Enhancement and Evaluation of SWAT Filter Strip Module reflecting Field Runoff Volume and Filter Strip Width

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Abstract

In the recent years, many methods to manage and prevent muddy water problem have been investigated such as greet chamber, reservoir, or debris barrier. Not only these methods, but also the vegetative filter strip (VFS) is thought to be one of the most effective methods to trap sediment effectively. The VFS are usually installed at the edge of agricultural areas adjacent to stream or drainage ditches, and it has been shown that the VFS effectively removes pollutants with upland runoff. However if the VFS is designed and installed without any scientific analysis of rainfall-runoff characteristics, soil erosion, and sediment analysis, sediment reduction effects cannot be expected. The Soil and Water Assessment Tool (SWAT) model have been used worldwide for hydrologic and Non-Point Source Pollution (NPSP) analysis at a watershed scale. The SWAT has ability to simulate the sediment and pollutant reduction effects with a VFS. However the VFS module in the SWAT is a function of solely VFS width. Thus, the VFS module is needed to be modified because the VFS module in the SWAT model considers only the VFS width in sediment trapping efficiency simulation process, even though there are many factors affecting the trapping efficiency of VFS, such as runoff volume caused by runoff, soil property, and vegetative property. In this study, the VFS module in the SWAT was modified to consider VFS width and upland runoff volume using the regression equation derived from over 10,000 simulation of the Vegetative Filter Strip (VFSMOD) model. In the simulations of reduced sediment by VFS, current SWAT model estimated 51.91 % and 51.93 % reduced when the surface flow were 6.79 m^3/s (6^{th} Jul. 2005) and 10.50 m^3/s (9^{th} Jul. 2005) respectably, but modified SWAT model estimated 40.39 % and 23.98 % reduced when the surface flow were 6.79 m^3/s (6^{th} Jul. 2005) and 10.50 m^3/s (9^{th} Jul. 2005) respectably. It was found that the enhanced VFS module in the SWAT performs well for various storm event analyses, such as higher and lower runoff cases, compared with the currently available SWAT VFS module which gives the same sediment reduction ratio irrespective of the upland runoff volume with various storm events. The enhanced version of the SWAT is available at http://www.EnvSys.co.kr/~swat.

Keywords: Vegetative Filter Strip, VFSMOD, SWAT, filter strip width