Provide Nitrogen to Floodplain Trees

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Illinois state map

Illinois River

Introduction

Nitrogen is a major nutrient for plants and trees. The Illinois River contains several of the highest concentrations of agricultural fertilizers in the United States. These agricultural fertilizers contain Nitrogen with a specific isotopic signature that is used to track the element through ecosystems. Nitrogen from anthropogenic sources is readily transported by groundwater flow as nitrate and appears in groundwater discharge to streams and rivers, and surface runoff and waste effluents often enrich streams with ammonium as well as nitrates (Mueller and Helsel 1996, Caraco and Cole 1999). Isotopic fractionation causes variation is isotopic ratios as materials move in the soil and trees. These isotopic signatures are used as Nitrogen fingerprints that can be identified in any nitrogen containing substance. Biological processes concentrate δ15N and agricultural land has a +3% to +7% value increase. There are several sources which might provide nitrogen to the river. One source is the Chicago Sanitary Canal which flows into the river. The canal carries sewage from the City of Chicago and may deposit nitrogen into the river. Even though Chicago's sewage is treated, it still may alter the nitrogen isotopic composition. Nitrogen might be from the watershed soils leached during a flood and may be present in groundwater that affects the isotopic signature of riverside vegetation. The vegetation should have the isotopic signature of the river if flooding is an important source of nitrogen. Floodplain trees should contain the isotopic signature of the Illinois River and it should be less obvious further away into the floodplain.

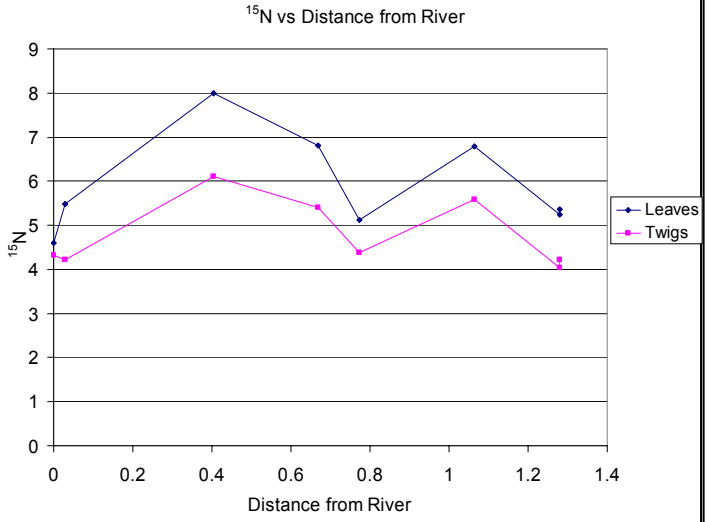
Materials and Methods

Leaves and twig shoots of *Acer saccharinum* were cut and taken from marked distances extending out from the Illinois River upland to Fowler Lake. The samples were put into several tubes and prepared in Dr. Retzlaff's lab at Southern Illinois University at Edwardsville. Then, the samples were dried until the moisture evaporated off of them until they could be put into the grinder. Then, the samples were ground in a Spex Certiprep cryogenic impact grinder cooled with liquid nitrogen. It took 3 minutes for each sample to grind. After that the samples were sent to COIL (Cornell Isotope laboratory) for $\delta^{15}N$ isotopic signature analysis. There was previous research done on the $\delta^{13}C$ signature which is used in comparison with the $\delta^{15}N$. After that, the samples were taken in Fall of 2005 in a transect from the Illinois River near Southern Illinois University at Edwardsville. Stable isotopes of nitrogen were used to reconstruct the sources of floodplain trees.

Hypothesis: As a result of periodic flooding, floodplain trees should have the same isotopic composition as the River

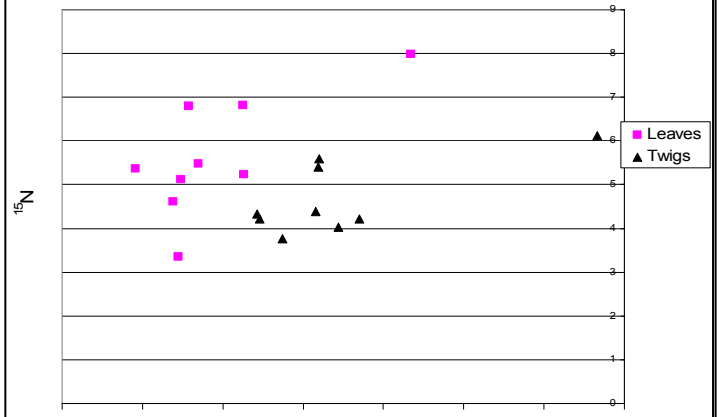
Results

Figure 1. $\delta^{15}N$ *Acer saccharinum samples* taken showing marked distances from Illinois River



Illinois River Samples

Figure 2. Comparison of Illinois Rivers sample of $\delta^{15}N$ and $\delta^{13}C$



The results suggest that the main source of nitrogen to the river does not supply a significant fraction of the nitrogen to the floodplain trees. Figure one shows the distance from the Illinois River in Kilometers and the $\delta^{15}N$ value for each sample. The third sample for twigs and leaves shows an increase in the $\delta^{15}N$ followed by a decrease in the fourth and the fifth samples. There is an increase in $\delta^{15}N$ in the 6th sample taken and a final decrease in $\delta^{15}N$ in the final sample. Figure two has $\delta^{15}N$ compared to $\delta^{13}C$. The isotopic signatures do not show much variation as the distance from the river increased into the uplands of Fowler Lake. Only sample one of leaves at $\delta^{15}C$ value is -26.66 and the twig δ13C at -24.335 show some variation.

Discussion

Further research could be directed towards seasonal sample uptake for nitrogen signatures but may also include vegetation sources near the bank of the Illinois River. Other vegetation sources may include sediment vegetation, oaks, and maples trees. *Acer* saccharinum gave a consistent isotopic signature that could be followed from the floodplain. My results suggest that the Illinois River is not supplying the upland Silver Maple with ^{15}N. My hypothesis is not supported because the same isotopic signature is found for all of tree sites along the floodplain. The isotopic analysis of Acer saccharinum showed that the isotopic signature of upland trees is not less obvious further away from the Illinois River. Several rivers could be analyzed in the United States to determine their isotopic Nitrogen sources as well. The Illinois river provides data that may relate to the hypoxic dead zones associated with Nitrogen pollution.

Acer saccharinum

Acer saccharinum

Acknowledgements

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References

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