Oil Contamination Impacts

Bioengineering GROUP
Building Sustainable Communities on an Ecological Foundation

The release of millions of gallons of crude oil from the Deepwater Horizon offshore rig has galvanized the attention of local residents, government agencies, and the national business community, provoking a level of dialogue never before heard. This event has made obvious the social and environmental costs of oil extraction which so often are abstract or theoretical. Greenhouse gas emissions, national security threats, spills in remote areas have never captured our minds like current aerial photos and live streaming video showing erupting and spreading plumes of petroleum. The question now is how to act to minimize impact and achieve clean-up, but also intervene in ways that achieve multi-purpose restoration objectives. Rapid constructive action is clearly needed. Handled ideally, can the catastrophe become a catalyst for restoring physical and biological integrity to Gulf Coast ecosystems and the human economy they support, and can it shift our energy policies toward non-fossil fuel options?

COURTESY OF NASA

Oil Spill as of May 24, 2010

Even in the face of tragic oil contamination, there is a potential to achieve accelerated benefits to the restoration of coastal Louisiana and other sensitive portions of the Gulf Coast. Much ecological and engineering study, detailed design, and physical modifications have recently been achieved in connection to the Greater New Orleans and wider Southeast Louisiana hurricane risk reduction programs. The long-term physical integrity and functional performance of reconstructed levees, elevated floodwalls, surge protection barriers, and other elements such as critical pump stations depend on healthy marshes shoreward of the protected areas. Most stakeholders agree that a "Multiple Lines of Defense" strategy for coastal protection and restoration is a resilient and adaptable, and hence reliable approach, based on redundant and complementary natural and built elements to provide a multi-purpose system that can meet flood management needs concurrently with fisheries productivity and other community values.

COURTESY OF LIZ WARD

Healthy Louisiana marsh provides for fisheries, tourism, and storm buffering

The foundation for this approach is the basic contribution of marsh vegetation to capture the sun's energy through photosynthesis and apply it selfishly to collecting and holding soil, and building land through accumulation of organic and mineral sediments. Without healthy plants, Louisiana's land mass has suffered chronic loss over most of the last century, depleting habitat productivity over time and allowing a once growing Mississippi River delta landform to systematically shrink for the first time in its geologic history. Marsh health can be restored through many of the same measures that can keep oil out of the marshes or promote its degradation after oil makes landfall. One of the biggest impacts to many coastal wetland plant communities in the region has been unnatural exposure to very salty water allowed in by petroleum exploration canals, navigational channels, and other perforations to the coastal system which allowed salinity levels to burn sensitive plant species. Now some of the measures that can keep oil out may offer additional layers of protection against hurricane impacts, while generally promoting the improvement of coastal ecosystems.

Oil and gas canals and ship channels have allowed salt water in to burn vegetation

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Success in oil impact mitigation, flood management, and ecosystem restoration are all aligned in this instance—the regional landscape is one physical, chemical, and biological system, and the geologic processes that create and support the landforms are inseparable from the ecosystem's health. Natural processes can work to provide degradation of petroleum, but they work best with support and enhancement—however, this does not resemble pristine natural systems conservation methods, but instead a hybrid blend of engineering and ecology, harnessing natural systems to hasten the assimilation and breakdown of oil. A panicked rush to help save individual oil soaked creatures is not likely to be a wise investment of money and attention, and though it often seems like the most obvious action to start with, it should be avoided in favor of solutions to improve habitat conditions to allow fish and wildlife populations to rebound and flourish in the longer term. Ideally, we will put measures in place not and continue to adaptively manage them permanently for the successful long-term restoration of healthy coastal habitats founded on stable landforms.

Pumping dredged sediment to form land is cost-effective

Standard dredging equipment can be readily deployed using proven techniques to build land

Managed vegetation promotes oil degradation

The Challenge

Because a large volume of oil has been released, short-term impacts to aquatic organisms are inevitable. While prioritizing the control of oil release and migration is valid, the remaining financial, human, and technical resources should be aligned to address long-term problems which may be less obvious, rather than short-term problems which may seem pressing to those unfamiliar with Gulf Coast landforms, habitats, historic problems, and ongoing planning for restoration of large-scale systems. Dead sea birds and dolphins are tragic but dead marsh that releases sediments and loses land mass during the next storms is a less visible but much larger tragedy that has no ready solution. Current options to prevent the spread of oil into sensitive habitats may also serve to promote their long-term health based on physical and biological integrity, and should be robustly implemented, but keeping all parties focused on this goal will require abundant discipline in the face of emotional distraction.

Vegetation can add long-term stabilization as well as remediation value

Cleanup & Restoration Strategies

Bioengineering GROUP
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Contain Concentrated Oil

Enhance & Create Earthen Barriers

Freshwater Flow to Deflect Oil

Collect, Remove, Reuse Oil

Facilitate Aquatic Bioremediation

Facilitate Terrestrial Bioremediation

Restore Healthy Coastal Habitats

Contain Concentrated Oil Reduce long-term impacts of oil contact with aquatic and terrestrial habitats, recognizing that areas already affected by oil will continue to receive much more over time, and new areas will be hit, thus containment through booms, skimming, and oil-water separation should happen as soon as possible and continue for as long as oil remains concentrated.

Enhance & Create Earthen Barriers Add land mass to increase length and height of barrier island systems to create obstacle to oil spread using pumped dredged material placed in a manner consistent with protecting and rebuilding existing habitats. Define final contouring and suitable revegetation or stabilization measures later, but act fast to construct barriers while further oil migration can be stopped.

Freshwater Flow to Deflect Oil Water must still flow through any natural or constructed barrier system, hence openings in the barrier landforms can be adaptively managed using curtains and booms to govern concentrated flows that push oil away from gaps. Use pumps where needed to convey water over forward of barrier systems in areas where gaps would allow tide or wind borne oil to penetrate gaps despite flow. Increase flow through estuary via selected releases of fresh water through regional diversion structures.

Collect, Remove, Reuse Oil Hay, straw, and coir fiber have all been studied and shown to selectively attract oil to their surfaces under spill conditions. Use natural fibers as permeable absorbent carriers to capture oil, then remove through retrieval of coir fascines/mats or raking of hay/straw for burning at facilities such as the Big Cajun II coal fired plant near New Roads, LA which accepts biomass to promote cleaner burning of its coal.

Facilitate Aquatic Bioremediation Manage improved productivity of naturally occurring microbes by placing organic and inorganic substrate in water column and enhancing aeration. Organic fiber bundles attached to buoys, trickling filter media, and other related materials can be incorporated with containment booms or positioned to reach deeper oil plumes.

Facilitate Terrestrial Bioremediation Land mass which becomes impacted by oil may be land farmed for remediation, using tillage and/or fertilization to accelerate in situ bioremediation. This is especially feasible for newly placed soils which lack vegetation, seed banks, and especially fibrous dead and living roots that provide critical soil reinforcement. Hence placement of a surface layer, 1-3 feet thick over poorly vegetated peaty soils may be a suitable measure to buffer and protect existing marsh.

Engineered barrier islands have been successful in the region

We Can Help

Bioengineering Group
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Bioengineering Group offers a skilled team of science, engineering, fieldwork, and construction management professionals who perform sampling, analysis, remediation, and design. Our approach uses specialized techniques and strategies to mitigate the environmental impact caused by natural or human-caused disasters. By assigning each project a team of experienced technical specialists that work together closely, we can achieve a client's objectives in the most economical and environmentally sustainable way. We pride ourselves on being able to develop creative solutions that can help restore the ecological balance and structural integrity of project sites. Our expertise includes:

Science

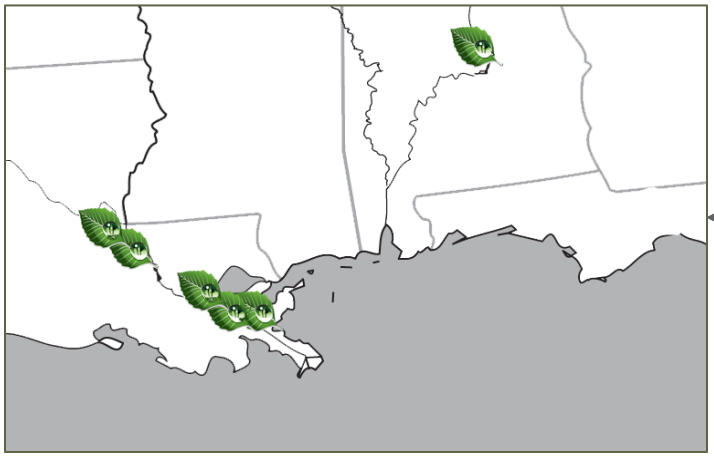
- Wetland delineation, restoration, and monitoring
- Habitat inventories, assessments, and conservation plans
- Rare and endangered species and rare plant surveys
- Environmental permitting and compliance (NEPA, CWA, ESA)
- Liaison services with key stakeholders

Engineering

- Geotechnical, structural, civil, hydraulic, and environmental engineering analysis and design
- Water quality permitting
- Computer modeling
- In situ remediation techniques, including phytoremediation and bioremediation

Fieldwork & Construction Management

- 40-Hour OSHA HAZWOPER certified staff
- Phase I Site Assessments
- Subsurface investigations
- Hydrographic survey
- Soil and groundwater sampling, monitoring, transportation, and cataloguing
- Operation of drill rigs, hollow stem augers, solid stem augers, and mud and air rotaries, and rock corers
- Air quality monitoring and mitigation design
- Temporary pumping station design and operation
- Construction management services for dredged material placement, wetland mitigation, and shoreline stabilization
- Dredging and beneficial re-use technical oversight
- Vegetation planting layout and monitoring, and plant selection and evaluation



Our experts are already on the ground and ready to deploy where needed from our current corporate and field office locations

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Success Stories

Bioengineering GROUP

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Oil contamination impacting marsh habitat

Romere Pass Marsh Restoration Project | Plaquemines Parish, LA

When an oil leak developed in a 3-inch flowline operated by a small local oil production company, crude oil and saltwater were released within the Delta National Wildlife Refuge (DNWR). The sensitive environmental area was damaged and habitat quality and suitability was impaired. Bioengineering Group was contracted to restore the marsh habitat, which serves as the food source for fish, waterfowl, and animals and as a winter home for snow geese, coots, and ducks. Bioengineering Group synthesized existing information on habitat condition and ecological character; conducted field reconnaissance to document the damage to the wetland features; oversaw the installation of plant and soil material; and acted as a liaison between the oil company and DNWR to smoothe communication and facilitate constructive action. The final planting layout establishes a baseline for future planning and resource management activities in addition to addressing key habitat needs.

Marsh planting on dredged sediment fill

Bayou Dupont Land Bridge | Jefferson & Plaquemines Parishes, LA

The Bayou Dupont region provides a vital brackish marsh ecosystem and a coastal erosion/hurricane storm barrier to nearby communities, including New Orleans. Restoration of the failing landform was imperative to offset the coastal erosion epidemic occurring in Louisiana. Nutrient rich sediment that was dredged from the nearby Mississippi River and pumped onsite created a platform for coastal plants to thrive. The Louisiana Office of Coastal Protection and Restoration tasked Bioengineering Group to perform planting inspection and monitoring that would best ensure the survival of the constructed wetland. Bioengineering Group evaluated the quality and quantity of plants, monitored the planting progress, and provided key planting procedures to increase survival rate. The result is a thriving 474 acres of restored Louisiana brackish marsh created through the planting of native plants on the constructed berms of dredged Mississippi River sediment. This project helps offset the coastal Louisiana landloss rate and serves as a model for performance monitoring and adaptive management practices on wetland restoration.

Sand-filled construction fabric geotube installed for dune strengthening

Rehabilitation of Hurricanes Gustav & Ike Damage | Grand Isle Beach, LA

A key line of defense against hurricane storm surges for New Orleans, Grand Isle serves as an economic hub and provides important coastal habitat for the region. After hurricanes devastated much of the island's beach and dune system, USACE led the rebuilding of the gulf side beach before another destructive storm destroyed the area. Bioengineering Group provided construction management services to assure efficient placement of engineered measures with the least environmental impact during the rebuilding process. The project employed the use of 31,000 linear feet of construction fabric geotubes filled with pumped sand to create a stable core for the beach dune, which was the first time this innovative technique was used on a Louisiana coastal project. The completed solid beach front decreases the risks associated with daily coastal erosive forces and potential hurricane storm surges. The use of geotubes helped to successfully build a long-lasting and vital beach dune that supported native dune grass growth.

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