Long Term Hydrological Impact Assessment of Landuse Change on Surface Annual Runoff at the Catchment Scale

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Introduction
Runoff changes is high due to change in land use and often making model is the only way to evaluate the potential of each area to flood. For simulating of watershed land use change effects, many water quality and hydrology models is developed which usually are integrated with a GIS.

A model of environmental non-point source watershed area (ANSWERS), Soil and Water Assessment Tool (SWAT), agricultural non-point sources (AGNPS), protecting the natural environment of the United States (NRCS) and long-term hydrology impact assessment (L-THIA) model are example of this models.

This models can be used for impact assessment of land use management and other changes on hydrology and water quality. In this study L-THIA model was used for estimating runoff due to change in land use in Chaloos and Noshahr. This model is a good tool for potential impact assessment of land use change on surface runoff and water pollution and has been developed as accessible and rapid tools for using in long –time impact assessment of land use change.

The core of this model based on curve number (CN) which is widely used for estimating the flow behavior in an urban watershed. Using CN equation in the L-THIA is a simple alternative for hydrology complex model that require a lot of data which often are not accessible for more areas. Failure to observe the river privacy and the removing excess sand from the river bottom , upward change in forest land use under the pretext of industrial development in Noshahr and Chaloos cities in addition to disturbance in the upstream Watersheds as result fluctuation in river input ,remind us the possibility of flood risk in heavy rainfall.
Besides this issues, lack of proper urban development plan and uncontrolled heterogeneous construction in addition to making ugly face of the city, create a lot of costs for local people. For instance the costs caused by traffic and the fertile land further degradation and increased pressure on the environment can be named. On this study, long-term effects of land use change and urban development on hydrology conditions has been studied in Noshahr and Chaloos region.

**Research Methodology**

L-THIA model are estimates the daily runoff for different amounts of CN by using daily rainfall data and the amount of CN afterward total values of daily data were sum and the model estimated the annual runoff which shall be considered as the model output. An analysis assessment of the L-THIA can be used with current and past or proposed land use layers. The Results estimate the effect of current and past or proposed future of land use change on the amount of generated runoff. Land use maps for the period of study was extracted from the classification of satellite images, the class of hydrological groups and soil map created from land resources and suitability maps.

**Discussion and Results**

Classification of satellite images showed that the highest percentage of change is related to residential landuse. The town have increased from 40.14 in 1987 to 38.32 square kilometers in 2001, Increased 125 percent in residential area lead to decrease in other landuse. The greatest decrease with 48.36 refer to river privacy and the lowest decrease related to forest (82.3- levels) changes. Percentage in landuses like agricultural, garden and woodland and bareland respectively is 42.7-, 49.21- 23.23

**Conclusion**

L-THIA presents the result of runoff model as raster map of depth and runoff volume, investigation the runoff depth map showed increased 17.3 mm height of the runoff in the studied basin in the period 1987-2001. Runoff volume Map is calculated on cubic feet in each cell. Based on cell size (28 mm), runoff volume is increased about 8.145 cubic meters per cell, including 566.31 km watershed area, increased total runoff volume produced in this period will be about 9.79 million cubic meters. As a result of this research land use changes during the studied period (2001-1987) lead to increase 125 percent in residential area. Spatial growth of urban due to growth population is natural, but this development can be a threat while reduce river privacy with 36.48% and the gardens and tree filled with 23.23%.

The results of the L-THIA model in Noshahr and Chaloos cities with regard to the strong trend of land use change during the study period, with dominance of change in river privacy, tree field and gardens to residential land use increased 1.23 mm average depth of runoff equivalent to 707.89 thousand cubic meters per year. Growing residential areas and wasteland along the decrease in tree field, gardens and agricultural areas in the short term, will be necessary the proper scientific management and control, as well as observance of sustainable development in the areas. On the other hand it is important to note that using the same rain fall data in model performance for watershed in 1987 and
2001 clearly indicate the land use role in runoff variation after the remove of rainfall fluctuation. Should be note that the result of L-THIA doesn’t predict the event in the certain year but crate a general insight to long term hydrology effect due to different land use scenario. Using Model for managers and planners provides the opportunity to control and manage the event before incidence. According to result L-THIA model have acceptable ability to expression of land use change impact on volume and depth of runoff according to different scenario. This model with providing runoff spatial distribution map create the possibility of identification the point with high disaster risk and flood zones as well as flood management. Priority of watershed sub basins for control flood is another capability of this method furthermore the results illustrate acceptable performance of L-THIA in management and planning of land use and runoff control in studied area. While the use of this model for other areas with different topographic and climatic characteristics of is recommended, with regard to some limitation in model result it is important to considered to great number not to the exact amount of them

Keywords: landuse change, runoff modeling, L-THIA, Nowshahr and Chalous.

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