Management of a natural floodplain wetland for mitigation of non-point source pollution

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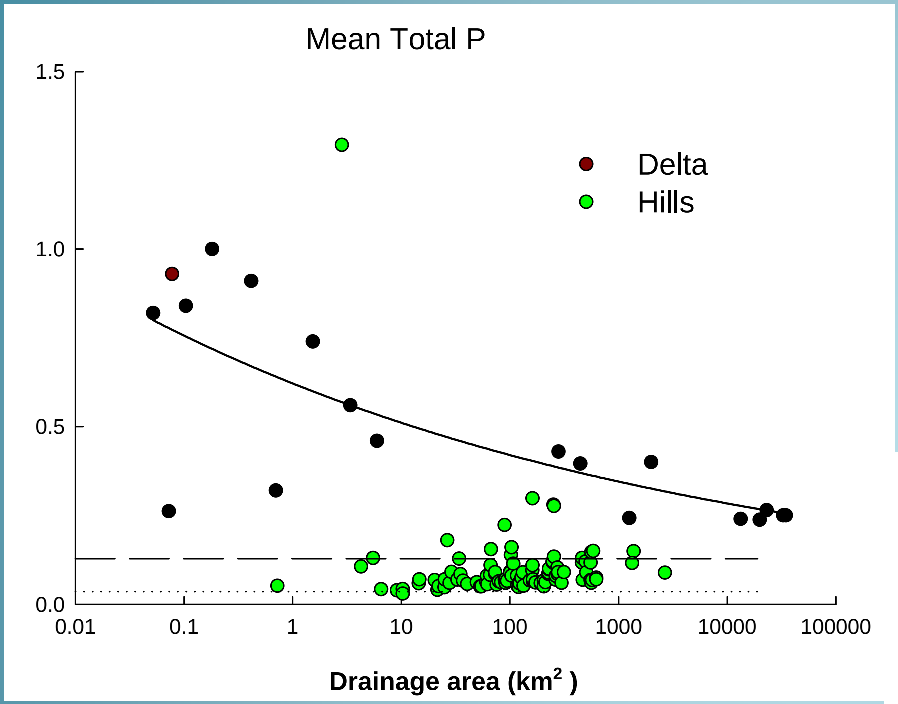
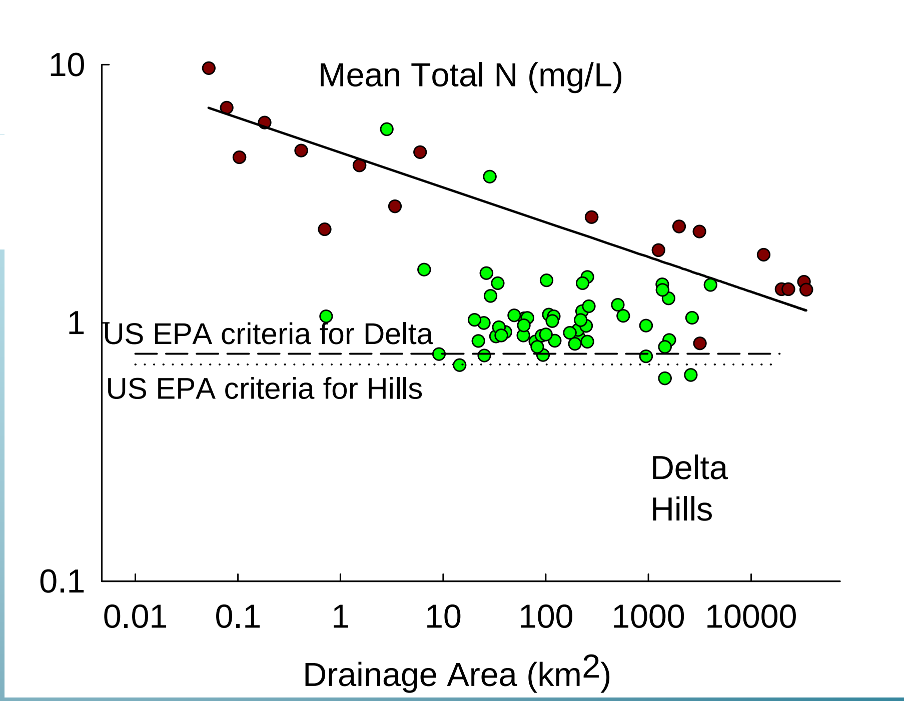
Problem Statement

- Non-point source nutrient pollution is a major problem in the United States.
- Many sites exceed EPA guidelines for N and P concentrations
- N and P pollution can dramatically alter marine ecosystems.

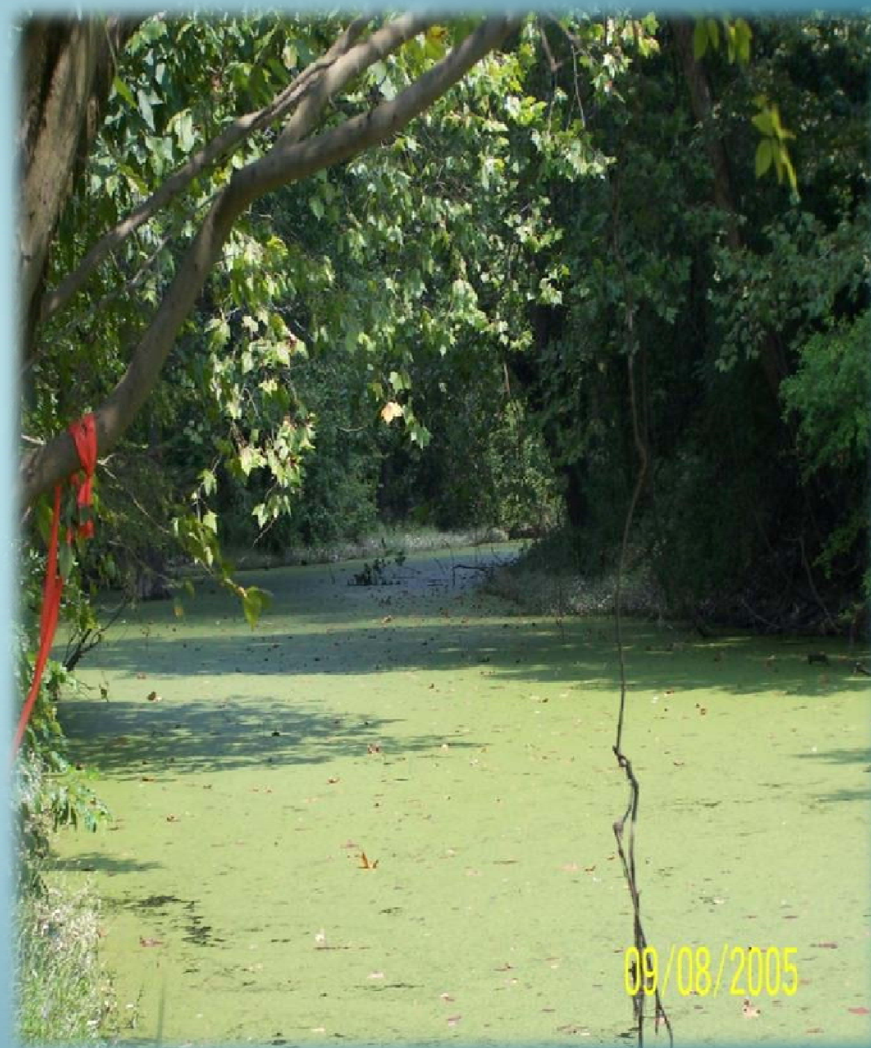
NPS in Mississippi





Hypothesis

- NPS pollution can be trapped and processed by natural wetland
- Riverine wetland receives water from runoff and river overflow
- Study period: 6/15/2007-11/28/2008

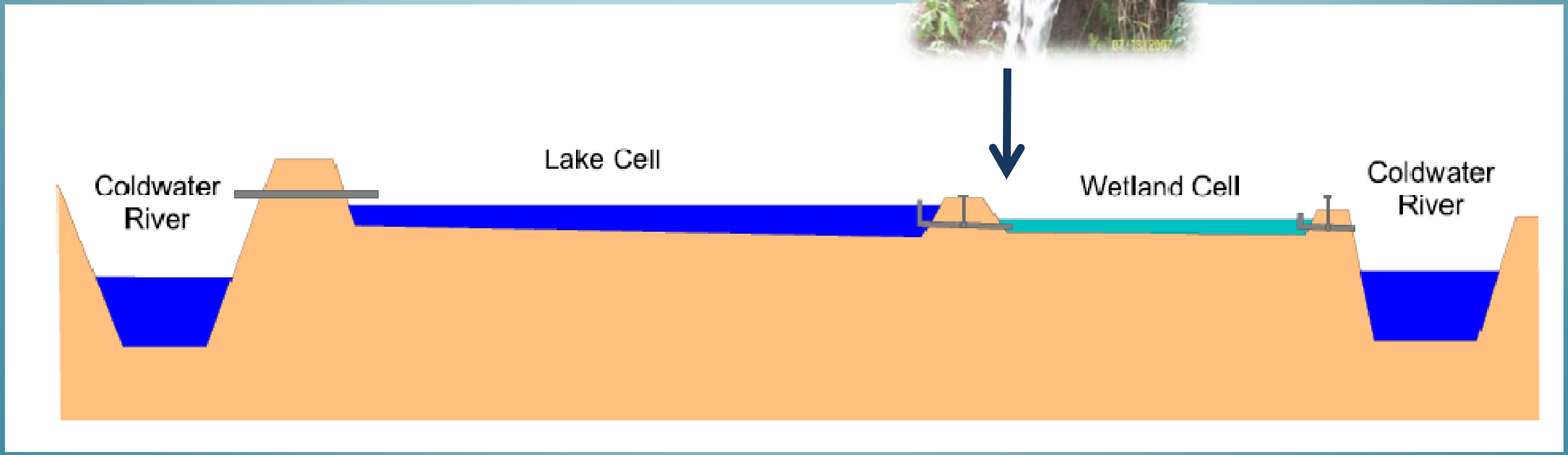


Site Description

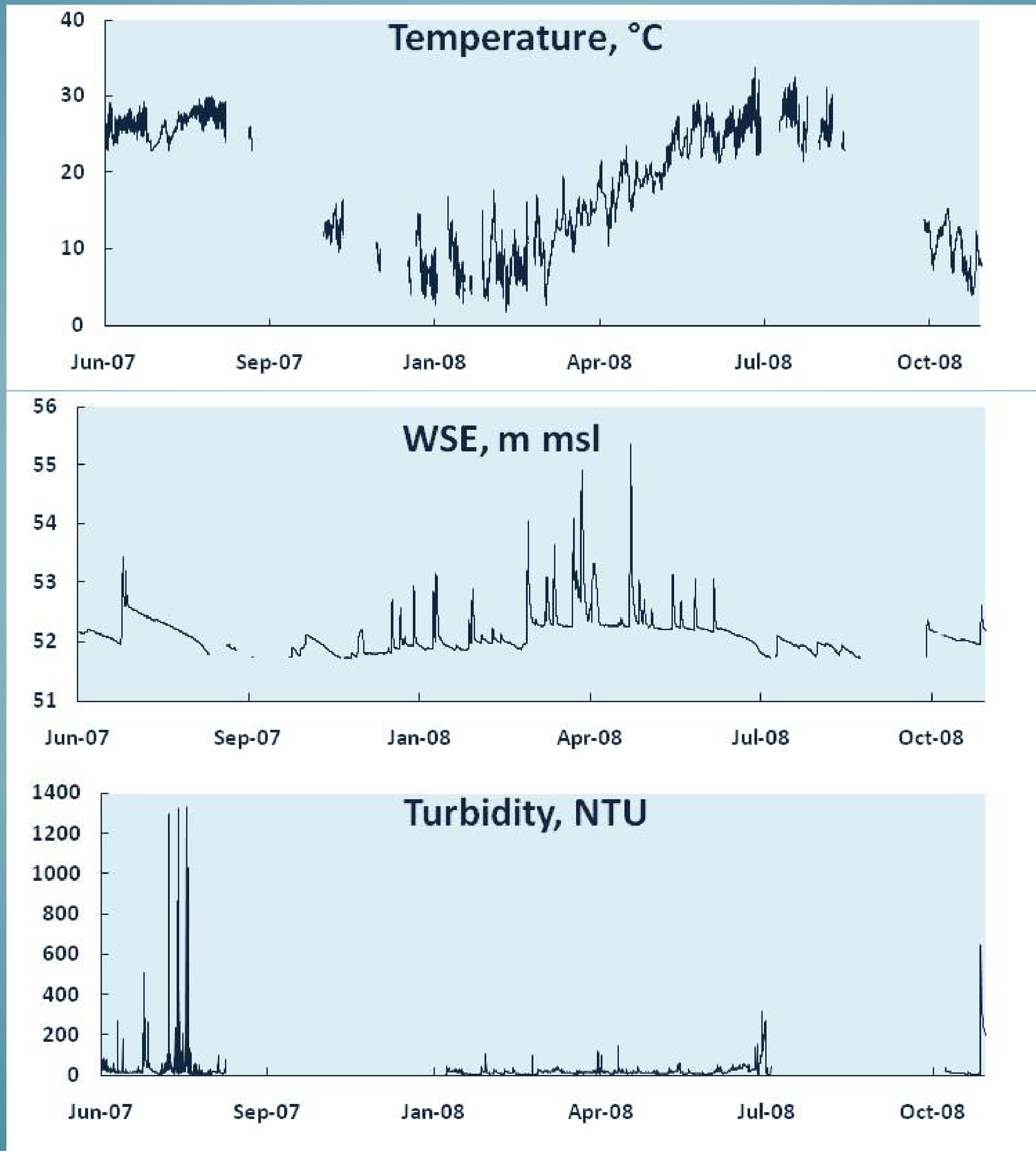
- 500 m long severed meander bend of the Coldwater River in Tunica County, MS
- 2 main inputs: drainage pipe & connection with river
- Two weirs constructed during restoration
- Wetland cell and lake cell created

Drainage Structure Operation

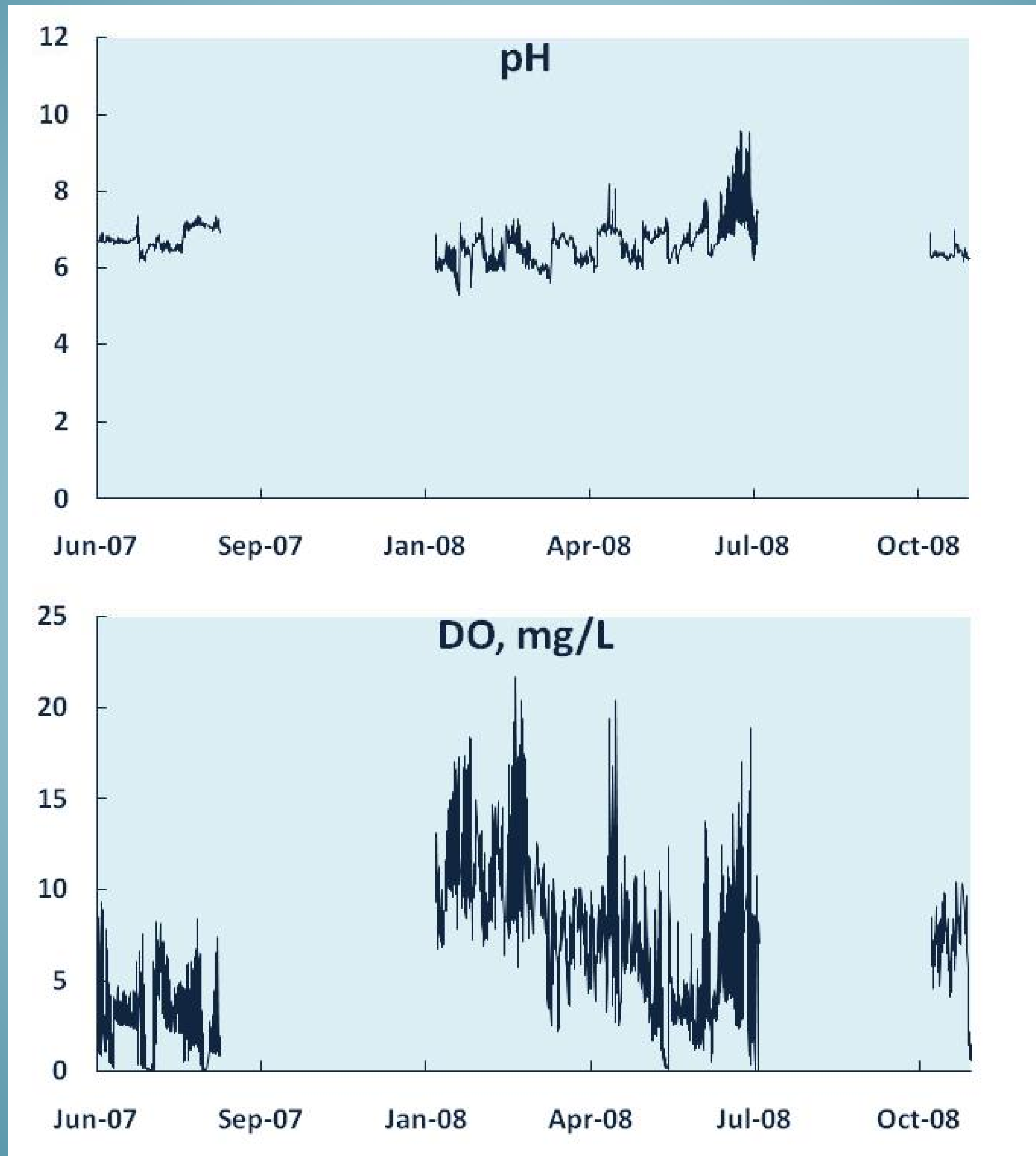
- Weir boards removed on 12/1
- Weir boards replaced on 3/1



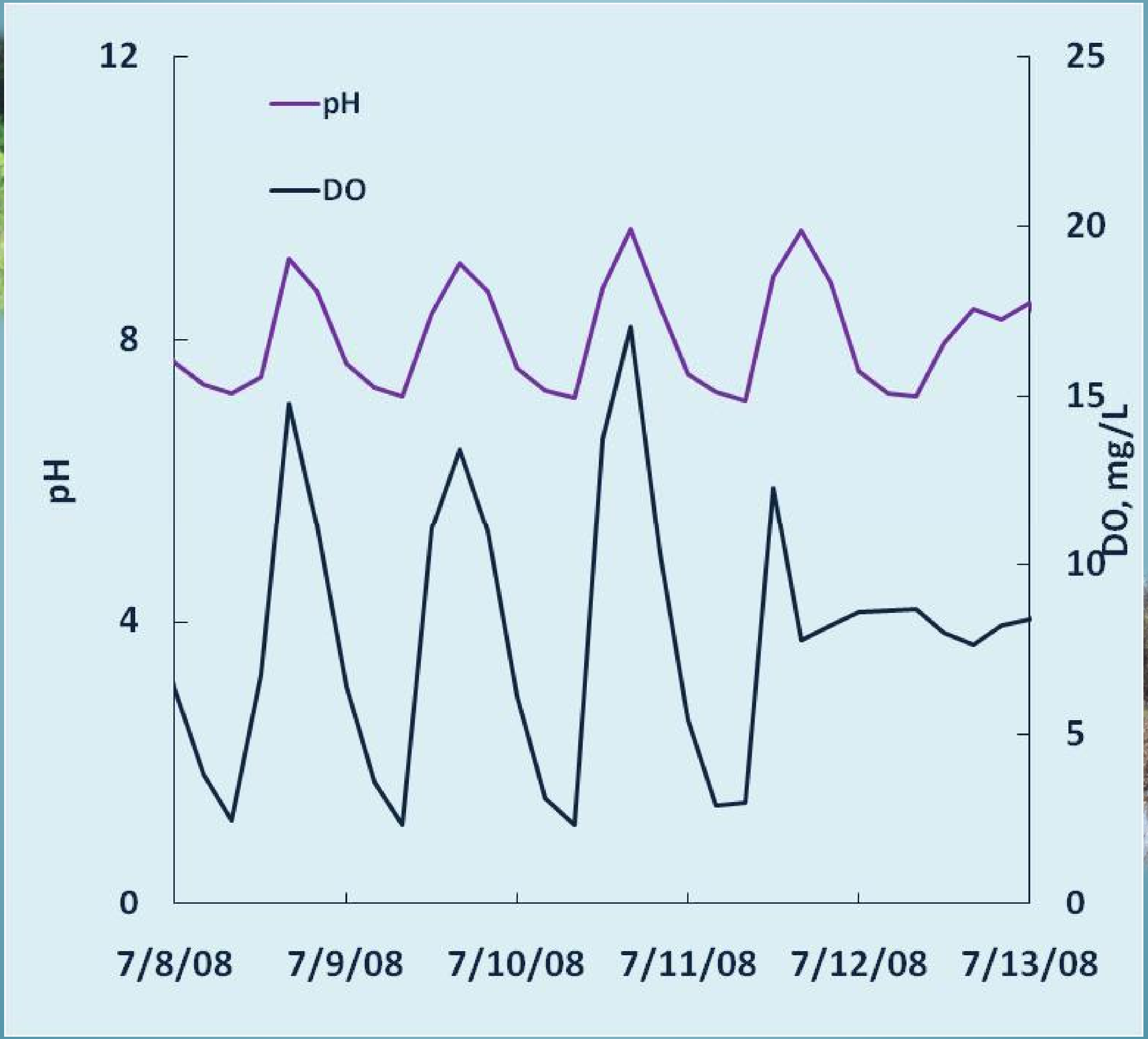
Wetland Conditions Time Series



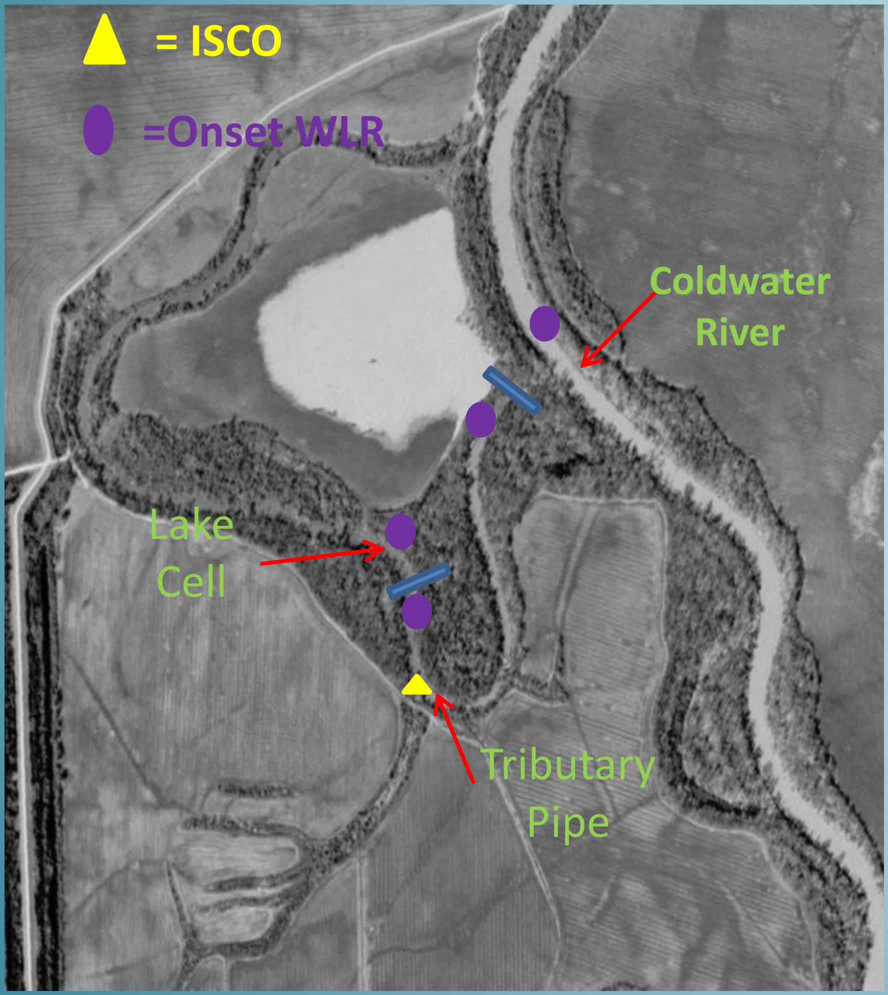
Wetland Conditions Time Series



Wetland Conditions Time Series

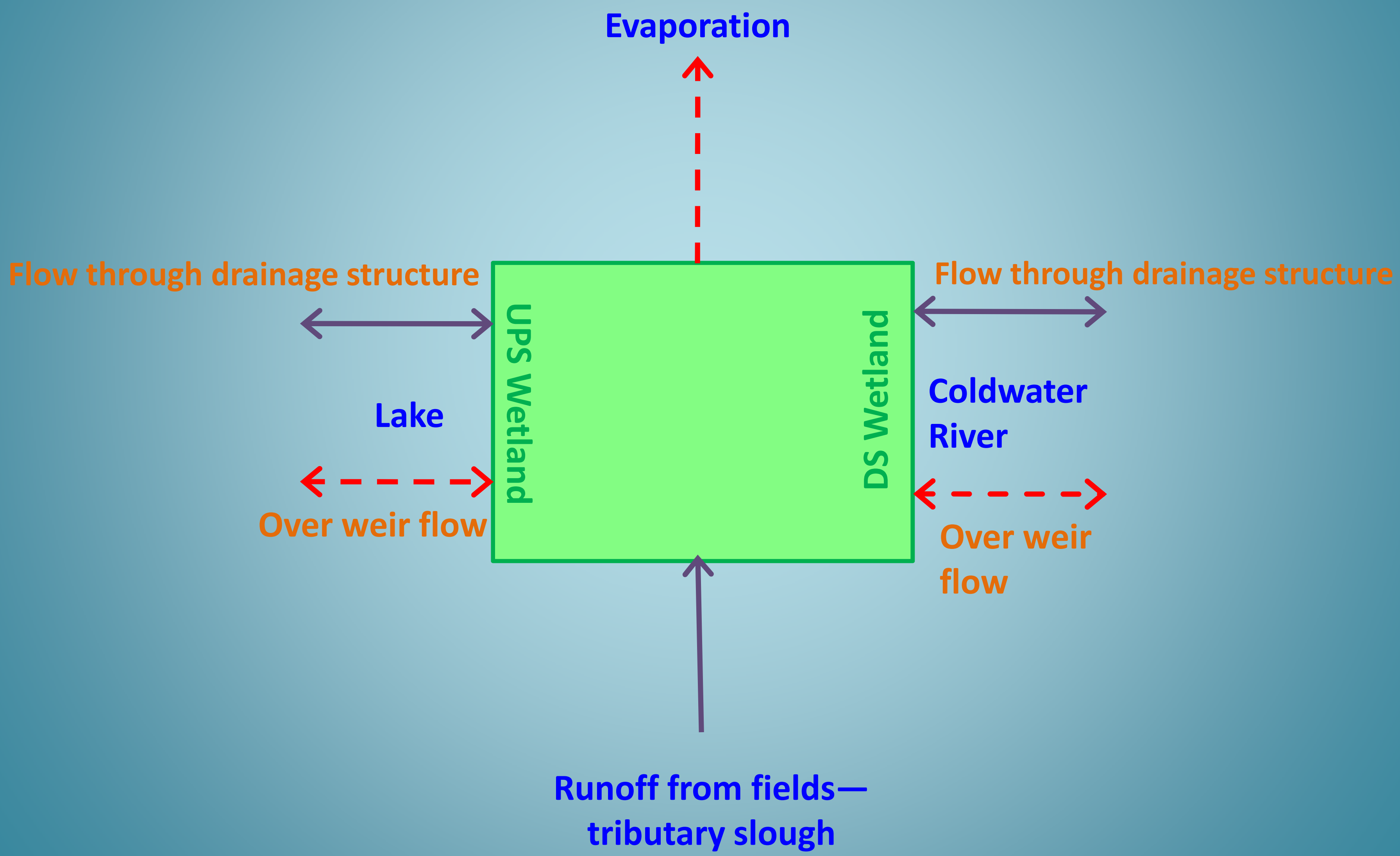


Methods-Data Collection



- ISCO 2150 Area Velocity Flow Module in drainage pipe
- Onset Water Level Recorders in wetland, lake, and river
- Weekly grab samples from all sites

Methods-Water Budget

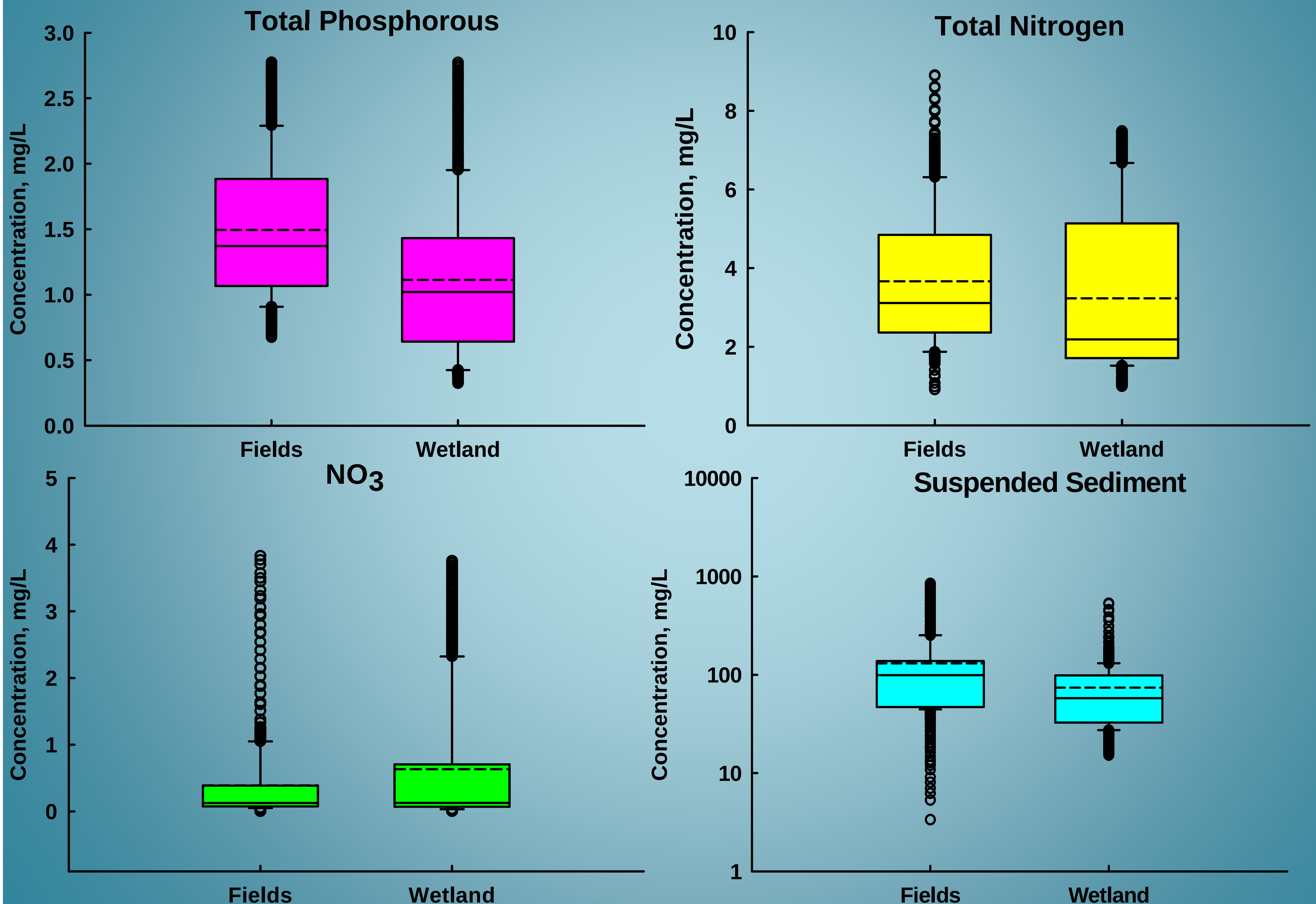


Methods-Water Budget

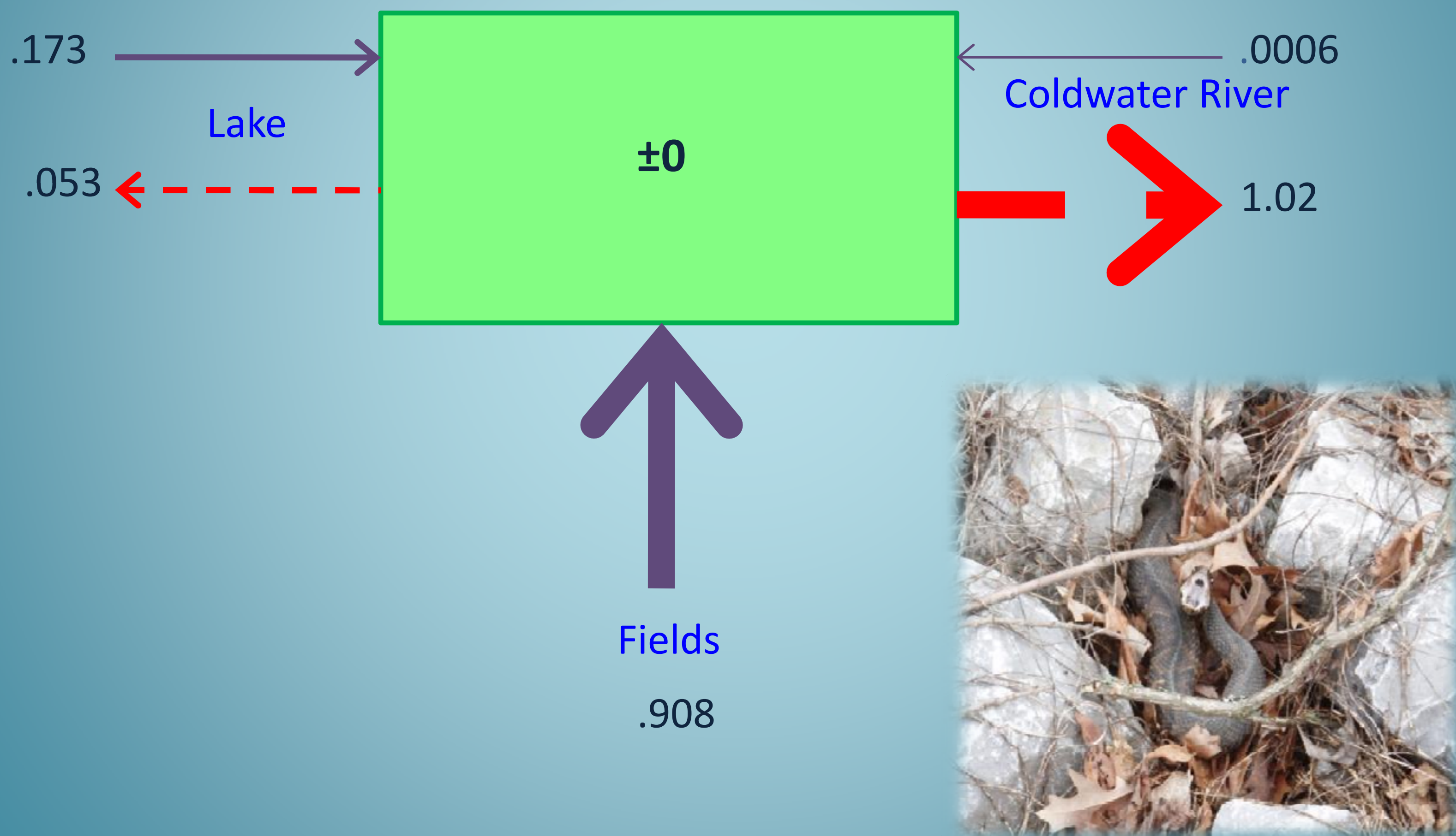
$$\frac{\Delta S}{\Delta t} = Q_{evap}(t) + Q_{pipe}(t) + Q_{drainw}(t) + Q_{drainl}(t) + Q_{stonew}(t) + Q_{stonel}(t)$$

- Balance ΔS with inflows and outflows during each time step
- Flow over weirs can be either critical or normal
- Nonlinear regression used to adjust coefficients and exponents for weir flow formulas
- Nutrient loads calculated

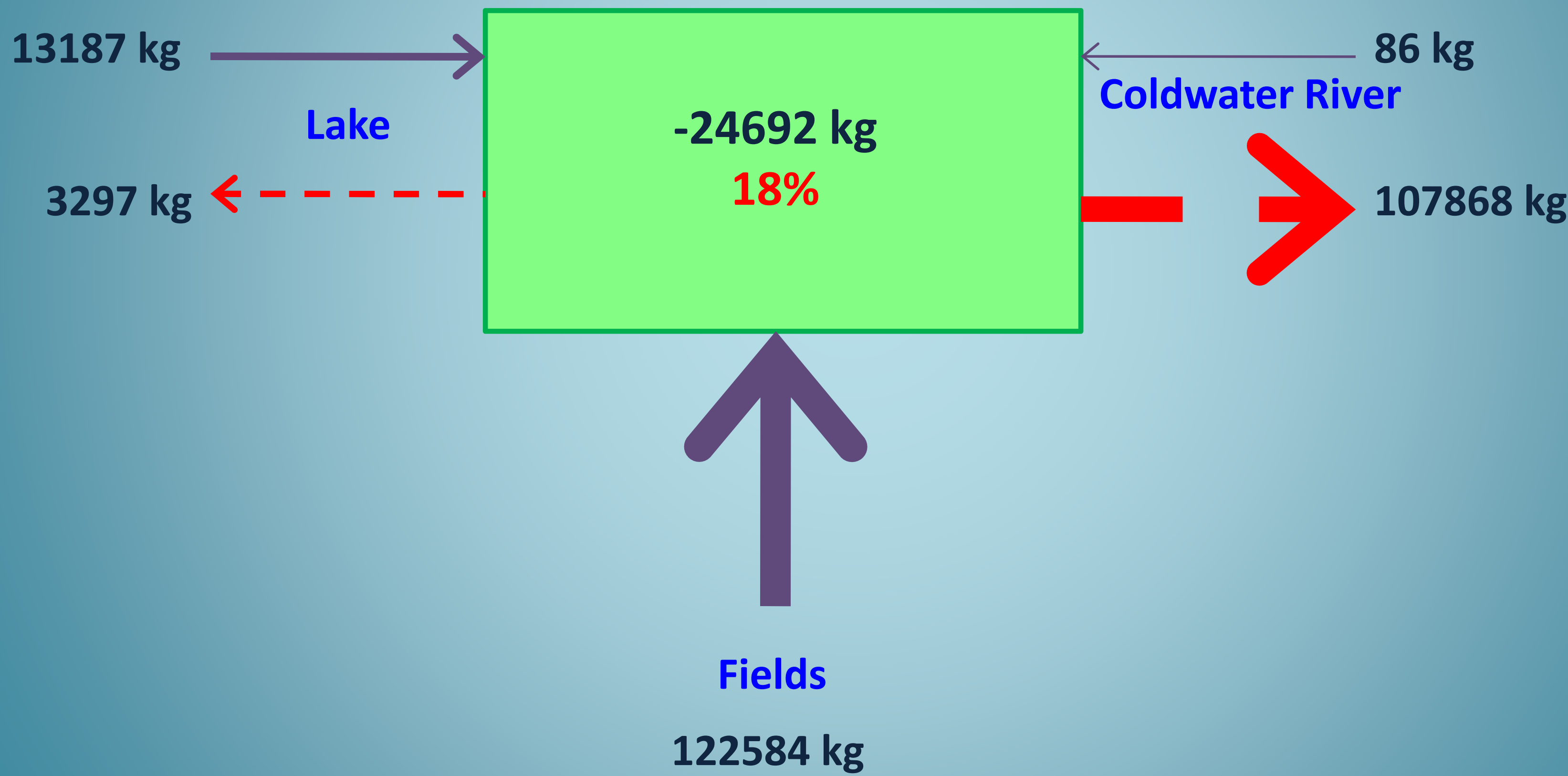
Concentrations



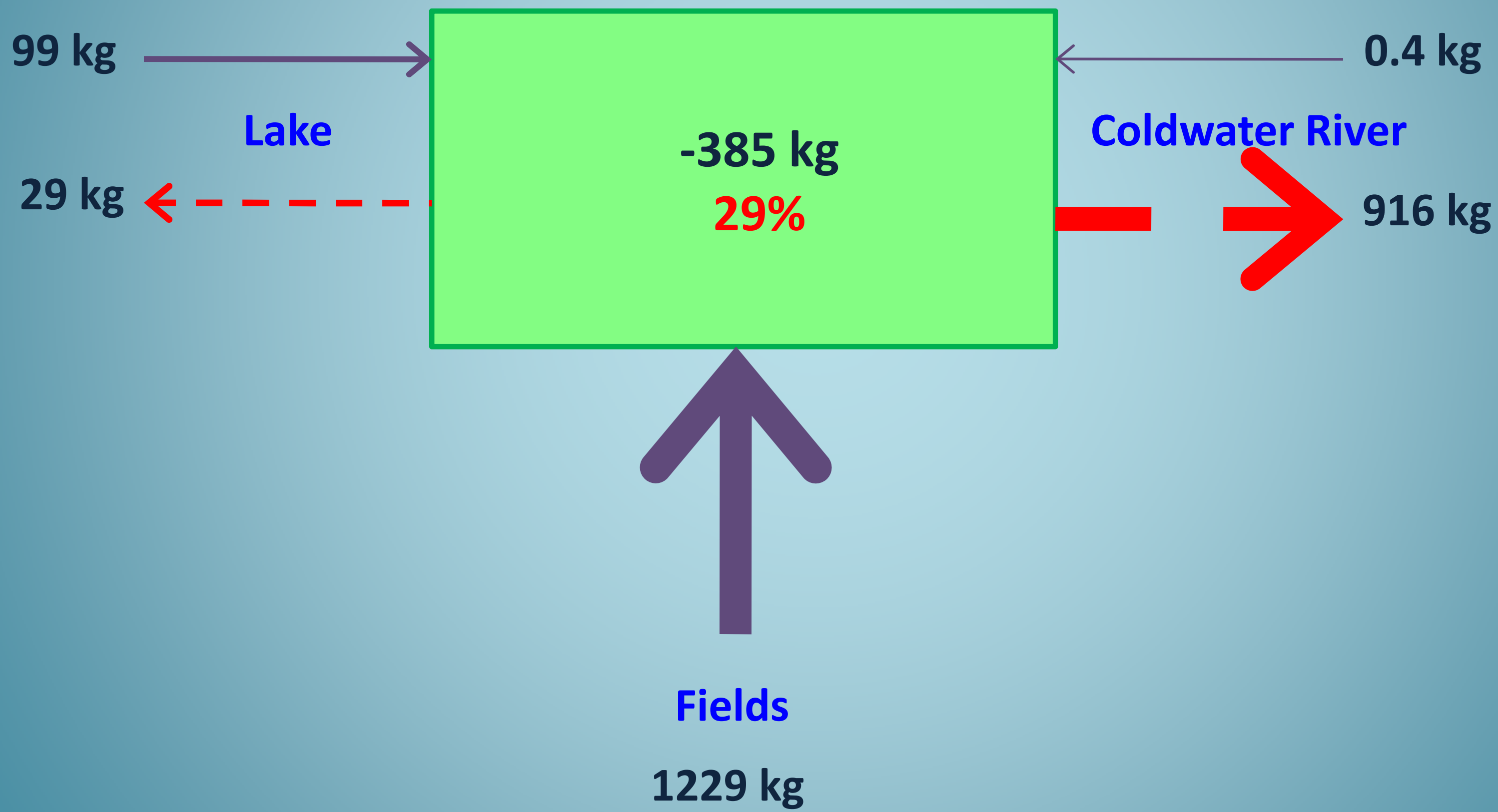
Wetland Water Budget, (millions of m^3)



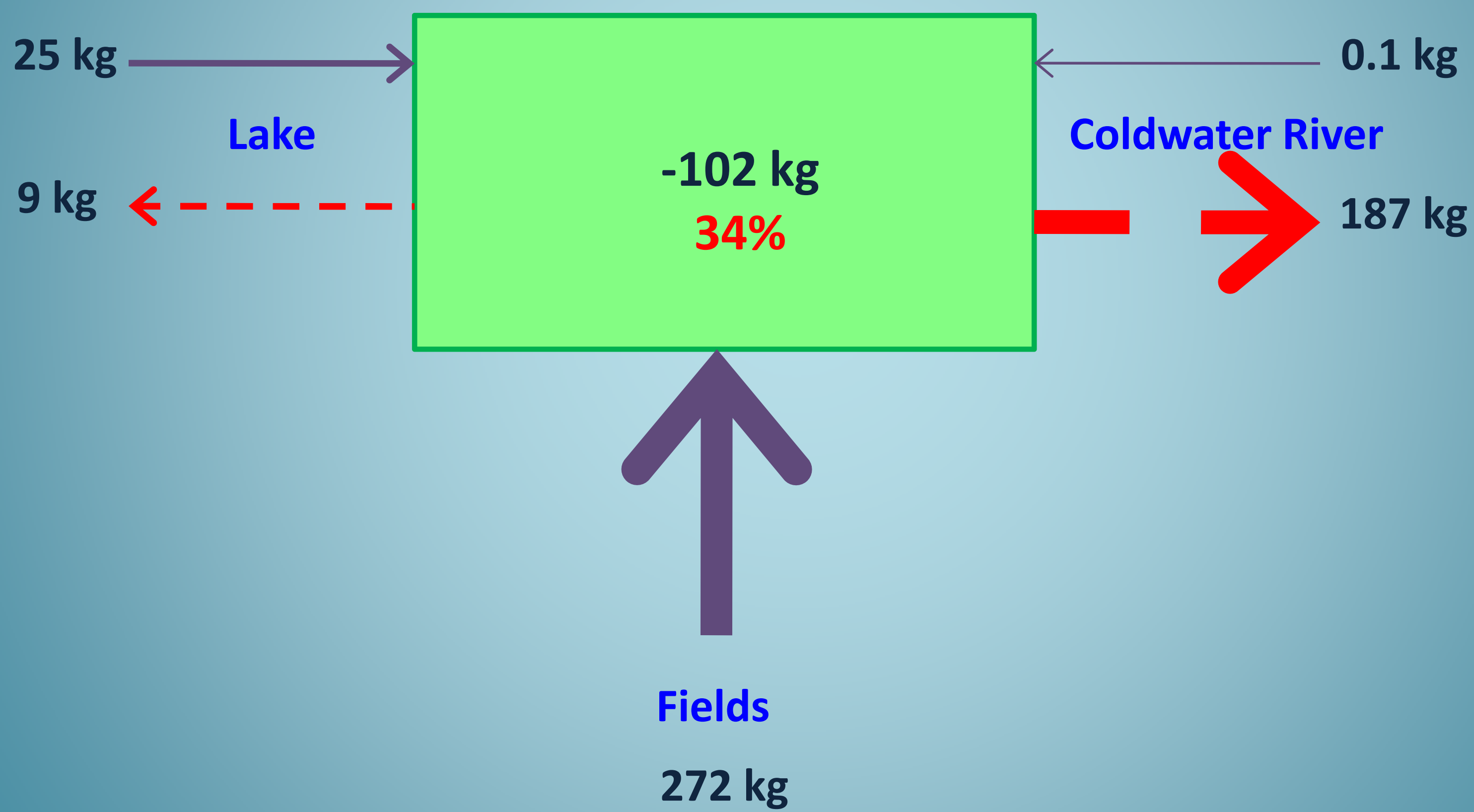
Wetland SS Budget



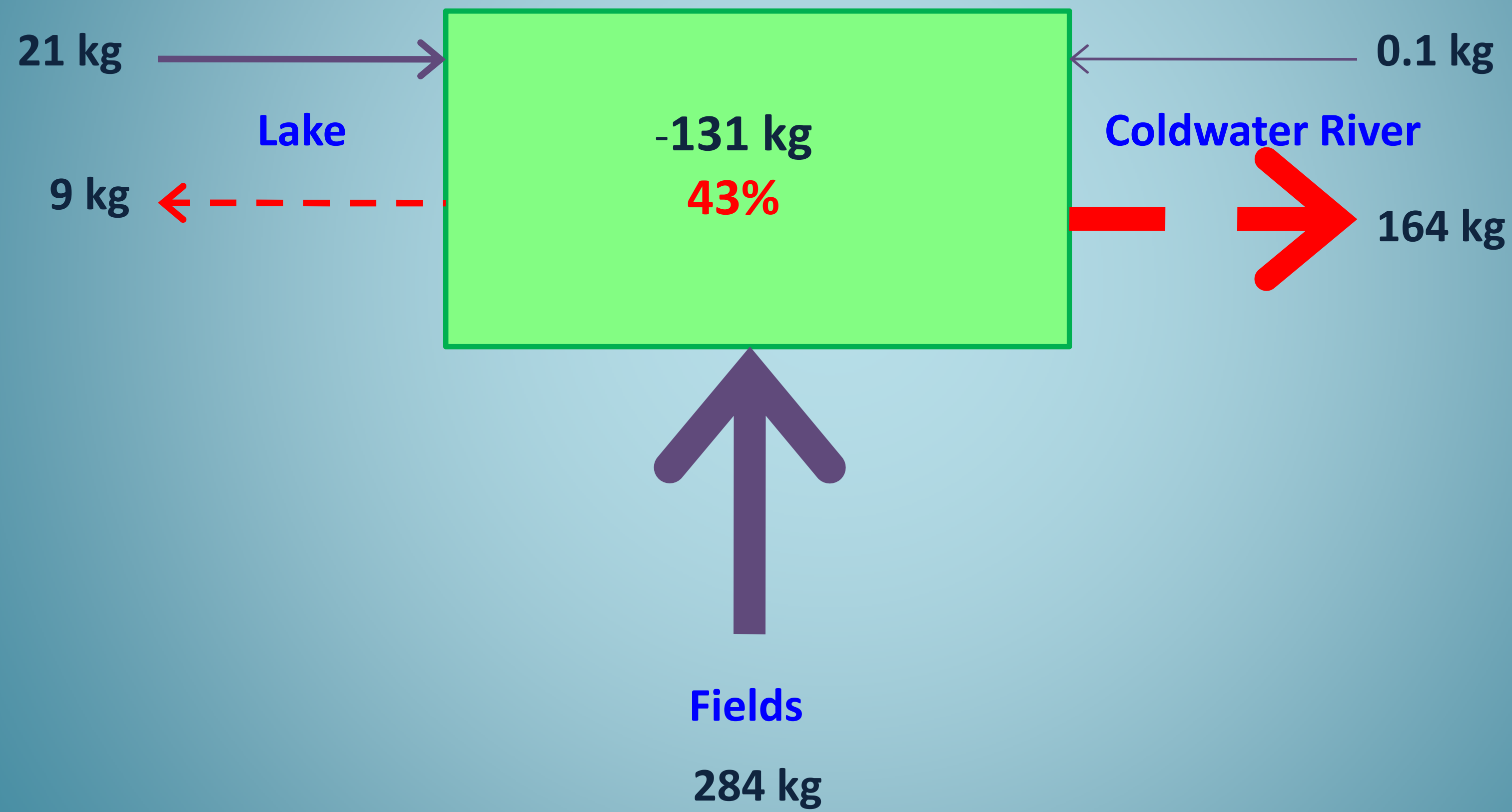
Wetland TP Budget



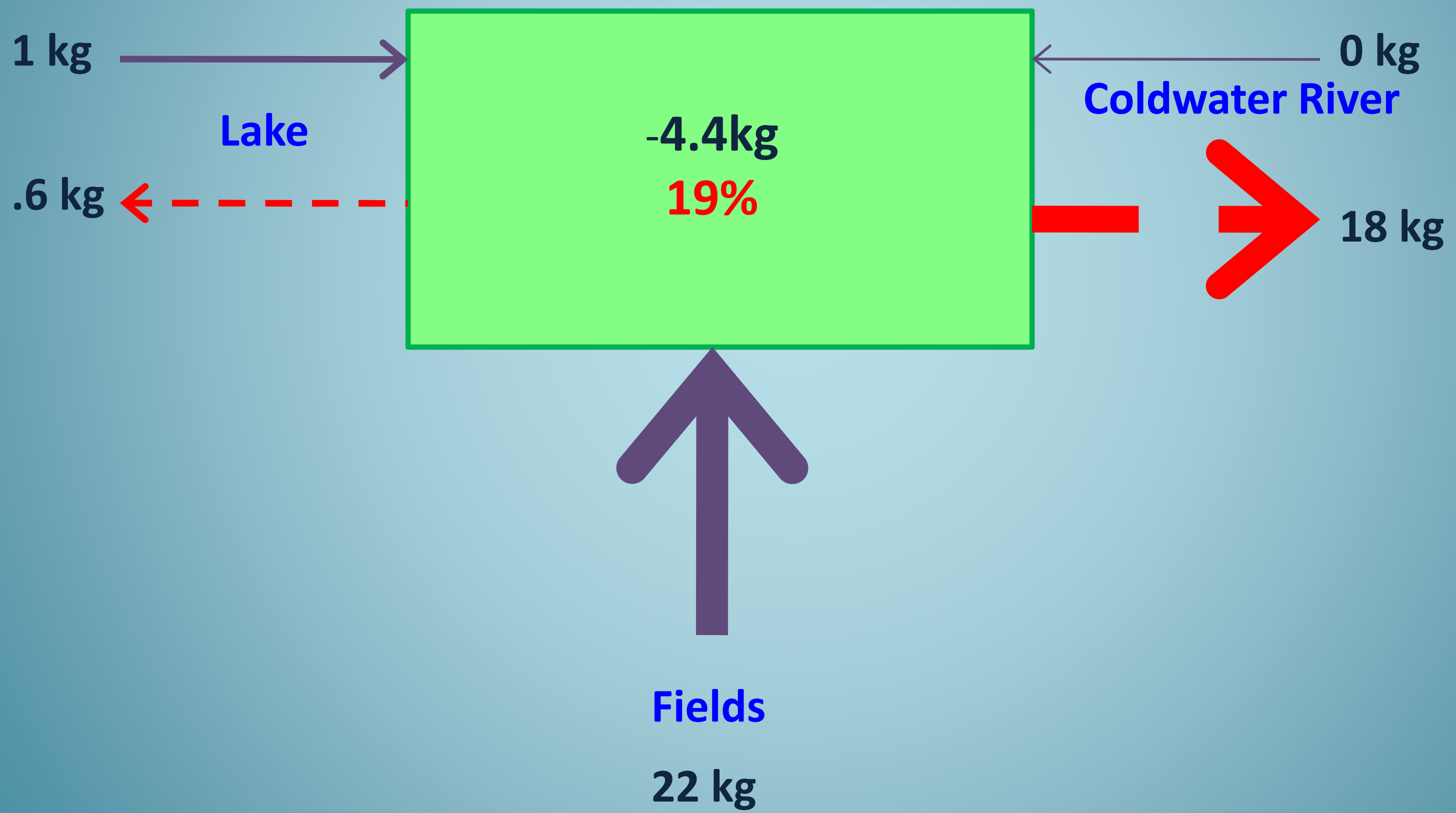
Wetland FP Budget



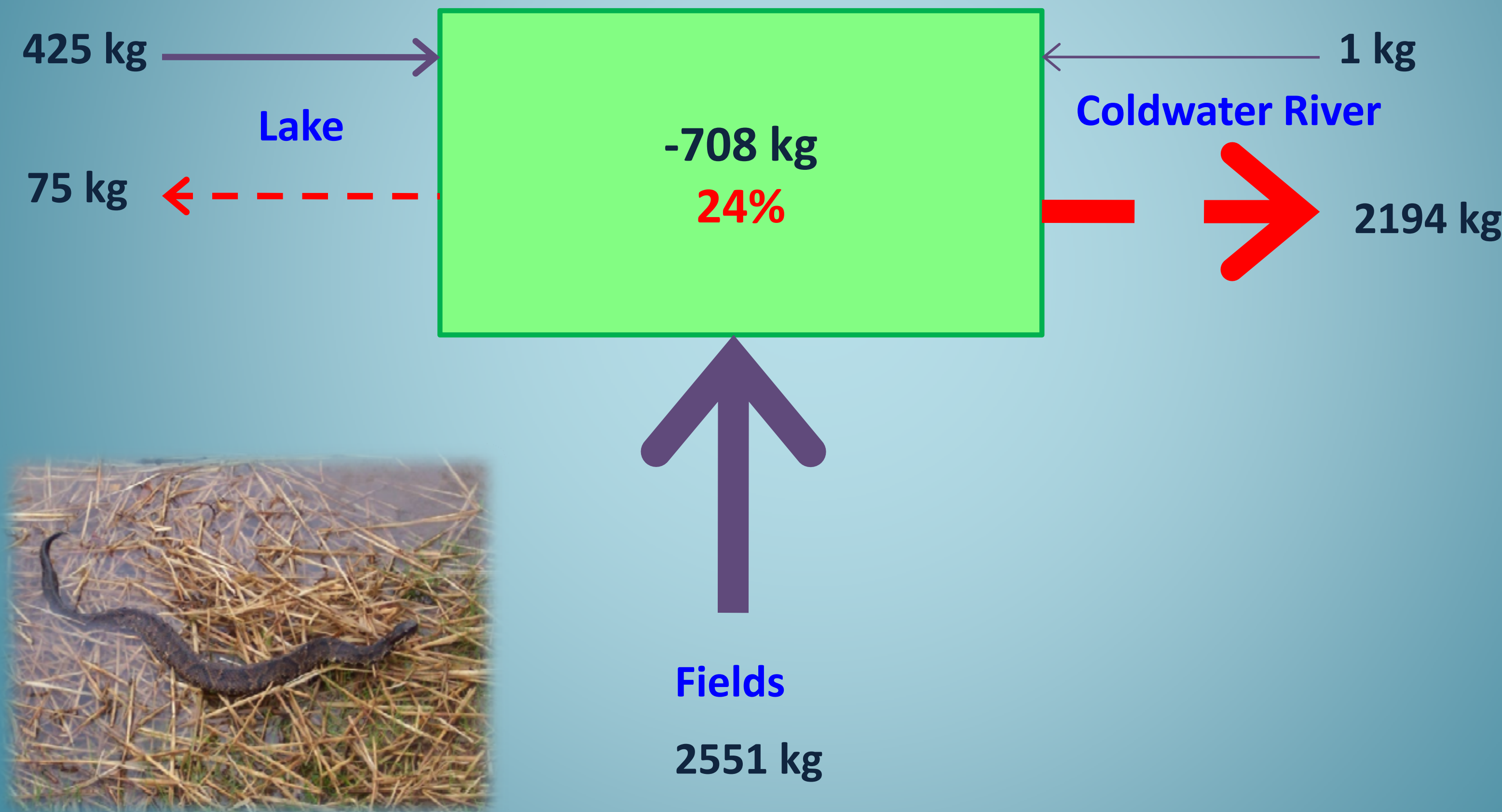
Wetland NO_3 Budget



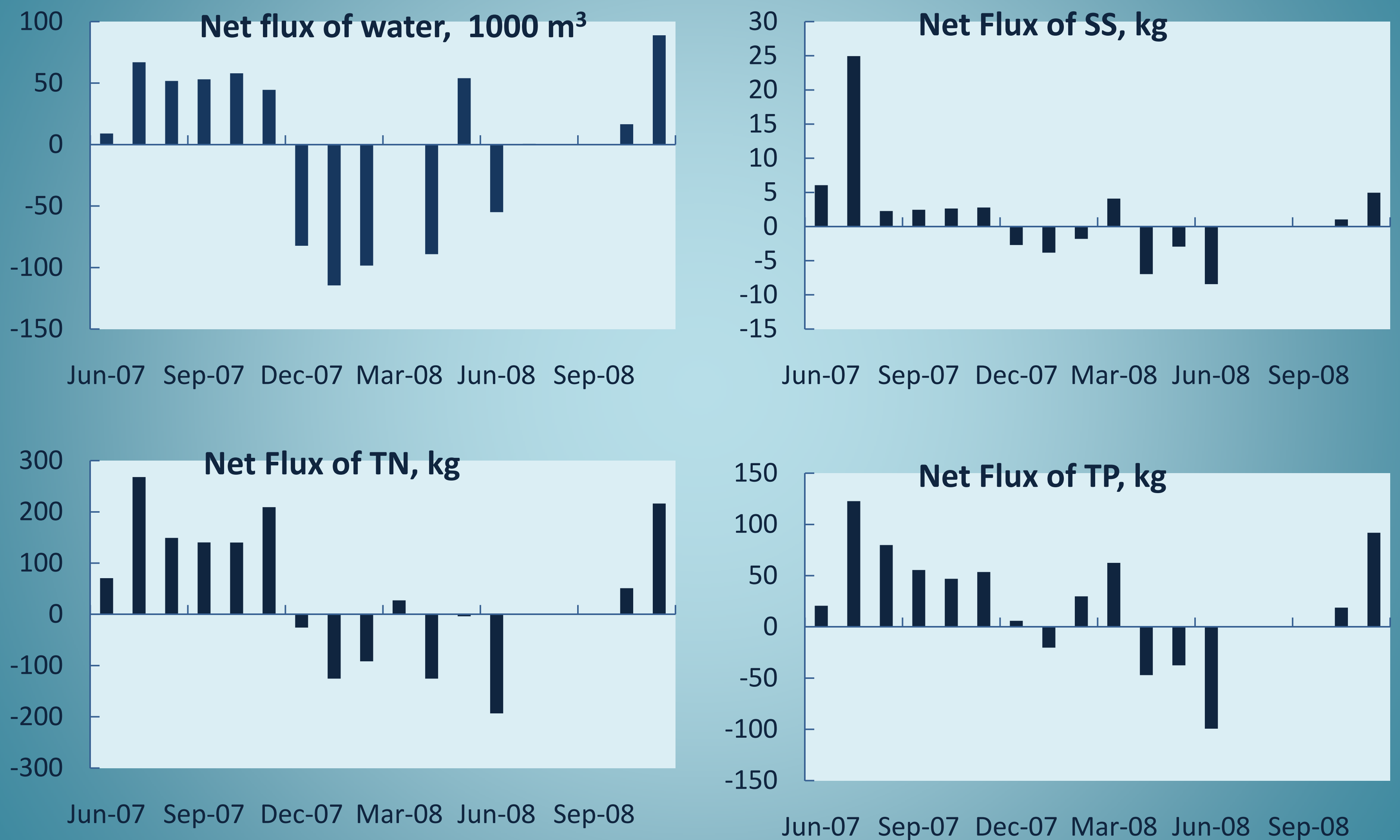
Wetland NH_3 Budget



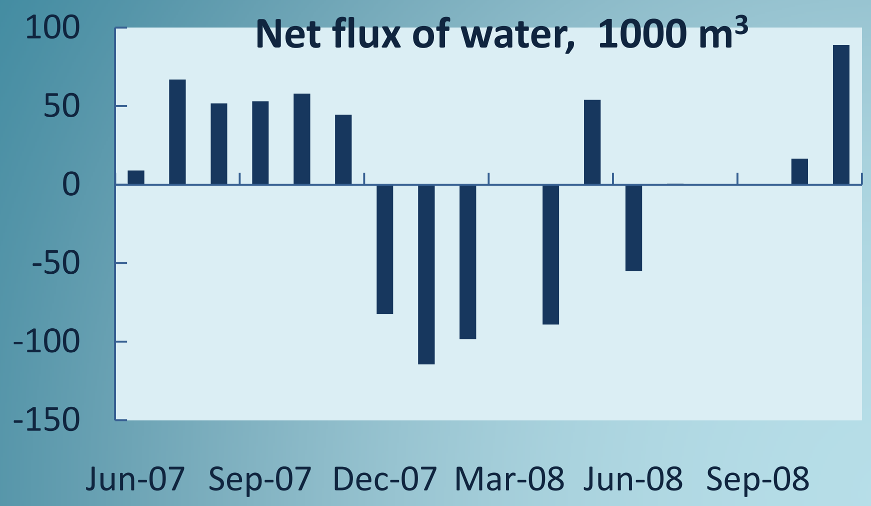
Wetland TN Budget

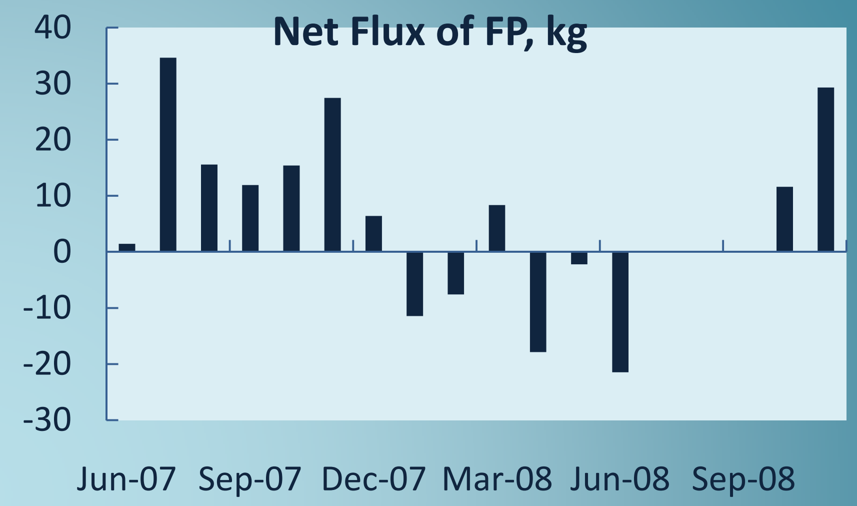


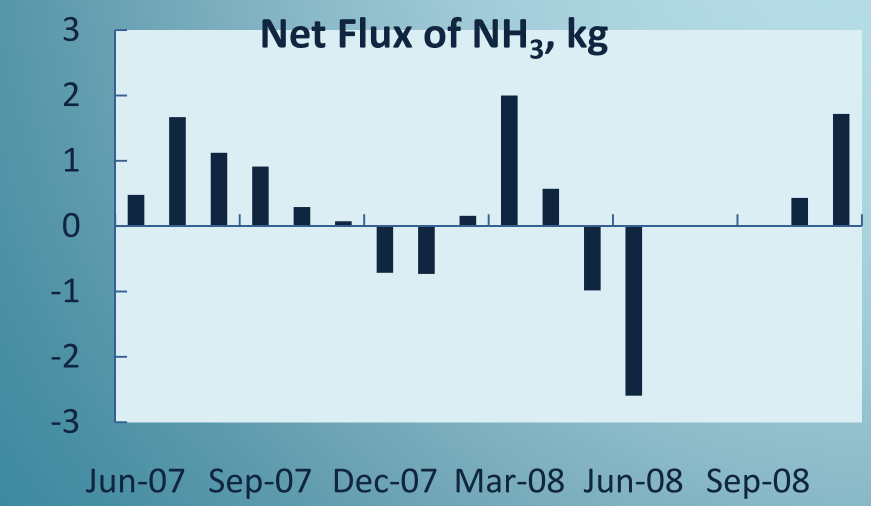
Monthly Net Flux

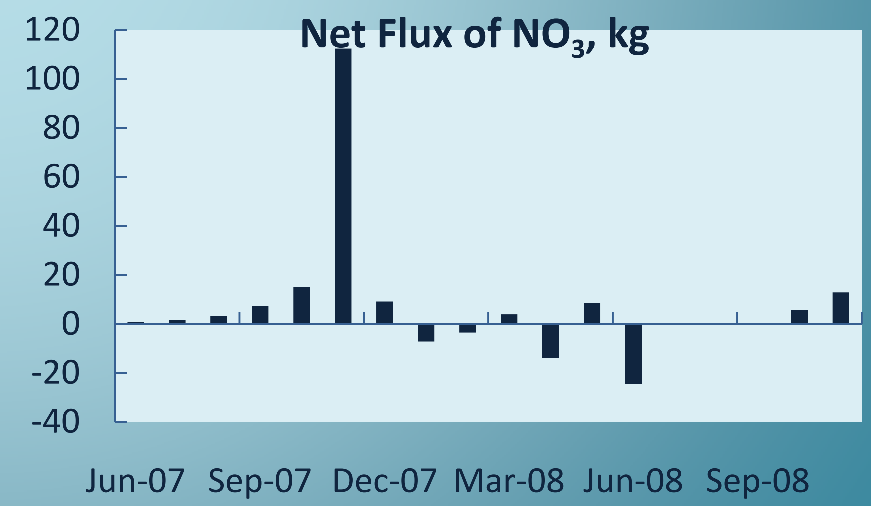


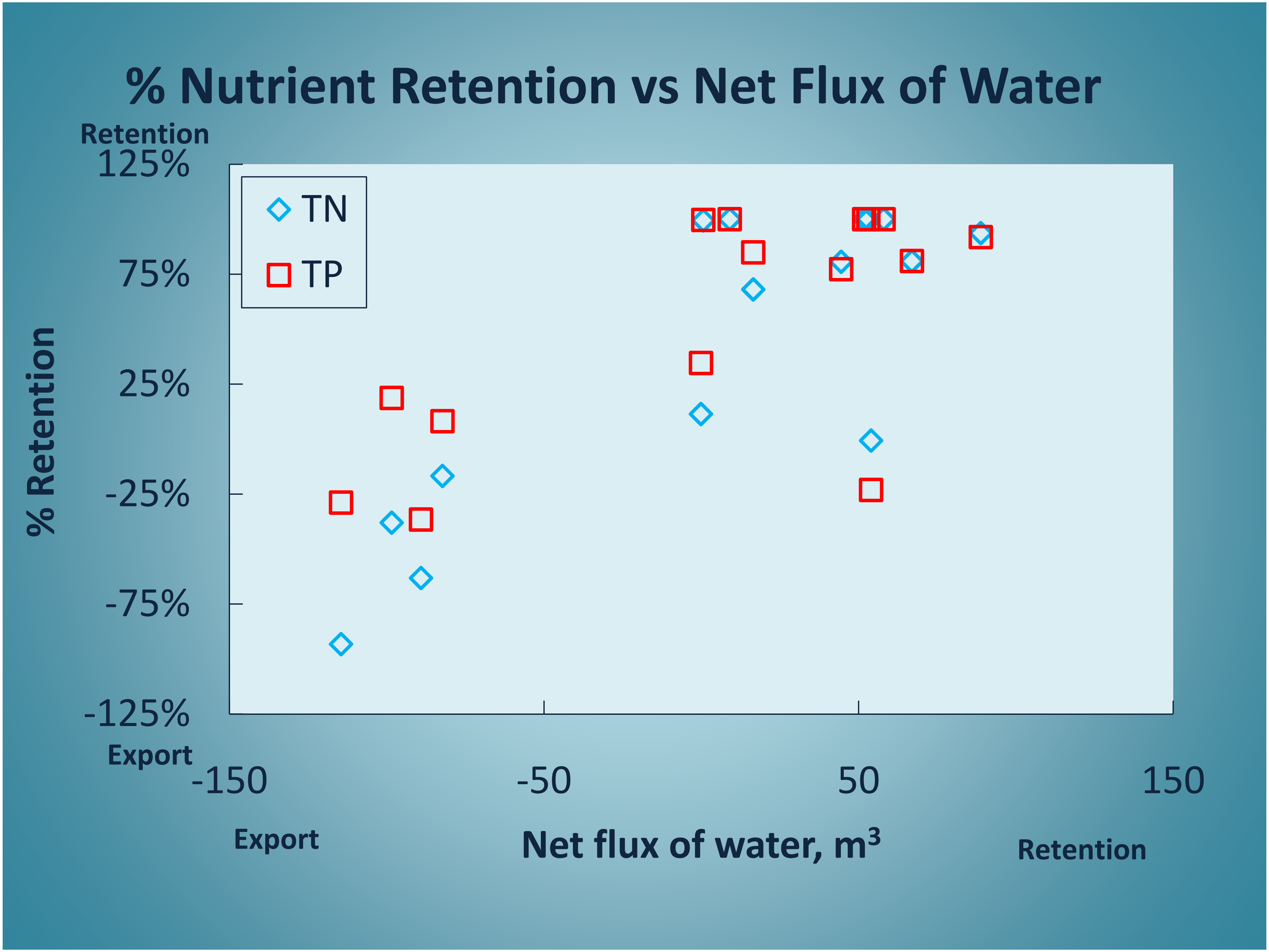
Monthly Net Flux, cont.










% Nutrient Retention vs Net Flux of Water
Retention
125%
75%
25%
-25%
-75%
-125%
Export
% Retention
TN
TP
-150
-50
50
150
Export
Net flux of water, m³
Retention

Conclusions

- Nutrient pollution from agricultural runoff is a problem globally, nationally, and locally
- With the exception of NO_3, the wetland proved effective in reducing concentrations of pollutants
- The wetland significantly reduced overall loads of all parameters
- Wetland performs best in drier periods, when retention time is increased
- More work is needed to assess performance during periods of intense interaction with the river