Public Abstract
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Non-point source pollution from agricultural activity is extremely problematic in the U.S. It is responsible for damage to aquatic ecosystems, contamination of drinking water sources, and loss of farm productivity. The Goodwater Creek Experimental Watershed (GCEW) is a claypan watershed in north-central Missouri that is particularly prone to non-point source pollution because it is comprised of soils with very high runoff potentials. Targeting indices are tools that have the potential to reduce non-point source pollution by identifying potential areas in watersheds that contribute the most to overall pollutant loads, allowing such areas to be treated with conservation practices. Applying conservation practices to critical areas identified by targeting indices is predicted to greatly reduce contaminants.

The objective of this study was to evaluate three targeting indices, the Soil Vulnerability Index (SVI), Conductivity Claypan Index (CCI), and CEAP Conservation Benefits Identifier (CCBI), in terms of their classification of critical areas in the GCEW. The SVI and CCI are intended to identify critical areas most vulnerable to contaminant transport by surface runoff, while the CCBI is designed to identify critical areas that lack sufficient conservation treatment considering their vulnerability to contaminant transport by surface runoff as determined by the SVI.

The SVI and CCI were evaluated in the first study by comparing the distribution of watershed vulnerability classifications determined by each, using contingency tables to calculate agreement between critical areas determined by each index, and assessing whether each index identified a known critical area in the watershed. Variability of input parameters in each index was analyzed as a means to explain differences in classification of watershed areas by indices. SSURGO and DEM slopes were used in each index to assess sensitivity to the slope parameter and assess effects of using different slope sources. The CCI consistently identified over twice the amount of potential critical areas identified by the SVI and also classified more of the watershed as moderately high vulnerability. Most of the potential critical areas identified by the SVI, however, were also identified as potential critical areas by the CCI. In comparison with field observations, the CCI was found to identify a known critical area that wasn’t identified by the SVI. Analysis of input parameters used by each index found that slope had the most impact in the SVI, while depth to claypan (CD) as well as slope had the most impact in the CCI. The additional variability of the CD parameter used by the CCI resulted in the CCI identifying a greater amount of potential critical areas than the SVI. Planners should consider the effect this limited variability has on SVI classifications in a watershed with a restrictive layer, such as the GCEW, before using it to make decisions about conservation treatment.

The CCBI identifies critical areas based on contaminant reductions that can be achieved through additional conservation treatment. In the second study, the Soil and Water Assessment Tool (SWAT) model calibrated and validated for the GCEW was used to determine contaminant reductions that could be obtained with additional treatment. While contaminant reductions obtainable through additional treatment according to the CCBI were calculated based on soil vulnerability levels determined using the SVI, soil vulnerability levels were determined using the CCI when the SWAT model was used to determine contaminant reductions obtainable through additional treatment in the GCEW. The CCI was used due to limited variety in watershed vulnerability classifications determined by the SVI using input parameters determined from SWAT model soils data. Contaminant reductions from additional conservation treatment determined from the SWAT model were compared with those associated with the CCBI. The SVI and CCI were used to determine vulnerability levels of cropland HRUs from the SWAT model based on soil type and hydrologic response unit (HRU) data from the model. CCI and SVI classification of HRUs was assessed by testing for

correlation between vulnerability levels of cropland HRUs and contaminant loads from cropland HRUs. Significant correlation was only found for vulnerability levels determined using the CCI. Contaminant reductions possible through additional treatment determined from the SWAT model and those associated with the CCBI both increased as vulnerability level increased, and decreased as level of conservation treatment increased. This suggests that the CCBI can be used to identify critical areas in a claypan watershed similar to the GCEW. Contaminant reductions of sediment estimated by the SWAT model were lower on average than those associated with the CCBI, while contaminant reductions of nitrogen and phosphorus estimated by the SWAT model were higher on average than those associated with the CCBI. This result shows that there is uncertainty regarding the values of contaminant reductions obtainable through additional conservation treatment according to the CCBI in the GCEW. Further evaluation of the CCBI is advised before it is used in the GCEW or a similar claypan watershed.