DASEES
Decision Analysis
for a Sustainable Environment, Economy, and Society

Structured Decision-Making for the US EPA Sustainable and Healthy Communities (SHC) Research Program

SB 673 Symposium

Cumulative Impacts and Community Vulnerability

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Comments from decision-makers about addressing complex environmental management problems

"Our decisions impact Tribal lands, I need a way to be transparent and show how we make decisions that they can check."

- EPA Remedial Project Manager

"I have to understand and include the concerns of the surrounding community in my plans for this project."

- Cincinnati Metropolitan Sewer District project engineer

"We want to include community stakeholder viewpoints to better implement our regional plan.

- Broward County, FL Environmental Compliance Director

General Decision Process:
Time and Information are key influencers

With the time you have:

- Identify/create options
- Use best *available information* to *assess* consequences of option implementation
- Then *evaluate* options using stakeholder input
- Decide, document, and explain

Structured Decision Making (SDM) with DASEES structures decision-relevant information, enabling the integration of stakeholder concerns for more inclusive evaluation of consequence assessments

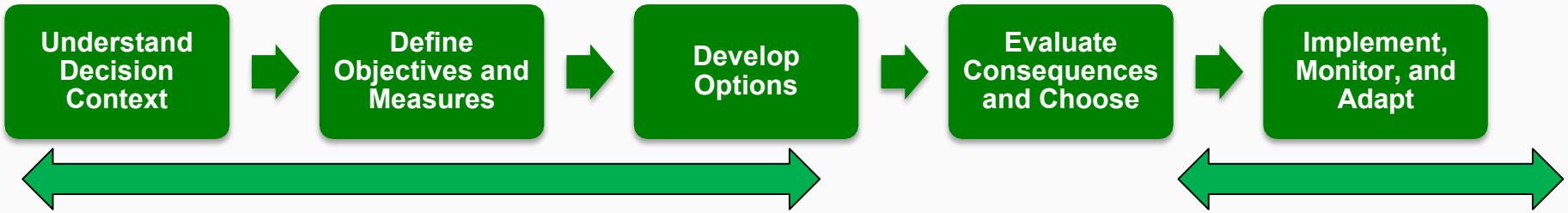
> ***"A formalization of common sense***
>
> ***for decision problems which are too complex***
>
> ***for informal use of common sense"***
>
> *- Keeney, 1982*

SDM provides an organized approach to integrate
Facts (Scientific Knowledge) & Values (Stakeholder concerns)

- **Problem Structuring**
  - Find common understanding of complex multi-faceted problem
- **Solution Creation, Evaluation, Implementation**
  - Identify and evaluate innovate management alternative
  - Implement, monitor, adapt

DASEES Function and Philosophy:

- **Web-based framework supporting stakeholder-driven group decision-making**
- **organizes use of tools/data/information needed for decision**
- **Includes stakeholder perspectives and tools for analysis and evaluation**



Stakeholder Participation

- Concerns
- Objectives
- Criteria
- Policy
- Regulatory Requirements
- Options Development

Assessment/Evaluation/Implementation

- Results from Studies (HIA, EJ, EIS)
- DASEES Consequence Modeling
  - Cumulative Impact
  - Trade-off Analyses
  - Uncertainty Analyses

Application:

Dania Beach Resiliency Planning Workshop

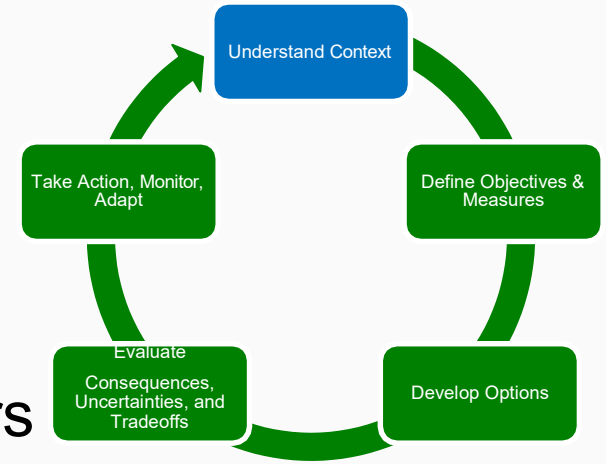
Purpose:

This two-day meeting will bring stakeholders together to develop common objectives and solutions for the resiliency challenges facing Dania Beach and identify the technical needs to evaluate those solutions.

Workshop Objectives

- Bring stakeholders together to develop a shared understanding of the inter-related economic, social, and environmental challenges facing Dania Beach.
- Identify resiliency goals for the region, including health & safety, community well-being, ecological integrity, and economic competitiveness.
- Devise management actions responsive to identified goals

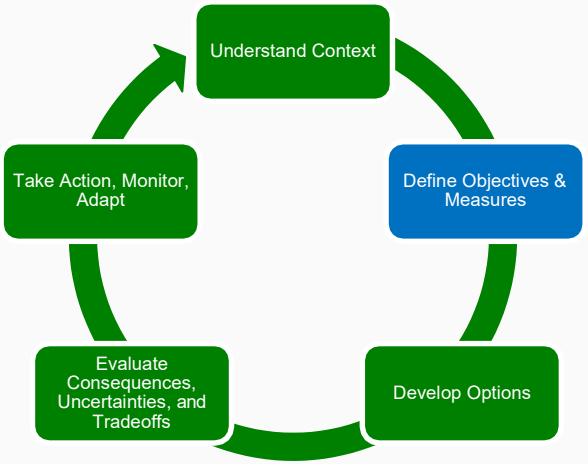
Application: Dania Beach



Understand Context

- Present Perspectives
  - Dania Beach, Broward County
- Establish Agreement on Problem Drivers
  - Sea Level Rise→Flooding→Infrastructure Impacts
  - Allocation of scarce resources to existing and emerging problems
- Identify Relationships
  - Formal and informal lines of communication
  - Administrative Authority: *Who can do what and where*
  - Areas of potential collaboration
    - Pooling funding and technical resources

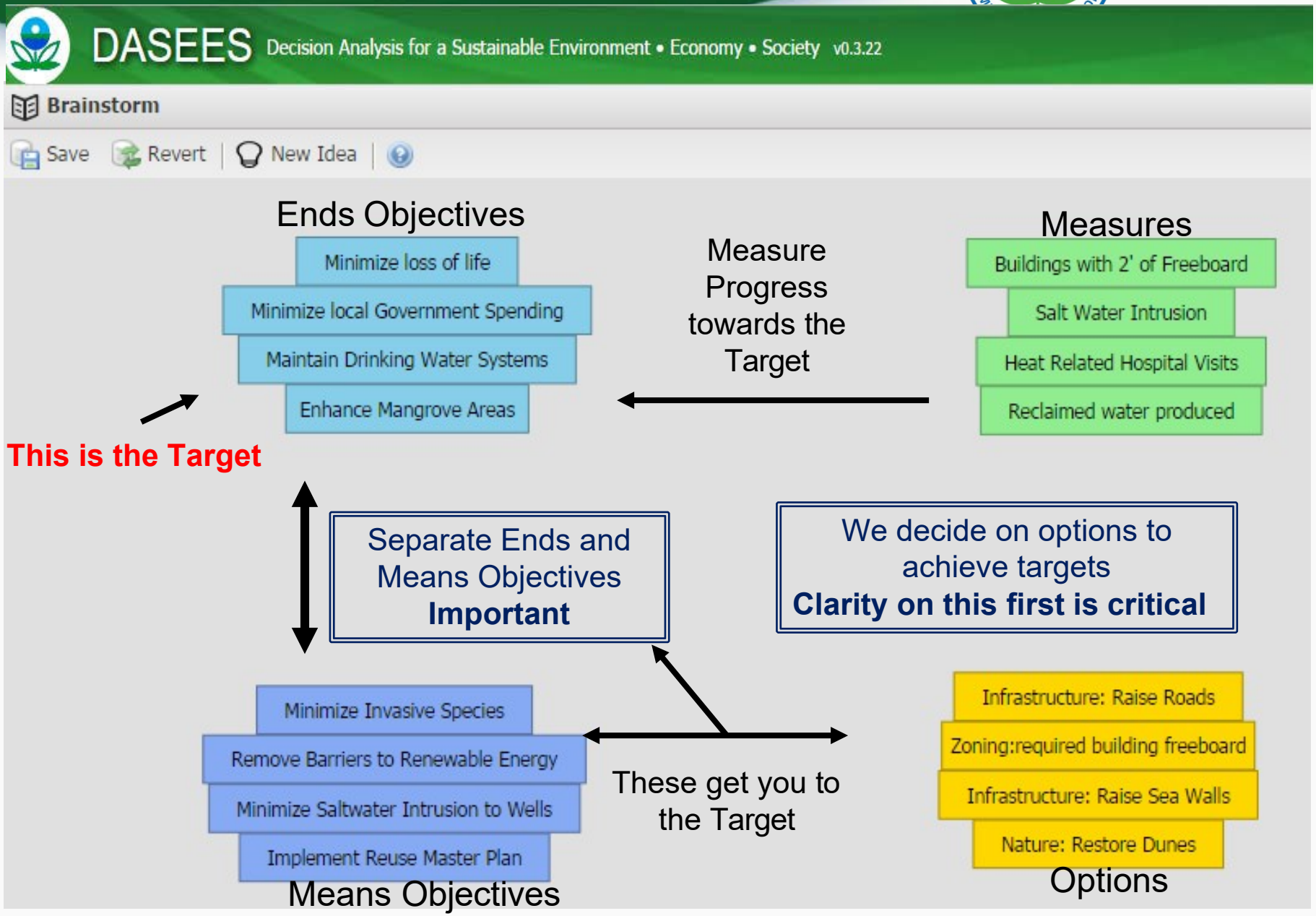
Application: Dania Beach



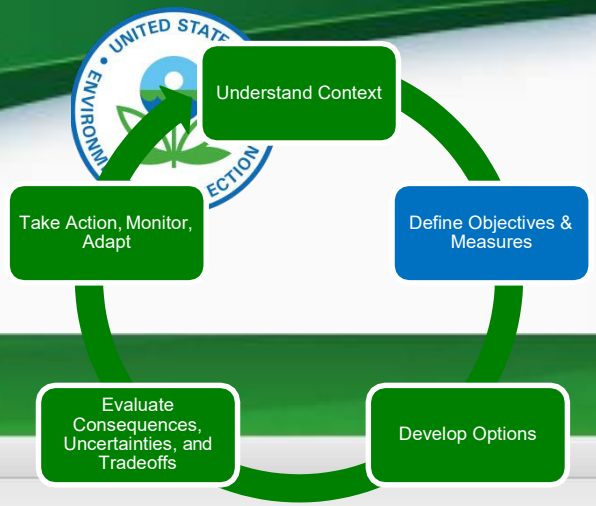
Define Objectives and Measures

- Elicitation
  - Generate stakeholder ideas
  - Sort ideas into categories
- Structure and capture in DASEES

Application: Dania Beach – Brainstorming and Structuring Stakeholder Ideas



Application: Dania Beach – Linking Criteria to Objectives



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Objectives

Save | Revert

Fundamental Objectives Hierarchy

New Objective | Delete Objective | Import Objectives

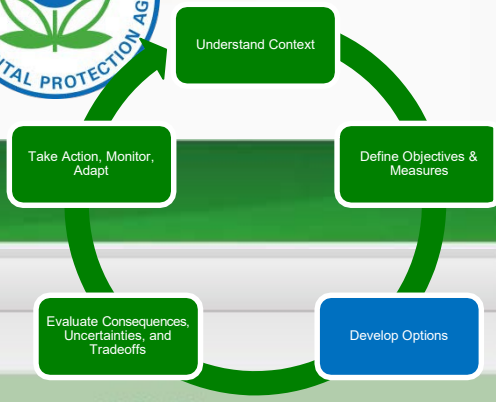
- Dania Beach Resiliency Redesign
  - Reduce reliance on fossil fuels
    - Improve efficiency of transportation system
    - Minimize non-transportation based use of fossil fuels
  - Ensure long-term water supply
    - Maintain drinking water systems
  - Preserve and protect natural infrastructure
    - Enhance mangrove areas
    - Provide space for ecosystems to transition
    - Maintain fisheries
    - Maintain structural integrity of dunes
  - Maintain and increase economic opportunity and prosperity
    - Minimize local government spending
    - Enhance recreation and public art areas
    - Minimize cost of impacts
      - Minimize recovery costs
  - Maintain desired level of services throughout community

Objective Measures

New Measure | Delete Measure

Measure	Units
Saltwater intrusion	square miles
Area flooded	square miles
Buildings with 2' of freeboard	%
Certified Green Partners	# of Participants
Dedicated Funding	Dollars
Dollars towards adaptation	Dollars expended
Duration of flooding	# of days
EV Charging Stations	Number of stations
Flooding related deaths	number
Grant dollars received	total funding
Heat related hospital visits	total number
Integration of standards in permitting and licensing	# of programs com
Local gov't resiliency investment	
Maintain regional monitoring network	# of active wells

Application: Dania Beach – Linking Options to Objectives



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Define Options

Save | Revert

Means - Ends Objectives Hierarchy

New Means Objective | Delete Means Objective

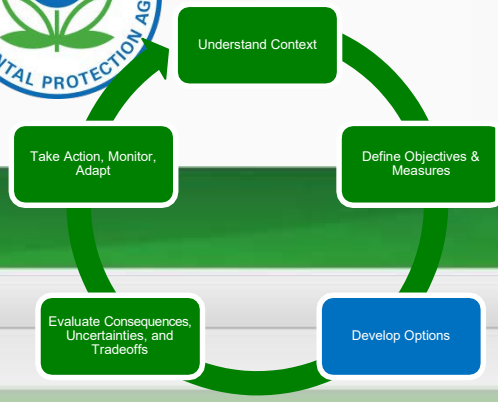
- Dania Beach Resiliency Redesign
  - Reduce reliance on fossil fuels
    - Improve efficiency of transportation system
    - Minimize non-transportation based use of fossil fuels
  - Ensure long-term water supply
    - Maintain drinking water systems
      - Minimize salt water intrusion to drinking wellls
      - Implement Reuse Master Pla
      - Develop flow connections and increase surface st
      - Monitor saltwater interface
  - + Preserve and protect natural infrastructure
  - + Maintain and increase economic opportunity and prosperity
  - Maintain desired level of services throughout community
    - Increase public tolerance for temporary flooding
    - Minimize impacts of flooding on community services
  - Protect value of public and private infrastructure and prope
    - Minimize flood damage to public infrastructure

Management Options

New Option | Delete Option

Option	Units
Infrastructure: Structure/Pump retrofits and installations	none
Federal grants	M$
Incentives: Certified Green Partners	number
Incentives: Interest rates	none
Incentives: Loans	none
Incentives: Rebates	noe
Infrastructure: Raise roads	meters
Infrastructure: Reclaimed water produced	MGD
Infrastructure: Seawalls	meters
Infrastructure: Surface water storage	gallons
Nature: Invasive species control	ha
Nature: Limit access	none
Nature: Restore dunes	ha
Nature: Wetlands	ha
Regional: Monitoring network	none

Application: Dania Beach – Generating Testable Alternatives



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ManagementScenarios

Save Revert

Management Scenarios

Management Options

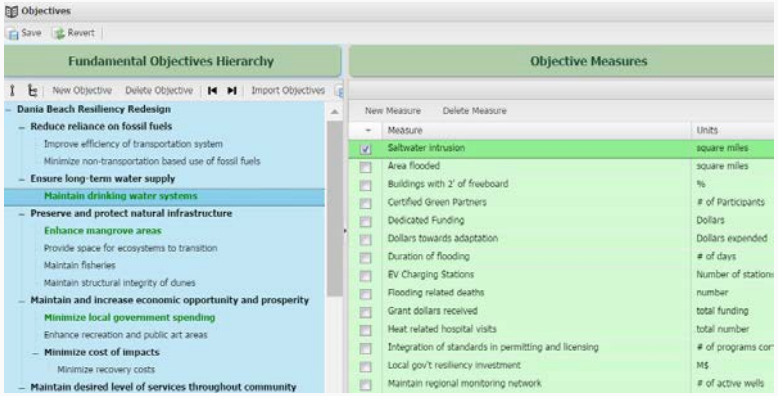
- *Federal grants*
- *Zoning: Building codes*
- *Nature: Invasive species control*
- *Infrastructure: Seawalls*
- *Infrastructure: Raise roads*
- *Incentives: Loans*
- *Nature: Limit access*
- *Regional: Monitoring network*
- *Infrastructure: Surface water s...*
- *Infrastructure: Structure/Pum...*
- *Nature: Restore dunes*

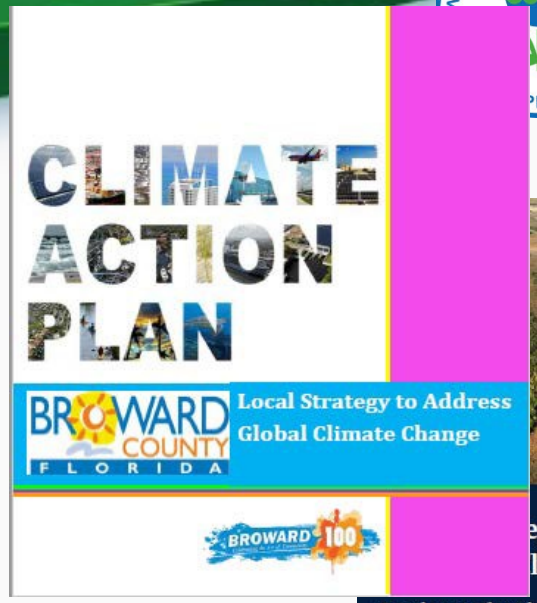
Scenarios

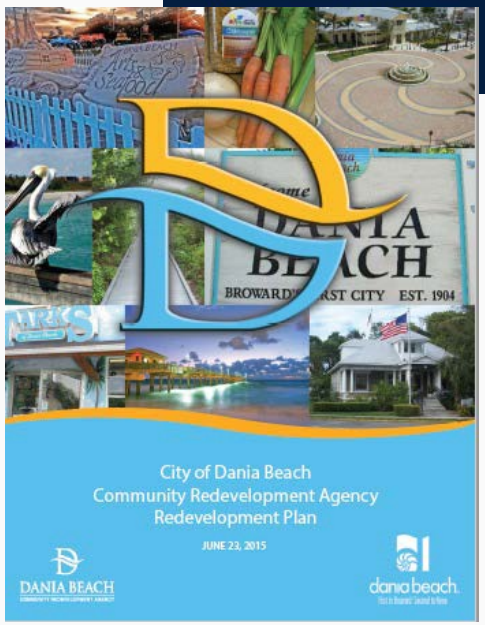
New Delete Edit Duplicate Expand/Collapse Options

Status Quo	scenario a
Federal grants: 5000 M$	*Federal grants*: 10000 M$
Infrastructure: Raise roads: 1 meters	*Infrastructure: Raise roads*: 2 meters
Infrastructure: Seawalls: 3 meters	*Infrastructure: Seawalls*: 5 meters

Results





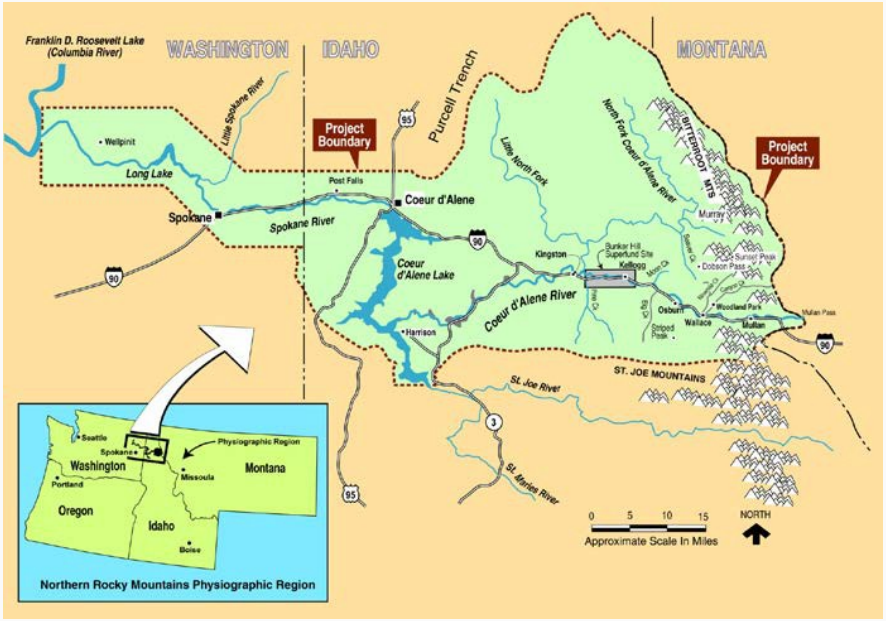


- Crosswalk Dania Beach Workshop Results with Regional, County, and City Plans
- Find common areas of effort
- Prioritize short and long term goals (FY17)
- Focus resources to assess options
- Model, evaluate, decide

Preliminary stages with Broward County

Application: Bunker Hill Superfund Site

Problem:
Waterfowl mortality from wetlands contaminated by the Bunker Hill Superfund Site in Idaho



Action:

State, Tribal, and Federal Agency remediation planning effort

COEUR D'ALENE TRIBE

USGS science for a changing world

IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY

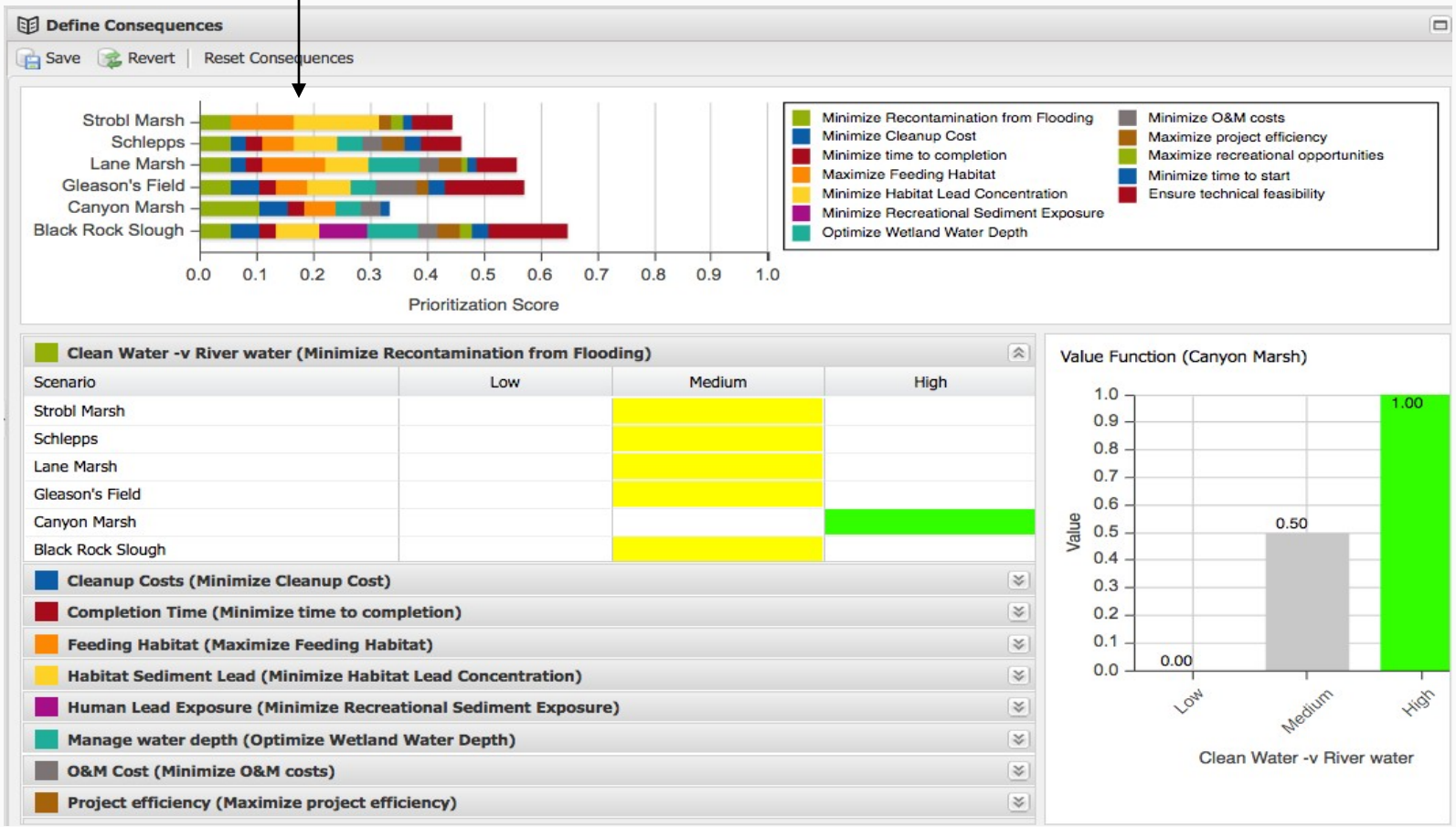
DEPARTMENT OF ECOLOGY State of Washington

Application: Bunker Hill Superfund Site - Cumulative Impact for Clean up selection

- Each color represents criterion impact on receptor
- Criteria can be evaluated individually or cumulatively

Result:

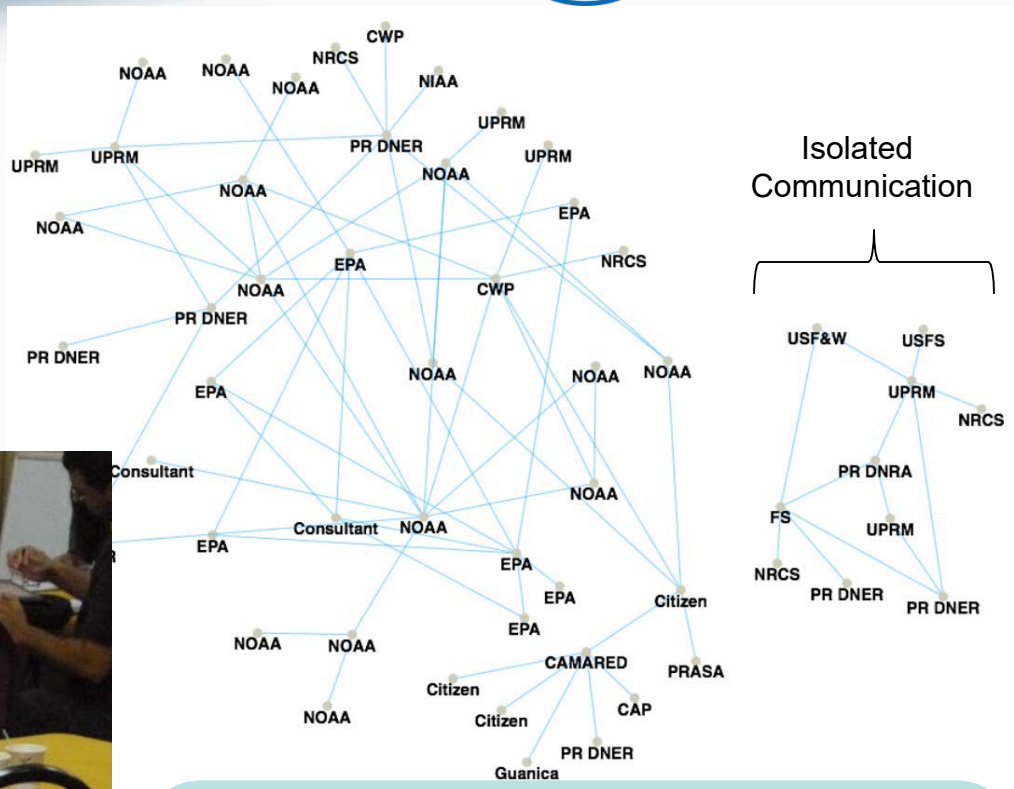
Multi-objective wetland remediation prioritization with DASEES



Application: Guánica Bay, Puerto Rico
Public Values Forum
January 23-25, 2013

Goals:

- **Identify stakeholder objectives and success measures across the Guánica Bay watershed**
- **Prioritize possible management actions for achieving multiple values**



Social Network Analysis (SNA)

- **Integral to DASEES**
- **Rapid analysis of stakeholder interactions and knowledge flow**
- **Identifies areas of limited interaction**

DASEES Application Insights

Making decisions about complex problems is hard.

SDM and tools like DASEES help to manage information, data, and analyses. They do not replace thinking or provide the "answer". People still make the decisions.

DASEES can effectively communicate information to stakeholders

Providing rapid feedback from group information e.g. Social Network Analysis gets stakeholders involved. They like to see their contribution lead to results. It promotes "buy in"

Guidance is critical

Deliberate structuring of decisions is a learned skill. Understanding the process before using DASEES is necessary. Not difficult, but necessary.

For more information or interest in being a beta user, Contact

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http://beta.dasees.org/

DASEES development: EPA Office of Research and Development (ORD) Sustainable and Healthy Communities Research (SHC)

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Anticipated public release in 2018

Decision Analysis for a Sustainable Environment, Economy and Society (DASEES): DASEES is a web-based interactive tool for structured decision-making. It provides an environment where communities can build common understanding of complex problems then create and evaluate management alternatives through a multi-objective decision analysis. DASEES serves as an integrative framework for combined assessment of environmental, economic, and social aspects of a decision problem where there is uncertainty. This is done with causal modeling with probability networks and can be used to communicate risk-based decision outcomes.

Dr. Brian Dyson

Dr. Brian Dyson is an Operations Research Analyst with EPA/ORD/ NRMRL in Cincinnati, OH. He is the Project lead in the Sustainable and Healthy Communities Research Program for Decision Science and Support Tools. He started with the EPA working on land management decision support for non-point source runoff and habitat conservation. His current work within the SHC program is aimed at integrating decision methods and developing decision support tools for community resilience planning, contaminated site remediation, landfill siting, sustainable materials management, and watershed/estuary management.

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