the animals it supports formed a connection no typical workshop could. Teachers were asked if they had discussed a partnership with one or more of the presenters they met. All of them stated that they were either planning field trips to Back Bay and False Cape, utilizing their traveling trunks or having someone come to their school to present a program.
Results: Increased public awareness and engagement in the importance of the Albemarle-Pamlico ecosystems and the educational and recreational opportunities that are available to them through talks by Back Bay NWR and False Cape State Park employees, as well as kayaking and hiking the areas.

2) Conduct targeted environmental education efforts regarding estuarine habitats, water quality and ecosystem services.
2.1 Provide environmental education training opportunities for educators
The 2-day summer workshop helped the teachers to learn about the AP watershed and resources that are available for designing engaging lesson plans, including those developed by the teachers who took part in the earlier APNEP "*Following the River: An Exploration of the VA Southern Watersheds/ Pasquotank River Basin"* grant.
Results: As evidenced by the difference between the pre and post assessments, the summer workshop increased their awareness of and engagement in the estuarine habitats. They used water quality kits to test waters and learned first-hand the ecosystem services that SAVs supply to the waters of Back Bay. The teachers were given resources they need to raise awareness of their students as to where the water drains when it leaves their school and/or home and the importance of caring for and restoring the health of the watershed.

Budget:
Although, Dr. Sweeten has worked in the Back Bay area many times, this is the first time she worked with schools in raising and transplanting the wild celery. We ended up working with three different schools, all with different needs, so plans were in constant flux to accommodate school schedules and needs. Dr. Sweeten lives near Blacksburg, VA and ended up having to make twice as many trips to Virginia Beach as was originally budgeted. Therefore, we exceeded

the original estimation of $8,900 to cover her expenses for gas and time. We changed the set up for the growing of the plants and the method we used to transplant, so the leftover money allocated for the boat and the equipment were used to cover some of the shortfall. We also had allocated money to help the schools pay for buses or vans. All of the schools paid fully for transporting the students to Back Bay, so that money was also used to cover Dr. Sweeten's expenses, along with some of the indirect expenses not used.

The budget sheets are attached.