

Second Annual Lamprey River Symposium

January 16, 2009

University of New Hampshire

Lamprey River Hydrologic Observatory

- Watershed is a platform to study the hydrology and biogeochemistry of a suburban basin
- Focal point for research, teaching and outreach
- Participating UNH departments to date:
 - Natural Resources & the Environment
 - Earth Sciences
 - Civil Engineering
 - Climate Change Research Center

LRHO Research Questions

Bill McDowell's group / NH Water Resources Research Center

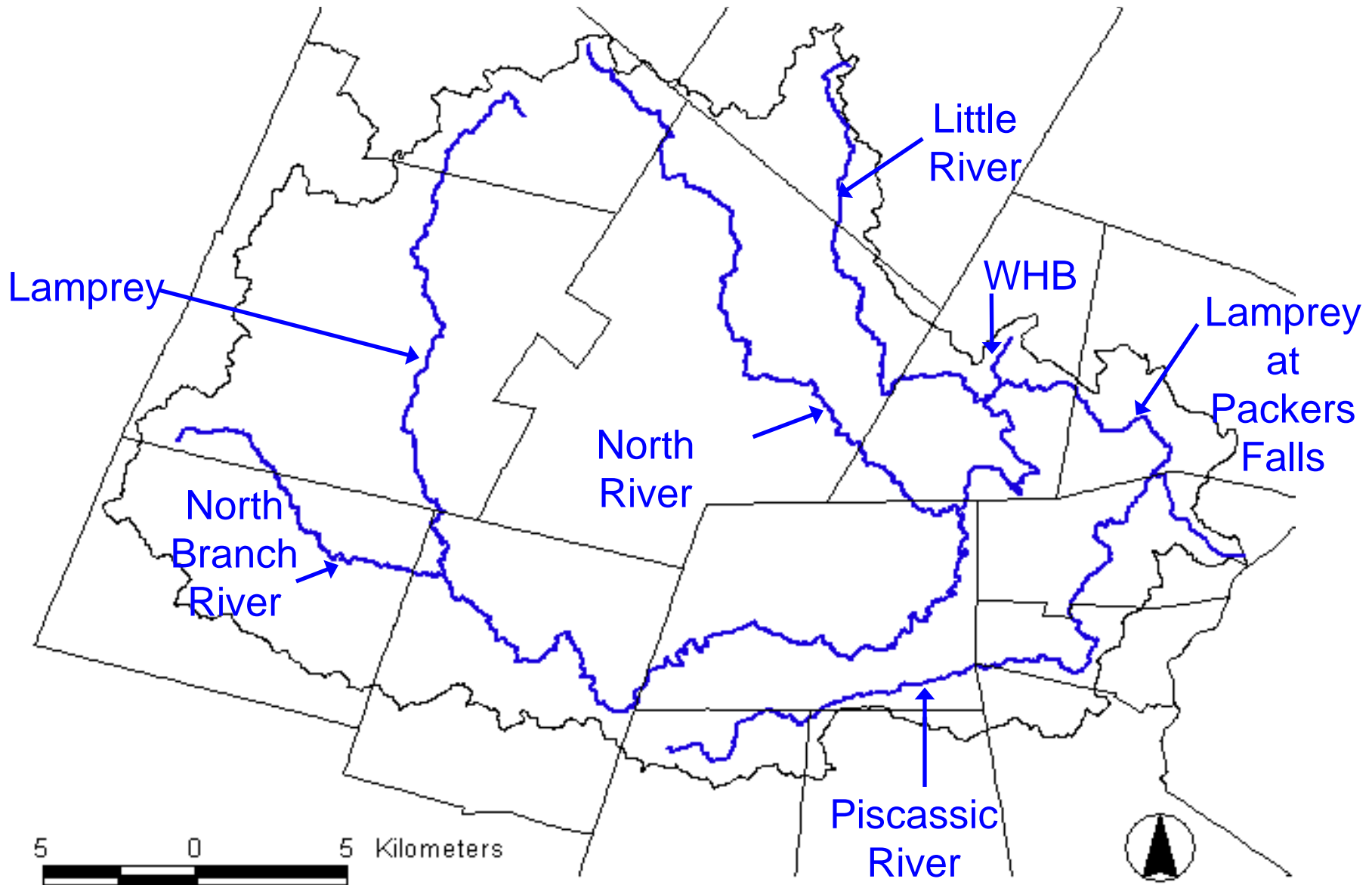
1. Can spatial variability in surface water and groundwater chemistry be predicted by watershed attributes?
2. Is suburbanization driving long-term trends in stream chemistry?
3. What controls long-term watershed N balance?



Lamprey River Hydrologic Observatory

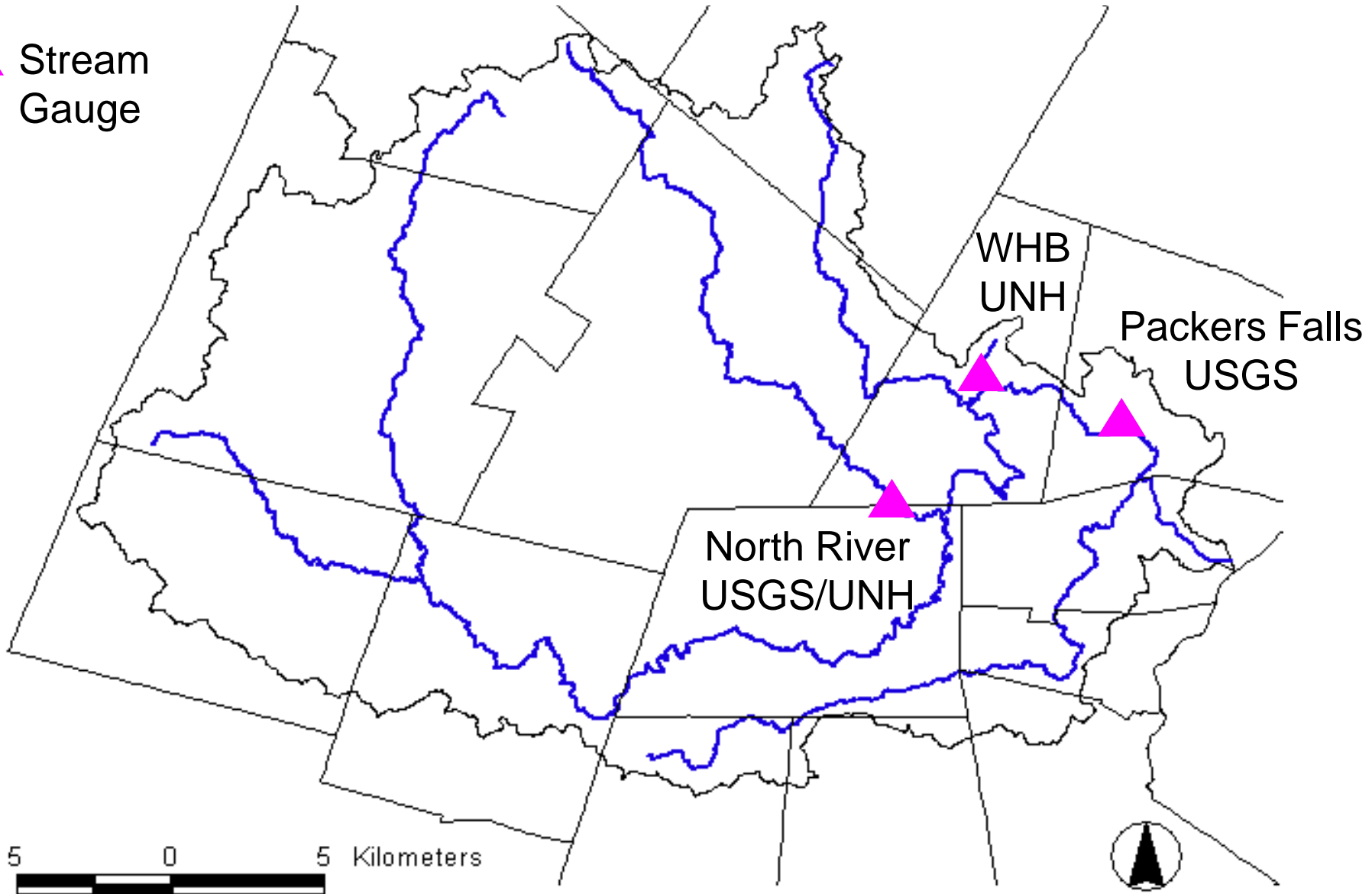


Lamprey River Hydrologic Observatory

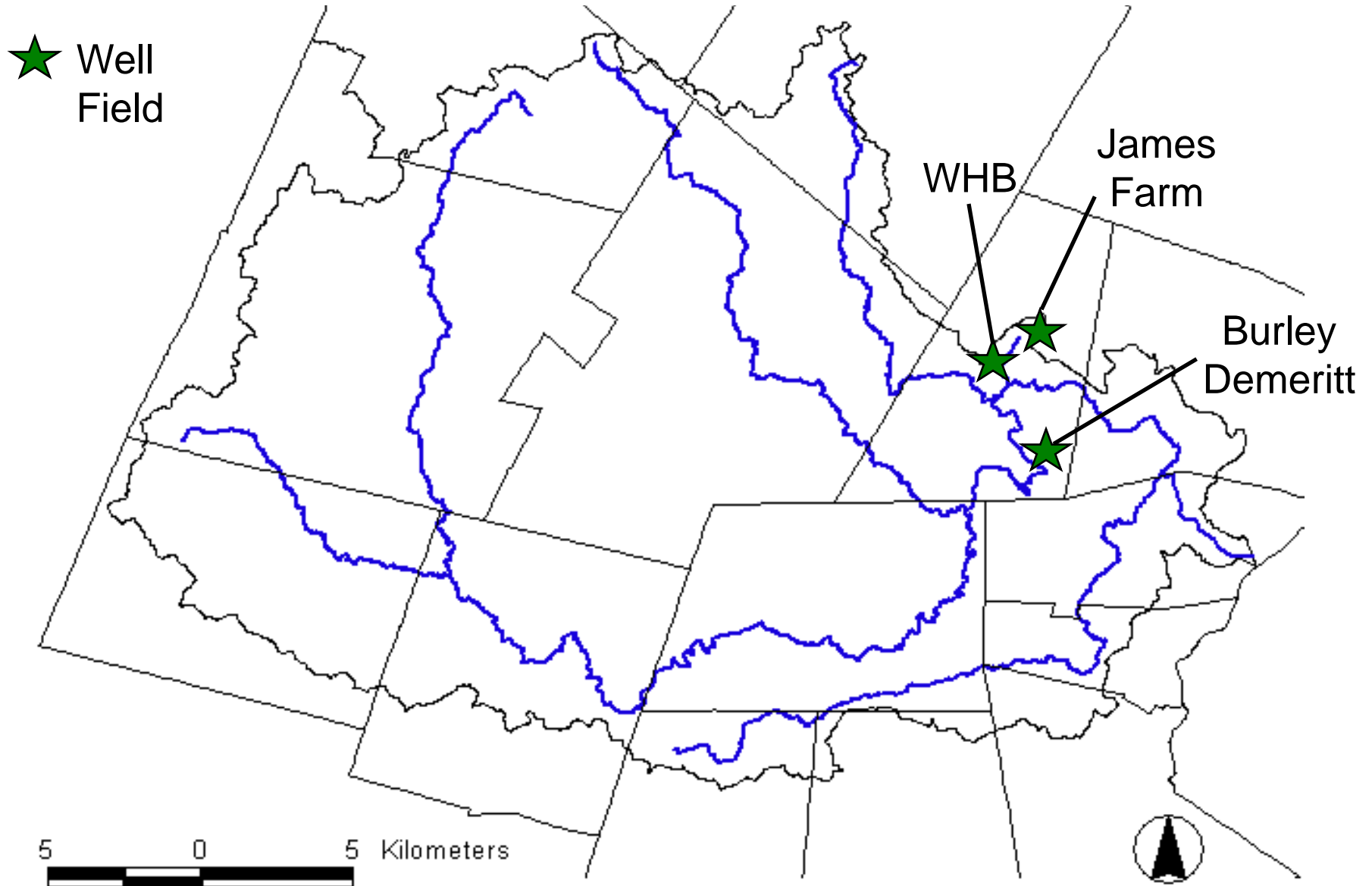


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▲ Stream Gauge

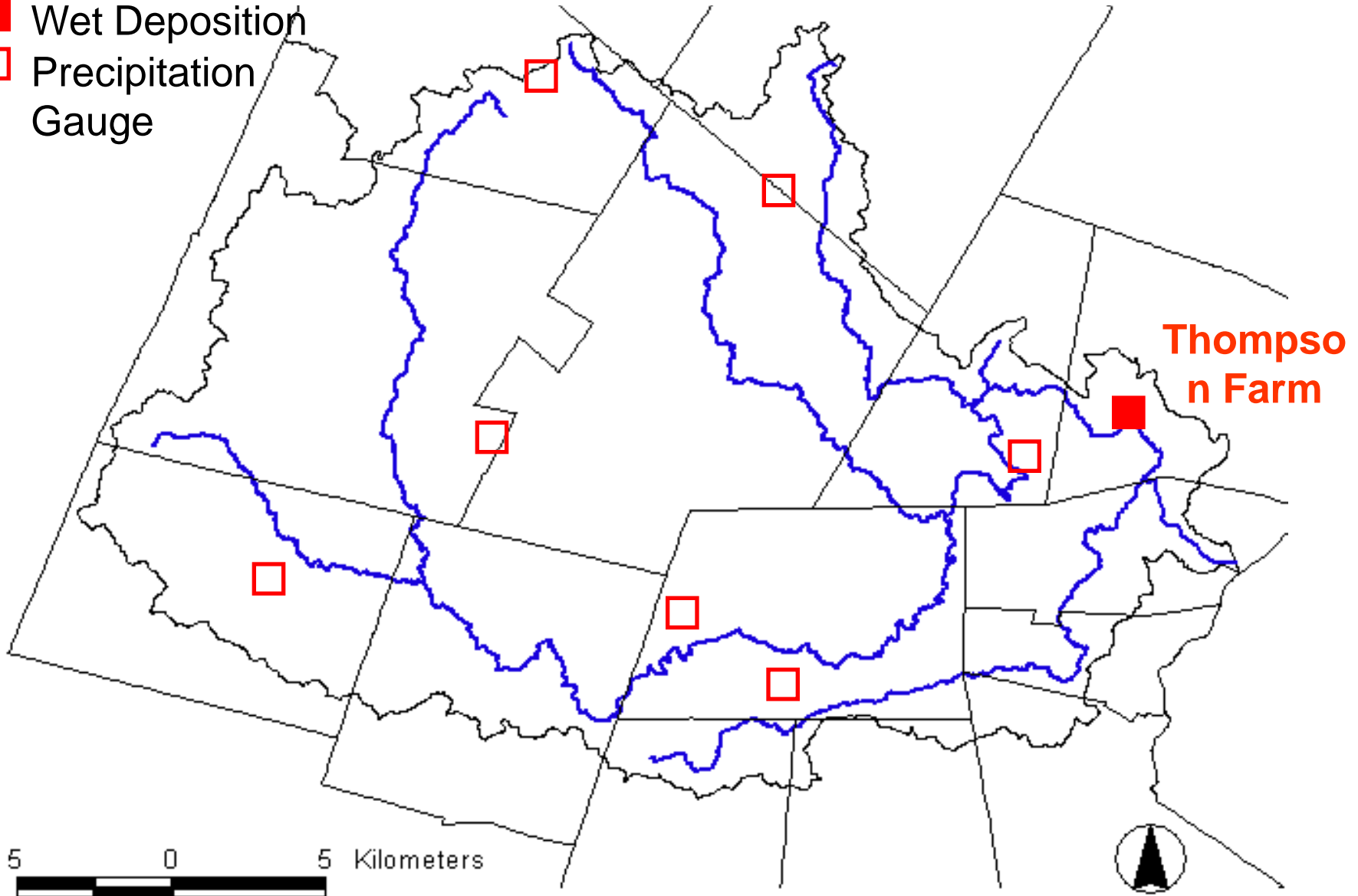


Lamprey River Hydrologic Observatory



Lamprey River Hydrologic Observatory

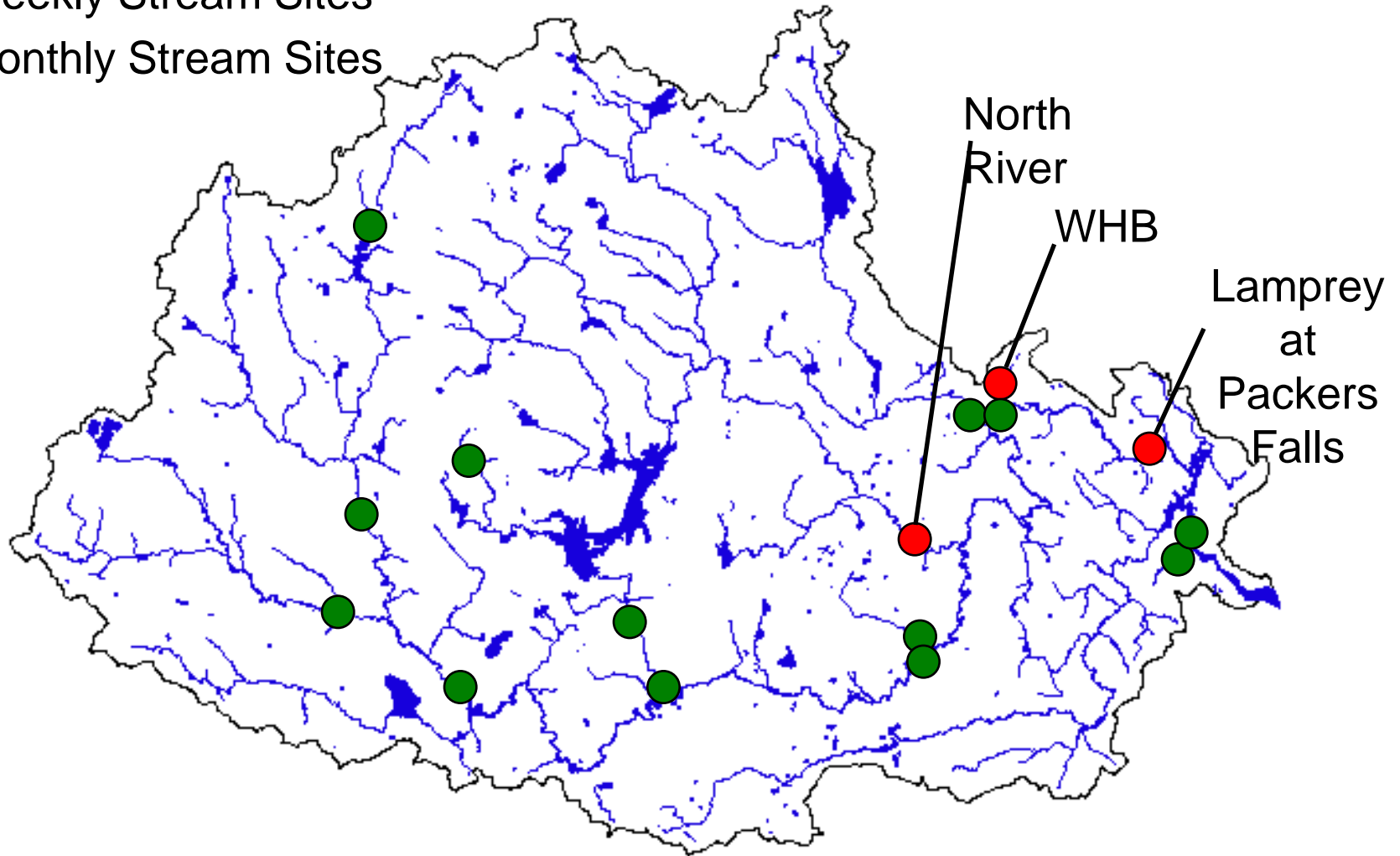
- Wet Deposition
- Precipitation Gauge



Lamprey River Hydrologic Observatory

● Weekly Stream Sites

● Monthly Stream Sites

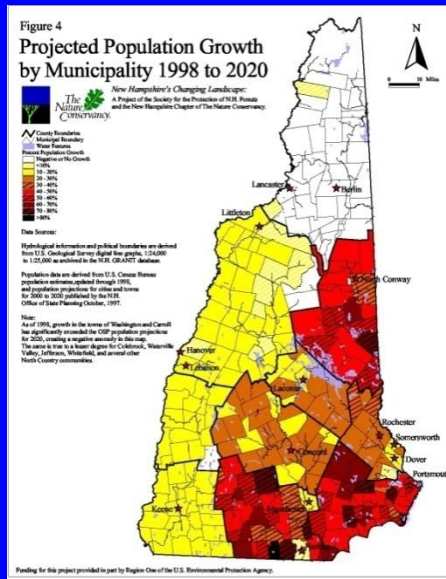


5 0 5 Kilometers

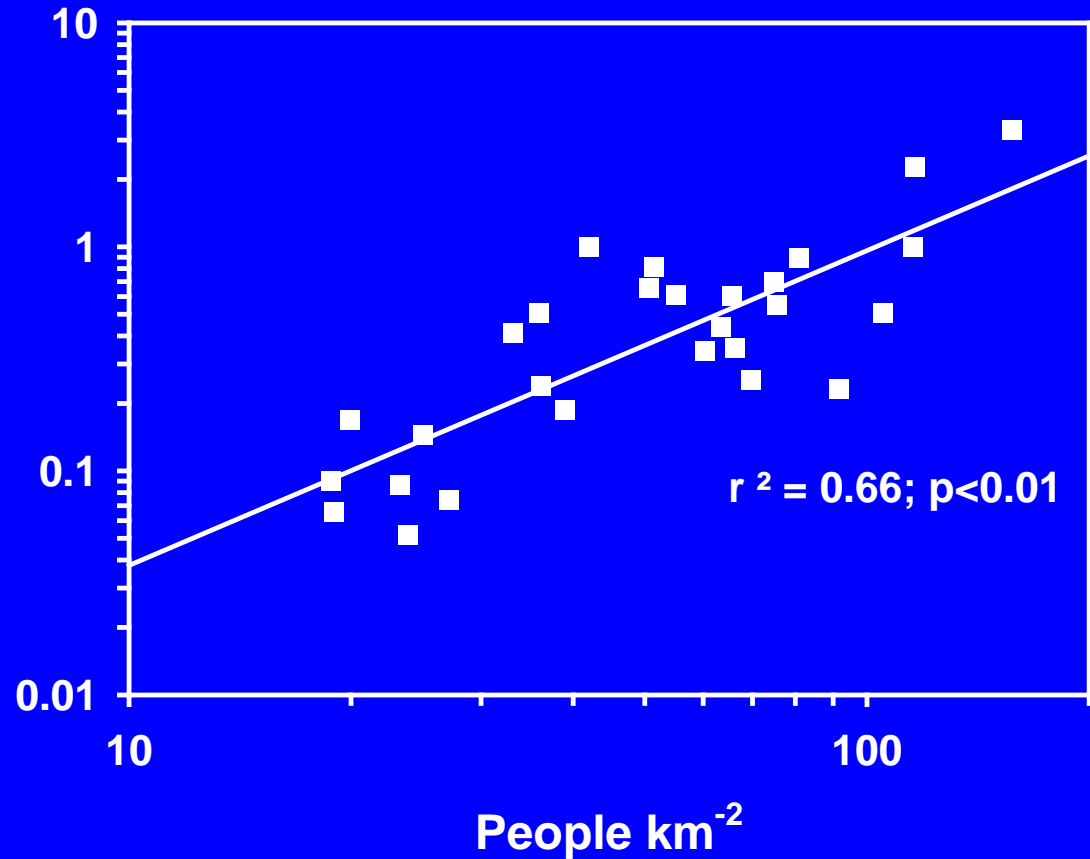


Variation in Surface Water Nitrogen Flux (and concentration) Driven by Population Density

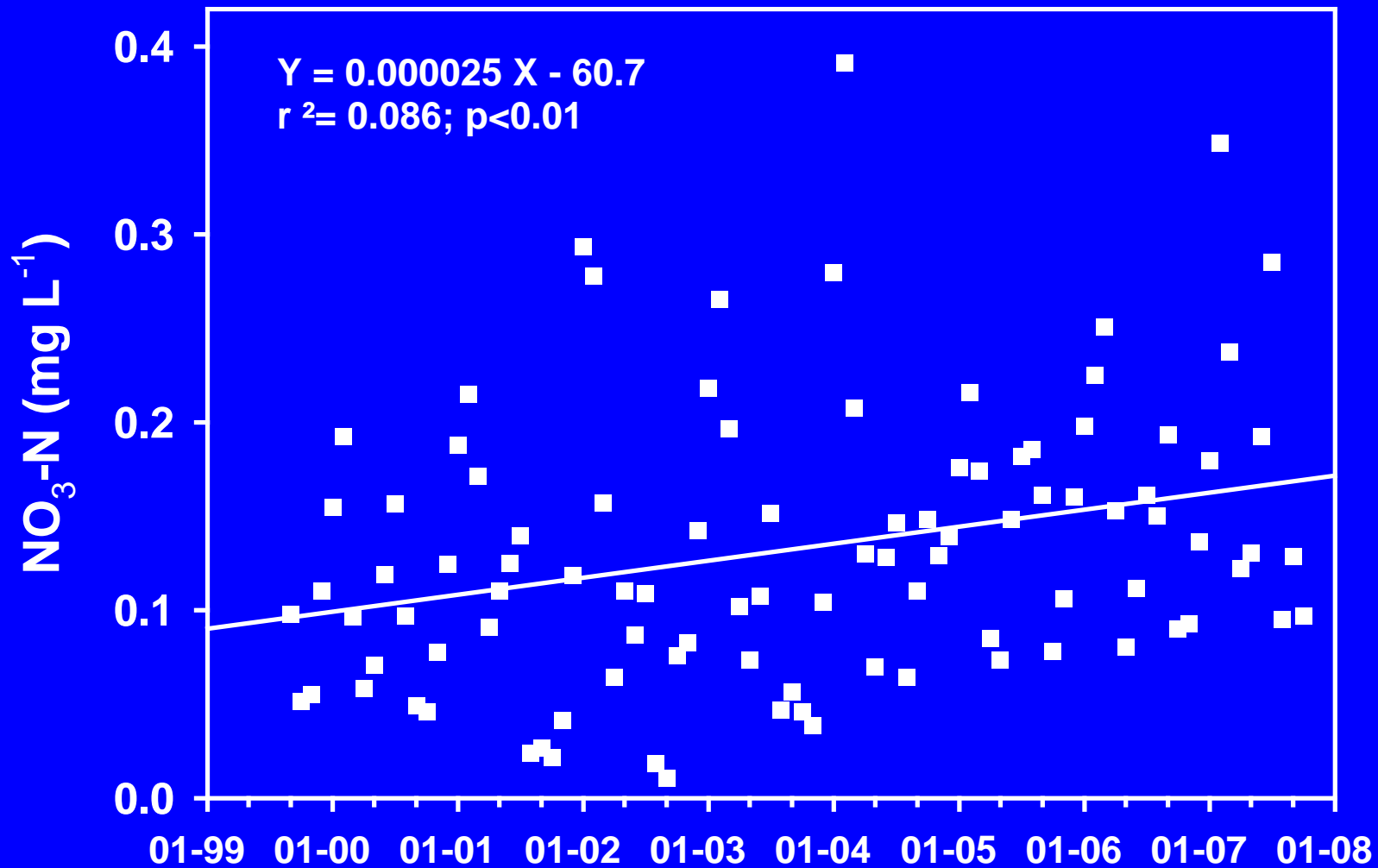
Sub-basins of the Lamprey River Hydrologic Observatory



$\text{NO}_3\text{-N kg ha}^{-1} \text{ yr}^{-1}$



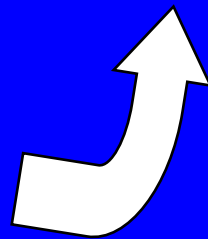
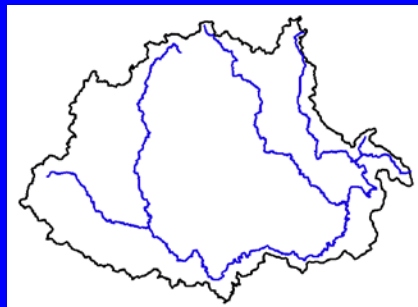
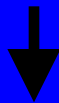
Monthly Nitrate from 1999 to 2008 in the Lamprey River



Controls on Watershed Nitrogen Balance?

Lamprey River Watershed Inputs and Outputs (2005)

Total Input
15.4 kg N ha⁻¹ yr⁻¹



Total N Retention
84% (or 13.0 kg N ha⁻¹ yr⁻¹)
Stored or lost to
atmosphere?

Total Output
2.4 kg N ha⁻¹ yr⁻¹
(34% DIN; 51% DON; 15% PN)



DIN varies with people
DON varies with wetlands

Other LRHO Research Questions

- What is the hydrologic residence time of groundwater and surface water at different spatial scales?
- In what ways and at what spatial scales does groundwater interact with surface water?
- What controls mercury exchange between forest canopy and atmosphere in the LRHO?

Long-term Research Needs

- What strategies would effectively reduce N loading to Great Bay?
- Is current and future groundwater use sustainable?
- Can ecological integrity of the Lamprey River be restored?
- What is the best way to reduce salt loading to groundwater and surface water?

Take Home Messages

- Watersheds with higher human population densities have higher stream water nitrate concentrations.
- We are already seeing long-term increases in nitrate in the Lamprey River and with future population growth we expect this to continue
- Even though nitrate is increasing and varies with population density, the Lamprey watershed is still highly effective at preventing N applied to the landscape from getting into the river (84% of N entering the watershed in rain, dry deposition, food, feed and fertilizers never makes its way to the stream). The problem is that we don't know where in the watershed this N is stored or removed. This lack of understanding of the ways in which the watershed process N will make it difficult to effectively manage for reduced N loading.