Phases in Scenario Planning

I. Preparing for the process
II. Building and refining scenarios
III. Using scenarios to evaluate, prioritize, and implement management actions
So What?

1: Just Let It Go / Habooby Trap
[HI DISTURBANCE – LO VALUES / HI SUMMER WINDS - DRY WINTER]

Winds, flood, fires, and humans damage physical remains but the public is willing to let these go because they have other concerns.

2: Nothing Happens but Nobody Cares / Tucson Good Ol’ Days
[LO DISTURBANCE – LO VALUES / EARLY MONSOON – DEC TROPICAL CYCLONES]

A lengthened dry season followed by energetic monsoon damages physical remains; loss is compounded if the public doesn’t connect and engage.

3: All Hands on the Land! / No Analog
[HI DISTURBANCE – HI VALUES / LATE MONSOON – INC TROPICAL CYCLONES]

The most damaging to physical remains, but public engagement is high in appreciation, involvement, funding, and hands-on stewardship.
### Use of Scenario Narratives

- Insight! -- Outreach
- Bring insight to ongoing processes: stakeholder discussions, modeling studies, vulnerability assessments, USFS ILAP, NPS RSS, BLM REA
- Evaluate existing plans: BLM landscape plan review
- Evaluate extant adaptation options: robust, no regrets?
- Innovate new adaptation options: stops, bridges
- Develop portfolios of options: time-varying, weighted

### Using Scenarios

0. Vet scenarios
1. Evaluate potential impacts and implications
2. Identify potential strategies or action plans
3. Prioritize actions
   - robust actions, no regrets actions
   - contingency actions
   - bridging actions
4. Structure monitoring and research
   - decisions
   - triggers
   - scenario differences
Identify Possible Decision Strategies

- Punt!
- Delay and assess
- Commit with fallbacks
- Shape the future
- Robust: good across all scenarios
- Portfolio of options: shifting over time

Categories of Adaptation Options

1. **Resistance**: defend against change (Homeland Security)
2. **Resilience**: ‘bounce back’ after disturbance (Health Care)
3. **Response**: facilitate change (Beginners Mind), e.g., regional approaches, interconnections, diversity
4. **Realignment**: accept different systems, focus on function (Auto Mechanics)
5. **Reduce**: mitigation of GHG (Good Samaritan)
6. **Triage**: let go (Pragmatic)

Some things to keep in mind....

The past is never dead. It isn’t even past. -- William Faulkner

The future is already here. It’s just not very evenly distributed. -- William Gibson

As we know,
There are known knowns.
There are things we know we know.
We also know
There are known unknowns.
That is to say
We know there are some things
We do not know.
But there are also unknown unknowns,
The ones we don’t know
We don’t know.
—D.H. Rumfeld, 2002

We should remember that the future is not a magnification of current challenges.

No Regrets – Different Concepts

No Regrets
- increase resilience

No Regrets
- avoid locking in vulnerabilities

No Regrets
- create benefits in the short-term
  - win-win-win: benefits across many values, needs

No Regrets
- appropriate across all plausible futures

No Regrets
- portfolio of weighted investments for multiple plausible futures
Is Typical Planning Flexible Enough?

Planning for a Desired Future
- Defining goals
- Taking stock
- Examining trends
- Setting targets, thresholds
- Directing management

Choosing Among Alternatives

One-Dimensional Planning vs. Robust Planning

Good example: City of Tucson Water Plan: 2000-2050 Updated Version
Case Study: Tucson Water 2000-2050, 2008 Update, and Beyond

Tucson Water: 225,000 connections, 775,000 people, 350 square miles

and 2008 Update

Values about Use of Colorado River Water

Industry Standard

Surface Enhancement

Public Accepts EPA/ADEQ Water Quality

Public willing to Pay for Enhanced Water Quality

No Direct Treatment - All Colorado River Water is Recharged

Recharge Only

Enhanced Recharge
Values about Use of Wastewater Effluent

Combining Short- and Long-term Scenarios
Lay Out Timelines for Each Adaptation Option

<table>
<thead>
<tr>
<th>Pathway</th>
<th>Major Pipelines</th>
<th>Potable System</th>
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<tbody>
<tr>
<td>1 2005</td>
<td>2006 2009</td>
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</table>

Natural resources analog for resource areas? Aquatic, terrestrial ?? Others? - facilities, visitor services

Some Options Common to All Futures: CO. R.

Clearwater Futures

- Common Elements: CAVSAP, Spencer Interconnect, Secondary Disinfectants, Public Outreach, SAVSARP Feasibility
- Some Direct Treatment
- All Recharge

Decision Point: 2006
Options Common to All or Some Futures: Effluent

Decision Point: 2014

Rate Collections of Options with Evaluation Criteria

9: Using both CO R water and effluent, recharging both.

Natural resources analog for criteria? Biodiversity, wilderness, scenery, recreation, carbon and water storage...
Criteria for other resource areas?
Timeline of Alternative Actions and Decision Points

Revisiting the Scenarios in 2008

New critical uncertainty: Water demand. City considers expanding service area.

Some uncertainties gone: Decision H2O in 2006/7. Customers OK with basic water standards
Revisiting the Scenarios in 2008: Considering Demand

Decision Points

Adaptation Options

- Collaboration, Communication, Inventory & Monitoring, Connectivity, Restoration in impaired locations.
- Headwaters restoration across the Region, Protect refugia over other locations.

Possible Futures

- Dams in the Park, Move fish stocks north, Bring new fish stocks from south, Let some systems go.

- Climate Complacency: Is Anyone Out There?
- Colorado Creeps North: Wheel Spinning
- Race to Refuge: Big Problems, Big Solutions
Decision Points for Each Action Option

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<th>SCENARIO</th>
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<th>Physical</th>
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<td>2050</td>
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<td>RR</td>
<td>2020  2040  2030</td>
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Categories: Institutional, biological, ecological, physical, geochemical

Timelines of Options

- **Climate Complacency: Is Anyone Out There?**
- **Colorado Creeps North: Wheel Spinning**
- **Race to Refuge: Big Problems, Big Solutions**

- **Raise Horseshoe Dam**
  - Policy, design, planning
  - Construction
  - Impact: indefinite
Timelines of Options

Adjust operating rules for Horseshoe Lake

Impact: Until 2040
Raise dam

Policy, design, planning

Adjust operating rules for Horseshoe Lake

Planning | Construction | Impact | Scenario
--- | --- | --- | ---
2015 | 2025 | 2050 | 2075 | 2100

Adjust operating rules for Horseshoe Lake | CC/IAOT | CCN/WS

Raise Horseshoe Dam | RR/BPBS | not effective

Keep false brome out of Horseshoe Lake watershed | RR/BPBS | CCN/WS | not effective | CC/IAOT

Stop maintaining bull trout populations in Horseshoe River | RR/BPBS
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Focus on the Triggers (hard and soft), not the year!

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Rate Collections of Options with Evaluation Criteria

NPS Analogs? Manage for biodiversity, wilderness, scenery, recreation, carbon and water storage

Nested Objectives

From Caves et al., Ecology and Society, 2013
Rate Collections of Options with Evaluation Criteria

NPS Analogs? Manage for biodiversity, wilderness, scenery, recreation, carbon and water storage

Re-starting the Scenario Planning Process

Adaptation Options


Headwaters restoration across the Region. Protect refugia over other locations.

Possible Futures

Identify Options, Timelines, and Decision Points

**Objective**: develop management options with links to monitoring, research, planning

**For a single scenario: work backwards in time**
- Perspective 1: Manager in 2100. What do you wish had been put into place in 2050?
- 2: Manager in 2050, end of career. What do you wish you had known/done at the start of your career in 2020

**Activity**
1. Describe action
2. Create timeline: implementation, impact persistence, preparation time (planning, construction, etc.)
3. Identify decision triggers: hard, soft

Using Scenarios in Planning: Different Conceptions
Ecology of Scenarios

Global Scenarios
- Emissions
  - Socioeconomic

Global Scenarios
- Climate
  - Environmental

Regional Scenarios
Driving Forces
- Climate
- Environmental
- Socioeconomic

Regional Scenarios
System Sensitivity & Impacts
- Climate
- Environmental
- Socioeconomic

Local/Regional Visioning Scenarios
- Community Desires
  - Mitigation
  - Adaptation Planning

Local/Regional Scenarios
Evaluating Adaptation Options
- Regions, Sectors
- Quantitative Planning Methods

Local/Regional Challenge Scenarios
Strategic Adaptation Challenges
- Regions, Sectors
- Strategic Narratives
- Adaptation Options and Screening

Embrace Uncertainty
Reduce Uncertainty
Characterize Uncertainty

Geneology of Projection-based Scenarios

Studies using various approaches:
1. Seager et al. 2007; Seager et al. 2013
2. Milly et al. 2005
3. Christensen et al. 2004; Christensen and Lettenmaier, 2007; Cayán et al. 2010; USBR 2011
5. Gao et al. 2012
6. Hoerling and Escheid 2007
7. Cook et al. 2004
8. Woodhouse et al. 2006; McCabe and Wolock 2007; Meko et al. 2007; USBR 2011

Abbreviations:
GCM – Global Climate Model
RCM – Regional Climate Model
PDSI – Palmer Drought Severity Index
P – Precipitation
T – Temperature
R – Runoff
E – Evaporation
S – downscaling – statistical downscaling

From Vano et al., BAMS, 2013
Institutional Learning – Practice with NWS Seasonal Climate Outlooks

Flow Chart for Using Outlooks

- Situational Assessment
- Vulnerability Assessment
- Climatic support
- Decision makers
- Decision makers and Climatic support

- Outlook Available?
- No
- No Skills/No Signal
  - Local Studies
  - Assess broad range of past conditions
- Yes
- Relevant Metrics
- Sufficient Skill?
  - Yes
  - Proportionality
    - Prepare for:
      - Correct Outlook
      - Incorrect Outlook
      - Outlook ‘Busy’

- Prepare for All Conditions
  - Problems/Opportunities
  - Thresholds, past frequency & variability
  - Mitigation of negatives
  - Positioning for positives

Ecology of Scenarios

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  - Emissions
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  - Climate
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