Coastal Science Assistantship Program Application

Name: John R. White

Mechanisms for Persistent Oiling Stress on Coastal Marshes from the BP Oil Spill Event: Potential Impacts to Coastal Marsh Sustainability and Ecological Function

Proposal Narrative

This research will seek to fund a student to investigate a proposed novel, recent, chronic oiling process that has not been well described or understood. Our research group has observed that there have been salt marshes within Barataria Basin which has buried BP oil in the soil profile. Work conducted on the oil by Dr Overton of SC&E has been able to identify the oil signature. We hypothesize that there are two longer term impacts of this oil pool that has virtually been ignored which could potentially impact sustainability of our coastal marshes well into the future. The first hypothesis i : The now buried oil, is centrally located within the rhizosphere of the coastal marsh plants. While almost all the oil research on the effects of oil on macrophytes has been surface oiling, this impact to this biogeochemically-active rhizosphere zone can likely impose significant stress on plants through increased oxygen consumption in the root zone, slowing plant productivity and carbon accumulation through decreased growth.

The plant roots will have access to this oil for as long as a decade or more and impacts on sustainably of this type of oiling impact on coastal marsh systems are not well understood. Experimental protocols will include both field and greenhouse studies and plant productivity measures both above and belowground. We will document the extent of the buried oil both in the vertical and lateral spatial dimensions using a series of cores. The PI is currently funded by the LSU-BP funding to investigate the effects of oils on microbial processes in wetland soils and information on the oil effects on soil nitrogen and carbon loss, through mineralization processes are a strong complement to the proposed research delineated here. The PI will be able to leverage those previous funds with data on characterization of the oiled marshes currently under investigation.

There is a second impact to this buried oil which may project the effects of the BP oil spill well further into the future than anyone has previously thought. This impact is related to the chronic high rates of erosions in many of our coastal systems, and Barataria Bay having some of
the highest erosion rates. It has been observed in the field, that as the front edges of the marsh erode, the previously buried oil has been exhumed or unearthed from the soil and due to wind and wave action, is then transported across the marsh surface, essentially re-oiling the marsh anew.

While our initial estimates of oiling impacts have been constrained from field observations to marshes which were oiled directly related to the spill event, our hypothesis is that, over time, this oiling will continue as the cycle of oil burial and erosion repeat over and again. Where we once believed the marsh oiling impact was constrained just to the edge of most marshes, as the edge continues to erode and retreat, so too will the oil impacts. This has a great potential impact on the long-term sustainably of our coastal marshes from this event.

Our current sites as well as others in Barataria Bay will be used to document this edge effect which has the potential to “expand” the oil impact spatially through repeats temporal cycles. We will document coastal marsh erosion rates in oiled and control marsh areas using edge markers and measure marsh distance from markers over time. We will core in heavily

oiled sites and moderately oiled sites to document the extent of the burial of oil from the edge of the marsh to the marsh interior. The extent of the re-oiling at the surface will be documented through grab samples on a spatial grid to quantify the spatial impact from this second generation oiling.

This research is directly related to the CPRA mission and the State Master Plan which is focused on sustainability of the coastal zone, in particular, the important coastal wetland margin which is vital for providing an extensive list of societal benefits though ecosystem services of improved water quality, carbon sequestration, storm protection and habitat for fisheries and wildlife being among the more valued by society. This work is also directly applicable to the Louisiana Oil Spill Coordinator's Office (LOSCO) which seeks to quantify the time and extent of impact of all types of oil spills on ecosystem services to the ecosystem "shareholders", the people of Louisiana.