LAKE PONTCHARTRAIN BASIN FOUNDATION

SAVE OUR COAST SAVE OUR LAKE

Use of Natural Gas for Coastal Restoration in Coastal Louisiana

John A. Lopez, Ph.D.

Introduction

Coastal degradation in Louisiana is catastrophic and threatens the ecology and economy of the coastal communities and to a significant extent, the ecology of the Gulf of Mexico. The coastal degradation is primarily manifested as permanent land change from emergent marsh habitat to open water. The cumulative land conversion is 2,300 square miles from 1932 to 2008. There are several coastal restoration approaches, but the two most often discussed are re-routing the Mississippi River into wetlands – a.k.a. "diversions"; and mechanical (hydrologic) pumping of sediment to re-establish soil elevation so that emergent vegetation can be planted and re-grow – a.k.a. "marsh creation".

Diversions replicate a natural process but can take a long time (decades) since it is essentially a geologic process. Marsh creation is an un-natural process but can be done quickly (a few years). Marsh creation uses fossil fuels to deliver sediment quickly rather than using the river's energy for diversions. The concept of marsh creation has been taken to new extremes using "long distance piping" of sediment. The first pump of sediment can usually deliver sediment a few miles. Further increments of sediment delivery, with booster pumps, essentially double the cost every 4-5 miles. It has been proposed to pump sediment as far as 40 miles. The current cost per acre for one pump cycle is about $26,000 per acre, so long distance pumping can be well over $100,000 per acre. The vast majority of this cost is energy cost.

LPBF has always advocated for both approaches. Diversions emulate the natural process of the estuary, and are therefore considered more sustainable. However, some areas of the coast need urgent restoration and provide a flood protection benefit and, therefore, we recommend use of marsh creation where it can be economically justified (LPBF and CRCL, 2008). Lowering the cost pumping of sediment expands the potential application of marsh creation; although it does not replace the estuarine importance of river diversions.

A New Natural Gas Approach

Past marsh creation projects and current planning for future marsh creation projects assumes a status quo of the dredging industry's use of diesel engines for their pumps. Conversion of diesel engines to natural gas for hydrologic pumping of sediment may create a significant savings in cost and, therefore, expand the usefulness or feasibility of marsh creation.

Use of natural gas would require cost to convert to natural gas use. Diesel combustion engine would likely need to be replaced with possibly larger natural gas engines. The natural gas engines may need to be supplemented with transmissions to develop adequate torque to large drive large pumps. The supply of natural gas for dredging would be different than diesel. Storage of natural gas on a potentially mobile barge represents new hazards. Flow lines could possibly be used if the barge or engines were fixed. Of course, due to the current infrastructure of natural gas lines across south Louisiana access to natural gas is generally good. Nevertheless, there would be front-end conversion costs. At this time it is unknown what those cost would be.

The current dredging industry is probably based on diesel because of the traditional need for portability and flexibility. This need may be greatly diminished by long- term planning of sediment delivery. Long-term contracts or other incentives could be devised. Louisiana has a long tradition of policy and revenue derived from oil and natural gas, creating a significant policy environment for expanded use of natural gas.

On an energy equivalency basis, one barrel of oil is generally equivalent to 5.8 MCF (1,000 cubic feet of gas). Natural gas is currently selling around $3.50 MCF, and a barrel of oil is $83. Simple calculations suggest that the cost of an equivalent (BTU) natural gas is about 1/5th the cost of unrefined crude oil. The natural gas cost compared to retail cost of diesel is about 1/6th.

There are other advantages to natural gas use other than simply cost of the product. If a delivery system (flow line) was put in place, there would not be re-occurring cost to deliver fuel as would be the case with barging or trucking diesel. Also it is well known that combustion engines which use natural gas have significantly lower maintenance since the fuel is more uniform than diesel.

Long-term contracts with fixed-pricing is common for natural gas, but not for diesel. Using the leverage of the state and incentives for a long-term contract with the oil and gas industry could induce a favorable pricing for the natural gas for 10 years or more. This would allow coastal planning to proceed with a reliable cost for its energy supply. The conversion of hydrologic dredging equipment to natural gas seems to offer an enormous price advantages and could greatly expand the application of marsh creation by pumping sediment.

Natural gas is also a cleaner fuel reducing air pollution. Some consider it a transition fuel to non-fossil fuels in the future. It seems especially appropriate for coastal restoration projects to use a more environmentally friendly fuel.

Natural gas is largely supplied domestically in the US. It is basically an American product. Current estimates are that we have sufficient natural gas supplies for decades to come. This is due in part to new exploration and development techniques for natural gas such as so called "shale gas". Natural gas is also a Louisiana product. More than half of Louisiana's onshore and offshore production is natural gas. Using natural gas instead of diesel does reduce our dependence on imported oil supply.

There are important question to be addressed:

1. What is the likely full cycle cost differential to convert to natural gas?
2. Can natural gas engines be built of sufficient torque for large hydrologic pumps?
3. Can a safe natural gas distribution system be devised for pump activities often conducted on barges (Possibly in a major navigation challenge such as the Mississippi River)?
4. Are there policy or regulatory barriers?
5. What incentives can be used to facilitate conversion?

Nevertheless, since natural gas has widespread use already for commercial power generation and is commonly used even offshore on oil and gas platforms, it seems likely these potential challenges could be overcome.

Example Applications

MRGO Restoration The Corps of Engineers is currently completing a major study to address coastal restoration needs due to the Mississippi River Gulf Outlet shipping channel. This is just one study covering about ¼th of Louisiana's coast. The reported estimated cost for construction is estimated to be $3.2 billion. The draft plan uses a balanced combination of restoration techniques, but its cost is uneven for the different restoration techniques. The project elements which use pumping of sediment to restore swamps or marsh probably represent more than $2 billion of the total cost. If natural gas could be used for these projects alone, the cost could be reduced well over 1 billion dollars. Possibly reduced to as little as $500 million, which would make the total project cost $1.5 billion, which is less than half the current estimate.

Cumulative Wetland Loss The total land loss in Louisiana from 1932 to the present is 2,300 square miles or 1.5 million acres. Using diesel at an estimated cost of $26,000 per acre, this would cost a $38 billion. But this assumes you are pumping a short distance which is not likely on this scale. The real cost is probably 2 to 3 times higher, that is $100 to 150 billion. Using natural gas and assuming dredging cost are reduced by 80%, suggest the cost to rebuild all of the wetlands is $20 to $30 billion. So even with natural gas and assuming huge cost savings, it is probably not cost feasible to restore wetlands on this scale. River diversion will likely still be necessary to deliver sediment, but also to maintain a freshwater supply for the estuary.

Current Average Rate of Wetland Loss The rate of wetland conversion to open water ("land loss") varies significantly from year to year. For example, hurricanes can cause a spike in the wetland loss. During Hurricanes Katrina and Rita, 217 square miles were lost in 2005,and yet the average rate is now generally estimated to be 24 square miles per year. Using diesel at an estimated cost of $26,000 per acre, suggests the cost to replace the annual average rate of wetland loss is $400 million. Using natural gas and assuming an 80% cost reduction would generate a cost of $80 million. Even if some of this is long distance pumping of sediment pushing cost to $200 million, this seems achievable even with current funding. That is, with the application of natural gas to dredging, achieving an average of no net loss, may be within our grasp now.

Conclusions

It is often suggested that Louisiana wetland loss crisis is a driven by a lack of sediment. Sediment load on the Mississippi River has been reduced over 50% compared to historic levels. Our coast requires new sediment be built on top of the landscape to keep pace with subsidence to maintain land. However, the Louisiana coast and offshore is composed of unconsolidated sediment which is thousands of feet thick and is ubiquitous to our coast. The vast majority of this sediment we need to leave in place, but the cost to pump sediment from where it can be mined to where it can be used for restoration is often the limiting factor for project feasibility.

Therefore, our wetland crisis can be seen as a lack of funds for the energy cost to move sediment around, rather than simply a shortage of sediment. The cost to move sediment is just as important as the supply of sediment. Natural gas seems to offer a new approach to the traditional and proven restoration technique of pumping sediment to re-create marsh or swamps. In the best case, use of natural gas for pumping of sediment will not replace any the other methods of restoration, but it may expand its application significantly and offers new hope that Louisiana can save its coast.

LPBF and CRCL, 2008, Comprehensive recommendation Supporting the Use of the Multiple Lines of Defense Strategy to Sustain Coastal Louisiana, http://www.saveourlake.org/PDF-documents/MLODSreportFINAL-12-7-08with-comments.pdf