

# San Francisco Bay Transition Zone Conservation and Management

## Preliminary Decision Support System (DSS)<sup>a</sup>



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SAN FRANCISCO BAY BIRD OBSERVATORY

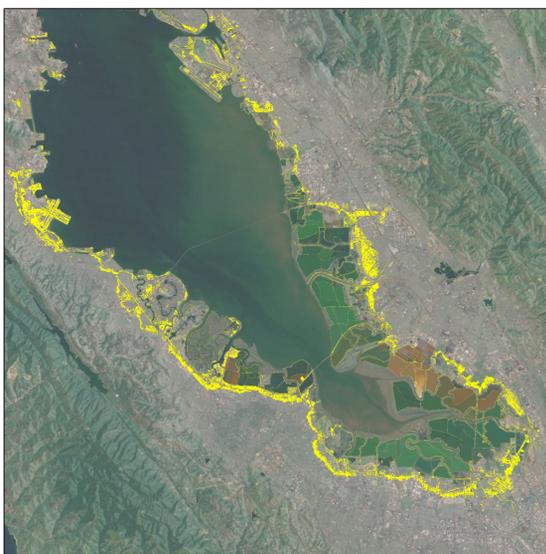
### Step 1: Define and characterize the biotic and abiotic elements of transition zone habitats (TZH)

With the help of tidal marsh ecosystem specialists throughout the region we drafted a thorough description of tidal marsh-terrestrial transition zones. This document contains a detailed characterization of the physical and biological properties of transition zones with respect to the *functions* of the tidal marsh ecosystem and needs for obligate fauna. A list of “working” habitat *indicators* were developed based on these functions which were utilized to map their distribution and assess their quality. These indicators were combined with threats, notably sea level rise, for ranking and prioritizing TZH for protection or restoration. Key indicators, and associated functions, are summarized below:

- Depth (width and slope of transitional zone)
  - distance needed by tidal marsh fauna and flora, SLR adaptation
- Elevation in relation to tides
  - high tide refugia for obligate fauna, SLR adaptation
- Size and Shape
  - as needed by tidal marsh fauna and flora, overall estuarine function
- Adjacent Habitats and Connectivity
  - as needed by tidal marsh fauna and flora, overall estuarine function
- Plant Community
  - high tide refugia, overall estuarine function
- Soils and Hydrology
  - as needed by tidal marsh flora, overall estuarine function

### Step 2: Map Potential Transition Zone (Tide and Elevation)

The transitional zone is largely determined by the extent of the tidal zone, the salinity of the soil, and the consequent distribution of flora. The first component of the transitional zone decision support was to map the potential transitional zone based on tidal and elevation constraints. High resolution Lidar (1 meter) was combined with tidal rasters created from NOAA tidal gauge datasets. Two tidal rasters (converted to NAVD88) were generated from the tidal gauges data to assist with mapping the *lower* and *upper limits* of the transitional zone: (1) interpolated surface of MHHW (using ~ 40 tidal gauges) and (2) a trend surface of the difference between MHHW and HOWL (using around ~16 tidal gauges) to account for tidal variability throughout the estuary. The Lidar elevation data was merged with the MHHW surface in ArcGIS so elevation represented elevation relative to MHHW for the entire SF Bay. **The “range” of potential transitional zone was identified as .31 meters above MHHW as the lower limit to HOWL + .27 meters as the upper limit.**



Raster output from the first order model was converted to vector polygons, simplified and adjacent polygons were merged. Final raster results were divided into “tidal and non-tidal based on “levee on” (tidal) and “levee off” (non-tidal) polygons provided by PRBO.

### Step 3: Patch Metrics (Area, Width, Shape)

Once the polygons were simplified and combined, patch metrics were calculated for each potential transitional zone polygon. These include:

- Area (Size)
- Mean Width
  - surface area / maximum length (diameter of smallest circumscribing circle)
- Shape (linear to compact)
  - ratio of patch area to the area of the smallest circumscribing circle

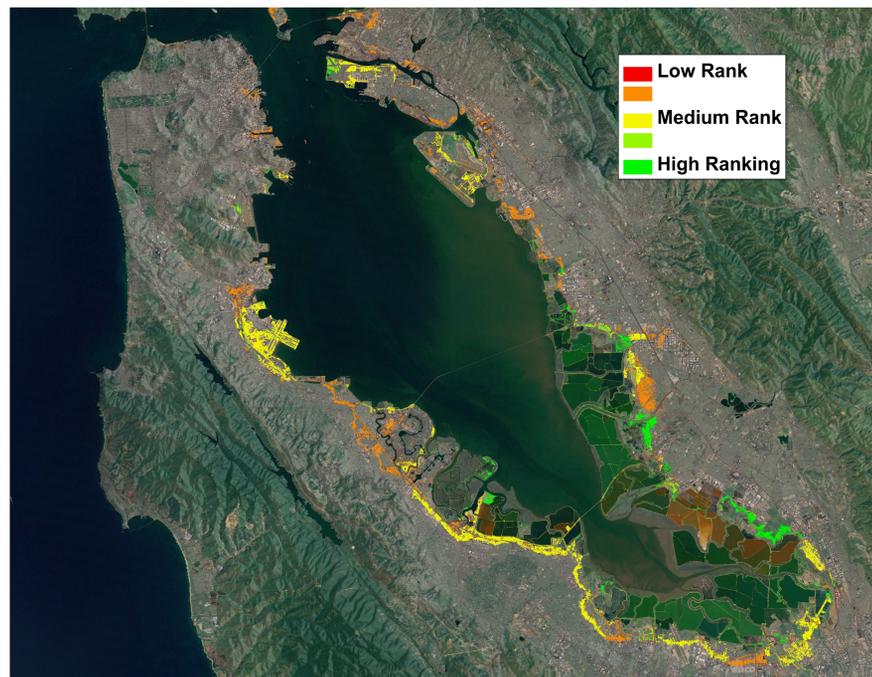


Shape Metric at Bair Island (red = liner, orange = mixed, green = compact)

A GIS based decision support system (DSS) to identify and prioritize marsh-upland ecotonal habitats (transitions) to assist land managers in restoring and protecting San Francisco Bay’s (estuary) tidal marsh ecosystem will be presented. The DSS takes a strategic approach towards decision support, by accounting for the landward migration of high marsh and other transitional habitats in response to predicted sea level rise (SLR). Current documents do not adequately describe ecotonal habitats, quantify the amount needed to aid listed species recovery while allowing for SLR, nor prioritize specific sites for protection and restoration. The DSS combines definitions, GIS models of the distribution of TZH at the landscape level, site specific indicators for ranking patch “quality” for restoration or protection, and parcels level maps for prioritizing TZH throughout the SF estuary. This toolkit will help managers allocate limited resources on site prioritization, alternative/scenario evaluation, and will include considerations for the influence of future climate change and land-use scenarios. Although most indicators were mapped throughout SF bay, our pilot study focused on the south bay. Project findings will be made available on the web through an interactive mapping tool.

### Step 6: Rank and Prioritize Transitional Zone “Patches”

Indicators values for Step 2 – Step 4 (ecological indicators) were summed into a combined index value. These values were modified through two multipliers based on land use and protection status. Final index values (max = 100+) were used to rank (and eventual prioritize) each transitional patch. Both *potential* existing transitional patches (“levee on”) and *potential* accommodation space (“levee off”) were assigned index values. Preliminary rankings for each transitional patch were determined as follows:



(1) Ecological Index  
 Width | Area (10 to 30) +  
 Adjacent Wetland (10 to 30) +  
 Adjacent Upland (10 to 30) +  
 Adjacent Water (5 to 15) +  
 Adjacent Urban (-10 to -30) +  
 Adjacent Agriculture (TBD) +  
 Shape (-10 to 10)

(2) Final Index  
 Ecological Index +  
 Land Use Type +  
 Protection Status



Final Index Value at Bair Island

### Next Steps

Still to be completed:

- Patch Connectivity
- Ground Truthing (field asses individual indicators, rank, vegetation)
- Sea Level Rise (future time horizons)
- Rank and Prioritize for Protection vs. Restoration

For questions please contact Brian Fulfroft at [bfaconsult@gmail.com](mailto:bfaconsult@gmail.com).

### Step 4: Adjacent Habitat

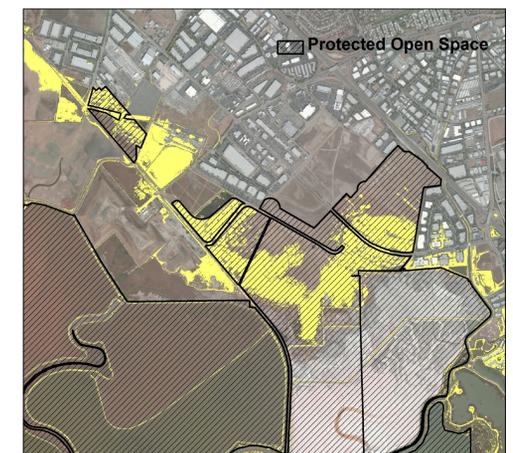
The focus on the DSS is to identify, map, and rank transitional zone patches *between wetlands and uplands*. Consequently, the (a) proportion of shared boundary for adjacent land cover(s); and (b) area (i.e. size) of these same adjacent land covers were quantified in ArcGIS for each transitional zone polygon “patch” mapped in Step 2. Land cover types included: tidal wetland, terrestrial wetland, urban, “upland”, agriculture, forestland, and water. Transitional zone patches adjacent to both wetland and uplands were given the highest positive indicator values while patches adjacent to urban land cover were given negative indicator values. Indicator values for adjacent land cover assigned to transitional zone patches were weighted based on both the proportion (>= 50% of shared boundary given the highest weight) and area (50 acres of land cover given the highest value). We used land cover data from both the SFEI BAARI dataset (for wetlands) and the USDA’s CalVeg dataset (for all other land cover types).



Adjacent Habitat at Bair Island

### Step 5: Land Use and Protection Status

Each transitional zone patch was assigned a land use (e.g. residential, commercial, industrial, parks, etc.) at the parcel level. Information about land use(s) designations assist land managers in determining the feasibility for restoring or protecting potential transitional zones at the parcel level – the geographic unit utilized by land managers and planners. Transitional zones within existing parks/open space or on vacant property can be prioritized for protection or restoration over patches within residential or commercial parcels. In addition to land use, potential transitional zone patches were also identified as currently within (or outside) existing protected open space, modifying the ranking (and priority) for restoration or protection. Land uses and protected open space were used as modifiers of the weighted index values of the ecological indicator values assigned in Step 2 – Step 4. Parcel based land use data (in GIS format) was acquired from the Metropolitan Transit Commission (MTC). Polygons of protected open space (in GIS format) was taken from the California Protected Areas Database (ver 1.8) courtesy of GreenInfo.



Protection Status at Warm Springs