R graphics and Tidal Wetland Restoration

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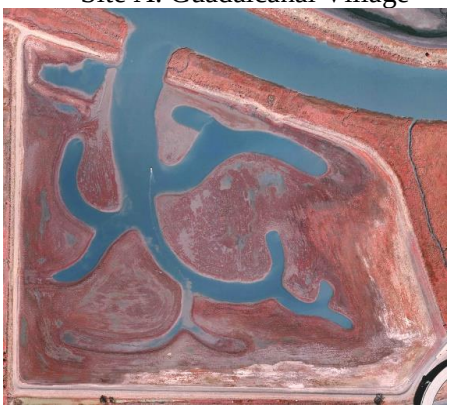
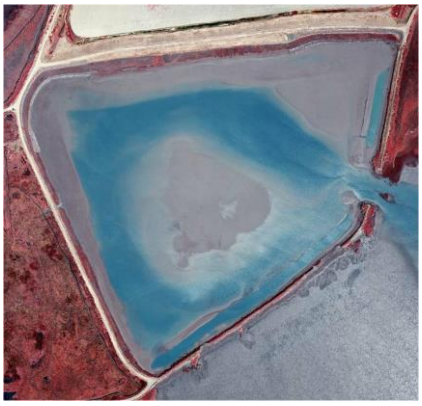
Guadalcanal and Tubbs Setback are two 20-30 ha tidal wetland restorations projects on the San Pablo Bay (north San Francisco Bay) that have been monitored by the US Geological Survey (USGS) for both mitigation and habitat restoration objectives. Both wetlands were restored in part through breaching of a levee to allow tidal inundation, sedimentation and vegetation colonization to occur. *Guadalcanal* [Site A, 1] is considered to have been "engineered" to a greater extent than *Tubbs Setback* [Site B, 2], with considerable design input and channel excavation efforts undertaken before the breach. The Tubbs Setback restoration is considered to be "self-design" with the primary project intervention the single breach to a levee on San Pablo Bay (SPB). Between 2002 and 2008, these two sites were monitored for various biophysical parameters including hydrology, sedimentation rates, vegetation, bird and mammal populations.

R packages including **ggplot2** and **plot.ly** were used to visualize restoration processes in tidal wetland systems, through datasets on hydrology /tidal inundation, sedimentation, vegetation, and bird populations at two wetland restoration sites. The levees were breeched at both sites in order to restore tidal inundation and sediment transport processes. At Site A, the site was designed to specifications, excavated to pre-specified grades, and into a complex engineered channel system. At Site B, the levee was simply breeched and with no additional design or construction of bank elevations or channels. Here we compare the two sites, using defined indicators of restoration efficacy over time. Using remotely sensed imagery and relationships of monitored data, we seek to determine whether there is significant different in restoration outcomes of these representative wetland sites, and predict temporal features of other tidal wetland restoration or mitigation efforts.

Site A. Guadalcanal Village



Site B. Tubbs Setback



References

[1] Woo, I., J. Y. Takekawa and R. Gardiner (2007). Guadalcanal Tidal Marsh Restoration: 2007 Annual Report. Data Summary Report, U. S. Geological Survey, Western Ecological Research Center, San Francisco Bay Estuary Field Station, Vallejo, CA. 57 pp.

[2] Woo, Isa, Takekawa, John Y., Rowan, Aariel, Gardiner, Rachel J. And Giselle T. Block (2006). The Tubbs setback Restoration Project: 2006 Final Report. Administrative Report, US Geological Survey, Western Ecological Research Center, San Francisco bay Estuary Field Station, Vallejo, CA. 70 pp.

~ Monitoring data was provided by the U.S. Geological Survey, Western Ecological Research Center, San Francisco Bay Estuary Field Station, Vallejo, CA, 2013.