Governance, Decision-Making, & Adaptive Management

Lessons from the Platte River Recovery Implementation Program

Adaptive Management for Large-Scale Water Infrastructure Projects Workshop

New Orleans, LA
July 26, 2018

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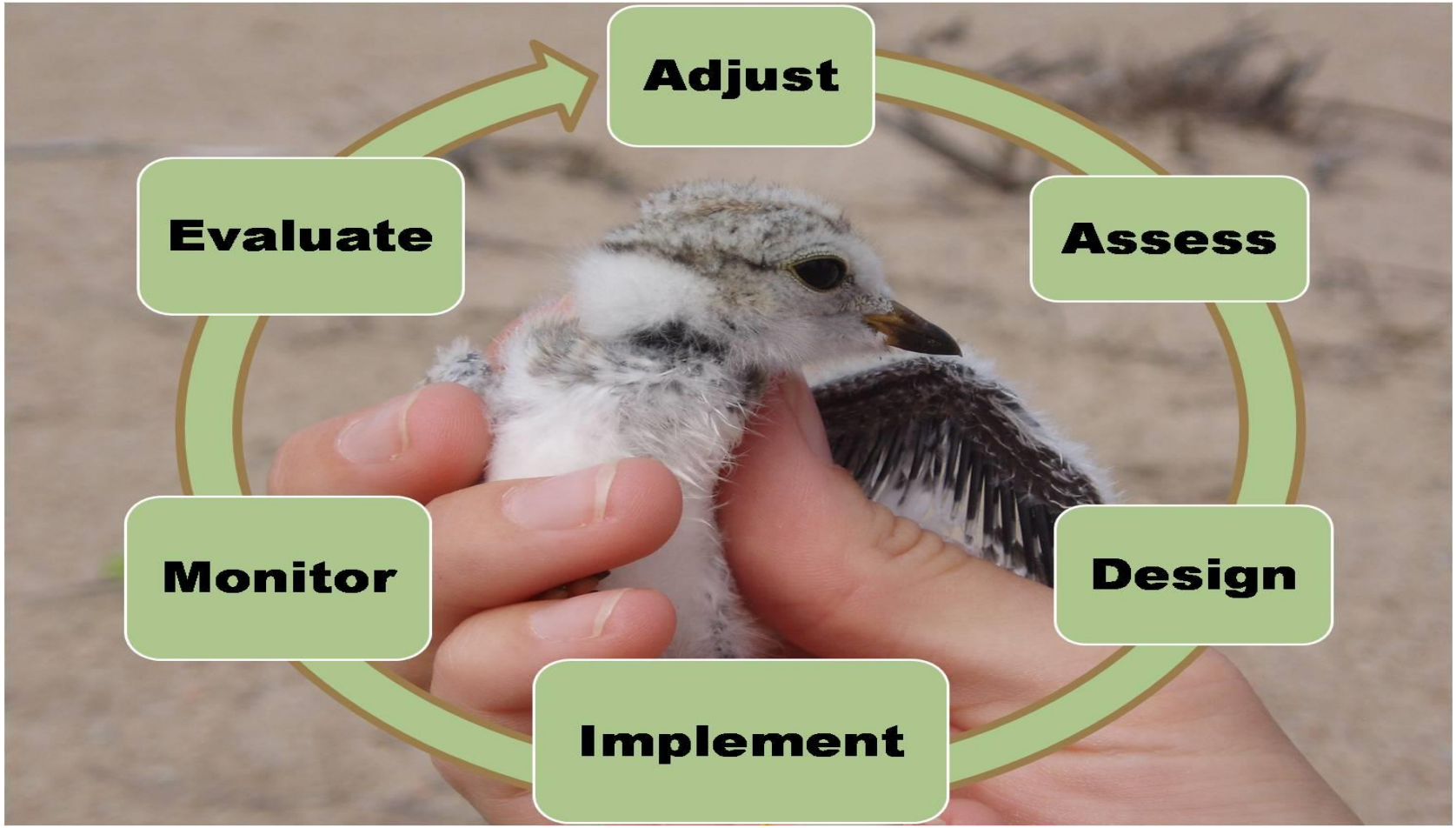
Platte River Recovery Implementation Program

Adaptive Management (AM) – What is it?



Rigorous approach for designing and implementing management actions to maximize learning about critical uncertainties that affect decisions, while simultaneously striving to meet multiple management objectives.

Lessons learned from the Platte (with assistance from the Middle Rio Grande, Trinity River, Everglades, Missouri River, and others)

Two "must haves"

1) **Governance**

- Get the **people** part right, and do it first
- Science must feed into decision making – it **informs**, does not **control**

2) **Why?**

- Make science **useful** for decision-makers
- Avoid the "science pile" – **synthesize** and tell the story!
- If using AM, don't get stuck in Monitor or Evaluate step – common problem

What do theory and practice tell us about AM?

Lee, 1999: ("Appraising Adaptive Management")

- Collaborative structure should be in place BEFORE AM gets underway. AM has not been used this way, experimentation has been adopted in planning context. This may be why few successes.
- AM should only be used after disputing parties agree to an agenda of questions to be answered using an adaptive approach.
- Adaptive approach – bioregional in scale, collaborative in governance, adaptive in managerial perspective.

Walters, 2007: ("Is Adaptive Management Helping to Solve Fisheries Problems?")

1) Failure to comprehend need for management experiments.
2) Lack of AM leadership – "compleat emmanuensis."
3) Inadequate funding for monitoring.

Huitema et al. 2009: (adaptive water governance)

- Match governance and AM to "bioregional scale" where ecosystem and institutional arrangements match.

Melis, Walters, Korman, 2015: (Glen Canyon Dam AMP)

- AM is not a science endeavor, but a complex societal collaboration with managers identifying management strategies under varying uncertainty and limited resources, including time.

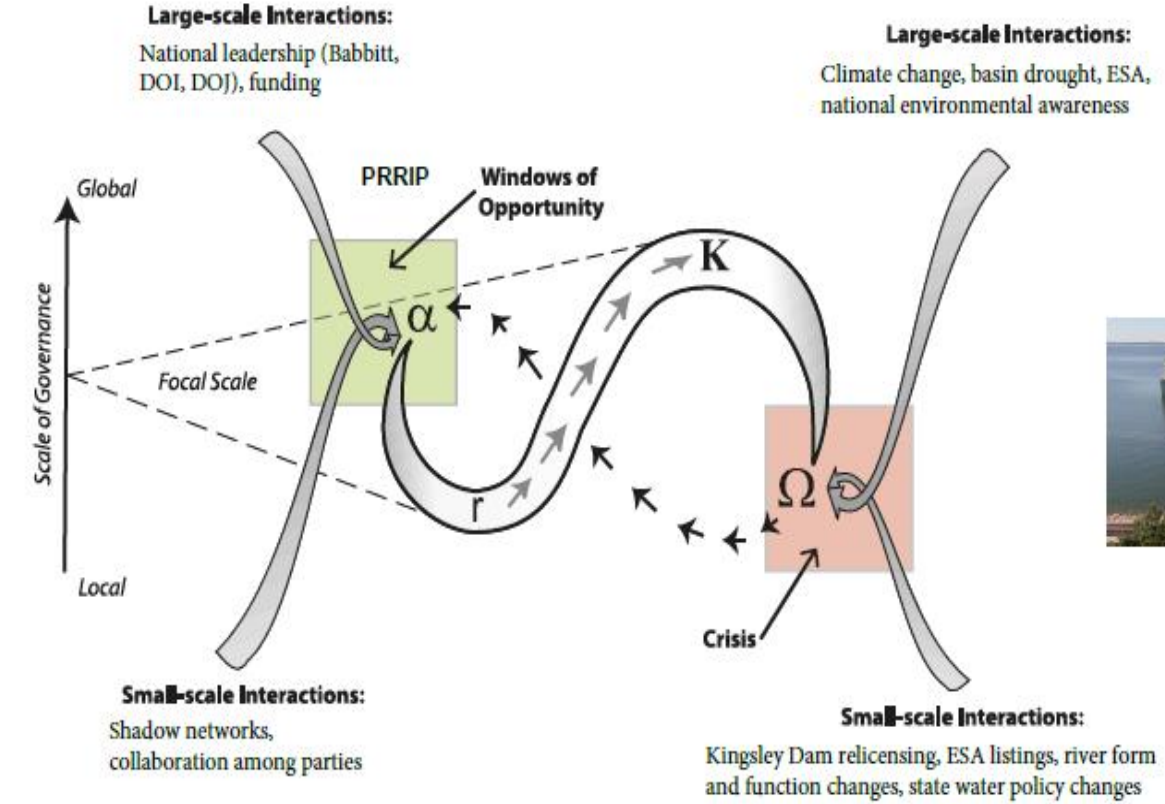
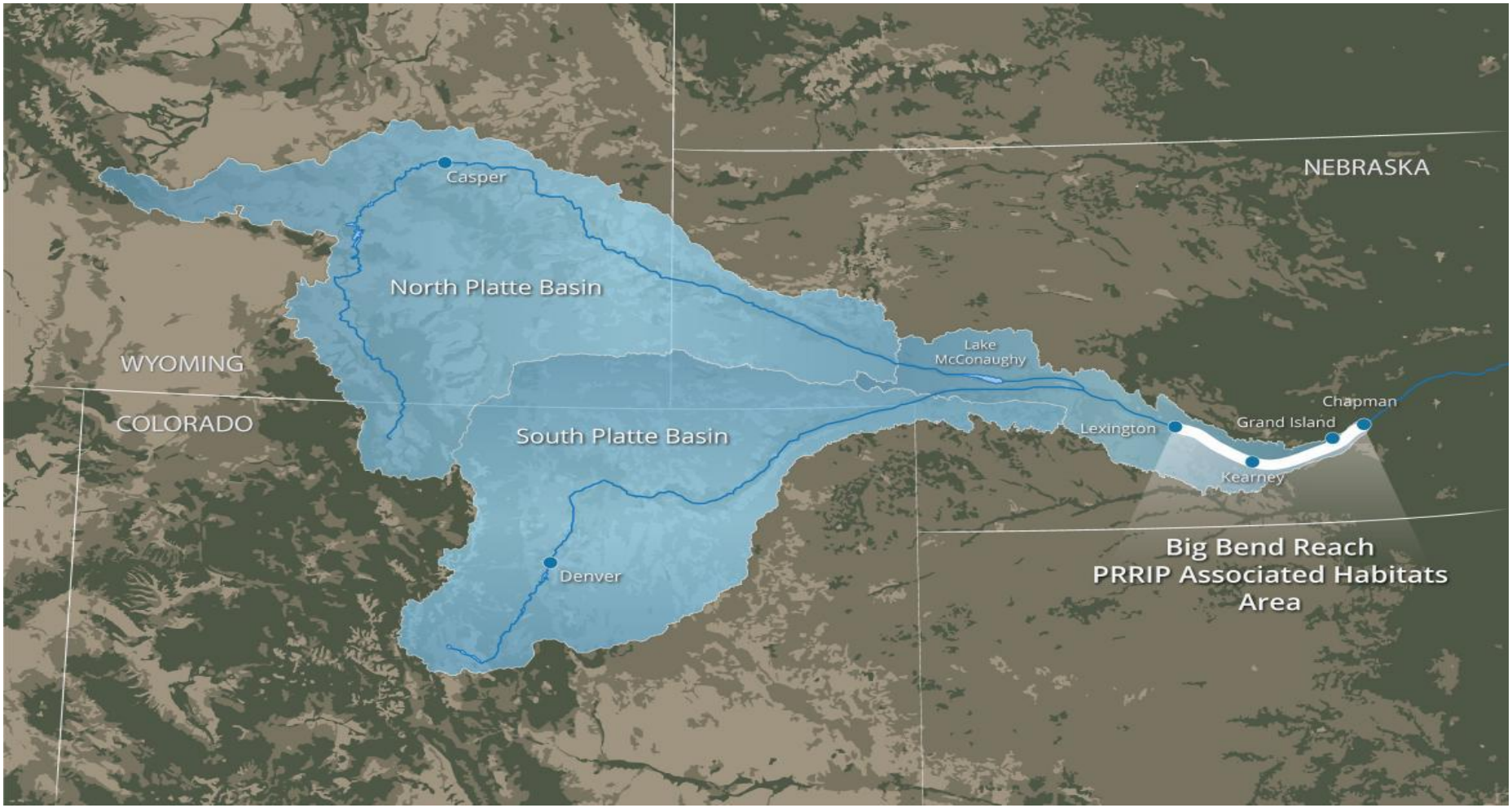
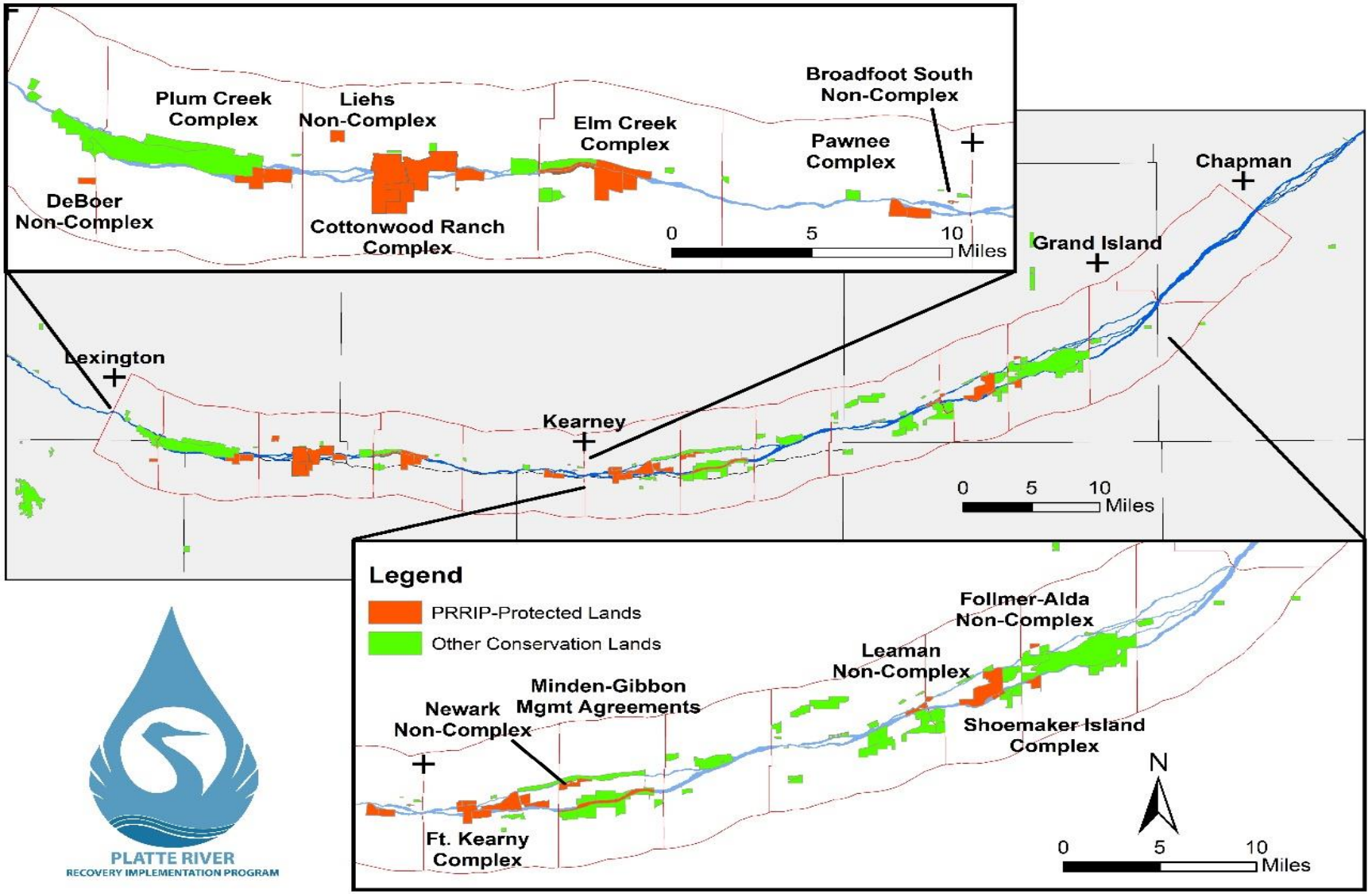


Fig. 1. Platte River social-ecological system (SES) panarchy.



- Cooperative effort between Department of Interior, Colorado, Wyoming, Nebraska, & stakeholders
- $325 million First Increment (2007-2019); First Increment Extension (2020-2032), $106M in new cash + remaining funds



PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

Target Species

Interior least tern

Piping plover

Whooping crane

Pallid sturgeon

PRRIP Goals and Objectives

- Securing defined benefits for target species
- ESA compliance for existing and new water uses
- Prevent additional ESA listings
- Mitigate adverse effects of water activities on Service target flows
- Organizational structure for agency and stakeholder involvement

First Increment Objectives

- 130,000-150,000 acre feet/year
- 10,000 acres of land

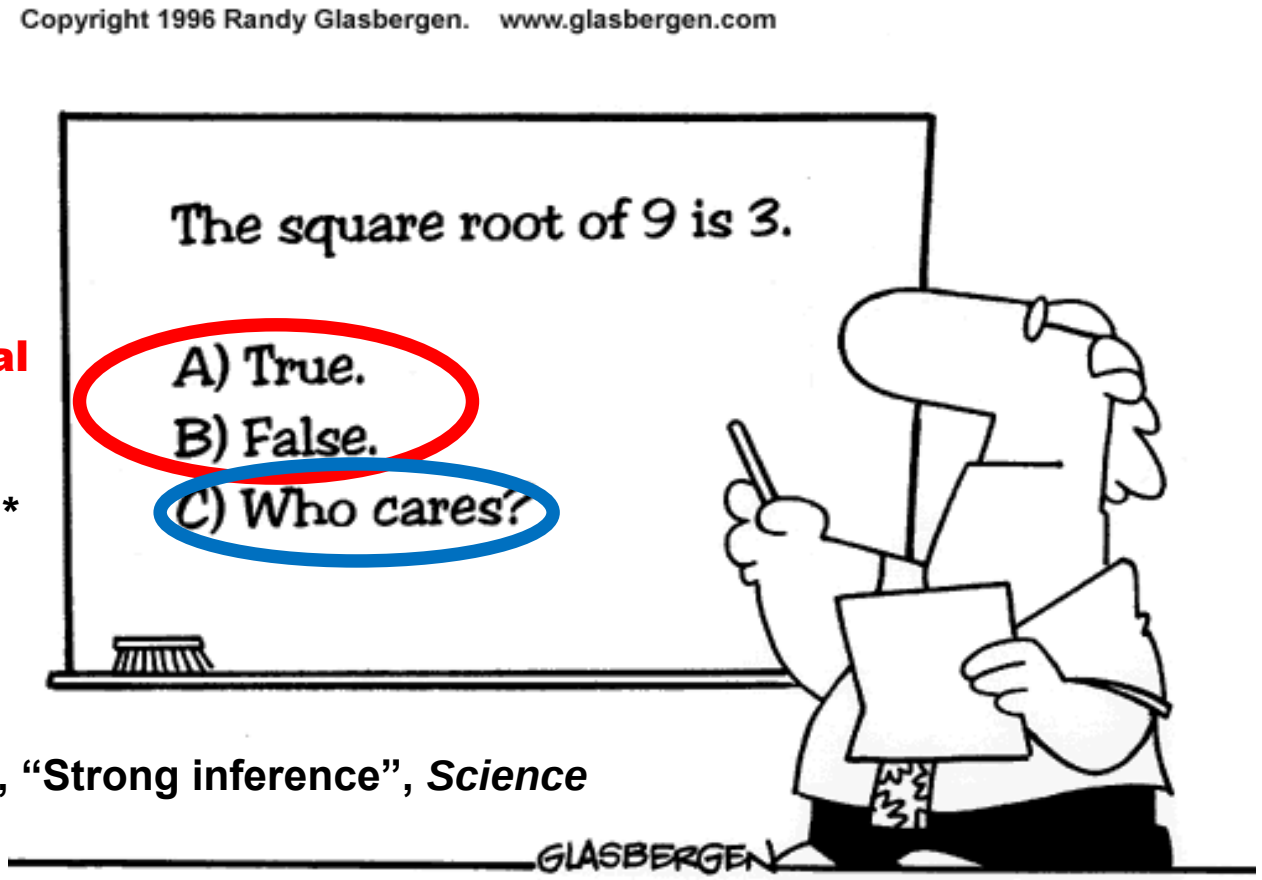
AMP Management Objectives

- Terns/plovers
- Whooping cranes
- Do no harm to pallid sturgeon

What's different about the Platte?

- Shared decision-making – stakeholders sit on Governance Committee
- 10 years of negotiation – agreed on water, land, and AMP; Final Program Document defines the Program; collaborative structure first, then AM
- Independent Executive Director and staff
- Consensus decision-making
- Commitment
- Meeting structure

Decisions – Why?



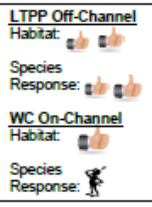
"Mathematical box"*

"Logical box"*

John Platt, 1964, "Strong inference", *Science

Many students actually look forward to Mr. Atwadder's math tests.

Critical Uncertainties

PRRIP Big Question	2016 Assessment	Basis for assessment
Implementation – Program Management Actions and Habitat		
1. **Will implementation of SDHF produce suitable tern and plover riverine nesting habitat on an annual or near-annual basis?**		Conclusively answered. Peer reviewed and published interior least tern and piping plover habitat synthesis chapters best address this question.[2]
2. **Will implementation of SDHF produce and/or maintain suitable whooping crane riverine roosting habitat on an annual or near-annual basis?**		Conclusively answered. Peer reviewed whooping crane habitat synthesis chapters[5] and published vegetation scour research[3] best address this question.
3. **Is sediment augmentation necessary for the creation and/or maintenance of suitable riverine tern, plover, and whooping crane habitat?**		Trending positive and certainty about the sediment deficit in the south channel above the Overton bridge; uncertainty about the role of that deficit in habitat creation and maintenance in the rest of the Associated Habitat Reach (AHR).
4. **Are mechanical channel alterations (channel widening and flow consolidation) necessary for the creation and/or maintenance of suitable riverine tern, plover, and whooping crane habitat?**		Conclusively answered. Peer-reviewed WEST habitat selection analysis, PRRIP WC habitat synthesis chapters,[5] and publications related to the Program's vegetation scour research[3] best address this question. Additional publications expected in early 2018.
Effectiveness – Habitat and Target Species Response		
5. **Do whooping cranes select suitable riverine roosting habitat in proportions equal to its availability?**		Conclusively answered. Peer-reviewed WEST habitat selection analysis and PRRIP WC habitat synthesis chapters best address this question. Related publications expected in early 2018.
6. **Does availability of suitable nesting habitat limit tern and plover use and reproductive success on the central Platte River?**		Conclusively answered. Tern and plover breeding pair manuscript published in 2015 best addresses this question.
7. **Are both suitable in-channel and off-channel nesting habitats required to maintain central Platte River tern and plover populations?**		Conclusively answered. Tern and plover breeding pair manuscript published in 2015 best addresses this question.
8. **Does forage availability limit tern and plover productivity on the central Platte River?**		Conclusively answered. Productivity in relationship to flow manuscript published in 2017 best addresses this question.
9. **Do Program flow management actions in the central Platte River avoid adverse impacts to pallid sturgeon in the lower Platte River?**		The GC is currently conducting a facilitated Pallid Sturgeon Process to determine how best to address this question and related issues.
10. **Do Program management actions in the central Platte River cumulatively 1) produce detectable changes in the physical environment (i.e. habitat) and 2) result in a detectable increase in tern, plover, and whooping crane use of the Associated Habitats?**		Generally trending positive. The EDO proposed a methodology for addressing this question at the 2017 AMP Reporting Session and will update this assessment and the related write-up based on that discussion.

Management Actions

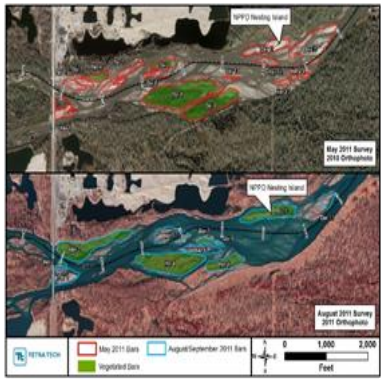
Flow-Sediment-Mechanical (FSM)
"Clear/Level/Pulse"

Mechanical Creation & Maintenance (MCM)
"Clear/Level/Plow"

- Short-duration high flows (SDHF)
- Sediment augmentation
- Mechanical island building, channel widening, vegetation clearing
- Off-channel habitat

Monitoring Data

Effort	Frequency	Description
Least Tern and Piping Plover Use and Productivity Monitoring	Annual	Document species use, habitat variables and productivity in the AHR.
Least Tern and Piping Plover Habitat Availability Analysis	Annual	Document occurrence and amount of habitat in AHR meeting minimum species habitat suitability criteria.
Discharge Measurements	Real-time	Real-time Platte River discharge monitoring at six locations in the AHR. Stream gaging conducted in cooperation with the USGS and Nebraska Department of Natural Resources
June Color-Infrared Imagery	Annual	Document in-channel and off-channel habitat conditions during least tern and piping plover nest initiation period.
November Color-Infrared Imagery and Light Detection and Ranging	Annual	Document channel morphology and topography under leaf-off and low discharge conditions.
System-Scale Geomorphology and Vegetation Monitoring	Annual	Monitor sediment transport, channel morphology and in-channel vegetation throughout the AHR. Data include bed and suspended sediment load measurements, repeat channel transect surveys, bed and bank material sampling, and vegetation monitoring.
HEC-GeoRAS Hydraulic Model of AHR	As Necessary	Segment-scale hydraulic model for evaluation of channel hydraulics and development of water surface profiles across a range of discharges.



2016 State of the Platte

Synthesis – Big Question #1

- Pulled together multiple lines of evidence regarding terns/plover productivity and relationship to flow
- Six “chapters” compiled into a single document
- Extensive review by Technical Advisory Committee and Independent Scientific Advisory Committee
- Utilized internal Program peer review process
- Data utilized to make definitive assessment of Big Question #1

Big Question #1

Will implementation of Short-Duration High Flow releases produce suitable tern and plover riverine nesting habitat on an annual or near-annual basis?

The minimum sandbar height suitability criterion is ≥1.5 ft above 1,200 cfs river stage.

2016 Assessment

- Observational studies of natural high flow events since 2007 have provided sufficient data to test the hypothesis that SDHF releases will create suitably-high sandbars.
- Full SDHF magnitude of 8,000 cfs is not sufficient to create sandbars exceeding the PRRIP's minimum height suitability criterion.
- Sandbars created by SDHF releases will be inundated during the nesting season in most years.
- Peak flow magnitudes of 15,000 cfs will produce sandbars meeting the minimum height criterion. However, suitably-high sandbar area would be well below the Adaptive Management Plan objective of 10 acres per river mile.

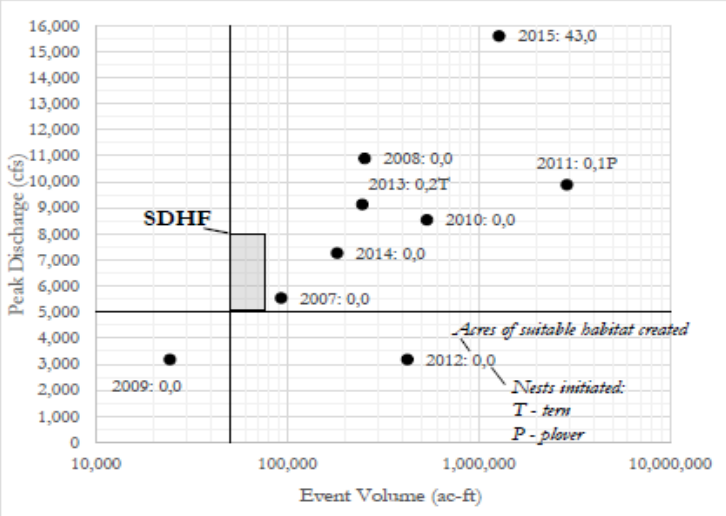


Figure 1. First Increment peak flow event magnitudes and volumes in relation to SDHF. Four events (2010, 2011, 2013, and 2014) exceeded SDHF magnitude and duration and did not produce suitably-high sandbar nesting habitat.

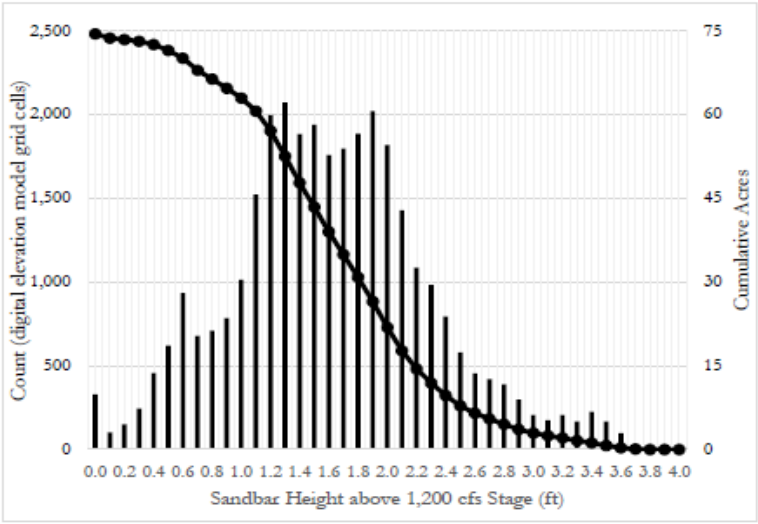


Figure 2. Distribution of emergent sandbar area produced during the 2015 peak flow event in the portion of the AHR downstream of Kearney. The 15,000 cfs event produced 43 acres of sandbar habitat exceeding the minimum height suitability criterion of 1.5 ft above 1,200 cfs stage. Median height of bars was 1.6 ft above 1,200 cfs stage.

IMPLEMENTATION - PROGRAM MANAGEMENT ACTIONS AND HABITAT

What the science says in 2016:

- The original analysis of SDHF performance assumed sandbars build to the water surface during peak flow events. The median height of sandbars formed during natural high flow events in 2010, 2011, 2014, and 2015 was 1.2 – 2.3 ft below peak stage.[1]
- Four peak flow events (2010, 2011, 2013, and 2014) that exceeded SDHF magnitude and duration did not produce sandbar habitat exceeding the minimum height criterion (Figure 1).
- A natural high flow event of 15,000 cfs in 2015 produced sandbars exceeding the minimum height criterion. The median height of sandbars formed in 2015 was 1.6 ft above 1,200 cfs stage (Figure 2).
- Approximately 43 acres of mid-channel bar area ≥1.5 ft above 1,200 cfs stage were present in the portion of the AHR downstream of Kearney in November of 2015 (Figure 2). This equates to 0.8 acres per river mile.

We estimate with confidence that:

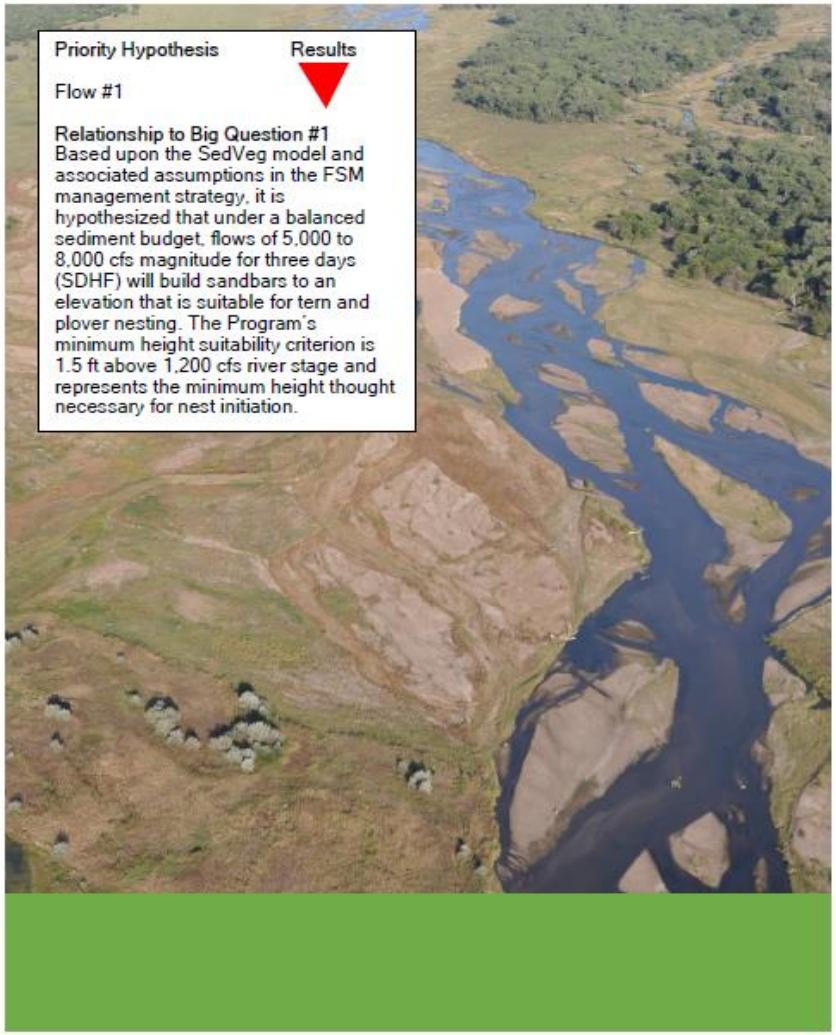
- SDHF magnitude of 5,000 to 8,000 cfs for a duration of three days at peak would not be sufficiently long to mobilize the bed and produce many new sandbars.
- Sandbars created by a full SDHF magnitude of 8,000 cfs would be 0.5 – 1.0 ft lower than the minimum height criterion and would be inundated at flows experienced in the AHR during most nesting seasons.
- Peak flow magnitudes of 15,000 cfs will produce sandbars exceeding the minimum height criterion given sufficiently long duration at peak.
- Even at a discharge magnitude of 15,000 cfs, total suitable sandbar area would be well below the AMP objective of 10 acres per river mile.

Answering BQ #1 during the First Increment

- Six tern/plover habitat synthesis chapters and associated publications serve as the best source for synthesized reference data for this question. Those chapters have been peer reviewed and accepted by the Governance Committee.[2]
- Geomorphic and species monitoring data collected in 2015 are consistent with and support the analyses and conclusions presented in the synthesis chapters.

Management Implications:

- Big Question #1 has been answered with a definitive "two thumbs down." The Governance Committee completed the final "Adjust" stage of adaptive management and decided to maintain 10 acres of on-channel moving complex approach (MCA) islands and to create an additional 60 acres of off-channel nesting habitat.



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"Getting to Adjust" on the Platte River

- Taking the final step – how do you bridge policy and science?
- Use Big Questions, State of the Platte Report, and data synthesis to tell the story
- Structured Decision Making (SDM)

AM and SDM

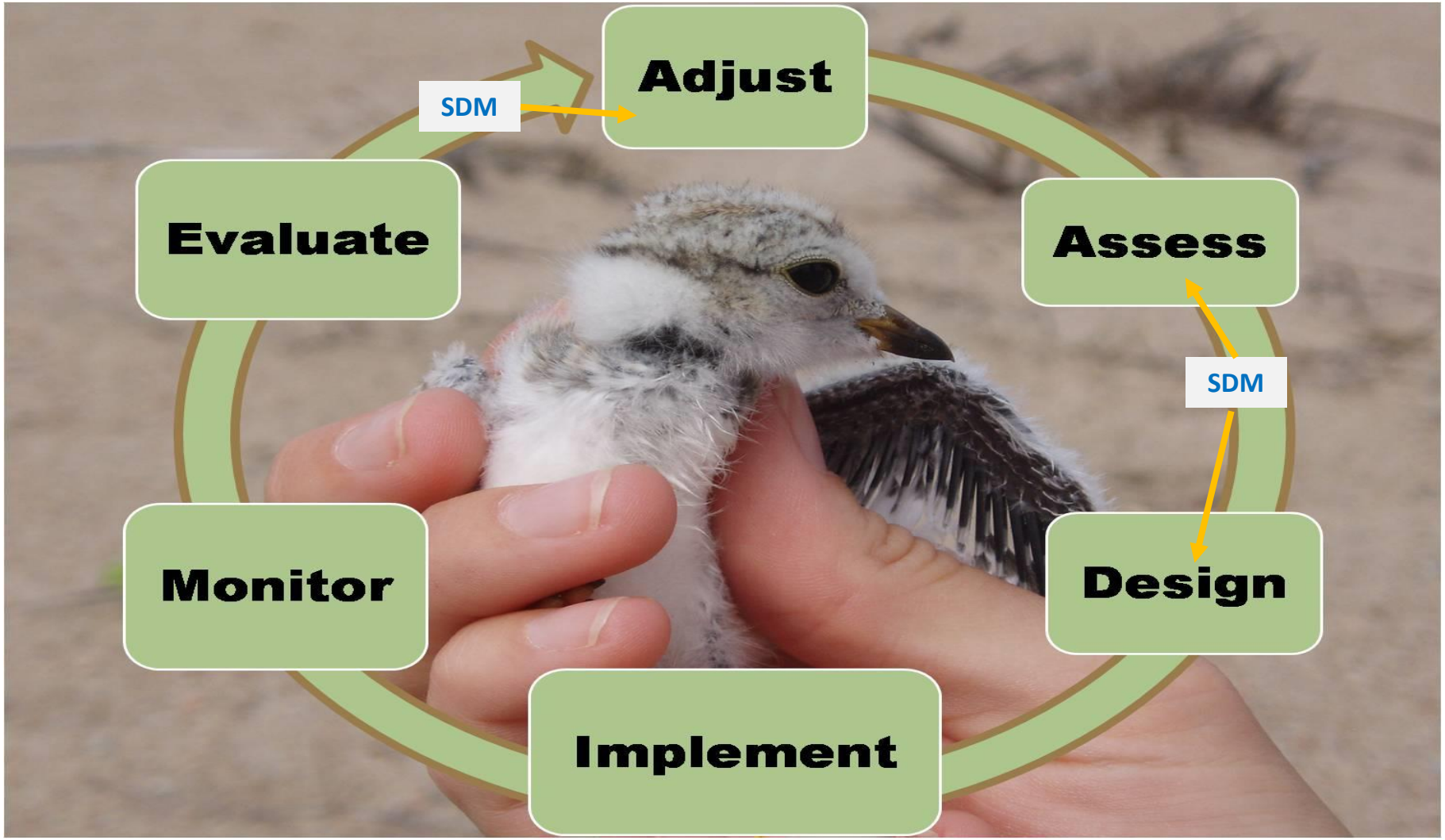


Figure 1: Structured Decision Making Steps

Figure 1: Round 4 Alternatives – Off-channel Habitat

Objective	Performance Measure	Units	Dir	STC: 42 / 102	A1: 0 / 102	C6: 0 / 162 (hybrid)	C1: 0 / 192
Piping Plovers							
Program Repro Success	Average Breeding Pair (BP)	#/year	H	22	18	28	31
	Total Fledglings over 50 yr	#	H	1,420	1,271	1,964	2,175
Interior Least Terns							
Program Repro Success	Average Breeding Pair (BP)	#/year	H	97	91	139	155
	Total Fledglings over 50 yr	#	H	5,187	4,992	7,669	8,546
Management Cost							
Total Long Term Cost	NPV (50 yrs)	1000$	L	$3,000	$532	$1,835	$2,229
Total Short Term Cost	2017-2019 Cost	1000$	L	$123	$34	$941	$1,477
Implementation Effort							
Implementation Costs/Risks	Implementation Scale	-4 to 0	H	0	0	-2	-1

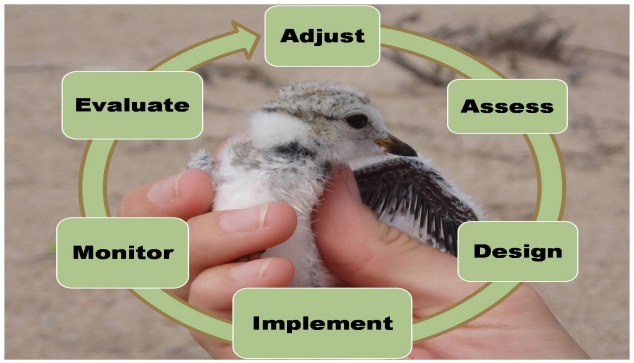
Legend

- Better than selected
- Worse than selected
- Selected

"Getting to Adjust" on the Platte River

- GC made a decision! Decided to change management approach – a mix of on-channel and off-channel tern/plover nesting habitat, and guidance on flow releases

- Completed one full loop of AM



- One of very few examples of successful AM in large-scale restoration program in U.S. – several have implemented management actions and/or science, but to what end?

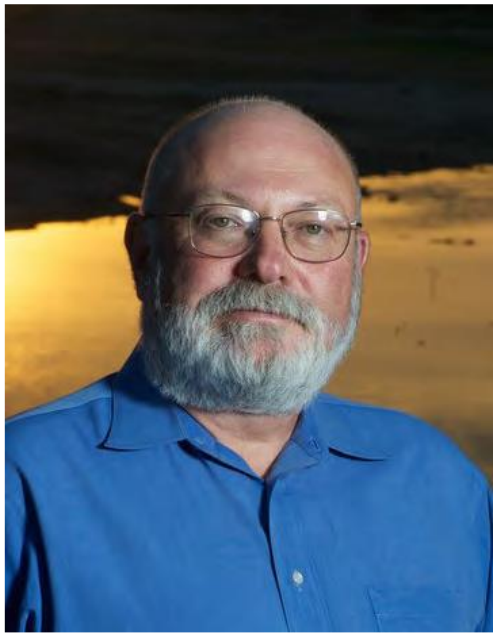
Lessons for Large-Scale Water Infrastructure Projects (Mid-Barataria)

- *Get collaborative decision-making structure (governance) determined now/first*
  - ✓ Are the right people/entities at the table?
  - ✓ Answer the “Why?” question.
  - ✓ Don’t think of this as a big science project.
  - ✓ Find the right bioregional fit.

- *Set clear and agreed-upon goals and objectives*
  - ✓ What questions do you want to answer, and who cares?
  - ✓ Ask decision-makers what information would be helpful.

- *Be rigorous in your approach*
  - ✓ Agree on what AM means.
  - ✓ Synthesize and tell the story, but avoid “science pile” – make data useful.
  - ✓ AM leadership.
  - ✓ Consider AM, but not always the right approach – is there uncertainty, or are you just implementing a project?

Thank you!



Dr. Jerry Kenny
1955-2018