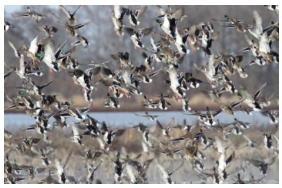
ECOSYSTEM SERVICES PROVIDED BY MOIST-SOIL WETLAND MANAGEMENT



Amy Alford
10 November 2014

What is ecosystem management?

"Management driven by explicit ***goals***, executed by ***practices*** and made adaptable by monitoring and research based on our best ***understanding of the ecological interactions and processes necessary to sustain ecosystem composition, structure, and function***." – adapted from ESA

Practice →

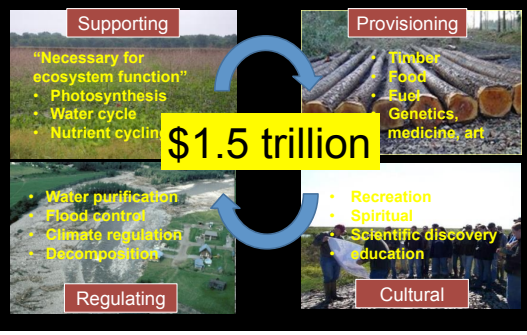
Goals →

Ecosystem structure and function →

Outcome →

ECOSYSTEM SERVICE

"Ecosystem goods and services are benefits human populations derive directly or indirectly from ecosystems" – Costanza et al. 1997



CAVEAT

"We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect".
– Aldo Leopold

HOWEVER
"…the most important contribution of the widespread recognition of ecosystem services is that it ***REFRAMES*** the relationship between humans and the rest of nature"
"…….is essential to solving the problem of how to build a sustainable and desirable future for humanity."
"All decisions that involve tradeoffs involve valuation either implicitly or explicitly"……
-Costanza et al. 2014. *Global Environmental Change*

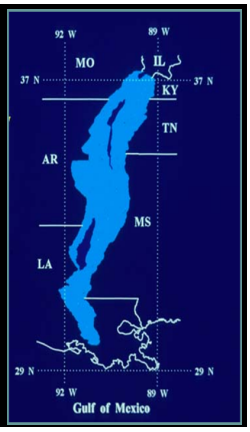
IT IS ALL ABOUT IDENTIFYING ANY BENEFIT FROM ECOSYSTEMS THAT HUMANS RELY ON AND DEMONSTRATING THIS TO THE GENERAL PUBLIC – *WHY?*

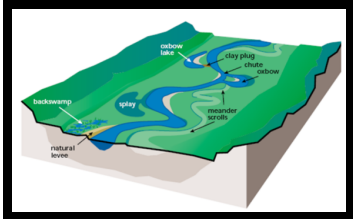
Assessing Ecosystem Services

Identify	What services have been lost? What services can be restored through ecosystem management?
Quantify	How is ecosystem management providing a benefit?
Valuation	Economics, non-market valuation, social valuation, willingness to pay

Mississippi Alluvial Valley

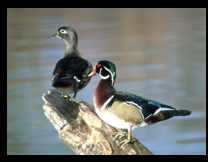
- 10 million ha bottomland forest
- Interspersed emergent wetlands
- Majority of discharge comes from upstream





Beneficial Seasonal Flooding

- Disturbance
- Scouring
- Nutrient cycling and sediment deposition
- Decomposition
- Mixture of mast-producing hardwoods and seed producing annuals
- Diversity of habitat



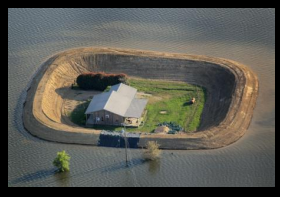
The Great Mississippi River Flood of 1927, photographed in Illinois on March 25.

"The Floods of 1927 in the Mississippi Basin," Frankenfield, H.C., 1927 Monthly Weather Review Supplement No. 29

Great Flood of…….

2011

- $4 billion in damages
- River closed to navigation
- Closed refineries
- Possible redirection of MS River



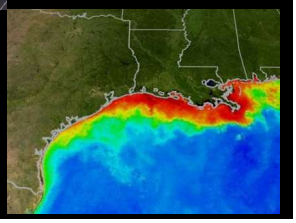
3,500 miles of Levees along the Lower Mississippi River

Alluvial Soils + Warm, Moist Climate = Perfect for agriculture

Only 16% of the remaining BLHW remains

Loss of Supporting Services

- Loss of nutrient cycling
  - Increase in N + P in runoff
- Eutrophication
- Dead Zone



Loss of Other Services

- Loss of wildlife habitat
- Flood protection
- Coastal fisheries

How do we restore these services?

Moist-soil wetland management

- Annual vegetation
- Seasonal flooding
- Managed hydrology
  - LMJV 1st priority is restoration of hydrology

Moist-soil Management

Practice →

Goals →

Ecosystem structure and function →

Outcome →

ECOSYSTEM SERVICE

Assessing Ecosystem Services of Moist-soil

Identify	What services have been lost? What services can be restored through ecosystem management?
Quantify	How is ecosystem management providing a benefit?
Valuation	Economics, non-market valuation, social valuation, willingness to pay

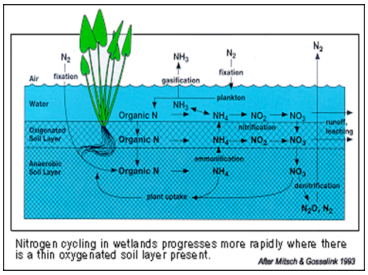
We've identified, quantified, and valued services provided by restoration of waterfowl habitat through moist-soil wetland management.

Can you identify any other potential services?

What are some other functions of wetlands?

Wildlife Habitat

Biogeochemical Cycling



Anoxic soils

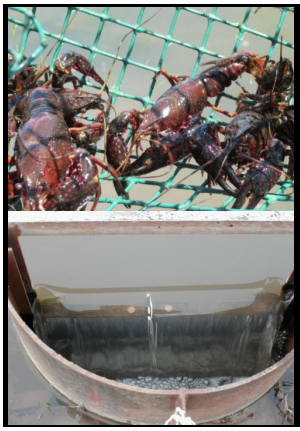
Plant assimilation

Slowing of water

Sediment deposition

Denitrification of NO_3 (bioavailable) to N_2 (gaseous) - TRANSFORMATION

Adsorption of PO_4 (bioavailable) to clay sediments - RETENTION



Identify

Because moist-soil management restores hydrology, it likely restores wetland functions such as habitat for other wetland wildlife and nutrient and sediment retention.

Quantify

How much crayfish are available for harvest?
How do N, P, and sediments in runoff from moist-soil compare to surrounding landscape?

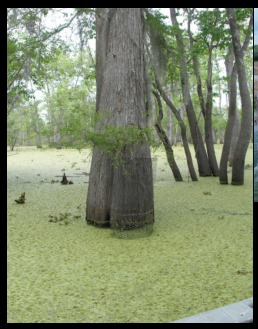
Valuation

What is the value of crayfish to landowners?
What is the value of reducing nutrient pollution?

Crayfish Ecology

- Adapted to drying environments
- Omnivorous
- ~300 eggs per female
- Multiple hatching events

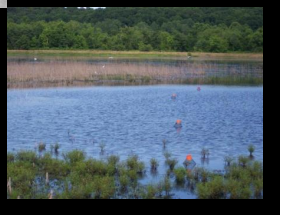
Commercial Crayfish Production



- 82% of land uses planted forage
- 600 kg/ha yield per farm
- Harvested November-May
- $135 million (2013)

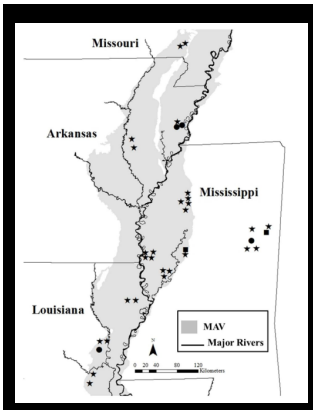
Rice Fields

- Seasonally flooded
- Annual vegetation
- Wetland soils
- Invertebrates



Moist-soil wetlands

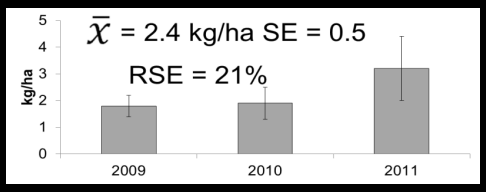
- Seasonally flooded
- Annual vegetation
- Wetland soils
- Invertebrates



- 34 wetlands
  - 2 in Missouri
  - 5 in Arkansas
  - 20 in Mississippi
  - 7 in Louisiana
- 3 years
  - 9 wetlands in 2009
  - 15 wetlands in 2010
  - 18 wetlands in 2011
  - 42 wetland-years
- Weekly trapping
- April-June
- Private and public lands

Quantify Crayfish Yield

- Estimate daily yield
  - Field run crayfish regardless of species
  - Mixed model approach
    - Repeated measures with day as repeated effect
  - Latitude and temperature as covariates



2.1 lbs/acre vs. 8.5 lbs/acre from LA rice fields

Value Crayfish Harvest

Crayfish harvesting in Louisiana

- Planted rice supports crayfish forage
- 45% of farmers plant rice
- 71 day harvest season Nov-May
- Hired labor and equipment costs
- Annual budgets prepared by LSU AgCenter

Crayfish in moist-soil wetlands

- Little equipment or labor costs
- Meets conservation goals for waterfowl
- 45 days March-June
- Yield, costs, and value unknown
- 4 scenarios with varying inputs

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Direct costs				
Self-Propelled Equipment				
Fuel	27.00	27.00	27.00	27.00
Labor	122.20		122.20	
Repair and maintenance	14.08	14.08	14.08	14.08
Nondurable goods				
Crayfish traps	82.50	82.50		
Waders	3.50	3.50	3.50	3.50
Ice chest 48qt	1.14	1.14	1.14	1.14
Sacks	0.68	0.68	0.68	0.68
Manufactured bait	71.28	71.28	71.28	71.28
Interest on operating capital	3.17	2.13	2.05	1.01
Total direct costs	325.57	202.33	241.95	118.71
Fixed costs				
Self-Propelled Equipment	45.18	45.18	45.18	45.18
Total specified costs ($/acre)	**370.75**	**247.51**	**287.13**	**163.89**
Yield (lb/acre)	96	96	96	96
Breakeven selling price ($/lb)	**3.86**	**2.57**	**2.99**	**1.70**

ENTERPRISE COMPARISON

	Rice-Crawfish in Louisiana	Moist-soil 1st year	Moist-soil 2nd year
Yield (lbs/acre)	600	96	96
Production cost $/acre	$750	$248	$164
Break-even $/lb	$1.25	$2.57	$1.70

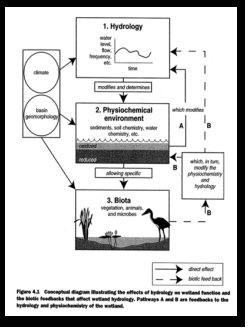
- Retail prices in North Mississippi $3.15-$5.00/ lb
- Recreational value as well
- Potential to reduce consumption of imported crayfish

To market any alternatively sourced seafood product, it must be accepted by consumers.

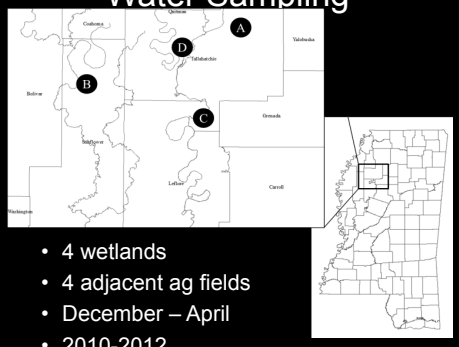
- Single blind test
- 149 participants
- Valued taste similarly

Moist-soil wetland water quality

- Hydrological management to promote annual vegetation and provide foraging habitat
- No evaluation of effluent quality

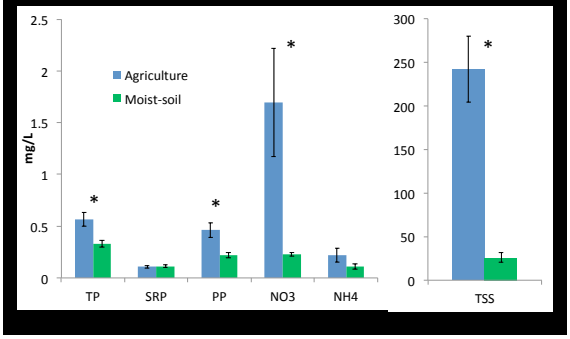


Water Sampling

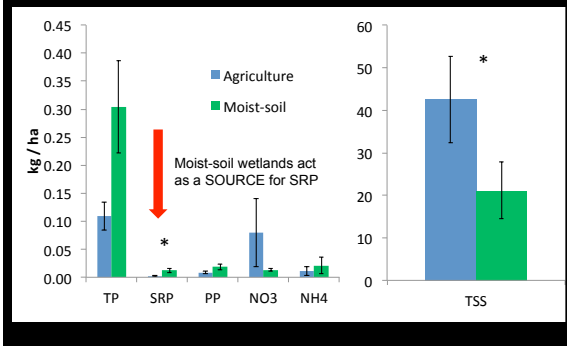


- 4 wetlands
- 4 adjacent ag fields
- December – April
- 2010-2012

Runoff Concentrations

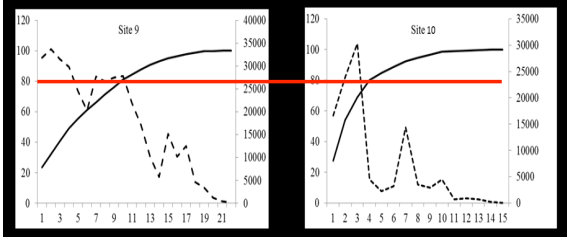


Runoff Loads



Peak discharge vs. SRP export

80% of total loads exported during 4 (27%) events in wetlands



Agriculture field

Moist-soil wetland

Moist-soil Management

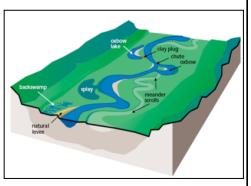
Practice →

Goals →

Ecosystem structure and function →

Outcome →

ECOSYSTEM SERVICE



How do we value water quality?

Replacement cost

Willingness to pay

Contingent valuation

Supporting

Provisioning

Regulating

Cultural

WHAT ARE WETLANDS WORTH TO YOU?

Remember that habitat management is driven by knowledge of ecological processes and structure.

Therefore, many benefits often occur from habitat (ecosystem) management.

Identify, quantify, and value these benefits.