

# Restoration of Submerged Aquatic Vegetation in Mesohaline Chesapeake Bay: A Design With Nature Approach

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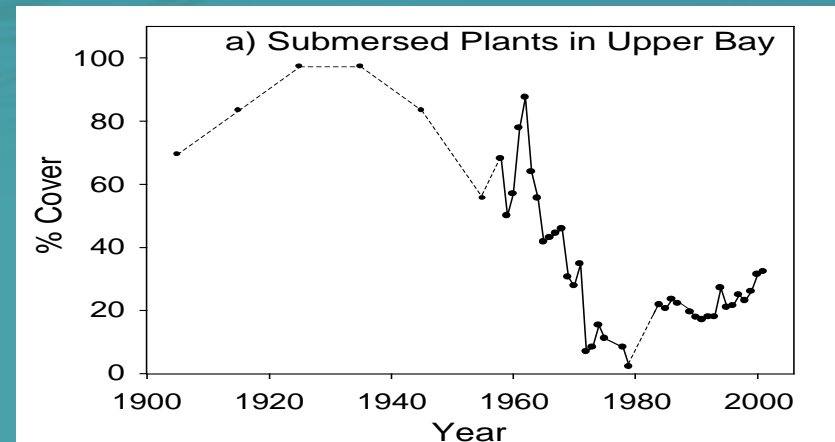
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- Army Corps of Engineers
- Chesapeake Bay Trust
- NOAA, NCBO (NFWSF)



# Dramatic Bay-Wide Decline of SAV in Chesapeake Bay

- Prior to 1960 most of the Bay bottom at depths < 1.5 -2 m was inhabited by diverse species of SAV
- SAV decline started in upper Bay and Western shore tributaries, then moved to lower Bay and Eastern shore systems



Solomons Island 1933



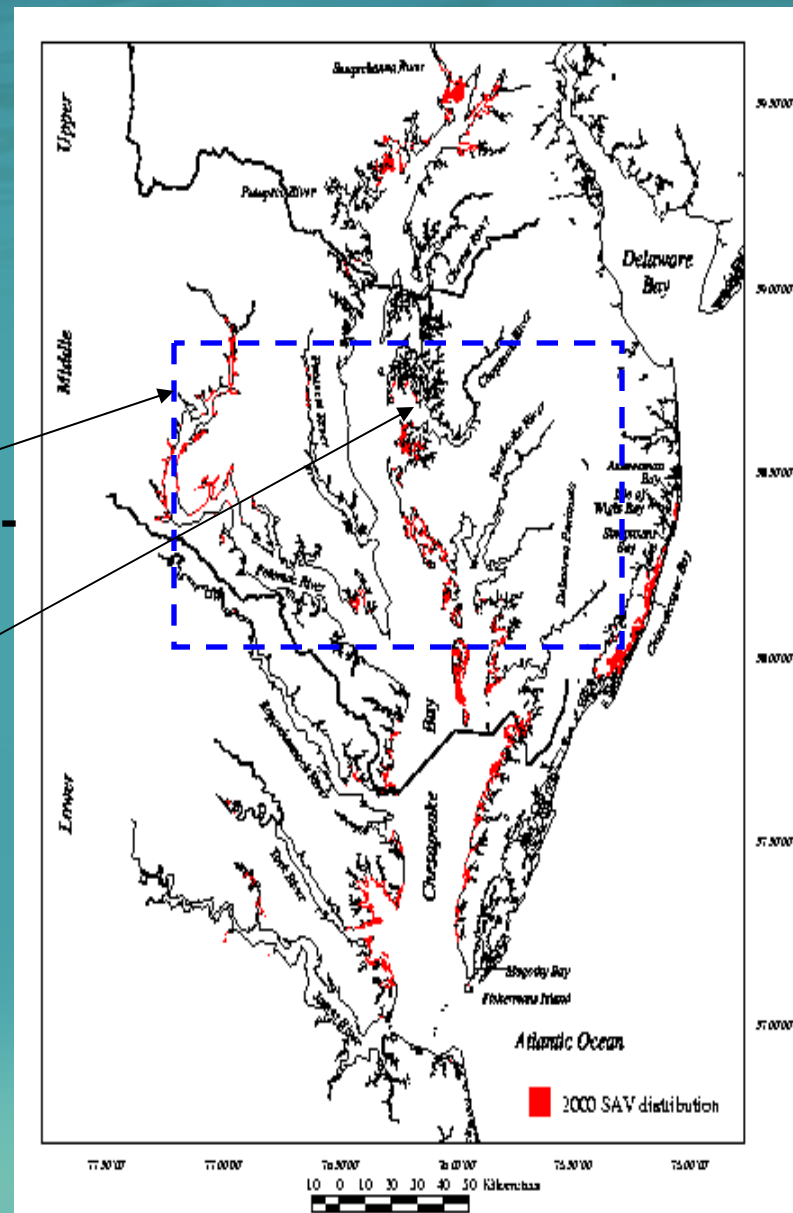
Solomons Island 1999



Historically 16 species of SAV were commonly found in the Chesapeake Bay or nearby rivers.

In the mesohaline regions, there is low species diversity when compared to pre-decline years. (Stevenson and Confer, 1978)

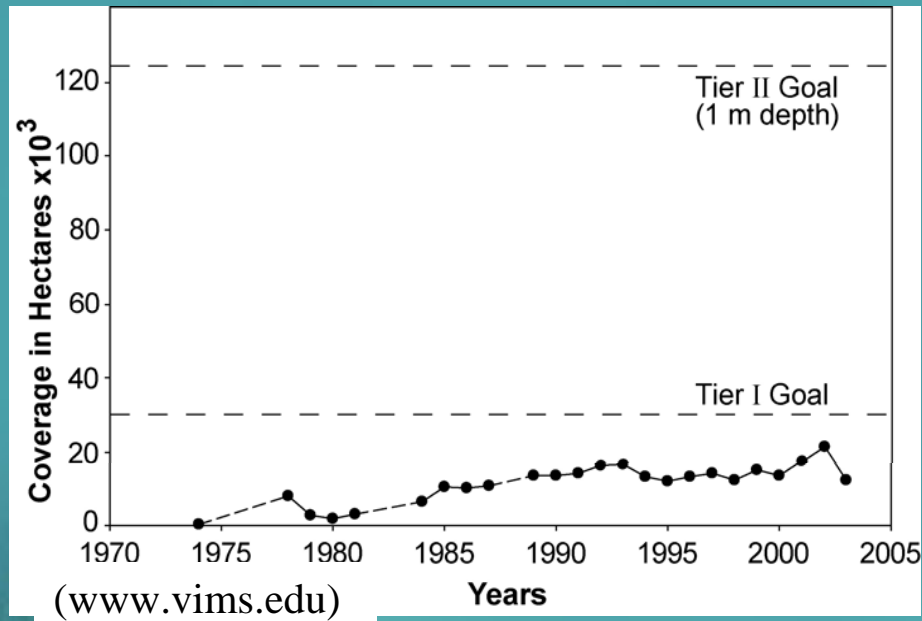
Our Study Sites were located in the Choptank River sub-estuary.



Approximately 90% of the SAV coverage in the Choptank River is one species, *Ruppia maritima* (Orth et. al, 1984-2001).



David Harp



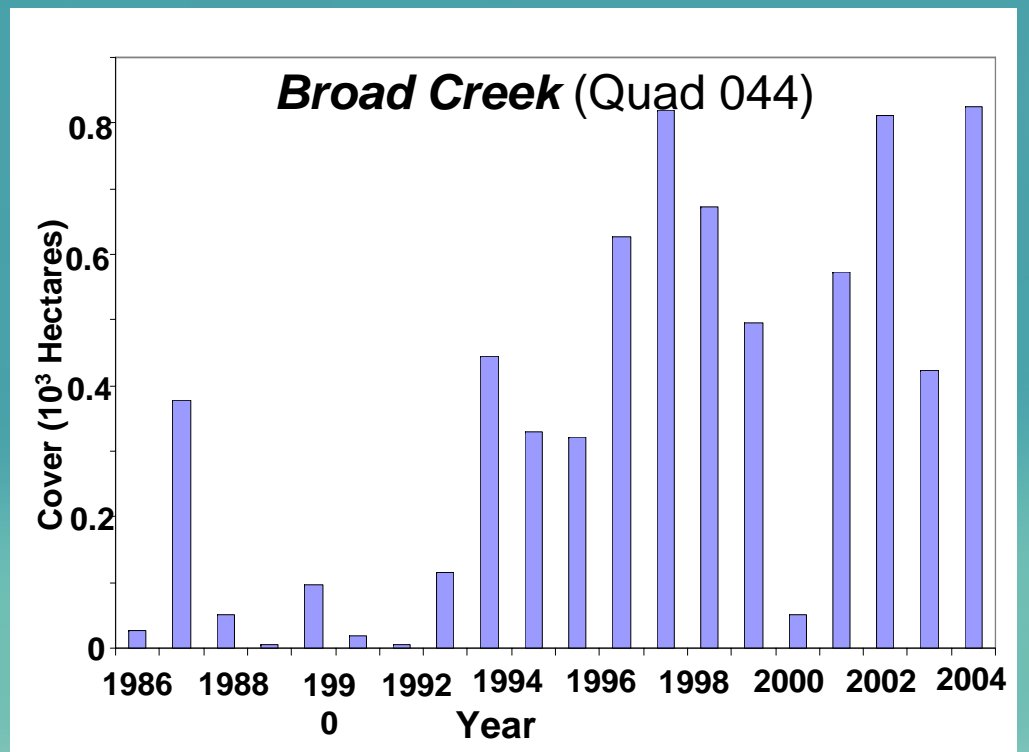
David Harp



***R. maritima* has been characterized as an ephemeral, colonizing species, reproducing mainly by seeds**



**Note the variability in total SAV cover since survey began!**



**Other, more stable species of SAV,  
are have not re-established**



***Stuckenia pectinata***



***Potamogeton perfoliatus***

## SAV beds can modify their environment



- Trap suspended materials
- Clean water
- Increase sediment nutrients
- Reduce water column nutrients



**Existing *R. maritima* beds can serve as *nurse crops* for other species of SAV**



**Planting other SAV species in *R. maritima* beds can:**

- **Increase species diversity**
- **Provide more stable SAV beds**

# Overall SAV (*P. perfoliatus* & *S. pectinata*) Restoration Survival

2001 planted in 4 areas  
of the Choptank River

Survival in Broad Creek  
where *R. maritima* beds  
occurred



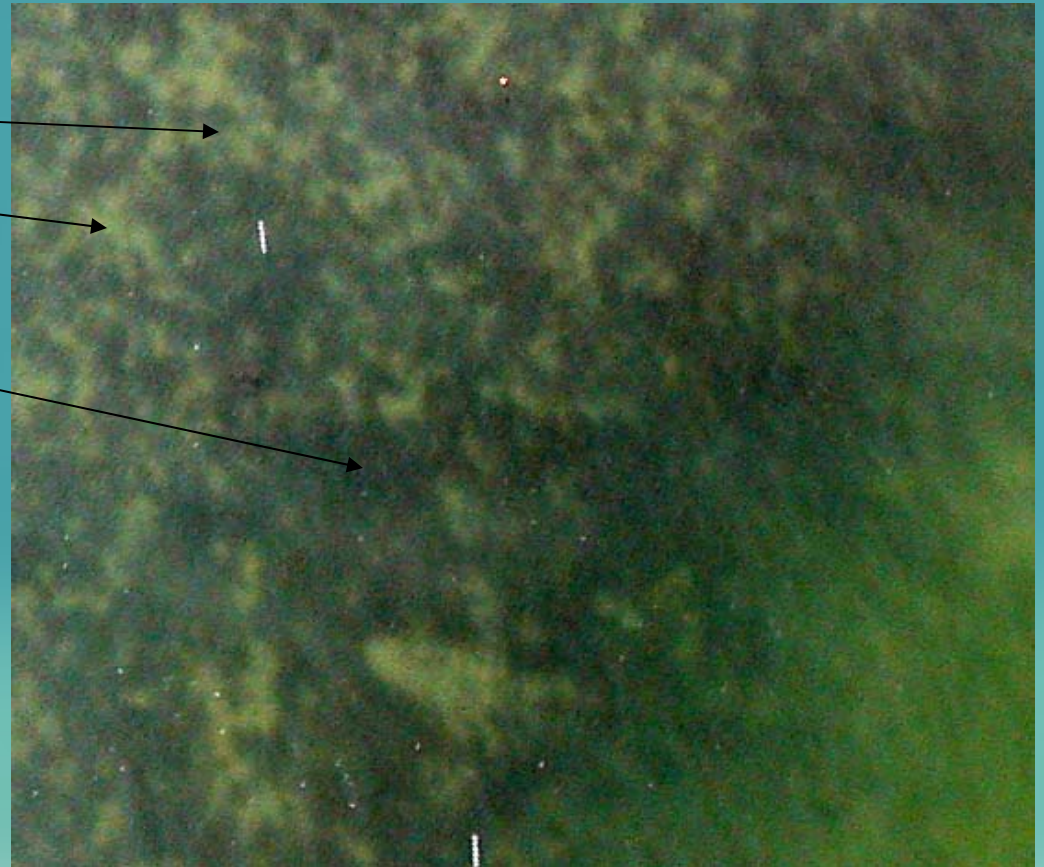
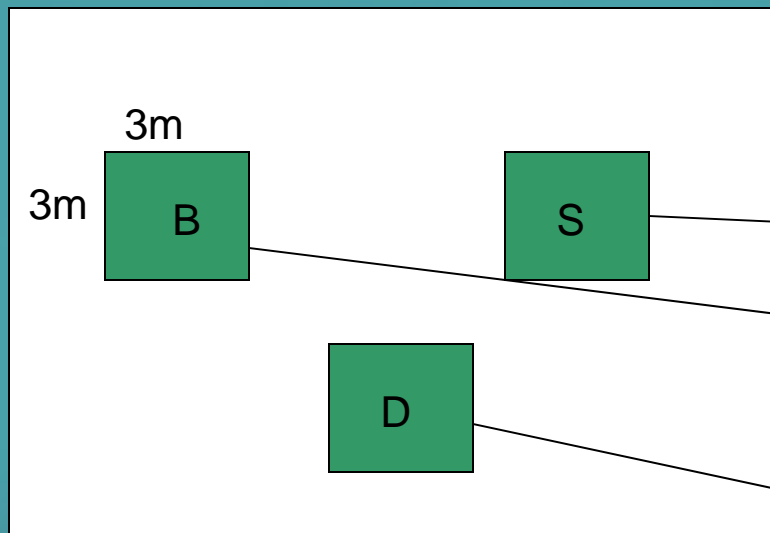
# 2001 Patch Density Experiment

*John Melton*

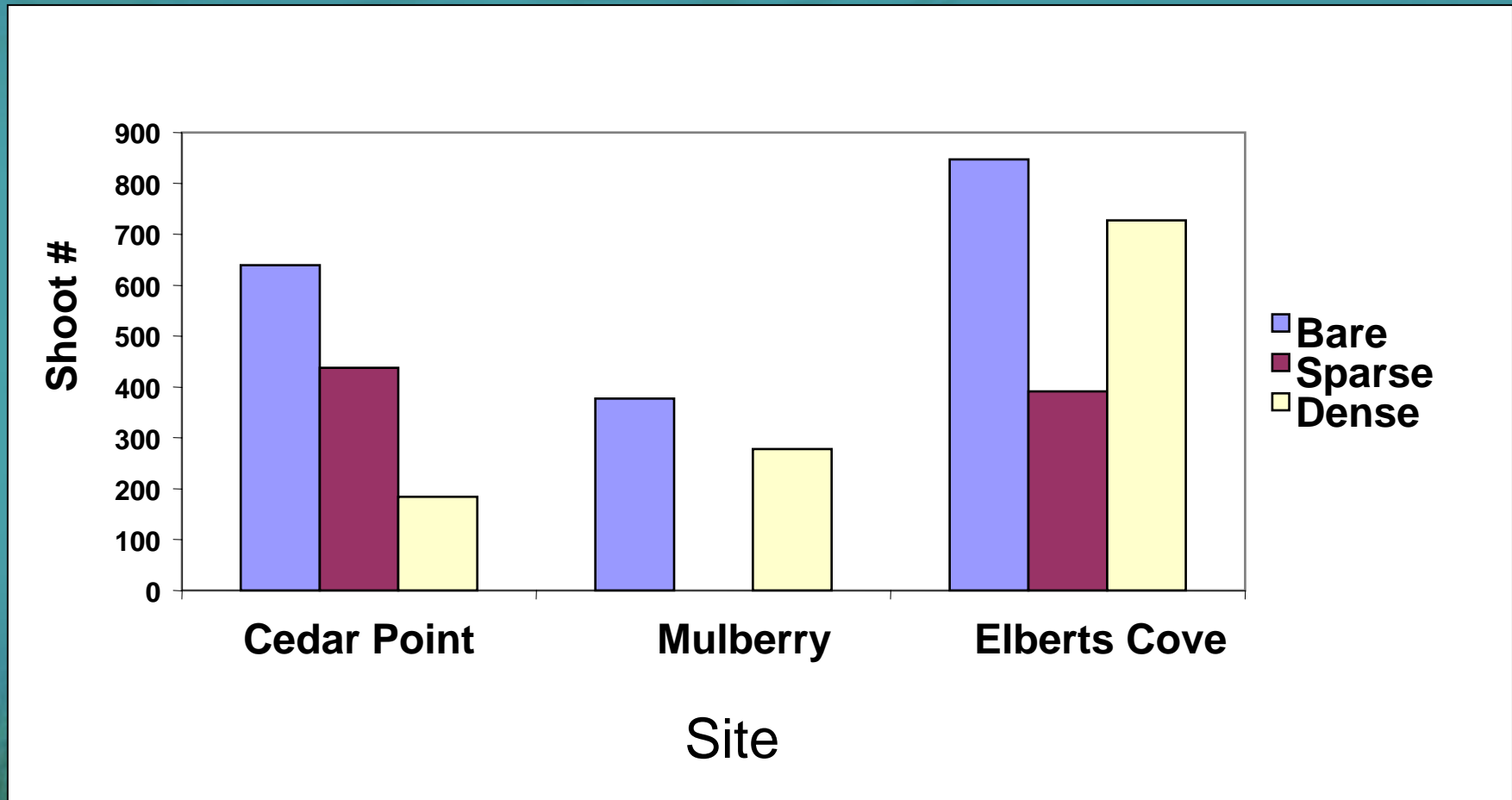
**B = Bare = 0 g/m<sup>2</sup> *R. maritima***

**S = Sparse = 20-27 g/m<sup>2</sup> *R. maritima***

**D = Dense = 47-57 g/m<sup>2</sup> *R. maritima***



## *P. perfoliatus* shoot number vs. patch density for the three experimental sites



# 2004 Bed Density Experiment

*Angela Hengst*

- *P. perfoliatus* planted in triplicate sites
- *R. maritima* cover defined at bed scale

Dense *Ruppia* Beds



Sparse *Ruppia* Beds

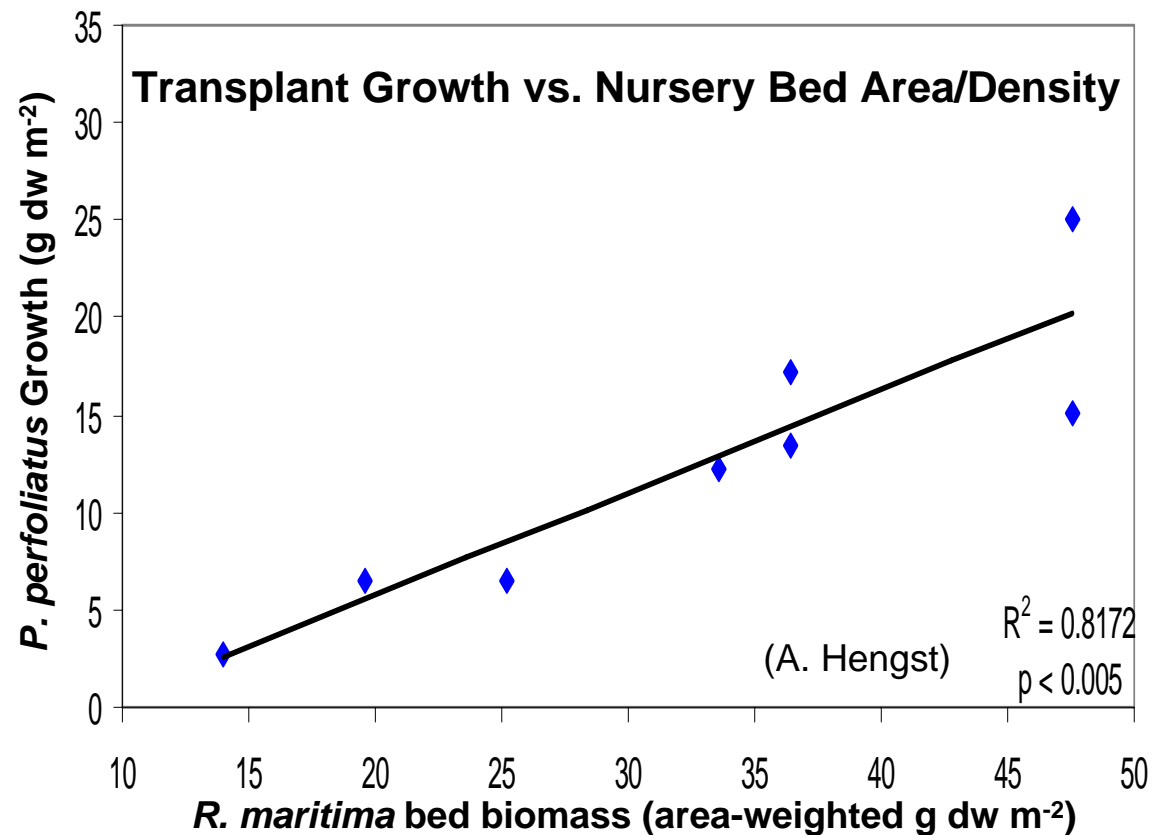


“Bare” Sites

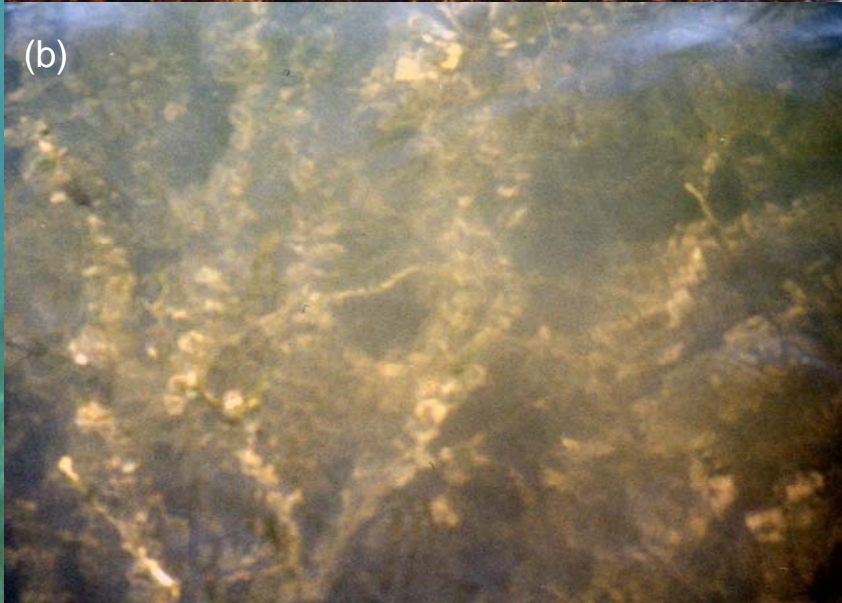


## Transplanted *P. perfoliatus* Growth in *R. maritima* Beds of Various Size & Density

- Transplant success (as growth) was related to *Ruppia* bed size & density
- Larger *Ruppia* beds provide better growth conditions for transplants



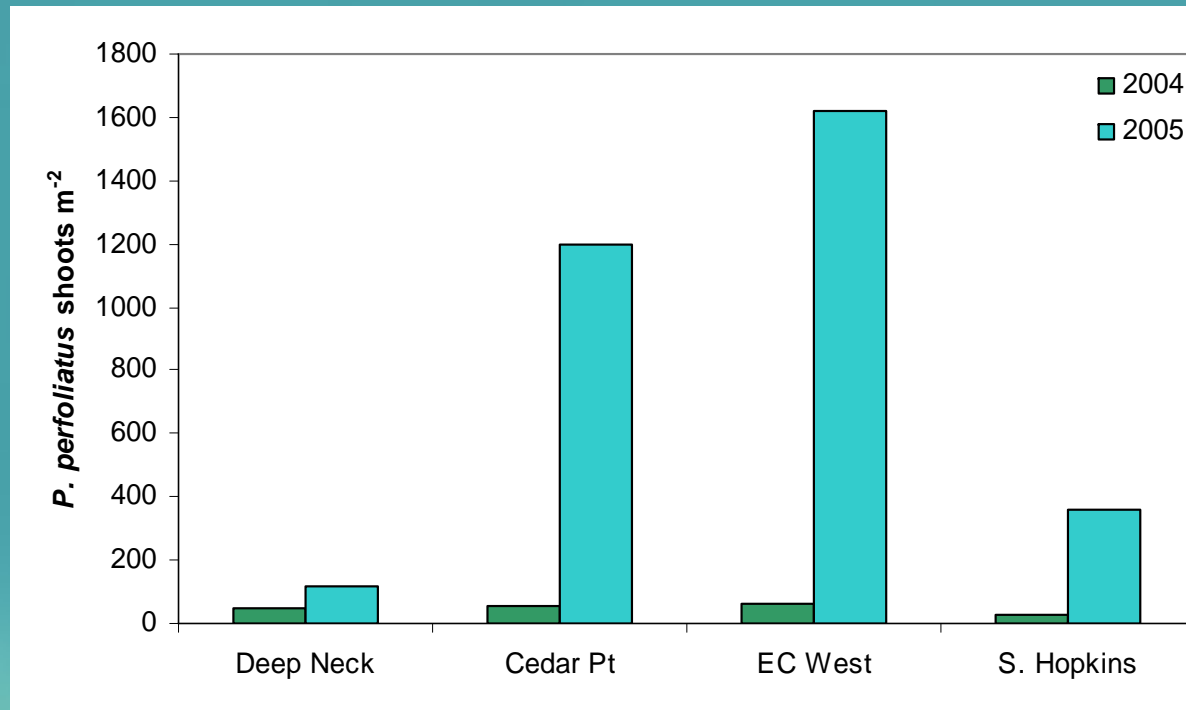
## ***P. perfoliatus* & *S. pectinata* transplanted into *R. maritima* beds: 3 years later**



- Dense, healthy stands of transplanted *P. perfoliatus* & *S. pectinata* cover original site
- Transplanted SAV have grown to fill bare patch and invading surrounding *R. maritima* bed
- *P. perfoliatus* stands persist in 4 transplanted sites & *S. pectinata* persists in 1 site.

# Shoot Density of *P. perfoliatus* one year later

Overall shoot density increased 13 times in 4 sites from 2004 (green bars) to 2005 (aqua bars)

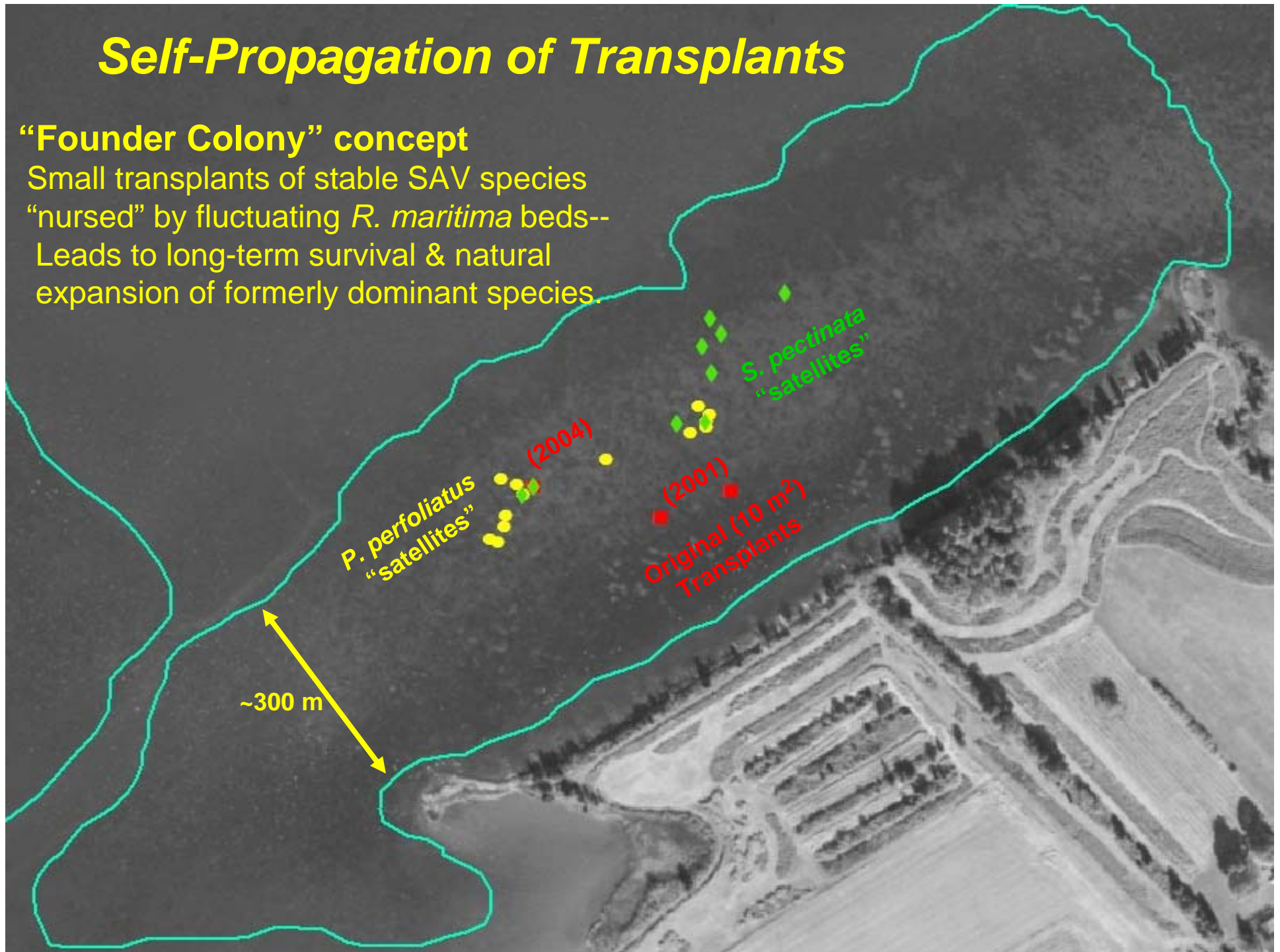


**A. Hengst**

# Self-Propagation of Transplants

## “Founder Colony” concept

Small transplants of stable SAV species  
“nursed” by fluctuating *R. maritima* beds--  
Leads to long-term survival & natural  
expansion of formerly dominant species.

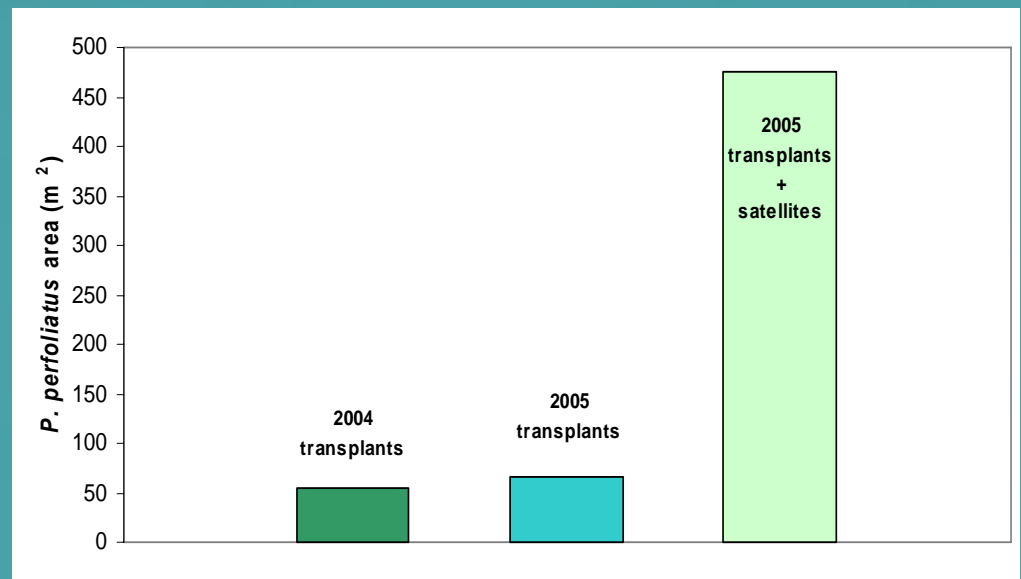


# Arial spread of *P. perfoliatus* from transplants

Satellite *P. perfoliatus* colonies were located at two of the transplant sites.

Area (m<sup>2</sup>) of the transplants increased by 23% from 2004 (green bar) to 2005 (aqua bar)

Area including satellites increased by 620% (light green bar)



# How do satellite colonies form?

## 1. Plant dispersal by fragmentation

**Day 1:**  
Fragment breaks  
off parent plant



**Day 2- 4:**  
Fragment  
floats

**Day 5-7:**  
Fragment  
sinks

**Day 14-20:**  
Fragment  
roots

**Day 30- 40:**  
New plant  
forms

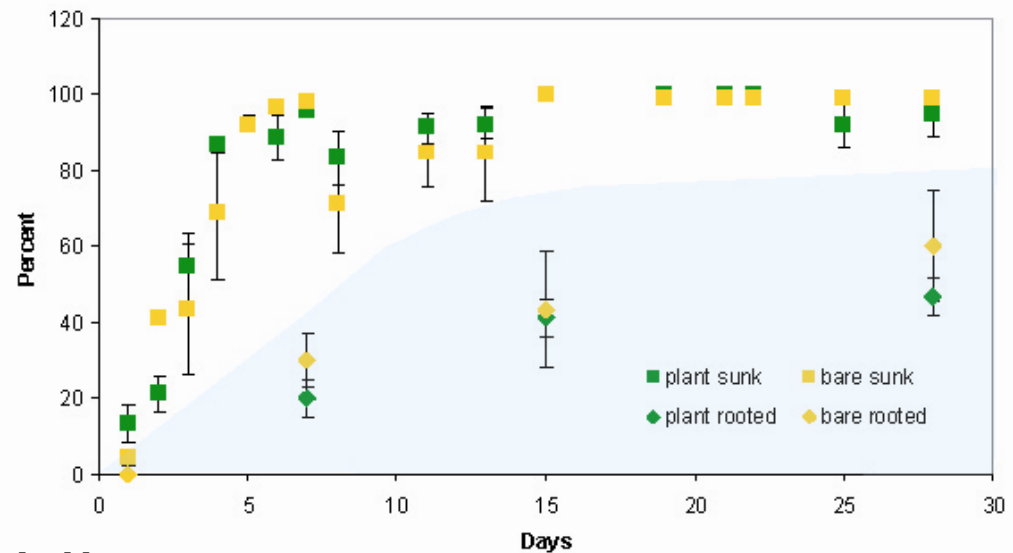


# Mesocosm experiment of new plant formation from fragments

Triplicate tanks with bare sediments and *R. maritima* plants

By day 5, over 80 % of fragments sank

By day 30, 40 % had rooted in the plant tanks and 60 % in the bare sediments



A. Hengst

*P. Perfoliatus* plants grown from fragments in bare sediment tanks (40 days)



## 2. Spreading from over-wintering buds (tubers)

### *Researching a better way to plant SAV*

Tubers planted using three techniques:



Redhead tuber



Sago tuber

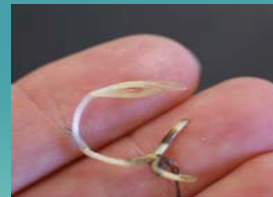
Tubers placed in weighted burlap bags



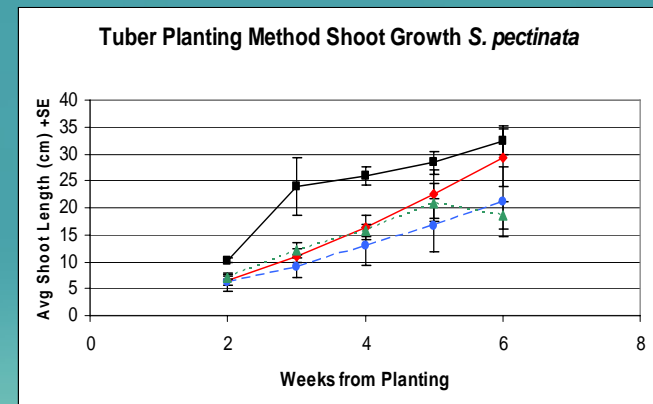
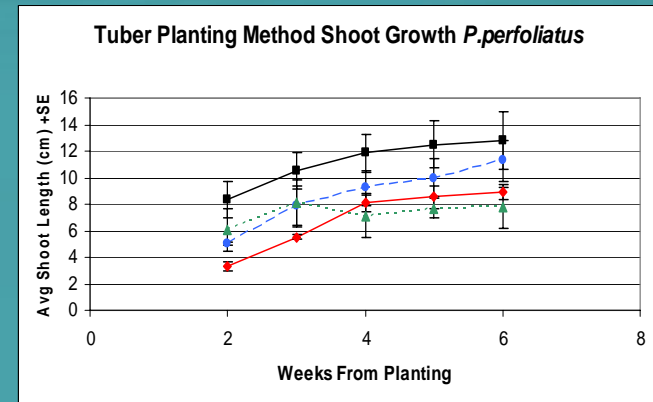
Tubers placed in clay balls



Tubers hand planted



## Results



Plant growth higher from tubers than from cuttings (red line)

## Conclusions:

- *R. maritima* beds can serve as “nurse crops” for restoration of other SAV species
- Transplants survive better in bare areas within existing *R. maritima* beds
- *R. maritima* bed size and density affect transplant success
- Satellite colony formation from transplants can significantly increase restoration efforts
- *P. perfoliatus* satellites may be formed from plant fragmentation &/or overwintering tubers

**Thank • You**

