1. INTRODUCTION

- Lake Decatur is the major source of public water supply for the City of Decatur, Illinois. Its drainage area (i.e., 925 sq. mi.) is mainly cropland (~90%) with extensive network of tile drains.
- Agricultural runoff has been the main cause of the lake’s water quality impairment, affecting its provision of a crucial life-supporting ecosystem service—public water supply.
- The lake was listed in the 2004 Section 303(d) for nitrate-N and total phosphorus impairment, and TMDL was completed in 2007.
- Two subwatersheds (i.e., Big Ditch and Big/Long Creek watersheds) were selected for developing TMDL implementation plan (see Figure 1).
- Decision support models (DSMs) were developed for generating optimal alternative scenarios (see Figure 3) of watershed best management practices (BMPs) (Bekele et al., 2014).
- A Decision Support Tool (DST) is further developed for evaluating different BMP implementation scenarios in the study watersheds (see Figure 2).

2. OBJECTIVE

- To develop a tool for evaluating different, user-specified implementation scenarios of selected BMPs (i.e., their placements in the watershed and implementation costs).
- To assist in making informed decision through comparison of different implementation scenarios with optimal alternatives provided by the tool and/or with each other.

3. DECISION SUPPORT TOOL (DST)

- The DST runs (i) Soil and Water Assessment Tool (SWAT) for simulating watershed responses including flow, sediment, and nutrients; (ii) evaluates impacts of selected BMPs and their implementation costs; and (iii) compares simulated BMP scenarios with optimal ones.
- SWAT is designed to predict the long-term impacts of land management practices on water, sediment, and agricultural chemical yields in watersheds. Data-driven routines were incorporated for evaluating those BMPs that were not included in SWAT.
- SWAT models of Big Ditch and Big/Long Creek watershed were calibrated and validated for flow, sediment, nitrate-N, and TP (Bekele et al., 2014); They were incorporated into the DST.

4. DST APPLICATION: IMPLEMENTATION OF CONSTRUCTED WETLANDS

- Constructed wetlands (CWs) can provide water quality benefits by removing sediment and nutrients from surface and subsurface agricultural runoffs.
- In SWAT, CWs are modeled as water bodies in a hydrologic response unit (HRU). CW treatment area to HRU area is set at 50% with a minimum CW drainage area of at least 5 hectares. Ratio of CW surface area to its drainage area equals 0.05. $2,700 per acre of wetland surface area and a maintenance cost of $0.11 per acre of CW treatment area, and revenue loss were used to estimate implementation cost.
- SWAT is modified to allow CWs to receive HRU tile flows.

- Optimal implementation alternatives for Big Ditch Watershed (BDW)
  - The most cost-effective implementation scenario is considered as the best tradeoff alternative (see Table 1, Figures 4a and 4b).

<table>
<thead>
<tr>
<th>BMP Implementation</th>
<th>Load Reductions</th>
<th>Implementation Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1</td>
<td>Sediment, Nitrate-N</td>
<td>$2,700 per acre</td>
</tr>
<tr>
<td>Scenario 2</td>
<td>Sediment, Nitrate-N</td>
<td>$2,700 per acre</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>Sediment, Nitrate-N</td>
<td>$2,700 per acre</td>
</tr>
</tbody>
</table>

5. CONCLUSION

- The DST is designed to develop user-specified scenarios of selected BMPs and evaluate their water quality benefits, assessing the level of ecosystem service provision (i.e., clean water supply).
- The DST can provide guidance to make informed decision through comparisons of different BMP implementation scenarios with each other and/or with optimal alternatives.
- Developing DST for the entire Lake Decatur watershed will increase the practical utility of this tool (e.g., screening of TMDL implementation projects, assessing nutrient trading potential in the watershed, etc…).


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