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**Geospatial model development for watershed based fecal coliform estimation and comparison with Virginia Tech's bacteria loading calculator**

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Abstract:

Thousands of nation's waterbodies are listed for impairments from stormwater sources. Most of the cited waterbodies in Section 303(d) in requirement of a TMDL are impaired from fecal coliform (FC) load. FC mostly comes from two main sources, i.e., nonpoint and point sources. The non-point source for the bacteria loading is the land-uses of the watershed. The point sources responsible for this bacteria loading are concentrated animal feedlot operations, livestock, wild animals, and septic systems. Virginia Tech's Fecal Coliform Load Calculator (FCLC) is a program developed through MS-Excel macro coding to calculate the FC load to the stream from the watershed. In this study, we have developed an automated geospatial model in ArcGIS Model Builder to calculate the amount of bacteria transported from each pixel grid of the watershed. Quenzer's equation was used to develop the actual grid based run off calculation using the 2005 NLCD data and the areal precipitation data created with surface interpolation of point precipitation record of the watershed. The fecal colony record for water from each land-use type was used to calculate the bacteria load from each grid using the map algebra function of GIS. This study, through the developed geospatial model with the application of zonal statistics summarized the subwatershed based total fecal coliform load. Virginia Tech's FCLC was used to calculate the bacteria load from the non-point sources of the same watershed. Both the results were compared. It was clearly observed that the authors' developed geo-spatial model easily (an automated process) calculated the bacteria load from non-point source on grid basis while FCLC could not. The results of the load calculation were pretty close with both techniques. Finally, the FCLC was used to calculate the fecal coliform load from point sources. As a future project, another geospatial model for spatial calculation of fecal coliform load from point sources is being developed.

Impact Statement:

This study basically paves way for developing geo-spatial models for impairment load calculations with perfection, i.e., calculations to the minimum grid level. It compares and shows the limitations of a widely used model, developed for the purpose of load calculation. The developed geo-spatial model, although not quite independent but more independent than the compared model of any empirical algorithm developed on experiments conducted on some particular spatial locations. This model can be replicated in any watershed of the nation with the change of GIS data only.

Category: Watershed Assessment and Restoration

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