Sebago Lake and the Water Quality Index: A Method for Subwatershed Prioritization

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Overview

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▪ EPA’s 319 Program

▪ Our Method
  ➔ The Water Quality Index
  ➔ Sensitivity Analysis

▪ Results and Take Home Thoughts

▪ Questions?
About Sebago Lake
About Sebago Lake

Development
- 30,000 acres in area
- 100 feet average depth
- 305 feet maximum depth
- Nearly a trillion gallons

10.6 Meters
Our Method

1. Define subwatersheds
2. Compile existing data
3. Rank the subwatersheds using four metrics
4. Conduct a Sensitivity Analysis
5. Communicate the Information Simply
Step 1: Define Subwatersheds

- Start with USGS HUC watersheds
- Subdivide some, combine others
- 34 total, each with one water body
Step 2: Compile existing data

- Lake Water Quality Data
- Land Use Data
- Partnership Data
- Sensitivity Data

How much P from this subwatershed reaches Sebago Lake?
Step 3:
Rank the Subwatersheds Using Four Metrics
Step 3:
Rank the Subwatersheds Using Four Metrics

First:
Current Water Quality Conditions
Step 3: Rank the Subwatersheds Using Four Metrics

First:
Current Water Quality Conditions

Second:
Water Quality Trends
Step 3: 
Rank the Subwatersheds Using Four Metrics

First:
Current Water Quality Conditions

Second:
Water Quality Trends

Third:
Land Cover Change
Step 3:  
Rank the Subwatersheds Using Four Metrics

First:  
Current Water Quality Conditions

Second:  
Water Quality Trends

Third:  
Land Cover Change

Fourth:  
Partnerships
Current Water Quality Conditions

The lower the TSI, the better

<table>
<thead>
<tr>
<th>Ranking</th>
<th>TSI Range</th>
<th>Percentile Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>44 – 68</td>
<td>0-20%</td>
</tr>
<tr>
<td>2</td>
<td>39 – 44</td>
<td>20-40%</td>
</tr>
<tr>
<td>3</td>
<td>37 – 39</td>
<td>40-60%</td>
</tr>
<tr>
<td>4</td>
<td>34-37</td>
<td>60-80%</td>
</tr>
<tr>
<td>5</td>
<td>24-34</td>
<td>80-100%</td>
</tr>
</tbody>
</table>

60% of subwatersheds have lakes with a TSI under 39
Water Quality Trends

Is TSI decreasing or increasing?

<table>
<thead>
<tr>
<th>Water Quality Trend Score</th>
<th>Trend Score Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Significantly increasing trophic state (declining water quality)</td>
</tr>
<tr>
<td>2</td>
<td>Potentially increasing trophic state</td>
</tr>
<tr>
<td>3</td>
<td>Not used for this parameter</td>
</tr>
<tr>
<td>4</td>
<td>Either stable or potentially decreasing trophic state</td>
</tr>
<tr>
<td>5</td>
<td>Significantly decreasing trophic state (improving water quality)</td>
</tr>
</tbody>
</table>

19 of 23 subwatersheds have stable or potentially decreasing TSI.
Land Cover Change

How much did land cover change from 1987-2013?
Land Cover Change

How much did land cover change from 1987-2013?

The mean change in land cover from “undeveloped” to “developed” for the entire watershed was 1.65%
Partnerships

How much successful work has already been done?

Most subwatersheds have a “high” or “medium high” likelihood of successful partnership.
Step 4: Conduct a Sensitivity Analysis

Lake A

Lake C

Lake B

Lake D

Lake of Interest

100 kg

50 kg

50 kg

50 kg

50 kg
68% of Phosphorous is from the direct watershed
68% of Phosphorous is from the direct watershed
Step 5: Communicate the Information Simply

Fact Sheets

- A report card
- Custom, Detailed, Factual
- Easy to understand
- Generate discussion
Peabody Pond

Peabody Pond is located in Bridgton, Naples, and Sebago, Maine, between Routes 107 and 302. Peabody Pond’s 8.2-mile shoreline is developed with a variety of residences and a boat launch in the south. Peabody Pond is also home to both coldwater and warmwater fisheries. A deep section in the middle of the lake, combined with rocky shores, provide ample habitat. However, oxygen depletion in late summer, possibly related to pollution, does affect the fish. Much of the land surrounding the Pond is undeveloped woods, and many feeder streams flow through these woods into Peabody Pond.

The Peabody Pond community has demonstrated commitment to protecting and improving the Pond. The Pond has been monitored since the 1970s. Overall, Peabody Pond enjoys water quality that is, according to the Maine Department of Environmental Protection, "excellent." Peabody Pond's water leaves from its southern end, flowing into the Northwest River, which eventually leads to Sebago Lake.

Part of the Sebago Lake System

Peabody Pond's health is an important factor in the health of Sebago Lake, which is the source of drinking water for 15% of Maine's residents. Portland Water District (PWD) filters and delivers this water and is the largest water utility in Maine. PWD has shown interest in keeping Sebago Lake clean and supports conservation efforts in the upland areas. The cleanliness and health of Sebago Lake likewise play an important role in the health of Casco Bay, found downstream.

Sebago Lake itself is the second largest lake in Maine. Approximately 361 square miles of land and numerous lakes, ponds, rivers, and streams in 24 towns drain into Sebago Lake. Over 80% of the land that surrounds the lake is forested. Many partners work together to ensure a clean, healthy Sebago Lake.
Overall Score
The higher the better

Land Use
Changes in forested versus developed land over decades determined using satellite imagery.

Lake Health Trend
Changes in biological activity over at least ten years.

Current Lake Clarity
Chlorophyll-a, phosphorus, and clarity measurements that indicate a lake's biological activity and nutrient levels.

Partnerships
Activity of local organizations that protect and use the lake.

What does this number mean?
- The total possible score is between 4 and 20.
- Each score is the sum of four equally important parts described on the page to the right. Each part is scored from 1 to 5, with 5 being the best.
- Higher numbers are better. The higher the number, the healthier the lake and surrounding area. The table to the right shows the scoring categories.

<table>
<thead>
<tr>
<th>Overall Lake Score</th>
<th>Level of Concern</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-20</td>
<td>Lowest</td>
</tr>
<tr>
<td>16-18</td>
<td>Moderate-Low</td>
</tr>
<tr>
<td>12-15</td>
<td>Moderate</td>
</tr>
<tr>
<td>8-11</td>
<td>Moderate-High</td>
</tr>
<tr>
<td>4-7</td>
<td>Highest</td>
</tr>
</tbody>
</table>

Next steps for Peabody Pond: Support existing partnerships to ensure that the lake remains healthy and clean.
How Healthy Is Peabody Pond?

Land Use (scored 3 out of 5)
Most of the land that drains into Peabody Pond is woods, enabling soil to filter pollution. The overall %5 of woods and vegetated land has not changed much over the past quarter century. However, road erosion and yard care chemicals are common pollution sources in the region.

Partnerships (scored 3 out of 5)
The Peabody Pond community has a few active partners who are committed to protecting the lake. Though partners can provide in-kind support, external financial support would help facilitate projects. An updated land survey would be needed to apply for federal funding.

Lake Health Trend (scored 4 out of 5)
Biological activity, as monitored over the past decade, indicates that Peabody Pond is healthy! The clean water trend has persisted even as many waterbodies in the area suffer from pollution washed off of the land. Residents can anticipate future years of clean water for recreation.

Current Lake Clarity (scored 4 out of 5)
Clean, clear water is found in Peabody Pond. Aquatic plants and animals are able to thrive and local residents benefit from clear swimming water and healthy fish populations. The current clear conditions could change if there are increases in area soil erosion or polluted surface runoffs.

For More Information
To learn more about your local waterbody, resources for property owners, or the Sebago Lake Watershed Assessment and Prioritization Project:
Visit: www.cumberlandsawd.org
Call: Cumberland County Soil & Waste Conservation District (207) 892-4700

Peabody Pond is enjoyed by youth, summer residents, anglers, and the local community from surrounding towns and beyond.

Volunteers and scientists have used Secchi disc tests (trials) to measure water clarity in lakes and estuaries since the late 1800s.

Custom recommendations based on the four scores
Peabody Pond Watershed
A watershed is the area of land that drains to a waterbody. Anything that occurs on land within the yellow outline of Peabody Pond’s watershed could affect Peabody Pond.

Watershed definition and outline

Location

More detail
Results and Take Home
About the Sebago Lake Watershed

• 19 of 23 subwatersheds show stable TSI
• 68% of P is from the direct watershed
• Just 6 subwatersheds were low in 2 metrics
Low in Water Quality
Low in Land Use Change
Low in Partnership
Low in Two metrics
About the project

1. The data already existed
2. Every partner played a key role
3. Communicating results was a key consideration
4. Identified many years of work to be done
Questions?
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