Hydrologic Phosphorus Transfer Following Field-Based Identification of Critical Source Areas

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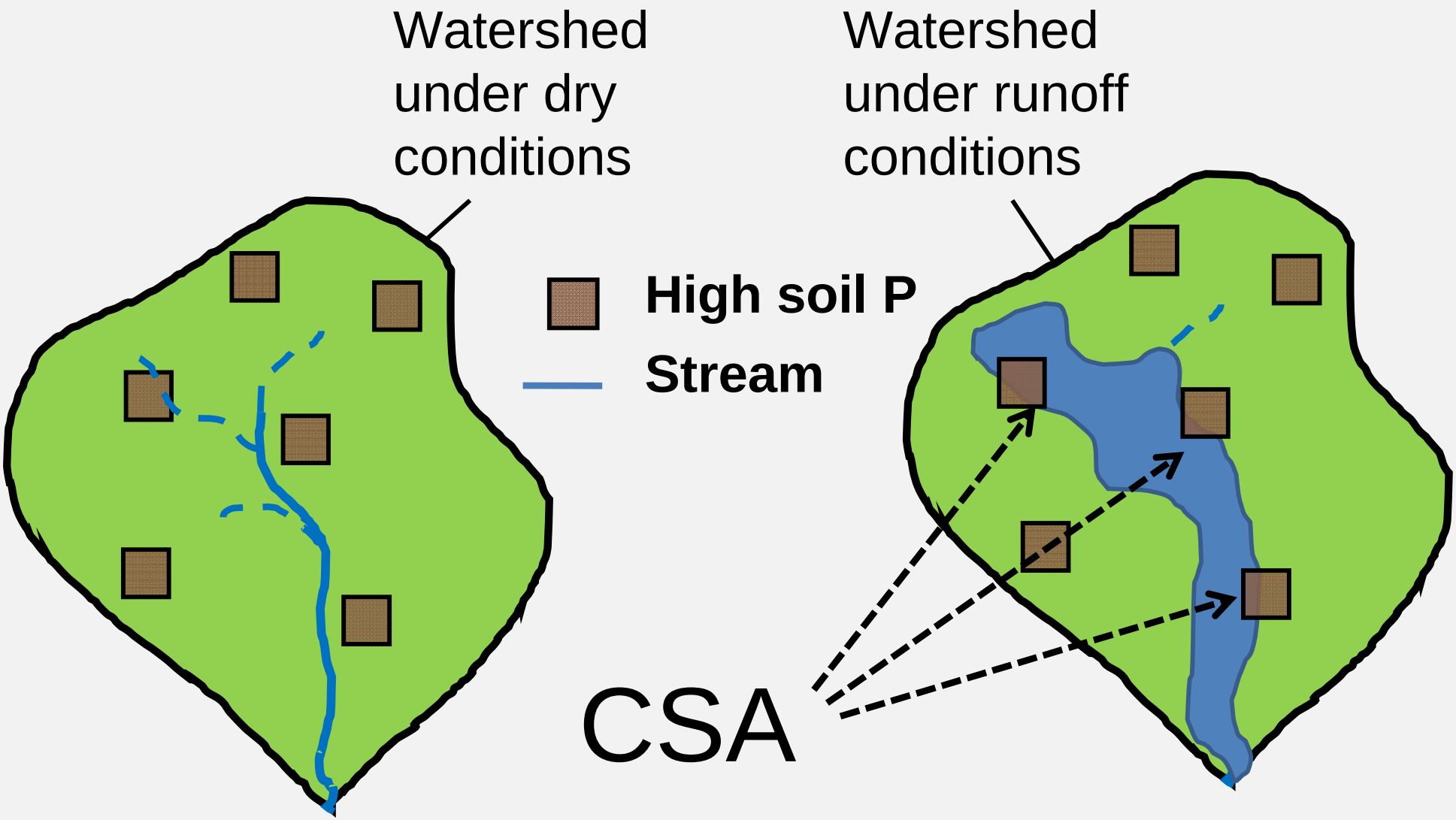
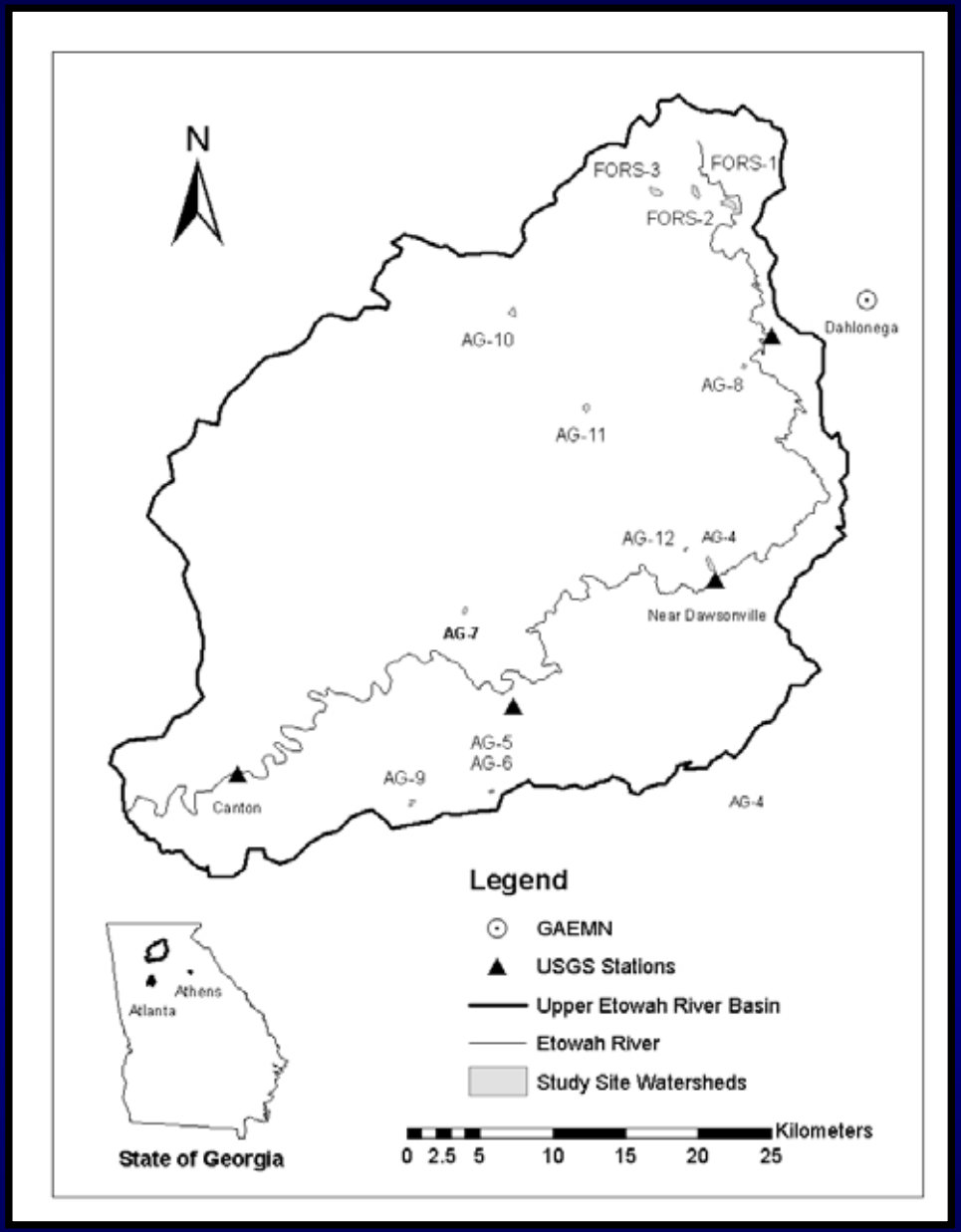
Critical Source Area (CSA) ≈ A "hotspot" where P and hydrologic source areas are co-located and connected to stream



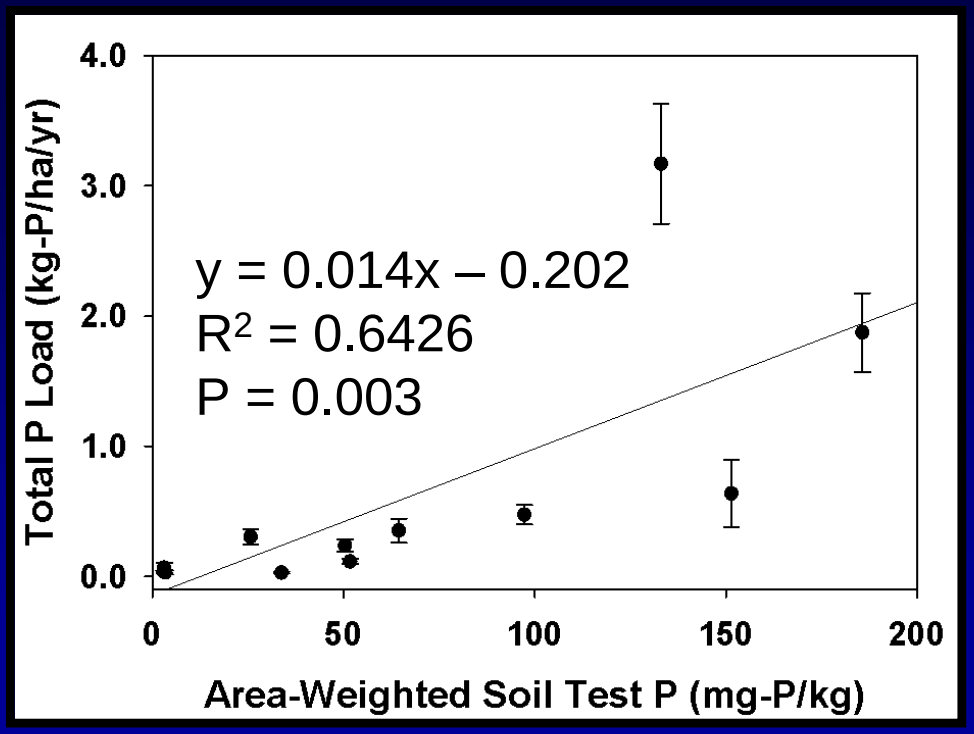
Upper Etowah River Basin Above Lake Allatoona

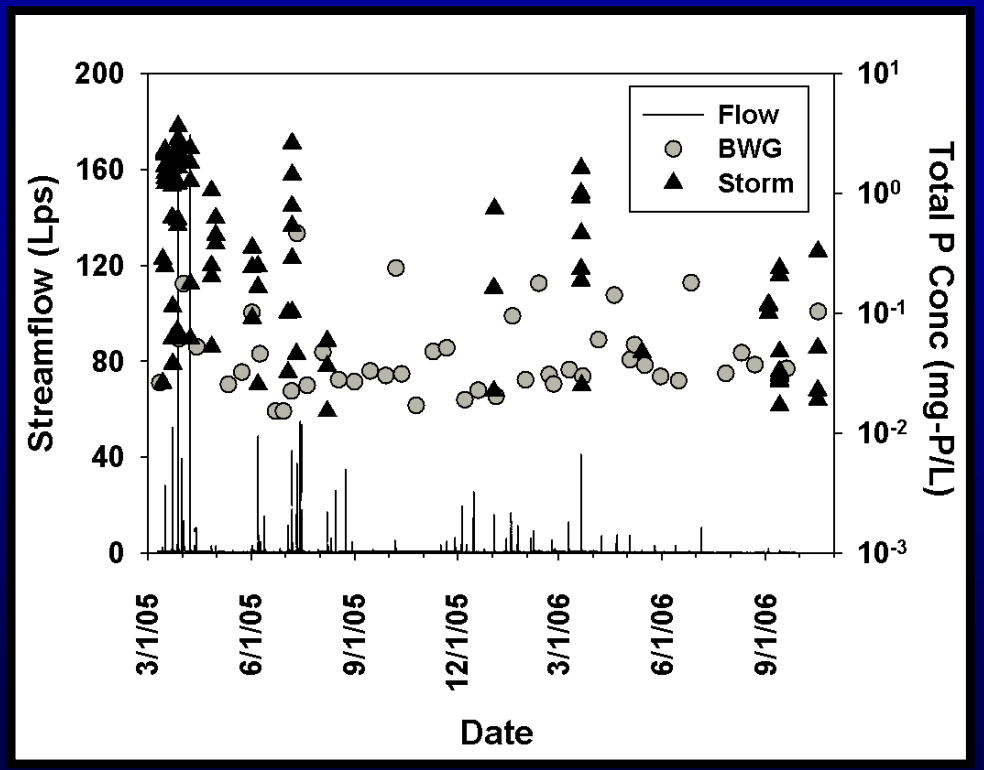
- Poultry farming since 1940s
- Rapidly growing suburbs
- Lake Allatoona 303(d)-listed
- CSREES-funded exploration of P-trading opportunities



PREVIOUSLY

- **Phosphorus yields:**
  - ***Forested sites 0.01 - 0.1 kg-P ha^{-1}***
  - ***Poultry-pasture sites 0.03 – 3.2 kg-P ha^{-1}***
  - ***Linear relationship with Mehlich-1 soil test P***
- **Streamflow P concentration relationships**
  - ***Among sites***
  - ***Within sites***

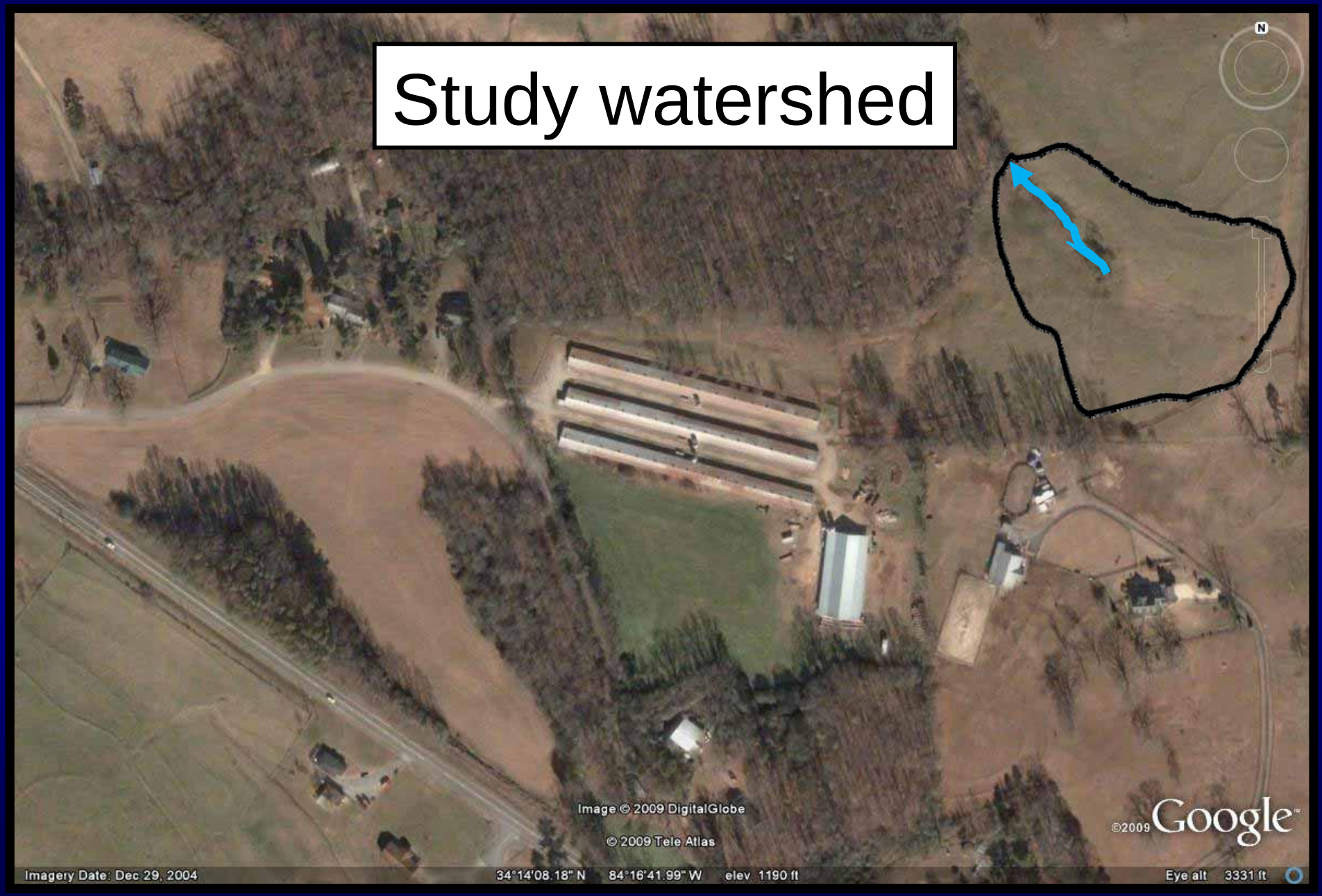




Objectives

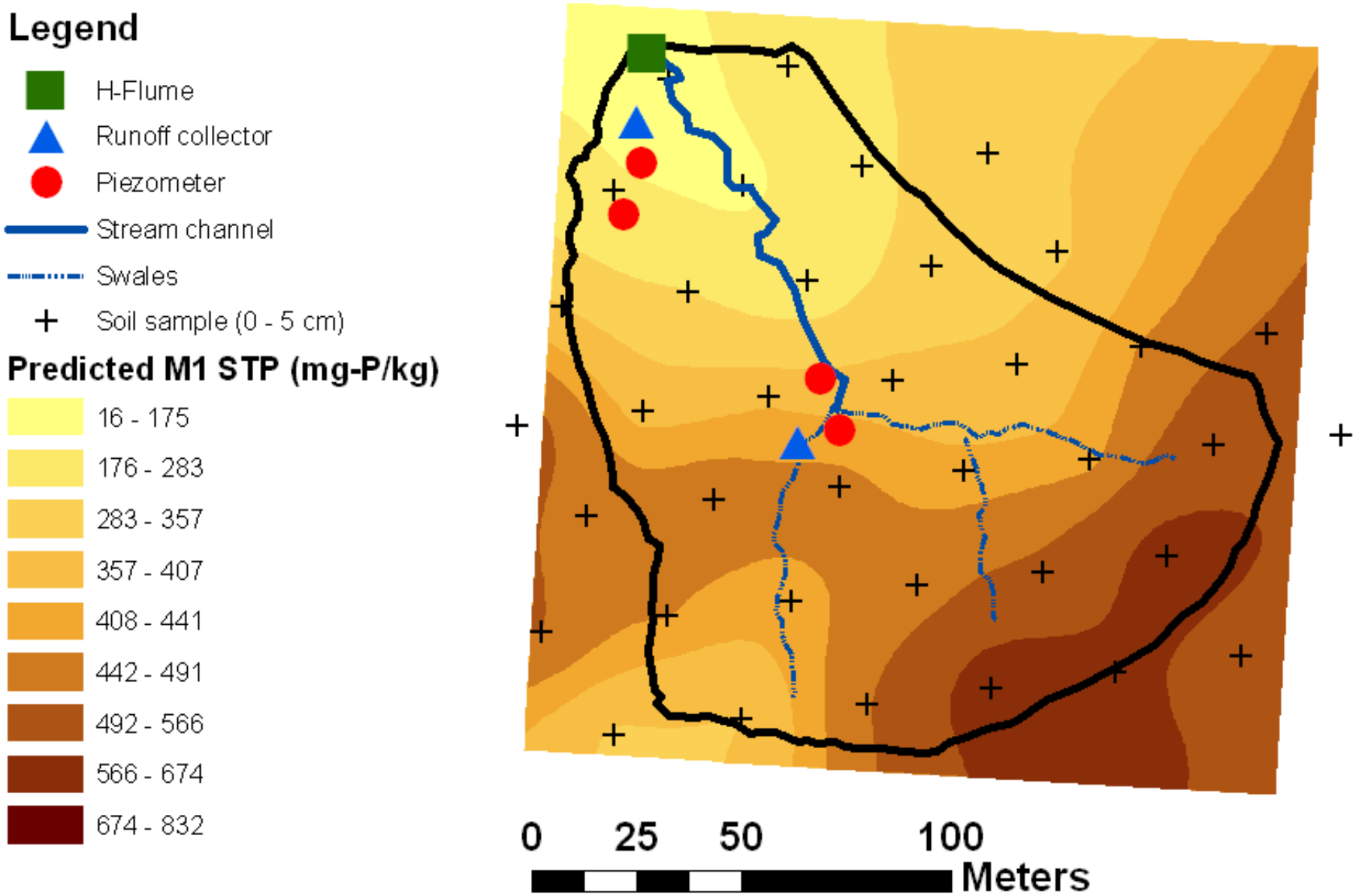
1. Identify P critical source areas
2. Characterize runoff-generation mechanisms
3. Examine P forms in different hydrologic pathways

Site AG-5 Poultry Farm



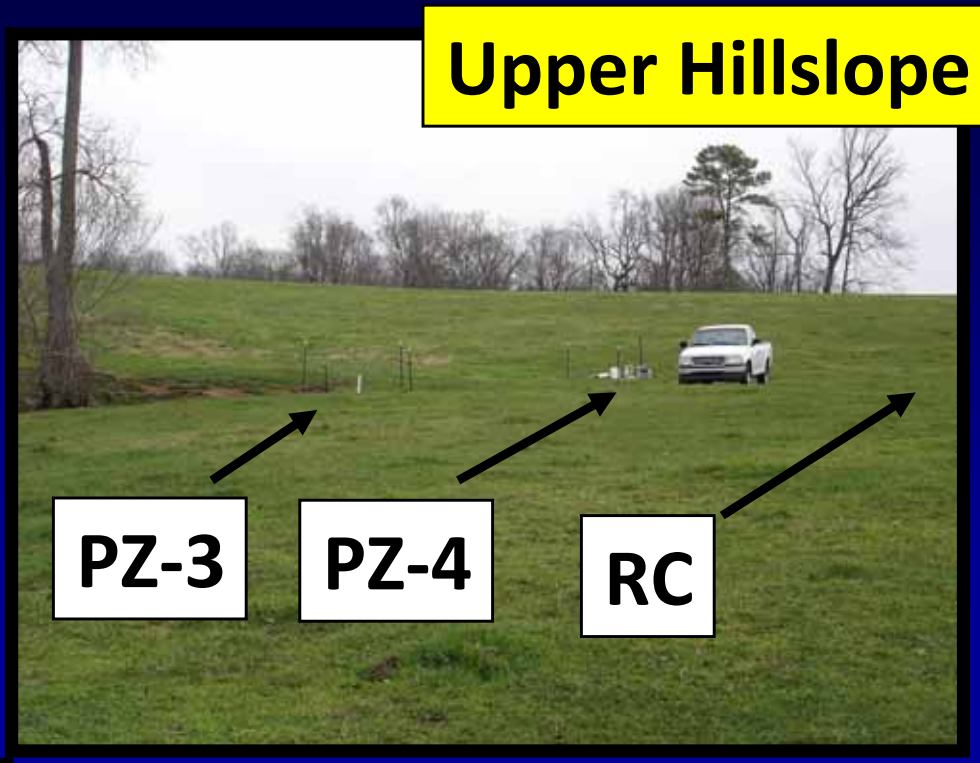
Site AG-5 Watershed Map:

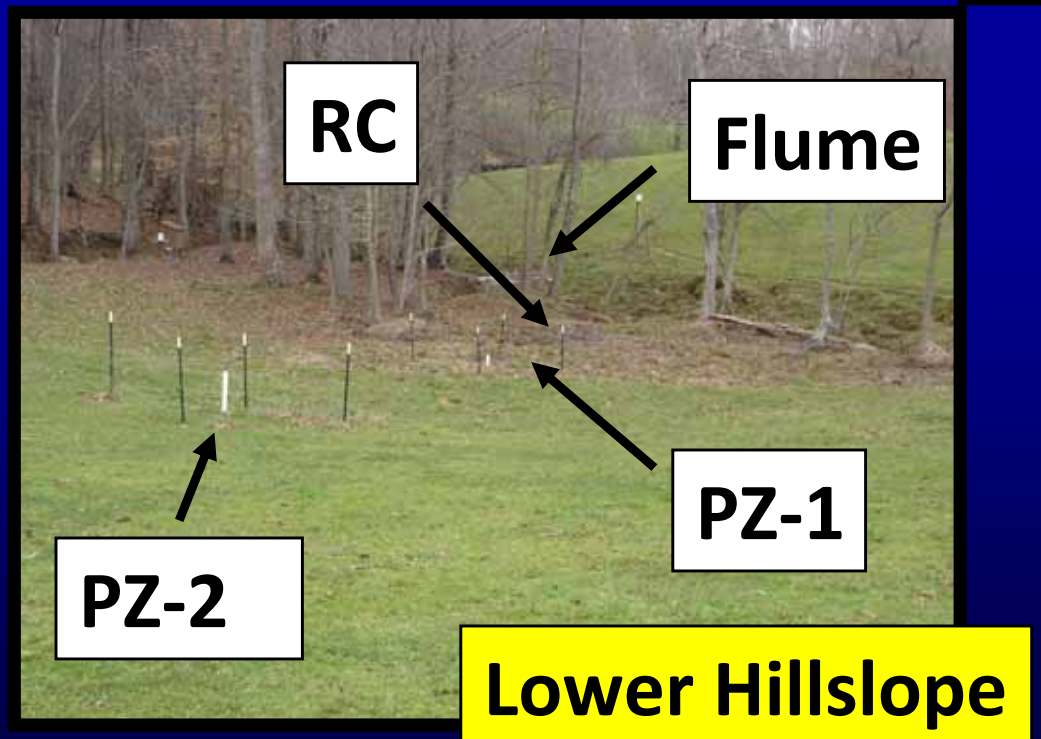
Hydrologic and Soil Sample Locations with Interpolated Mehlich-1 Soil Test Phosphorus



Hydrologic Monitoring

- *Streamflow*
- *Piezometers (PZ)*
- *Runoff collectors (RC)*





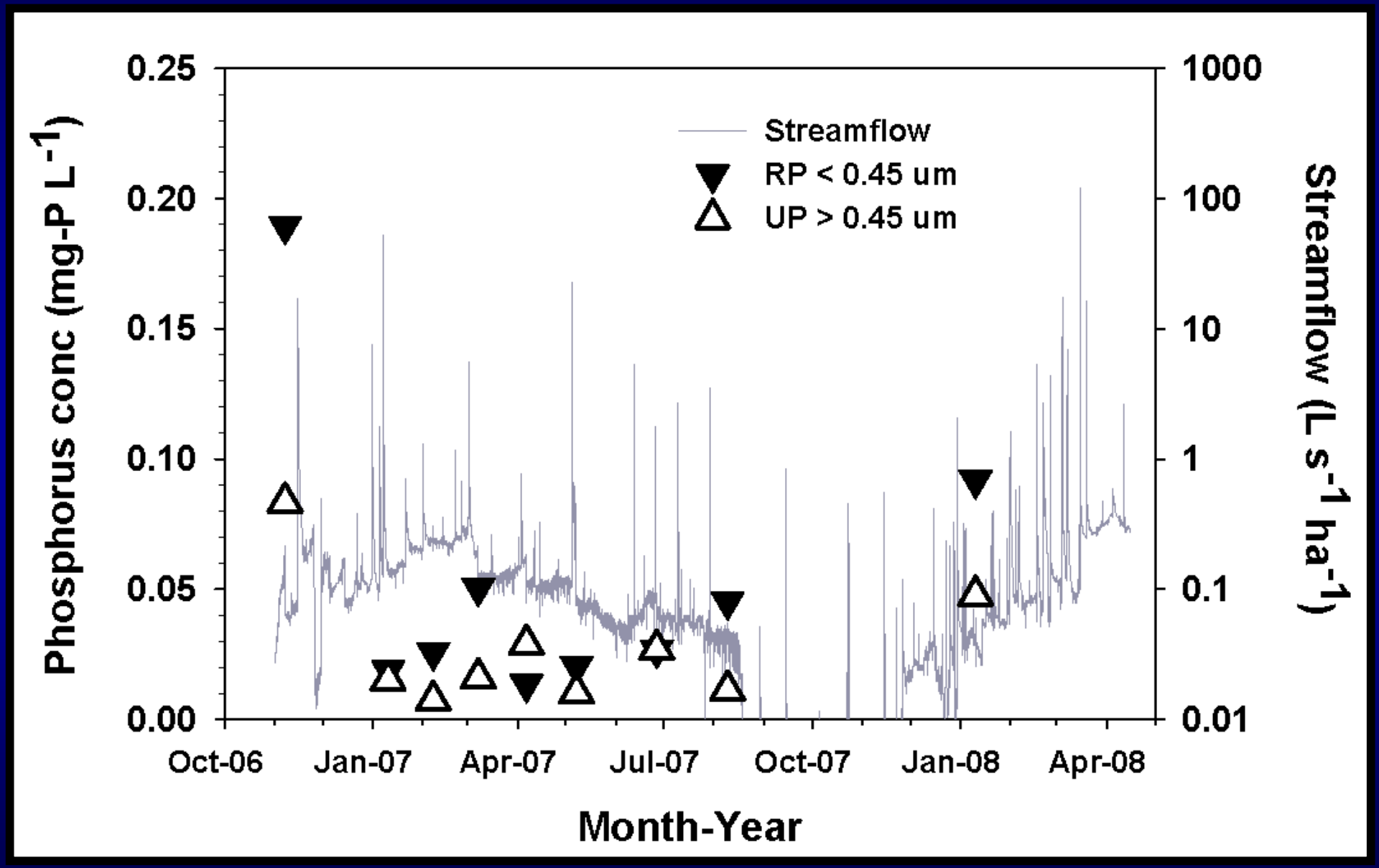
Stormwater Runoff Sampling

- Collectors positioned near edge-of-field or below swales
- Simple design

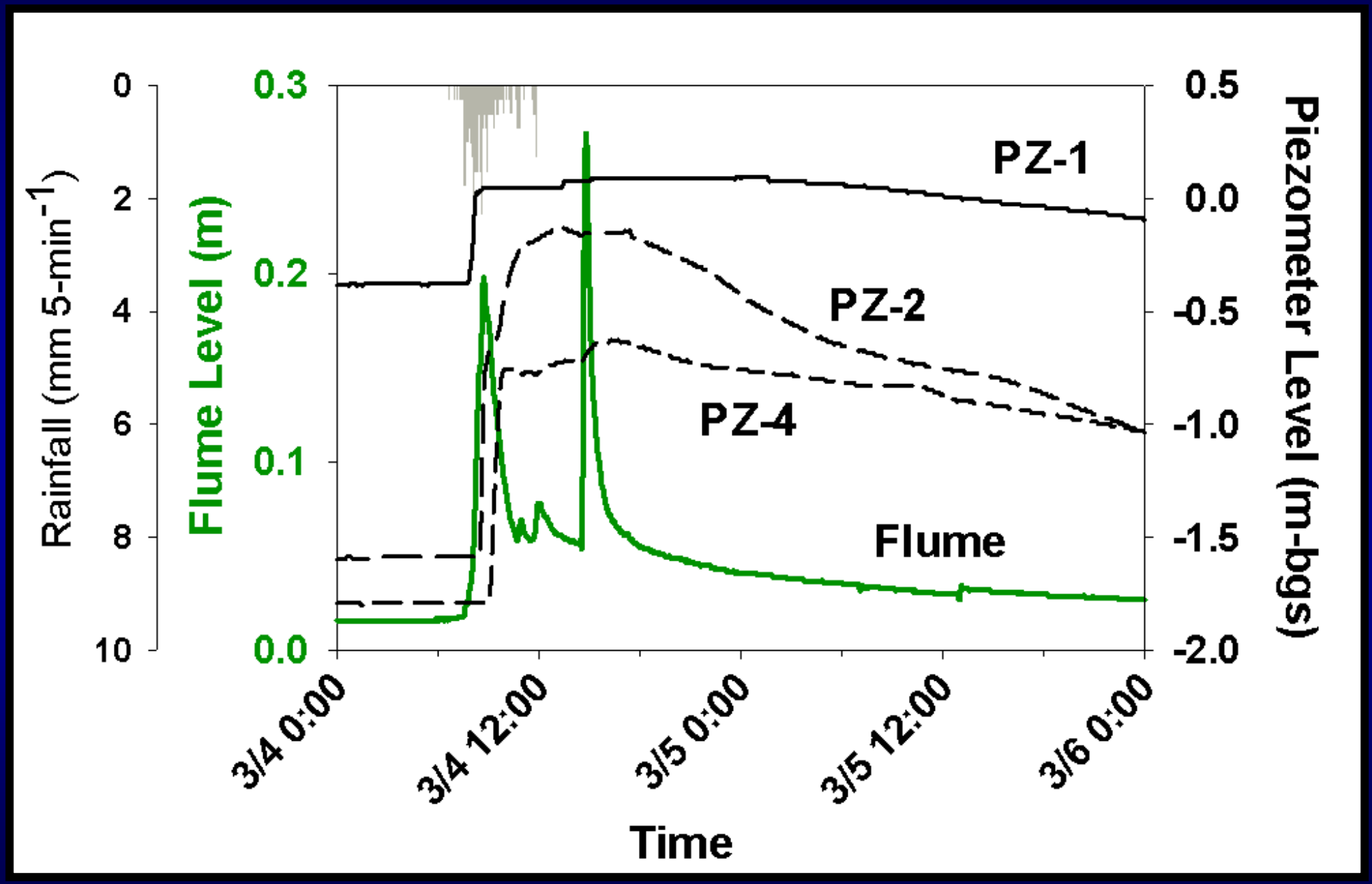
Water Quality Sampling and Analysis

- Monthly sampling
- Storm event sampling
- Laboratory analyses
  - *RP and UP*
  - *< 0.45 um and > 0.45 um*
- Physicochemical parameters

Streamflow and Monthly Samples—P forms

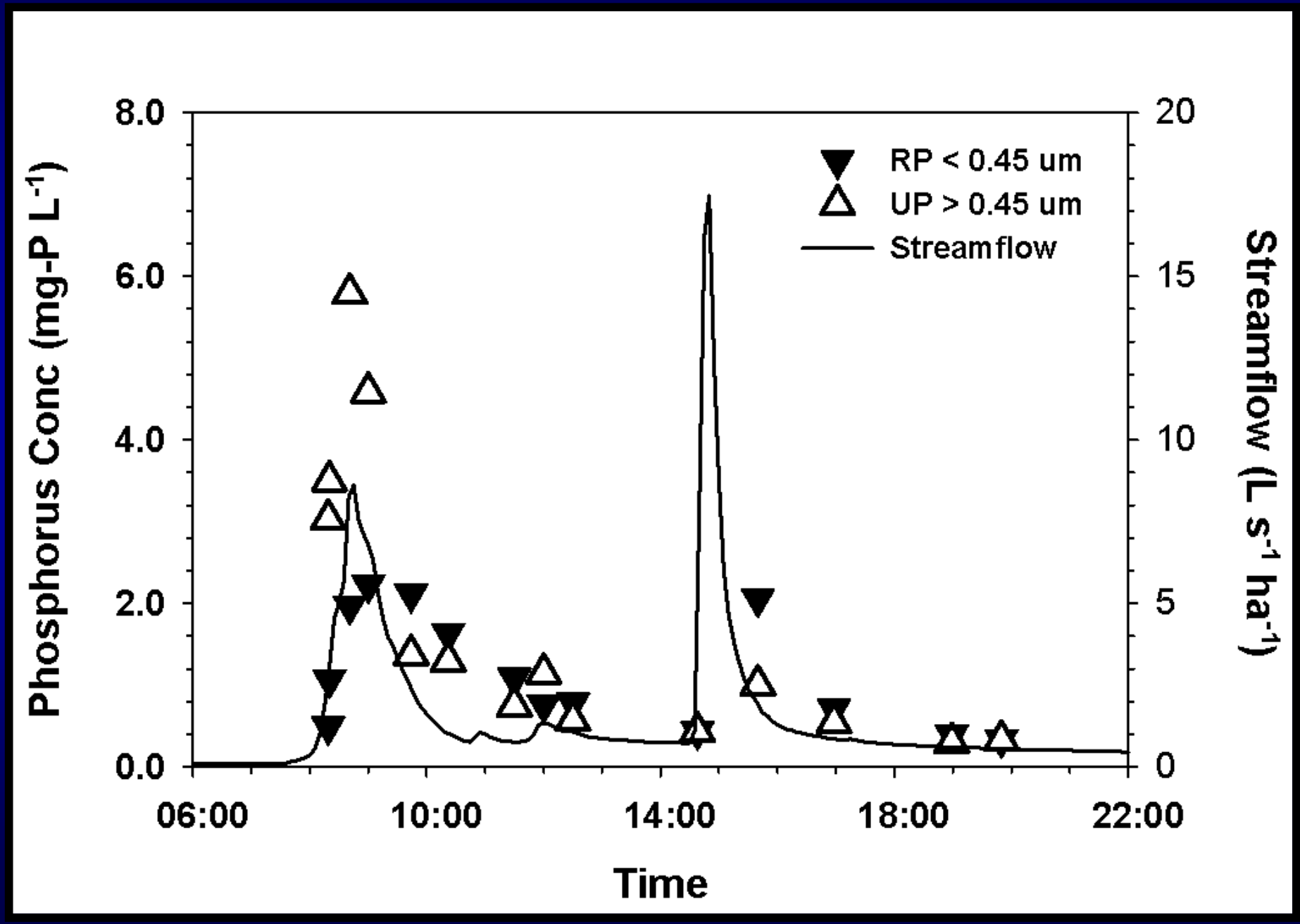


March 4, 2008 Storm Event—Hydro Response

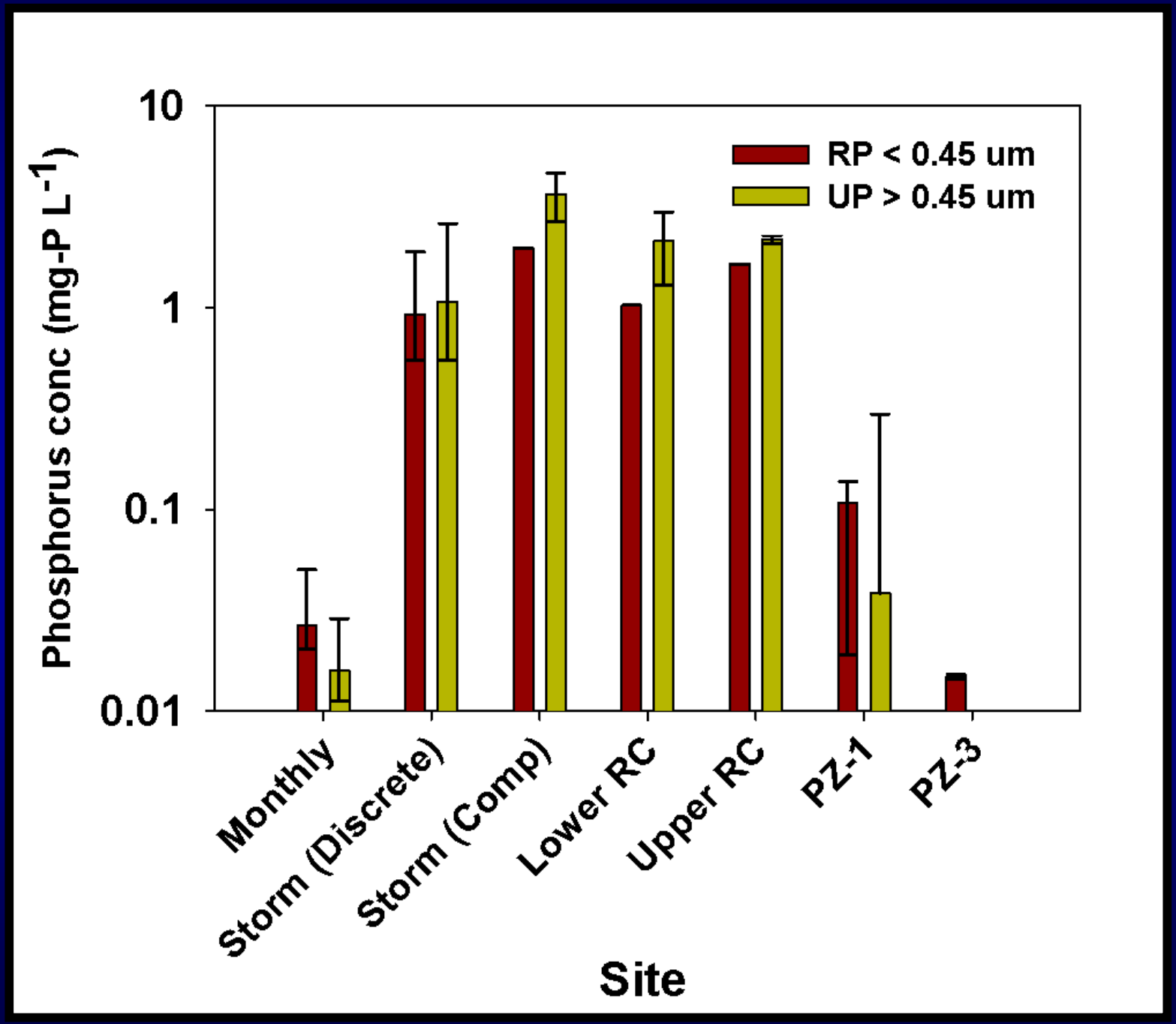


March 4, 2008 Event* Streamflow and P forms

*Litter application ~Feb 26, 2008



Comparison of P Forms by Pathway + Flow Regime



Summary

- **Elevation gradient in M-1 STP with moderate spatial correlation**
- **Hydrologic pathway P content varies by pathway and flow regime**
- **Critical source areas**
  - ***High P source area coupled with infiltration-excess runoff***
  - ***Low P source area coupled with saturation-excess runoff (i.e. VSA)***

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