Located along Ecuador’s Pacific coast, the 2700km² Rio Chone watershed lies within the Manabi Province. The Rio Chone estuary (2484km²), which resides at the outlet to the ocean, is an ecosystem that once housed great swaths of mangroves and small sustenance fisheries.

The estuary is experiencing increased sedimentation rates, coinciding with a high degree of human disturbance in the estuary and upper watershed over the last five decades. The ecosystem that once housed great swaths of mangroves and small sustenance fisheries is suffering from increased soil loss over time. Sedimentation of an estuary can create murky water conditions, harming tourist operations as sunlight cannot penetrate as deep into the water column, lowering dissolved oxygen concentrations. Sedimentation decreases water depths in the estuary, changing the salinity, pH, and temperature of its waters. In addition, increased turbidity influences photosynthetic cation, abrasion, and mortality, and behaviorally, affecting migration patterns, feeding, and mating.

PROJECT INTRODUCTION

PROFESSOR: Dr Steve Gaines
CHIEF: Global Student Embassy

PROJECT MOTIVATION: Why is sedimentation a problem?

To quantify sedimentation in the estuary, we compared depth measurements from bathymetric maps created in 1990 and 2011. Bathymetric maps were used to prove that sedimentation is occurring, and to allow a crude rate of accretion to be calculated.

RESULTS

<table>
<thead>
<tr>
<th>Erosional Process</th>
<th>Total Sediment Contribution (Million Tonnes/Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Streambank-Erosion</td>
<td>0.02</td>
</tr>
<tr>
<td>Unpaved Roads</td>
<td>0.2–0.8</td>
</tr>
<tr>
<td>Sheetwash</td>
<td>50</td>
</tr>
</tbody>
</table>

To estimate the volume of sediment produced from surface water erosion (sheetwash and rilling) we used the InVEST Sediment Retention Model. InVEST pairs the Revised Universal Soil Loss Equation with Global Information System (GIS) technologies to estimate the amount and location of sediment produced from eroded topsoils. Our study area is comprised of 68% cropland. As such, over two-thirds of the watershed has been cleared of native vegetation for farming practices, and has now become vulnerable to surface water erosion as topsoils have been eroded.

CONCLUSIONS

- Perform bathymetric maps: Sedimentation of the estuary is occurring. Approximatively 2 million tonnes of sediment was deposited and retained in the estuary each year from 1990 to 2011.
- Perform sediment budget: Of all the geomorphic processes occurring in the Rio Chone watershed, the amount of sediment produced from sheetwash erosion on bare soils is time-changed by several orders of magnitude.
- Perform InVEST model: Erosion rates in the terrestrial watershed can be reduced back down to pre-disturbance levels by reforesting, practicing soil conservation techniques, or performing a combination of the two on all lands that have been cleared of native vegetation for agricultural purposes.

IMPLEMENTATION CONSIDERATIONS

- Re-vegetation
  - PROS: Long-term effect, site-time effort
  - CONS: Cost of establishment

- Soil conservation techniques
  - PROS: Immediate implementation, income/sustainability from farming maintained, or reforestation
  - CONS: Requires educational outreach, cost of establishing

REFERENCES