

Plan Formulation Strategies for Ecosystem Restoration Projects

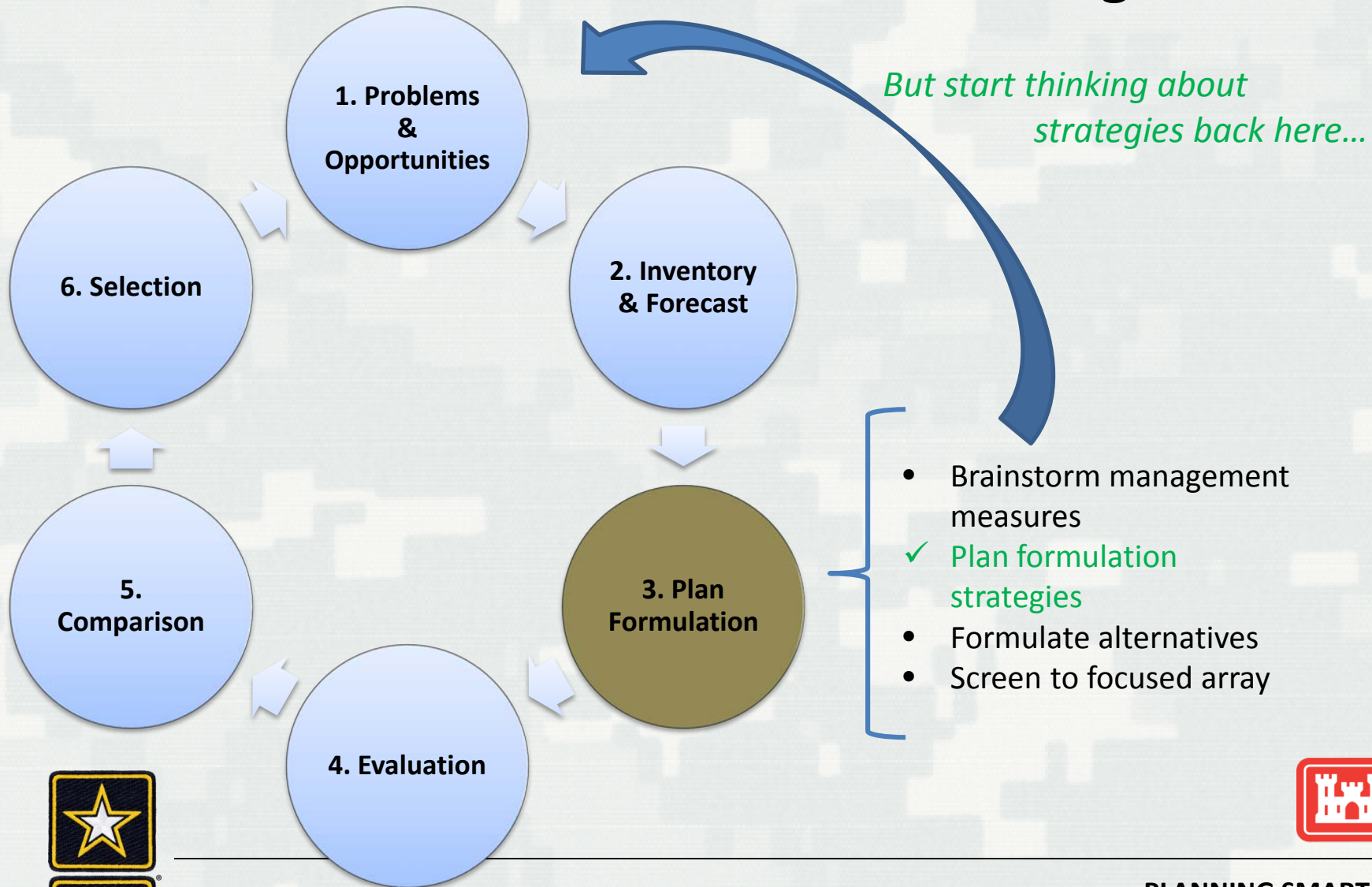
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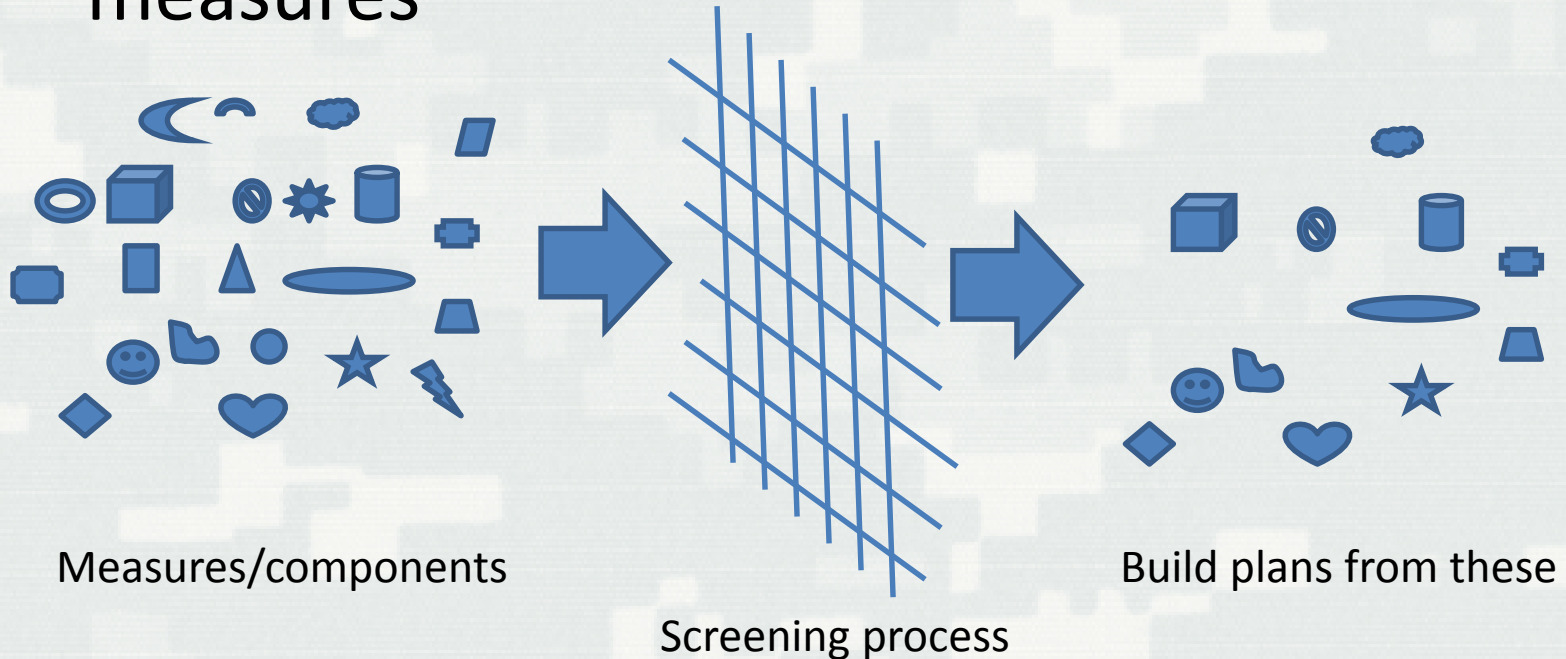


A quick recap from our April PCoP webinar on “Initial Plan Formulation Strategies”...



Where Do Alternative Plans Come From?

- We often start with long lists of management measures



- This is where plan formulation ***strategies*** can help!



Why Do We Formulate Alternative Plans?

*To address **planning objectives** while
avoiding planning constraints**

**as well as meet the requirements of Principles & Guidelines, NEPA, etc.*



What is a Plan Formulation Strategy?

- Definition:
 - A systematic method of combining management measures into alternative plans based upon specific planning objectives
 - A method of narrowing down the universe of possible solutions to a concise group of initial alternatives
 - A means of obtaining input/preferences from the public, stakeholders, other agencies, and non-Federal sponsors



Why Are Plan Formulation Strategies Important?

- Plan form strategies help us progress *rationally & deliberately* from many management measures to distinct alternative plans
- Allow us to make basic links between planning objectives and alternatives
- Help identify different ways of solving the problem(s)
- Help PDT develop a reasonable array of distinctly different alternatives
- Provide a quick focus to help PDT move to the initial and focused array of plans
- Plan formulation is not a “mechanized” process



Plan Formulation Strategies for Ecosystem Restoration



What Are Examples of Plan Form Strategies for Ecosystem Restoration?

- Your turn...
- Think back on your own studies and projects -- what strategies did you use to start developing conceptual alternatives?
- Share 1 using the Chat tool
- Let's discuss...



Where Do Plan Formulation Strategies Come From?

- Strategies can originate from several sources, but remember, we always start with our **PLANNING OBJECTIVES – what are we trying to achieve?**
- Here are some strategies we'll cover:
 - Generic strategies
 - Conceptual models
 - Ecological Models
 - Other examples... *and not exhaustive!*



“Generic” Examples of Plan Formulation Strategies

- Non-Federal Sponsor’s plan/LPP
- Other agency’s plan (e.g., resource agency)
- Public input plan
- Prior studies/reports



LOS ANGELES RIVER REVITALIZATION MASTER PLAN



On July 1, 1999, the Secretary of the Army and the State of Florida presented to Congress the Central and Southern Florida Project ...

Comprehensive Everglades Restoration Plan

Conceptual Models as Plan Form Strategies

- Conceptual models are very useful in describing cause and effect relationships (and not just for eco restoration)
 - What drivers and stressors should we focus on?
 - What effects do we (including others, not just the Corps) care about and how will we measure them?
 - What management measures are most effective in addressing effects?
 - What management measures are most likely to succeed or be self-sustaining?



Hypothetical, not a real USACE study

“Dry Creek” Conceptual Model Example

- Let's say you have a river flowing through a semi-arid landscape that has been altered by upstream urban and infrastructure development...
- After rainfall events, flows are now higher – greater velocities and stages (the hydrograph is “spikier”)
- Higher flows are causing stream bank erosion and incision of the stream... as the stream digs deeper, it leaves its “stranded” floodplain behind



“Dry Creek” Conceptual Model Example

- Problems:
 - Riparian habitat is degrading
 - Floodplain no longer floods – water table is dropping
 - Loss of lateral connectivity between stream and floodplain
 - Native riparian vegetation is dying
 - Exotic plants are moving in
 - Stream banks are failing/ sloughing off
 - Aquatic habitat is degrading
 - High sediment loads are burying in-stream benthic habitat
 - Loss of shade, vegetated banks, structural complexity, organic and nutrient inputs
 - Base flows lower, high flows higher
 - Poor water quality from sediment, higher temperatures
 - *Remember to forecast what will happen regarding these problems in the future... not just existing conditions!*



"Dry Creek" Streambank Erosion Conceptual Model

Drivers

High flow from
urban runoff

Altered hydrology
and landforms

Stressors

Stream incision

**Streambank erosion
and bluff failure**

Effects

Loss of floodplain
connectivity &
riparian
vegetation

Sedimentation -
degraded water
quality

Houses
at risk of
collapse

Infrastructure
(waste water plant
& pipes) at risk of
undermining

Attributes

Fish habitat – pools
& riffles are buried
by sediment, loss of
shade & cover

Economic
damages

Human
health &
safety

**Performance
Measures**

Fish habitat units,
comprised of WQ,
substrate, & other
variables

Structural
damages (\$)

Estimated
life loss

EQ

NED

OSE

“Dry Creek” Conceptual Model Example

- Planning objectives:
 - Restore both 1) the quality and quantity of degraded aquatic and riparian habitat; and 2) riverine-floodplain connectivity; in the Dry Creek watershed over the period of analysis.
- So we want to focus on restoring Q&Q of aquatic and riparian habitat, + connectivity...
- *What strategies can help us achieve those objectives while addressing underlying drivers/stressors/effects?*



"Dry Creek" Streambank Erosion Conceptual Model

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Example Formulation Strategies for “Dry Creek”

- Strategy #1: Focus on source of flows driving the increased runoff and higher volumes and velocities of water entering Dry Creek and causing downstream erosion
- Try to delay, capture or divert some portion of the upstream flows before entering the creek
 - Best Management Practices (BMP's)
 - in the developed/urbanized areas
 - Management of agricultural lands
 - Groundwater recharge/infiltration
 - Detention basins
 - Depressional wetlands
 - Vegetated swales
 - Bypass channels

*May require
implementation
by others*



Example Formulation Strategies for “Dry Creek”

- Strategy #2: Focus on reducing the erosion and stream incision caused by the higher flows and velocities
 - Instream grade control structures
 - Streamside erosion reduction measures, whether “hard” (rip-rap, gabions) or “bioengineered” with vegetation
 - Elevation of channel invert with addition of sediment/substrate
- Strategy #3: Focus on better connecting the stream to the floodplain
 - Terracing
 - Side channels
 - Overbank wetlands



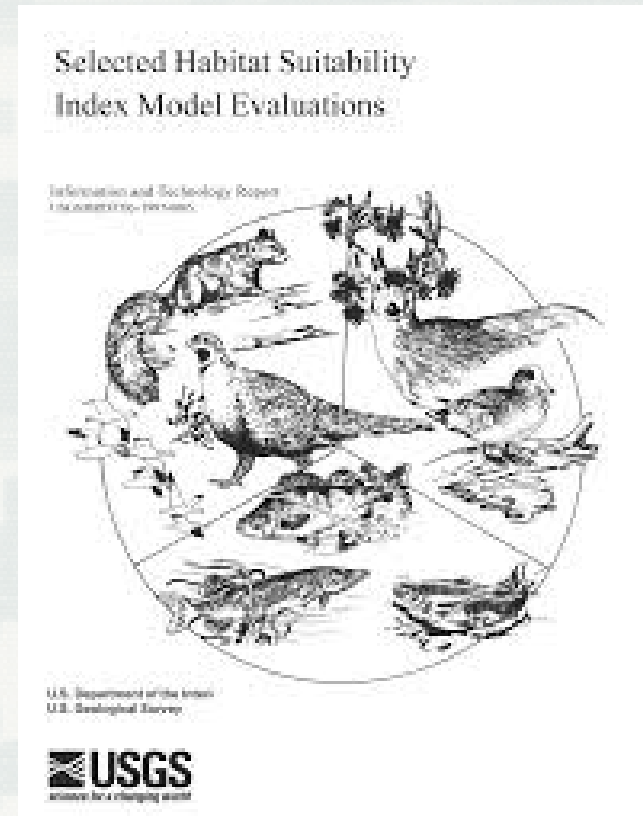
Example Formulation Strategies for “Dry Creek”

- Strategy #4: “Grand” strategy combines all these measures to maximize achievement of planning objectives
- Strategy #5: “Low hanging fruit” strategy seeks to formulate the low-cost, “no regrets” measures, but which don’t fully meet the planning objectives



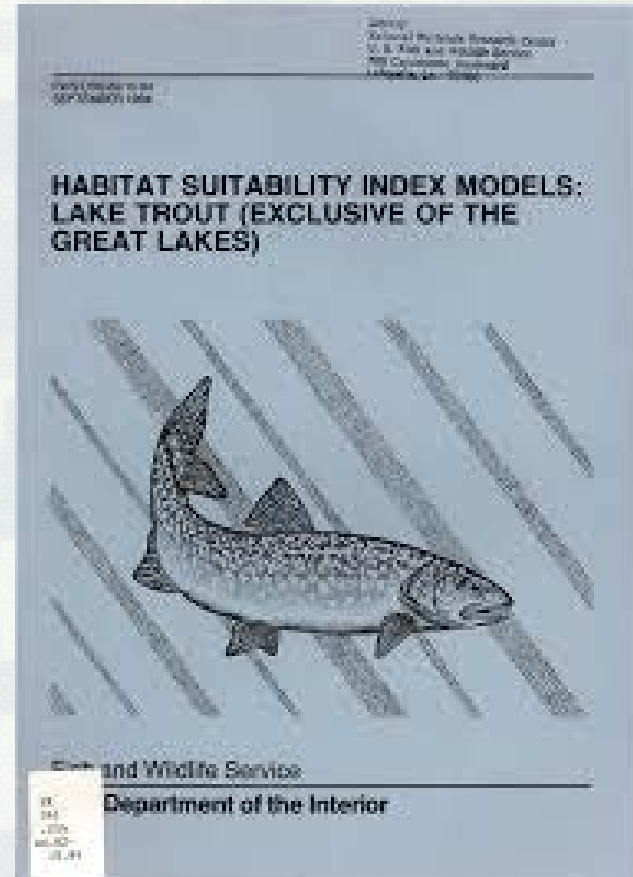
Ecological Models as Plan Form Strategies for Ecosystem Restoration

- Use a Habitat Suitability Index Model
 - Assumes we can select a species (or suite of species) that well represents output/ benefit/ “lift” for a given planning objective
 - Focus on the habitat variables important to that species
 - Which habitat variables exhibit low suitability values?
 - Which habitat variables can/should we influence or improve?



Ecological Models as Plan Form Strategies for Ecosystem Restoration

- Formulation strategies:
 - Are there thresholds in terms of habitat parameters/variables?
 - Are there factors limiting habitat structure and function, quantity and quality?
 - What management measures can affect/ address these habitat variables?



Model and Method Format, HEP

$$\text{Index} = \frac{\text{Site condition}}{\text{Optimum conditions}} = 0 \text{ to } 1$$

0 to 1 is on the ratio scale

Index X Area = Habitat Unit

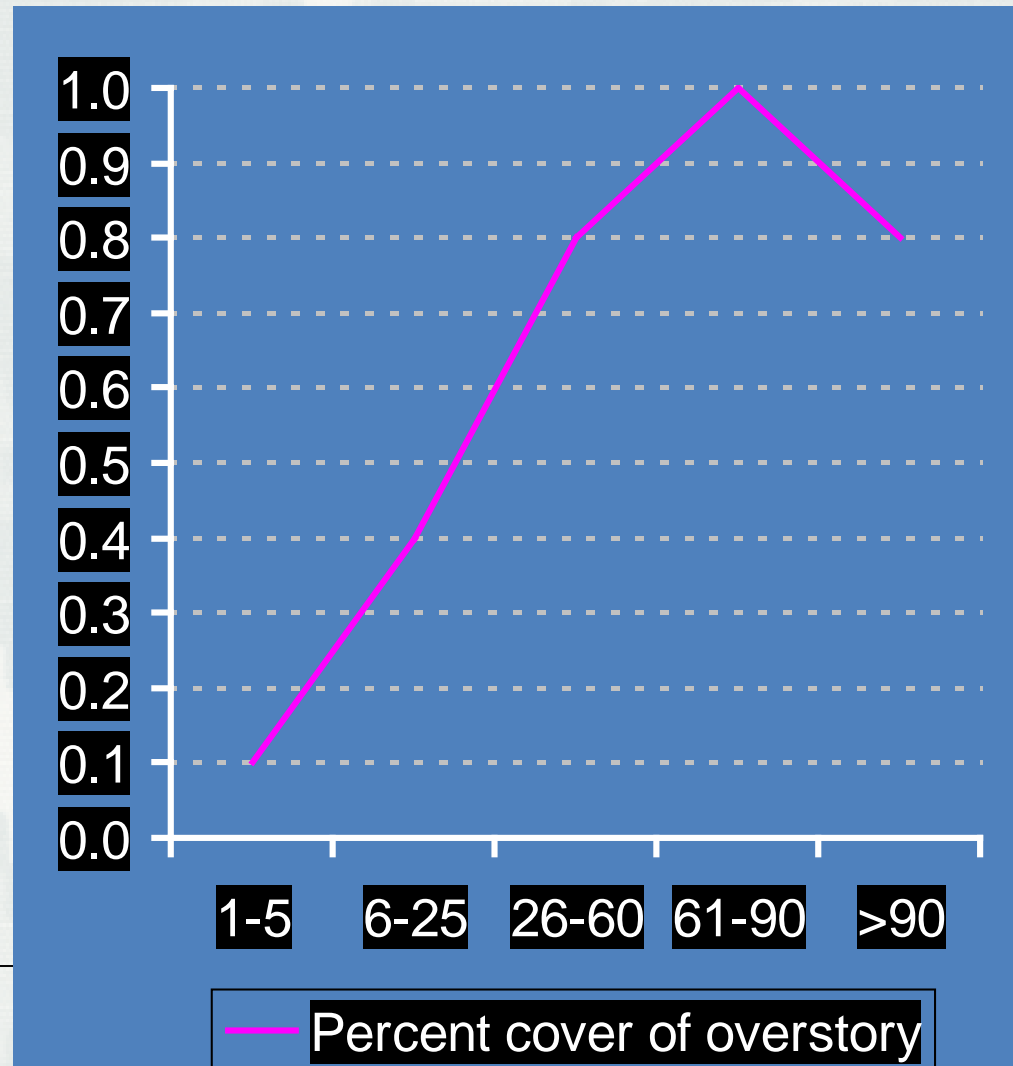


Ex: 0.7 X 10 ac = 7 HU; 0.2 X 10 ac = 2 HU



Example of Suitability Index (SI) Curve

SI curves are generally line or bar graphs. Y axis is on a 0-1 scale, X axis is the range of interest for the variable.



Yellow Warbler HSI



Riparian (Terrestrial) Restoration Overall Objective: Reduce non-natives and increase native riparian vegetation complexity.

Model Applicability

Model applies to deciduous shrubland and deciduous scrub/shrub wetland.

$$\text{HSI} = (\text{V1} * \text{V2} * \text{V3})^{1/3}$$

Model Pros:

Present along Dry Creek.

Associated with riparian areas.

Would benefit from early successional veg and shrubby/willow areas.

Species of Special Concern (breeding)

Model Variables

- a. **V1**-% of ground shaded by canopy of woody deciduous veg. less than 16.5ft in height (60-80% best).
- b. **V2**-Average height of deciduous shrub canopy (≥ 6.5 ft best).
- c. **V3**-Proportion of deciduous shrub canopy comprised of hydrophytic shrubs (100% best).

Model Cons:

Benefit may be temporary (early successional) depending on what vegetation is planted and how it's managed long-term.

Summary: Eco Models as Plan Form Strategies

- Assumption: model(s) we are using aligns with our planning objectives
- Are there critical habitat variables, thresholds, and/or limiting factors?
- Which variables can we influence? How?
- Estimate future with and future without project conditions employing different MM's/scales/alts
- Which alts meet planning objectives?
- Screen, then further evaluation



Other Plan Form Strategies for Ecosystem Restoration

- Beyond just combinations of management measures, how might we formulate eco restoration alternatives within an entire watershed?
 - Focus on potential to restore **significant (technical, institutional, public)** resources – and “bang for the buck”
 - Do significance criteria (e.g., scarcity, connectivity, limiting habitat, effects on T&E species, biodiversity) lead to particular objectives, plan form requirements, necessary linkages or minimum increments?
 - Are certain planning objectives more important than others (e.g., is “getting the water right” a pre-requisite, then other objectives or outputs may follow – a’ la Everglades)?
 - Is a mosaic of habitats necessary – need some amount of several types of habitat for overall restoration success?



Other Plan Form Strategies for Ecosystem Restoration (cont'd)

- Beyond just combinations of management measures, how might we formulate eco restoration alternatives within an entire watershed?
 - Differing characteristics or problems between river reaches?
 - Formulate within mainstem reaches or tributary sub-basins?
 - Tackle upstream OR downstream problems first?
 - Need to increase connectivity – lateral or longitudinal?
 - Legitimate/reasonable real estate or HTRW constraints or considerations?



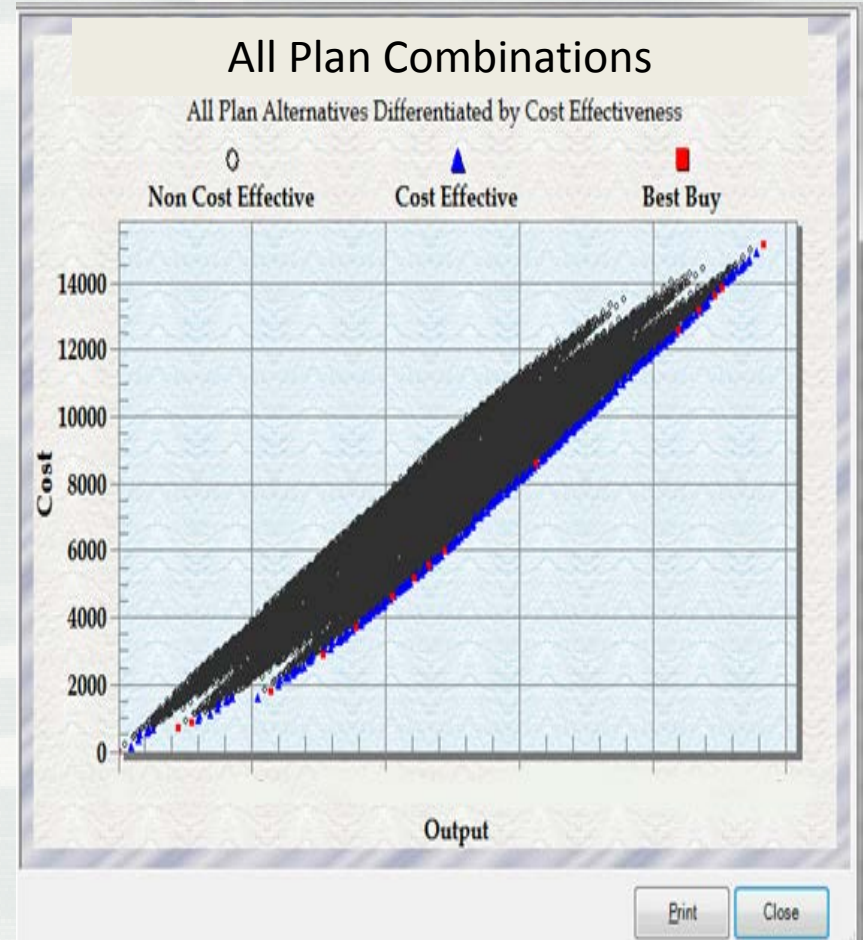
Other Plan Form Strategies for Ecosystem Restoration (cont'd)

- *Reference* ecosystems (e.g., wetlands, rivers, watersheds) can serve as a guiding image for what “ecosystem restoration” should look like or is possible
 - Can be thought of as the “best” representation(s) of a particular class of ecosystem
- Non-structural (e.g., changes to O&M manual; invasive species, controlled burn, livestock, sediment & runoff management, BMP's)
- Multi-objective ecosystem restoration + groundwater recharge/water conservation (e.g., dry dams, spreading grounds)
- Multi-objective ecosystem restoration + FRM/CSDR (e.g., floodplain bypasses, coastal wetlands)
- IWRM: “true” multi-objective
 - Consider actions/measures that work in concert together to achieve ER, FRM, CSDR
 - Formulate & evaluate whole plans rather than pieces of plans
- Complementary actions taken by others (Fed, State, local, NGO's)



IWR Planning Suite as a **Tool** to Support Plan Form Strategies

- Need to employ well-specified planning objectives in concert with combinatorial (“plan generation”) routine
 - What is the minimum plan that meets planning objectives?
 - How much output is “enough?”
 - How much risk (reduced performance) is acceptable?
- Recommend starting with alternatives or at least suites of management measures that work together within a reach/ area/ sub-basin to meet planning objectives



More on IWR Planning Suite as a **Tool** to Support Plan Form Strategies

- Software can still be used to optimize fully formulated alternatives
 - We usually speak of optimizing only the recommended plan, but we can also optimize (or improve upon) alternatives we've already formulated
 - ID more cost effective or efficient measures for a given reach or objective
 - ID new combinations of mgt. measures from original alternatives



– LA River example



Which Strategies have you Employed?

Other Agency's Plan	Public Input Plan	Prior Study/ Report	Conceptual Model
"Low Hanging Fruit" Strategy	"Grand" Strategy	Ecological Model	Focus on Significant Resources
Mosaic of Habitats	Real Estate Considerations/ HTRW Constraints	Reference Ecosystem	Mainstem Reaches/ Tribs
Non-structural	Upstream/ Downstream	Connectivity – Lateral/ Longitudinal	Multi-objective



Put a green check mark in the boxes for the ecosystem restoration plan formulation strategies you have previously employed



Your Turn...

- Do you have any “take away” lessons or insights from today’s webinar?
- Please type your responses in the chat box for all to see
- Let’s discuss...



Questions or Comments?

- Email or call the following individuals:
 - Leigh Skaggs, OWPR
 - Jeff Trulick, OWPR
 - Jodi Creswell, HQ
 - Maria Wegner, HQ
 - Greg Miller, ECO PCX
 - Shawn Komlos, IWR

