Evaluating the impacts of LBSP management investments in Culebra, PR

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Partners
OUTLINE

- NOAA’s LBSP management priorities
- Need for Monitoring and Evaluation Framework
- Process for developing monitoring framework
- Preliminary outcomes
- Next steps
NOAA’s LBSP MANAGEMENT PRIORITIES

- 50 Miles of Unpaved Roads
- 28 Miles Prioritized for Stabilization
- 15 Miles Stabilized (5 completed | 10 in progress)
- 13 Miles Funded for Stabilization

Watershed attributes:
- Subwatershed boundaries
- Unpaved road stabilization priority
- Coastal stabilization priority
- Wastewater treatment priority
- Stormwater treatment priority
- Stream
- Floating treatment wetland
- Stormwater treatment
- Stabilized road
LBSP MANAGEMENT OUTCOMES

**BMP / SITE**
- Stabilize unpaved roads and bare soils in priority subwatersheds
- Stabilize and protect the coastal zone in priority locations
- Install tertiary treatment at the Culebra WWTP
- Enhance stormwater treatment in priority locations

**WATERSHED**
- Reduce sediment and nutrient delivery from priority subwatersheds

**NEARSHORE PHYSICAL**
- Improve nearshore water quality
- Reduce terrigenous sedimentation rates

**NEARSHORE BIOLOGICAL**
- Improve nearshore seagrass and coral reef habitat condition
MANAGEMENT NEED

- Inform development of success criteria
  - Percent pollutant removal at the BMP
  - Subwatershed pollutant load reductions
  - Nearshore water quality goals
  - Site-specific benthic habitat condition goals?

- Track changes to resources and evaluate success of resource management

- Inform adaptive management needs
SCIENTIFIC NEED

- Difficulty linking watershed restoration to coral benefits
  - Lag in response
  - Residence time of pollutants
  - Impact of external variables

- Promising advances
  - Unpaved road monitoring / modeling
  - Faga’alu monitoring
  - Seagrass as indicator species

### Table

<table>
<thead>
<tr>
<th>Mitigation stage</th>
<th>SSL</th>
<th>% reduction</th>
<th>All storms</th>
<th>Small storms</th>
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</thead>
<tbody>
<tr>
<td>Pre-mitigation</td>
<td>93</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-gravel</td>
<td>64</td>
<td>-31</td>
<td>26</td>
<td>-70</td>
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<tr>
<td>Post-pond</td>
<td>62</td>
<td>-33</td>
<td>8</td>
<td>-86</td>
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<tr>
<td>Forest</td>
<td>69</td>
<td>-</td>
<td>4</td>
<td>-</td>
</tr>
</tbody>
</table>

*Biggs et al. 2020*

*Vargas-Ángel et al. 2020*
DEVELOPING A MONITORING AND EVALUATION FRAMEWORK

- Build off existing programs and/or research
  - Success stories and lessons learned
  - Existing local data and lessons learned
- Developing a common language for targeting monitoring and evaluation needs
- Identify mutually beneficial monitoring opportunities
**PROCESS FOR DEVELOPING FRAMEWORK**

**INTRODUCTORY WEBINAR**
- **JULY 15TH**
  - Establish the process for collaboration moving forward

**EXISTING DATA**
- **JULY 24TH**
  - Researchers provide an overview of existing data that can inform the evaluation questions across multiple spatial and temporal scales

**WORKING SUBGROUPS**
- **JULY - OCTOBER**
  - Identify cost-effective monitoring approaches to evaluate the success of LBSP management at multiple spatial and temporal scales

**FINAL MONITORING FRAMEWORK**
- **JANUARY / FEBRUARY**
  - Presentation of framework to confirm that we captured the information provided in working groups
MANAGEMENT GOAL STATEMENTS

**BMP / SITE**
By 2025, 100% implementation of NOAA LBSP management priorities AND reduction in sediment and nutrient loads discharged from the site

**WATERSHED**
By 2025, reduction in sediment and nutrient loads from priority subwatersheds

**NEARSHORE PHYSICAL**
By 2030, improvements to Culebra’s nearshore physical environment - downstream of priority subwatersheds

**NEARSHORE BIOLOGICAL**
By 2035, improvements to Culebra’s nearshore habitat condition - downstream of priority subwatersheds
MANAGEMENT EVALUATION QUESTIONS

BMP / SITE

2025 - 100% implemented & reduced pollutant transport

● What area has been stabilized?
● What percent of the BMPs are functioning as designed?
● Has pollutant transport - from the site - been reduced?

WATERSHED

2025 - Reduced pollutant transport

● Has pollutant transport - from priority subwatersheds - been reduced?

NEARSHORE PHYSICAL

2030 - Improved physical condition

● Has nearshore water quality conditions improved?
● Has nearshore terrigenous sedimentation decreased?

NEARSHORE BIOLOGICAL

2035 - Improved biological condition

● Has seagrass habitat conditions improved?
● Has coral reef habitat conditions improved?
DISCUSSION TOPICS FOR WORKING SUBGROUPS

- Indicators - focus on parameters most sensitive to LBSP threats
- Methods - focus on the lowest cost for highest return
- Opportunities to build off of existing data and/or programs
- Considerations for siting sample locations
- Preference in frequency / timing of sampling
- Logistical considerations for sampling in and around Culebra
## PRELIMINARY RESULTS: BASELINE DATA

<table>
<thead>
<tr>
<th>SCALE</th>
<th>BASELINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site / BMP</td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td></td>
</tr>
<tr>
<td>Water quality</td>
<td></td>
</tr>
<tr>
<td>Sedimentation</td>
<td></td>
</tr>
<tr>
<td>Seagrass</td>
<td></td>
</tr>
<tr>
<td>Coral reef</td>
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</table>

*Photo Credit A. Otaño-Cruz*
# Preliminary Results: Priority Indicators

<table>
<thead>
<tr>
<th>Spatial Scale</th>
<th>Evaluation Questions</th>
<th>Indicators</th>
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<tbody>
<tr>
<td><strong>BMP / Site</strong></td>
<td>What area has been stabilized?</td>
<td>Area of project footprint</td>
</tr>
<tr>
<td></td>
<td>What percent of the BMPs are functioning as designed?</td>
<td>Percent project function</td>
</tr>
<tr>
<td></td>
<td>Has pollutant transport been reduced?</td>
<td>Nutrient (TN, TP) and/or sediment load</td>
</tr>
<tr>
<td><strong>Watershed</strong></td>
<td>Has pollutant transport been reduced?</td>
<td>Nutrient (TN, TP) and/or sediment load</td>
</tr>
<tr>
<td><strong>Nearshore Physical</strong></td>
<td>Has nearshore water quality conditions improved?</td>
<td>Light attenuation (water clarity, turbidity, SSC, TSS, chl a, CDOM, PAR), Nutrient concentration (TN, TP, Ammonia, Nitrate+Nitrite, Orthophosphate)</td>
</tr>
<tr>
<td></td>
<td>Has nearshore terrigenous sedimentation decreased?</td>
<td>Sediment constituent accumulation (Percent terrigenous, Sediment accumulation rate)</td>
</tr>
<tr>
<td><strong>Nearshore Biological</strong></td>
<td>Have seagrass habitat conditions improved?</td>
<td>Benthic cover, Shoot density, Epiphyte load, Deep edge of bed, Areal extent</td>
</tr>
<tr>
<td></td>
<td>Have coral reef habitat conditions improved?</td>
<td>Benthic Cover, Coral Species Composition, Coral Recruitment, Recent Colony Mortality</td>
</tr>
</tbody>
</table>
### Preliminary Results: Framework Options

<table>
<thead>
<tr>
<th>Options</th>
<th>Frequency</th>
<th>Location</th>
<th>Methods</th>
<th>Longevity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minimum</strong></td>
<td>Low</td>
<td>Priority Site</td>
<td>Qualitative</td>
<td>Short-term</td>
</tr>
<tr>
<td><strong>Ideal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Aspirational</strong></td>
<td>High</td>
<td>Island-wide</td>
<td>Experimental</td>
<td>Long-term</td>
</tr>
</tbody>
</table>

**Legend:**
- High: Maximum effort, extensive coverage
- Low: Minimal effort, limited coverage
- Island-wide: Broad geographical scope
- Priority Site: Targeted, localized
- Qualitative: Subjective, descriptive
- Experimental: Innovative, pilot studies
- Short-term: Immediate, rapid outcomes
- Long-term: Sustainable, enduring benefits
NEXT STEPS: IDENTIFY PRIORITY LOCATIONS

- Watershed priorities
  - Unpaved road stabilization
  - Wastewater treatment

- Nearshore fixed stations
  - ID discharge points
  - Evaluate spatial distribution of pollutants
    - Prevailing and seasonal coastal hydrodynamics
    - Mapping sediment plumes
  - Synoptic surveys (if needed)

Existing CariCOOS model resolution - Courtesy of M. Canals
NEXT STEPS: IDENTIFY OPPORTUNITIES

● Integrate Existing Monitoring into Framework

● Coordinate with Federal and Jurisdictional Monitoring Programs
  ○ Integrate fixed stations and/or indicators into Existing programs

● Identify Additional Funding Opportunities

● Continued collaboration with Local Partners
Questions? Feedback?

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