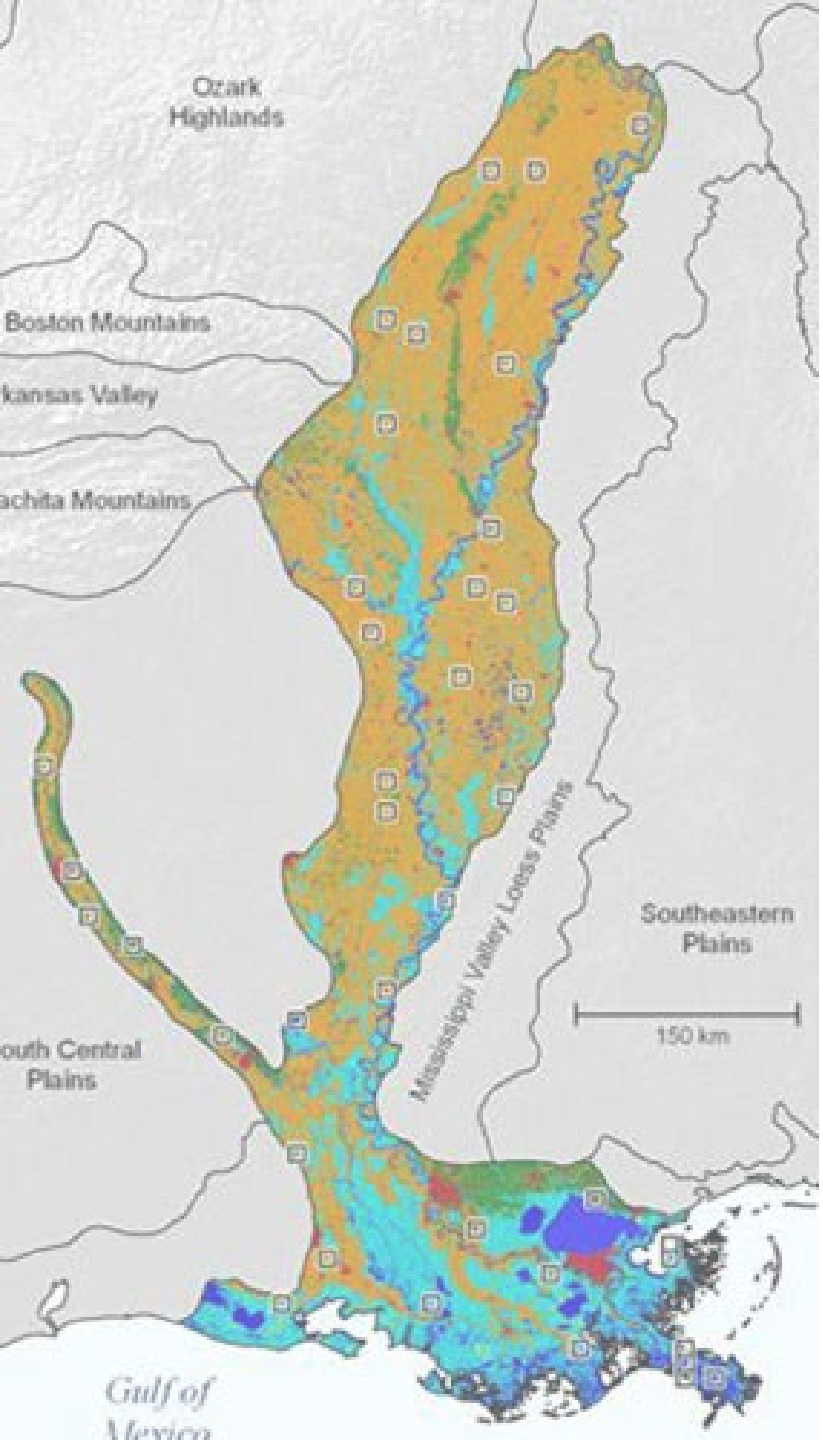
Fall waterbird habitat use in the MS Delta

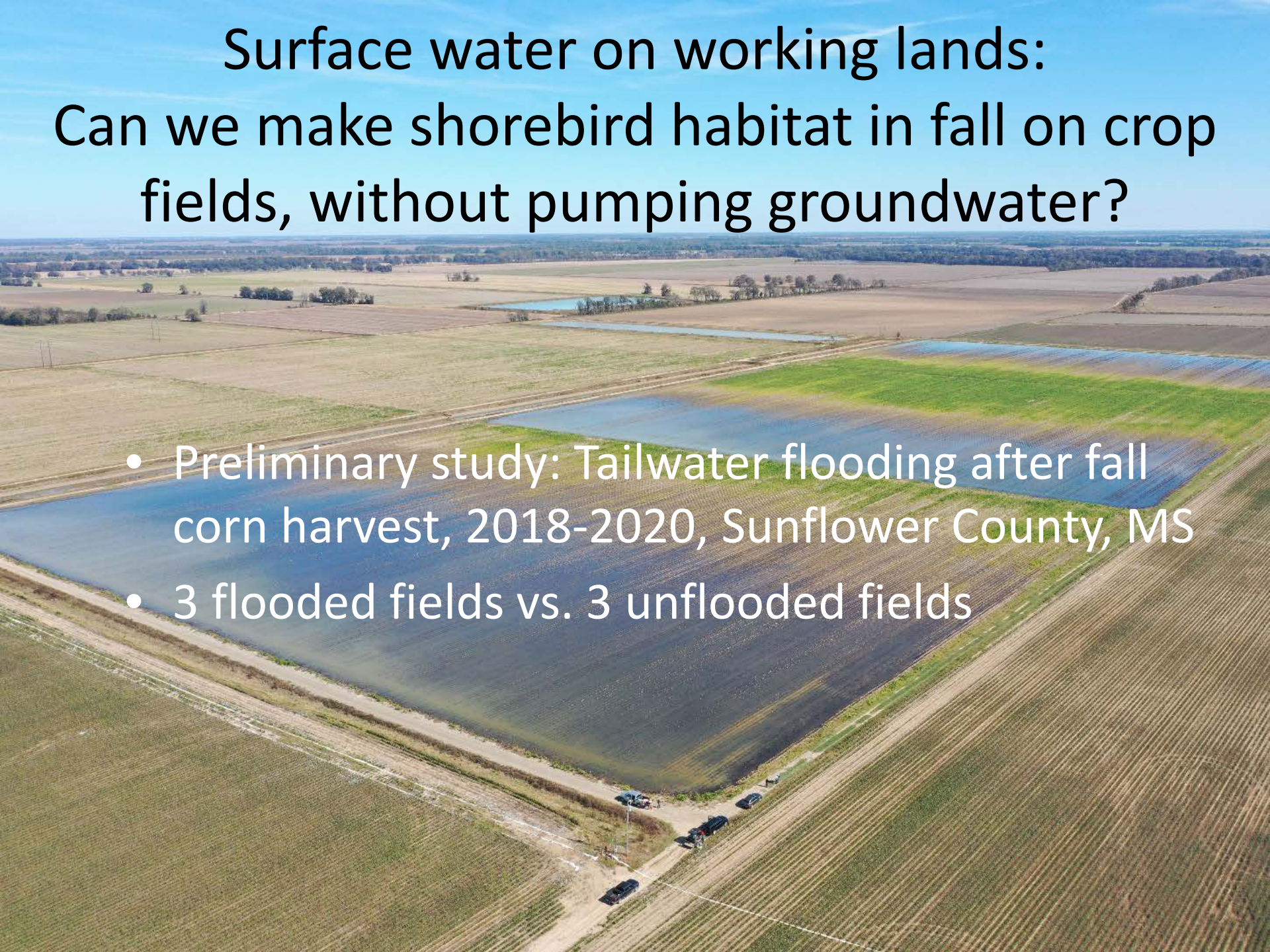
Jason Hoeksema
Professor, Dept of Biology, Univ. of Mississippi
President, Delta Wind Birds



MS River Valley (Delta):

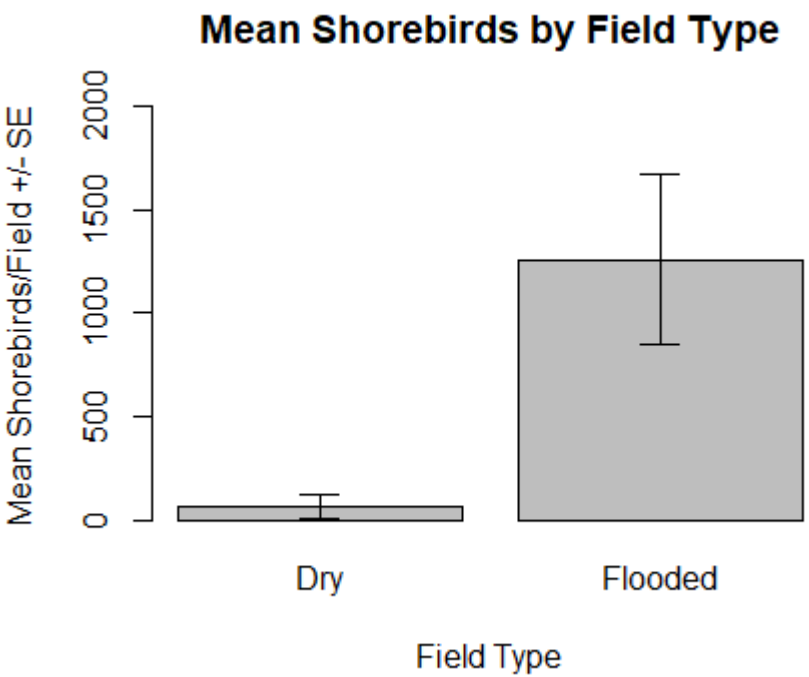
* >500,000 shorebirds/yr
* 27 species
* Main conservation problem we can help address: Limited shorebird stopover habitat in fall
* How to address it without pumping groundwater?

Surface water on working lands: Can we make shorebird habitat in fall on crop fields, without pumping groundwater?



- Preliminary study: Tailwater flooding after fall corn harvest, 2018-2020, Sunflower County, MS
- 3 flooded fields vs. 3 unflooded fields

Initial focus: Quantifying bird usage


Mean Shorebirds by Field Type
Mean Shorebirds/Field +/- SE
0
500
1000
1500
2000
Dry
Flooded
Field Type

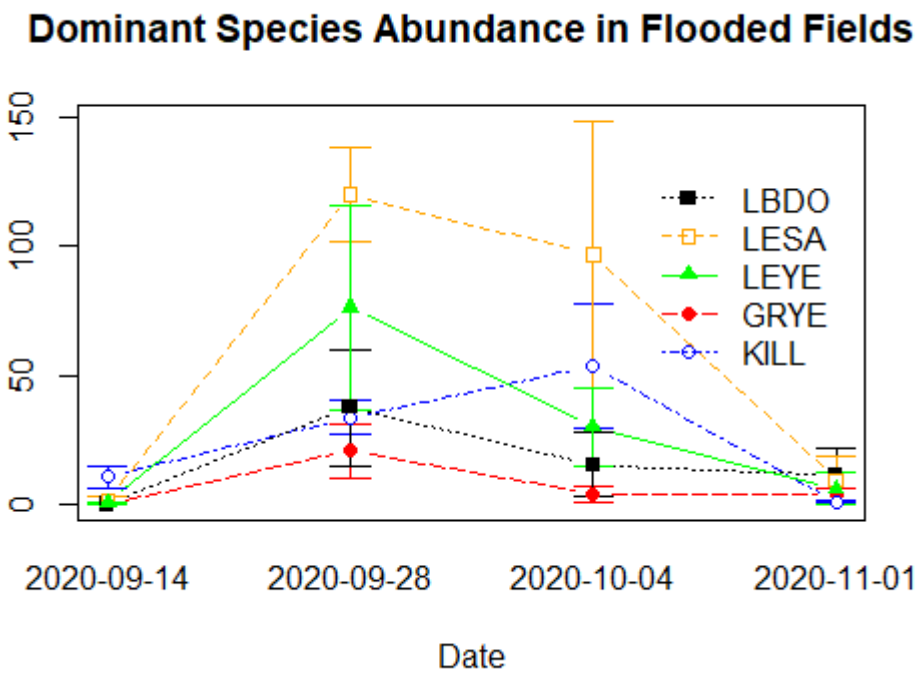
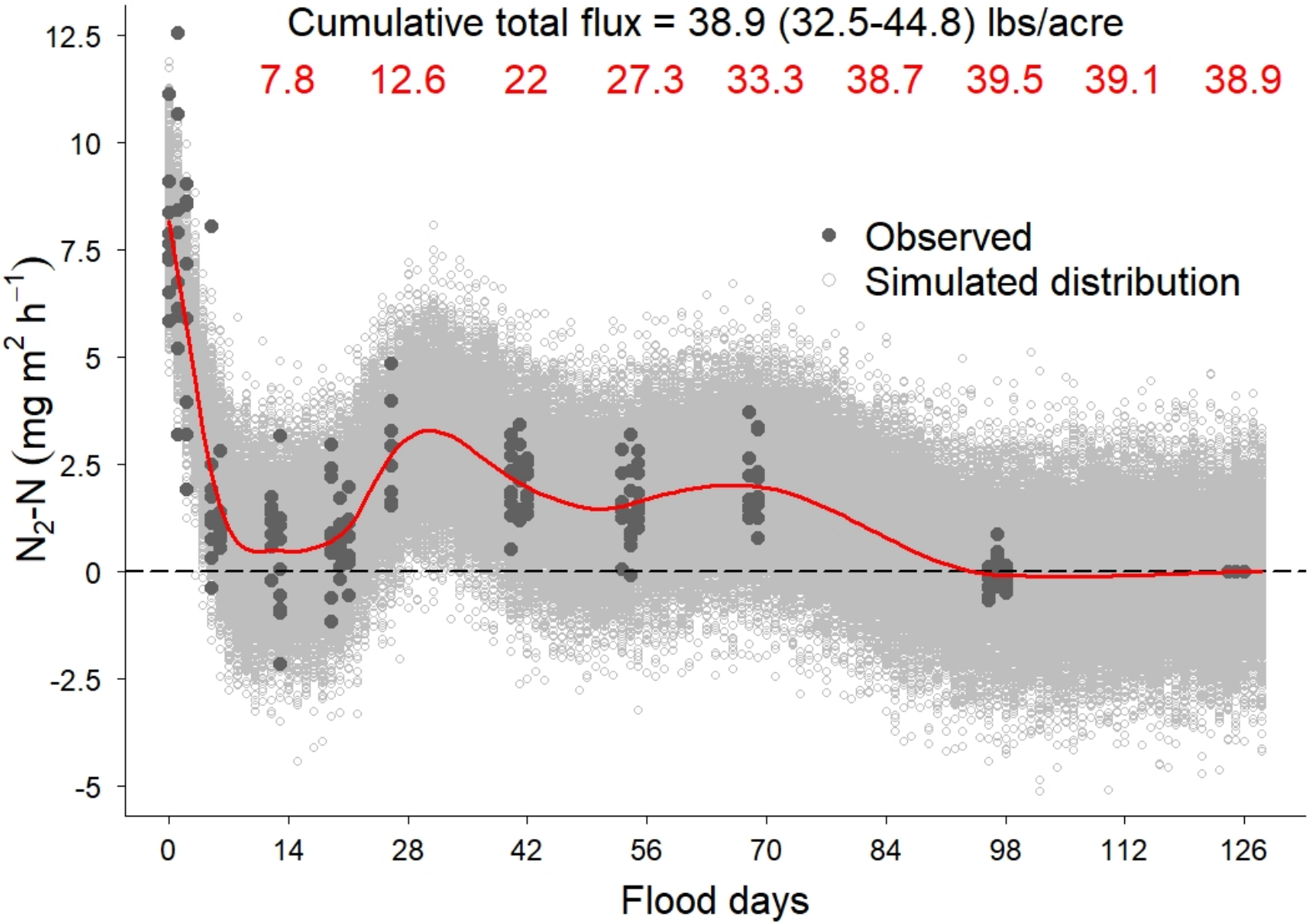

Dominant Species Abundance in Flooded Fields
0
50
100
150
LBDO
LESA
LEYE
GRYE
KILL
2020-09-14
2020-09-28
2020-10-04
2020-11-01
Date


photo: Larry Pace

Jason Taylor, USDA-ARS: Hypothesized that holding surface water in fall has additional benefits, especially denitrification and sediment retention


Measurements in fall 2019 & fall 2020:
• denitrification
• sediment runoff
• bird & macroinvertebrate densities
• subsequent crop yield

Denitrification, fall 2019



Sediment retention, fall 2019

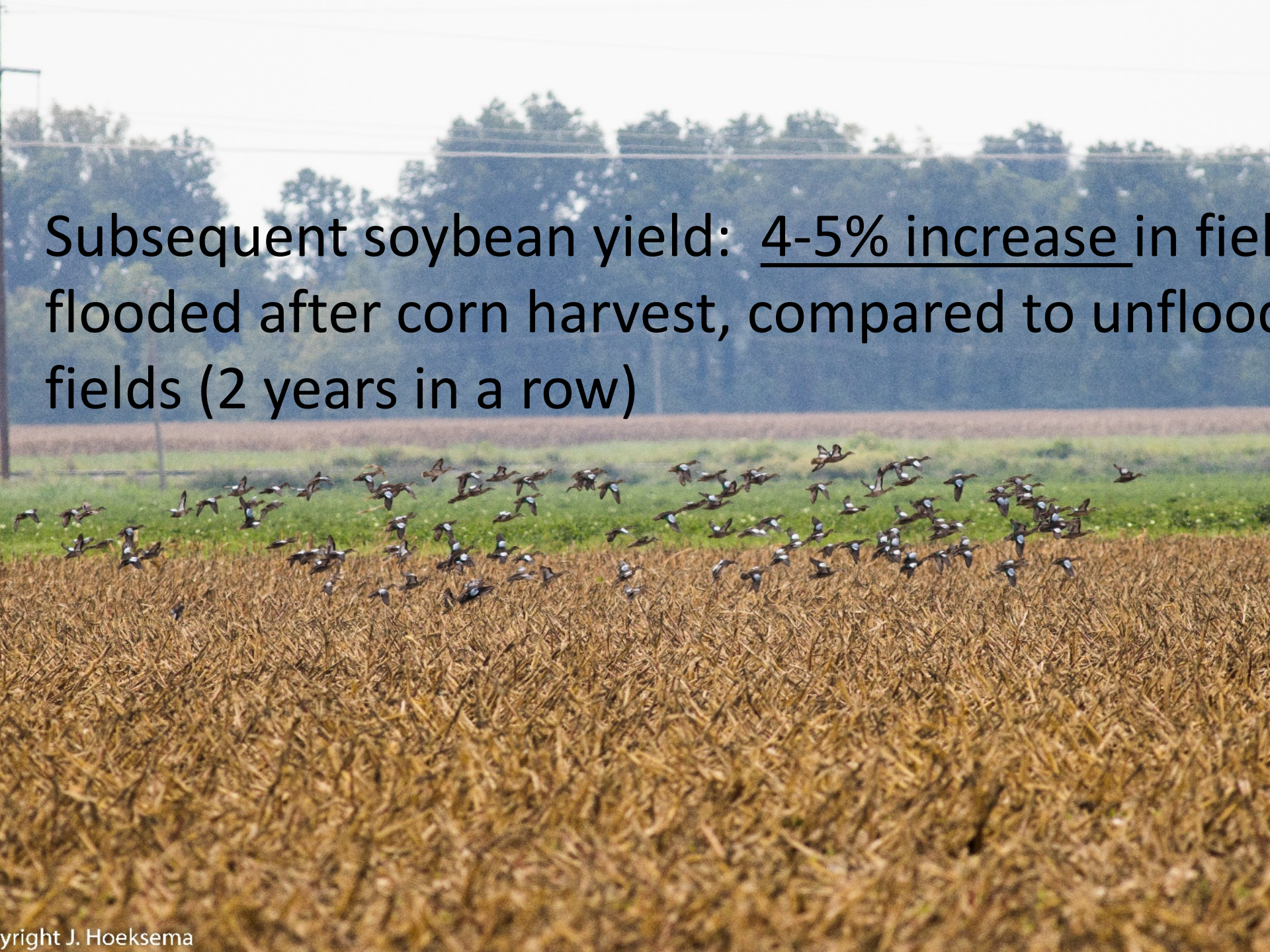
Susp. Sed. (mg L^{-1})

6000
5000
4000
3000
2000
1000
0

Flooded
Unflooded

0 20 40 60 80 100 120 140

Flood days


Subsequent soybean yield: 4-5% increase in fiel
flooded after corn harvest, compared to unfloo
fields (2 years in a row)
yright J. Hoeksema

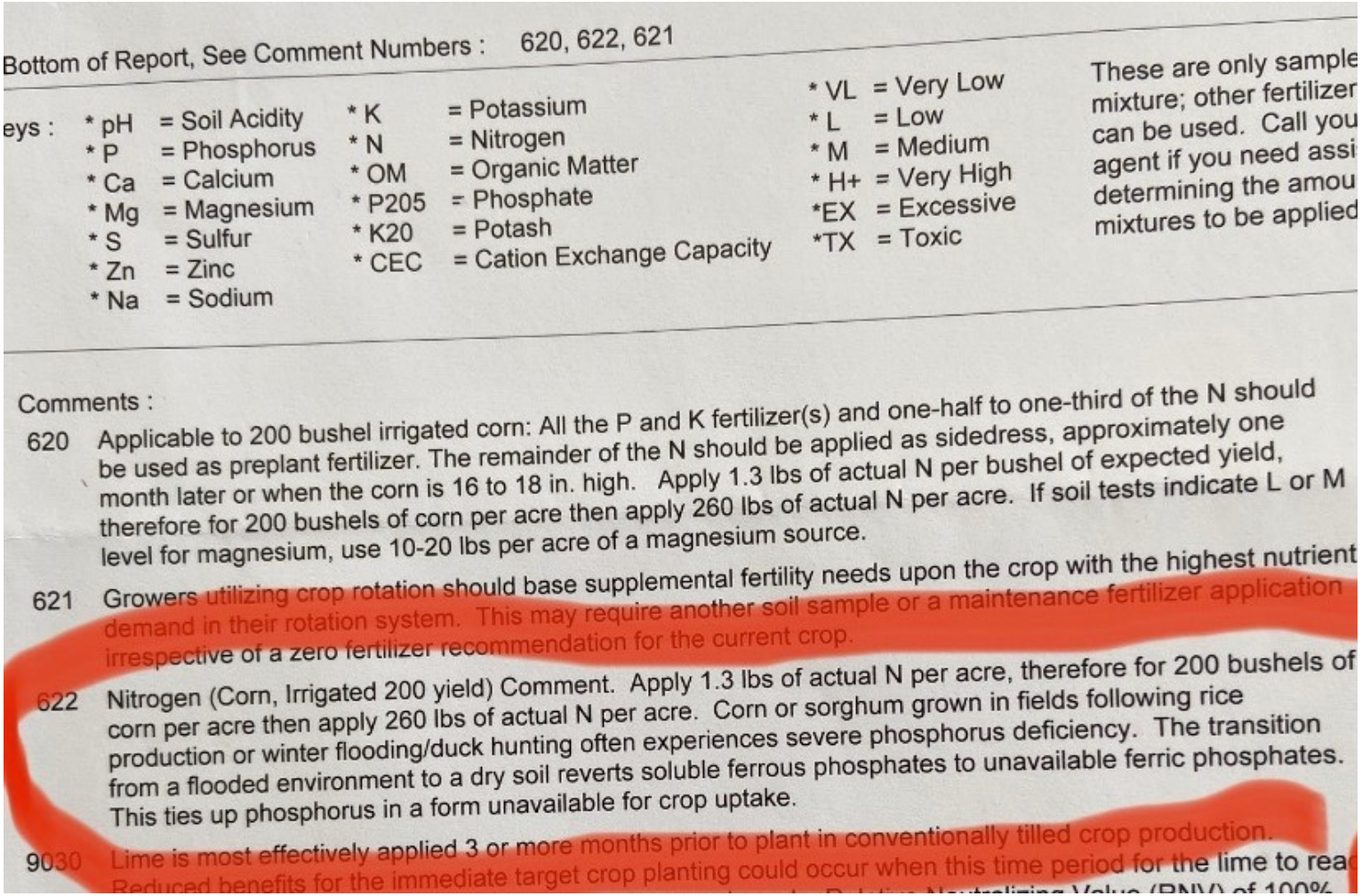
Policy opportunities to encourage fall flooding with surface water?

- EQIP-644: Wetland Wildlife Habitat Management, incentive to closer risers
  - fall option now available in MS

Farmer concerns about flooding for wildlife

- fall flooding takes time away from harvest & field prep activities
- erodes beds that have already been prepped
- causes stubble drift, which interferes with planting
- delays getting into fields in spring
- hardens soil, which reduces yield
- forms a crust, which impedes planting
- "locks up" phosphorus, reducing yield

MSU Soil & Plant Nutrient Lab:



Bottom of Report, See Comment Numbers : 620, 622, 621

eys :
* pH = Soil Acidity
* P = Phosphorus
* Ca = Calcium
* Mg = Magnesium
* S = Sulfur
* Zn = Zinc
* Na = Sodium
* K = Potassium
* N = Nitrogen
* OM = Organic Matter
* P205 = Phosphate
* K20 = Potash
* CEC = Cation Exchange Capacity
* VL = Very Low
* L = Low
* M = Medium
* H+ = Very High
*EX = Excessive
*TX = Toxic

These are only sample mixture; other fertilizer can be used. Call you agent if you need assi determining the amou mixtures to be applied

Comments :

620 Applicable to 200 bushel irrigated corn: All the P and K fertilizer(s) and one-half to one-third of the N should be used as preplant fertilizer. The remainder of the N should be applied as sidedress, approximately one month later or when the corn is 16 to 18 in. high. Apply 1.3 lbs of actual N per bushel of expected yield, therefore for 200 bushels of corn per acre then apply 260 lbs of actual N per acre. If soil tests indicate L or M level for magnesium, use 10-20 lbs per acre of a magnesium source.

621 Growers utilizing crop rotation should base supplemental fertility needs upon the crop with the highest nutrient demand in their rotation system. This may require another soil sample or a maintenance fertilizer application irrespective of a zero fertilizer recommendation for the current crop.

622 Nitrogen (Corn, Irrigated 200 yield) Comment. Apply 1.3 lbs of actual N per acre, therefore for 200 bushels of corn per acre then apply 260 lbs of actual N per acre. Corn or sorghum grown in fields following rice production or winter flooding/duck hunting often experiences severe phosphorus deficiency. The transition from a flooded environment to a dry soil reverts soluble ferrous phosphates to unavailable ferric phosphates. This ties up phosphorus in a form unavailable for crop uptake.

9030 Lime is most effectively applied 3 or more months prior to plant in conventionally tilled crop production. Reduced benefits for the immediate target crop planting could occur when this time period for the lime to rea

"Flooded Field Syndrome" – evidence from studies on Midwestern corn & soy fields after floods in 1993

an influential paper

American Journal of Plant Sciences, 2013, 4, 10-18
http://dx.doi.org/10.4236/ajps.2013.47A2002 Published Online July 2013 (http://www.scirp.org/journal/ajps)

Scientific Research

Effect of Winter Flooding on Weeds, Soybean Yield, Straw Degradation, and Soil Chemical and Biochemical Characteristics

Clifford H. Koger[1,2,3,4], Robert M. Zablotowicz[2], Mark A. Weaver[2,5], Melanie R. Tucker-Patterson[2], J. L. Krutz[2,3], Timothy W. Walker[3], Joe E. Street[3]

[1]Crop Genetics and Production Research Unit, USDA-ARS, Stoneville, USA; [2]Crop Production Research Unit, USDA-ARS, Stoneville, USA; [3]Delta Branch Experiment Station, Mississippi State University, Stoneville, USA; [4]Syngenta 112 Meadowlark Lane, Indianola, USA; [5]Biological Control Pests Research Unit, USDA-ARS, Stoneville, USA.
Email: Mark.Weaver@ars.usda.gov

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ABSTRACT

Winter flooding of harvested rice fields attracts migratory waterfowl and may assist in degrading rice straw residue. Field studies were conducted between 2003 and 2005 in Stoneville, MS to evaluate the impacts of winter flooding of harvested rice fields on rice straw degradation, winter weeds, soybean yield, and soil biochemical and chemical properties. The experimental area each year consisted of a harvested rice field that remained no-till after harvest and that was dissected into 7.6- by 15-m bays with constructed levees to accommodate winter flooding treatments. Flooding treatments (10-cm depth) consisted of: 1) flooded from mid-October to early March; 2) flooded mid-October to early January; 3) flooded mid-December to early March; 4) flooded mid-December to mid-January; and 5) no flood. Winter weeds were counted, biomass determined as well as residual rice straw before flooding and in early April of each year. Winter flooding reduced rice straw biomass 32% to 60% compared to 21% to 31% reduction for no winter flood with the longest flood duration resulting in the greatest loss of carbon and nitrogen from straw residues in both years. Winter flooding treatments reduced weed populations and weed biomass from 43% to 99% when compared to no flooding treatment. Soybean yields ranged from 3295 $kg \cdot ha^{-1}$ with the longest winter flooding regime to 4295 $kg \cdot ha^{-1}$ with no flooding. Significant reductions in soil nitrate levels were most consistent in the upper 0 to 2.5-cm surface soil. Soil enzymatic activity (dehydrogenase and fluorescein diacetate hydrolysis) was increased by flooding in 2003, while minimal effects were found in the second year consistent with more anaerobic conditions attained in 2003 compared to 2004. Environmental benefits of accelerated straw decomposition and weed control is achieved by winter flooding; however, there are negative consequences of nitrogen losses and reduced soybean yield.

- 5m x 8m plots on one rice field in Stoneville, MS
- Groundwater flooding in fall/winter after rice harvest resulted in accelerated straw decomp & weed control
- Fall-initiated floods reduced soybean yield
- Mechanism of yield reduction?
  - Options: P less available, N loss, allelopathy from rice straw decomp

Next questions:

- When we flood with tailwater on corn & soybean fields...
  - Are yield benefits consistent?
  - If so, what is the mechanism?
  - Effects on soil biogeochemistry?
  - Effect of flood timing (fall vs. winter)?
  - Effect of crop rotation (corn vs. soy)?

EPA Gulf of Mexico Farmer to Farmer grant (2021-2024):

- Partners: University of Mississippi (Hoeksema & D'Alessio), USDA-ARS (Taylor, Moore), Mississippi State University & Extension (Ashwell, Lacy, Baker), & Delta Wind Birds
- 4 farm sites in Sunflower River basin
- 5 whole-field treatments: control, passive flood (boards only), fall flood, winter flood, fall + winter flood
- 3 years, corn/soy rotation
- Farmer outreach, field days, networking

Thank You!

Questions?