Kawagama Lake Calcium Decline Mitigation Cost Benefit Analysis

Purpose

- This research is concerned with assessing the present state of calcium pools in the Kawagama Lake watershed in Haliburton county, Ontario
- This information is intended to guide future decisions regarding mitigation and further research

Background

- Calcium is an important nutrient, essential for plant growth and ecosystem health
- Calcium decline is occurring in lakes across the boreal shield region, including Kawagama Lake
- Previous work has focused on lake chemistry, but little information is available concerning the state of soils
- Soils and lakes of watersheds are hydrologically and chemically connected, so sampling soils can help develop a better understanding for lake health
- This study builds on a report from Trent University students who worked with the Kawagama Lake Cottagers Association; it explained the mechanisms, consequences, and mitigation methods for calcium decline
- This study aims to assess the soil characteristics of the Kawagama Lake watershed, with specific focus on the state of calcium decline in this region, as well as whether mitigation methods are needed

Methods

- Soil samples were collected from six sites along the north shore of the Kawagama Lake watershed. Each sample was comprised of four soil horizons: L (litter), FH (fibric and humus), A (upper mineral soil), and B (lower mineral soil)
- The samples from each horizon at the six sites were tested for their pH level, percent of organic matter, and exchangeable base cations (including calcium, magnesium, and potassium)
- Using GIS software, maps were created to display the regional calcium gradient and site specific calcium concentrations in the A horizon (Figure 1 & 2)
- Graphs were created to show the differences between horizons (Figure 3 & 4)
- The concentrations of calcium, magnesium, and potassium were compared across soil horizons and site locations, which was all compared to the regional values

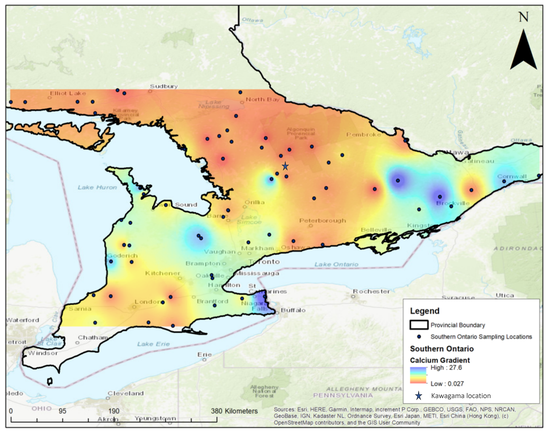

Figure 1: Calcium concentration gradient across southern and central Ontario, A horizon

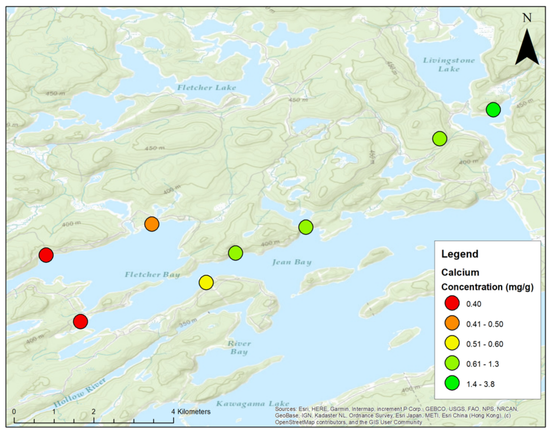

Figure 2: Calcium concentrations at sampling sites in the Kawagama Lake watershed

Findings

- Kawagama is situated in an area of low calcium concentration (Figure 2)
- Calcium concentrations varied with soil depth and across site locations (Figure 2 & 4)
- The concentration of nutrients decreases with soil depth (Figure 4)
- Calcium has the highest concentration, compared to magnesium and potassium, but the measurements from the Kawagama are lower than the regional average (Figure 1 & 3)
- The watershed's calcium pool is approximately 0.45 kg/m^2, with a concentration of 3.74 meq/100g soil. Milliequivalents (meq) are a unit of measurement that describes concentrations to the thousandth chemical equivalent
- When comparing the numbers from Kawagama to related literature, it is apparent that the watershed A horizon soils are calcium deficient
- Although the average concentration is above the critical threshold of 2 meq/100g soil, two of the sites were approaching the threshold

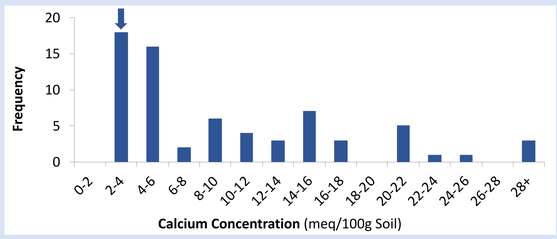

Figure 3: Distribution of calcium concentration measured from the A horizon throughout southern and central Ontario, with an arrow indicating the range in which the Kawagama Lake watershed fits, at 3.6 meq/100g soil

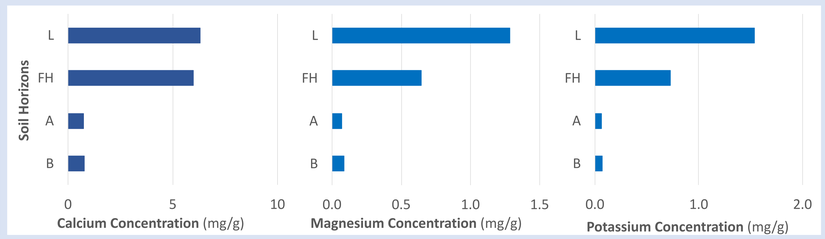

Figure 4: Average concentration of calcium, magnesium, and potassium across the soil horizons at the sampling sites around Kawagama

Recommendations

- The current state of calcium in the Kawagama watershed would benefit from mitigation efforts such as liming the soil or applying wood ash
- The areas of low calcium concentrations require about 400 kg/ha of calcium to be added
- To increase soil calcium levels by 2 meq/100g soil in areas where soil calcium is low would cost $200/ha – assuming liming costs of $0.5/kg

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