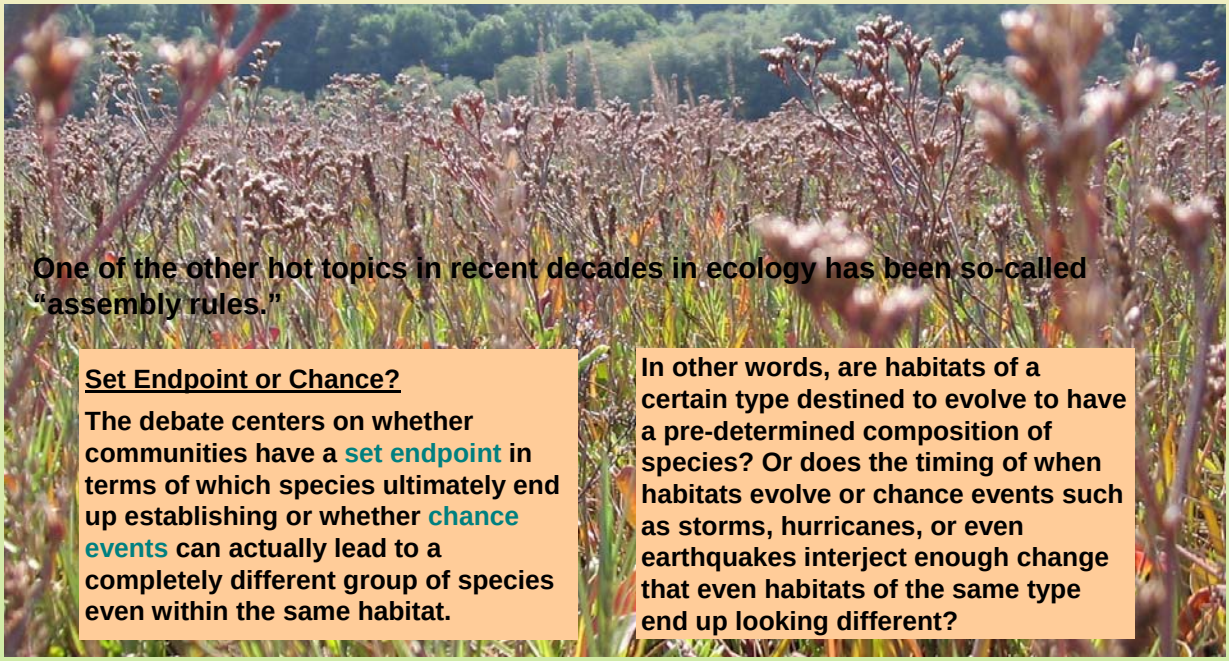
How Will Vegetation Evolve In This New Landscape? Part 1

A New Paradigm: To the north of Giacomini Ranch lies the undiked marsh that was once physically connected to the restored wetlands until they were diked off in the 1940s. When we ask what the new vegetation communities will look like once they have developed, this marsh and others in Tomales Bay such as Walker Creek Marsh, which is also a deltaic marsh, seem the logical comparison habitats.

So, the new wetlands should look just like these marshes, right? After all, they are right next door. Wrong. What ecology has learned in recent years is that just because a marsh established with a particular suite of species in the past is no guarantee that it will evolve to have those same species in the future.

Community Assembly Theory: Determining Who Comes – and Who Goes



One of the other hot topics in recent decades in ecology has been so-called "assembly rules."

Set Endpoint or Chance?

The debate centers on whether communities have a set endpoint in terms of which species ultimately end up establishing or whether chance events can actually lead to a completely different group of species even within the same habitat.

In other words, are habitats of a certain type destined to evolve to have a pre-determined composition of species? Or does the timing of when habitats evolve or chance events such as storms, hurricanes, or even earthquakes interject enough change that even habitats of the same type end up looking different?

Difference in Timing:

Historic Marsh Formed 100 Years Earlier

Tidal marsh north of Giacomini Ranch in 1906 (USGS)

Not only were conditions different back then, but there were fewer or at least different non-native species. These non-native species not only affect the value of habitat for wildlife, but also the very processes by which habitats are formed and can ultimately lead to different types of habitats. Also, some native species that were once present may have since become locally extinct, as was the case with *Suaeda* in San Francisco Bay.

Some species may have reduced greatly in number

Carex lyngbyei:
once more prevalent in Tomales Bay

Photos: Doreen Smith

Photo:Peter Baye

Suaeda californica:
once extinct in S.F. Bay, now reintroduced

Some species may no longer be present

New invaders have come in

What New Invaders Are Changing the Face of Our Marshes?

Kathyn Boyer, SFSU

Perennial pepperweed (*Lepidium latifolium*):

this member of the mustard family is taking over the high marsh/upland ecotone all over San Francisco Bay and eliminating habitat for many uncommon and rare plants.

Present in Tomales Bay?: Yes
Where? Giacomini, Walker Creek

Invasive Spartina Project

Atlantic cordgrass and hybrids (*Spartina alterniflora*):

this member of the grass family was accidentally planted in the 1980s and has since taken over much of the San Francisco Bay low marshes, primarily as a hybrid with the native cordgrass, Pacific cordgrass (*Spartina foliosa*). It occurs at a broader elevational range and has encroached mudflat areas used by foraging shorebirds.

Other Bad Guys:

Limonium ramosissimum

Dittrichia graveolens

Present in Tomales Bay?: Maybe. Recent surveys showed one sample to be potentially weak hybrid.
Where?: North of Giacomini

Limonium ramosissimum and *Dittrichia graveolens* are two other species that have been discovered in the last few years to be invading the high marsh and upland ecotone habitats around San Francisco Bay. *Limonium* is thought to have escaped from ornamental plantings. They aren't here yet – and it is important we keep it that way.

Present in Tomales Bay?: No... NOT YET!

How Will Vegetation Evolve In This New Landscape? Part 2

So What "Rules" Have We Observed So Far?

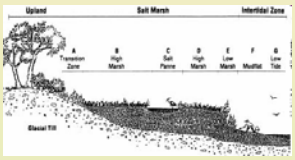
The transition from pasture to marsh appears to be guided by specific rules that are driving "succession" and causing conversion to occur in specific stages or steps

1. First "Wave" of Plant Change Caused by Immediate Inundation Once Levees Were Breached

Inundation killed off many plants immediately, particularly in the northern end of the restored wetlands

2. Zonation Developed in Response to Patterns in Tidal Inundation

After initial die-off, vegetation begins to change more subtly in terms of die-off and plant establishment along elevational gradients in response to fairly consistent patterns in duration and frequency of tidal inundation, although wind interaction with water levels may ultimately "blur" edges of these zones.



3. Second Wave of Mass Die-Off Occurs As Salts Build Up in Soils and Waters

A second wave of extensive die-off occurs with build-up of salt in soils. In transitional areas or areas on the upper extent of tides, pasture grasses that survived initial levee breaching die. At lower elevations, brackish marsh species die with increase in salinity levels through summer.

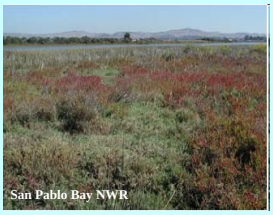
4. Species More Likely to Establish Within Certain Hydrologic Zones

Pickleweed is more likely to establish first along channels, while saltgrass more commonly establishes away from channels. Gumplant often occurs on the wrack line at the upper extent of high tides.

Will the New Marsh be as Diverse as the Old Marsh?

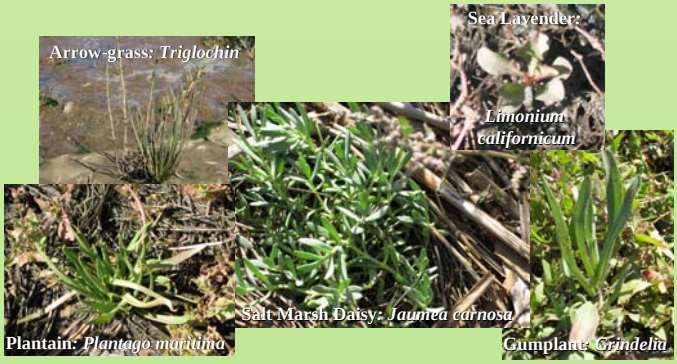
The implications of community assembly are that we may not end up with the same marsh we had before – or even the one next door.

This would be a loss, because Tomales Bay marshes are incredibly diverse. In fact, they are much more diverse than some of the remaining marshes in San Francisco Bay. Many of the "newer" wetlands are completely dominated by pickleweed, and San Francisco Bay has lost many of its less common or rare marsh plants.


San Pablo Bay NWR

All Signs Point to – Possibly Yes:

We are beginning to see many of the uncommon species establishing in the restored wetlands, along with pickleweed and saltgrass.



Diverse assemblages occur in the other marshes of Tomales Bay