Precipitation Filtration by *Sphagnum russowii* from a Jack Pine Plantation in the Upper Peninsula of Michigan

Christa M. Luokkala[1,2], Janice M. Glime[2], & Beth M. Scafone[2]

[1]*School of Forest Resources and Environmental Sciences, Michigan Technological University, Houghton, MI 49931*

[2]*Department of Biological Sciences, Michigan Technological University, Houghton, MI 49931*

Introduction

• *Sphagnum* displays a direct link between the environment and nutrient cycling.

• The capability of *Sphagnum* plants to absorb nutrients from precipitation and tolerate desiccation makes them perfect sinks for certain elements in their environment.

• *Sphagnum* plants take up nutrients over their entire surface and are capable of internally recycling minerals from old to young tissue.

• *Sphagnum* acts as a nutrient sink by exhibiting the greatest amount of nutrient exchange sites among bryophytes, quickly exchanging protons (hydrogen) for another cation.

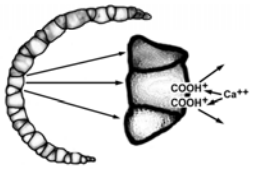
• We investigated the difference in nutrient uptake habits of *Sphagnum russowii* collected from open canopy and closed canopy areas in a Jack pine (*Pinus banksiana*) plantation.

Hypotheses

1. *Sphagnum russowii* recycles potassium (K^+) and does not remove it from the precipitation.

2. Under closed canopy *Sphagnum russowii* will not retain as much magnesium (Mg^{++}) and calcium (Ca^{++}) as under open canopy.

3. The filtrate from the *Sphagnum russowii* will display a lower pH than the control filtrate.



Drawing by Janice Glime

Figure 1. (a) A close-up of *Sphagnum russowii* displaying the many overlapping leaves. (b) Cross-section of a *Sphagnum russowii* leaf with an enlarged view depicting a single cell and its carboxyl group attached to the cell membrane. Enlargement shows carboxyl groups ($COOH^+$) attached to the cell membrane and in this example one Ca++ exchanging for two H+ ions in cation exchange.

Experimental Design

Sphagnum russowii from open-canopy and closed-canopy sites were incubated under controlled conditions.

• 10 moss replicates each under open canopy, under closed canopy, and controls were suspended in funnels over collection cups

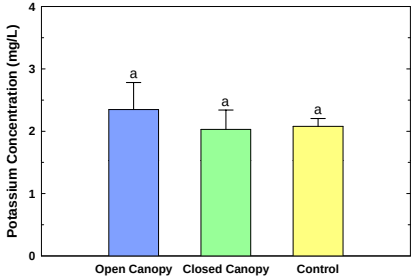
• A single store of vacuum-filtered rainwater from the study site was used to water the treatments.

• Experiment ran for 7 weeks and watering and collection of filtrate occurred 3 times a week.

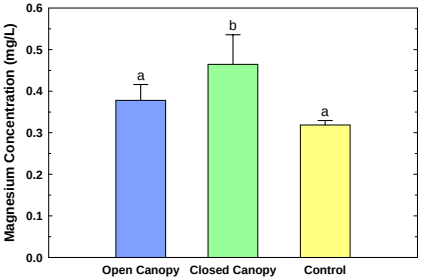
• Filtrate samples were measured for pH level and spectrophotometrically for magnesium, calcium, and potassium levels.

Results

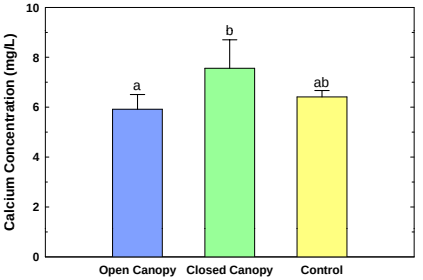
Sphagnum russowii maintained stable K^+ levels



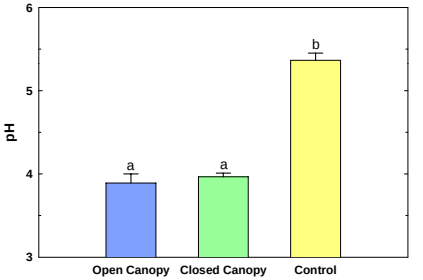
Closed canopy filtrate displayed increased Mg^{++}



Closed-canopy filtrate contained greater Ca^{++} than in the open-canopy filtrate



Sphagnum russowii reduced the pH of the filtrate



Conclusions

H_1: Potassium was retained by the *Sphagnum russowii* plants.

H_2: *Sphagnum russowii* under closed canopy did not retain as much magnesium and calcium as it did under open canopy.

H_3: The pH of the *Sphagnum* through-fall was significantly lower under both open and closed canopy.

Our study supports previous findings that potassium is more easily recycled by the moss layer compared to magnesium and calcium.

Acknowledgments

Funding for this project was provided by the MTU Department of Biological Sciences. Special thanks to Andy Burgess and John Hribljan for technical assistance.

For further information

Please contact Christa Luokkala : cmluokka@mtu.edu