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Nitrogen content of lichens as an indicator of inversion-based deposition

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I. Introduction

Temperature inversions due to pollution are common in Utah valleys. The ecological impact of these inversions is unknown. Inversion-based pollution events deposit nutrients and pollutants in the ecosystems. Previous studies showed that nitrogen content of snowmelt in the Wasatch Range is greater during inversion events; the sites closer to Salt Lake City, the pollution source, had more nitrogen deposition. The purpose of this study is to determine if nitrogen-fixing lichens preserve a record of inversion-based nitrogen deposition in order to assess the ecological impact of the inversions.



Figure 1— *Xanthomendoza fallax* and *Xanthomendoza montana*
Figure 2— Lichens on box elder maple (*Acer negundo*)

II. Methods

To complement the snow melt data we collected 111 samples of lichens from sites along Red Butte Creek and on an elevation gradient on Grandeur Peak with a focus on two species (*Xanthomendoza fallax* and *Xanthomendoza montana*) because they are common and easily identifiable in the field. The samples were powdered and analyzed using a stable isotope ratio mass spectrometer for %N and $\delta^{15}N$. Only the samples from the three highest and three lowest Red Butte Creek and Grandeur Peak sampling sites were analyzed.



Figure 3 – The view from Grandeur Peak during an inversion

III. Results

Based on the graphs in Figure 6 and a linear regression analysis there is no correlation between either the nitrogen content of *X. fallax* and *X. montana*, their stable isotope ratios and elevation. There is a division in the nitrogen content due to variation within the two species. The previous snow melt data proved there is an increase in deposition due to the inversions, evidence of deposition is not shown in the lichen data. The isotopic variability within the samples was greater than expected and requires further research.

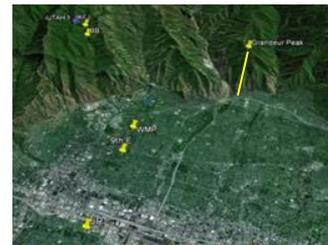


Figure 4 – Red Butte Creek and Grandeur Peak sampling sites

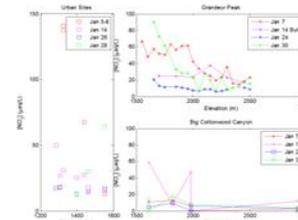


Figure 5 – Nitrogen content from snow melt sites in 2011

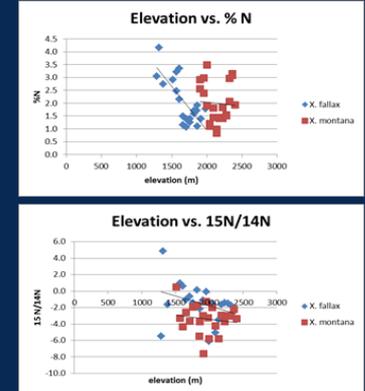


Figure 6 – Results of nitrogen content and isotope analysis

IV. Conclusions

The previous snow melt study in 2011 showed that inversions are spreading into the surrounding ecosystems and depositing particulates. The purpose of this study was to determine if lichens could be used to monitor this deposition by indicating varying levels of nitrogen deposition at locations impacted differently by the inversions on an elevation gradient. Based on the data collected in the summer of 2013, lichens can not be used as indicators of nitrogen-based inversion deposition.

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