

Determining Sources of Nitrogen Pollution using Lichens in the Wind River Range

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Western Wyoming



- ◆ National Forests and Parks
- ◆ Oil and Gas Industry
- Ozone spikes of 166 ppm
 - Standard 75 ppm



Atmospheric Nitrogen

- 80% N_2
- NH_x , NO_x
- Eutrophication



Sources of Nitrogen Pollution

- ◆ Mitigates efforts
 - ◆ Industry
 - ◆ Agriculture
- ◆ Sensors
- ◆ Natural indicator?

Lichens

- Algae and Fungus
- Environmental Sponge
- Occur almost everywhere



Objectives

- ◆ Do lichens indicate amounts and sources of pollutions?
- ◆ Will lichens show significant nitrogen deposition from Oil and Gas development?

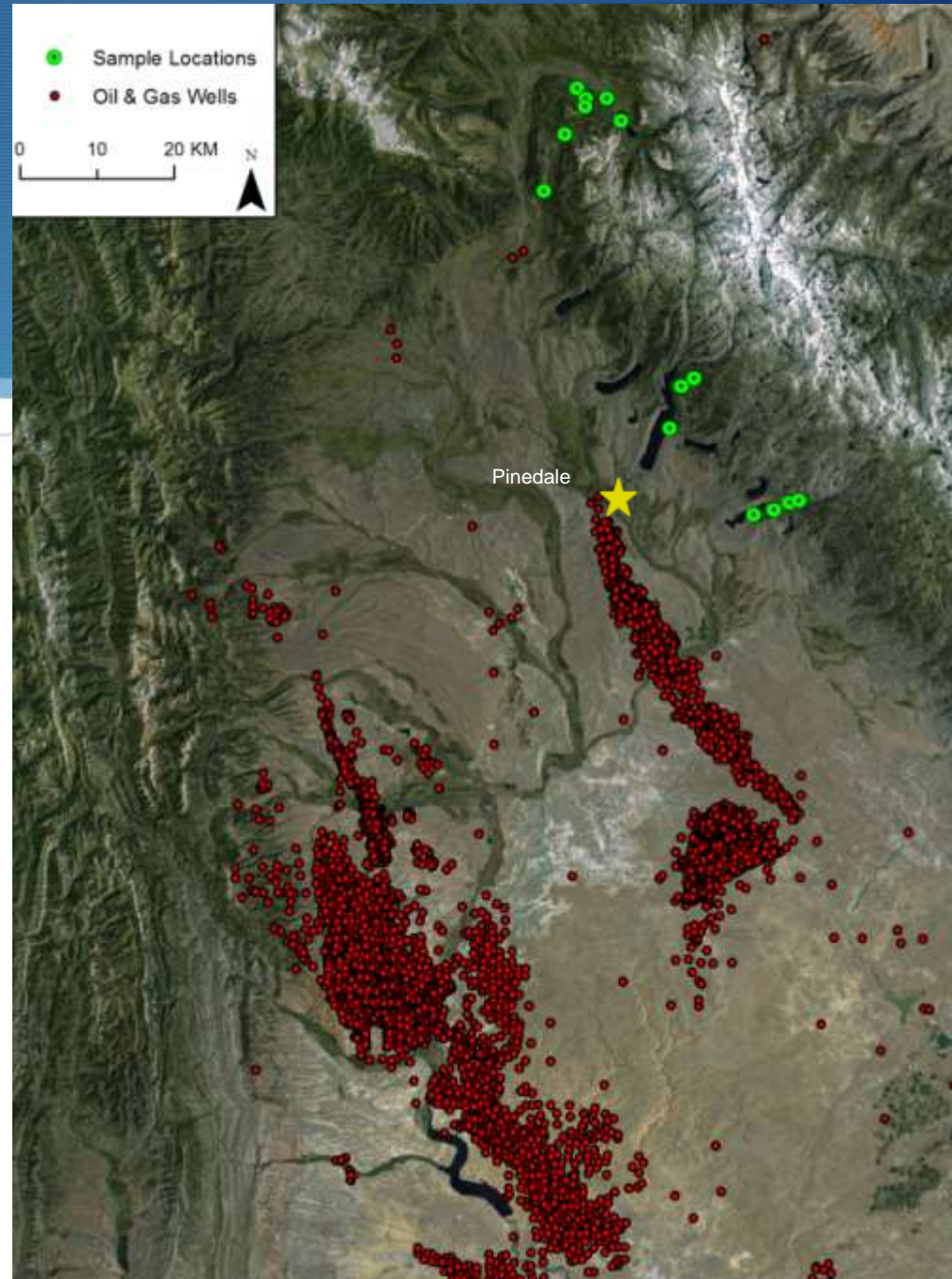
Isotope Signatures

- High $\delta^{15}\text{N}$ from industry
- More negative $\delta^{15}\text{N}$ Agriculture



Study Area

🟢 Pinedale Anticline



Samples

Letharia vulpina



Usnea lapponica



http://naturechronicles.files.wordpress.com/2013/02/sized_usnea-species-hair-lichens-moss-on-red-alder-11-copy.jpg?w=604&h=524

Analysis

- Isotope Analysis

 - $\%N$

 - $\delta^{15}N$

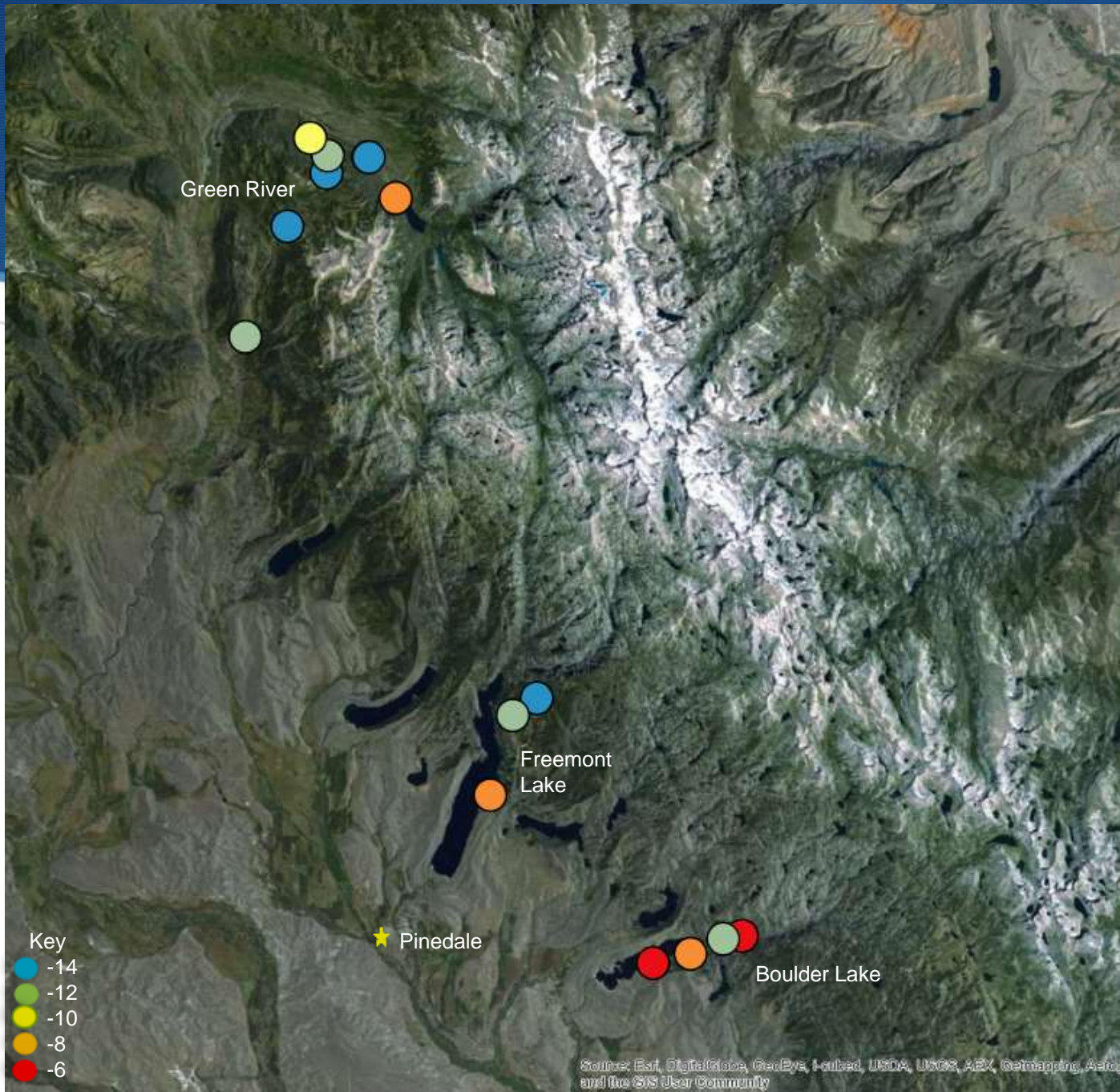
 - C:N ratio

- Locality

- Relationship to Bulk Deposition

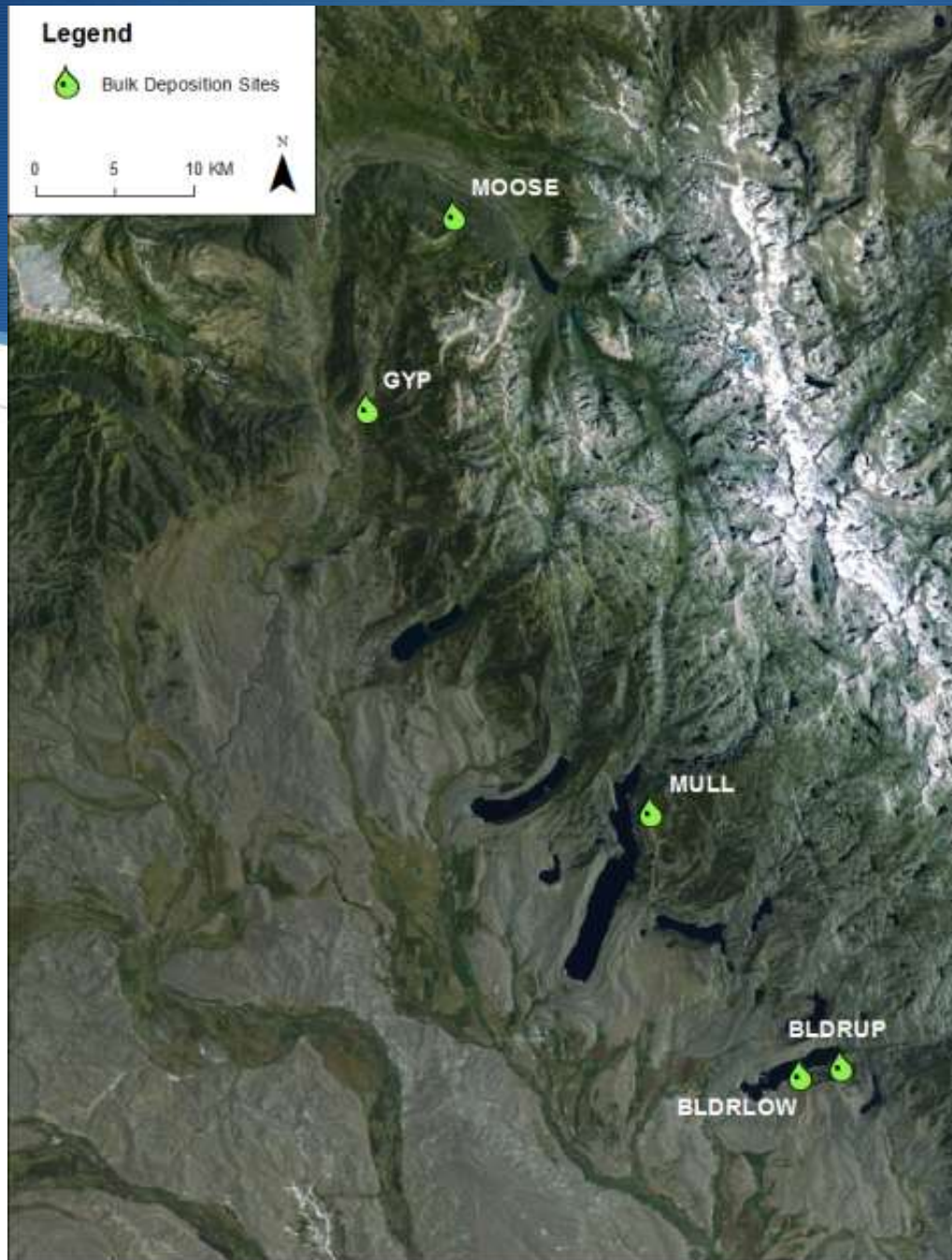
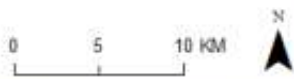


UW Stable Isotope Facility

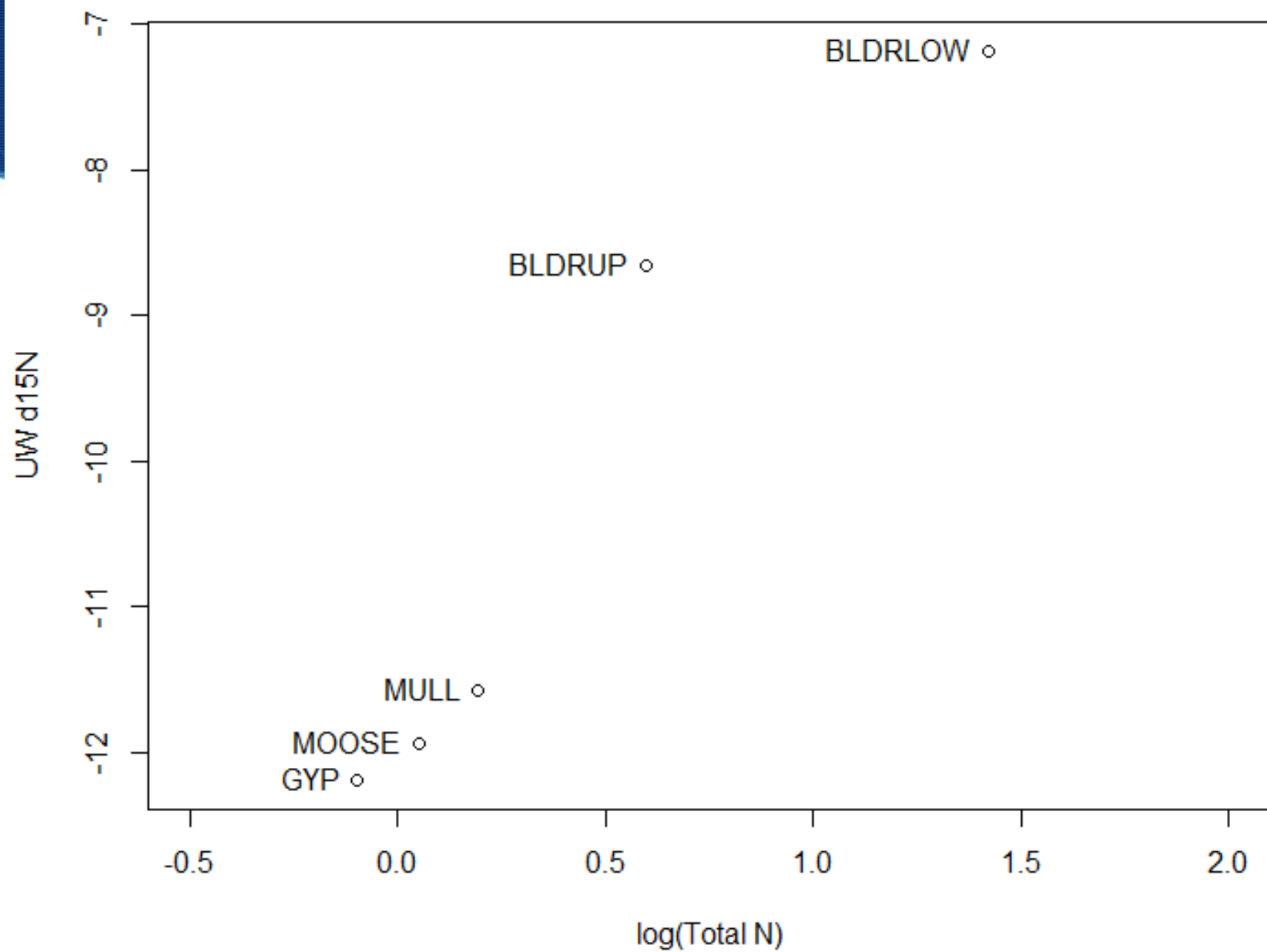


Legend

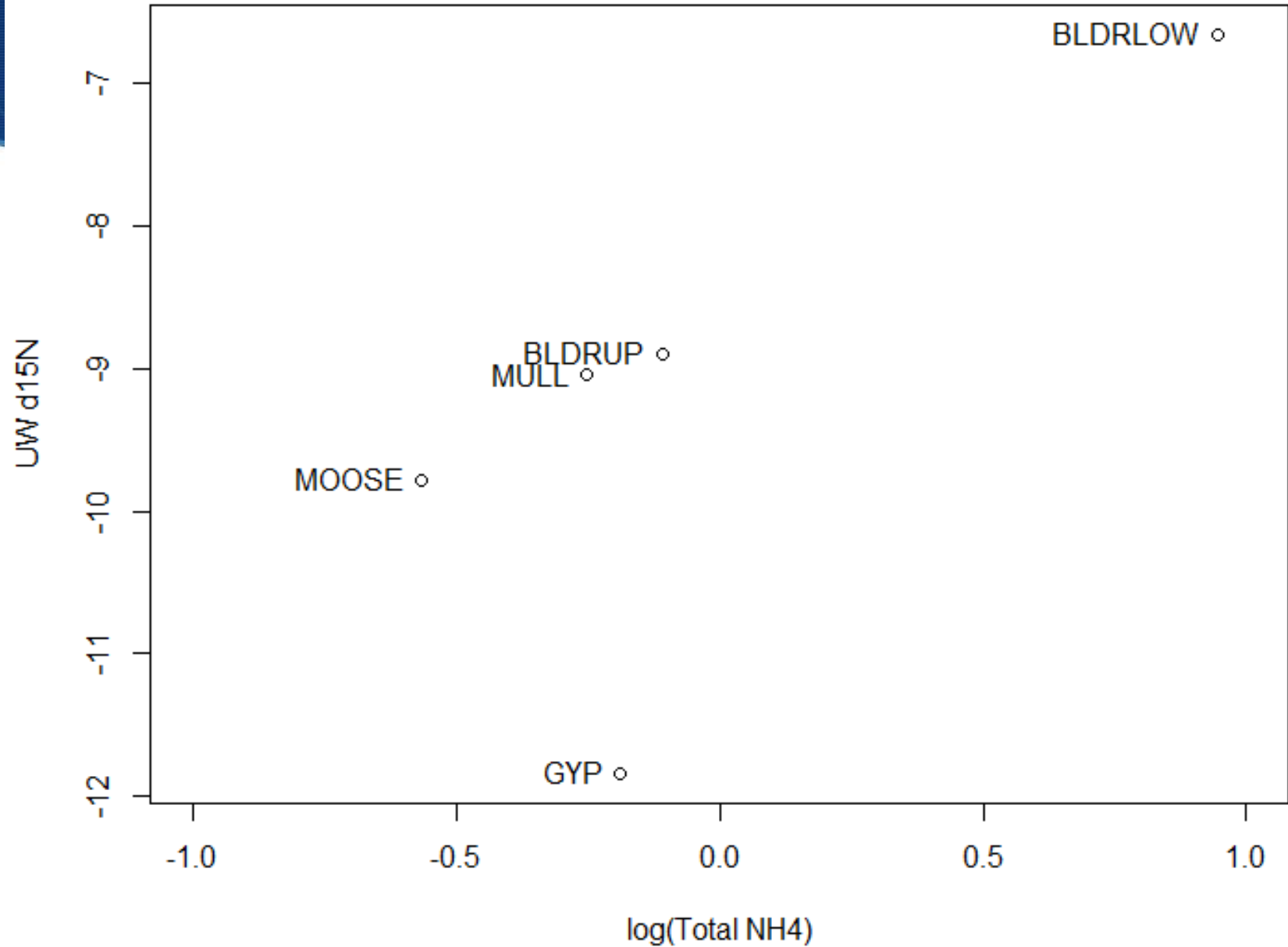
 Bulk Deposition Sites



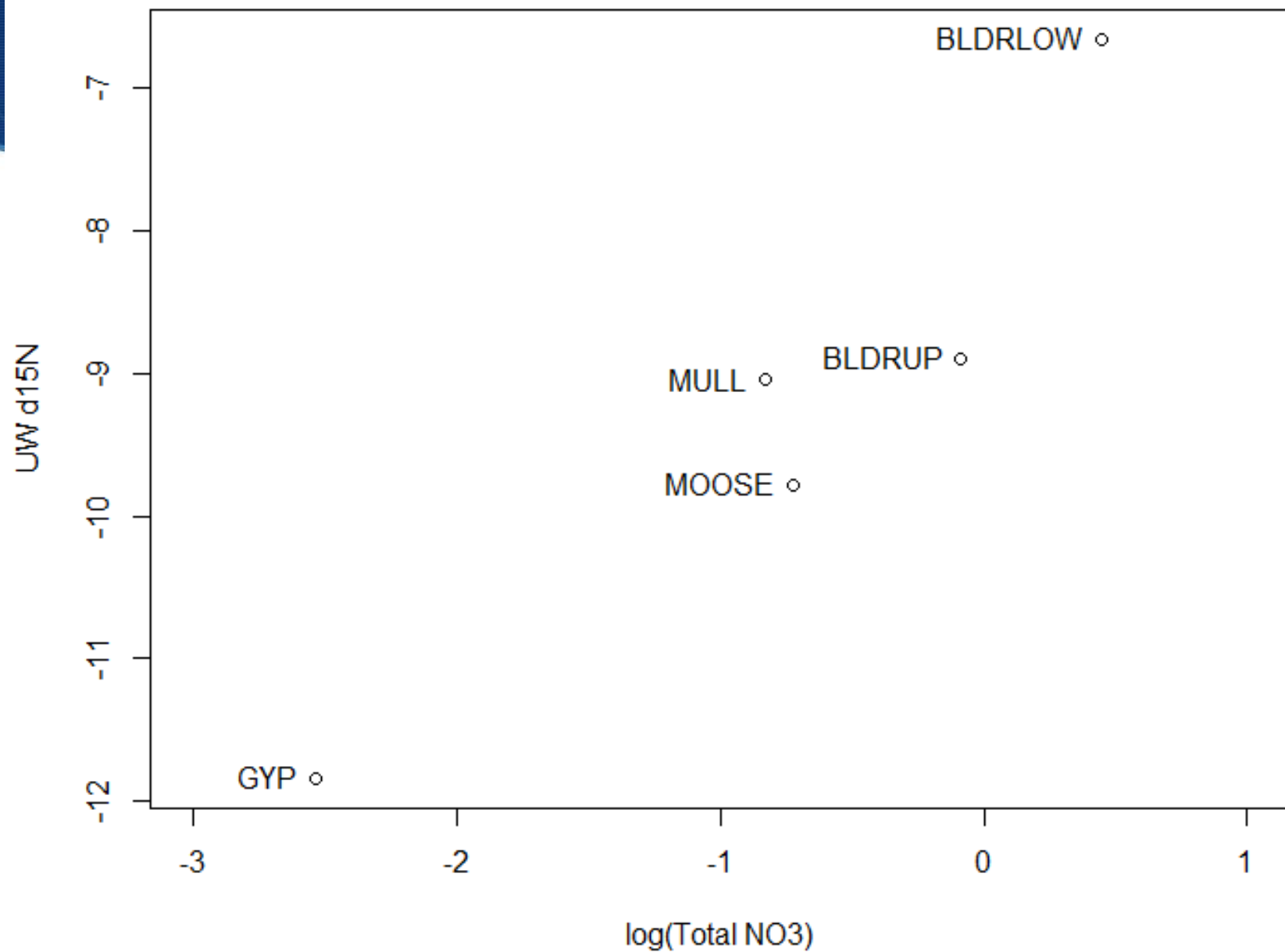
Usnea
Pearson's r = 0.961



Letharia
Pearson's $r = 0.736$



Letharia
Pearson's $r = 0.946$



Conclusion

- ◆ Lichens show atmospheric N amounts
- ◆ Slight trend for No_x
- ◆ Continued research, and isotope trend could be found

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- ◆ Shannon Albeke
- ◆ William's Lab Group

References

- ◆ Bragazza, L. et al. 2005. Nitrogen concentration and $\delta^{15}\text{N}$ signature of ombrotrophic Sphagnum mosses at different N deposition levels in Europe. *Global Change Biology* 11; 106-114. DOI 10.1111/j.1365-2486.2004.00886.x
- ◆ McMurray, J et al. 2013. Using Epiphytic Lichens to Monitor Nitrogen Deposition Near Natural Gas Drilling Operations in the Wind River Range, WY, USA. *Water Air Soil Pollut* 224:1487. DOI 10.1007/s11270-013-1487-3