Organic matter decomposition in created and natural brackish marshes in coastal Louisiana

Introduction

Coastal land loss is a major issue in Louisiana and marsh creation projects help to rebuild lost coastal wetlands. However, to determine the success of these efforts, it is important to compare the ecological functionality of created mashes and existing natural marshes. Organic matter decomposition in an important ecological function that affects the amount of carbon stored in a marsh. It can be affected by internal controls, like plant community composition, and external controls like flooding.

Objective

We focus on the Lake Hermitage Marsh Creation Project in Plaquemines Parish, LA, which created over 1,000 acres of marsh over a three-year period (2012-14). Specifically, we quantified decomposition rates relative to: 1) Created versus natural marshes, 2) Distance from the marsh edge, and 3) Elevation and water level range.

Fig. 1 - Deploying litter bags in a Louisiana marsh

Methods

- Two created (LHA, LHB) and one natural marsh site (LHC)
- Five plots per site at 1, 10, 25, 50, & 100 m from marsh edge
- Five *Spartina alterniflora* litter bags per plot with 25 grams of material per bag
- Elevation measured at each plot and water level range recorded at each site.
- Two month deployment (May-Jul. 2018)
- Leaf litter was dried, weighed, and compared to initial mass.
- Two-way ANOVA used to analyze data by site and plot, and liner regression used to compare data with an index of inundation
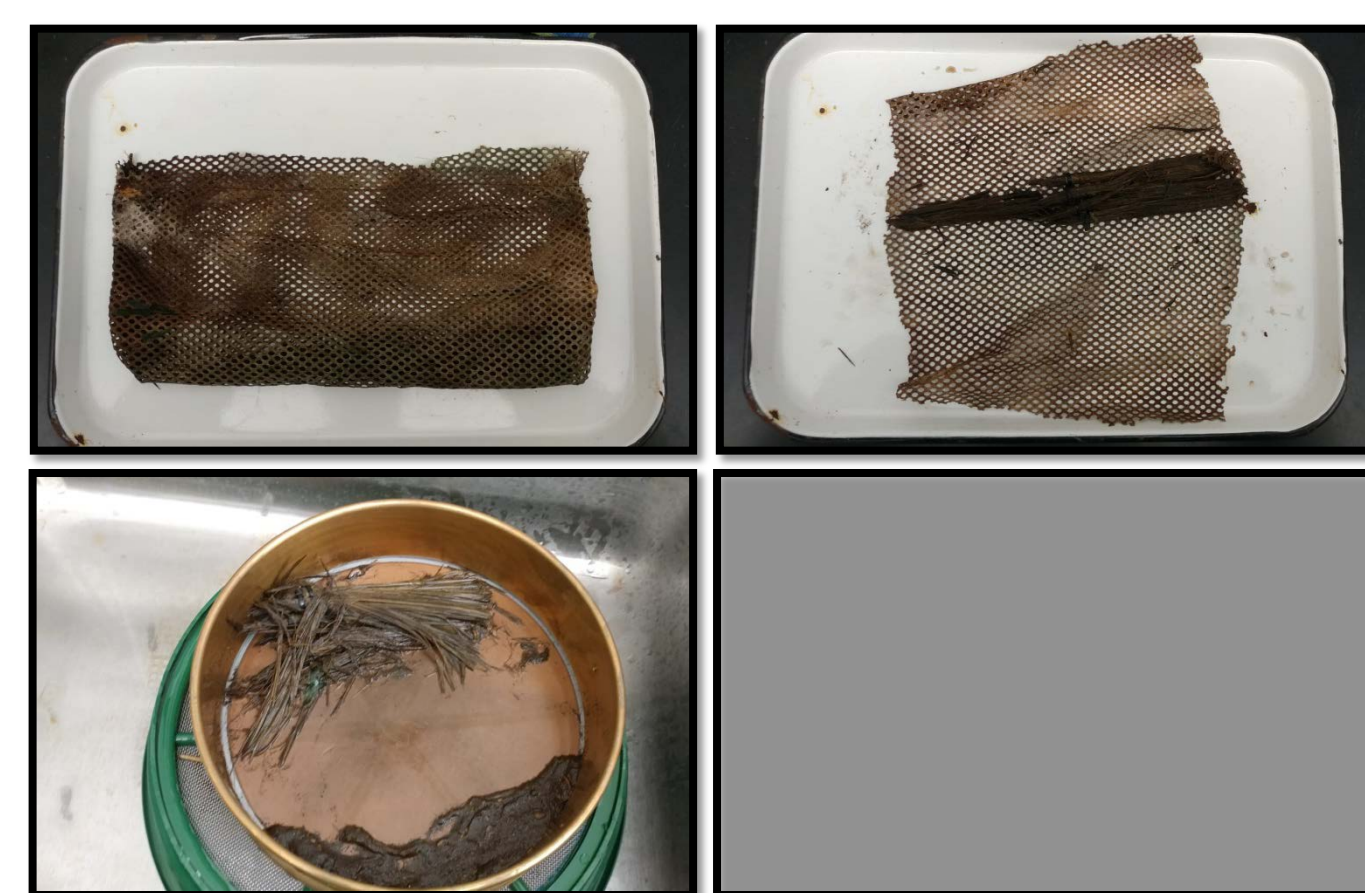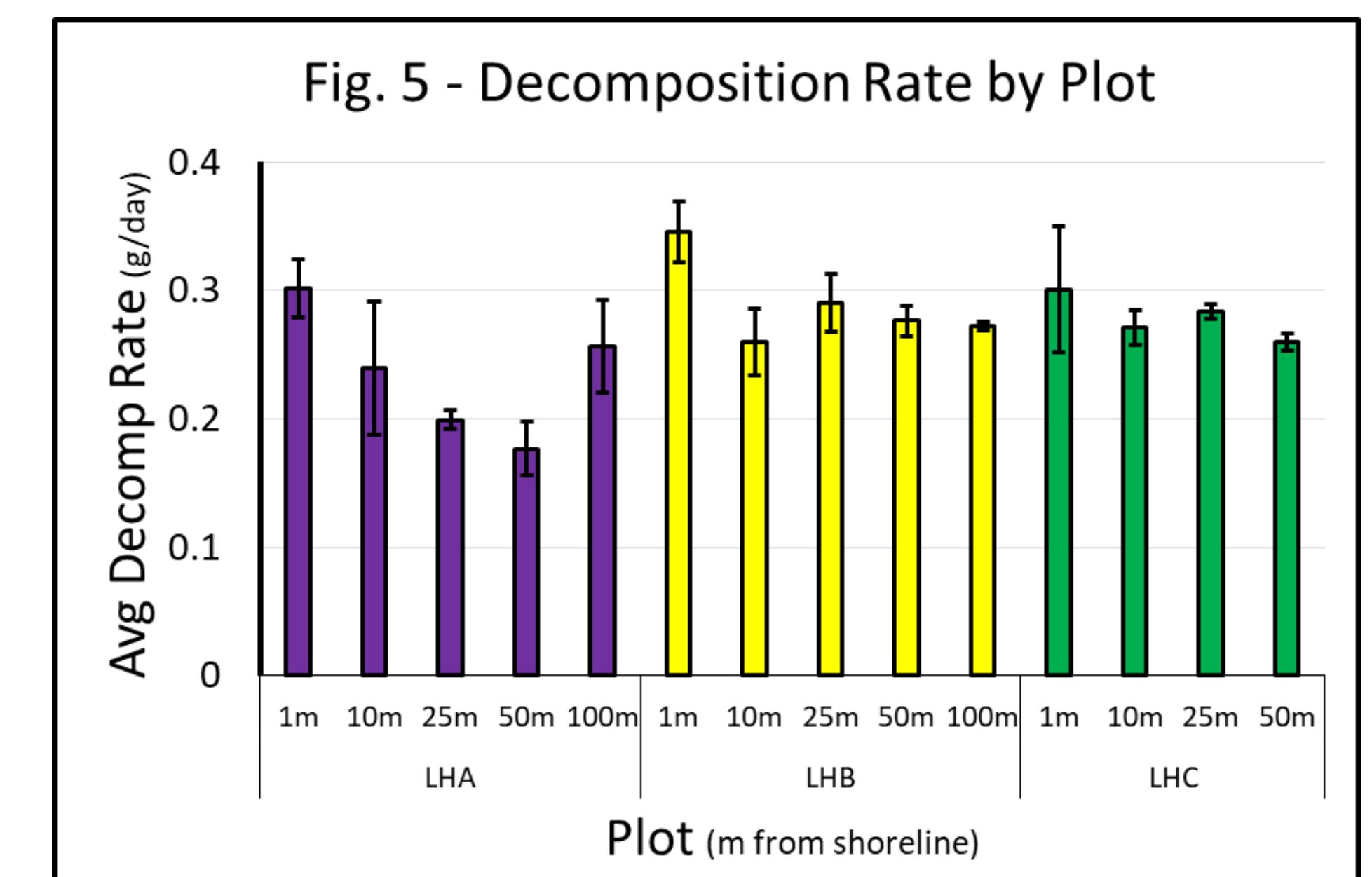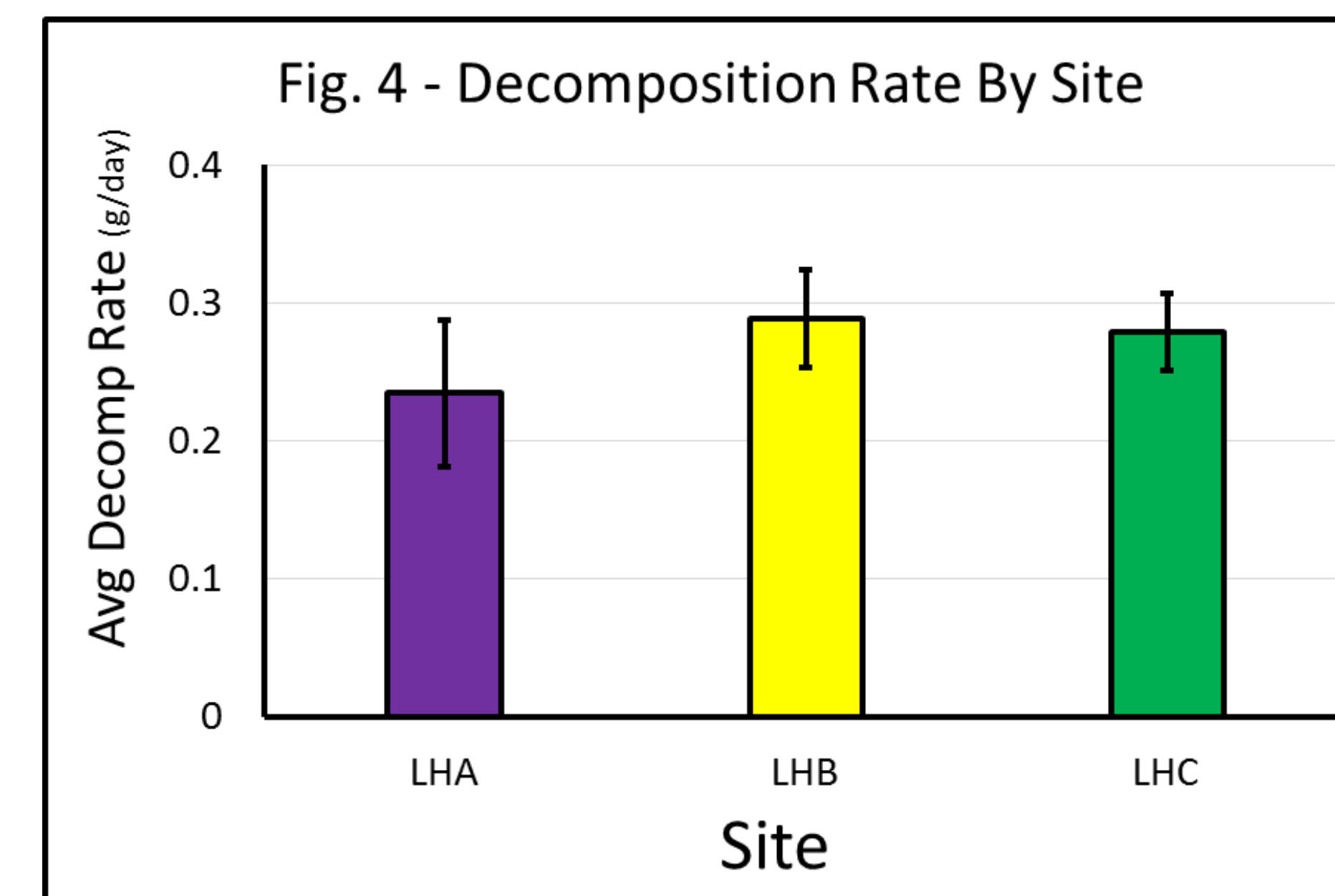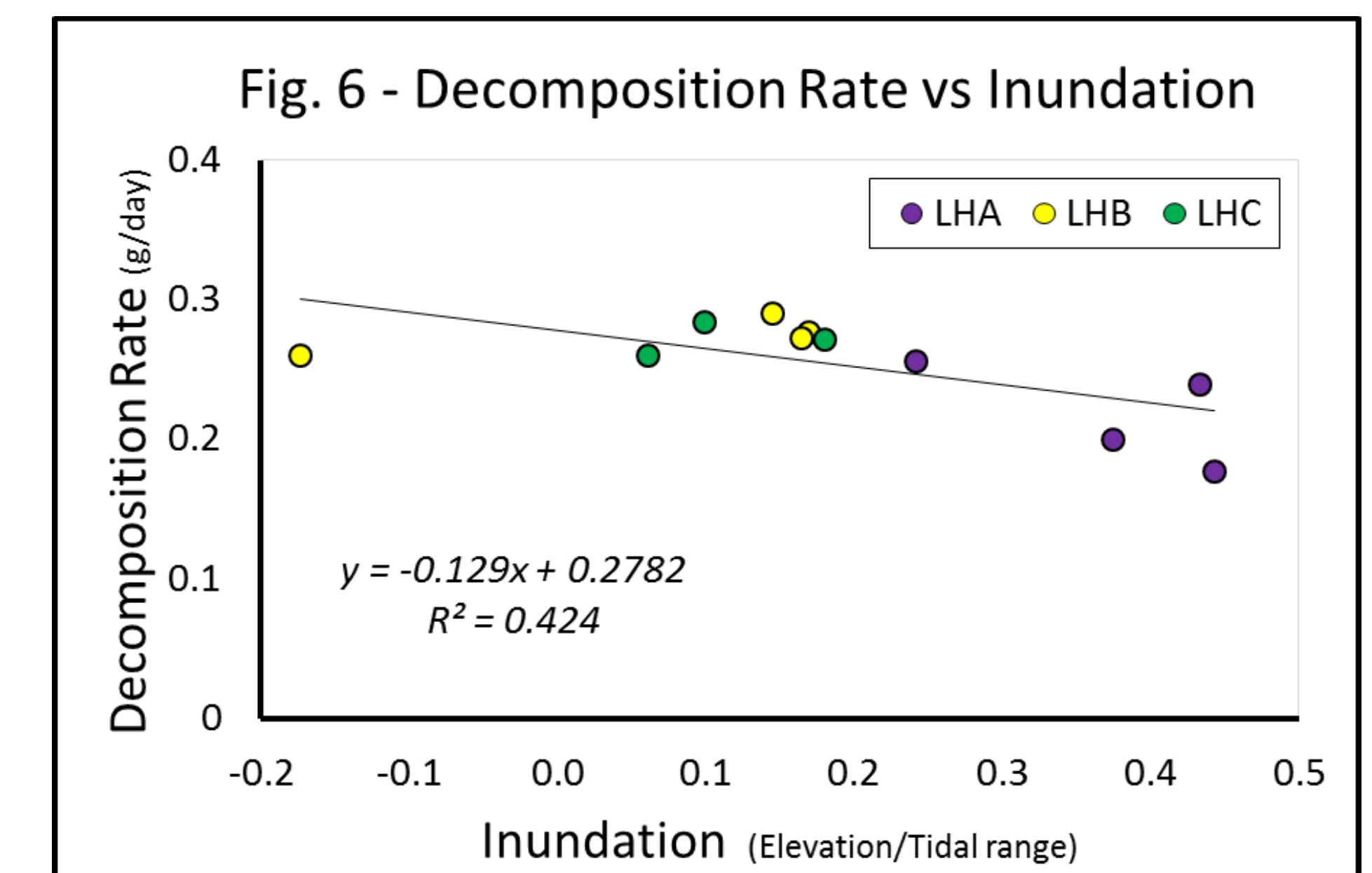

Fig. 2 - Study sites and litter bag plots

Fig. 3 - Litter bag processing

Results

Litter decomposition rates differed among sites ($p < 0.0001$, df = 2, F = 32.9516), by plot ($p < 0.0001$, df = 3, F = 25.4938), and had a significant interaction ($p = 0.0010$, df = 6, F = 4.5546). Natural site LHC and created site LHB had higher decomposition rates relative to created site LHA (Fig. 4). Decomposition rate was highest at 1m from the edge relative to other distances (Fig. 5).

There was a significant relationship between decomposition rate and inundation at plots when excluding edge plots ($p = 0.0300$, $R^2 = 0.424$). Decomposition rates were higher in plots with higher inundation measured as the ratio between elevation and water level range (Fig . 6).

Conclusion

Our results identify marsh elevation and hydrology as key factors influencing organic matter decomposition rates within and among created and natural marshes in Plaquemines Parish, LA. Differences observed between sites are likely a reflection of higher decomposition rates at sites with lower elevation and higher inundation, as opposed to their created versus natural status. In addition, decomposition rates were highest at the marsh edge in both created and natural sites. These results suggest that marsh elevation and hydrology are important determinants if created marshes are to effectively replicate the carbon storage features of natural marshes.

Joseph Winston[1], Elena Boardman[1], Erick Swenson[1], Brian Roberts[2], Michael J. Polito[1]

[1]Louisiana State University, Baton Rouge, Louisiana, USA, [2]Louisiana Universities Marine Consortium, Cocodrie, Louisiana, USA

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