A Risk Informed Decision Framework for Hurricane Protection and Coastal Planning

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Todd Bridges, Burton Suedel and Martin Schultz
USACE-ERDC-EL
Brian Harper
USACE-Galveston
Tim Axtman
USACE-New Orleans

Burton.suedel@usace.army.mil
Objectives for RIDF

- Broader than Corps’ traditional National Economic Development analysis
- Solidly founded upon the Corps’ planning process
- Incorporate risk and uncertainty information into the decision process
- Provides the means to score and rank alternatives
- Promote transparency in decision making
- Provide a structure and process that facilitates interaction with partners and stakeholders
  - Promote understanding
  - Promote credibility and legitimacy
- Facilitate adaptive planning and engineering
RIDF Process Goals

- Develop a set of tools that will help identify tradeoffs (pros and cons) among various alternatives
- Conduct an open, transparent planning process
- Keep everyone informed and involved on the path forward
- Better understanding of risk and consequences of existing conditions and future scenarios
- Allow stakeholder input on factors that are important to them
Multi-Criteria Decision Analysis

- An approach for structuring and analyzing decision problems
- Emphasis given to:
  - Establishing explicit objectives
  - Defining metrics for evaluating alternatives
  - Incorporating human values in regard to objectives, i.e., preferences
  - Ranking alternatives based on quantitative scores derived from metrics and preferences
    - Using multi-attribute utility theory

One Team: Relevant, Ready, Responsive, Reliable
## LACPR Scenarios

<table>
<thead>
<tr>
<th>Pattern of Development</th>
<th>Relative Sea Level Rise</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Lower)</td>
</tr>
<tr>
<td>High employment / dispersed population</td>
<td>$k = 1$</td>
</tr>
<tr>
<td>BAU employment / compact population</td>
<td>$k = 3$</td>
</tr>
</tbody>
</table>
Problems and Opportunities

- Specify problem
- Structure project objectives
- Establish clear linkage between objectives and metrics used to evaluate alternatives
- Develop a coherent set of metrics
  - Quantifiable, understandable, independent, etc.
  - Establish means to develop uncertainty estimates for metrics
LACPR Objectives and Metrics

- Reduce risk to public health and safety from catastrophic storm inundation
  - Population impacted
- Reduce damages from catastrophic storm inundation
  - Residual damages
  - Life-cycle costs (Implementation, O&M)
  - Construction time
  - Employment impacts
- Promote a sustainable coastal ecosystem
  - Indirect impacts
- Restore and sustain diverse fish and wildlife habitats
  - Direct wetland impacts
- Sustain the unique heritage of coastal Louisiana by protecting cultural sites and supporting traditional cultures
  - Historical properties protected
  - Historical districts protected
  - Archeological sites protected
MSCIP Objectives and Metrics

Planning Objectives

- Reduce risk to **public health and safety** from catastrophic storm inundation
- Reduce storm damages to infrastructure from catastrophic storm inundation
- Restore and protect upland and tidal wetland habitats
- Reduce residual risk from catastrophic storm damage

Risk Metrics

- National Economic Development
  - Monetary damages reduced/avoided (EAD)
  - Residual damages
  - Cost to implement plan
- Regional Economic Development
  - Positive regional economic benefits (sales, income and jobs)
  - Local cost burdens
- Environmental Quality
  - Tidal habitat lost
  - Tidal habitat restored
  - Non-tidal habitat lost
  - Non-tidal habitat restored
- Other Social Effects
  - Cultural and historical heritage impacts
  - Public service and infrastructure disruptions
  - Personal impacts
- Risk Metrics
  - Long-term sustainability of plan
  - Consequences of plan failing
  - Residual risk

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Compare Effects of Alternatives

- Metrics used to calculate a quantitative score, with associated uncertainty, for each alternative
  - Technical team obtains weights for metrics
  - Survey partners and stakeholders for their weighting preferences
    - Used as information source for technical team
    - Develop value landscape for basis of comparison
- Trade-off analysis to refine list of measures
  - Explore “conflicts” among objectives
- Sensitivity analysis to explore robustness of alternative rankings
  - Facilitate negotiation among decision-makers and stakeholders
Purpose of Stakeholder Engagement

- Capture stakeholder value information that will guide the ranking of alternatives and recommendations
- Document differences among stakeholders
  - Identify consensus areas and potential compromises
- Capture additional feedback and guidance for Corps planners
- Iterate the RIDF process
Example LACPR Rankings

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### Example Optimal Decisions by Scenario

**LACPR**

<table>
<thead>
<tr>
<th>PU-1</th>
<th>Relative Sea-level Rise</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pattern of Development</strong></td>
<td><strong>Lower</strong></td>
</tr>
<tr>
<td>High/Dispersed</td>
<td>PU1-NS-100</td>
</tr>
<tr>
<td>BAU/Compact</td>
<td>PU1-NS-400</td>
</tr>
</tbody>
</table>

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Functions and Outputs of RIDF

- Identify, assess, communicate the risks to life, health, environment and economics
- Account for the major uncertainties that could affect the performance of alternatives in the future
- Identify data gaps that could influence decisions
- Provide the basis for ranking the performance of alternatives based on risk metrics and values
- Establish confidence levels for planning decisions and recommendations
Insights Gained/Reinforced

- Stakeholders value being asked for information about their preferences
- Stakeholders seek read-ahead materials
- Encountered stakeholder “fatigue”
- Smaller, more focused metric set desirable
- Developing a set of relevant and useful metrics requires a lot of work
- Approaches that depart from customary practice will encounter “hurdles”
RIDF Applications

Any project evaluations which involve non-monetary values:

- Environmental restoration
- Infrastructure maintenance and management
- Environmental remediation
  - Contaminated sediment
- Risk ranking
  - Invasive species
  - Species at risk (SAR) prioritization
  - Flood risk analysis
  - Dredging operations affecting human and ecological health