Non-point source pollutants constitute a major portion of water pollution in the world. In fact, non-point source pollutants are prevalent in approximately 30 to 40 per cent of earth’s land. This in turn, would enter the food chain via farming, grazing or aquifers and cause long term health problems. Unlike points source pollution, where the effluents directly discharged into the concerned area are relatively more apparent, the sources behind non-point pollutants are unobservable and spatially distributed. These sources vary from run off chemicals used in agriculture, sewage wastes from rural houses and cities and/or effluents from factories (Corwin and Wagenet 1996; Wang et al 2012).

The large amount of heterogeneous data for non-point pollutant sources, both spatially as well as temporally, makes it difficult to collect as well as analyze. Both human activities and natural factors influence the cause, dispersal and decay rate of such pollutants. As a result, there are several limitations to field data collection. Moreover, several tools are required to examine the collected data and produce conclusive results. GIS and remote sensing techniques have made significant contribution in non-point source pollution modelling from data collection to analyzing the data and providing conclusive results (Corwin and Wagenet 1996).

Non-point source pollution modelling requires several parameters which are attainable due to GIS and remote sensing technology. Parameters often used in non-point source models are topology, vegetation cover, digital elevation data, land use/land cover, soil type, salinity accumulation level and flow parameters. Socio economic dataset such as fertilizer application rates, farming and life data are also used in some of the non-point source pollution models. At times images from multiple satellites are used to obtain and identify these parameters. Landsat thematic mapper, SPOT panchromatic, SPOT multispectral and QuickBird high resolution satellite imagery datasets are used in most of the sited literature. (Jakubauskas et al 1992; Lee et al 2010)
Non-point source pollution models coupled with GIS techniques are a popular approach used in several research studies. Transport models, index models and regression models are those which are coupled with GIS techniques. Transport models are used to understand flow parameters and movement of pollutants. These models can be either under steady state conditions or under non-equilibrium conditions. The transient state solute transport model works under non-equilibrium conditions. Index models, such as DRASTIC or Seepage, are used to understand the possibility of groundwater pollution occurring and regression models are used to assess the effect of the required independent variables such as soil characteristics and changes in land use/land cover types on groundwater vulnerability (Corwin and Wagenet 1996). Since majority non-point source pollution affects aquifers, several hydrological models are also coupled with GIS techniques depending on the research question.

GIS and remote sensing datasets and tool packages are an essential part of majority studies related to non-point source pollution. Despite the available technology, there are still gaps in literature related to NPS modelling and solutions. With more progress parameters required to identify specific non-point pollutants and sources would become more defined. At the same time, new development in GIS and remote sensing techniques would make data collection and modelling more efficient and accurate.
Annotated Bibliography:


This research focuses on identifying the areas, within a watershed basin (Fish River watershed basin), that contributes to nitrate pollution based on basin characteristics. These areas, denoted as ‘contributing zones’, are identified using GIS and remote sensing techniques. Land use or land cover patterns were determined using the LANDSAT Thematic Mapper data and the SPOT Panchromatic data. Soil characteristics taken from USDA-NRCS, were also analyzed by GIS to understand nutrient transport capacity. The ‘contributing zones’ were identified using a nutrient linkage model. The study concluded that urban residential areas, orchards and agricultural land act as major sources of nitrate pollution in the Fish River Watershed basin.


In this paper, the authors give an overview about non-point source pollutant models that uses GIS techniques. Since contamination of drinking water is one of the main consequences of non-point source pollution, solute transport models which can examine ground water flow movements are often conducted. GIS is essential to identify the parameters required for such models. Further, GIS tools are used to analyze the procured data. This paper also mentions a study conducted to examine the impact of non-point source pollution on the Vadose Zone. In this study, GIS was used to separate the areas which has salinity accumulation using phenological models of salinity development. Then they used GIS tools to assess the potential for groundwater pollution to occur by using a weighted index site assessment method (eg. DRASTIC or Seepage). Later they isolated and classified the required variables and then used regression models to relate them to ground water vulnerability.

The authors in this paper focus on finding the required dataset which can be used to model agricultural non-point source pollution via remote sensing techniques. This model was applied on the Cedar Creek Watershed in Kansas. The Landsat thematic mapper data, SPOT multispectral data, SPOT panchromatic data and a combination of both Landsat TM and SPOT panchromatic datasets were used in this research. This model, also called the AGNPS model, had 20 parameters, most of which were from land use/land cover and soil type datasets. This was mainly because several hydrological processes are based on these variables. They used Cohen’s kappa statistic to compare the data type and classification method.


Best management practices such as application of vegetative filter strip to reduce the effect of non-point pollutants. However, to identify an appropriate best management practice details about soil, topography and land use is relevant. In this research, SWAT (Soil and Water Assessment Tool) model is used to apply these best management practices in Gyeongancheon watershed (in South Korea). The authors used QuickBird high resolution satellite imagery dataset for this study. SWAT models are used to predict run-off parameters, the average annual gross erosion, the pollutant trapping efficiency and fertilizer applications.


The authors use multi temporal remote sensing images from SPOT satellite imagery to examine the impact of soil erosion and non-point source pollution in Kao Ping river basin (South Taiwan). For this research, classified eight types of land use patterns in the concerned area during the period 1991 to 2001. The data required for conducting the assessment is then procured. The General
Watershed Loading Function (GWLF) model was then used to assess the impact based on run-off, erosion, urban wash off and groundwater modelling techniques. Later, the ArcView system was used to calculate land use statistics for each sub basin. The study concludes that the land use patterns have changed significantly during this decade and have contributed to the non-point pollution occurring in this region.


The author provides a brief history of non-point source pollution in China. The model used in this paper, ‘Dualistic Structure’, assumes the influence of both human activities as well as natural factors on non-point source pollution. Multitemporal images acquired from remote sensing data under similar phenological conditions was used for this research. Using variables such as precipitation, topography, vegetation cover, landforms, fertilizer application rates, census data, livestock and poultry population are used in this Dualistic structure model. This study concluded that soil and water conservation and agricultural management practices are significantly impacted by non-point source pollution.