INNSPUB

Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 9, No. 4, p. 272-278, 2016
http://www.innspub.net

RESEARCH PAPER OPEN ACCESS

The effect of land use changes on groundwater level decline (Case study: North of Urmia lake basin)

M. Ranjpishe[1], M. Karimpour Rayhan[1], G. H. Zehtabian[2], H. Khosravi[*2]

[1]*International Desert Research Center, University of Tehran, Iran*

[2]*Department of Arid and Mountainous Regions Reclamation, University of Tehran, Iran*

Article published on October 30, 2016

Key words: Remote sensing, Land use changes, Drawdown in groundwater level, drought, North Lake subbasin

Abstract

One of the direct impacts of land use on the hydrological situation of each region is relationship between land use changes with fluctuations in ground water table. The aim of this study was to investigate the relationship between land use changes and a drawdown in water level underground basin is Shabestar. This basin is located near Urmia Lake which Groundwater Level Decline of this basin effect on Urmia drought. For this purpose land use map were extracted over the three time periods, 1990, 2007 and 2015, satellite images ETM, TM. In order to investigate the relationship of these changes falling groundwater level of the water table level was used 40wellsstatistics in over ten years (2002 to 2012). The study also aims to identify trends and determine rainfall and drought and wet periods of the moving average at3, 5and7-year-old was due to the results obtained from1997 to2003yearsdue to lack of rainfall and the drought period and uncontrolled exploitation of groundwater, the water level was low. Spatial variability analysis of a drawdown in the underground water basin in western and central regions due to increased garden sand irrigated land showed that the water level in these areas is a sharp drop, however, due to a rainfall increase from 2004 years to 2012, and consistent with the wet period, despite an increase in cultivated area and indiscriminate exploitation, we saw an increase of 16 cm water level.

***Corresponding Author:** H. Khosravi ✉ hakhosravi@ut.ac.ir

Introduction

A variety of methods to assess the impact of land use change son ground water hydrology, which is a direct approach to the relationship between the changes of land use. Land cover with fluctuations in the water table under ground (Scanlon *et al.,* 2005).

Land use change, over-exploitation of soil, surface water and ground water continued use of significant negative effect son the environment (Vito *et al*., 2003). Use changes as a result of factors such as drought, fires, flooding and human activities such as overgrazing, expansion of agricultural lands, gardens and natural re source management policies to increase use change, in the arid region that does not exist or its value is less surface water use of ground water as a replace mention this respect, so that the ground water in some areas is the only source of water supply (Shabani, 1999).

The assessment of ground water level fluctuation scan is used in the management of water re sources and also to identify the factors of land use changes and their causes during a specified time period maybe of interest to planners (Shaban, 2006). In the whole world, studies on the review and assessment of land use change impact of drought on draw downs ground water that was mentioned some of them at below.

(Ekrami *et al*, 2011) to assess the qualitative and quantitative changes in groundwater resources of Yazd-Ardakan plain in their 2000-2009 periods. The results indicated a downward trend of groundwater level changes and in every year average drawdown of water is about0.5 meters.

The main reason for the sharp drop in ground water table is increasing the frequency of droughts and uncontrolled exploitation of groundwater. (Singh *et al*, 2010) study changes in land use. Land cover ground water resources of remote sensing and GIS techniques were utilized, they toward reaching heir goals and sensor images of IRS, LISS, ground water quality and quantity of information during 17 years were used, the results showed that the amount of natural and artificial ground water recharge using due to changes inland use and land cover pattern (an increase of fallow land) has increased. (Akbari *et al*, 2009) studied that the level of ground water of Mashhad plain concluded increasing dry and irrigated lands taken from ground water is the main cause of decline in groundwater levels to over exploitation, population growth, increased acreage and a large number well shave been harvested. Among other studies done in this field, such as research (Shakiba *et al*, 2003; Razaghmanesh *et al*, 2010; Shahid and Haryka, 2009) cited. The aim of this study was to investigate the relationship between land use changes and loss impact of drought on ground water in the basin Shabestar.

Materials and methods

The study area

Shabestar city in the north-west city of Tabriz and Urmia lake's north-east, the area of this city is 2750 km² in terms of geographic location is located between 37 degrees and 42 minutes and 38 degrees 24 minutes north latitude and 45 degrees and 46 degrees 9 minutes and 5 minutes east longitude from Greenwich meridian.

The maximum height of 3155 meters on the summit of mount Alamdar and at least 1280 meters above sea level in the low land lake (Fig. 1).

Search method

The first step in this research was to determine changes in water level since 2002 to 2012. The number of wells in the area have been studied piezometer is 40 rings, (fig. 2) after sorting the statistical data hydrography, the water level during the mentioned period drawn in Excel 2013 software, then using Arc GIS 9.3 software zoning map of the underground water level was developed in three phases. In order to prep area land use map used from compilation method of interpretation that for using from satellite image first was evaluated in terms of radiometric and geometric,

3 period data that content Landsat TM image data, the shooting date in 1998 and 2007, pictures of ETM to the shooting date in 2015, were imported to ENVI. The images were classified in six classes range, gardens, and abandoned, agricultural, urban and blue zones. Then, pictures imported to Arc GIS 10.1 software and land use maps were prepared. To evaluate the impact of wet and dry year son the level the ground water was used from moving average.

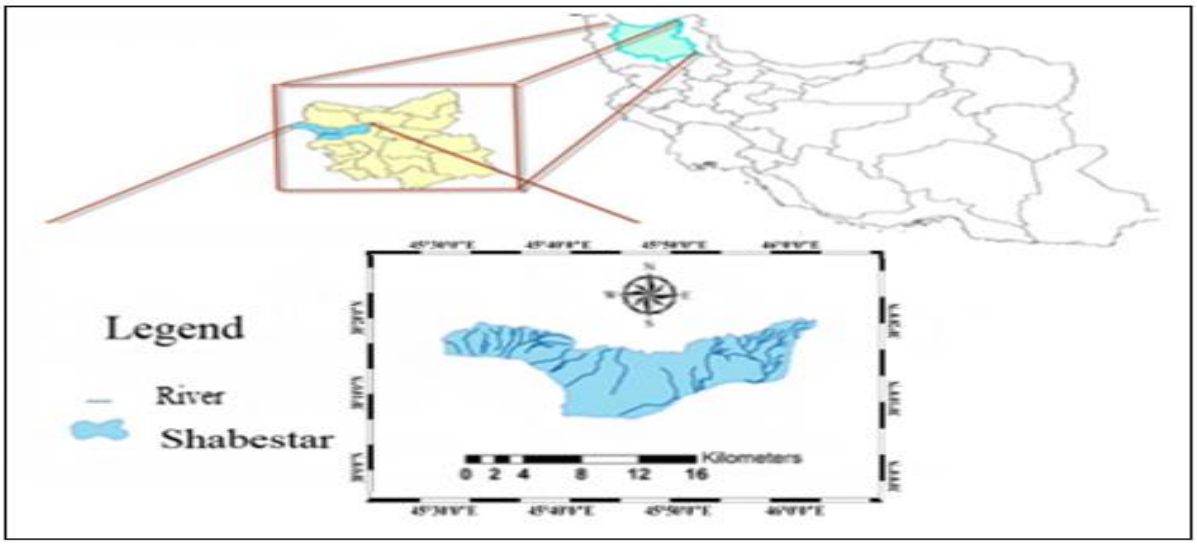

Fig. 1. Geographical location of the study area.

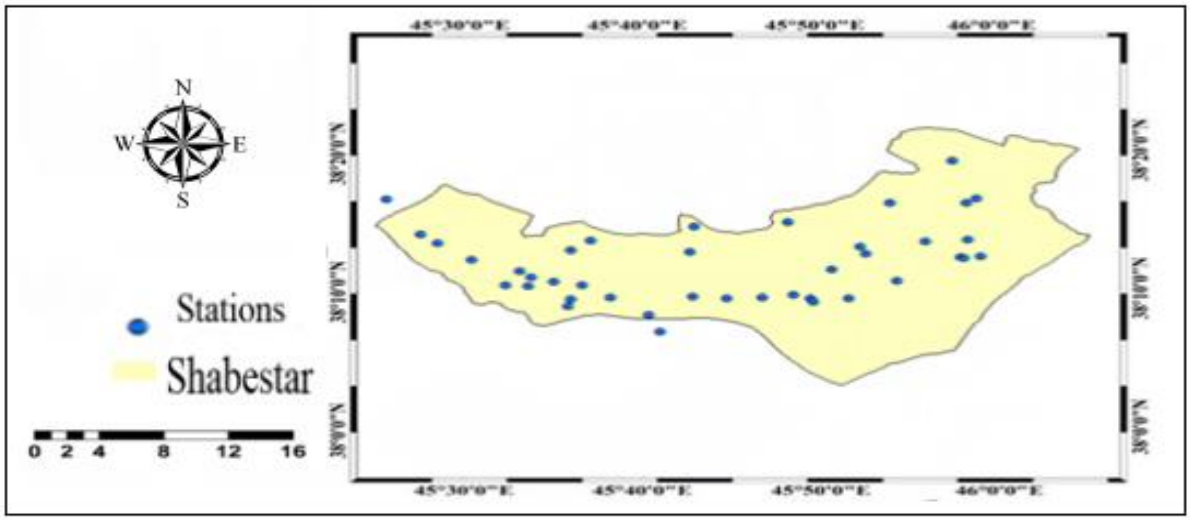

Fig. 2. Location of the study are a wells.

Results

Land use changes

In this part, by study in satellite images of the years 1990, 2007, 2015, six land uses were identified agricultural lands, gardens, residential, ranch, barren lands (abandoned lands) and aquatic area. Since the interpretation of satellite imagery in the study of hybrid interpretation, different land use changes were evaluated accordingly.

Results visual interpretation satellite images related to the casein Fig. 3, Table 1 also shows the area of different land use in the study area, most changes have occurred in the period from 1990 to2007. According to Table 1 agricultural lands, residential gardens, barren lands (abandoned lands) from 1990 to 2007, respectively 4221.03, 1587.03, 718.31, 4337.04 hectares has increased and range land was

reduced since this period about 10312.99 hectares of limitations and aquatic areas have been eliminated. Due to the deep and semi-deep well sand increased rain fall in the region has increased farm land and gardens and also agricultural lands, houses, gardens, barren lands (abandoned lands) have increased from 2007 to 2015, respectively 709.53, 293.37, 310.02, 553 hectares, range land has decreased 1866.09 hectares.

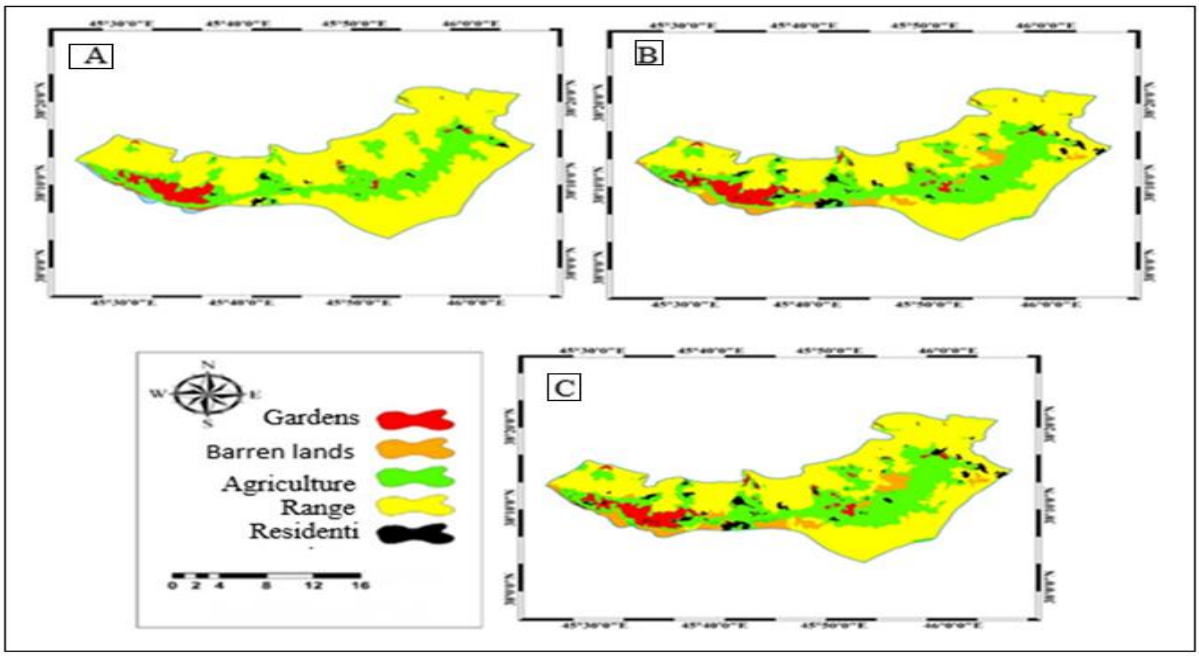

Fig. 3. Map of land use changes, A.1990 B.2007 C.2015.

Changes in ground water level

At reviews changes in ground water level (Fig. 4) showed that the water level in the 2012s was higher than 2003s. This is due to the occurrence of a drought period from years 1998 to 2003 and from 2004 to2012, despite the increasing exploitation of ground water and land use change due to increased precipitation and wet period saw an increase in ground water levels are 16cm. Figure 5 maps of spatial variations has been prepared using Gaussian interpolation, which shows ground water loss in the study area.

Table 1. Area of different land use in observation area.

Area of land use classes in hectares			Use type
2015 (hectare)	2007 (hectare)	1990 (hectare)	
26390.24	25680.71	21459.68	agriculture
2707.25	2413.88	826.85	residential
0.00	0.00	550.42	water
4558.89	4248.69	3530.38	gardens
5473.63	4920.63	583.59	barren lands
49042.2	50908.29	61221.28	range

Loss maps were grouped by model IMDPA. Studying maps of groundwater has relocated shows high groundwater level in north and south-eastern and south-western part of the city and the central and western parts of the region has been very severe loss ground water level. Comparison of tree period studies maps show that severe routing degradation is increasing in the central and western part and the severe degradation has stabilized.

Table 2. The amount of area dedicated to groundwater degradation classes in study area, using the model IMDPA.

Area (percent) 2010-2012	Area (percent) 2006-2009	Area (percent) 2002-2005	Class I MDPA	Ground water degradation (Centimeter per year)
32	33	34	Low	20>
14	14	15	Medium	20-30
40	39	37	Severe	30-50
14	14	14	Very severe	50<

Motivating average

Motivating average in the study area is shown in Figure 6. Based on the charts and given that the average rain fall in the study area 309.83 mm, in years 1991 to 1997 and 2004 to 2012 witnesses were wet period and the impact of drought has increased from 1998 to 2003 years due to reduced rainfall, on decline of aquifer water table.

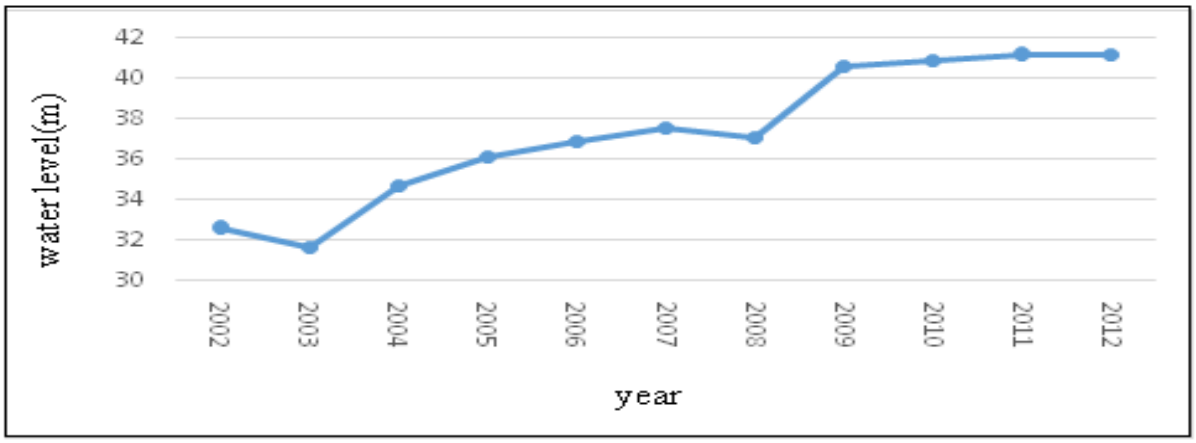

Fig. 4. Hydrograph changes in groundwater level in years (2002-2012).

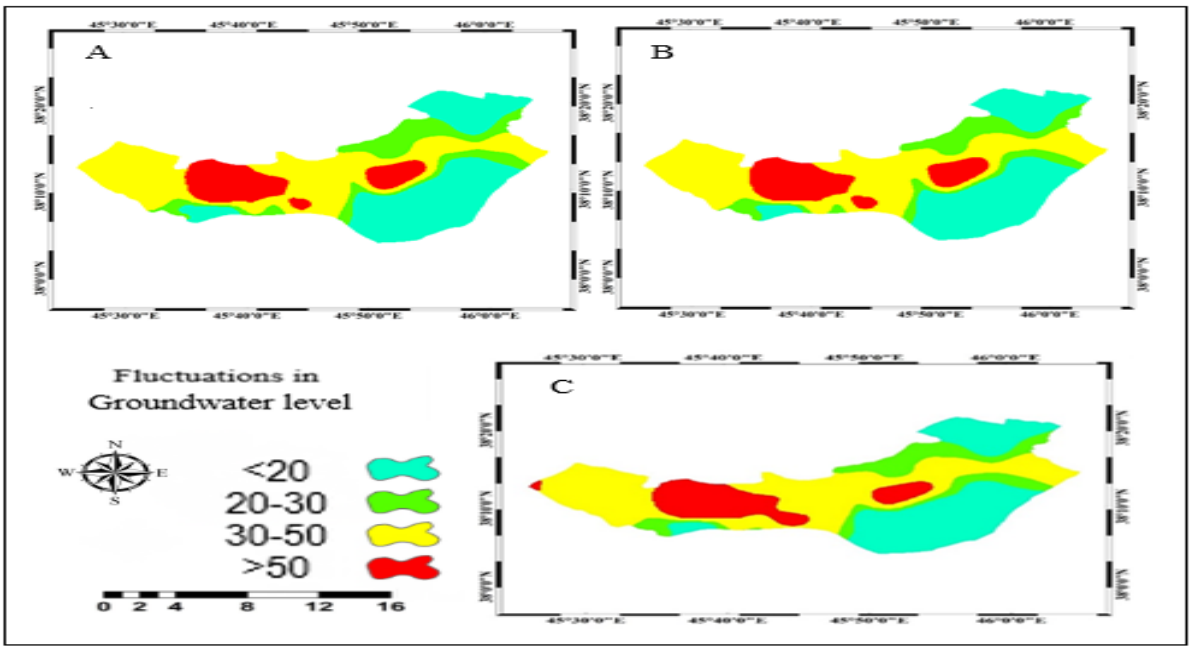

Fig. 5. Spatial variations of groundwater study area A: The years (2002-2005), B: The year (2006-2009), C: The year (2010-2012).

Discussion

The results showed that due to land use changes, in crease its agricultural lands and in line with the period of drought in years 1998 and 2002 witnessed a sharp drop of water in this area, with increase in rain fall in years 2003 to 2012, also being consistent with the wet period, despite agricultural increasing trend of water loss is negligible that Its cause groundwater recharge caused by increased rainfall, but in central and western parts of the region witnessed a sharp loss because of the concentration of agricultural land in wells of this area, these results agree to Khosrojerdi, 2014 (Zeid Abad and Manjir Abad), Khosravi *et al,* 2013 (Mehran-Illam), Sadeghi, 2013 (Zibar lake), Khan *et al*, 2008 (Australia), Hamidianpour, 2005 (Mashhad).

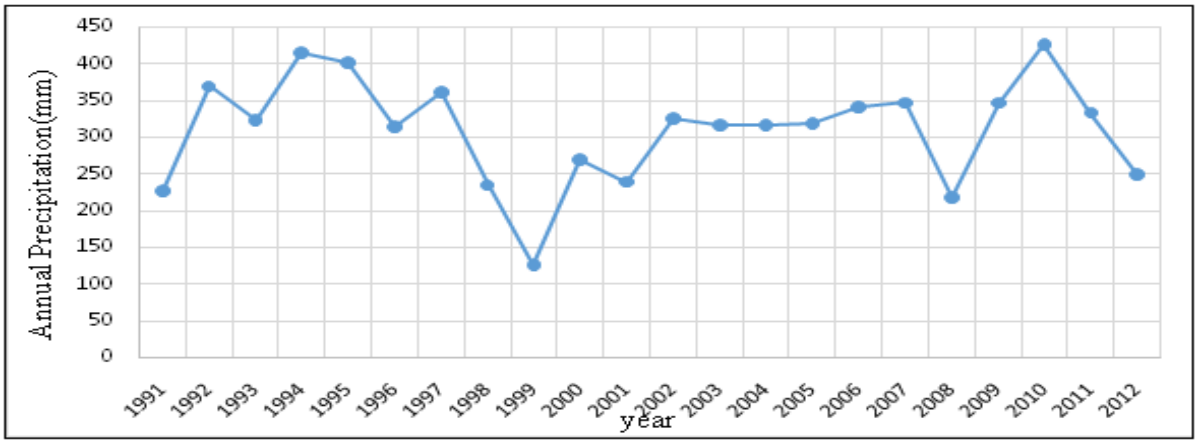

Fig. 6. Plot of annual rain fall during the period (1991 to 2012).

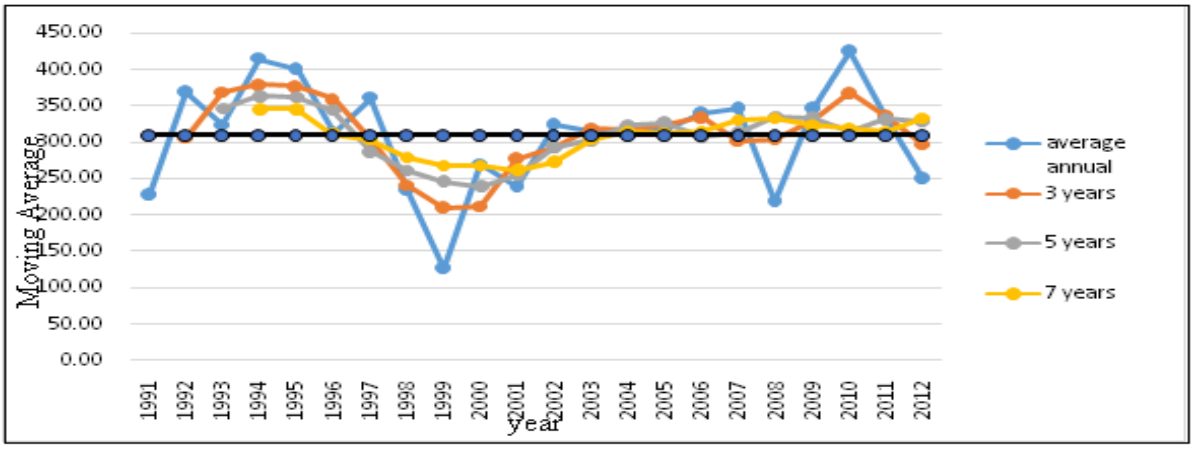

Fig. 7. Moving average chart 3, 5, 7 years of the study area.

References

Akbari M, Jorge M, Madanisadat H. 2009. Check declining groundwater levels using sGIS (Case Study: Aquifer Mashhad), Journal of Soil and Water Conservation Research **6(IV),** 78-63.

Ekrami M, Sharif Z, Maleki nejad H, Ekhtesasy M. 2011. Changes in the quality and quantity of groundwater resources Yazd- Ardekan, Journal of School Health, Yazd, year I, number II and III, pages 92-82.

Faramarzi M, Yaghoubi S, Karimi K. 2014. The effect of land use changes on ground water level loss (Case Study: Dehloranplain, Elam province), Journal of Water Management in Arid Regions, **1** number 2.

Hamidianpour M. 2005. Periods of drought analysis of Mashhad and the impact on water resources, Master of climatology, Beheshti University of Tehran.

Khan S, Gabriel HF, Rona T. 2008. Standard precipitation index to track drought and assess impact of rainfall on water tables in irrigation areas, Irrig Drainage Syst, 159–177, online at: Springer Science + Business Media B.V.

Keykhosravi R. 2014. Ground water quality zoning with geostatistical methods (case study Sabzevar plain), Master's thesis, Department of Natural Resources, Tehran University.

Mohamadzade SH, Sedighi H, Pezeshki-rad CH, Makhdoum M, Sharifikia M. 2014. Analyze the consequences of land use change from the perspective of horticultural crop grower sin West catchment area of Lake Uremia, Iran Agricultural Economics and Development Research, Volume 45, Number **4,** S775-785.

Nasrollahi M, Mambini M, Valizadeh S, Khosravi H. 2014. The effect of changes in land use. Land cover status of groundwater resources using satellite images (Case Study: Gilan-e Gharbplain), geographic information Journal, **23,** Number 91.

Razaghmanesh M, Salemi T, Seraj M. 2006. Assessment of Groundwater quality and quantity of Tabriz plain, National Conference on Irrigation and Drainage Networks, Shahid Chamran University.

Sadeghi A. 2013. Assessment and monitoring of land degradation and its impact on ground water quality and quantity Basin Zibar, master's thesis, Department of Natural Resources, Tehran University.

Scanlon B, Reedy R, Tonestromw D, Prudicz D, Dennehy K. 2005. Impact of land use and land cover change on groundwater recharge and quality in The south western US, Global Change Biology **11,** 1577-1593.

Shaban M. 2006. The application of digital data + ETM in mapping land use to improve rangeland management in Mouteh Wildlife Refuge, The first conference, University of pasture management.

Shabani M. 2008. Determine the most appropriate geostatistical method to map the change sin ground water TD Sand PH (Case study: Plain Arsanjan), Journal of Water Engineering **1,** 58-47.

Shahid SH, Hazarika MK. 2009. Groundwater Drought inthe Northwestern District of Bangladesh, Water Resour Manage.
www.dx.doi.org/10.1007.s11269-009-9534-y.

Shakiba A, Mirbagheri B, khyri A. 2010. Drought and its impact on groundwater resources in the East of Kermanshah using SPI, Geography (Journal - Research of Iran Geographic Society), Year VIII, Number 25, Pages 124-104.

Singh SK, Singh CHK, Mukherjee S. 2010. Impact of land-use and la cover change on groundwater quality in the Lower Shiwalik hills: a remote sensing and GIS based approach. Cent. Eur. J. Geosci. 124-131.

Vito FU, Rafael G, Nicola L. 2003. A Fuzzy Knowledge-Based Decision Support System for Groundwater Pollution Risk Evaluation, Environmental Management. 197-**189, (3)** 73.