Show Me the Service: Scientific Trade-Offs In Documenting the Services in A Payment for Environmental Services Program

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Lake Okeechobee

P load reduction targets

- Average 1974-2012
- TMDL Target--2015
The Goal of FRESP

- Create a Payment for Environmental Services program for **documented** increases in:
  - Water retention
  - P retention

- That is:
  - Profitable to ranchers, cost-effective for tax-payers
  - Feasible to administer
  - Compliments existing programs
  - Based on credible methods for documenting services
Simple concept

- Without WMA
- With WMA—Water Management Alternative

P load per year vs. Year (over contract life)
Dealing with Uncertainty

- PES programs require assurance on environmental service provided, but...
  - ecological systems are complex, nonlinear, and strongly stochastic
  - predictions of dynamics is difficult
  - available information is often equivocal

- Distill complexity into simple, clear advice

Sources of Uncertainty

1. Process stochasticity
   - Natural variation and random behavior

2. Observation error
   - Sampling strategy, errors in data collection

3. Model error
   - Estimation and forecasting errors

4. Implementation error
   - System not managed as required
Scientific certainty

Program needs
Nutrient Loads Driven by Runoff Volume
Clear effects

Equivocal effects

Average annual nutrient load (kg ha\(^{-1}\))

Year

structures installed

* * 

* * 

* * 

with water control structures

without water control structures
Reducing Uncertainty

- Review available data
  - often limited or inadequate
- Monitor and collect more data
  - costly to do well
  - develop easily measured proxies
- Improve models
- Clearly specify implementation
Monitoring Data
POTENTIAL WATER RETENTION MODEL
Williamson Cattle Company - Basin 1
Annual Retention

Uncontrolled Discharge (Pre-WMA) and Controlled Discharge (Post-WMA)

Average Annual Retention
(Post - Pre) = 266 ac-ft
Average Annual Discharge (ac-ft)
Pre = 621
Post = 355

Acre-feet

<table>
<thead>
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<th>Year</th>
<th>Rainfall</th>
<th>Retention - Uncontrolled</th>
<th>Retention - Controlled</th>
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“Simple” Case: Williamson Cattle Company
250-Acre Wetland With 900 Acre Drainage Area
Hard Case--Buck Island Ranch
3,700 Acre Cascading Pasture Water Retention System
Non-linear, Counterintuitive Results

Increased Board Height

No conclusive evidence for increased water or P retention

2009

Inundated area

2010

Inundated area
Conclusions

- Many environmental services involve complex natural systems with unpredictable behavior.
- PES Programs need tools that can be understood by buyers and sellers of services.
- Science is only half the battle.
- Scientists need to be willing to step outside their comfort zones.
- Monitoring can improve modeling and performance, but resources are often lacking.
“Simple” Case--Lykes Bros. Inc
2,500 Acre Treatment Marsh In Existing Reservoir
Stochasticity