Mathematical and Computer Modelling 54 (2011) 1151–1159

Contents lists available at ScienceDirect

Mathematical and Computer Modelling

journal homepage: www.elsevier.com/locate/mcm

Research on non-point source pollution spatial distribution of Qingdao based on L-THIA model

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ARTICLE INFO

Article history:
Received 17 August 2010
Accepted 4 November 2010

Keywords:
Non-point source pollution
L-THIA model
Spatial information technology

ABSTRACT

Non-point source (NPS) pollution originating from agricultural development is the root cause of environmental pollution. Herein, we explore the integration of a NPS pollution model with novel spatial information technology to further understand the effects of enhanced crop development on local water resources.

This study was based on land use, soil and precipitation data from studies conducted using the L-THIA (Long-Term Hydrologic Impact Assessment, L-THIA) model, in concert with an analysis of the spatial distribution of NPS pollution within the study area. The L-THIA model was consistent in anticipating increased pollution levels and, therefore, may be used to provide information critical to land use and environmental protection planning.

1. Introduction

Non-point source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. Unlike pollution from industrial and sewage treatment plants, NPS pollution originates from many diffuse sources. NPS pollution is caused by precipitation moving over and through the ground. This runoff washes natural and synthetic pollutants into lakes, rivers, wetlands, coastal waters and ground waters. Agricultural activities that cause NPS pollution include poorly located or mismanaged animal feeding; overgrazing; mismanaged plowing; and improper, excessive or poorly timed application of pesticides, irrigation water and fertilizer.

To date, many scholars have investigated NPS pollution. Model simulation is accepted as the most effective and direct method to quantify temporal–spatial changes in NPS pollution and to control NPS pollutants [1]. However, there is a need for critical studies of small watershed agricultural NPS pollution [2]. In addition, transitions in land use/land cover have impacted the non-point pollution load by changing the soil and runoff characteristics [3,4].

The influences of different classes of land use on NPS pollution are various. Quantitative evaluation of various types of NPS pollution on the environment is fundamental in land use planning and in the reduction non-point source pollution [5]. According to reported domestic references, the introduction of the pollution load method has positively impacted the normalization of some sources of pollution. Using this method, various normalized pollutants are scaled to unity to create a quantitative reference to determine the major pollutants, key pollution and, therefore, pollution load [6,7]. Some researchers have conducted specific investigations of NPS pollution of Dagu river watershed. Zhang Jinheng used agrochemical, poultry farming and livestock data of cultivated areas during 2000–2006 in Qingdao to establish an index system for evaluation of nitrogen and phosphate fertilizer, and livestock and poultry manure pollutant loads [8]. The Gray correlation analysis

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doi:10.1016/j.mcm.2010.11.048