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**HABITAT RESTORATION  
ENVIRONMENTAL MANAGEMENT**



### **ENVIRONMENTAL STRESS & COASTAL HABITAT DIVERSITY**

This booklet explores the synergistic role played by environmental stressors, in determining diversity within coastal habitats. We often view cofactors synoptically but it is their synergy, which creates site-specific habitat envelopes. We use the term “Envelope” because it has an intuitive sense of limit. In our case, limit refers to the amount of diversity, which can be contained within any specific habitat envelope. Understanding site-specific synergistic stress is important in understanding coastal restoration projects.

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**EACH CO FACTOR HAS BUILT IN STRESS LEVELS**



**STRESS LEVELS CREATE SUSTAINABLE ENVELOPES**



**ANOMALOUS STRESS IMPACTS SUSTAINABILITY**

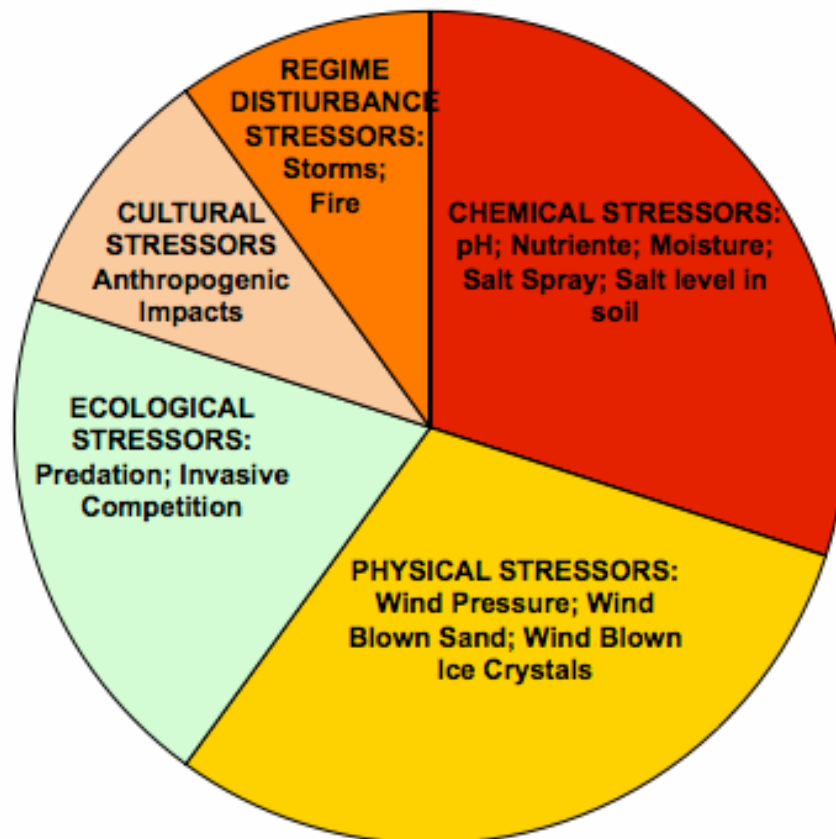
Each co-factor envelope has some degree of fluctuation during a given year, decade or century. Habitat is defined by combining all of the co-factor fluctuations into a synergistic envelope. Site-specific habitat envelopes have built in limits to diversity, based on specific combinations of stressors. **Anomalous Stress** may be part of what is referred to as “Disturbance Regime”, caused by mega scale events on a regional scale.



Subtle elevation differences in a Chatham high marsh create microhabitats with differences in salt-water stress and diversity. Image by Gordon Peabody

Unique environmental variables (stressors) define the physical and chemical parameters of Coastal Habitat. Variables are not necessarily in equal control or intensity in any given habitat. Each variable has its own fluctuations defining habitat parameters (envelope). Low stress envelopes exhibit higher diversity. Extreme co-factor anomalies create a very reduced envelope, lowering Coastal Habitat diversity.

## **SYNERGISTIC STRESS COMPONENTS DETERMINE HABITAT DIVERSITY**



Lower synergistic stress envelopes exhibit higher diversity with higher food web complexity. This provides more nutrient options on each trophic level. Food web complexity contributes to ecosystem resiliency. Higher stress envelopes may have lower diversity but nonetheless still successfully satisfy habitat performance on sites with anomalous stress.





**A Core Value of Habitat is the transition of carbohydrates into protein.**

### **WHEN IS IT APPROPRIATE TO USE ADAPTIVE MANAGEMENT?**

Approved vegetation for restoration projects is planted in a diverse, random matrix mimicking native vegetation on adjacent sites (or as otherwise specified). Vegetation subject to mortality normally requires replacement but consistent mortality may be sending a message. Site condition exposures may change as part of an ongoing project. Changes in vegetation mortality, abundance or diversity may be signal changes in stressors. Any changes in stressors, regardless of origin, reconfigure the synergistic habitat envelopes. Changes in mortality may provide confirmation of stressor modification. Planting changes should adhere to adaptive management guidelines.

- ✓ *Evaluation should de-select synoptic assessments*
- ✓ *Evaluate comprehensive ecological system performance*
- ✓ *Adaptive management tools include:*
  - *Shifting; reorganizing; adding; removing species*
  - *Adjusting location, abundance and/or diversity of species*
- ✓ *Decisions should be based on early and continuing assessment of:*
  - *Survivability and competition under normal stress levels*
  - *Survivability and competition under anomalous stress levels*
- ✓ *Coastal restoration goals evolve through the balancing of ecological energy, collaborative assessments and adaptive management.*