Economic and Geomorphic Comparison of OCS Sand vs. Nearshore Sand for Coastal Restoration Projects

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GoM Offshore Sand Management Working Group
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Funding

- Cooperative Agreement
  - BOEM MMP & Louisiana Coastal Marine Institute
- Project began 9/1/2015
- LSU lead institution
  - subawards to MSU & UNO
- Project Personnel:
  - Economics: Caffey (LSU) & Petrolia (MSU)
  - Geology / Engineering: Georgiou (UNO) & Miner (BOEM)
Motivation

• US Demand for dedicated dredging >2x in past decade
  – Coastal LA: ~90 million yd$^3$ needed for barrier shoreline and wetland restoration over next 50 years

• Beach and dune barrier habitat restoration
  – High-quality sand (similar to native beach)

• Coastal marshes
  – Sandy muds
Motivation

• ~80% of restoration budget is exploration, dredging, and emplacement of sediment (Khalil et al. 2010, Wang 2011)

• Economic comparison of sand sources has not been systematically treated

• Overall Objectives
  – Quantify the cost-effectiveness of sand extracted and delivered from alternative sources for restoration projects
  – Quantify the value of the trajectory of benefits over time
Sand Sources

• In-System: nearshore sand (state resource)
  – Limited quantity
  – Poorer quality
  – non-renewable resource

• Out-of System
  – OCS sand (federal resource)
    • higher-quality
    • potentially higher cost
    • non-renewable resource
  – MS River sediment load / bar deposits (federal resource)
    • potentially renewable
  – USACE maintenance dredging (renewable)
    • Current / BUDMAT
    • Potential / BUDMAT
  – Other
    • Atchafalaya River? (renewable)
    • USACE dry storage facilities? (non-renewable)
Specific Objectives: Economics

• Estimate cost of extraction, delivery, and placement as function of location, composition, technology, distance, and other key variables

• Combine cost function with non-monetary benefit metric (e.g., volume) to predict cost-effectiveness for placing a given quantity at each candidate borrow source and representative project site

• Combine above with:
  – simulated trajectories of volumes retained at project site over time
  – Estimated ESV per unit volume
  – Yield comparison of net benefits delivered over time
Specific Objectives: Geomorphic

• Analyze and compare quality of nearshore vs. OCS sediment resources
• Summarize existing works on impacts of dredging closer to shore
• Quantify benefits of supplementing coastal sediment budget with external sediment resources
• Compare outcomes of representative projects using both nearshore and OCS resources
• Create matrix categorizing sediment type based on suitability for project type
Conceptual Diagram

System boundary

C = C(distance, composition, technology)

Borrow Sites

Project Sites

B1

B2

B3

B4

B5

P1

P2

P3
Conceptual Schematic of Benefits Trajectory
### Summary of Key Tradeoffs

<table>
<thead>
<tr>
<th>OCS / out-of-system:</th>
<th>Nearshore / in-system:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distant (-)</td>
<td>Proximal (+)</td>
</tr>
<tr>
<td>Greater depth (-)</td>
<td>Shallow depth (+)</td>
</tr>
<tr>
<td>Oil/gas infrastructure (-)</td>
<td>Oil/gas infrastructure (-)</td>
</tr>
<tr>
<td>Longer federal permitting process (-)</td>
<td>Shorter state permitting process (+)</td>
</tr>
<tr>
<td>Higher quality (+)</td>
<td>Lower quality ? (-)</td>
</tr>
<tr>
<td>Higher quantity (+)</td>
<td>Limited quantity (-)</td>
</tr>
<tr>
<td>Less overburden (+)</td>
<td>More overburden ? (-)</td>
</tr>
<tr>
<td>New sediment introduced to system (+)</td>
<td>No new sediment introduced to system (-)</td>
</tr>
<tr>
<td>Little/no opportunity costs ? (+)</td>
<td>Greater opportunity costs (-)</td>
</tr>
<tr>
<td>More technology options ? (+)</td>
<td>Fewer technology options ? (-)</td>
</tr>
</tbody>
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Some Challenges

**Cost:**
- USACE data available, but project site not reported
  - Difficult to identify distance from source to project site
  - Will need to work with specific districts to ID project sites for beneficial use projects
- State (LA) project data (bids) available but fairly sparse to construct cost function
- Randall (TAMU): dredging cost estimator
  - Appears to assume relatively “short” distances (max ~7.5 mi)
  - Current Caminada Headland project: 27 mi from source (Ship Shoal) to project site
  - Not clear if estimator needs to be modified to allow for substantial re-handling

**Benefits:**
- Estimating the time trajectory of sand retained in place under alternative scenarios (Ioannis & Mike’s job!)
- Linking volume metric to ecological benefits
  - Use volume placed? Subarial acreage?
  - Even so, we cannot yet clearly map from units of sand to ecological benefits
- Way around: back-calculate the ESV threshold required to make OCS vs nearshore sources comparable (Caffey, Wang, Petrolia, Ecol Econ 2014)
“Solving for” the Ecosystem Service Value
Questions / Suggestions?

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