Abstract:

The Upper North Bosque River (UNBR) is impaired due P. The watershed’s primary agricultural activity is dairy production and large quantities of manure are produced. A best management practice being proposed is to use composted dairy manure in commercial turfgrass operations to remove manure from the watershed. When turfgrass sod is harvested a thin layer of soil is also removed. Therefore excess P bound to the soil can be transported out of the watershed in a sustainable manner. The Soil and Water Assessment Tool (SWAT) was calibrated to simulate the effectiveness of using turfgrass sod fertilized with composted dairy manure to export P from the watershed. The model was first calibrated to predict average monthly flows and sediment loadings from 1996 to 1999. The Nash-Sutcliffe model fit efficiency was used for evaluating the model. The model fit efficiency ranged from 0.77 to 0.89 for the various simulated parameters.

Proposed Solution:

The UNBRs Watershed in North Central Texas is one of the most studied watersheds in the U.S. An assessment of the Total Maximum Daily Loads (TMDLs) for the UNBR led to a recommendation of a 50% reduction of soluble P. Soil and P would be harvested and exported out of the impaired watershed in a sustainable manner. (TNRCC, 2001). A new Best Management Practice (BMP) proposed for P reduction in the UNBR watershed is the use of turfgrass sod to export manure nutrients. This new BMP would:

- Use of composted dairy manure as a fertilizer for commercial grown sod to bind a high percentage of the manure’s P in the soil sod layer.
- Prior plot-scale experiments indicated 48 to 77% of applied manure P was removed in a single sod harvest. (Vietor, et. al., 2002)
- Use suitable sites for turfgrass already determined from previous research (J. Hanzlik, et al. 2003).

The objective of this research is to use the SWAT model to simulate water quality improvements due to the implementation of the turfgrass BMP in the UNBR watershed. Therefore, the goal of the SWAT simulations will be to assess the effectiveness of turfgrass farms to help achieve the TMDL for the UNBR.

References & Resources:

USGS: Digital Elevation Models, Land Cover/Use Datasets.
- Anna McPhail, Texas Institute for Applied Environmental Research (TIARE).

• SWAT model to determine production scale efficiency of turfgrass operation in P exports.
- Simulation in the Upper North Bosque River based on prior site selection (J. Hanzlik, et al., 2003).

Future and Ongoing Research:

Plot Scale BMP Testing:
- Ongoing plot scale research to quantify turfgrass BMP effectiveness:
  - Variable application rates
  - Variable slope
  - Variable Soils

Field Scale Research:
- Comparative Fields grown with and without manure are monitored:
  - Runoff water quality
  - Turfgrass quality

Watershed and Model Characteristics

<table>
<thead>
<tr>
<th>Watershed Properties</th>
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<tbody>
<tr>
<td>Watershed Area</td>
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<tr>
<td>Minimum Elevation</td>
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<tr>
<td>Maximum Elevation</td>
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<tr>
<td>Stream Flow</td>
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<td>Minimum Elevation</td>
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<td>Maximum Elevation</td>
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<td>Average Temp (F)</td>
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<td>Average Min Temp (F)</td>
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<td>Population</td>
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Model Calibration:

Flow:
- E(NS)= 0.86
- R²= 0.86

Sediment:
- E(NS)= 0.69
- R²= 0.90

Phosphorous Organic:
- E(NS)= 0.78
- R²= 0.79

Mineral:
- E(NS)= 0.69
- R²= 0.83

Observed Values

Future and Ongoing Research:

Swat Model Simulation of Turfgrass BMP:
- Use the SWAT model to determine production scale efficiency of turfgrass operation in P exports.
- Simulation in the Upper North Bosque River based on prior site selection (J. Hanzlik, et al., 2003).