Buffers Before Boulders:

Rethinking the "Partially-Engineered-Approach" on mountain meadow streams

EcoMetrics

Stream and Riparian Monitoring, Assessment and Restoration

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Buffers Before Boulders:

Rethinking the "Partially-Engineered-Approach" on mountain meadow streams

P-E-A - hard **artificial structures** in otherwise **natural dynamic** systems.

Stream monitoring in South Park: a study

Mark Beardsley and Jessica Doran
EcoMetrics, LLC

Primary habitat parameters

- width/depth ratio
- bank erosion
- woody vegetation
- overhead cover
- pool area

Defined range of variability: watershed/regional survey

Evaluating before-after conditions on projects

- 40,000 ft
- 246 sites
- 7 projects - different designers and construction crews

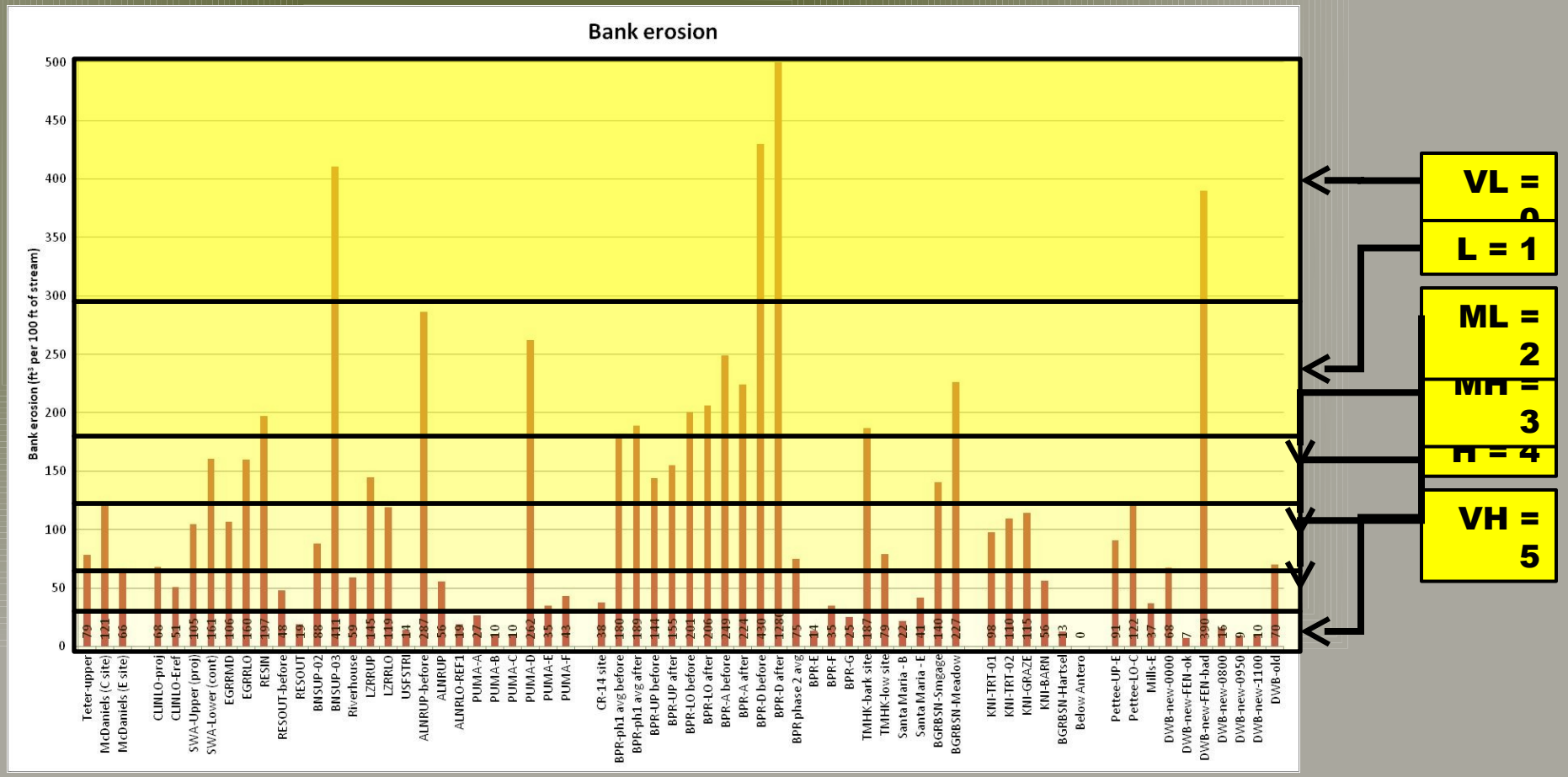
Stream monitoring: Range of variability

Reference (least impacted)

Impaired (most impacted)

3rd order meadow streams with Qbkf between 300 and 500 cfs.

Stream monitoring: Range of variability



· Parameter scoring based on quantitative measures

PARAMETER SCORE	0	1	2	3	4	5
ADJECTIVE	VL	L	ML	MH	H	VH
WIDTH/ DEPTH (W:D/ W:D_{ref})	>1.8	1.7-1.8	1.5-1.6	1.3-1.4	1.1-1.2	1.0
BANK EROSION by volume (ft^3/ 100 ft)	>300	180-300	120-180	60-120	30-60	< 30
STREAM SIDE VEG (% woodies GL)	< 5	5-15	15-25	25-40	40-60	> 60
OVERHEAD COVER (ft)	< 10	10-30	30-45	45-60	60-80	> 80
POOL AREA >2.0 ft RPD (ft^2/ 100 ft)	< 20	20-50	50-100	100-250	250-400	> 400

· Improvement rating (before → after)

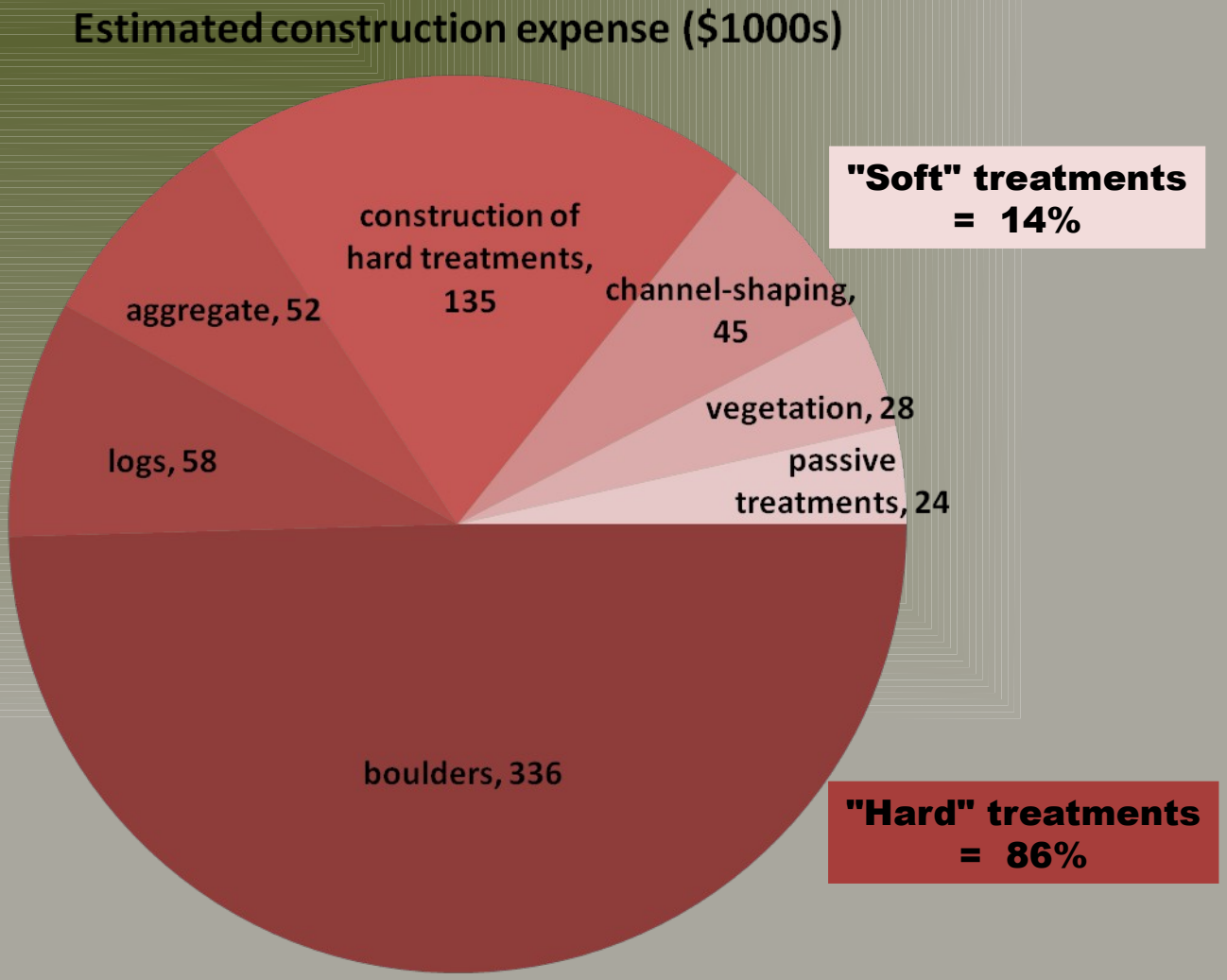
parameter score	suggested interpretation
+3	excellent improvement
+2	significant improvement
+1	slight improvement
0	no change
-1	slight decline
-2	significant decline
-3	severe decline

"Boulders" approach: P-E-A
Bank armor & deflectors

"Boulders" approach: P-E-A
İn-stream structures

"Boulders" approach:
P-E-A
Distribution of costs

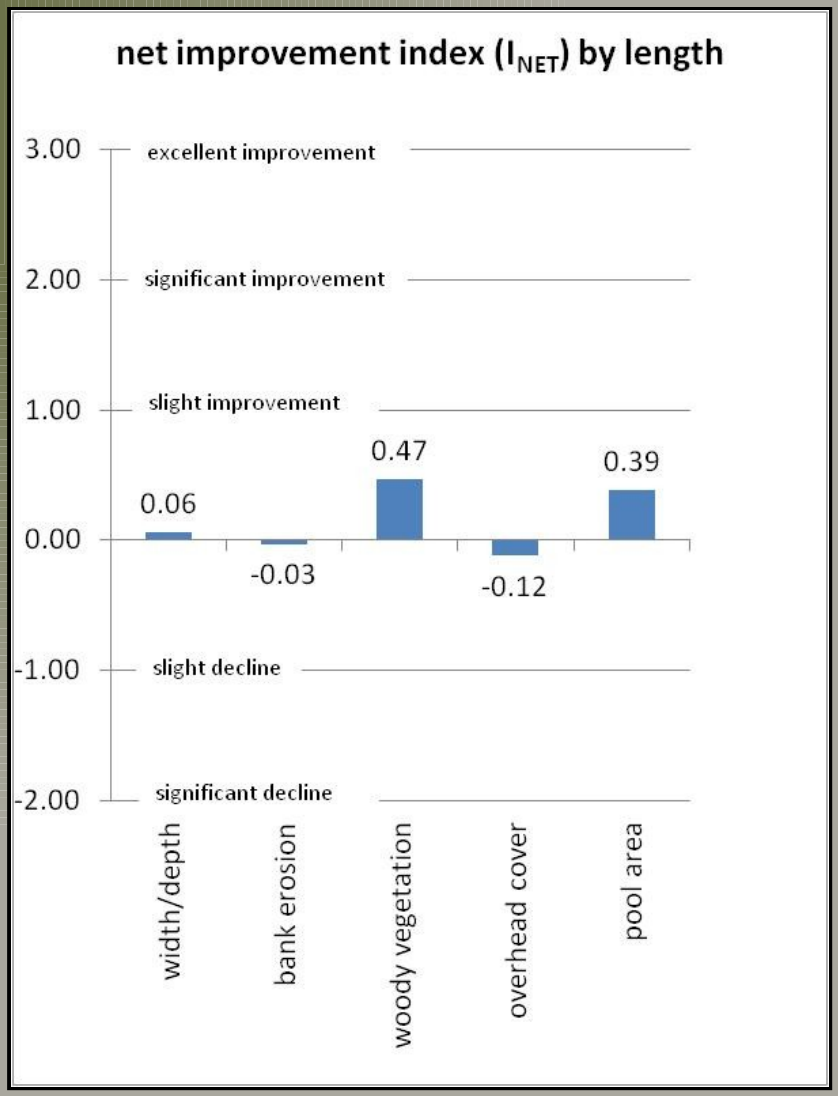
$678,000 over 40,000 ft
$17 per foot



Results by site (n=246)

effects of structural enhancement on habitat (246 treated sites)			
habitat parameter	improvement	no change	decline
width depth ratio	13%	77%	10%
bank erosion	24%	48%	28%
woody vegetation	26%	74%	0%
overhead cover	15%	63%	22%
pool area	22%	73%	5%

Results by length (~40,000 ft)



"Boulders" approach:

Overall, the Partially-Engineered Approach has not effectively improved habitat

Buffers Before Boulders

Back to basics…

"Structural treatments should be a last resort."

"Always consider passive restoration and recovery potential first."

"First fix the cause."

- Dave Rosgen

Buffers Before Boulders

Back to basics…

"Buffers" (restoration):

- Alleviate ecological stress
- Restore natural processes

"Boulders" (P-E-A):

- Augment existing habitat
- Constructed features, structures

Back to basics…

What is wrong with this system?

Ecological stressors

1) **Riparian vegetation shift**
2) **Channel adjustment**
3) **No beavers**
4) Livestock
5) Hydrology (depletion)
6) Sediment regime

Back to basics…

Ecological restoration

"Buffers" (restoration)**:**

- Alleviate ecological stress

Ecological stressors

1) **Riparian vegetation shift**
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Back to basics…

Ecological restoration

Habitat Improvement

- **Width/depth ratio ↘**
- **Bank erosion ↘**
- **Woody vegetation ↗**
- **Pool area ↗**
- **Cover ↗**

"Buffers" (restoration)**:**

- Alleviate ecological stress
- Restore natural processes

Back to basics…

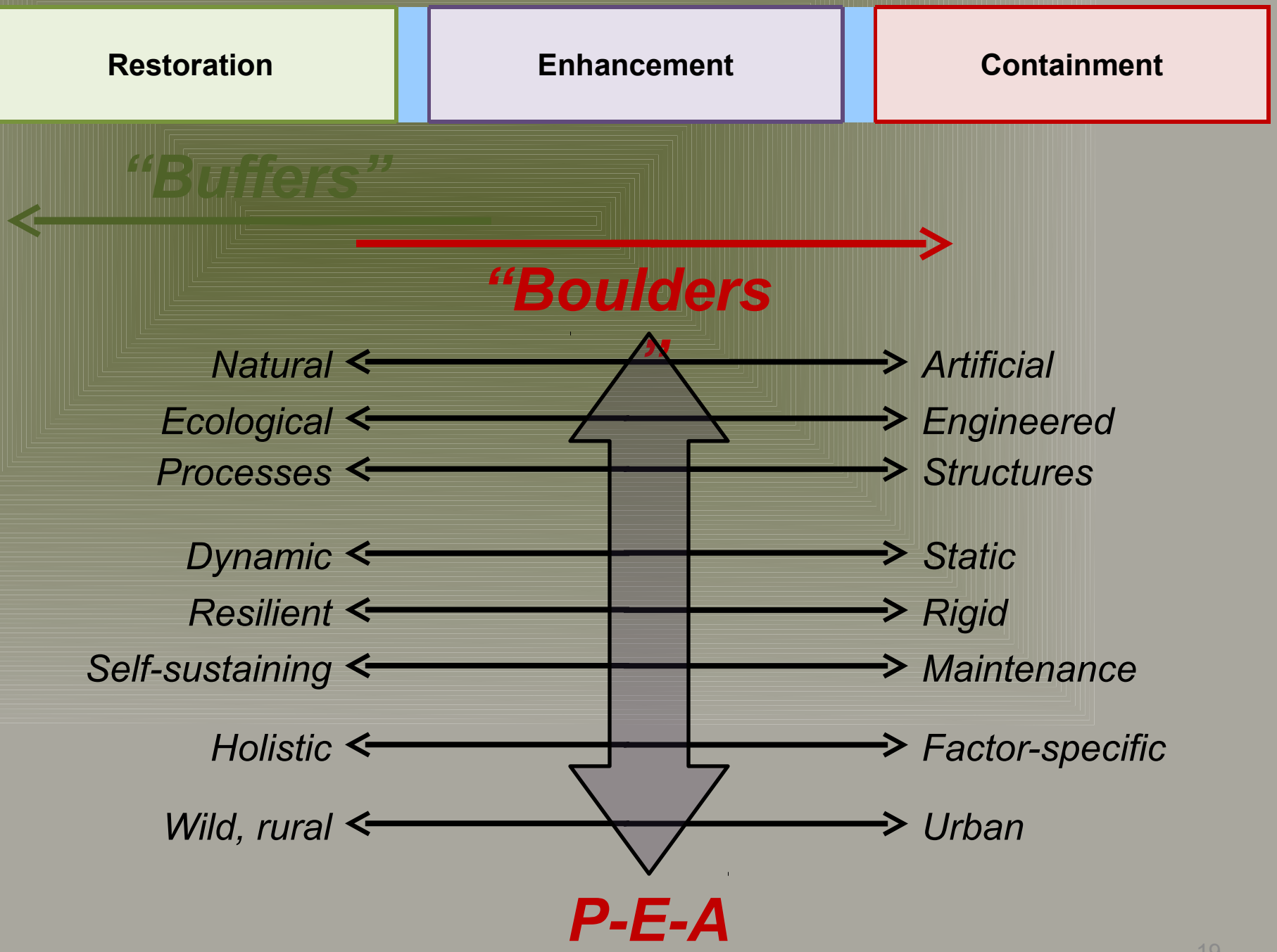
Artificial enhancement

"Boulders" (P-E-A)**:**

- Augment existing habitat
- Constructed features

Buffers

Boulders


Restoration
Enhancement
Containment
"Buffers"
"Boulders"
Natural
Ecological
Processes
Dynamic
Resilient
Self-sustaining
Holistic
Wild, rural
Artificial
Engineered
Structures
Static
Rigid
Maintenance
Factor-specific
Urban
P-E-A

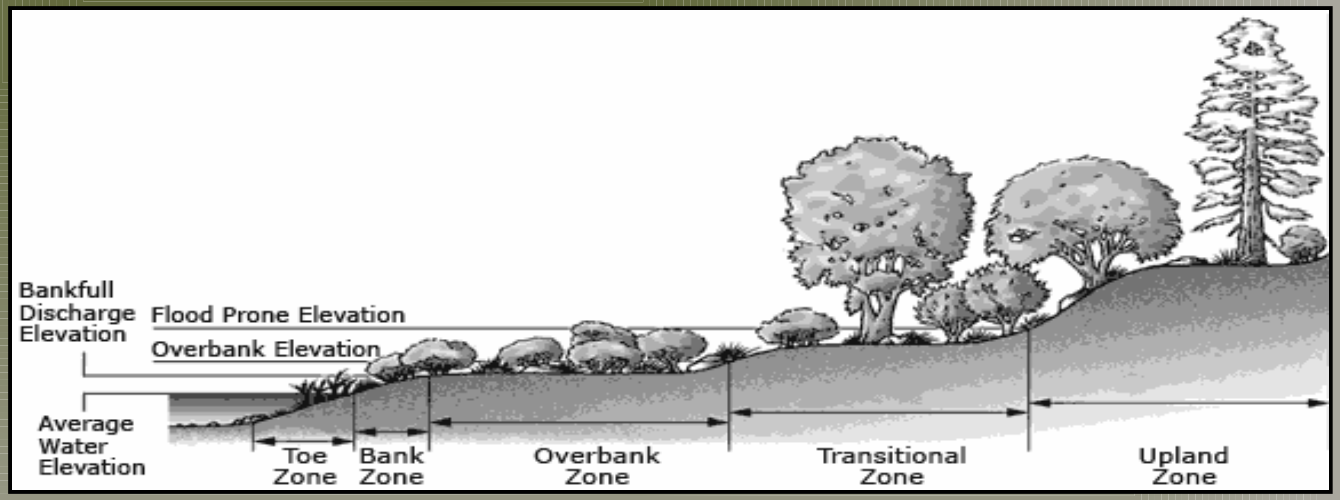

2007/10/09

2006/09/28

Back to basics: the "riverine eco-system"

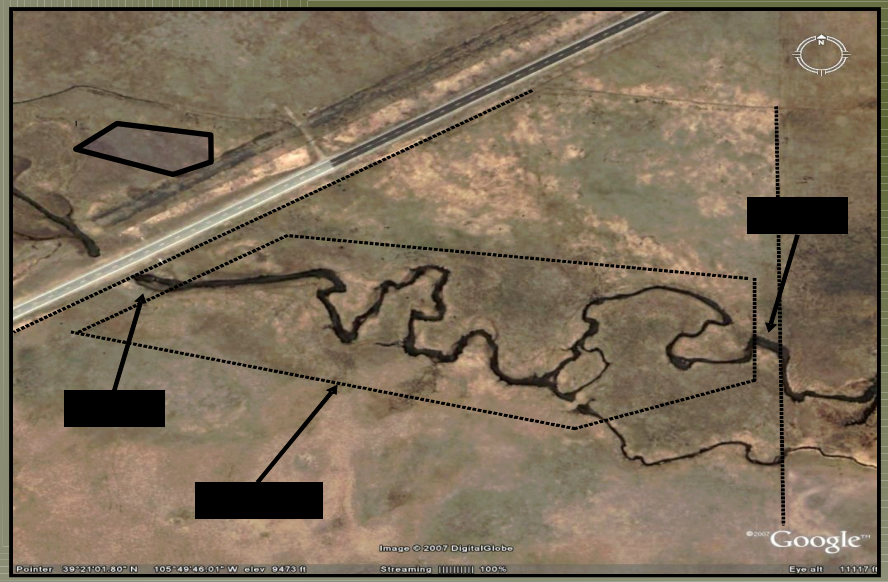
- Stream channel
- Riparian zone

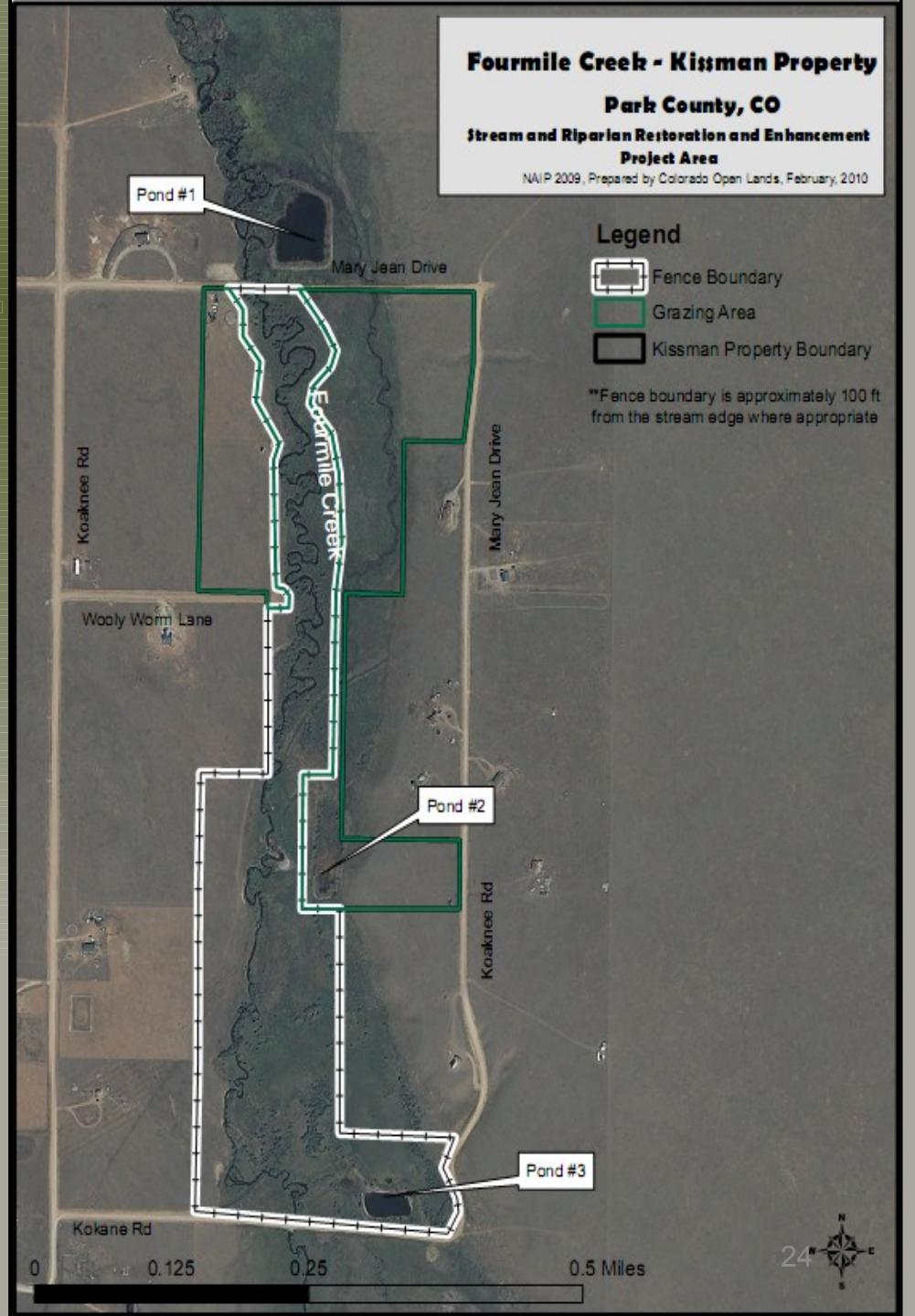
} **integrated system**



“Buffers” in South Park:

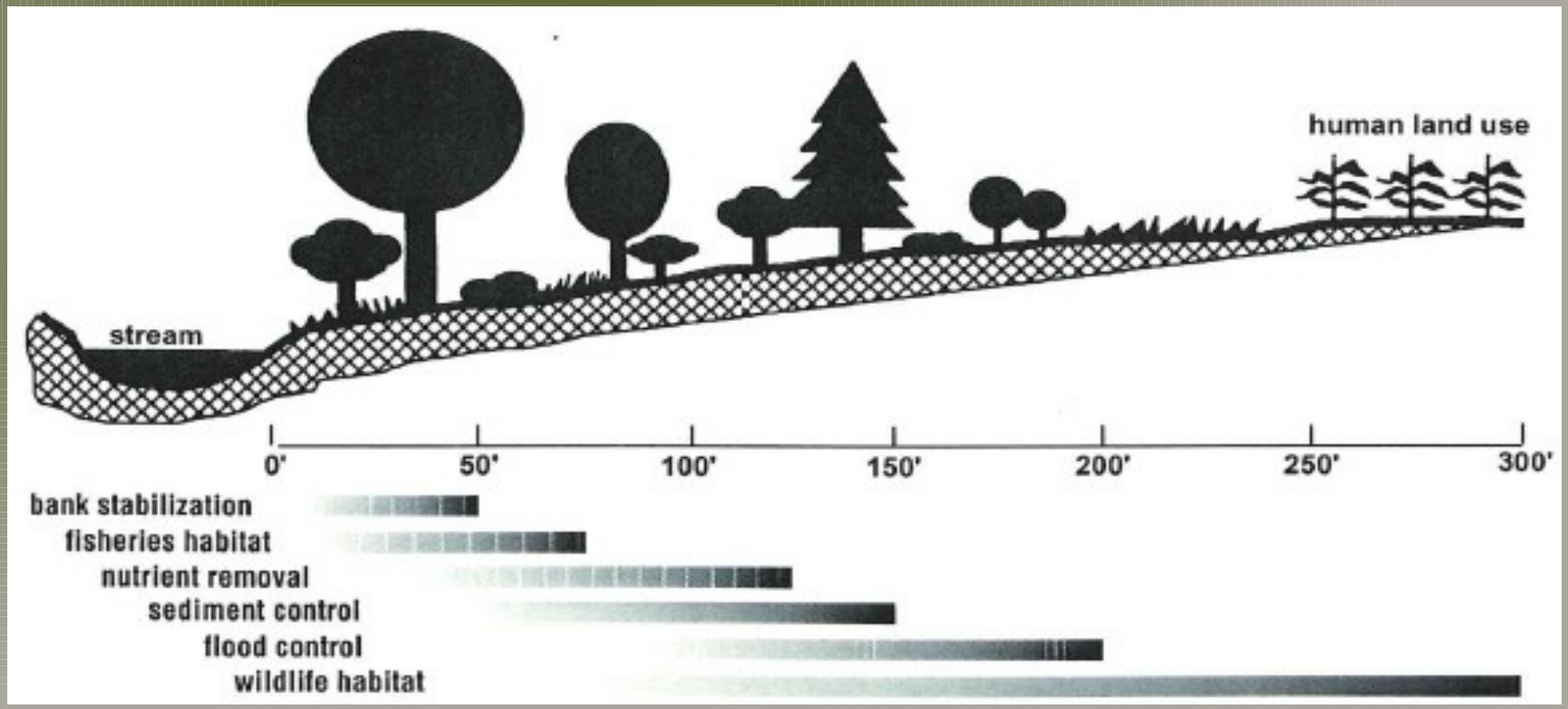
"Buffers" approach: Restoration Establishing buffers



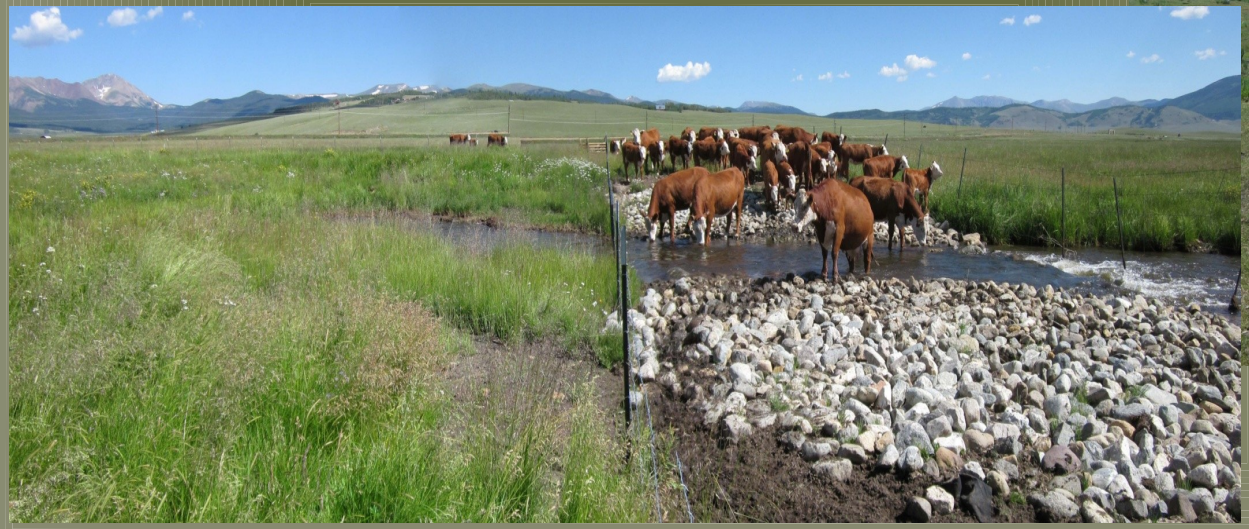


"Buffers" approach: Restoration

"Buffers" approach:
Restoration
Establishing buffers



"Buffers" approach:
Restoration
Establishing buffers



"Buffers" approach:
Restoration
Vegetation

"Buffers" Restoration Vegetation

"Buffers" approach:
Restoration
Vegetation

"Buffers" approach: Restoration Channel morphology

"Buffers" approach:
Restoration
Channel morphology

Buffers Before Boulders: