

Developing and Testing a Biotic Functional Assessment to Guide Adaptive Management Along the Middle Rio Grande, NM



Steven Albert, Parametrix, Inc.

Special Thanks

A vibrant field of yellow sunflowers with dark brown centers is the central focus. The flowers are in various stages of bloom, some fully open and others as buds. They are set against a backdrop of lush green trees and foliage, suggesting a natural, outdoor setting. The lighting is bright, indicating a sunny day.

Ondrea Hummel and the U.S. ACOE

Kevin Halsey and Jim Koloszar, Parametrix

Todd Caplan and Chad McKenna, GeoSystems Analysis

Filling A Need

- Restoration work on the MRG needed a consistent, measurable way to determine success of restoration.
- Restoration is expensive and may take years to grow into suitable habitat – how do we know if we're on the right track?
- The usual metric, the presence or absence of species, may not always be the best measure of success or failure.
- If predicted outcomes are not achieved, can we control the direction of restoration?



Functional Assessment to Guide Adaptive Management

- 1) Develop FA Tool
- 2) Score Baseline Data
- 3) Project Uplift after
Planned Restoration
- 4) Conduct Restoration
- 5) Score Uplift and
Adaptively Manage
Sites

- Where do we work?
- What should we do?
- Did we succeed?
- What needs to
change?

A Few Definitions...

- **Function** – A specific environmental service (biotic/abiotic)
 - Broad: Water Quality, Songbird Diversity
 - Narrow: GW Infiltration, Willow Flycatcher Habitat Support
- **Attribute** – A measurable characteristic supporting a function
 - % Ground Cover, Forb Diversity, Surface Water Flow
- **Uplift** – Increase in ecological function (e.g. from restoration)

Southwestern Willow Flycatcher

- 1 of 4 subspecies
- Insectivorous, neo-tropical migrant
- Riparian obligate
- Listed in 1995

Reasons for decline:

Loss of habitat due to major changes to SW riparian ecosystems

Dam building, exotic species, drought, nest parasitism

**Cooperators: ACOE, Reclamation
NM Game & Fish**

Empidonax traillii extimus



Rio Grande Silvery Minnow

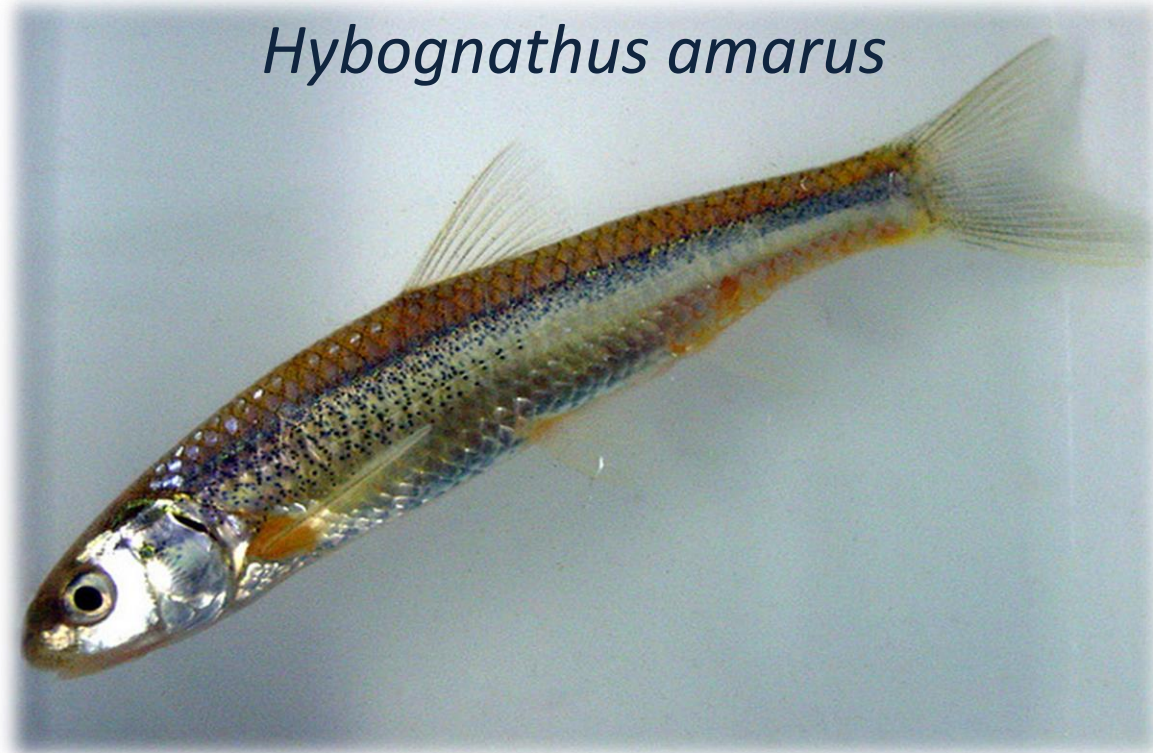
- Algae-feeder
- Shallow, low velocity
- 7% of former range
- Listed in 1994

Reasons for decline:

Loss of habitat due to major changes to SW river ecosystems

Dam building, water diversions, channel incision, sedimentation, loss of habitat complexity, esp. overbanking

Cooperators: ACOE and Reclamation



RGSM – Function Attributes



Floodplain Spawning & Rearing

- Duration of Spring Inundation
- % Ground Cover
- Velocity
- % Inundation



SWFL – Attribute Scoring

Cover and Nesting (40%)

Width and Area of MU
Visual Occlusion
Ac of Dense Habitat
Stem/Twig structure

Connectivity (20%)

Distance to Breeding,
Migration Sites
Disturbance
% Native Veg.
Dist. to Water

Foraging (40%)

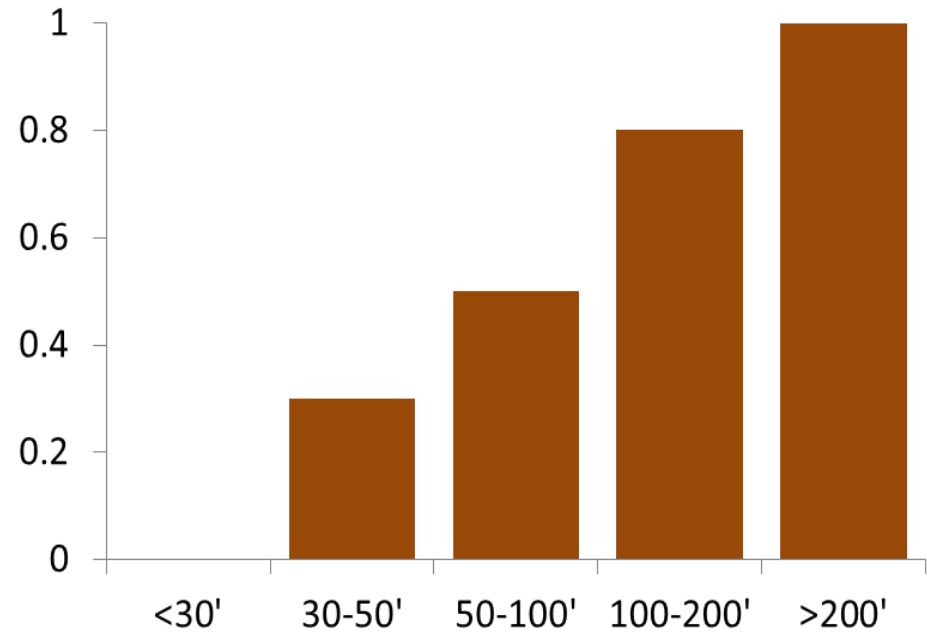
Area, Timing,
Duration, and
Depth of
Inundation

Habitat Diversity
Tree Cover



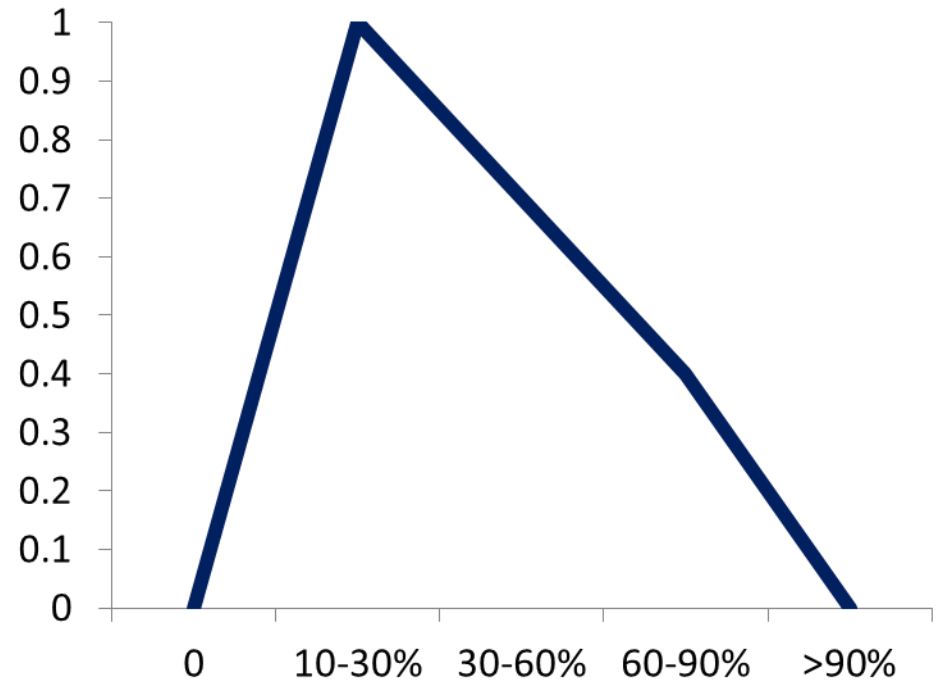
Attribute Scoring - GIS

MU Width	Score
<30'	0
30-50'	0.3
50-100'	0.5
100-200'	0.8
>200'	1



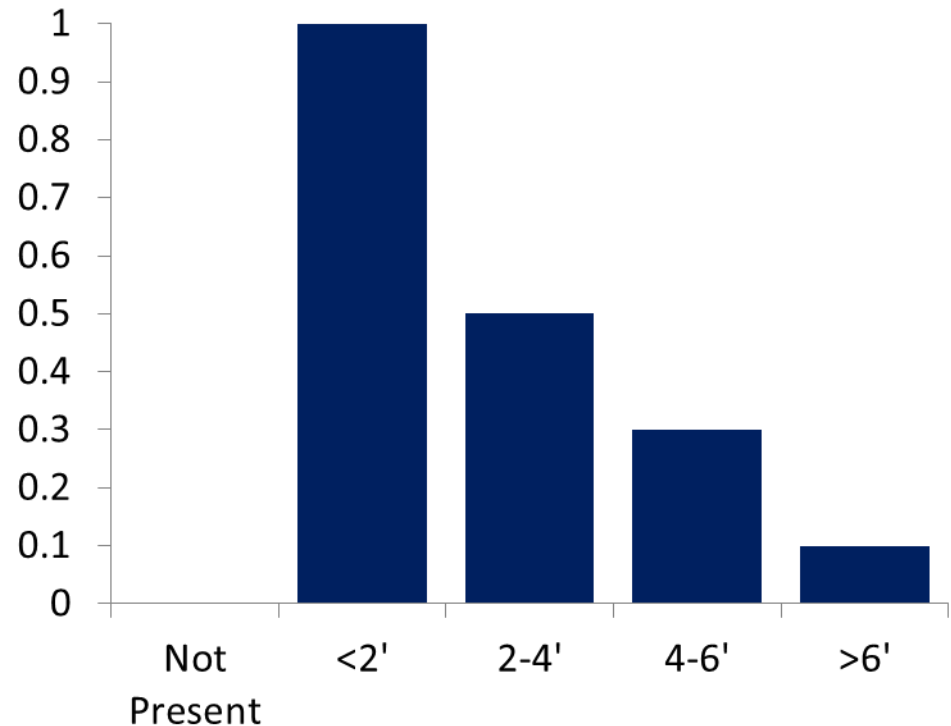
Attribute Scoring - Field Data

Canopy Cover	Score
<10%	0
10-30%	1.0
30-60%	0.7
60-90%	0.4
>90%	0



Attribute Scoring - Hydrographic Data (HEC-RAS)

Seasonal Inundation Depth	Score
Not Present	0
<2'	1.0
2-4'	0.5
4-6'	0.3
>6'	0.1

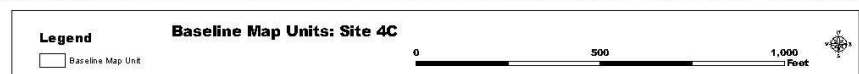
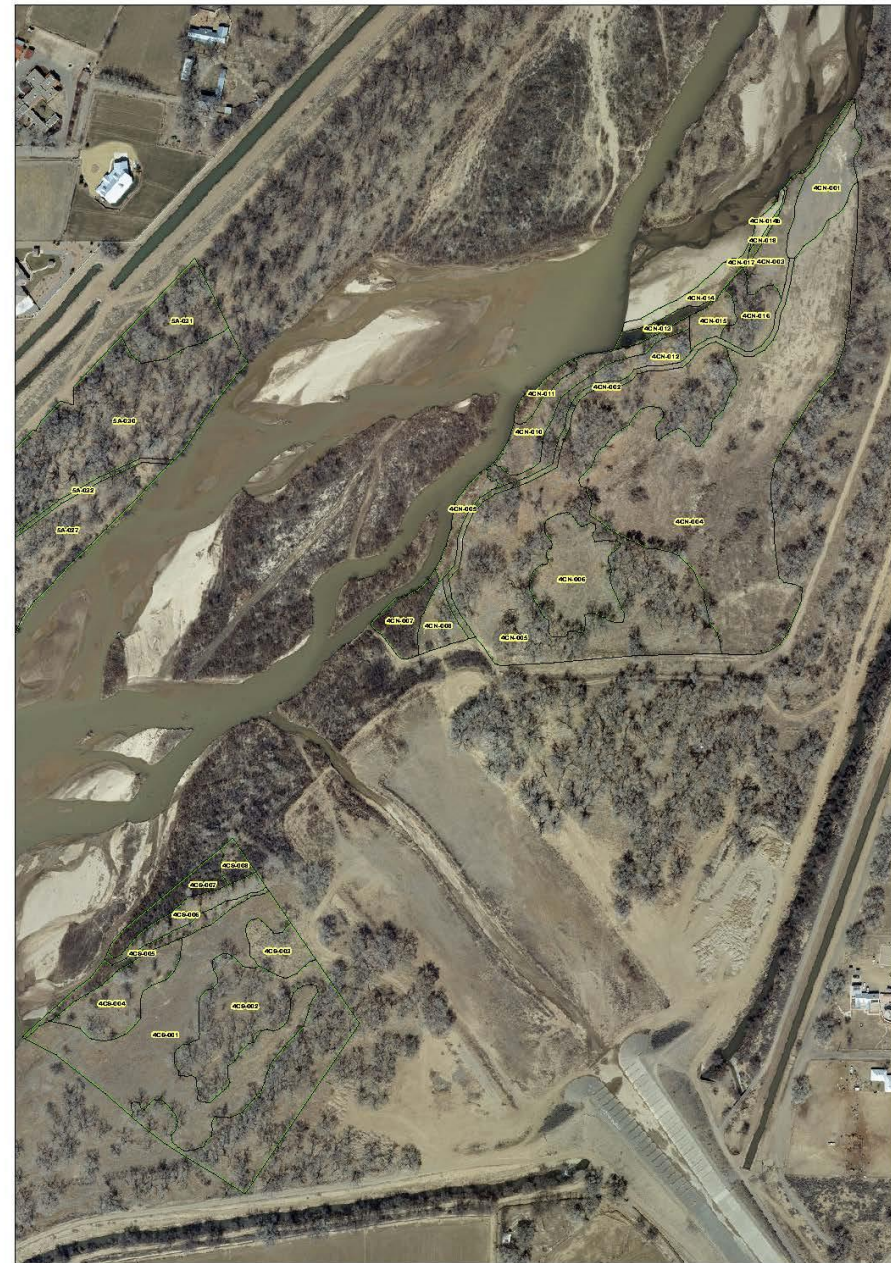


Map Unit Level Assessment

Functional Performance Score for each MU (the unit of management)

Site Functional Acres - weighted by MU.

Functional Acres are the Currency of Evaluation.

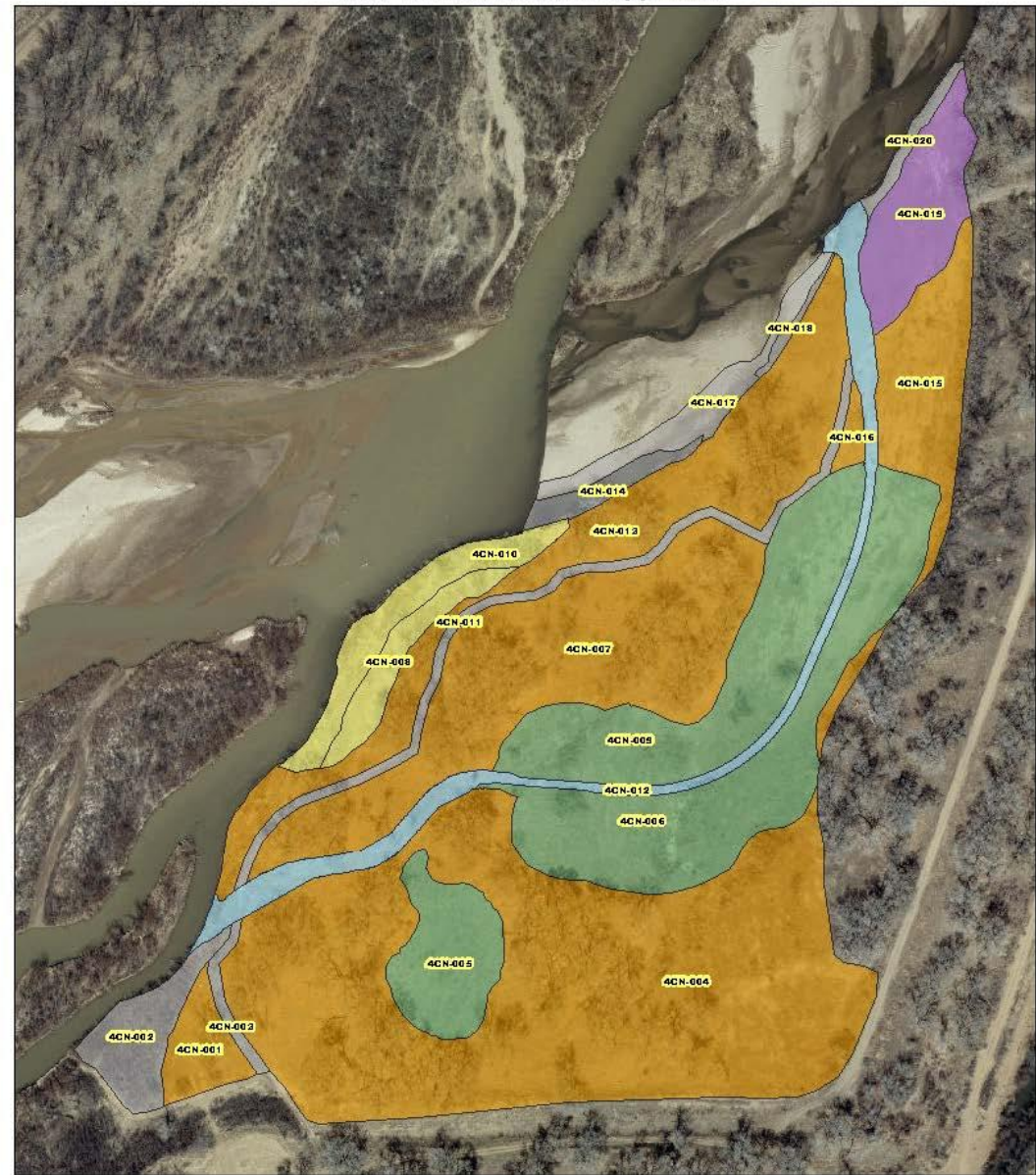


Post-Restoration Projections

Work Planned

- Non-native fuels reduction
- Re-vegetation
- Bankline terracing (lowering)
- High-flow channel
- Willow swale

- 1) Measure
- 2) Re-draw MUs based upon planned restoration
- 3) Complete hypothetical datasheets
- 4) Project functional uplift



Legend

Map Unit Boundary

Restoration Approach

Constructed Bankline Terrace

Constructed High Flow Channel

Constructed Willow Swale

Fuels Reduction and Vegetation

No Activity

Revegetation Only

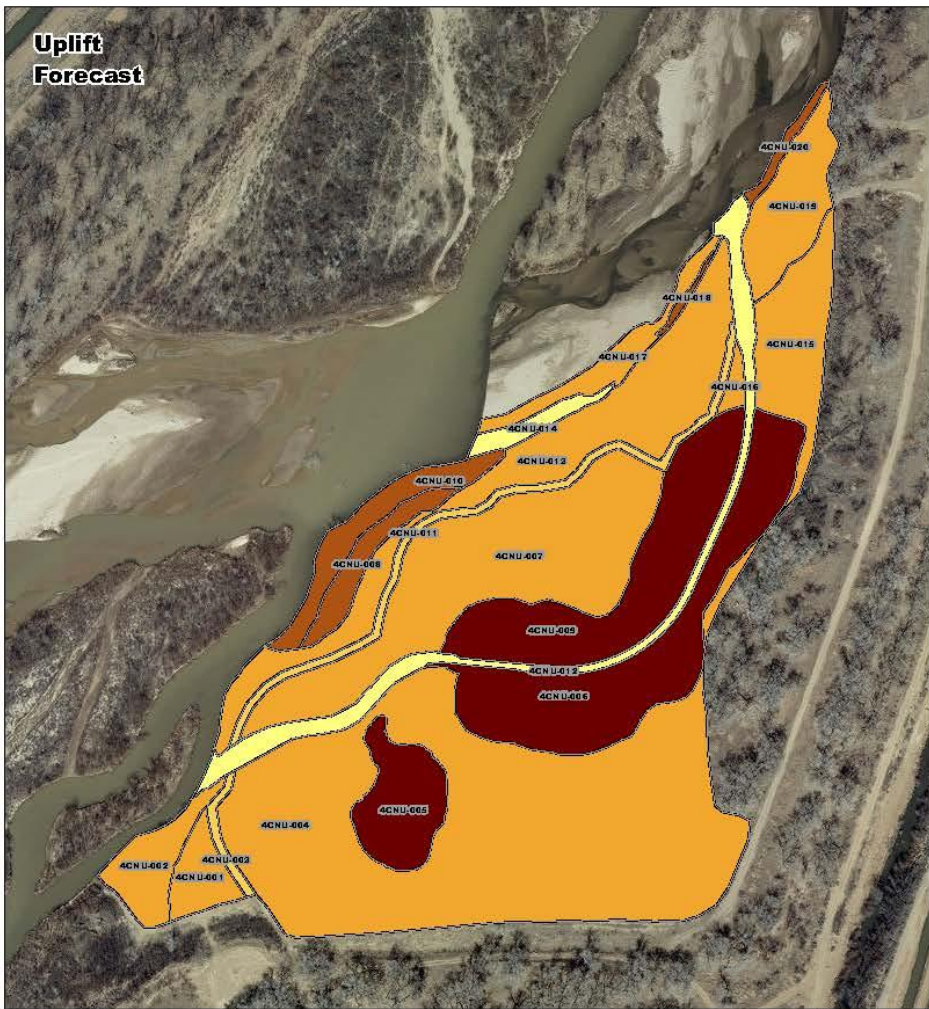
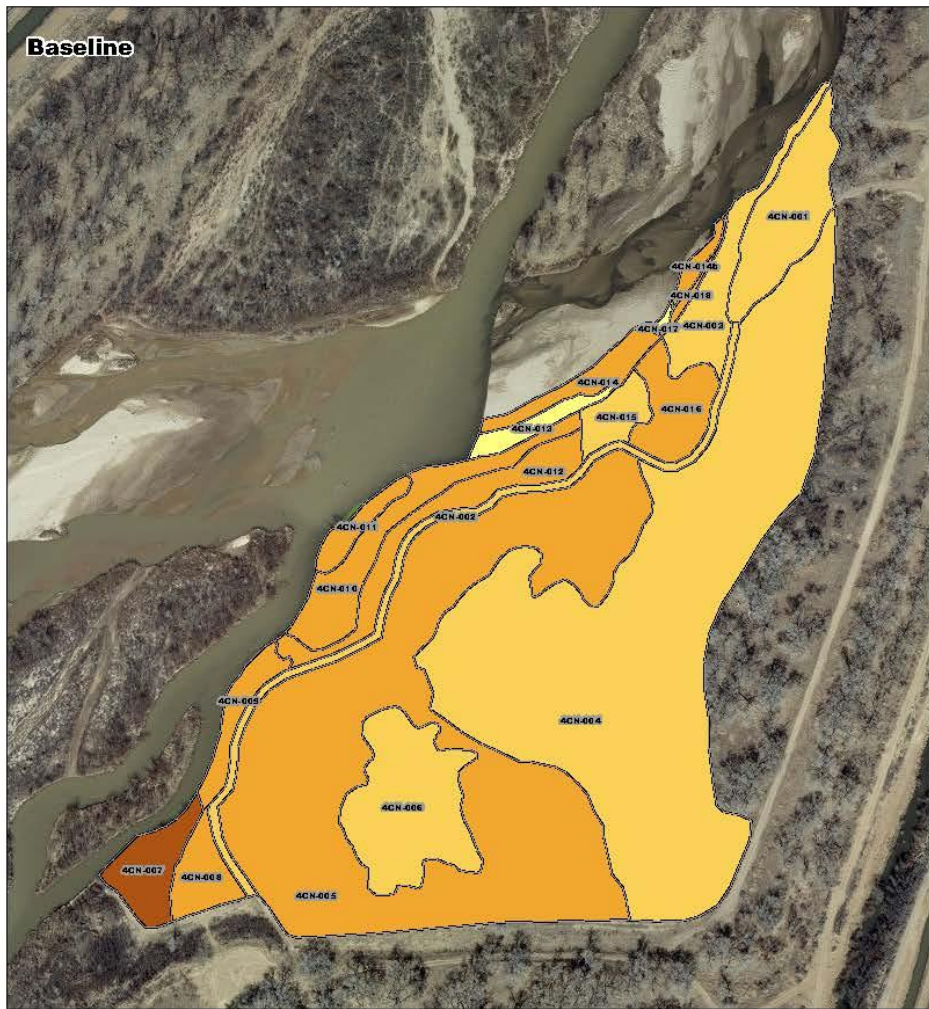
Map created by Chad McKenna,
GeoSystems Analysis, Inc. 01/22/2013
Restoration approach based on GPS
perimeters of Corps restoration features.



0 250 500 Feet

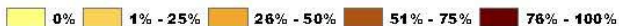


Baseline vs. Restoration - SWFL 3500 cfs at 10 years post-restoration



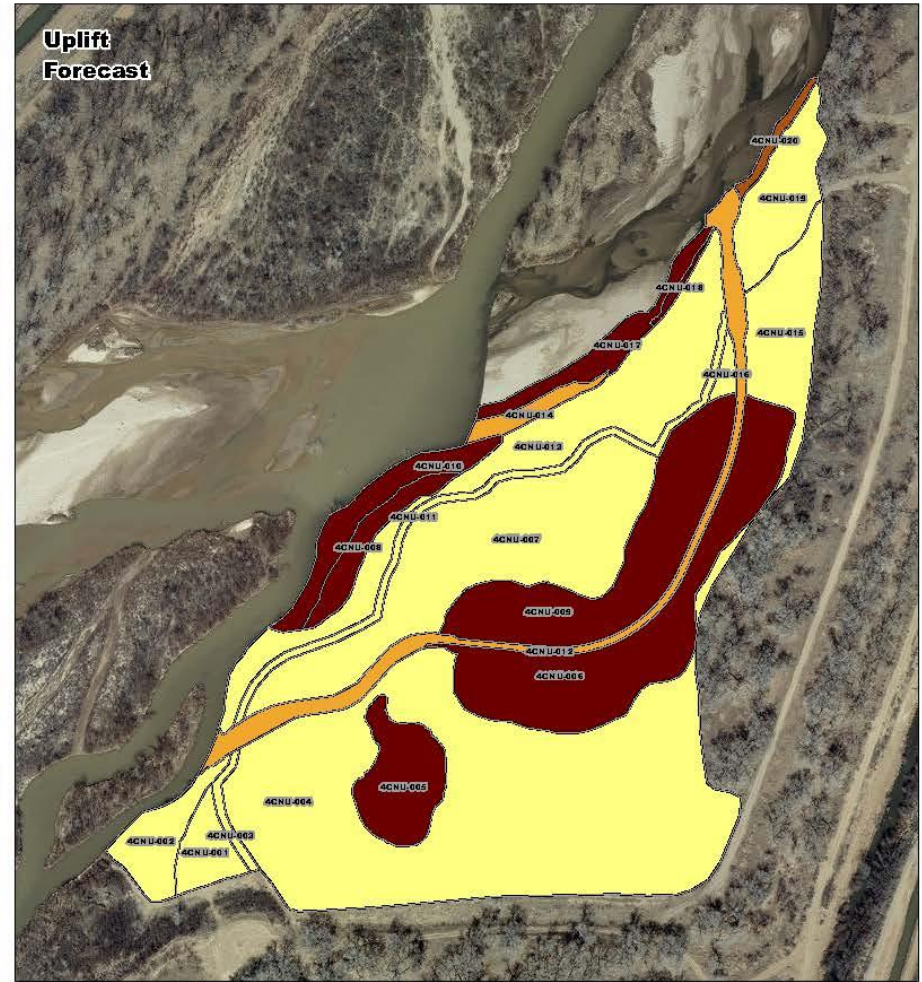
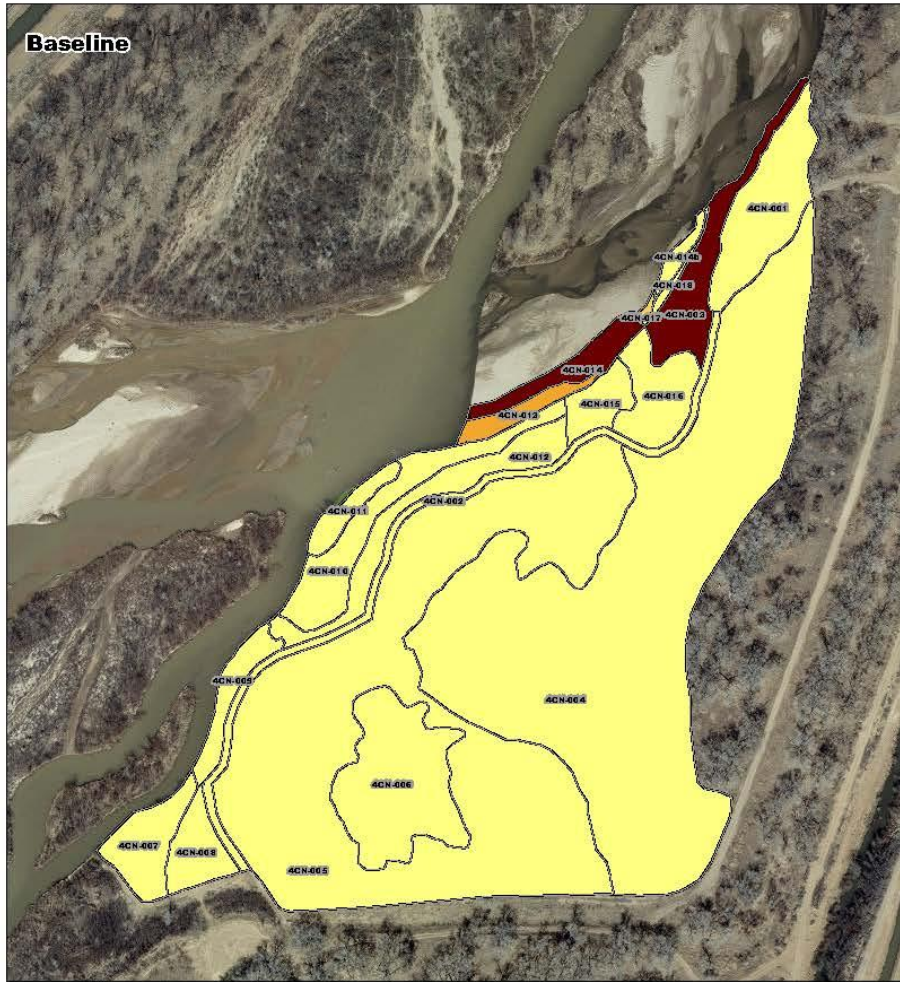
Site 4C Flycatcher Habitat Performance (3,500 cfs): Baseline and Uplift Forecast Score

Legend



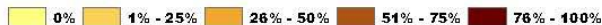
Map created by: Chad McKeena, Geosystems Analysis, Inc.
 Analyst: M.A., Inc. Future Baseline performance developed from EcoMetric, Inc. model. Background imagery: 2010 MRG Restoration Project Mosaic, provided by: U.S. Army Corps of Engineers.

Baseline vs. Restoration - RGSM 3500 cfs at 10 years post-restoration



Site 4C Silvery Minnow Habitat Performance (3,500 cfs): Baseline and Uplift Forecast Score

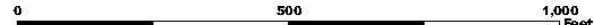
Legend



Map created by: Chad McKeown, GeoSystems Analysis, Inc. Runoff data provided from EcoMetric's model. Background Imagery: 2010 MRG Restoration Project Morale, provided by U.S. Army Corps of Engineers.



1:2,500



Parametrix
PROFESSIONAL CORPORATION



SWFL – Baseline & Uplift Scores at 10-years @ 3500 cfs (1.5 year return flow)

3500 Baseline						3500 Uplift					
MU	Acres	Cover-Nesting	Foraging	Connect.	Score	MU	Acres	Cover-Nesting	Foraging	Connect.	Score
1	0.8	0.00	0.17	0.36	0.14	1	0.3	0.38	0.05	0.68	0.31
2	0.6	0.00	0.17	0.36	0.14	2	0.5	0.75	0.05	0.72	0.46
3	0.6	0.00	0.17	0.36	0.14	3	0.1	0.00	0.05	0.36	0.09
4	7.7	0.00	0.17	0.52	0.17	4	6.5	0.58	0.05	0.68	0.39
5	6.4	0.53	0.17	0.64	0.40	5	0.7	0.83	0.75	0.68	0.77
6	1.3	0.00	0.17	0.56	0.18	6	2.0	0.83	0.75	0.68	0.77
7	0.4	0.75	0.17	0.72	0.51	7	2.7	0.65	0.05	0.68	0.42
8	0.3	0.33	0.17	0.64	0.32	8	0.3	0.60	0.75	0.56	0.65
9	0.3	0.33	0.17	0.64	0.32	9	1.7	0.83	0.75	0.68	0.77
10	0.7	0.40	0.17	0.60	0.35	10	0.5	0.68	0.78	0.56	0.70
11	0.2	0.53	0.17	0.64	0.40	11	0.4	0.00	0.05	0.36	0.09
12	0.6	0.40	0.17	0.62	0.35	12	0.9				
13	0.2					13	2.0	0.60	0.05	0.68	0.40
14	0.3	0.00	0.87	0.72	0.49	14	0.2				
15	0.3	0.00	0.17	0.52	0.17	15	1.0	0.60	0.05	0.68	0.40
16	0.5	0.28	0.17	0.54	0.28	16	0.1	0.53	0.05	0.68	0.37
17	0.0					17	0.4	0.00	0.75	0.72	0.44
18	0.1	0.33	0.17	0.64	0.32	18	0.0	0.53	0.78	0.68	0.66
14b	0.1	0.00	0.80	0.72	0.46	14b	0.7	0.60	0.05	0.68	0.40
		0.23	0.25	0.58	0.30			0.53	0.34	0.63	0.47

Post-Restoration Projections

Site 4c	Baseline 3500 cfs		Uplift 3500 cfs	
21 Ac.	Functional Performance	Functional Acres	Functional Performance	Functional Acres
SWFL	.30	5.8	.48	9.8
RGSM	.14	.9	.42	6.1

- Considerable uplift for RGSM
 - Swale connection via high-flow channel
- SWFL scores increase due to willow swale and ephemeral channel treatment
 - No difference between 3,500 cfs & 5,000 cfs (wetted area stays the same).

Summary

- FAs are a valuable tool in planning & implementing restoration
- Results are measurable, site-specific, and scalable
- They can be used predictively or for Adaptive Management – are we on the right trajectory?
- “Open source” model easily adjusted with improved understanding



Other Applications

- Habitat mitigation banking