Microbial degradation of labile organic matter from *Spartina alterniflora*-dominated marshes

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Coastal marshes at land-ocean interfaces accumulate and store large quantities of C in predominately anoxic soils. This results in long-term organic C burial. Short-term organic C turnover of marsh vegetation (e.g. *Spartina alterniflora*) by marsh soil microbial communities impacts production rates of greenhouse gases and marsh soil susceptibility to erosion. Organic C degradation rates were evaluated in the context of changes in microbial community composition, soil depth, proximity to water, and even the potential impact of the *Deepwater Horizon* oil spill in 2010 to Louisiana marshes. Soil and sediment cores were collected from 5 m inland and 1 m off the edge of the marsh, respectively, at two marshes that had varying oil levels in 2010. Inland microbial communities differed between the two locations, as well as between depths, particularly among proteobacterial classes, and Chloroflexi, and Bacteriodetes groups. Laboratory enrichment experiments were conducted using native soil or sediment (0-1 cm or 9-10 cm depths) and filter-sterilized seawater, to which *S. alterniflora* leachate produced by tyndallisation was added (300 μmol-C; 20 μmol-N). Changes in chromophoric dissolved organic matter were measured by UV-Vis and fluorescence spectroscopy to determine rates of organic C humification, as a proxy for microbial degradation of labile C sourced from the leachate. Humification rates for both depths, at both sites, were fastest within two weeks after leachate introduction; however, degradation rates were an order of magnitude higher for the more heavily oiled inland soils than the other sediments. Enhanced microbial organic C degradation, linked to specific microbial communities at the more oil-impacted marshes, may be due to the priming effect caused by exogenous organic C (i.e. oil). These results may help to explain observed changes in variable gas flux and soil erosion rates at the oil-impacted marshes.