Assessing the Ecological Benefits of River and Floodplain Restoration

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Presentation Overview

Background
- Central Valley Flood Protection Plan (CVFPP) context
- Basin-Wide Feasibility Studies

Assessment Rationale
- Key influences and concepts

Assessment
- Methods
- Results
- Conclusions and Recommendations
Background

- CVFPP context
- Basin-Wide Feasibility Studies
A Stressed System, the Need for Action

- Central Valley people, property and assets at risk
- Current flood risk management path unsustainable
- Lack of funding for capital works and for ongoing operations and maintenance of existing infrastructure
- In 2008, the Legislature enacted the Central Valley Flood Protection Act, which authorized and required development of the Central Valley Flood Protection Plan (CVFPP) to address these issues
2017 Update to the CVFPP

- CVFPP is a dynamic, programmatic plan, updated in five year cycles – CVFPP first adopted in 2012, first “Update” in 2017
- 2017 Update has same goals 2012 CVFPP
- The planning horizon is the 30 years
- Refines and updates the State Systemwide Investment Approach (SSIA)
- Adds specificity about recommended near and longer-term investment and financing approach
- Provides broad guidance about more resilient risk management
- Coordinated and aligned with other major flood management efforts
Technical Work to Support CVFPP Goals

- Technical analyses informing a reasonable, balanced and cost-effective approach
- Emphasis on sustainable, integrated flood management
- Diverse array of actions to improve flood protection
- CVFPP Public Draft December 2016

**CVFPP GOALS**

**Primary Goal: Improve flood risk management**
- Reduce the chance of flooding
- Reduce damages once flooding occurs
- Improve public safety, preparedness, and emergency response

**Supporting Goals**
- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Promote Multi-benefit Projects
- Improve Institutional Support
Basin-Wide Feasibility Studies

Ecosystem Restoration Concepts

- Bypass improvements
- Levee setbacks
- Transitory storage areas
Assessment Rationale

• Key influences
• Key concepts
Key influences

• Draft Central Valley Flood System Conservation Strategy (Conservation Strategy)
• California Rapid Assessment Method (CRAM)
• Habitat Equivalency Analysis (HEA)
Key influences

**Flood Risk**
- Unregulated discharge
- Regulated discharge
- Channel stage
- Annual exceedance probability
- Floodplain stage
- Damage

**Ecosystem Function**
- River meander
- Marsh/other wetland habitat
- Invasive plant infestations
- Riparian habitat
- Natural Stream-bank
- Riparian-lined banks
- Fish barriers

**Service (Functional) Acre-Years**
Key concepts

- Functions vary with hydrologic process: floodplain inundation

Riparian plantation
- Lower Colorado River, Cibola Valley Conservation Area

Riparian inundation
- Sacramento River, Fremont Weir
Key concepts

- Functions vary with geomorphic process: river meander

Reveted river

Meandering river
Assessment

• Methods
• Results
• Conclusions and Recommendations
Methods

Models

- Riparian
- Marsh & other wetland
- Channel bank

Ecosystem Models

Riparian (functional acre-years) + Channel Bank (functional acre-years) + Marsh & other wetland habitat (functional acre-years) = Total (functional acre-years)

Species Assessments

Benefit to Species X of 17 (Yes/No)
Methods

Conservation Strategy Goals and Metrics

Ecosystem Processes
- Inundated floodplain (acres)
- River meander (acres)
- Natural Streambank (miles)

Target Species
- Riparian habitat (acres)
- Marsh/other wetland habitat (acres)
- Riparian-lined banks (miles)

Habitats
- Invasive plant infestations (acres removed)
- Fish barriers (# removed)

Stressors
Methods

Ecosystem Models

Riparian (functional acre-years) + Channel Bank (functional acre-years) + Marsh & other wetland (functional acre-years) = Total (functional acre-years)

Species Assessments

Benefit to Species X of 17 (Yes/No)
Methods

Structure for all models

\[ = f \left[ \text{Acreage} \times (\text{Process} + \text{Structure} + \text{Landscape} + R) \right] \]
Methods

Variables

1. Ecosystem Process Variables
   • Floodplain inundation (Expected Annual Habitat)
   • Meander potential, presence vs. absence
   • Tidal range

2. Structure Variables
   • Width
   • Vegetation structure development
   • Invasive plant dominance
   • Crop type
   • Shading vegetation type

3. Landscape Variable - buffer condition

4. Remainder Variable - residual value
Results

Raw Acres vs. Fully Functional Acres

Net increase in Riparian Scrub/Woodland Acreage

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</table>
Results

Raw Acres vs. Fully Functional Acres

- Ecological processes (inundation, meander potential) contribute to functionality

Net increase in Riparian Scrub/Woodland Acreage & Function
Conclusions of Expert Review

• Reconsider weightings of variables

• Enhance site-scale attributes
  – Reduce patch size/shape bias
  – Include corridor width
  – Measure continuity of functional habitat
Recommended Applications

- Assess cost/benefit of restoration
- Refine or optimize the restoration concepts
- Potential yardstick for compliance or effectiveness monitoring
- Assess the potential for a Conservation Strategy target species to use a specific locality
- Identify target species with unmet conservation needs
The Path Forward

• Need to change how we think about flood risk management

• 2017 Update will refine the 2012 CVFPP and provides a holistic path forward to a different approach

• The refined SSIA enables the State to integrate and prioritize investments in multi-benefit flood risk reduction projects

• CVFPP will take 30 years to implement
References and Resources

Primary References
• Central Valley Flood System Conservation Strategy (DWR, 2015)
• Handbook for Assessing Value of State Flood Management Investments (DWR, 2014)
• California Rapid Assessment Method (California Wetland Monitoring Workgroup, 2013)

Other Resources
• Habitat Equivalency Analysis: An Overview (NOAA, 2006)
• Application of Habitat Equivalency Analysis to USACE Projects (Ray, 2009)
Key influences

Habitat / Resource Equivalency Analysis

- **Resource Services**
  - Baseline Service Level

- **Time**
  - Impact begins
  - Restoration begins
  - “Full” Restoration

- **Lost Services**
- **Restored Services**
Methods

Structure for all models

\[ \text{Functional Acre} = f \left( \text{Acreage} \times (\text{Process} + \text{Structure} + \text{Landscape} + R) \right) \]

\[ \text{Functional Acre-Years} = \sum_{\text{first time interval}}^{\text{last time interval}} \text{Functional Acre} \]
Riparian Model

\[ \sum_{p=1}^{n} \sum_{t=1}^{n} \left[ \text{Area}_{p,t} \left( W_{t_{PrEAH}} \frac{EAH_i}{EAH_{ff}} + W_{t_{PrMP}} \text{MP} \right) + W_{t_{St}} \left( \text{VegSt}_{i} \cdot \text{Inv}_{i} \frac{\text{Width}_{i}}{\text{Width}_{ff}} \right) + W_{t_{Buff}} \left( \frac{\text{BuffCond}_{i}}{\text{BuffCond}_{ff}} \right) + R \right] \]

- Inundation (EAH) fully functional at intervals of at least once every 2 years
- Meander potential (MP) based only on geology and bank type (natural vs. revetted)
- Vegetation structure (VegSt) represents change in functions as vegetation develops during initial 20-year period
- Structure term varies inversely with invasive plant dominance (Inv)
- Polygon width of 100 meters is considered fully functional
- Buffer condition (BuffCond) is fully functional if 250-m buffer is entirely in natural vegetation