INTRODUCTION

The sediment yield in a watershed describes the amount of solid material that has been transported through a river away from points of erosion. The total amount of sediment moved by a river over time can be represented by its “specific” sediment yield in t/km² yr. This facilitates comparisons of yield at different spatial scales. Specific sediment yield has been related directly to rates of soil loss and river erosion. Specific sediment yield has many controlling factors including climate, soil type, vegetation, and land use. Boer & Crosby (1996) have highlighted the importance of drainage basin geology as a primary control of sediment yield and thus it must be considered along with other controlling factors.

METHODS

Using archived data from Environment Canada HYDAT, the suspended sediment yield for 99 southern Ontario river gauges was obtained. The gauge record spanned 34 years (1972-2005). Using these data, the specific sediment yield was calculated for secondary and tertiary scale watersheds. Geospatial data on the geologic makeup of Ontario watersheds was analyzed using ArcMap software. The geologic composition of each watershed, at both secondary and tertiary scales, was calculated. Correlation and regression analyses were conducted to determine relations between geologic boundary materials and the specific sediment yield.

OBJECTIVE

The goal of this project is to assess the relationship between sediment production in southern Ontario watersheds and their corresponding geology and climate. The analysis was conducted on watershed areas aggregated at two different scales: secondary (small scale) and tertiary (larger scale).

The primary objectives are to understand the pattern and controls of the spatial variability in suspended sediment yield and determine the sensitivity of sediment yield to the erodibility of land surface materials and to spatially varying climate conditions.

RESULTS AND ANALYSIS

A Kruskal-Wallis test showed significant differences in the specific sediment yield (SSy) of the Northern Lake Huron & Eastern Georgian Bay watersheds from the Northern Lake Erie watershed.

<table>
<thead>
<tr>
<th>Watershed</th>
<th>Mean SSy</th>
<th>Median SSy</th>
<th>Minimum SSy</th>
<th>Maximum SSy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Lake Erie</td>
<td>25.46</td>
<td>24.88</td>
<td>11.24</td>
<td>51.16</td>
</tr>
<tr>
<td>Northern Lake Huron</td>
<td>8.89</td>
<td>8.50</td>
<td>2.40</td>
<td>13.11</td>
</tr>
<tr>
<td>Georgian Bay</td>
<td>20.73</td>
<td>20.26</td>
<td>14.60</td>
<td>25.00</td>
</tr>
</tbody>
</table>

- **Fig 3.** A weak negative relation between drainage area (A) and specific sediment yield for 99 individual gauges.
- **Fig 4a.** A weak non-existent relation between SSy and the proportion of the secondary-level watersheds comprised of bedrock and organic materials (i.e., low sediment producing materials).
- **Fig 4b.** A strong, and expected, negative relationship between SSy and bedrock-organics. Where Paleozoic and pre-Cambrian bedrock outcrops in significant proportions, erosion rates and thus sediment yield are expected to be lower.
- **Fig 5.** A regression of fluvial deposits against SSy at the secondary watershed level.
- **Fig 6.** A regression of fluvial deposits with SSy at the tertiary watershed scale.

CONCLUSION

- Drainage area (A) is not a good predictor of clastic sediment yields in southern Ontario watersheds because of the high spatial variability in surface materials and sub-regional climates.
- The composition of specific surface materials in watersheds appears to be a good predictor of yield particularly the contrast between low erodibility materials like bedrock and organics versus highly erodible fine-grained materials such as glaciolacustrine and fluvial deposits.
- Tertiary-scale analyses show stronger correlations as the finer distinctions in material types become obvious.
- Specific sediment yields appear to be highest in sub-regions like the north shore of Lake Erie where fine materials are abundant, and annual rainfall and temperatures are higher.
- The next step is to include more explicitly the influence of sub-regional climate indices and land use variability and to improve the resolution of analysis to the individual watershed level (i.e. quaternary scale).

WORK CITED


