A hyperspectral approach to estimating biomass and plant production in a heterogeneous restored temperate peatland

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Figure 1. The Sacramento-San Joaquin River Delta

Figure 2. cattail (*Typha* spp.) and tule or bulrush (*Schoenoplectus acutus*)

Questions

1. What vegetation indices best correlate with biomass, by water depth and season?
2. Does addition of plant structure data (leaf height above water) improve biomass estimates?
3. How does a dense litter layer influence the correlation between f_{APAR} and vegetation indices?
4. How does APAR, calculated as daily PAR*average f_{APAR}, relate to GPP modeled from eddy correlation flux measurements?

Table 1. Best Two-Band Vegetation Indices (TBVI) for predicting biomass

Dataset	Index	R^2
All Data	$TBVI_{1195,854}$	0.41
May-June	$TBVI_{885,722}$	0.32
July-August	$TBVI_{1155,1003}$	0.48
Sept.-October	$TBVI_{2224,518}$	0.33
water depth < 5 cm	$TBVI_{1730,1710}$	0.61
5 cm < water depth < 35 cm	$TBVI_{1205,993}$	0.47
water depth > 35 cm	$TBVI_{973,885}$	0.16

Figure 3. Addition of leaf height above water improves estimation of biomass, with R^2 = 0.63 for a mid-summer dataset compared to R^2 = 0.48.

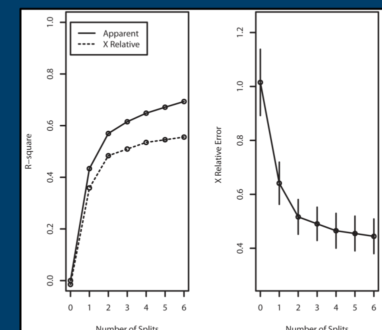


Figure 4. $PAR_{transmitted}$ above litter $TBVI_{1114,539}$ ~ f_{APAR} R^2 = 0.50

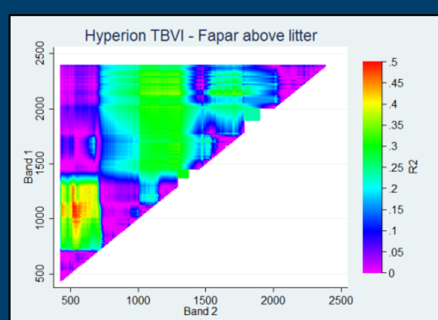
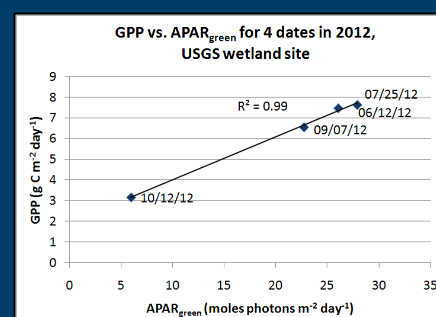


Figure 5. $APAR_{green}$ increased with GPP, R^2 = 0.99



Conclusions

1. Need for data-fusion approach for mapping biomass
2. Feasible to model productivity
3. Combine maps with elevation forecast model to predict marsh response to sea level rise.

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