Tracking the Attainment of Environmental Flow Targets

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The Team

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• And others...
Voluntary Water Transactions

• Prior appropriation
  • “First in time, first in right”
• Water is over-allocated.
• Results in depleted streamflows.
• All sectors at risk of shortage:
  • Agriculture
  • Municipal & Industrial
  • Environment
• Drought worsens the situation.

Voluntary transactions work within the prior appropriation system to re-allocate water equitably.
Transaction Indicator Goals

• Multi-objective outcomes:
  • Environmental Health
  • Provider supply security
  • Rural and agricultural economies
  • Drought resilience

• Communicating and tracking progress toward goals.
• Retrospective (How did my transaction program perform?); or
• Forward-looking (How will a potential transaction affect my goals?).
• Transfer of methods – Indicator protocols and due-diligence.
• Simple to use – Readily accessible methods and data.
Environmental Health

• Questions:
  • How often do environmental needs go unmet?
  • When do environmental needs go unmet?
  • How much additional water is needed to meet environmental needs?
  • Are existing rights/agreements sufficient to protect environmental needs?

• Required Data:
  • E-flow targets – science-based targets based on conservation goals.
  • Actual flow data – average daily flows (USGS, State Agencies, Irrigation Districts, Modeled Flows).
  • Legal rights – Water rights, leases, agreements.
Case Study: Whychus Creek, OR

• Historic study.
• Transaction program operating since 2000.
• USGS gage above all diversions.
• ODWR gage at Sisters, OR operating since 10/2000.
• Flat 33 CFS year-round target.
• "Baseline" data unavailable.
Pilot Project: Navarro River, CA

Navarro River Modeled Flow and Target

- 80% Exceedance
- Median
- 20% Exceedance
- Target
Is this program effective?

Can we quantify this?
Indicator: Temporal Deficit

Δ Percent of days target levels are met before and after transactions.

Whychus Creek Case Study

Navarro River Pilot Project
Indicator: Volume Deficit

Δ in volume deficit before and after transactions, during days of deficit.

**Whychus Creek Case Study**
Annual Volume Deficit Relative to Target

**Navarro River Pilot Project**
Average monthly volume deficit relative to target
Is this program effective?

- Ranked by prior appropriation.
  - For the Whychus Basin:
    - Pre-1895 is High Security
    - 1895 is Moderate Security
    - 1896-1909 is Low Security
    - Post-1909 is Very Low Security
- “Paper Water” vs. “Wet Water”.
- Also ranked by permanence.
- Note the vertical scale.
Indicator: Security

• Change in protected water volume.
• Qualitatively classed according to security & permanence.
• Measured as a fraction of the environmental flow target.
• Evaluated seasonally and during e-flow deficits.
Water Sharing Dashboard

- Analysis is not complex*.
- It is time consuming.
- Unless you know Python.
- Public data sources:
  - USGS Stream Gaging System
  - USDA NASS
  - Bureau of Labor Statistics
- Temporal variation.
- Spatial variation.
- Transactions take time.

\[
f = \frac{\#\{Q_{\text{gap}}: Q_{\text{gap}} < 0\}}{\#\{Q_{\text{gap}}\}} \times 100\%
\]

\[
V_{\text{gap}} = \sum 1.9835 \times Q_{\text{gap}}
\]

\[
V_{\text{target}} = \sum 1.9835 \times Q_{\text{target}}
\]

* Once you have a target and a flow dataset.
Data Sources & Archival

• Integration with public data.
  • USGS – Flow data.
  • USDA – Crop census & surveys.
  • BLS – Price indices.

• Automate analysis
  • Download
  • Visualization

• Custom input via spreadsheets.
  • Non-public data.
  • Modeled data.
  • Modifications of public data.

• Database to maintain records.
Reporting and Visualization

- Web-based visualization & reports.
- Simple mapping to display scale and data.
- Integration with NHD services for HUC basins and gage locations.
- Integration with ArcGIS feature services for custom layers.
- Automatic generation of useful graphs & visualizations.
- Data download for custom analysis.
Future Plans (& Hopes)

• Indicators from other sectors.
  • Agriculture mostly complete.
• More general flow targets.
• Spatial variation.
• Transactions database.
• Integrated tracking and analysis.
Questions?

http://snappartnership.net/groups/sharing-water/
https://www.nceas.ucsb.edu/projects/12707
https://byers.nceas.ucsb.edu - Dashboard Prototype

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