Journal of Middle East Applied Science and Technology (JMEAST)

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 823-828

Evaluation of the efficacy of shrimp farms in the west Hormozgan province (Iran)

Sedighe Paroon [*1], Abdolmajid Paroon[2] and Sedighe bolouki[3]

[1] Department of agricultural, Payame Noor University, PO BOX 19395-3697 Tehran, IRAN phone: 0989177627334;e-mail: sparoon@ pnu.ac.ir).
[2] Graduated from fisheries, Department of Natural Resources, Khalij Fars University, Bousher, IRAN (e-mail: parroonmajid@yahoo.com).
[3] Department of management, Payame Noor University, PO BOX 19395-3697 Tehran, IRAN (e-mail: bolouki_sedighe@yahoo.com).

Abstract- In this study, the technical efficiency of shrimp breeders in the west Hormozgan province is measured using the data analysis approach. We also study the affecting factors on their efficiency. Required data for this study was collected through questionnaires in 1392. The data is analyzed using the software SPSS, DEAP and EVIEWS. The results of this study show that the average efficiency of shrimp breeders under the constant and variable returns to the scale assumptions is 0.87 and 0.91, respectively. Moreover, the influence of various factors such as age and experience are assessed using the Pearson correlation coefficients. Other factors such as the type of management training courses, membership in cooperatives, having insurance and taking out a loan are assessed using the t tests. The level of education and facilities are evaluated using the analysis of variance. Then, the simultaneous effect of variables on efficiency is studies using a linear regression model with the method of OLS. The results show that each of the variable, i.e. experience, education, utilities, participate in training, the use of credit and insurance independently have a significant relationship on the efficiency. The study of combined variables in the regression model shows that the variables of experience, education, training courses, facilities and insurance have a positive and significant relationship on the efficiency.

Keywords- efficiency, data envelopment analysis, shrimp, Hormozgan Province

I. INTRODUCTION

The importance of the shrimp industry in the southern provinces of Iran is worthy of consideration from several points of views. Due to the strong competition in the global market on the one hand, and the production status of shrimp in Iran on the other hand, Iran's share of the world's shrimp demand is likely to decrease. Shrimp-exporting countries have increased their market shares due to cheaper inputs, along with the efficiency and high productivity. As a result, the industrial competition for emerging countries such as Iran becomes difficult [6].

In recent years, various factors create a challenging situation for the hardware manufacturers. These factors include repeated infections (outbreak of the serious disease of white spots at sites shrimp), operating liabilities to banks, low productivity of shrimp farms, and most importantly decreasing the world price of shrimp. Small share of Iran in the global market of shrimp demand could not affect the world market price. Therefore, it is inevitable to reduce the total cost and to use the production factors in an optimal way. To this end, increasing the efficiency and improving the productivity should be established so that it provides policies for the sustainable development of the industry.

The development of the industry is done by utilizing factors including non-arable lands and saltwater which cannot be used to produce other products. Therefore, it is important to maintain and develop this industry. In this regard, we evaluate the performance of the firms [16].

Fisheries sector as one of the development pillars of the Hormozgan province has adequate capacity in the fishing and aquaculture. This sector plays an important role in the economic growth, regional development and job creation. We should remark that currently the livelihood of about 30 thousand people in the province comes in this way.

The Hormozgan province has a significant fishery capacity which includes fifty thousand hectares of fertile lands for shrimp production, thirteen centers with the capacity of producing 160 million pieces of shrimp larvae per year, five sites shrimp farming, four infrastructure sites, and five thousand hectares of arable surface in shrimp farms [6],[15].

There are five shrimp farming sites in the province. Sites of northern and southern Tiyab are located in Minab, Mogham and Saieh Khosh in Bandarlenge, and Hengam in Gheshm island. Two sites, Mogham and Saieh Khosh, are located in the west Hormozgan province [4].

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 823-828

Saieh Khosh shrimp farming site is located 55 km east of the Bandarlenge. The project area is 1,400 hectares with 900 hectares of net area. The Saieh Khosh complex includes 115 farms, 10 hectares of shrimp farming, and 100 farms of 2/5 hectares area under construction and operation. The Mogham Shrimp farming of Nayband village in the west Hormozgan province is located 160 km far from Lengeh and 70 km far from the Persian. The shrimp farming of Nayband is lunched in 2003 with 12 hectares of farmland.

Planning to increase the efficiency of production units requires measuring efficiency and recognition of the factors affecting its efficiency. By identifying the factors affecting it, as well as reinforce their strengths and eliminate weaknesses we can plan for the improvement of the efficiency and optimal use of the production factors. In order to achieve this goal, this research is devoted to measure the efficiency in shrimp farms in the west Hormozgan province and also examines the effects of various factors on the efficiency. Thus, it provides a useful data for official administrative member and industrial programmer in order to achieve an effective long-term plan.

II. Theory And Literatures

Many studies have conducted to determine the efficiency inside and outside of Iran. Different methods have been used to calculate the efficiency.

Pakravan et al (2009) in a study entitled " the determination of the efficiency for the canola producers in the city of Sari", calculated the average technical, allocating, scaling, and economical efficiency of the canola farmers in the region. The most non-optimal use was related to pesticides, and the inefficiency was related to the allocation of resources to the seeds and machineries.

Ansari and Salami (2007) used a Translog cost function for calculating the economies of scale in the shrimp farming industry. Larvae, fuel, rations were independent variables, and the labor productivity, a dependent variable.

Salehi (2007) analyzed the production of shrimp in the southern provinces of Iran for the economic point of view. The variables used in this study were larvae, labor and diet.

Hajiani et al (2005) studied the technical efficiency of the fleet of shrimp fishing in Bushehr province using the stochastic frontier analysis. The shrimp production was the independent variable, and duration of fishing, motor power, recorded gross capacity (Replacement deck area) and the width of the tour were the independent variables in this study.

Agha-Mohammadi (1999) estimated the factors affecting the rate of production per unit area in Khuzestan shrimp farms during 1998, using the SFA method. Independent variables included density per unit area, the average survival rates, average feed conversion, average feed intake, and the average number of working days during the breeding. A dependent variable was the average production.

Tang (2010) calculated the technical efficiency of shrimp farms in Kamayv province, Vietnam Using DEA, the super efficiency, and the input–based assumption. Input variables included the pool area, experience, type of shrimp, stocking density and awareness raisers, and output variables included production rates.

Huy (2009) studied the efficiency of black tiger shrimps in shrimp farms in Trang Vietnam using DEA models and the input-based method with the assumption of constant returns up to scale. The inputs were the shrimp weight, total production output of the system, pool area, labor forces, machinery systems (aeration, etc.), the pool size and the cost of rations.

Alam et al (2008) obtained the efficiency in the combined shrimp and carp farming using the data envelopment analysis for 105 farms in Bangladesh. Labor, larvae, feed, fertilizer and pool size were the independent variables and the dependent variable was the catches.

Den et al (2007) calculated the technical efficiency of Mykang Delta units of shrimp farming in Vietnam using SFA. The dependent variables were the rate of production and rationing of food, fertilizer, fuel, labor, dummy variable (type of shrimp in semi-intensive and intensive shrimp farms), and other costs were independent variables.

III. Materials and Methods

Required data for this study collected using a questionnaire to random sampling groups of shrimp breeders in the west Hormozgan province. In this study the efficiency is first measured by the data envelopment analysis using the software package DEAP. Then, using SPSS software, the effect of different variables on the efficiency of shrimp farms is studied. The effects of age and experience variables are examined using Pearson's correlation coefficient. Type of management training courses, membership in cooperatives, insurance and loans were assessed using t-tests and the level of education and facilities were evaluated using analysis of variance. Follow up, by the software EVIEWS and the regression-processing model, we determine the influencing factors on the efficiency.

$$EF = C - \sum b_i X_i \qquad (1)$$

In equation (1), EF is the efficiency of shrimp farms and X_i are variables under consideration including experience, education, utilities, membership in the cooperative, type of management, insurance, age, use of facilities and participation in training courses.

There are a variety of methods to assess performance and technical efficiency of production units. These methods divide into parametric and non-parametric. In the parametric methods, production functions are estimated using

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 823-828

econometric methods. Then, using these functions, we attempt to determine the efficiency. The second approach of measuring performance is non-parametric methods. DEA is one of the most important non-parametric methods that by a linear program determine the efficiency of those decision units that have the same inputs and outputs [13]. Efficiency in the DEA method is relative. The efficiency boundary is made up by a convex combination of efficient units. Therefore, any firm, which is located on the efficiency frontier, is efficient; otherwise it is inefficient. In order to make an inefficient unit efficient, we should make changes in the inputs and outputs of the unit. After running the DEA model, a set identified as a reference set. In this approach, we can maximize the target function based on inputs or using its dual, minimize inputs. In the data analysis method, the efficiency can be calculated with constant and variable assumption with respect to scale. In this study, the efficiency calculated using both assumptions. The general linear programming model assuming the constant returns to scale is as in equation (2) [2], [17].

$$MaxE \quad \frac{\sum_{r=1}^{s} W_r O_{rj}}{\sum_{i=1}^{m} V_i I_{ij}}$$

S.T.

$$\frac{\sum_{r=1}^{s} W_r O_{rj}}{\sum_{i=1}^{m} V_i I_{ij}} \leq 1 \qquad (2)$$

$$W_r \geq 0 \, , V_i \geq 0$$

In equation (2), W: product weight, V: the weight factor, O: products and I: inputs. The above relation is a model of nonlinear convex model, which has infinitely many optimization solutions. In order to solve the problem with a linear transformation, we transform this model into linear model. We assume that the denominator equals to one and maximize the numerator. It is called the input oriented DEA model. Equivalently, we can assume the numerator is one and minimize the denominator. It is called the output Oriented DEA model [8], [15]. The choice of the appropriate model depends on the size of the control outputs and inputs. Thus, the one, which is more manageable, will be chosen as the suitable model [13], [17].

In this study, the input is greater than output controls. Capacity of each unit is almost unknown. We use input-oriented model. As follows:

$$Max E = \sum_{r=1}^{s} W_r O_{rj}$$

S.T.

$$\sum W_r O_{rj} - \sum V_i I_{ij} \leq 1 \qquad (3)$$

$$\sum V_i I_{ij} = 1$$

$$W_r \geq 0, V_i \geq 0$$

Due to the limitations of the model, the optimum value of the maximized objective functioned equals to one. Since the optimal values are independent of the unit measurements and are the same for all unit decisions, thus, output is measured by the unit measurement [6], [10]. The dual problem requires fewer constraints than the original problem. Therefore, the dual form is preferred which is as follows:

$$Min \, \alpha$$

S.T.

$$-Y_i + YA \geq 0 \qquad (4)$$

$$\alpha X_i - XA \geq 0$$

$$\lambda \geq 0$$

In the above equation λ is a vector, and N*1 is fixed numbers representing the weights of the reference collection. Values obtained for α represent the firm's performance. The first constraint in the above equation represent if the actual amount of product produced by the firm i using the factors of production can be greater than this value.

The second constraint implies that the production factors used in the firm i should be the same as ones used in the reference firm. Linear programming model should be solved for each decision unit so that the performance levels achieve for each unit (α).

As mentioned earlier, the above calculations are given under the assumption of the constant returns to the scale. The assumption of the constant returns to the scale is applicable only if firms operate at the optimal scale. Different issues such as competitive effects, constraints, etc., cause that firms do not operate at the optimal scale. The data envelopment analysis with the variable returns to the scale assumption give the technical efficiencies, including the pure technical efficiency (efficiency resulting from management) and the saving efficiency due to the scale of a firm. In order to encourage managers, it is necessary to have data on the performance

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 823-828

management. To this end, in the formulation of the dual problem of the linear programming, we assume the constant return to the scale by adding a convexity constraint using the restriction NIλ = 1 in equation (4). Calculations are done under the assumption of the variable returns to scale [16], [9], [5].

IV. Results and Discussion

In this section, we discuss the analytical results obtained in this study.

The efficiency of units under study using the data envelopment analysis with the software package DEAP is calculated and summarized in Table (1).

Table (1) - Performance calculated with assumption of constant and variable returns to scale

efficiency	Minimum	Maximum	Average	Standard deviation
Constant returns to scale	0.56	1	0.87	0.142
Variable returns to scale	0.58	1	0.91	0.112

Source: Findings

Table (2) - Factors Affecting Performance

Variable name	The coefficient of correlation	Base	Significant level
Age	Pearson	1.14	----
Experience	Pearson	4.53	0.01
Education	Analysis of Variance	8.09	0.01
Installation	Analysis of Variance	2.7	0.05
Owner	Comparing the mean	0.879	----
Attend training courses	Comparing the mean	0.981	0.05
Use of Facilities	Comparing the mean	2.323	0.01
The Cooperative Membership	Comparing the mean	10.12	----
Insurance	Comparing the mean	0.217	0.1

Source: Findings

In Table (1) we can see the average of unit's efficiency assuming the variable return to scale is more than the efficiency of the constant return to scale and is equal to 91 percent. The performance of inefficient units is equal to 58 percent. In other words, 42 percent of the units are inefficient.

Table (2) shows the effect of different factors on the performance evaluation of shrimp breeders.

As shown in Table (2), the experience, education, utilities, participate in training courses, using the facilities and insurance are significantly associated with the performance. The results show that the age is positively related to the performance, but not very significant. You could say that younger people are as successful as older people. The experience variable has a positive and significant relation with the performance. In other words, units with more experienced managers are more efficient. The education also has a significant relationship with the performance and it seems that farmers with higher education have been efficient farmers. Although education may be unrelated to their professional in breeders shrimp, their efficiency could be due to their greater ability to look at literature and search among references. The facility has a significant effect on the efficiency. The farms with more modern facilities are of higher efficiency. Ownership has no significant influence on the performance. Attending training has a positive and significant effect on the performance. It can be a result of the correlation between the material presented in the classroom and the real needs of farmers. Using the facility has a positive and significant impact on the performance due to its role in enabling micro savings breeders, replacement of aging facilities, and usage of the modern equipment. The cooperative membership has no significant effect on performance. This can be the result of the lack of real co-operatives among the shrimp farmers or lack of knowledge of farmers about the existence of such cooperative. Insurance has a significant and positive effect on the efficiency of farms. This indicates that a farmer is more efficient in certain circumstances.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 823-828

After examining the performance of individual variables, in order to examine the simultaneous effect of variables on the performance, the regression model (5) is obtained by OLS.

$$EF \quad \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 \qquad (5)$$

EF represents the performance and X1, X2, X3, X4 and X5 are the level of education, experience, insurance, utilities and education courses, respectively. Therefore, after the estimation of various models and their impact on the performance of all variables, we conclude that only the above-mentioned variables in the regression model have a significant and positive impact on the performance. Coefficients and significant levels show in Table (3).

Table (3) - Factors affecting the efficiency of shrimp breeders West Hormozgan province

Variable	Coefficient of Variation	T-statistics
Constant factor	1.23	2.54^{**}
Level of Education	0.211	10.23^{***}
Experience	0.008	1.93^{*}
Insurance	0.001	1.95^{*}
Installation	0.067	4.82^{***}
Attend training courses	0.012	2.48^{**}
$R^2 = 0.87$		

Source: Findings, *, ** And * respectively 10, 5 and 1 percent are significant.**

Results in Table 3 shows that education and facilities have significant impact on the efficiency of shrimp farms at the level of one percent. Attending courses at the level of five percent, and experience and insurance at 10% level are significant. The sign indicates the positive relationship between these variables and efficiencies.

V. SUGGESTIONS

Considering a significant and positive impact of banking facilities on the efficiency, it seems that facilitating the path for providing modern convenience to traditional units accelerates their industrialization and increases their efficiency. The regression estimates also show that facilities have a positive impact on performance, which is significant at one percent level. This could indicate a direct relationship between the facilities, installations and performance.

The significant relationship between performance and participation in training shows that these training courses meet the needs of farmers. Therefore, training classes for shrimp keepers and monitoring engineers increases their efficiency.

Having a significant and positive impact of insurance on the performance of farms suggests that strengthening the insurance system can increase the efficiency. Because working in a reliable and less risky environment increases the work progress and speed up the technological development in farms.

VI. RESOURCES

[1]. Agha Mohammadi, S. M., Factors affecting the production rate per unit area of shrimp farms in Khuzestan province 77, Master's thesis, University of Economics and Social Sciences, University of Shahid Chamran, 2008.

[2]. Alam M.F., Murshed J.K., Resource allocation efficiency of prawn-carp farmers of Bangladesh. Aquaculture Economics & Management, Volume 12, Issue 3, 188-206, 2008.

[3]. Anderson, P. and Petersen, N. C,. A procedure for ranking efficient units in DEA, Management Science, Vol.39:1261-1264, 1993.

[4]. Ansari, H. & A. Eslami, Economies of scale shrimp farming industry in Iran Journal of Agricultural Economics, Special Sixth Conference of Iranian Agricultural Economics, 35- 51, 2007.

[5]. Avkiran Necimi, K., Investigating technical and scale efficiencies of Australian universities through data envelopment analysis, socio-economic planning sciences, Volume 35, issue 1:57-80, 2001.

[6]. Daneshvar Ameri, Zh. & S. Yazdani, Factors affecting marketing margins shrimp, Journal of Agricultural Sciences, 13 (2):275-283, 2007.

[7]. Den D.T., Ancev T, Harris M., Technical Efficiency of Prawn Farms in Mekong Delta, Vietnam – Australian Agricultural and

Resource Economics Society – Cocference (51 st), February 13- 16, Queenstown New Zealand, 2007 .

[8]. Emami Meibodi, A. Measurement of efficiency and productivity (scientific and practical), Institute for Trade Studies and Research, First published in Tehran, 2000.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 823-828

[9]. Esfahani, S. M. J. & J. Khazai, Factors affecting the efficiency of poultry South Khorasan, Agricultural Economics Research, Volume 2, Number 4, 165-180, 2010.

[10]. Fazli, S. Developed a mathematical model to evaluate the performance of managers in state agencies - approach to the analysis of data covering, Ph.D. dissertation, Tarbiat Modarres University, Tehran, 2002.

[11]. Hajiani, P., S. Khalilian, H. Abrishami & Gh. R. Peykani, Examine the technical efficiency of shrimp fishing fleet in the Persian Gulf, Bushehr Case Study, Agricultural and Development Economics, 13 (Special Issue): 201-225 2011.

[12]. Huy D., Technical Efficiency Analysis for Commercial Black Tiger Prawn (Penaeus monodon) Aquaculture Farms in Nha Trang City, Vietnam. M.S Thesis, Faculty of Fisheries and Aquaculture, Management and EconomicsNorway & Nha Trang University, Vietnam, 2009.

[13]. Mohammadi, A. Measuring the efficiency of poultry production units with the approach of DEA, Fars case study, Journal of Agricultural Economics and Development, 16 (63), 89-116, 2008.

[14]. Pakravan, M., H. Mehrabi Bashar Abadi & A. Shakibai, Canola production efficiency in the city of Sari, Journal of Agricultural Economics, Volume 14, 2009.

[15]. Salehi, H., Economic analysis of white shrimp Hindi in the southern provinces of Iran, Iranian Journal of Fisheries, 16 (2):103-116, 2007.

[16]. Shahraki, J., A. R. Karbasi & M. Yaghubi, Evaluate the profitability and efficiency of regional case study of shrimp farms goiter city of Chabahar, Agricultural Economics Research, Volume 3, Number 3, 17-36, 2011.

[17]. Tung P, Technical efficiency of improved extensive shrimp farming in Ca Mau province, Vietnam. M.S. Thesis in Fisheries and Aquaculture Management and Economics, University of Troms, 2010.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 829-834

Flood Zone Investigation and soil erosion potential mapping in Kahsan watershed using GIS

R.Ghzavi

Abstract— Flood is one of the natural disasters that the control or decrease of its damages needs a special planning. Investigation of flood potential area and erodibility of watersheds have an important role in integrated watershed management. The main aim of this study is to estimate flood and erosion potential of Kashan watershed using EPM (Erosion Potential Method), SCS (Soil Conservation Service) and field data using GIS software. The rate of erosion and deposition was evaluated using EPM model. Discharge at each sub-basin was estimated using the SCS model. Annual runoff volume was estimated via runoff coefficient, and annual precipitation for each sub-basin. According to results, sub-basin preference for practical watershed management works was different due to method of classification. Based on results, classification of sub basin was organized by overlay maps of discharge, special runoff and erosion maps using Arc Gis 9.3.

***Keywords*—**Flood, Discharge, Erosion, Sediment, GIS, Kashan watershed

I. INTRODUCTION

Flood is one of the natural disasters in the world. There are many inconvenient effects of flooding on human settlements and economic activities. Moreover, important parts of fertile soil are being physically lost each year via flood events [7].Changes in land use due to development strategies and natural erosion in the recent years increased flood events in arid and semi arid area such as Iran [16].According to researches ,yearly soil erosion in Iran is more than 1.4 milliard ton[1].

Investigation sediment and flood sources in watersheds are important to reduce flood damaging in arid and semiarid areas [7],[18]. Also different factors such as watershed area, rainfall condition, slope, shape, time of concentration and geology should affect flood and erodibility of watersheds, but flood and erosion are results of the interaction of the above factors [4]. For correct planning, the extent and weight of each factor should be considered. Based on previous studies, land use change was the most important factor of the damage caused by floods. Destruction of vegetation [13] , land use change [12], and development of the impervious area[19] should increase flood events and erodibility in different area of the world.

In the arid and semi arid area, combination and organization of all effective parameter in soil and water conservation are difficult due to the huge area and volume of calculations. Using GIS for flood and erosion zone mapping, not only generates a visualization of flooding but also increase the amount and accuracy of the estimated data [10],[17]. Geographical information systems (GIS) has become a critical tool for flood and erosion zoning because it provides a framework for collecting, storing, analysing, transforming and displaying spatial and non-spatial data for particular purposes[14],[3]. Using some of its features such as map overlay and analysis could help to aggregate hydrologic information from different sources such as rainfall data, land use/land cover, soil and physiographical characteristics of watersheds[20],[5]. Because of its capacity to handle large amount of spatial and attribute data, GIS in integrated with runoff and sediment modeling such as SCS-CN and EPM methods could be a suitable tools for Identification of suitable sites for flood and erosion control [20],[6],[15],[11].

Investigation of flood potential area and erodibility of watersheds have an important role in integrated watershed management. This necessitates the identification of the more sensible area within higher accuracy. For correct planning, the important and role of each factor should be considered. The main object of this study is to estimate flood and erosion potential of Kashan watershed sub basin using EPM, SCS and field data using GIS software.

II. MATERIAL AND METHODS

The study area named Kashan watershed covering an area of about 2000km2 in the center of Iran in Esfahan province lies between latitudes 33˚ .31".37' N- 34˚ .8".22' N and longitudes 50˚ .57".40' E- 51˚ .38".37' E (Figure 1).

R. Ghazavi. is with the University of Kashan in Iran (corresponding author to provide phone: 98 3153221591; fax: 98 3153222591; e-mail :ghazavi@kashanu.ac.ir .

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 829-834

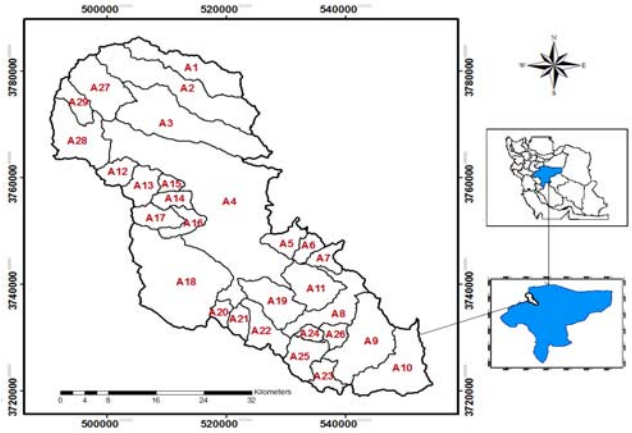


Fig1. Location map of the study area in Iran

Mean annual rainfall in the study area is about 186 mm. Potential evapotranspiration reaches 2620mm (measured class-A pan evaporation). The average annual air temperatures in this area varied from 9ºC in January to 37ºC in July. Approximately 64% of annual rainfall occurs in the winter-autumn period, 32% in the spring, and 4% in the summer. The average elevation of the study area is approximately 1650m above mean sea level (ranges from a minimum of 1022 to a maximum of 3579 m).Kashan watershed is a part of a natural geological unit contains two mountainous and plain areas with various kind of landscape formed by erosion.

For this study, the study area divided in to 29 sub-basins (Figure 1). Drainage, Land use, soil classification, geological, and physiographical maps for each sub-basin were derived from topographical maps, GIS, satellite data, and direct land survey. SCS method was used for runoff estimations in each sub-basin. The precipitation for each sub-basin was estimated through a linear regression of rainfall versus elevation. The rate of erosion and deposition was evaluated using EPM model.

Digital Elevation Model (DEM) of the study area draws via 3d analysis toolbar in ArcGis9.3 . Sub basin area was separated via Arc Hydro toolbar in Gis software based on DEM of the study area and controlled by direct survey . Slope map draws from DEM using 3D analysis toolbar. Land use map obtained from ETM+ image of 2007 using ENVI4.5 and Arc GIS. Figure (2) indicate drainage, land use, runoff potential, slope, and soil texture maps of the study area.

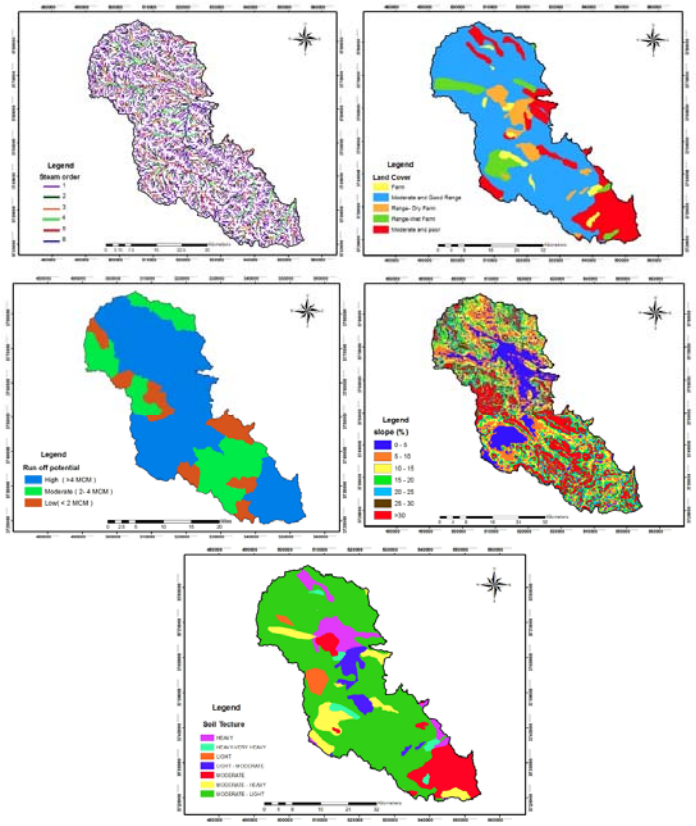


Fig2. Drainage, Land-cover, runoff potential , slope, , and soil texture maps of the study area

Average temperature and rainfall of each sub basin for EPM model was estimated through a linear regression of rainfall and temperature versus elevation. Isotherm and isohyets maps of the study area then draw via spatial analays toolbar and raster calculator in GIS.

Volume of runoff per unit of area with different return period (25 and 50 year) was estimated via runoff coefficient, annual precipitation and area of each sub-basin. Runoff coefficient was estimated using land use and slope maps.

Special sediment rate, volume of special erosion, and total sediment rate of each sub basin was estimated using EPM model. The equation of model was presented in table (1)

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 829-834

Table 1 . The contributing equation in EPM model to estimate the soil erosion

Parameters	Equation	Equation number
WSP: the volume of soil erosion (m3/km2/yr) , H: mean annual rainfall (mm), π: 3. 14, T: coefficient of temperature ,Z: coefficient of erosion intensity	$W_{sp} = T.H.Z^{3/2}.\pi$	1
Y: susceptibility of rock and soil to erosion, Xa: land use coefficient, Ψ : Erosion coefficient of watershed , I: mean watershed slope	$Z = YX_a(\psi + I^{0.5})$	2
t: mean annual temperature	$T = \left(\frac{t}{10} + 0.1\right)^{1/2}$	3
P: circumference of the watershed, L: watershed length (km), D: height difference in watershed area (km)	$R_u = \frac{4(P \times D)^{1/2}}{L + 10}$	4
GSP: special sediment rate, WSP: volume of special erosion, Ru: coefficient of sedimentation, GS: total sediment rate (m3/yr) , F: total watershed area (Km2)	$G_{sp} = W_{sp}.R_u$	5

III RESULTS

Estimated specific discharge, volume of runoff per unit of area with different return period, erosion and sediment per unit of area were shown in table (2). At first stage, the preference of sub basins determined based on specific discharge, specific volume of runoff, specific erosion, and sediment per unit of area(figure 2 and figure3) separately. The preference of sub basins for soil and water conservation activity was changed when the basic effective parameters changed(table 3).

Table 2. Estimated specific discharge, volume of runoff per unit of area with different return period, erosion and sediment per unit of area

Sediment per unit of area	Erosion per unit of area	volume of runoff per unit of area with 50 year return period	volume of runoff per unit of area with25 year return period	Maximum specific discharge with 50 year return period	Maximum specific discharge with 25 year return period	CN	area (Km^2)	Sub basin
37.41	327.6	1344.2	1201.8	3.77	3.11	82	79.25	A1
35.01	315	1381.5	1237.7	2.77	2.28	81.2	139.6	A2
20.23	182.9	1251.5	1108	1.83	1.45	75.1	151.1	A3
10.49	92.68	1475.4	1320	1.55	1.22	71.3	408.1	A4
74.88	600	1540.1	1387.7	10.5	8.82	86.4	26.79	A5
76.52	594.8	1486.9	1337.7	14.1	11.9	87	16.91	A6
63.81	509.2	1376.8	1227.9	10.8	9.11	86.4	20.31	A7
33.09	269.6	1618.3	1450.1	6.51	5.4	81.7	64.98	A8
45.86	401	1619.5	1453.6	4.2	3.46	79.1	108.5	A9
71.17	603.3	1739	1591.9	5.13	4.23	78.9	95.6	A10
71.59	599	1730.8	1555.9	9.17	7.81	87.5	58.29	A11
47.69	362	1763.4	1597.6	17	14.5	88.7	24.88	A12

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 829-834

85.8	659.7	1874.1	1701.6	16.1	13.7	88.3	33.69	A13
61.76	506.6	1629.7	1503.2	12.2	10.4	86.7	19.46	A14
44.86	349.4	1495.2	1343.8	14.8	12.4	84.3	11.07	A15
44.54	360	1572.6	1409.3	9.65	8.02	82.3	22.32	A16
24.69	199.6	1881.5	1697.3	15	13.1	92.5	30.21	A17
17.69	156.6	1663	1500.9	2.68	2.11	70.2	211.6	A18
47.58	384.6	1867.1	1692.9	10.5	8.95	87	56.85	A19
40.28	325	1757.9	1581.7	18.5	15.9	90.1	12.72	A20
42.11	343.1	1867.8	1694	14.1	12	85	18.36	A21
29.7	242.1	2053	1868.6	12.2	10.5	89.2	43.6	A22
45.29	333.1	1922.4	1735.4	17.7	15.1	86.9	23.38	A23
41.55	309.9	1983.6	1804.6	21.4	18.1	84.8	10.35	A24
61.72	502.7	2078.6	1893.9	13	11.2	88	39.42	A25
76.2	620.2	1757.3	1591.9	13.9	11.9	88.7	16.77	A26
58.55	503.6	1692.3	1528.1	7.85	6.69	87.3	72.27	A27
25.39	219	1717.4	1544.3	3.68	2.89	69.6	81.91	A28
38.94	313.5	1916.7	1740.6	14.4	12.3	89	26.45	A29

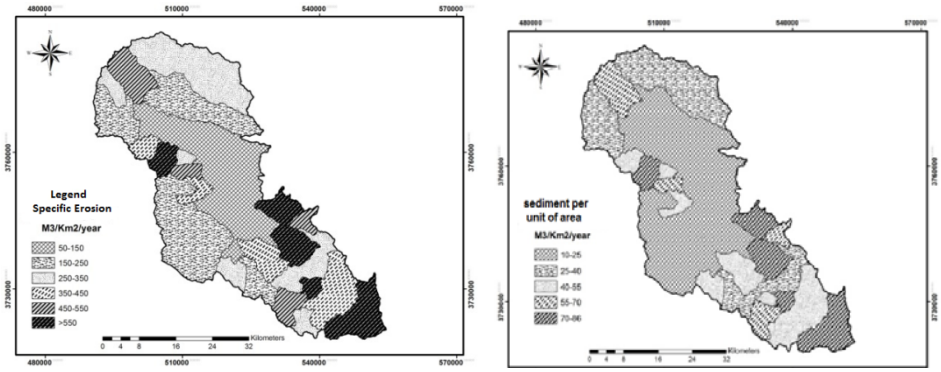


Fig3. Specific erosion and sediment per unite area maps of the study watershed

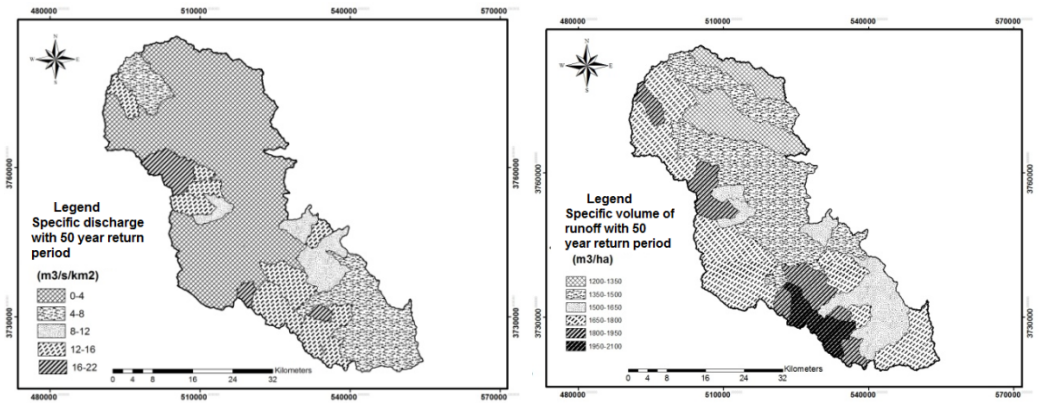


Fig 4.Specific discharge and specific volume of runoff maps of the study area

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 829-834

Table 3.Preference of soil and water conservation activity in studied sub basin based of different effective parameters.

Combination effects (overlay map)	Specific erosion	Specific volume of runoff with 50 year return period	Specific discharge with 50 year return period	Parameter Preference
A26,A25,A24.A13	A5، A6 ، A10، A11 ، A13، A26	A25 ،A22	A12، A13 ، A23، A24 ، A20	1
A11 ، A12، A14، A17، A19، A20، A10، A6، A5، A21، A22، A23، A27، A29	A7، A14، A25، A27	A13، A17، A19، A21، A23، A24، A29	A6، A14،A15، A17، A21، A22، A25، A26، A29	2
A9، A8، A7، A16، A15	A9، A12، A16، A19	A11 ، A10، A12، A26، A18، A27، A28، A20	A5، A7، A11 ، A16، A19	3
A1، A2، A18، A28	A1، A2، A8، A15، A20، A21، A23، A24، A29	A5، A8، A9، A14، A16	A8، A9، A10، A27	4
A4، A3	A3، A17، A18، A22، A28	A2، A4، A6، A7، A15	A1، A2، A3، A4، A18، A28	5
-	A4	A3، A1	-	6

For determination the preference of soil and water conservation activity in a sustainable management, combination effect of all affective characters in runoff and erosion should be contained. So, an overlay map contain specific discharge and volume of runoff per unit of area with 50 year return period, erosion and sediment per unit of area was created via GIS(figure 5).

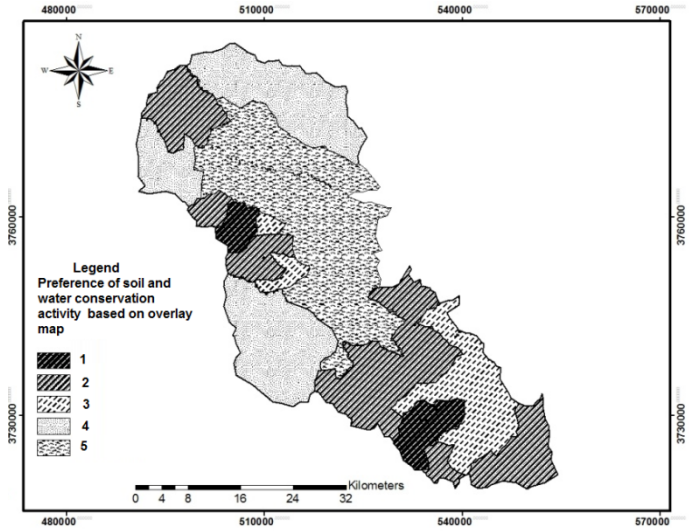


Fig 5. Preference of soil and water conservation activity in the study area based on combination effects (Overlay map)

Based on overlay maps , A13 ،A24، A25 and A26 sub basins are located in the first choice, whereas A3 and A4 located in the extremity for soil and water conservation activity(Table 3).

IV. Results and Discussion

Floods and soil erosion mainly occurs in the arid and semi-arid regions, which cover more than 30% of world surface. Important of soil and water conservation is increasing as an option to augmenting soil and water sources . High surface and large number of the sub-basin in the watershed and budget limitation in arid and semi arid area caused a growing need for identification and classification of the suitable areas for flood and erosion control in the areas where such innovations are needed[9]. Soil and Water resources management is a complex subject of enormous strategic importance for sustainable development that impact almost all aspects of society and economy. In most studies, integration and involvement of all factors are difficult due to the volume of calculations. Integrated soil and water management planning with the help of GIS and satellite images is one of the giant tasks for planner, so the advance method discussed in the present study will definitely give correct idea about the area more sensible to soil erosion and floods. Sensibility to erosion, land use, slope, amount of rainfall, surface area of catchment and time of concentration was considered for erodibility estimation in Kashan watershed. According to results of EPM model, high slope ,geological formation and plant cover degradation were the most important factors affected soil erosion in the study area. Same results has been reported by many authors[13],[7].Surface runoff and maximum discharge as a function of rainfall is affected by many factors that are often difficult to define. Maximum runoff was estimated in the area with high slope, soil located in C and D hydrological groups, and area with low vegetation cover. Flood increased with land use change and land degradation in the study area as reported in other researches[8],[2]. Our results did not show a direct relationship between maximum specific discharge and soil erosion. No Relationship was also observed between maximum discharge and specific volume of runoff. Sub basin classification priority for soil and water conservation activity changed when classification accomplished via such factors. We conclude that combination effects of effective parameters should be consider for classification of soil and water conservation activity.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 829-834

V.ACKNOWLEDGEMENTS

This research was supported by a grant (90004847) sponsored by the Iran National Science Foundation (INSF) and university of Kashan. Author is very grateful to INSF for financial support.

VI. REFERENCES

[1] *M. Arabkhedri . 2003. Suspended sediment yield in Iran, Journal of Watershed Management, 11:4 -6.(In Persian).*

[2] *A.Burton , B. pitt . 2001. Storm water effects hand book, a tool box for watershed managers scientists and engineers,CRC Press LLC.924p.*

[3] *M. Coskun ,N. Musaoglu .2004. Investigation of rainfall runoff modeling of the Van Lake catchment by using remote sensing and GIS integration. In: Twentieth International Society for Photogrammetry and Remote Sensing (ISPRS) Congress, Istanbul, Turkey, 12–23 July 2004.*

[4] *M. Davari .B. Bahrami,J. Ghossousi ,N. Tahmasebipour . 2006. Using GIS in estimation soil erosion and sediment yield of Nojyan watershed (Southeastern of Khorram Abad), Modarres Oloom Ensani 2: 103-122.*

[5] *F.A. El-Awar M.K. Makke R.A., Zurayk R.H. Mohtar .2000. A hydro-spatial hierarchical method for siting water harvesting reservoirs in dry; Applied Engineering in Agriculture 16(4) 395–404.*

[6] *J. Ghayoumian , B.Ghermezcheshmeh ,S. Feiznia ,A.A. Norooz. 2005.Integrating GIS and DSS for identification of suitable areas for artificial recharge, case study Meimeh Basin, Isfahan, Iran. Environmental Geology 47 (4), 493–500.*

[7] *R. Ghazavi A.B., Vali S. Eslamian.2010.Impact of flood spreading on infiltration rate and soil properties in an arid environment. Water Resour Manag 24(11):2781–2793.*

[8] *S.Gill . 2004. Impact of climate change on urban environment, CENTOR FOR URBAN & REGIONAL ECOLOGY, school of planning & landscap,University of Manchester.72p.*

[9] *J.Gould ,E. Nissen-Petersen 1999. Rainwater Catchment Systems for Domestic Supply: Design, construction and implementation. IT Publications, London.*

[10] *S.K. Jenson, J. O. Dominique. 1988. Extracting topographic structure from digital elevation data for Geographic Information Systems analysis. Photo grammetric Engineering and Remote Sensing. 54(11). PP. 1593-1600.*

[11] *Y. Le Bissonnais, C. Montier,M. Jamagne, J. Daroussin, D. King.2000. Mapping erosion risk for cultivated soil in France. Catena 46 (2- 3), 207- 220.*

[12] *J. K. Lorup , J.C. Refsgaard ,D. Mazimavi . 1998. Assessing the effect of land use change on catchment runoff by combined use of statistical tests and hydrological modelling: case studies from Zimbabwe, Journal of hydrology, 205, PP: 147-163.*

[13] *A. Loukas ,L. Vasiliades ,N.R. Dalezios . 2000. Flood producing mechanisms identification in southern British Cloumbia, Canada, Journal of Hydrology, Vol. 227, PP:218-235.*

[14] *A.S. Padmavathy ,K. Ganesha Raj ,N. Yogarajan P. Thangavel . 1993. Check dam site selection using GIS approach, Adv. Space Res. 13(11) 123–127.*

[15] *S.Sahin, ,E. Kurum.2002. Erosion risk analysis by GIS in environmental impact assessment: a case study-Seyhan Kopru dam construction. Journal of Environmental Management 66, 239– 247.*

[16] *F. Sharifi , B. Saghafian ,A.Telvari . 2002. The Great Flood in Golestan Province, IRAN: Causes and Consequences, Proceedings of International Conference on Flood Estimation, Berne, Switzerland, pp.263-271.*

[17] *M.K. Sheresta . 2001. Soil erosion modeling using remote sensing and GIS, Case study of Jhikhu Khola watershed, Nepal.*

[18] *A.K. Sikka ,J.S. Sarma ,V.N. Sharda ,P. Samraj ,V. Lakshmanam .2003. "Low Flow and High Flow Responses to Converting Natural Grassland into Bluegum (Eucalyptus globules) in Nilgiris Watersheds of South India", Journal of Hydrology, 270: pp. 12-26.*

[19] *S.Tommy ,W. Wong, L.I. Yunjie . 1998. Assessment of changes in overland time of concentration for two opposing urbanization sequences, Hydrological sciences Journal, 43 (1), PP. 115-130.*

[20] *G. Winnaar G.P.W. Jewitt ,M. Horan .2007. A GIS-based approach for identifying potential runoff harvestingsites in the Thukela River basin, South Africa. Phys Chem Earth 34:767–775.*

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 835-840

Identification and classification of suitable water recharging/harvesting site in an arid environments area using GIS approach

R.Ghazavi

Abstract
In the arid and semi arid area of the world, also rainfall patterns are unpredictable, both in amount and time, but, rainfall could be sufficient to make rainwater recharging/harvesting as a reliable and economical source of water .Artificial recharge methods describes all methods for concentrating, storing and collecting runoff from rainwater. The main object of this research is investigated to identify the potential sites to construct rainwater-harvesting structures using remote sensing and geographical information system. Attempt was made to understand the basaltic terrain in spatial context to find out the rainwater harvesting structures like farm ponds, check dams and flood spreading deriving from thematic layers such as landuse/landcover, slope, soil, drainage and runoff from Landsat Thematic Mapper imagery and other collateral data. Subsequently, these layers were processed to derive runoff from Soil Conservation Service Curve Number SCS-CN method using Arc-CN runoff tool. The thematic layers overlaid using intersection based on these specifications. Derived sites were investigated for its suitability and implementation by ground truth field verification. In conclusion, the method adopted in present study deciphers the more precise, accurate and ability to process large catchment area than other methods.

Keywords—Rainwater harvesting, Groundwater recharge, Suitable area, curve number method, GIS

I. Introduction

In the arid and semi arid area of the world, also rainfall patterns are unpredictable, both in amount and time, but, rainfall could be sufficient to make rainwater recharging/harvesting as a reliable and economical source of water [15],[21]. Constructions of rainwater harvesting structures are proposed to augment both surface and sub-surface storage, decrease runoff rate, retard the soil erosion and recharge the aquifer [23],[2].[14].

R.Ghazavi is with the University of Kashan, Kashan. IRAN (corresponding author to provide phone: +98 3155913221; fax: +983155913227; e-mail: ghazavi@kashanu.ac.ir

Rainwater-runoff can be captured and efficiently used for domestic and agricultural uses in an economically and environmentally sustainable manner[26].In the arid and semi arid area, harvested rainwater may be the only source of water supply for many areas where no other water supply is available [13]. Rainwater harvesting has considerable potential as a source of alternate water supply in arid and semi arid area if the systems that collect the rainwater are properly designed and implemented [18]. The amount of rainwater that can be collected is a function of runoff harvesting method, land condition and rainfall characteristics. Successful of rainwater harvesting systems also requires a professional programs and opportunities for education, training, and certification on rainwater harvesting systems [20].[21].
Budget limitation, high surface and large number of the sub-basin in the watershed caused a growing need for identification and classification of the suitable areas for introducing water recharging/harvesting technologies in the areas where such innovations are needed [16].. Constructions of rainwater recharging/harvesting structures are proposed to augment both surface and sub-surface storage [6],[23]. Research has indicated that collection and storage of runoff via artificial recharge methods can reduce storm water runoff, reduce soil erosion , decrease peak runoff rates, recharge the aquifer, and be economically viable at both the development and regional scales [7],[14],[2]. There are the different forms of storing harvested runoff such as farm dams or reservoirs, groundwater recharge systems, check dams, tanks and bunds [15],[9]. The amount of rainwater that can be collected is a function of application methods, watershed and runoff characteristics [17]. Moreover, runoff is one of the most important parameter to predict potential rainwater harvesting systems. The runoff amount and intensity is primarily dependent on rainfall duration and intensity, catchment area, soil type, landuse, land cover and antecedent moisture conditions of the area [25],[10].
Also various methods have been used to estimate the surface runoff of watershed, SCS-CN method is a suitable methods when integrated with advance tools such as GIS. Geographical information systems GIS has become a critical tool for identification of potential rainwater harvesting structures because it provides a framework for collecting, storing, analysing, transforming and displaying spatial and non-spatial

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 835-840

data for particular purposes[22].[8]. Using some of its features such as map overlay and analysis could help to aggregate hydrologic information from different sources such as rainfall data, land use/land cover, soil and physiographical characteristics of watersheds [25],[10]. Because of its capacity to handle large amount of spatial and attribute data, GIS in integrated with runoff modeling such as SCS-CN method could be a suitable tools for Identification of suitable sites for water recharging/harvesting structures .[25],[13].[1] used GIS to predict the runoff volume for several basins using the SCS runoff curve number model. [5] used RS data and GIS to identify the potential sites for water harvesting. Suitable area for Check dam construction was selected according to suitability using GIS[22].

In the arid and semi arid area, constructions of rainwater recharging/harvesting structures are essential for water resources management due to nature of monsoonal rainfall. These structures should reduce the runoff velocity and allow the retained runoff to percolate, consequently increased the recharge of groundwater. The different forms of storing harvested runoff should be applied in the different area of each watershed due to its land-use, land-cover and physiological condition. This necessitates the identification the best method of runoff recharging /harvesting sites for each area within higher accuracy. The main objects of this research are (1) to estimate the runoff potential of each sub-basin using SCS-CN method, (2) to identify the best potential rainwater recharging/harvesting method for each area due to its runoff and land condition (3) to estimate the accuracy of proposed method for water recharging/harvesting

II.Material and Methods

The study area named Kashan watershed covering an area of about 2000km^2 in the center of Iran in Esfahan province lies between latitudes 33˚ .31".37' N- 34˚ .8".22' N and longitudes 50˚ .57".40' E- 51˚ .38".37' E (Figure 1).

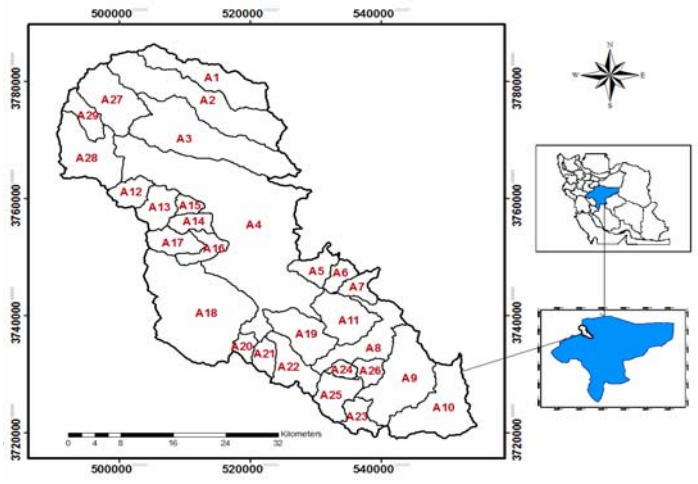


Fig1. Location map of the study area

Mean annual rainfall in the study area is about 186 mm range between 233.9 mm in mountainous areas and 138.1mm in plan area. Potential evapotranspiration reaches 2620mm measured class-A pan evaporation. The average annual air temperatures in this area varied from 9ºC in January to 37ºC in July. Approximately 64% of annual rainfall occurs in the winter-autumn period, 32% in the spring, and 4% in the summer. The average elevation of the study area is approximately 1650m above mean sea level ranges from a minimum of 1022 to a maximum of 3579 m.In the study area, recharge accounts for 5% of the precipitation while the rest 85.5% and 9.5% becomes evapotranspiration and surface runoff respectively.

The study area has been divided in to 29 sub-basins using topographical map Figure 1.Spatial data such as land-use/land-cover, soil classification, geological, drainage, and physiographical maps for each sub-basin were derived from topographical maps, GIS, satellite data, and direct land survey. Horton 1945 method was adopted for giving stream order. Climatic data recorded at a meteorological station in the study site Kashan Station, 32°56 N, 50°06E was used. Rainfall data of the watershed for the period from 2003 to 2011 was analyzed for recurrence of storm/flood event at different returns periods 2, 5,10,20,50 and 100 years. For each returns periods and for each sub-basin, the precipitation was estimated separately through a linear regression of rainfall versus elevation.

The soil conservation service curve number SCS-CN method was used for runoff estimations in each sub-basin. This method takes into account major runoff producing watershed characteristics like different combinations of soil group, land use classes and antecedent moisture conditions classes.

The value of curve number, runoff from each sub-basin, and T-year maximum discharges was computed from Eqs.1, 2 and 3 respectively.

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)} \quad (1)$$

$$S = \frac{25400}{CN} - 254 \quad (2)$$

$$Q_{\max} = \frac{0.2083AQ}{T_P} \quad (3)$$

$$T_P = \sqrt{T_C} + 0.6T_C \quad (4)$$

Where Q is the direct runoff mm, P is total precipitation mm, S is the potential maximum retention mm, CN is Curve number a dimensionless number ranging from 0 to 100, A is surface area km2, Q_{max} is T-year maximum discharges, TP is time to peak and TC is the time of concentration.

Rainfall for each sub basin were calculated using regression relationship between maximum daily rainfall with 50 years return period and average altitude of sub basin R2>0.95

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 835-840

.Runoff depth with 50 years return period was calculated for each sub-basin equation 1. Curve number was calculated using land- use and land cover, topography, soil characteristics, and hydrologic condition maps.
Various factors should be considered when selecting the suitable site of a water harvesting structure. Land-use, soil structure, slope, drainage, runoff, and physiographical conditions were selected as the most impotents factor for selecting of a suitable site [12]
Land cover map was derived from digital images of Landsat-7 satellite ETM+ sensor and NDVI index in ENVI 4.5 software and controlled with data collected during field studies. Topographic maps of the study area scale 1:25,000 were used to develop a slope map by the means of a Digital Elevation Model DEM on the slope map and reclassified as per guidelines [13]. Soil map was generated from the published soil map of the study area. The drainage lines are digitized from the topographic sheets and subsequently updated with the aid of DEM in Arc SWAT Arc Gis9.3. Strahler 1964 method of stream ordering was adopted for giving order to drainage

III.Results:

Land-use, soil classification, slope, drainage, and physiographical maps of the study site were shown in figure(2). Suitable sites for each rainwater harvesting/ recharge method are determined using Iranian reports standard for rainwater harvesting structure and international researches .Table (2)shows the suitable condition match for rain-water harvesting structures.

Table 2. Adopted specifications for potential rainwater harvesting structures

Structure	Land cover	Slope %	Soil Structure	Stream order	Specific Runoff volume
Pitting	Low	3-8	clay loam	1-2	Low
Earthen bunds	Moderate	0-20	clay loam	1-2	Low/moderate
Contour line	Moderate/low	20-30	Sandy clay	1-2	Moderate/low
Flood spreading	High	1-5	Sandy clay	3-4	High
Check dam	Moderate/High	15<	Sandy clay loam	1-4	Moderate

To implement the decision rules, an information layer is created by overlay of drainage network, land cover, runoff potential, slope, and soil structure maps. Suitable sites for different rainwater harvesting structure are determined with the conditions defined in table (2). Structures were selected for the area wherever the condition matches with the attributes of the information layer (Figure 3). To validate the results and estimate the accuracy of prediction, several floods spreading field were compared with the attributes of the information layer. All sites were matches with the area that specified for their suitability. Table (3) indicates the surface of suitable area for different rainwater harvesting structure. According to results, 28% of the total surface area approximately 530 km^2 was suitable for creating rainwater harvesting structures.

Table 3. Surface of suitable area for different rainwater harvesting structure

Row	Rain water harvesting method	Area ha
1	Earthen Bunds	3899.85
2	Pitting system	3846.57
3	Check Dams	19100.94
4	Contour line	9294.11
5	Flood Spreading	16860.09

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 835-840

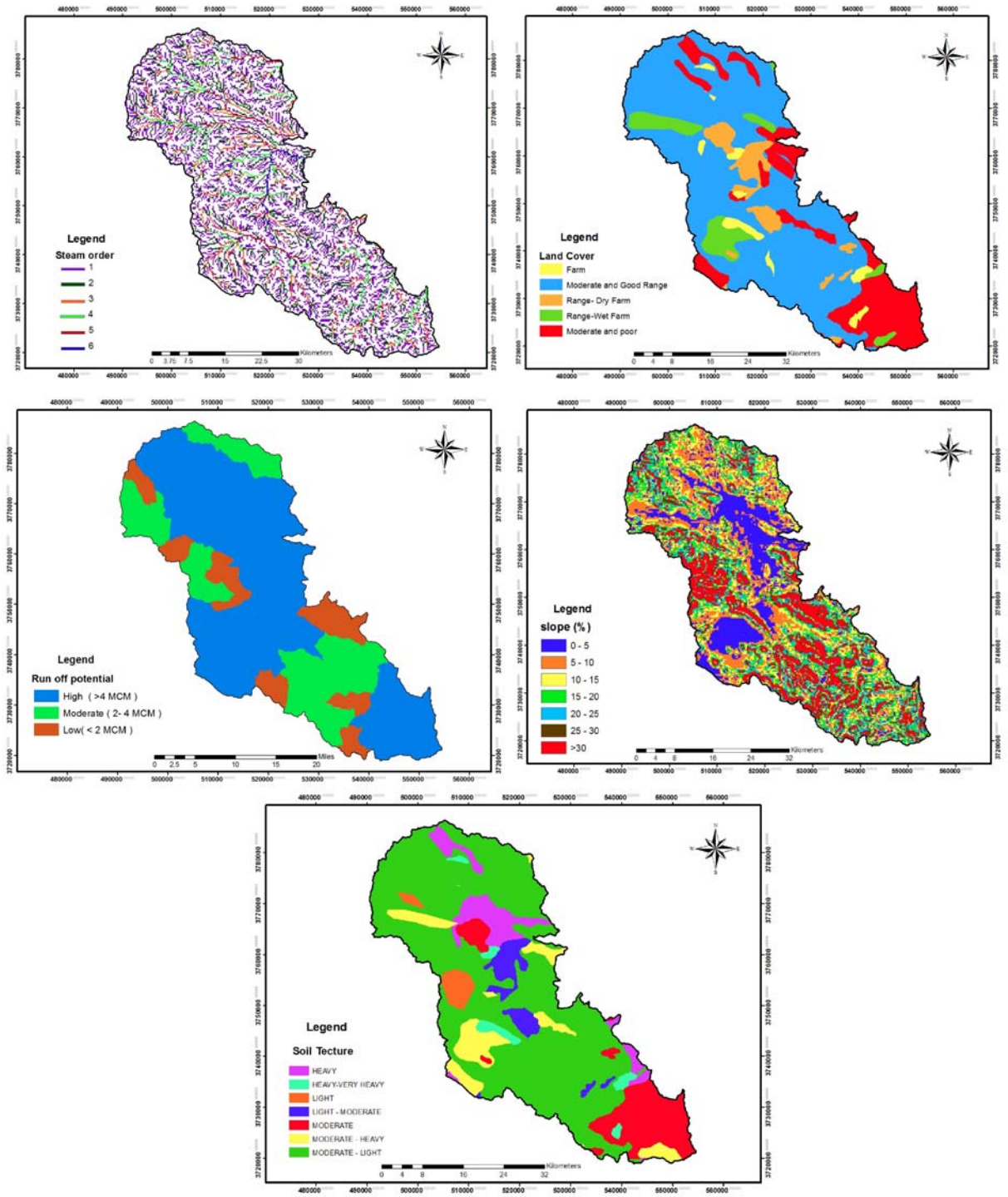


fig.2. Land-cover, soil classification, slope, drainage, and physiographical maps of the study area

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 835-840

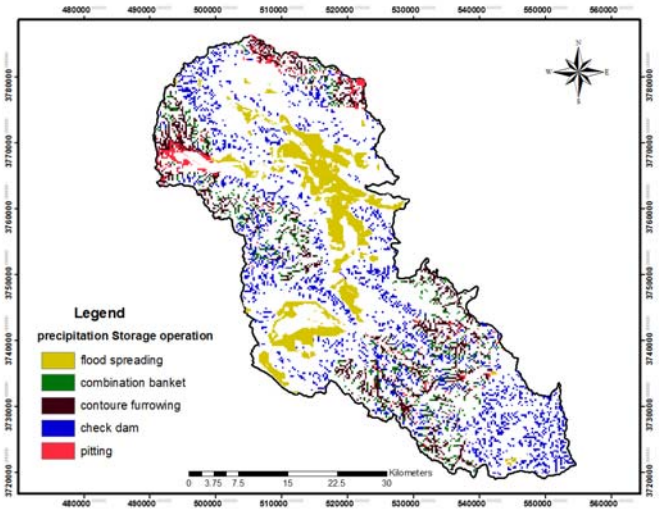


Fig 3. Potential rainwater harvesting site map of upper Karha watershed

IV. Results and discussion:

High evapotranspiration and low rainfall in arid area are the most limiting factor to socioeconomic development in the river basin. Annual rainfall in the study area is about 186mm. The Kashan aquifer experiences an average annual loss of about 0.57 m and a critical negative budget about -32 million ^{m3} annual discharge [14]. The simplest way to decrease the decline of the groundwater-table would be to reduce the groundwater discharge and to increase groundwater recharge. According to results, 28% of the study area is suitable for crating rainwater harvesting structure. Suitable area for flood spreading and check dam in the study area is about 168 and 191 km^2 respectively. Flood spreading is one of the suitable and inexpensive methods for flood management and water harvesting that increases the groundwater recharge. Based on average infiltration rate and surface area of the water spreading projection, in each flood event until 6000 $m^3.h^{-1}$ of flood-water could penetrate to the soil [15].

Various researchers have emphasis on the impact of check dams on groundwater recharge and groundwater quality. Due to check dam instruction, an increase recharge of 6- 40 percent was reported in different area of the worlds[3],[11],[24].

The recharge of rainfall runoff drained from different land use of the catchment water may also change the quality of groundwater. Several researchers indicates that groundwater recharge via check dam instruction have Improved groundwater quality[11],[4].

We can concluded that managed aquifer recharge through water harvesting structure is found to be one of the efficient method to improve the groundwater head, and quality.

But due to budget limitation, high surface and large number of the sub-basin in the watershed, identification and classification of the suitable areas for introducing water recharging/harvesting technologies are needed. Identifying the suitable rainwater harvesting structures with the help of GIS and satellite images is one of the giant tasks for planner, so the advance method discussed in present study will definitely give correct idea about possible locations of rainwater harvesting sites.

V. ACKNOWLEDGEMENTS

This research was supported by a grant 90004847 sponsored by the Iran National Science Foundation INSF. Author is very grateful to INSF for financial support.

VI .References

[1] Ajaykumar K, Kale S, Nagesh N, Pande N. J, Pawar R, Sankhua. N .2012. Identifying Potential Rainwater Harvesting Sites of a Semi-arid, Basaltic Region of Western India using SCS-CN Method. Water Resour Manage 2012 26:2537–2554.

[2]Aladenola OO, Adeboye OB 2010 Assessing the potential of rainwater harvesting. Water Resour Manage 24:2129–2137. Alderwish AM 2010 Induced recharge at new dam sites-Sana'a Basin, Yemen. Arab J. of geosci, 3: 283-293.

[3]Ashraf M, Kahlown, M.A and Ashfaq A 2007 Impact of small dams on agriculture and groundwater development: A case study from Pakistan. Agric Water Manag 921-2:90-98.

[4]Bhagavan S, Raghu V 2005 Utility of check dams in dilution of fluoride concentration in groundwater and the resultant analysis of blood serum and urine of villagers, anantapur district, Aandra Pradesh, India. Environ Geochem and Health, 271.

[5]Chowdary V. M , Ramakrishnan D, Srivastava Y, Vinu Chandran K, Jeyaram A2009 Integrated Water Resource Development Plan for Sustainable Management of Mayurakshi Watershed,India using Remote Sensing and GIS. Water Resour Manage 2009 23:1581–1602.

[6]Coombes P. J, Argue J.R, Kuczera G 2000 Figtree Place: A case study in Water Sensitive Urban Development. Urban Water, 41. 335-343.

[7]Coombes P.J, Kuczera G Rainwater tank design for water supply and stormwater management. Stormwater Industry Association (2001) Regional Conference.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 835-840

[8]Coskun M, Musaoglu N . Investigation of rainfall runoff modeling of the Van Lake catchment by using remote sensing and GIS integration. In: Twentieth International Society for Photogrammetry and Remote Sensing ISPRS Congress, Istanbul, Turkey, 12–23 July 2004.
[9]Durga Rao, K.H.V, Hari Prasad V, Roy P.S. 2001. A Suitable Site: Geographic Information Systems and Remote Sensing Technology, Making Water Everybody's Business, edited by Anil Agarval, Sunita Narain and Indira Khurana, Centre for Science and Environment, New Delhi, pp. 243-245.
[10]El-Awar F. A, Makke M. K, Zurayk R. A , Mohtar R.H 2000 A hydro-spatial hierarchical method for sitting water harvesting reservoirs in dry; Applied Engineering in Agriculture 164 395–404.
[11]Gale I.N, Macdonald D.M.J, Calow R.C, Moench M, Kulkarni H, Mudrakartha S, Palanisami K 2006 Managed aquifer recharge: An assessment of its role and effectiveness in watershed Management. Rep. No.CR/06/107N BGS.
[12]Geetha K, Mishra S.K, Eldho T. I, Rastogi A.K , Pandey R. P2007 Modifications to SCS-CN Method for Long- Term Hydrologic Simulation; Journal of Irrigation and Drainage Engineering 1335 475–486.
[13]Ghayoumian J, Ghermezcheshmeh B, Feiznia S, Noroozi A.A2005Integrating GIS and DSS for identification of suitable areas for artificial recharge, case study Meimeh Basin, Isfahan, Iran. Environmental Geology 47 4, 493–500.
[14]Ghazavi R , VAli A.B , S eslamian S2012 Impact of flood spreading on groundwater level variation and groundwater quality in an arid environment. Water resources management .26:1651-1663.
[15]Ghazavi R, Vali A.B, Eslamian S2010 Impact of flood spreading on infiltration rate and soil Properties in an arid environment. Water Resources Management. 24:2781– 2793.
[16]Gould J, Nissen-Petersen E 1999 Rainwater Catchment Systems for Domestic Supply: Design, construction and implementation. IT Publications, London.
[17]Kim S.J, Kwon H.J, Jung I.K, Park G.A 2003 A comparative study on grid-based storm runoff prediction using Thiessen and spatially distributed rainfall. Paddy Water Environ 1:149–155.
[18]Krishna J2005 The success of rainwater harvesting in Texas – a model for other states, Paper presented at the North American Rainwater Harvesting Conference, Seattle, WA
[19]Krishna Hari J The success of rainwater harvesting in Texas – a model for other states, Paper presented at the North American Rainwater Harvesting Conference, Seattle, WA. 2005
[20]Lycon S.W, McHale M.R, Walter M.T, Steenhuis T.S2006 The impact or runoff generation mechanisms on the location of critical source areas. Journal of the American Water Resources Association 42 3, 793–804.
[21]Mbilinyi B.P, Tumbo S.D, Mahoo H.F, SenkondoE.M, Hatibu N 2005 Indigenous knowledge as decision support tool in rainwater harvesting. Physics and Chemistry of the Earth 30, 792–798.
[22]Padmavathy A. S, Ganesha Raj K, Yogarajan N , Thangavel P 1993 Check dam site selection using GIS approach, *Adv. Space Res.* 1311 123–127.
[23]Ramakrishnan D, Rao D. H .V , Tiwari K. C 2008 Integrated approach of remote sensing and GIS in delineation of sites for water harvesting structures, Kali Watershed, Dohad, Gujarat, India: Geocarto International 232 95–108.
[24]Saxena P,Chandra A,Garg, A,Sharma G, Varma P 2010 Conservation of groundwater by artificial recharge in Delhi and Haryana State of India-A review. Int. J. App. Bio. Pharmaceutical Tech.1 3, 989-993.
[25]Winnaar G, Jewitt G.P.W, Horan M 2007 A GIS-based approach for identifying potential runoff harvestingsites in the Thukela River basin, South Africa. Phys Chem Earth 34:767–775
[26]Ziadat F.M, Mazahreh S.S, Oweis T.Y, Bruggeman A A GIS based approach for assessing water harvesting suitability in a Badia benchmark watershed in Jordan. In: Fourteenth International Soil ConservationOrganization Conference:WaterManagement and Soil Conservation in Semi-Arid Environments, Marrakech, Morocco, (2006)14–19 May

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 841-844

Spatial Distribution Analysis of Groundwater Quality Using GIS

Somayeh Jamshidi[1]*, Seyed Ali Almodarresi[1], Mohammad Sharifi Pichoon[1]

Abstract— groundwater quality comprises the physical, chemical, and biological qualities of ground water. The purpose of this study is to assess the groundwater quality. The groundwater quality parameters were analyzed for 750 samples collected from the existing wells in Fars province in 2010. The maps of each water quality parameters were generated using geostatistical (ordinary Kriging) approach in the ArcGIS software. Experimental semivariogram values are tested for different ordinary Kriging models to identify the best fitted for the four water quality parameters (TDS, SAR, Ec, and Na) and the best models are selected on the basis of root mean square error (RMSE. The results show that the best model for providing ground water map is Spherical model for four parameters.

Keywords—Geostatistics; Groundwater quality; kriging.

I. INTRODUCTION

Kriging method considers the spatial correlation between the sample points and is mostly used for mapping spatial variability (Ella et al., 2001; Stein, 1999). It is recognized that the statistical approach (geostatistical methods or Kriging), has several advantages over the deterministic techniques (Isaaks and Srivastava 1989; Goovaerts 1997). Moreover, besides interpolation, Kriging provides information on interpolation errors. Such values can be mapped to generate error surfaces which inform about the reliability of estimates.

The role of geographic information system (GIS) softwares in analyzing spatial distribution of quality and quantitive groundwater have been investigated by many authors such as Mehrjardi et al. (2008). Pradhan (2009) studied groundwater potential zonation for basaltic watersheds. Ayazi et al. (2010) investigated disasters and risk reduction in groundwater. El Afly (2012) and Machiwal et al. (2012) applied an integrated geostatistic and GIS technique in groundwater. Manap et al. (2012) applied the probabilistic based frequency ratio in groundwater potential. Manap et al. (2013) studied prediction of groundwater potential zones, Neshat et al. (2013) estimated groundwater vulnerability to pollution, and Marko et al (2013) used GIS for mapping groundwater quality in the recharge area of Wadi Usfan, western Saudi Arabia.

II. MATERIAL AND METHOD

Kriging is a branch of geostatistical techniques. It provides the best linear unbiased estimation of the variable of interest at an unobserved location from observations of the random field at nearby locations.

Ordinary kriging is a common type of Kriging in practice. In the OK, the trend is considered as unknown and constant. The optimal weights are obtained through solving a series of linear functions known as the Ordinary Kriging Syste (Goovaerts, 2000, Zhang and Srinivasan, 2009), kriging techniques have added some constraints to the matrices, to minimize the error, and these techniques are unbiasedness estimations. Generally, these factors would describe some external limit (restriction) on the input data, which cannot simply be observed in the measured values (Balić and Malvić).

In Kriging methods, the random variable Z is decomposed into a trend (m) and a residual (ε), where $Z(x) = m(x) + \varepsilon(x)$ (Zhang and Srinivasan, 2009). The Kriging estimator is given by a linear combination of the surrounding observations (Goovaerts, 1997).

As discussed above, if the sum of all weighting coefficient is 1, kriging expression can be written as:

$$\gamma(Z_1-Z_1)x\lambda_1 + g(Z_1-Z_2)x\lambda_2 + \ldots + \gamma(Z_1-Z_n)x\lambda_n + m = \gamma(Z_1-Z)$$

$$\gamma(Z_2-Z_1)x\lambda_1 + g(Z_2-Z_2)x\,\lambda_2 + \ldots + \gamma(Z_2-Z_n)x\lambda_n + m = \gamma(Z_2-Z)$$

$$\ldots\ldots\ldots\ldots$$

$$\gamma(Z_n-Z_1)x\lambda_1 + g(Zn-Z2)x\,\lambda_2 + \ldots + \gamma(Zn-Zn)x\lambda_n + m = \gamma(Z_n-Z)$$

$$\lambda_1 + \lambda_2 + \ldots + \lambda_n + 0 = 1$$

If such a system of linear equations is shown as kriging matrices it can be written as (Balić and Malvić):

$$\begin{bmatrix} \gamma(Z_1-Z_1) & \gamma(Z_1-Z_2) & \ldots & \gamma(Z_1-Z_n) & 1 \\ \gamma(Z_2-Z_1) & \gamma(Z_2-Z_2) & \ldots & \gamma(Z_2-Z_n) & 1 \\ & & & & 1 \\ \gamma(Z_n-Z_1) & \gamma(Z_n-Z_2) & \ldots & \gamma(Z_n-Z_n) & 1 \\ 1 & 1 & \ldots & 1 & 0 \end{bmatrix} \times \begin{bmatrix} \lambda_1 \\ \lambda_2 \\ \\ \lambda_n \\ m \end{bmatrix} = \begin{bmatrix} \gamma(Z_1-Z) \\ \gamma(Z_2-Z) \\ \\ \gamma(Z_n-Z) \\ 1 \end{bmatrix}$$

The number of weighting coefficients and control points can be very large, but contemporary computers can successfully solve numerically demanding tasks. The estimation can be performed simply by calculating the influence of all control points weighted (Balić and Malvić):

$$Z = \lambda_1 \cdot Z_1 + \lambda_2 \cdot Z_2 + \ldots + \lambda_n \cdot Z_n$$

*[1]Department of Remote Sensing and GIS Engineering, Islamic Azad University, Yazd. Iran

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 841-844

Kriging relates the semivariogram, half the expected squared difference between paired data values z(x) and z(x + h) to the distance lag h, by which locations are separated (Gorai and Kumar, 2013).

$$\gamma(\mathbf{h}) = \frac{1}{2} E\left[z(x) - z(x+h)\right]^2$$

For discrete sampling sites the function is written in the form:

$$\gamma(\mathbf{h}) = \frac{1}{2N(h)} \sum_{i=1}^{N(h)} \left[\mathbf{z}(\mathbf{x_i}) - \mathbf{z}(\mathbf{x_i} + \mathbf{h})\right]^2$$

Where z (x_i) is the value of the variable Z at location of x_i, h is the lag, and N (h) is the number of pairs of sample points separated by h.

Two types of semivariogram models (Circular, Spherical) were tested for each water quality parameters (TDS, SAR, Ec, and Na) for the selection of the best one. Predictive performances of the fitted models were checked on the basis of cross validation tests. The values of (RMSE) was estimated to ascertain the performance of the developed models.

Case study

The study area is located at 29 ° 17′ 17″ to 31 ° 14′ 31″ N and 51 ° 42′ 13″ to 53 ° 45′ 59″E (Figure 1).

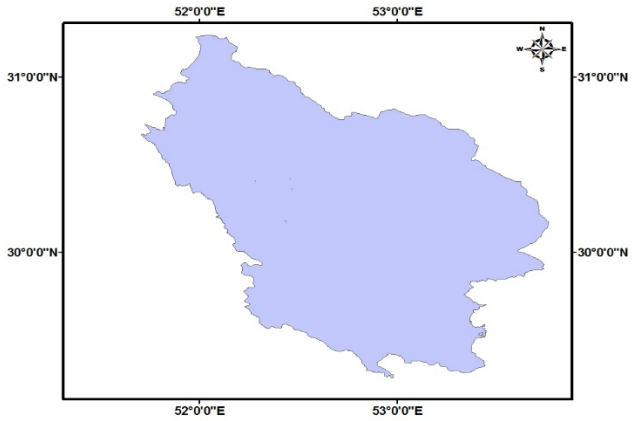


Fig. 1 Location of the study area

In the study area used 750 samples collected from the existing wells in 2010. The models to identify the best fitted for the four water quality parameters (TDS, SAR, Ec, Na) (Figure 2).

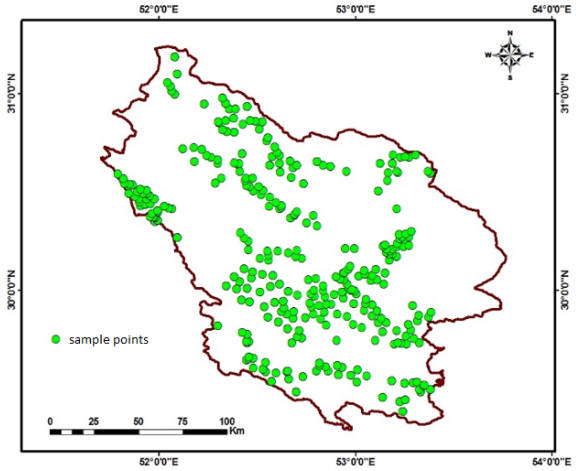


Fig. 2 sample points of the study area

III. RESULT AND DISCUSSION

Water samples were collected directly from 750 wells in 2010 from different parts of the case study as shown in Figure 2. Maximum, minimum, average and CV for each parameters show in Table 1.

Table 1. Information of each of parameters.

Average	Min	Max	CV	Parameters
13/88	0/02	841/35	39/00	Na
3/59	0/01	98/81	6/30	SAR
1987/96	147/00	16240/00	2234/13	TDS
3154/42	222/00	65940/00	4361/82	EC

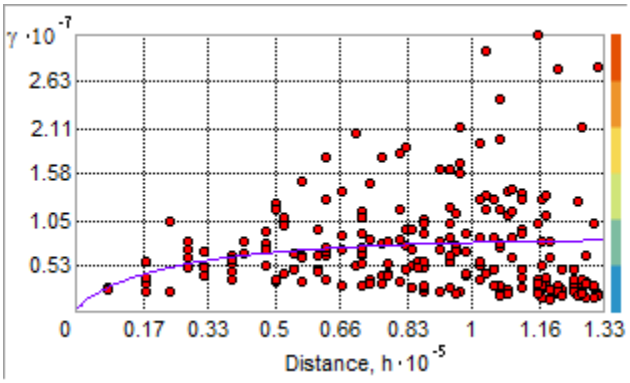
Based on RMSE value, the best model for providing of ground water map show in Table 2.

Table 2. RMSE value for four model.

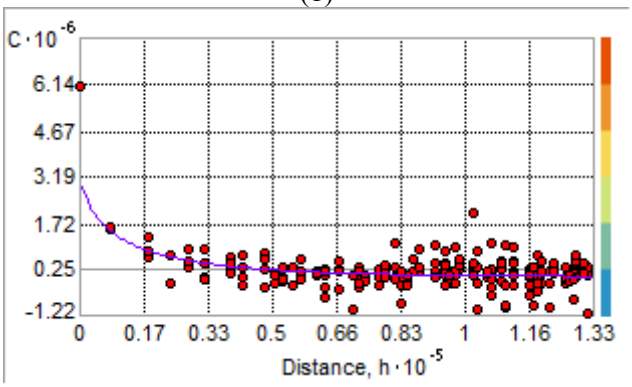
exponential	Tetra spherical	spherical	circular	
6/039	5/417	5/205	5/217	SAR
17/78	17/87	17/87	17/88	Na
1881	1903	1904	1905	TDS
2011	2037	2040	2042	EC

According to results of Table 2, the best model for determination of SAR is spherical model and Na, TDS, and EC are exponential model. Using ordinary kriging prepared TDS, SAR, Ec, and Na maps that show in Figure 3 to Figure 6.

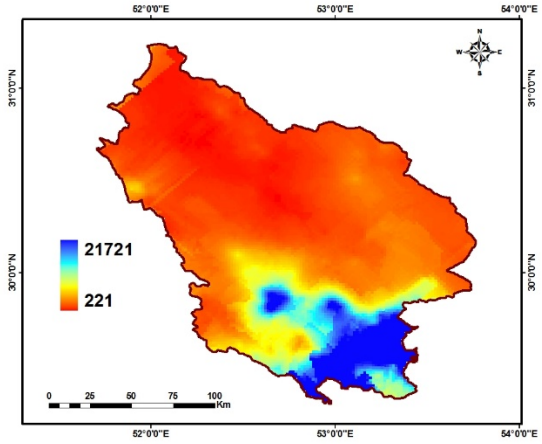
ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 841-844



(1)

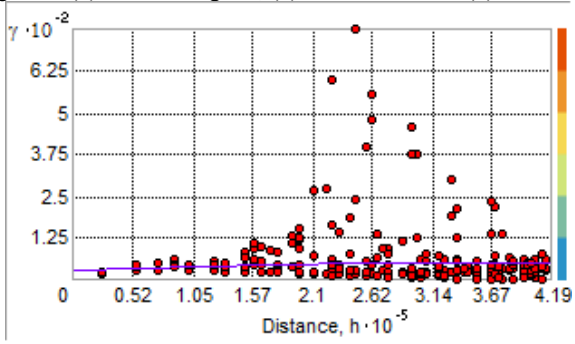


(2)

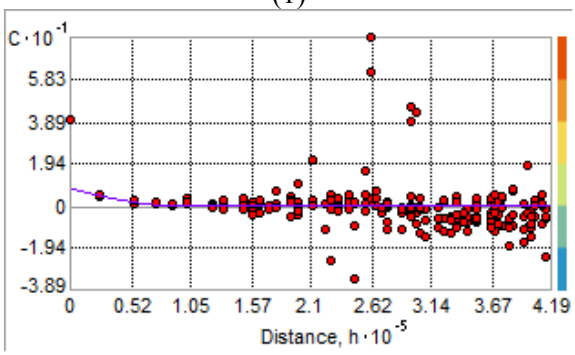


(3)

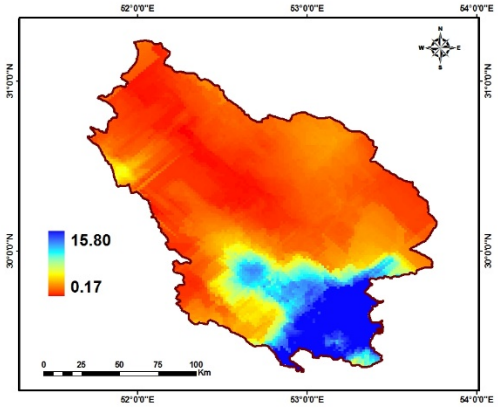
Figure 3. (1): Semivariogram, (2): Covariance and (3): TDS map



(1)

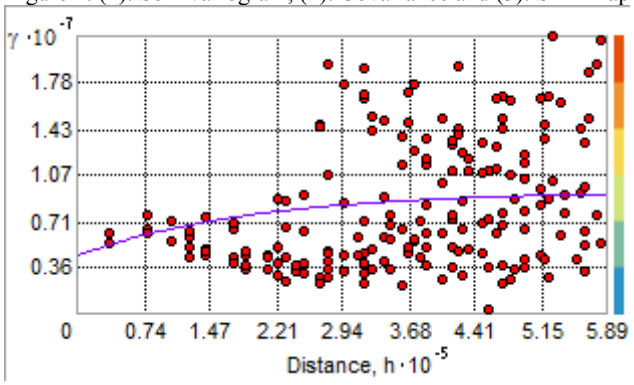


(2)

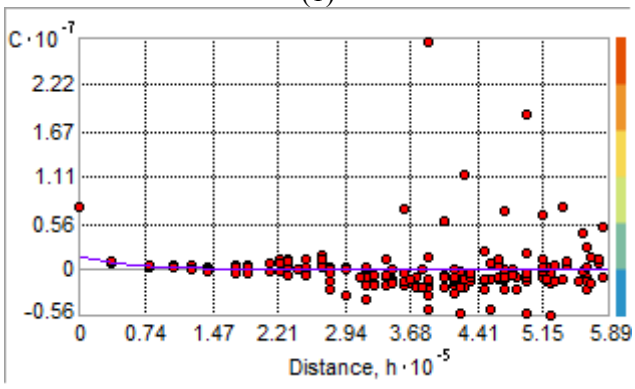


(3)

Figure 4. (1): Semivariogram, (2): Covariance and (3): SAR map

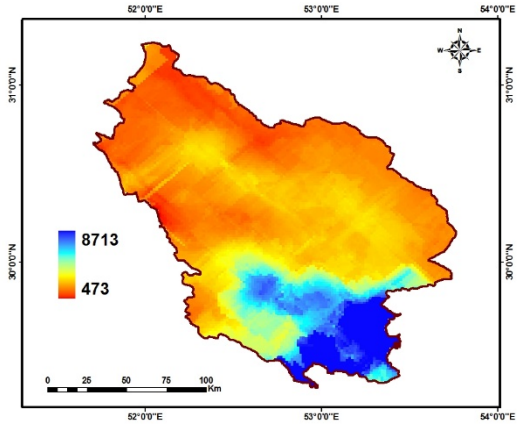


(1)



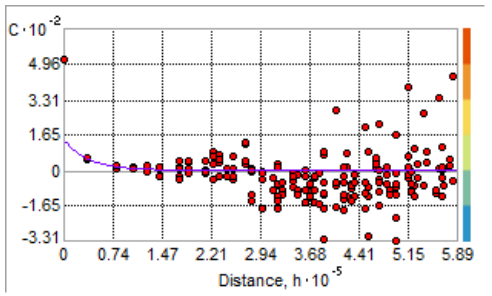
ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 841-844

(2)

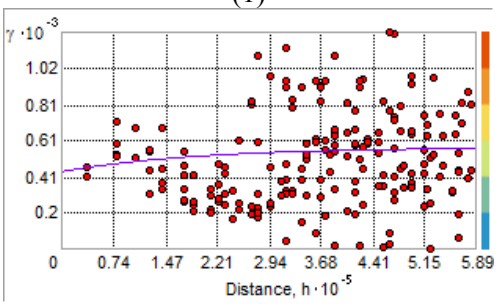


(3)

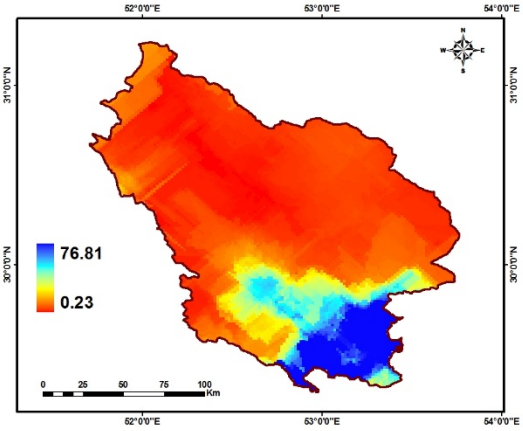
Figure 5. (1): Semivariogram, (2): Covariance and (3): EC map



(1)



(2)



(3)

Figure 6. (1): Semivariogram, (2): Covariance and (3): Na map

IV. CONCLUSION

Results showed that there are only the parts of north and center of the study area suitable in therms of EC, TDS, SAR and Na. but in the south of the area, the values of EC, TDS, SAR and Na are high and not suitable. So in the study area for a better groundwater quality management, spatial distribution analyses of groundwater quality parameters in the regions were carried out. Also prevent the indiscriminate harvesting of ground water.

REFERENCES

[1] Ayazi MH, Pirasteh S, Arvin AKP, Pradhan B, Nikouravan B, Mansor S (2010) Disasters and risk reduction in groundwater: Zagros Mountain Southwest Iran using geoinformatics techniques. Disaster Adv 3(1):51–57.

[2] Balić1, D., Malvić. T. 2008. Ordinary Kriging as the most appropriate interpolation method for porosity in the Sava depression Neogene sandstones. 13 pp.

[3] El Afly M (2012) Integrated geostatistics and GIS techniques for assessing groundwater contamination in Al Arish area, Sinai, Egypt. Arab J Geosci 5(2):197–215. doi:10.1007/s12517-010- 0153-y.

[4] Ella VB, Melvin SW, Kanwar RS (2001) Spatial analysis of NO3–N concentration in glacial till. Transact ASAE 44: 317–327.

[5] Goovaerts, P., 1997. *Geostatistics for Natural Resources Evaluation. Oxford University Press, New York.*

[6] Gorai, AK., Kumar, S. 2013. Spatial Distribution Analysis of Groundwater Quality Index Using GIS: A Case Study of Ranchi Municipal Corporation (RMC) Area.Geoinfor Geostat: An Overview 2013, 1:2

[7] Isaaks EH, Srivastava RH (1989) An Introduction to Applied Geostatistics. Oxford University Press, New York.

[8] Machiwal D, Mishra A, JhaMK, Sharma A, Sisodia SS (2012)Modeling short-term spatial and temporal variability of groundwater level using geostatistics and GIS. Arab J Geosci 21(1):117–136. doi:10. 1007/s11053-011-9167-8

[9] Manap MA, Nampak H, Pradhan B, Lee S, Sulaiman WNA, Ramli MF (2012) Application of probabilistic-based frequency ratio model in groundwater potential mapping using remote sensing data and GIS. Arab J Geosci. doi:10.1007/s12517-012-0795-z.

[10] Manap MA, Sulaiman WNA, Ramli MF, Pradhan B, Surip N (2013) A knowledge driven GIS modelling technique for prediction of groundwater potential zones at the Upper Langat Basin, Malaysia. Arab J Geosci 6(5):1621–1637.

[11] Marko, K., Al-Amri., N.S., Elfeki., A.M.M. 2013. Geostatistical analysis using GIS for mapping groundwater quality: case study in the recharge area ofWadi Usfan, western Saudi Arabia. Arabian journal of geoscience. DOI 10.1007/s12517-013-1156-2.

[12] Mehrjardi RT, Jahromi MZ, Mahmodi S, Heidari A (2008) Spatial distribution of groundwater quality with geostatistics (case study: Yazd-Ardakan Plain). World Appl Sci J 4(1):9–17

[13] Neshat A, Pradhan B, Pirasteh S, Shafri HZM (2013) Estimating groundwater vulnerability to pollution using modified DRASTIC model in the Kerman agricultural area. Iran Environ Earth Sci. doi: 10.1007/s12665-013-2690-7.

[14] Pradhan B (2009) Ground water potential zonation for basaltic watersheds using satellite remote sensing data and GIS techniques. Cent Eur J Geosci 1(1):120–129. doi:10.2478/v10085-009-0008-5

[15] Ranade, P., Irmak, A., Maidment., D.R. 2008. eostatistical Analyst. 18pp.

[16] Stein ML (1999) Interpolation of spatial data: Some theory for kriging. Berlin: Springer.

[17] Zhang, X, Srinivasan, R. 2009. GIS-Based Spatial Precipitation Estimation: A Comparison of Geostatistical Approaches. Volume 45, Issue 4, pages 894–906, August 2009.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 845-850

Assessment soil organic carbon in different land uses in the College of Agriculture, Lorestan

Fatemeh Ghodoosifard[1], Hamid reza Matinfar[2]

***Abstract*—**today, the population growth increases pressure on natural resource, including soil and non-systematic exploitation. Land use changes are causing damage to ecosystems. Different forms of land use change takes place and the changes in physical, chemical and biological soil properties such as soil organic matter and organic carbon. The total carbon content between different lands uses vary by more than 15 times. Soil organic carbon plays a crucial role in the global carbon cycle and greenhouse gas emissions and is vital indicators of soil quality. One way of reducing carbon dioxide emissions is increasing carbon sequestration in soil. The experiments conducted to investigate the effects of different land use on organic carbon content in the College of Agriculture; University of Lorestan. Results have shown that the amount of organic carbon in forest and orchard land use is the maximum amount but in cultivated land is minimal. The highest rate of carbon sequestration is in land use of garden, pasture and forest. And has been observed highest of clay and the lowest bulk density in forest land use.

***Keywords*—**land use, soil organic carbon, carbon sequestration

I. Introduction

Sustainable use of natural resources and create a balance between production and improve the quality of natural resources in recent years has been taken into account. The soil ecosystem stability is a very important component. Today, the population growth increases pressure on natural areas, including soil and non-systematic exploitation and land use change are causing damage to ecosystems [17].Word of Land use made of tow word land and use, the land is made up to go to work. All natural land features or characteristics such as location and natural conditions of climate, geology, soils, topography, hydrology and refers. The use of natural resources in terms of human needs, which may be based on the potential of land and scientific manner and or traditional methods, and is probably one of the sources of land degradation [7].Types of land use are such as rain fed agriculture, irrigated agriculture, grazing natural pastures, resorts, forests and more.

The causes of land use change and its impact on soil properties:

Dye et al (2000) the main causes of land use change, population growth, migration and economic development and political thought, and the uses may also change due to factors such as drought, fire, flood, volcanic activity, and human activities such as grazing livestock, urban development, agricultural land and natural resource management mode is established.

Changes that occur after forest clearing and farming operations decreased soil organic matter, soil microbial activity, soil porosity and permeability which will result in runoff and soil erosion [25]. This reduces the amount of soil organic matter, occurs through mechanisms to accelerate biodegradation and loss of soil organic matter. Rasouli (1385), shows the effect of changes in different parent material on some physical and chemical and biological properties in Lahigan and concluded that a change in forestry tea gardens, decreased soil pH, organic carbon, cation exchange capacity, exchangeable cations (K^+, calcium, magnesium), humic acid, bacterial population and microbial respiration. Emadi and Bagher Nejad (1386), study on the land use change from forest to pasture in Sari area, results showed that organic matter content of about 50% within 16 years at a depth of 20-0 cm dropped and bulk density of about 15 percent compared with agricultural land, forest, grassland, also arable soil hydraulic conductivity greater (average about 12%) than the other two has been reduced by ecosystem.

Zolfaghari and Hajj Abbasi (1386), with study the effect of land use change on some physical and chemical properties of soils in Lordegan concluded which, respectively, a decrease of 29, 45, 48 and 10% organic matter, mean weighted diameter, saturated hydraulic conductivity and soil total porosity and soil bulk density increased by 10% in the conversion of forests to agricultural land, respectively.

What is clear, as stated in the study one of the factors that is affect land management and land use is organic matter and

1. M.S Student, Department of Soil Science, Faculty of Agriculture, Lorestan University, (corresponding author to provide phone: +989166733959; e-mail: fatemeh.ghodoosi68@yahoo.com).

2. Assistant Professor, Soil science and engineering Department, Lorestan University, Iran, (e-mail:matinfar44@gmail.com).

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 845-850

organic carbon.

Soil organic matter as a factor effect of land use:

Many scientists believe that soil organic matter, is a key element in evaluation soil quality [28]. the strong association between its physical, chemical and biological properties [28] Soil's ability to function well in your life, such as providing nutrient for plants, water storage, sequestration of greenhouse gases from the atmosphere, Filtering pollutants, and physical resistance opposite degradation production is strongly influenced by their organic matter [19].Soil organic matter are comprised of two parts Labile compounds and humic substances. Labile organic matter reserves as defined in sections include: particulate organic carbon, microbial biomass carbon, dissolved inorganic carbon and carbon extraction with different juicer [10].

The amount of organic matter is variable from less than one percent in arid soils to more than 40% of peat soils. Several factors affect the amount of carbon that can be include kind of climate, drainage, soil texture, slope gradient, vegetation and topographic characteristics [31]. Improve soil organic matter in addition to the decrease in evaporation rate and sequestration of atmospheric carbon dioxide and is the result of modification global warming, But also will be enhanced the quality and quantity of water in the area, increase production and food security, soil protection and remediation of degraded lands, Filtering pollutants, facilitate the transfer and storage of mineral and water, revived soil and ecosystems [13, 19, 32].

The role of soil organic carbon in ecosystems:

Recently, due to the vital role of soil organic carbon in the global carbon cycle and its ability to modulate or exacerbate greenhouse gas emissions, studies focused on soil organic carbon stocks and the use of technology to reduce the increasing concentration of atmospheric carbon dioxide has become the most important problem of the 21st century [14].Risks and consequences of increasing concentrations of greenhouse gases, especially carbon dioxide has been emphasized and international attention so in 1992, almost all countries signed climate change convention with the aim of reducing and balancing the concentration of greenhouse gases. Subsequently, the Kyoto Protocol in 1997, the long-term goal to limit effluence of these gases was officially agreed upon of 55 countries [18]. Achieving increased carbon sequestration as a useful technique to reduce the atmospheric concentration of carbon dioxide has been proposed by the scientific and political world [12].

Carbon Sequestration:

Carbon sequestration is the change in atmospheric carbon dioxide into organic compounds by plants and carbon capture for a specific period of time. This process takes place during photosynthesis by plants [15] and should be considered increase carbon sequestration equivalent to an increase in plant biomass, increase productivity, improve soil fertility, water-holding capacity of the soil and prevent water and wind erosion. Therefore, carbon sequestration in addition to having protective, due to increased biomass production; the economy is worth and can be proposed as an additional benefit resulting from the activities and operations of reclamation of degraded lands [1].

Spatial variation of soil organic carbon:

Many factors such as topography, land use, soil type, vegetation, land management can control spatial variability of organic carbon in various scales. In recent years, researches have been done to determine the spatial variability of soil organic carbon in the world and the results of these studies have shown that on a global scale climate variability is primary controlling factor of content soil organic carbon and the speed of its the cycle and the topography is second controlling factor of a specific region [32]. Land management is known as the most important human factor affecting soil organic carbon and aggregate stability.

Organic Carbon and land use:

Soils with different land uses have the different organic materials, and the resulting different organic carbon [30].The total carbon content is more than 15 times varies between different land uses [27]. The greatest impacts of land use change on soil organic carbon levels in the soil occurs in first eight centimeters. At a depth of 8-15 cm is little variation and depth More than 15 cm will not significantly change [16]. Land use change occurs in different forms which affects any user on the organic carbon content varies depending land use type For example, land use change from natural ecosystems to agricultural lands can alter carbon stocks over time because increases the mineralization rate under tillage systems due to exposure to organic matter [9].

Ranges according to how their management, able to store as an important reservoir of carbon dioxide are considered. Cultivation in pastures, causing dispersion of soil particles and organic matter, increased organic matter corruption, increased microbial activity and will be increase in carbon dioxide emissions into the atmosphere. Those agricultural practices that enhance soil properties and increase initial production will be increased carbon sequestration and would be reduced carbon dioxide emissions. Conversion of agricultural lands into pastures, rapidly increase the power of capacity holding water, reducing the amount of sediment and nutrient leaching [32]. Soil organic carbon in forests, often accumulate on the ground that this will accelerate analysis organic carbon ranges opposite organic carbon pastures and was determined which dissolved organic carbon in soil is less than the pasture soil. This reduces their leaching potential and slow decay and decomposition process them.

The aim of this study was to evaluate organic carbon and carbon sequestration in different land use of the College of Agriculture; Lorestan university, Iran.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 845-850

II. MATERIALS AND METHODS

The study area is located in Lorestan University between longitude of 45º 22´east and latitude 32º 18´north. According closest synoptic weather station, the climate is semi-arid. The average maximum daily temperature in July is equal to 29.5°c , and the average minimum daily temperature in January 5.5 ° C have been recorded and annual rainfall is 509 mm. Soils were classified in two categories: inseptisoils and entisoils. Soil moisture regime is xeric and temperature regime is thermic.

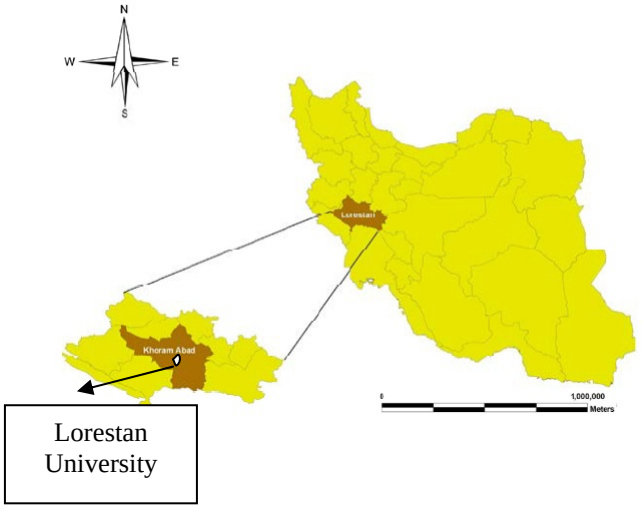


Fig 1. Study area in Iran

In order to this study four land uses were selected; forest, pasture, orchards and fields cultivated and with simple random sampling at a depth of 20-0 cm. After air drying and sieving through a 2 mm were transferred to the laboratory for analysis. Some of the undisturbed soil samples to determine soil bulk density were selected using the core sampler.

Soil organic content was determined using wet oxidation. And calculated amount carbon Sequestration using Equation 1 and soil organic carbon content was using Equation 2.

$$Cs = 10000 \times OC\ (\%) \times Bd \times e \quad (1)$$

Cs = the amount carbon sequestration (Kg / ha), % OC = percent organic carbon, Bd = bulk density (gr/cm^3), e = depth of sample (cm)

$$\%O.M=\%O.C\times 1.724 \quad (2)$$

% 0.M = percent organic matter (ton / ha)

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 845-850

III. Results and Discussion

Table 1. Results of laboratory analysis

Forest 2	Forest 1	Agriculture 2	Agriculture 1	Range 2	Range 1	Gardens 2	Gardens 1	**Landuse** / **result**
.89	.36	.94	.82	.73	.89	.51	.91	Bd
.234	1.638	.195	.39	.351	.975	.195	1.014	%O.C
.403	2.82	.336	.672	.605	1.86	.336	1.75	%O.M
40248	117936	36660	63960	51246	173550	19890	184548	Cs
49.48	34.2	43.4	44.12	68.2	74.12	58.36	56.2	Sand
39.04	36.32	40.72	47.72	31	25.88	35.6	30.32	Silt
11.48	29.48	15.8	13.88	.76	0	6.04	13.48	Clay
Clay loam	loam	Loam	loam	Sandy loam	Loamy sand	Sandy loam	Sandy loam	Soil texture

According to the results (Table 1) observed that the maximum amount of organic carbon is in forest soils and garden that can be covered due to the steady and voluminous than the trees and the soil disturbance . There is good and dense vegetation in the forest and the garden and each year a large amount of organic matter is added to soil as plant residues. In the other hand, addition manure, water supply requirements and other management actions in the garden is of other reasons for this type of use in have highest organic carbon amount. These results are in agreement with the results of Merino et al (2004) and Pullman et al (2006). Also observed that the lowest organic carbon and organic matter is in land use under cultivation. In study area using different methods of irrigation and fertigation and different crop were planted. But after a while the products are picked and the amount of organic material is removed from the area. On the other hand, most of the conventional plow apply, decomposition and oxidation of organic materials have been exposed to carbon dioxide are removed from the soil.

Plowing is causes soil aggregates and organic matter collide, accelerated degradation, increased microbial activity and the increase in carbon dioxide emissions from soils. In addition, tillage resulted in mixing layers of soil organic carbon in soil under organic carbon-containing supernatant, may result in soil organic carbon levels will decrease relative to the initial state [2, 20]. The result has also been confirmed by results Su et al (2004). And also observed that the highest rate of carbon sequestration is related to Garden 2, Range 1, and the forest 1. Generally, in an ecosystem carbon sequestration rate of carbon input and carbon balancing the resultant output. Carbon content of the input and output of both land management and how biological processes are affected in the production of microbial decomposition of organic matter in the soil. biological processes also is controlled by their physical, chemical and biological, such as climate, soil microbial populations and diversity, soil moisture, nutrient availability, vegetation and soil erosion [11]. The maximum range of clay observation in the forest 1. Studies have shown that more than 90 percent of total organic carbon exists in soil organic matter and clay complexes [3] and adsorption on the surface of clay minerals, oxides and hydroxides of iron and aluminum are the most effective in the preservation process. Microbial decomposition of organic matter [22].

Power and Schlesinger (2002) also conducted research in Costa Rica, observed that soil organic carbon concentration is correlated with the amount of soil clays. The results Gartn and Charles (2002) showed that soil carbon sequestration is associated with organic matter and silt – clay (Fig 2 and Fig 3).

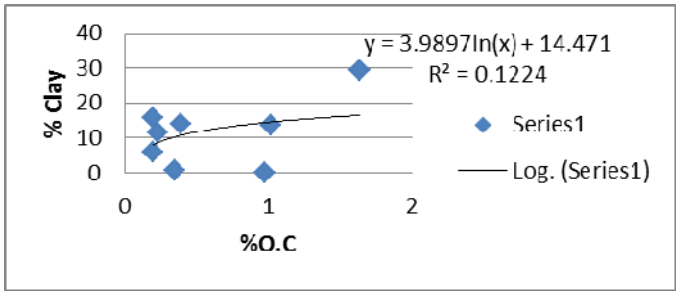


Fig 2) correlations between the percentages of organic carbon and clay

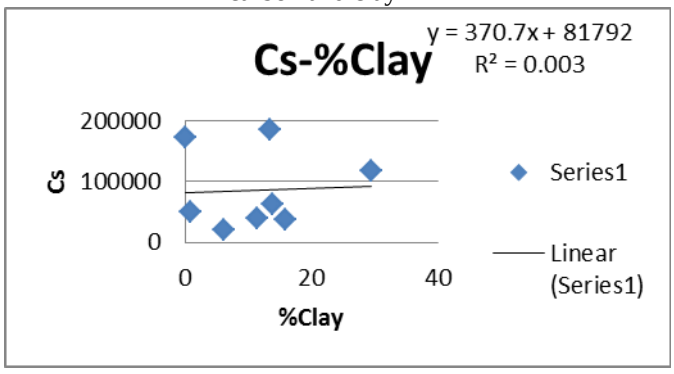


Fig 3) correlation between carbon sequestration with clay

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 845-850

Also shown is the lowest bulk density of the forest 1 because most of the organic matter is in the soil pores and there is a negative correlation between soil organic carbon and carbon sequestration associated with bulk density (Fig 4 and Fig 5). And conclude is confirmed by Dunn et al (2003).

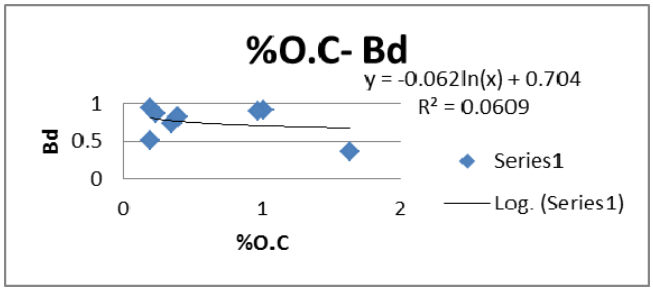


Fig 4) correlation between the percentage of soil organic carbon and soil bulk density

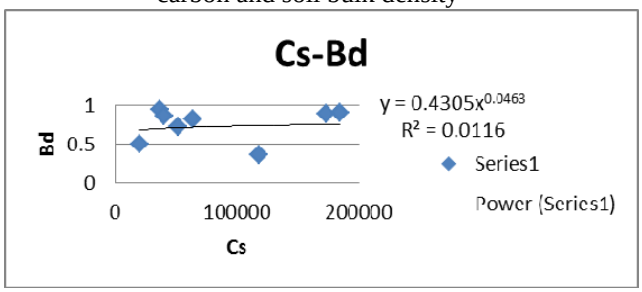


Fig 5) correlation between carbon sequestration and soil bulk density

IV. Conclusion

Soil organic carbon is the most important soil quality indicators that affect soil physical, chemical and biological properties and processes soil. Organic carbon storage is balance between carbon inputs and output in the soil. This equilibrium is strongly influenced by land use and management. The vegetation on the Earth's surface is more and more frequently are also more soil organic carbon content. there is also a discrepancy between the data obtained by the same land use can be concluded which the methods for estimating soil organic carbon is not complete and also reflects the complexity is of the soil system. In general, the factors affecting soil quality, land management, is only factor which controllable by humans. Thus, having a good understanding of the inherent potential of soils, it is enjoying. This can be an effective step in achieving sustainable development and environmental principles.

References

[1] Abdi, N, 1385. Carbon sequestration as a result of the introduction of an index measuring the sustainable development of natural resources. Abstract Proceedings of the Third International Conference on strategies for sustainable development in agriculture and natural resources, Arak, January 5, 62-57.

[2] Burke, I.C. Lauenroth, W.K. and Coffin D.P. (1995) Soil organic matter recovery in semiarid grasslands: implications for the conservation reserve program. *Ecol. Appl.* Vol 5. Pp: 793-801.

[3] Crow, S.E., Swantson, C., and Lajtha, K. 2007. Density fraction of forest soils: Methodological question and interpretation of incubation result and turnover time in an ecosystem context. Biogechemistry, 85: 69-90.

[4] Dunn, C.P. Stearns, F. Guntenspergen, G.R. and Sharpe, D.M. (1993) Ecological benefits of the conservation reserve program. J. Soil Water Conserv: Vol 47. Pp: 132-139.

[5] Dye, D. G., Hinchliffe, H. and Woodcock, E. (2000). Modeling the effects of recent land use change on the carbon cycle in the zhu jiang delta region Of southern china. GISdevelopment.net. ACRS 2000.

[6] Emadi, R and B, M. (1386) Effects of land use change on soil organic carbon and some soil physical properties in high altitude areas in northern Iran. Iran-Tehran Congress of Soil Science. Pp. 1140-1141

[7] FAO Soils bulletin 32, 1981.A framework for land evaluation. FAO Publication, Rome, 66 p.

[8] Garten, Jr. & T. Charles, 2002. Soil carbon storage beneath recently established tree plantations in Tennessee and South Carolina, USA, *Biomass and Bioenergy*. 23(2): 93-102.

[9] Govaerts, B., K. Sayre, K. Lichter, L. Dendooven & J. Deckers, 2007. Influence of permanent raised bed planting and residue management on physical and chemical soil quality in rain fed maize/wheat systems. J. Soil Plant, 291:39-54.

[10] Haynes, R. J. 2005. Labile organic matter fractions as central components of the quality of agricultural soils: An overview. Adv. In Agron. 85: 221-268.

[11] Ingram, L.J., Stahl, P.D., and Schuman, G.E. 2008. Grazing impact on soil carbon and microbial communities in a mixed-grass ecosystem. Soil. Sci. Soc. Am. 72: 939-948.

[12] Kimble, J.M., L.S. Heath, R.A. Birdsey & R. Lal, 2003. The Potential of U.S. Forest Soils to Sequester Carbon and Mitigate the Greenhouse Effect. CRC Press, New York.

[13] Lal R. 2002. Soil carbon dynamics in cropland and rangeland. Environment PollutIon, 116:353–362.

[14] Lal, R. 2008. Carbon sequestration. Philos. Trans. R. Soc. B. Biol. Sci. 363: 815-830.

[15] Lal, R., 2004. Soil carbon sequestration to mitigate climate change. Geoderma, 123: 1-22.

[16] Liu, X., Herbert, S. J., Hashemi, A. M., Zhang1, X. and Ding, G. (2006). Effects of agricultural management on soil organic matter and carbon transformation – a review. *Plant and Soil Environment*. 52(12), 531–543.

[17] Lu. D. and Q. Weng. 2007. A survey of image classification methods and techniques for improving classification performance. International Journal of Remote Sensing. 28 (5): 823–870.

[18] Mahmoudi taleghani, E., G. Zahedi amiri, E. Adeli & Kh. Sagheb talebi, 2007. Assessment of carbon sequestration in soil layers of managed forest. Iranian J. of Forest and Spruce Research, 15(3): 241-252. (In Persian).

[19] Maia S.M.F., Ogle S.M., Carlos C.C., and Carlos E.P.C. 2010. Changes in soil organic carbon storage under different agricultural management systems in the Southwest Amazon Region of Brazi. Soil & Tillage Research, 106:177–184.

[20] McLauchlan, K. (2006) the nature and longevity of agricultural impacts on soil carbon and nutrients: A review, *Ecosystems*, Vol 9. Pp: 1364-1382.

[21] Merino, A., Pérez-Batallón, P. and Macías, F. (2004). Responses of soil organic matter and greenhouse gas fluxes to soil management and land use change in a humid temperate region of southern Europe. *Soil Biology and Biochemistry*. 36, 917- 925.

[22] Mikutta, R., Kleber, M., Torn, M.S., and Jhan, R. 2006. Stabilization of soil organic matter: association with minerals or chemical recalcitrance Biogeochemistry, 77: 25-56.

[23] Powers, J.S. & W.H. Schlesinger, 2002. Relationships among soil carbon distributions and biophysical factors at nested spatial scales in rainforests of northeastern Costa Rica, Geoderma, 109: 165-190.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 845-850

[24] Pulleman, M. M. et al. (2000). Soil organic matter content as a function of different land use history. *Soil Science Society of America*, 64, 689-693.
[25] Rasiah, V. and Kay, B. D. (1995) Runoff and soil loss as influenced by selected stability parameters and cropping and tillage practices. *Geoderma*, 68: 321–329.
[26] Rasouli, N. (1385) Effect of different land use and parent material on some physical and chemical properties and biological Master's thesis Department of Soil Science, University of Guilan, p .152.
[27] Sharma, P. and Ray, S. C. (2007). Carbon sequestration with land-use covers change in a Himalayan watershed. *Geoderma*. 139, 371-378.
[28] Spaccini, R., J.S.C.Mbagwu, C.A.Igwe, P.Conte and A. Piccolo. 2004. Carbohydrate and aggregation in lowland soils of Nigeria as influenced by organic input. Soil till Res. 75:161-172.
[29] Su, Y., Zhao, H., Zhang, T., and Zhao, X. 2004. Soil properties following cultivation and non-grazing of a semi-arid sandy grassland in northern China. Soil and Tillage, 75: 27-36.
[30] Stevens, A. and Wesemael, B. (2008). Soil organic carbon dynamics at the regional scale as influenced by land use history: a case study in forest soils from southern Belgium. *Soil Use and Management*. 24, 69–79.
[31] Tan, Z.X., Lal, R., 2004. Relationships between surface soil organic carbon pool and site variables. Geoderma. 121, 187-195.
[32] Wang Y., Zhang X.C., Zhang J.L., and Li S.J. 2009. Spatial variability of soil organic carbon in a watershed on the loess plateau. Pedosphere, 19(4): 486–495.
[33] Zolfaghari, as Hajj Abbas, M. (1386) Impact of change of land use on some physical and chemical properties of soils. Iran-Tehran Congress of Soil Science. Pp. 1008-1009.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 851-856

The effect of management factors on the control of potato pests in Jiroft region

Parvar Abbas[1] and Azimzade Najmeh[2]

1 . Islamic Azad University, Jiroft Branch, faculty member, Member of Young Researchers and Elite Club, Jiroft, Iran
2. Islamic Azad University, Rafsanjan Branch, Member of Young Researchers and Elite Club, faculty member, Rafsanjan, Iran
Email: a.parvar55@gmail.com

***Abstract*—** Potato is the most important staple food of people, after rice and wheat. Potato cultivation in Iran in recent years is about 150,000 hectares with an average yield of 7.20 tons per hectares that is about three thousand acres under cultivation in Jiroft. Hence pest control management is very important. Thus, social and technical economic factors can be expressed in terms of management. In this research by using data obtained through questionnaires and interviews with farmers the role of economic and social factors in farmer decision making were evaluated by the way of production function and statistical analysis. In investigating elasticity of production inputs being Significant inputs of pesticides insecticides, fungicides and herbicides as well as its negative claim that farmers use inputs of pesticides, fungicides and herbicides than their optimal. Indiscriminate use of pesticides indicates, that farmers have not adhered Stability Index to maintain crop health and the environment and this itself will cause a decrease in performance. Fertilizer used by farmers is in a manner that has a significant positive effect on performance. In assessing the effect of factors such as age and years of farming, frequency of participation in educational programs, credit and income second job on chemical pesticides consumption a significant positive correlation has been seen, And also there is a significant negative relationship between the education and access to pesticides and pesticide application.

Keywords— inputs elasticity, management factors Potatoes, production function

I. INTRODUCTION

Jiroft with a good and Mediterranean climate (hot and humid), is the best place to cultivate crops in Kerman province. It has been green in every season and has a thriving farming. Jiroft city with an area of about 13,799 square kilometers is located in the south of Kerman province and south-east of Iran. It possesses in 4 of the 13 villages. Now, more than four million tons annually of various horticultural crops and salads produced in this region and taking advantage of this potential needs support. Potato, onion and cucumber have usually a high thriving. According to FAO statistics, Potato cultivation in Iran in recent years is about 150,000 acres, with an average yield of 7.20 tons per hectare with an average yield of 7.20 tons per hectare, potatoes are a staple food for people.

The world's growing population has led to significantly increased demand for food. Since the area of land suitable for agriculture is limited, increasing the acreage is not possible, and considering the fact that the raw materials constantly are reducing, Therefore existence of effective methods for producing is essential. [13]. Production and preservation of agricultural products, are always parallel to each other, Hence, effective strategies for preserving agricultural products, which Plays a major role in human diet always had been exist. In order to protect the crops against pests, various methods have been designed throughout history, some have succeeded and some other methods have not had much success [16].

One of the region requirements for achieving a favorable situation in the agricultural sector is Crop management and control of agricultural pests, so necessary training must be given the to farmers and manufacturers. Today, Management is considered to be as a significant factor in all economic sectors, especially agriculture, So that to the three factors of production, ie land, labor, capital Management has been added as a fourth factor[9].

Integrated pests Management (IPM) that itself is one part of a comprehensive approach product management (ICM) involves applying a set of methods While achieving a sustainable economic and Pest Control minimize using chemicals and thereby minimize environmental hazards. Since pests population and their control methods affect by several factors. Such as the cultivar, soil type, topography, history, culture, climate and etc thus, a business plan based on the research findings offer is essential for each region (Khanjani et al, 2008). In the field of plant management of farm several

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 851-856

studies have been conducted which some of them include the relative economic adaptation of agricultural, Different methods of weed control for small producers in north eastern Brazil, which was conducted in 1986 by Shenk et al. [18]. This study shows that the use of chemical and mechanical weed control techniques for the replacement of hand weeding, economically gives less benefits Which the major reasons are Cheap labor, lack of job opportunities in the region, very low under cultivation area, low education and region climate that have been major reasons of advantage for weeding compared to alternative methods.

Hassani Moghaddam and Deliri (2004) in a research entitled by Management causing soybean loss of control factors demonstrated that in calculating marginal productivity of different groups of study, illiterate farmers have higher productivity than Literate ones, which shows that the classical teaching culture in the study does not have significant effect. The cost of combination in various sectors of farm Management indicates the cost of pest Management after irrigation and car costs, is ranked Third with 12.8 percent of the total cost of production, and in compared with non-chemical and chemical cost is 35 percent[5]. In this study, the optimal use of factors of production in agriculture, were determined such as chemical pesticides, And also production functions estimated and production elasticity were calculated. Finally, the impact of various factors, managerial, economic, social and agricultural pesticide consumption was measured.

II. MATERIALS AND METHODS

In order to achieve the research objectives, The data were collected by means of questionnaires and interviews with farmers. In order to collect, first list of rural farmers of rural service center approved. Then by using cluster sampling then by using a two-stage cluster sampling some villages were selected some samples was randomly selected between them. Cochran's formula was used to determine sample size and to eliminate any possible problems of completing the questionnaire, six questionnaires were completed in the study area, and then by done survey existing deficiencies have been resolved that in the end, 100 people were selected and asked as samples. After extracting information, in order to obtain the efficiency of economic, using chemical pesticides to control pests and diseases of potatoes by utilizing the ratio of the average value of the marginal product of used pesticides, prices were used to estimate the production function efficiency is simply defined the value of output to input values [14].So the concept of efficiency will have the two different approaches for calculating.

A) Outcomes-based approach suggests, that how much partially we can enhance a product without changing the amount of used inputs.

B) Input based approach identifies that how much it possible to partially reduce values of inputs without changing the product [11].

In functional analysis this condition provide in the second production. Davan- Benzan formula ($\frac{VMP_X}{P_X}$) aim is optimal point of maximum profit. The profits of a production process has its own maximum while that final product of each input value is equal to the cost of one unit of input. In other word Mc marginal cost must equal to marginal revenue Mp. Therefore the point is efficient where the variable inputs are equally charges as well as generate income [3]. If this equation that indicates the economic efficiency is equal to 1 consumption is economically at level of efficient. Thus this ratio imply that the use of any applied agent Can be increased to the extent that the value of its marginal product is greater than its cost, Therefore the optimal amount of input variables is achieved by maximizing the profit function. Interest can be expressed in equation (1).

$$\pi = TR - TC \quad (1)$$

Where the TR and TC are total cost and total revenue thus represents the economic benefit. Now the profit equation is provided as (2).

$$\pi = P_y.y - P_{X1}.X_1 \quad (2)$$

To find the best deal inputs, it is enough to derive from equation 2 by the amount of consider variable inputs, and thus make (The final product) equal to zero.

$$\frac{d\pi}{dxi} = \frac{dy}{dx}.py - p_{xi} = 0 \quad (3)$$

$$\frac{dy}{dxi} = py = pxi \quad (4)$$

$$(MP_{Xi}).P_y = P_{Xi} \quad (5)$$

$$VMP_{Xi} = P_{Xi} \quad (6)$$

$$\frac{VMP_{Xi}}{P_{Xi}} = 1 \quad (7)$$

Equation 6 is the optimal allocation criteria, that pxi and MPxi respectively represent the desired marginal cost of production [2]. Thus, the optimal is included use of each input point, that value of the marginal product of each input is equal to the input price. In other words, each input provides income as its own price.

By using generating functions, we will be able to determine Intermediate production, final production, elasticity of substitution, maximized production, efficiency, returns to scale, the production and ...,and use each of them as A technical and economic indices toward performance and evaluation guidance and tips Suppliers. For this purpose, the most important functions used in agricultural production has

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 851-856

been studied and then proportionate to the intended appropriate target function was used to estimate the relationship between inputs and outputs in agriculture, there are a variety of functions, in this study, according to the characteristics of the production functions, the two Cobb-Douglas function, Due to its simple form as well as provide an easy interpretation and its application by researchers as well as the ability to transform into transcendental logarithmic function has been used because of High explanatory power of the three stages of production and productive capacity of the natural logarithm of a variable elasticity are estimated using ols and its widespread use in research.

III. RESULTS AND DISCUSSION

In this research in addition examined ways was studied the relationship between input and output, Factors such as age, education, farming experience that can have a significant impact on managerial activities, had been analysis. (Tables 1, 2, 3 and etc)

Table 1: Distribution the state of farmer education

Literacy	Frequency	Cumulative percentage
Illiterate	11	11
Elementary	18	29
Guideschoolness	29	58
Diploma	27	85
Higher diploma	15	100
Total	100	-
Average: 3.170	Standard deviation : 1.214	Variance : 1.164

The results of the above table show that 71 percent of cases are secondary higher education and the percentage of illiterates is 11%. So in the education and promotion of agriculture we are face with people in the middle to upper levels of literacy. This issue leads us to the efficient use of agricultural inputs.

Table 2: Age distribution the state of farmers

age	Frequency	Cumulative percentage
20-30	27	27
31-40	27	54
41-50	30	84
51-60	11	96
Above 60	5	100
total	100	-
Average: 39.910	Standard deviation : 11.548	Variance : 133.355

According to being Young and Middle-aged of the most studied people, and thus they are more risky than older people, Promoting the use of modern agricultural methods would be more effective.

Table 3: Distribution of the state of cropping history

Background Culture	Frequency	Cumulative percentage
1-5	9	9
6-10	35	44
11-15	19	63
16-20	18	81
Above 20	19	100
total	100	-
Average: 15.770	Standard deviation : 10.105	Variance : 102.118

According to the results of Table, 56% of people have over 10 years of experience in the cultivation of the product, It shows the history of potato farmers in this region is higher than average.

IV. RESULTS AND DISCUSSION

For measuring the effect of factors of production on the the desired product, it is necessary to identify relationships between factors of production, or the production. For this purpose by using the way of estimating the production function, by using the E-views software system and the method of least, regular squares (ols) were performed. The general form of production functions of potatoes might have been considered as following.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 851-856

y =f(X_1,X_2,X_3,X_4,X_5,X6,…)
In the above function, dependent variable y and Xi are considered as the explanatory variables (independent).
(: Y value of the potato crop in kilograms, ,: X1 workforce in terms of man days of work, : X2 fungicides and herbicides in liters, X3 machines in terms of worked hours, : X5 amount of fertilizer used in kg)
To analyze the relationships between inputs and outputs in research, The Cobb-Douglas and transcendental functions was used with regard to the advantages mentioned in the previous section, The general form of this two function at two input are as following.
General form of the Cobb-Douglas

$$y = Ax1^{\alpha 1} x2^{\alpha 2}$$

General form of transcendental functions

$$y = Ax1^{\alpha 1} x2^{\alpha 2} e^{y1x1+y2x2}$$

In both functions output y and Xi Shows input quantities, Initially ols method for both the Cobb-Douglas and transcendental estimated, And then the estimated functions for both groups were compared by using f-test, The Cobb-Douglas functions were used to form f test for comparing two (LTD) and transcendental (unbound) in the presence of all variables. The general form of the formula f is as follows (99%).[10]

$$F = \frac{(RSS_R - RSS_{UR})/K - K^*}{RSS_{UR}/N - K}$$

$$\mathrm{F} = \frac{35.514 - 33.074/(17-9)}{33.074/100-17} = \frac{0.18}{0.398} = 0.45$$

In this formula RSS_R The residual sum of squares limited sentence , RSS_{UR}, Residual sum of squares sentences of unrestricted model (Unlimited), k is the number of not limited parameters k * is limited number of parameters, And N is the number of observations. Considering that computing f (45/0) is less than f table (2.28) indicates that there is no significant difference between the two models. by this status both models can be used to estimate production functions.
But since by estimating the transcendental production function, Some of the variables, especially pesticides, which currently are the main variables, didn't significant, Therefore function of the Cobb-Douglas production function was used to estimate, So the function is estimated as follows:

$$Lny = 2.478 + 1.25Lnx_1 - o.26Lnx_2 + 0.55Lnx_3 - 0.53Lnx_4 + 0.065Lnx_5$$

R^2 $D.W = 1.94$ $F = 8$ $N = 100$

the above f function indicates , that production factors has justified 86 percent of the variation, high quantities of f represents the high power of a regression anatomy, In order to function according to the production results, farmers 'method activities and rates of its reasonable can be commented. each elasticity production input has been calculated. Generally each elasticity production input specifies the technical efficiency of utilization input. In Cobb-Douglas function, Coefficients of each variable indicates elasticity of production (input) of variable. But this function as a transcendental function, Cannot identify the triple parts, in the following table each elasticity production input are defined.

Table 4: various production elasticity

production factors	e
Workforce	1.25
Fungicides and Herbicides	-0.26
Machinery	0.55
Insecticides	-0.53
Fertilizer	0.065

Elasticity production suggests that against a percent change in an independent variable, The dependent variable is change some percentage. The coefficient of 1.25 indicates the labor force that which equal to a percentage increase in consumption of labor force potatoes yields increase 1.25%. This issue suggests that the potato crop is a user product and this can be a good field to create more jobs and reduce unemployment in the area.
Meaningful inputs of pesticides, insecticides, fungicides and herbicides, as well as its negative, Suggests that farmers use inputs insecticides, fungicides and herbicides more than their optimal. Indiscriminate use of pesticides indicate that farmers have not observed Sustainability Index for maintaining product safety and environmental compliance and it itself reduce performance.
Fertilizer use by farmers as well as a significant positive effect on performance which elasticity of this entry shows input so well.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 851-856

Table 5 - management factors - socioeconomic factors on the use of pesticides

Variable	The correlation coefficient
age	0.18
Agriculture Experience	0.222
Education level	-0.202
attend classes times	0.187
Bank credits	0.163
Access to pesticides	-0.347
Second Job income	0.193

The results in Table 5 show that there is a significant positive correlation between use of chemical pesticides and factors such as age, years of farming, the number of training classes, Bank credits and income second job, and there is a significant negative relationship between education level and access the pesticide pesticide application.

V. SUGGESTIONS

Investigating Correlation between management factors and use of chemical pesticides shows that a significant relationship can be observed between frequency of corporate training classes and pesticides consumption. Thus training classes can have dissatisfying. Therefore, it is suggested, more modern methods of education must be considered in farm schools, doing so requires providing the necessary facilities. Proper and timely use of pesticides is consider as a last resort in the management of pest control Something that farmers and producers of agricultural products do not pay attention to it is has led to ease of use, immediate impact on the availability and widespread use of pesticides. Irrational use of pesticides resulting rising production costs, environmental degradation, loss of natural enemies, secondary pest outbreaks and increased pesticide residues in agricultural products and as a result of unauthorized health risk to consumers. To achieve these objectives and provide integrated management program to control major pests, Requires for serious planning, staffing requirements and funding is necessary. In the pest control methods, It is believed that in management only integrate don't happen. But rather the best way to Collate must be determine, in a way that socially, economically and environmentally for a farmer is an acceptable manner.

REFERENCES

[1] Asadi,Ali and Maryam Naderi Mahdiea (2009) Sustainable Agriculture, Payam Noor University Press.

[2] Akbari,Ahmad and Mohammad Bakhshoodeh (2000) Evaluate the effect of changes in input prices on agricultural output in Kerman, Quarterly Economics Agricultural and Development, The eighth Year,number 29.

[3] Jan.Pi.Dal.Frank.Arazam(1987) Production Economics, Translated by Mohammad Reza Arsalan Bad, First Edition,Tehran, Jahad Daneshgahi Center.

[4] Habibi,Jalaloddin,Hajiyanfar,Ramin and Seyyed Hossein mirkamali(2004) Pests, Important diseases and weeds of potato in Iran and their compilation management, Office of Educational Technology.

[5] Hasaani Moghadam,Majid and Jalil Deliri (2005) Economic Survey of damage-causing factors in management of soybean fields, Research Reports, Plant Pests and Diseases Research Institute.

[6] Khanjani,Mohammad,Khalghani,Jafar and Soleymani par,Mohammadjavad(2008) Control Principles of Pests and Plant Diseases, Payam Noor University Press.

[7] Khajeh poor,MohammadReza(2006) Industrial plants, Chapter 13, "potato" (second edition) Jihad Technology University of Isfahan Press.

[8] Rahmani,HmidReza(2010) Challenges in sustainable agriculture and healthy product, Publishing Nasoohi Press.

[9] Soltani,GholamReza.Najafi,Bahaodin and Javad Torkamani(1985) Agriculture management,Shiraz university press.

[10] Ferdosi,Rahmat AND saeed Yazdani(1995) Cotton production estimate, The Case of Gorgan city, Quarterly of economics agricultural and development,number 9.

[11] Journal of Economic Policy Eighteenth Year Issue number 56, Winter 1389 Page 52 of 27.

[12] Koochaki,Avaz.Hosseini,Mohammad and Hashemi Dezfooli,Abolhassan(1996), Sustainable Agriculture, Jahad Daneshgahi of Mashhad Press.

[13] Cohen M.B., Gould F., and Bentur J.S. 2000. Bt rice: Practical steps to sustainable use. International Rice Research Notes, 25, 2, 14 p.

[14] Farrell, M.J. (1957), "The Measurement of Productive Efficiency", Journal of The Royal Statistical Society Series A, CXX, Part 3, PP. 253-290

[15] Kaneda C. 1993. Rice. *In*: Traditional Crop Breeding Practices: An Historical Review to Serve as a Baseline for Assessing the Role of Modern Biotechnology: 37-46, OECD, 235 pp.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 851-856

[16] Khan Z.R., Litsinger J.A., Barrion A.T., Villanueva F.F.D., Fernandez N.J., and Taylor L.D. 1991. World bibliography of rice stem borers 1974-1990. International Rice Research Institute and International Centre of Insect Physiology and Ecology. 415 pp.
[17] Virmani S.S. 1994. Heterosis and Hybrid Rice Breeding. Springer-Verlag, Berlin Heidelberg New York. 189 pp.
[18] CAB International crop protection Compendium 1985-2000.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 857-862

Investigation, the administrative-economic factors, influencing the adoption of Integrated Campaign against pests of pistachio in Rafsanjan

Najmeh Azimi Zadeh[1] and Abbas Parvar[2]

1. Islamic Azad University, Rafsanjan Branch, Member of Young Researchers and Elite Club, faculty member, Rafsanjan, Iran
2. Islamic Azad University, Jiroft Branch, Member of Young Researchers and Elite Club, faculty member, Jiroft, Iran

Email: n.azimizadeh@yahoo.com

Abstract—The difficulties arising from chemical pesticides to human health not covered on a person. So, to avoid pest damage is necessary to according to integrated management and fight against them as a step towards reducing the population and damage them. The integrated management system used all the methods of struggle on a consistent basis and in a manner that apply minimum disruption in effective control of this pest in the long term. These methods can be referred to using a variety of mechanisms to fight including agricultural mechanical, physical, biological and chemical and pheromone. Predatory insects such as green lacewing ladybird predator are active in pistachio gardens in Rafsanjan region and therefore are the need to support mass rearing and release them in pistachio gardens. The present study used a multistage cluster sampling to determine the management-economic factors influencing the adoption of Integrated campaign against pests by farmers. In general, the results of this study suggest that there is a significant relationship between adoption of integrated pest management with a distance of home to garden having a second job in addition to farming the amount of relationship with agricultural service centers degree of opinion leadership in integrated campaign the amount of annual income from agricultural activities, attendance rates promotional educational activities the amount of use of chemical pesticides and the use of integrated control costs compared to chemical pest control. However, the most important factor influencing the success of the development and application of integrated control programs and the participation of all farmers in all stages. In this regard, it is recommended that the provision of training and participation of farmers is necessary to hold regular classes. Placed at the disposal of farmers students use integrated control, including biological methods are receptive to the technology as transparent and positive way.

Keywords—acceptance, Integrated Campaign, Pistachio pests, Rafsanjan.

I. INTRODUCTION

Today, with despite the problems that caused by chemical pesticides to human health, it is very practical using Integrated campaign with a pests (IPM) which in part used the methods of biological control against pests [5]. In this regard, it has become more efficient, green lacewing, ladybird predator and parasitoid Hymenoptera for pest control in agriculture the environment [9]. In recent years, the damage Pistachio pests, including the common pistachio psylla growing up and in all areas of pistachio is considered part of economic pests and first grade. Other pests are active in pistachio gardens, such as twig borer moth, fruit fly-eating pistachios and pistachio typical psyllid, which is a major pest of pistachio gardens in Iran, by sucking plant sap can be reduced kernel weight percentage of osteoporosis and reduce the amount smiling. Infested plants, the weak and sometimes seen burnt brown spots on the leaves. Pest damage, the loss of leaves and fruit buds the following year as well as stomatal closure the

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 857-862

honeydew secreted. Therefore, due to the economic importance of pistachios and prevent pests damage checked on to fight compilation. In this study the most effective methods on the adoption of Integrated Campaign against pests by farmers in Rafsanjan region and also tried to assess the advantage non- chemical methods against pests. Because pesticide pesticides are known as one of the most important pollutants. Despite recent promotional efforts to take advantage of this new technology (IPM) in agriculture, yet as it is a worthy, is not acceptable to farmers. In recent years, there is a significant increase pistachio orchards in Rafsanjan region. Farmers resort to chemical pesticides due to inadequate knowledge of pest management approach to pest control. Unfortunately despite the fact that for over half a century ago to entering chemical pesticides in the country in general are not included in the study and assessment of adverse effects of this material [3]. These limitations especially in terms of assessment teaching methods and to promote in connection with, the use of pesticides, and lack of data, non-chemical methods of fighting pest is more strongly by farmers. Rafsanjan, because being a single product and because it is located in the vicinity of copper smelters, Khatoon Abad and in Babak city and the winds are mostly from the West to the East is located right in smoke emissions, the three factories. On the other hand, Rafsanjan located in the center of pistachio gardens, gardens annually, even up to 14 times to be sprayed, sprinkled every day amounting to tens of tons of pesticides in pistachio gardens Rafsanjan and this is the very thing that, Rafsanjan is a polluted cities in the world. Therefore, it is necessary to takes measures to improve the situation pest control region and reduced use of agricultural pesticides. The aim of this study was to "identify the structures and the characteristics of effective pest control adoption by farmers of Rafsanjan to identify potential adopters and contribute to the promotion of integrated approaches to pests".

II. MATERIALS AND METHODS

In the present study, the study area is in Rafsanjan region. with a an area of 10,678 square kilometers is situated in south-eastern Iran, and North West of Kerman province at latitude 30 degrees north and 56 degrees east longitude.

Table 1: surface area and classification, in Rafsanjan region

surface area (km^2)	Number of city	Number of sections	Number of villages
7678	6	5	16

Source: Statistical Center of Iran

The population of the present study is composed of farmers in Rafsanjan region, who are doing to fight against Pistachio pests. Were attempting to collect information through a stratified random sampling method. Farmers divided into two parts adopter or not accept to fight fusion are studied.

III. SAMPLING AND SAMPLE SIZE

Used, a multistage cluster sampling. If unavailable a full list of participants can be clustered in families community members and then take samples from the cluster. First in each of the cities in the region Rafsanjan, from among villages that have been proposed innovation (Integrated campaign) select the number of villages by simple random sampling and then in each of the villages mentioned by stratified random sampling farmers were divided into two categories adopters and not accept biological control of pests. This study which is a survey collected data relating to the questionnaire.

In the present study, the theoretical framework and an accurate knowledge of the study area was used in the research library contains documents and documents related to agriculture and the survey papers thesis and books, the kind we have for their help the better and deeper understanding of the topic. Information was also obtained through observation, interviews and library research were the basis for developing the questionnaire for field activities. In this context, we propose an initial questionnaire were attempting to pre-test the hypotheses and the final questionnaire was designed after analyzing the results and remove flaws in it. The information was obtained through this questionnaire is the basis of research findings and the basis of the analysis and conclusions. In other words the data in this study is a questionnaire.

IV. VARIABLES OF THE RESEARCH

Dependent variable: The dependent variable in this study is the adoption of integrated pest control between farmers in Rafsanjan region.

Independent variables: independent variables are included, demographic variables and independent the two, and multilevel. Demographic variables, are as follows: age of the farmer, number of family members, distance between the place of residence to the garden, the property, the amount of product performance, income, and annual costs of agricultural activities (in Rials), experience in agriculture (years) . Independent variables, the two, and multi-level, are as follows: gender (females (1) Man (2)), marital status (married (1) single (2)), the farmer's level of education (illiterate (1), elementary (2), intermediate (3), a high school and diploma (4), associate and higher (5)), having a second job in addition

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 857-862

to farming (Yes (1) No (2)), the amount of involvement of family members, in agriculture (very low (1), low (2), moderate (3), high (4), very high (5)), the amount of communication, agricultural service centers (very low (1), low (2) moderate (3), high (4), very high (5)), the amount of opinion leaders in the to fight compilation (very low (1), low (2), moderate (3), high (4), very high (5)), the company, training - extension (very low (1), low (2), moderate (3), high (4), very high (5)), the availability, agricultural inputs (fertilizer poison, equipment, etc.) (very low (1), low (2), moderate (3), high (4), very high (5)), the availability of resources, financial / credit / capital investment (very low (1), low (2), moderate (3), high (4), very high (5)), the amount of use of chemical pesticides (very high (1), high (2), moderate (3) low (4), very low (5)), dealing advocates in promoting integrated pest management (very good (1) good (2), moderate (3), Bad (4), very good (5)) and the cost of fighting the fusion, compared to the use of chemical pesticides, alone (very low (1), less (2) to (3), so (4), very much (5)).

Methods of statistical analysis: For statistical analysis, we used descriptive statistics such as frequency, percentage, mean and standard deviation. In addition, inferential statistics were also used in statistics such as chi square tests for independent groups.

V. RESULTS AND DISCUSSION

In this section, according to the methods described, analysis, descriptive and inferential statistics in the Materials and methods, the first using frequency tables drawing a picture of the general characteristics of the target population, then was analyzed the relationships between variables.

Shown in Table 2 are the mean and standard deviations of the characteristics of the respondents and in Table 3, the mean rank, the characteristics of the respondents.

Table 2: Mean and standard deviation of respondents characteristics.

Independent variable	Number	Average	Standard deviation
Age	150	41.84	1.18
The number of family members	150	5.20	2.27
Work Experience in farming (years)	150	16.92	1.09
Distance from home to garden (km)	150	18.91	8.71
The amount of property (in acres)	150	2.93	1.40
Peanut yield in year (ton in acres)	150	1.46	0.22
The amount of annual income from agricultural activities (in million Rials)	150	424.99	81.53
Annual spending on agricultural activities (in million Rials)	150	118.39	10.69

- Average age of the patients was 41.84, which indicates that between the years, the majority of study subjects.
- Average family size among respondents was 5.20 persons which represents in large households among respondents.
- The history of agriculture, among these patients is approximately 17 years, which is demonstrated by an average of pistachio orchards in Rafsanjan area and agricultural transport children.
- Average distance from home to garden, is 18.91 km, which does not take much space and is indicative of the extent of pistachio orchards and gardens close to where you live in this area.
- Average amount an individual is approximately 3 acres according to the Economic pistachios and the amount of annual income the optimal value of the product.
- Average yield of nuts per year is 1.46 tons per hectare, which is the average yield.
- Average annual earnings of pistachios is about 425 million ha which indicates a good income.
- Average annual spending on agricultural activities Rafsanjan Pistachio growers is estimated at approximately 118 million ha, of which a figure is not far-fetched, according to agricultural practices in the gardens and the indiscriminate use of fertilizers and chemical pesticides.

Table 3: Average ratings of the characteristics of respondents

Independent variable	Number	Average rank	Standard deviation
Education level	150	3.02	1.24
Having a second job in addition to farming *	150	1.22	0.41
Amount of, relating to, agricultural service centers	150	3.24	0.71
Amount of opinion leader in the fight compilation	150	1.53	0.88

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 857-862

Family participation in agricultural	150	2.87	1.21
The amount of pesticide application	150	2.62	0.72
Access to agricultural inputs (fertilizers, pesticides, tools, etc.)	150	3.12	0.80
Access to finance / credit / investment	150	2.13	0.85
Level of participation in educational activities and advocacy	150	1.88	1.00
Approach advocates in promotion of integrated pest management	150	2.13	0.85
Cost of controlling fusion, rather than chemical	150	3.58	0.93

Note: Table 5-1 is the score variable. * This is the scope of the variable points 1 and 2.

The average Education level among farmers indicating that the majority of people have at least, middle school education. Rate of connection with agricultural service centers are moderate. Reported is relatively low rate of thought leadership in fight compilation, involvement of family members in agriculture are moderately or less. Average consumption of poison indicates that almost excessive amount of pesticides in Rafsanjan Pistachio growers. Access to agricultural inputs is moderate to high and access to finance credit and investment is lower than average.

The average rate of participation in educational activities - promotion, is at the low and very low and it is showing the absence of farmers, classes and activities in this field. It is reported dealing advocates in promoting integrated pest management moderate to good. But, despite this, the integrated control of pests has been welcomed farmers and this can be illustrated by the negative attitudes of farmers in this area.

Chi-square test

Shown, respectively, in table 4, the effect of managerial - economics, the adoption of integrated control of pests the Chi square test.

Table 4: Effect of managerial – economics factors on adoption of integrated control of Pistachio pests.

The independent variable	X^2	P
Age	1.246 ns	0.870
Sex	1.001 ns	0.317
Level of education	6.439 ns	0.169
Marital status	0.121 ns	0.728
Number of family members	6.324 ns	0.851
Experience in agriculture	20.514 ns	0.809
Distance from home to garden	*** 67.016	0.000
Having a second job in addition to farming	** 6.005	0.014
amount of, relating to, agricultural service centers	** 9.968	0.019
amount of opinion leader in fight compilation	*** 1.408	0.000
The property (in acres)	6.505 ns	0.970
Involvement of family members in agriculture	0.897 ns	0.925
amount of yield	23.406 ns	0.610
amount of annual income from agricultural activities (in Rails)	** 94.239	0.010
Annual spending in agricultural activities (in Rails)	27.242 ns	0.749
Level of participation in educational activities - promotion	*** 81.548	0.000
Access to agricultural inputs (fertilizers, pesticides, tools, etc.)	2.924 ns	0.571
Access to financial resources / credit / investment	1.864 ns	0.761
amount of use of chemical pesticides	*** 45.109	0.000
Approach advocates in promotion of integrated pest management	6.885 ns	0.076
Cost of controlling fusion, rather than chemical	*** 29.516	0.000

* Significant in 99% confidence level, ** significant in the 95% confidence level, ns not significant

There is no significant relationship between adoption of integrated pest control, with age, sex, education, marital status, family size, experience in agriculture, amount of ownership amount of involvement of family members in agriculture, crop yield, amount of annual agricultural activities, dealing advocates in promoting integrated pest management and the availability of agricultural inputs, credit and finance ($p > 0.05$). There is significant relationship between adoption of integrated pest management, a habitat space to gardening, having a second job in addition to farming, amount of Farm Service Contact Centers, amount of opinion leaders in fight fusion, amount of annual income from agricultural activities, level of participation in educational activities - promotion, amount of use of chemical pesticides, and the use of integrated control costs rather than chemicals to control pests. ($P < 0.01$ and $p < 0.05$). In general, the results of this study suggest that these factors have a significant effect in reducing the amount of pesticide application, and adoption of integrated control of pests. Pest control methods, in pistachio orchards are more inclusive, modern methods of combat such as the use of yellow sticky cards various optical and pheromone traps and biological farming methods along with the correct and rational use of chemical pesticides.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 857-862

Yellow sticky cards against the common pistachio psylla which is known the dried sap and is a very important pest and primarily pistachio as applicable against the cricket pistachio and different aphid species. Light and pheromone traps are used against pests Butterfly as pistachio twig borer moth. Important biological factors family Baltoris, bees, beetles, predatory insects and are active in pistachio orchards on different pests the indiscriminate use of chemical pesticides to eliminate them and the imbalance in the biological in these ecosystems. In general farmers to stop the destruction and the loss of their agricultural produce which comes with costs, inconvenience and many times as well, due to population growth and limitations in production of various food products, the use of chemical methods to control pests and disposal and the immediate effects of the poison to kill pests, regardless of the side effects of pesticides such as resistor and the outbreak of pests, exterminate of natural enemies, appearance of secondary pests and environmental pollution are attempting to do the indiscriminate use of chemical pesticides. Pistachio orchards pistachio because of the economy and export it to other countries and intolerance number of low pest by farmers in the region are heavily exposed to chemical pesticides. Because of the use of pesticides increased exposure to these toxins resulting in increased complications and its effects on human health. Thus, in this context can be very important thought leadership to adopt integrated pest management and brought in farmers reduce their pesticide intake substantially. However, the most important factor influencing the success development and application of integrated control programs participation of all farmers in all stages. It is therefore recommended that the provision of training and participation of farmers is necessary to hold educational courses. Placed in the disposal of farmers, students use pest control and important issues in the field of IPM to be more transparent and in a positive way to accept the technology. Therefore, implementers should pay for their education while revising in traditional methods the organization of farmers in participatory approaches. Achieve this it is necessary to provide the necessary facilities. Experimental studies in different countries show that from a large set socioeconomic factors may influence the decision farmers use pesticides [8]. All farmers in the region while providing technology or new ideas coupled with a fast reject the innovation required and their attitudes towards innovation depends on the characteristics of new ideas as well as other variables such as anomalies cultural facilities and people need to change. The farmer's decision to adopt or reject, in fact may not be considered an immediate decision. Therefore, in order to utilize and develop the technology in addition to the efforts of scholars specialists and pest control are responsible for the heavy responsibilities and duties, educational researchers, and advocates as well as promoting the ease and expedite the admission process, and consequences study of cultural, social, economic and innovation [6]. In a study in the Philippines, it was shown that farmers who accepted the panel's work fighting for control of pests of rice during the rainy season 93-1992 years, had cost 266 Pzota rate (about 5.4 dollars) per acres. But farmers, IPM methods repudiated it paid about 761 Pzota (15.5 dollars) per acres [1]. In order to perform any type of fight, whether chemical, biological and agronomic proper understanding of the nature and life stages of the pest is one of the pillars of the fight. The present study shows that most of the farmers do not have a high knowledge of the affair. We plan to increase farmers' awareness in this issue; it is necessary and the organs of promotional activities. The use of chemical pesticides in agriculture is constantly faced with problems and numerous restrictions. On the one hand, lack of timely access to poisons and most of them are imported and on the other hand, the risks of which are a threat to the environment and human health due to their policy to encourage farmers to use the methods of compilation.

VI. SUGGESTIONS

Since most farmers in the area had a lower educational level, those involved in the promotion, choose instructional methods to be farmers, effective learning. In this regard, the continuous education scientific and efficient to be more willing to use integrated control methods. Major problem has always been threatened agricultural sector is the lack of proper education of farmers. Therefore, efforts to increase farmers' education, they will become familiar with the benefits of modern methods of pest control. In general, since the use integrated pest control methods is less chemical pesticides which require some risk taking on behalf of farmers, therefore, having a non-agricultural job which leads to less reliance of farmers, farm income and shall with the additional risk. Thus, executives revising the traditional methods while training for farmers are organizing them in a participatory approach. Achieve this it is necessary to provide the necessary facilities changes in the attitudes of managers and executives understand and teach them how to implement the program. It is therefore recommended that a suitable tool for the provision of training and participation of farmers in integrated pest management programs and participate in continuing education classes to promote.

REFERENCES

[1] Abeydeera, W. M. 1994. Impact of intervention: integrated pest management in rice based farming system .paper presented of the third Asia farming systems symposium. (From agric abstract).

[2] Alston, D.G., and grading, M. E. 1998. Factors influencing adoption and educational outreach of

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 857-862

integrated pest management. {On line}.available http://www .joe.org/ Joe / 1998 June /a 3.html.

[3] Asghari, S. and Hadi, F. 2009. The study of extension effects on adoption of biological control in soybean farmer at Moghan (Ardebil province, Iran). 1st National New Technology in Agriculture and Natural Resources, Rasht, pp: 982-996.

[4] Bartlett, J. E., Kotrlik, J. W. and Higgins, C. C. 2001. Organizational research: determining appropriate sample size in survey research. Information Technology, Learning and Performance Journal, 19 (1): 43- 50.

[5] Hadian, Z., Azizi, M. H. and Ferdosi, R. 2006. Determination of chlorinated pesticide residues in vegetables by gas chromatography/mass spectrometry. Iranian Journal of Food Science Technology, 3(1): 67-74.

[6] Jitter, K. 2005. Economic framework for decision making in biological control, Biological Control, 35: 348–357.

[7] Lame, M. L.1992. A study of the diffusion of Integrated Pest Management in cotton growing community (Pest Management) (Doctoral dissertation, University of Arizona State). Dissertation Abstracts International.

[8] Noorhosseini Niyaki, S. A., Radjabi, R. and Allahyari, M. S. 2010 Social Factors Critical for Adoption of Biological Control agents *Trichogramma* spp. Egg parasitoid of rice stem borer *Chilo suppressalis* in North of Iran, American-Eurasian J. Agric. and Environ. Sci., 9(2): 133-139.

[9] Pezeshkirad, G., Masaeli, M. and Yaghoubi, J. 2006. A study of the effective factors involved in adoption of integrated pest management of rice stem borer (*Chilo suppressalis*), Isfahan, Iran. Iranian Journal of Agricultural Sciences, 2(1): 27-33.

[10] Riley, D. G., J. V. Edelson, R. E. Roberts, N. Roe, M. E. Miller, and Couperus, G. 1998. Integrated Pest Management in Cucurbit Crops in South Central USA: Pest Status, Attitudes Toward IPM and Plan for Implementation. [Online]. Available: http://www.joe.org/joe/1998august/a3html.

[11] Salami, H. A. and Khaledi, M. 2001. Impact of Biological Technology of *Chilo Suppressalis* Control on Pesticides Use: Case Study in Mazandaran Province. Eqtesad-E Keshavarzi Va Towse'e, 9(1 (33)):247-270 (In Persian with English Abstract)

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 863-866

A comparison of EPM and MPSIAC models in estimation of erosion and sediment yield in Mashangi Watershed (Rudan, Hormozgan Province)

Abuzar Niknam, Hossein Mohsenizadeh, Emad Fahim, and Hasan vagharfard

***Abstract*—**This study aimed to compare two models of MPSIAC and EPM in order to estimate the erosion and sedimentation of Mashangi watershed (a part of the watershed of the Esteghlal dam of Minab, Rudan-Iran), to do so, at first the existing information and mapping of hydrology units and sub-basins, the factors of models in the region of interest were investigated. Then the MPSIAC method was used with mapping of geomorphology, and specifying facies as a complementary method of PSIAC model. Using the two above mentioned models the amount of erosion in the basin area was estimated. the Comparison of the results of two models of MPSIAC and EPM with field observations suggest that although the results obtained from the model in most of the regions are in a good agreement, the results of EPM model in compare to MPSIAC model are less reliable in identifying regions with medium and higher level of erosion.

***Keywords*—** EPM, erosion, Hormozgan, Mashangi, , MPSIAC.

I. Introduction

The role of soil erosion and sediment yield in soil fertility reduction and waste, reservoirs filling, clogging and blockage of the ducts of the irrigation streams and rivers, muddy river water and reduction of water quality, pollution of downstream and so on is well established.

To prevent and mitigate these effects, soil conservation and watershed management measures are needed to control the erosion and sedimentation [6]. To execute the conservation plans and determine the methods of erosion management and sediment control, as well as the calculation and precious designing of dams' constructions, it is necessary to estimate and evaluate the annual sediment production rate in the total volume of a watershed as well. Whenever the watershed statistics and information relating to water discharge and sediment are available, the calculation of the total volume of annual sedimentation by using of statistical methods will be possible, while lack of information on soil erosion and sediment yield in most of catchment basins of the country like the other countries around the world, requires the application of appropriate experimental methods for estimating the intensity of soil erosion and sedimentation [8].

Jalalian, [7], in assessment of the amount of sediment yield based on PSIAC model in the Northern watershed of Karun concluded that the model has good correlation with the sediment amount obtained from the sedimeter stations. Bagherzadeh-Karimi, [4], in a study on Uzundareh's sub catchment of QezelUzan watershed found a good agreement with PSIAC model and also recommended EPM model as a suitable one for other homogenous regions. Sadeghi [9] in a study on Uzundareh's sub catchment for determining erosion and sediment production rate by use of EPM, PSIAC, Douglas Fournier and Krikby methods, also concluded that PSIAC model is superior to other models and that EPM model has accuracy and reliability in estimating erosion and sediment yield.

Asadi [3] in the evaluation of the application of the PSIAC model in combination with qualitative method of geomorphology concluded that in regions with limited sediment statistics, aerial photography and field studies based on geomorphologic methods, and changing the coefficients of the model according to the conditions of the region can be used.

Ahmadi [2] in a study on EPM and PSIAC models implementation, found that watershed should be studied in categories as unit, type, faces and working units and models factors should be evaluated in hydrological sub basins; also erosion and erosion coefficient in sub basins and watershed in

A. Niknam, master student of watershed management in Hormozgan University, Bandar Abbas, Hormozgan, Iran (e-mail:).

H. Mohsenizadeh, master student of watershed management in Hormozgan University, Bandar Abbas, Hormozgan, Iran (corresponding author to provide e-mail: hosein5rh@yahoo.com).

E. Fahim, master student of watershed management in Hormozgan University, Bandar Abbas, Hormozgan, Iran (e-mail:).

H. Vagharfard, Faculty of Agriculture and Natural Resource in Hormozgan University, Bandar Abbas, Hormozgan, Iran (e-mail:).

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 863-866

total should be calculated to obtain results with validity and reliability compatible with experimental models.

II. METHODS AND MATERIALS

Mashangi catchment basin is a part of Esteghlal dam's watershed of Minab in Rudan –County, Iran. This basin with an area of 13487 hectare is located between 27° 40' 44" latitude to 27° 51' 54" N and 56° 42' 00" longitude to 57° 02' 30" E. This area borders with Mashangi mountains in the North, Qal'e Dar and Dokhtaran Daraeh villages in the East and ZiaratAli village in the West and SarKahnan village in the South. The main watercourse of the basin rises from the Mashangi Mountains and flows for 27.11 km , excludes from the basin in the North and upstream of Mashangi village, with its tributaries (Ziarat and Rezuieh Rivers), reaches into Rudan river and finally flows into Esteghlal dam's reservoir.

The highest elevation of the basin is 71.1218 m and the lowest is 43/560 meters from the sea level. Basin area is 65.71 km. Average height of basin is 783.65 ; the average slope is 35% and more than 60% of the land area have a slope of 30-60% and less than 1% of the land area has a slope of less than 8 percent ;these lands scattered in the margins of the main river, which is in the risk of flooding. Based on the climatic classification of De Martin, Mashangi region is considered acrid with annual temperature of 23°c and Average annual rainfall of 206 mm. The dominant species of the watershed includes Cymbopogon olivieri, Convolvulus argroacanthaand Artemisia (Artemisia sp).

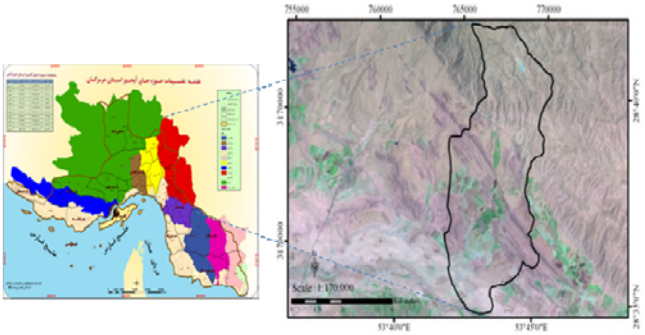


Fig. 1 satellite imagery of the study watershed among the other catchment basins of Hormozgan province

PSIAC model introduced by water management Committee of Southwestern Atlantic ocean region in 1968 to estimate the sediment of the Southwest America, which has arid to semi-arid climate [12]. This model in terms of the nine effective factors of surface erosion and sedimentation, soil, climate, runoff, vegetation coverage, slope, land use, the current state of erosion and river erosion, and sediment transportation and river has been taking into consideration more than other models in Iran. To use of MPSIAC model, It is necessary to divide the watershed according to the intended purpose to hydrological units (sub catchment basin) or land units or components of homogeneous geomorphological working units. After the division of the watershed to the aforementioned units, the scores in each of the nine factors is calculated in working units. The sum of these scores, specifies sediment and intensity of erosion in each unit. Determining the degree of sediment and intensity of erosion in MPSIAC model, the following equation is used to obtain the sediment yield [1, 10].

$$Q_s = 18.6e^{0.0353R} \qquad (1)$$

Where;
Q_a: The amount of the annual sediment production (M^3/km^2),
R: the sediment rate equals the sum of the nine factors.

III. EROSION AND SEDIMENT CALCULATION

After evaluation of the nine factors of MPSIAC method, sediment-yielding rate is calculated in each sub catchment. In this stage, qualitative amount should be converted into quantitative amounts. This process is conducted by the following formula:

$$Q_s = 38.77e0.035R \qquad (2)$$

Where;

Qs is the amount of annual sediment yield (m^3/km^2.year); e is Napier' constant 2.7828; and R is the rate of sediment yield (algebraic sum of nine factors) sediment volume in each sub basin.

IV. EPM MODEL

The EPM model was originally developed for Yugoslavia by Gavrilovic [11]. The method has been tested in some catchment areas, and it is found that output results are compatible with field observation in relatively small-scale lands.

This model is factor-based, which means that a series of factors are combined to yield an overall estimation of soil loss. These factors include topographical, lithological, soils status, the method of land applications and climate conditions. The following Eq. is used to estimate erosion severity:

$$Z = X_a Y (\varphi + I^{0.5}) \qquad (3)$$

Where;
Z is the coefficient of the severity of erosion; X_a is land use coefficient; Y is the coefficient of soil and stone sensitivity to erosion; φ is the erosion in watershed; and I is the average slope of the watershed.

All the factors mentioned are studied based on watershed division in homogeneous working units.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 863-866

V. COMPARING THE RESULTS OF ESTIMATION EROSION AND SEDIMENT YIELD OF BASIN BY USE OF QUANTITATIVE METHODS

In the present study, the two qualitative methods of MPSIAC and EPM are used for determination of erosion and sedimentation of Mashangi watershed. The results of the two methods in different sub catchments vary; the results have shown in the following tables. The obtained values presented in the tables indicate that the particular sediment values in the EPM method and total sediment and specific sediment amount is much more in compare to the equivalent amount estimated by MPSIAC method. Since the later model considers a variety of factors insediment yield estimation, it is more comprehensive than the first model. Thus, the results are more efficient and rational.

Table 1 the comparison of erosion and sediment yield in basin catchment by use of EPM and MPSIAC models (a)

Hydrological Units	EPM Methods	
	Specific sedimentTon/ha/y	Total sediment Ton/y
1	12.5	3117.8
2	11.9	24367.8
3	20.8	21836
4	12.2	4471
5	9.9	633
6	7.4	464
7	5.1	1653
8	9.6	1235
9	20.2	13290
10	11.7	7895
11	18.3	35822
12	11.9	6206
13	4.5	1189
14	20.5	1828
15	18	955
16	10.9	2971
17	11.1	1107
18	11.4	1316
19	18.9	3129
20	18.3	13610
total	9.9	133532

Table 1 the comparison of erosion and sediment yield in basin catchment by use of EPM and MPSIAC models (b)

Hydrological Units	MPSIAC Methods	
	Specific sedimentTon/ha/y	Total sediment Ton/y
1	2.16	538.11
2	2.23	4529.40
3	3.58	3743.41
4	3.93	1433.84
5	1.85	118.26
6	2.30	142.87
7	1.75	566.44
8	2.03	259.77
9	2.69	1764.13
10	2.92	1966.37
11	4.02	7849.16
12	4.21	2182.28
13	2.91	765.08
14	5.06	450.59
15	5.20	275.62
16	2.44	663.57
17	2.28	225.70
18	2.53	290.53
19	2.40	395.77

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 863-866

20	2.07	1533.59
total	2.94	39717.01

REFERENCES

[1] H. Ahmadi, "A*pplied geomorphology*," Tehran University Publications, 1994.
[2] H. Ahmadi, "A*pplied geomorphology*," Tehran University Publications, vol. 1, third ed., 1998, p. 688.
[3] S. M. Asadi, "*An evaluation of PSIAC method application in erosion and sediment estimation in sub catchments of Zayanderood watershed-Esfahan based on geomorphological methods*," M.S thesis in Watershed studies, faculty of natural resources, Tehran University, 1995, p.136..
[4] M. Bagherzadeh-Karimi,, "*An evaluation of erosion and sediment estimation models and remote sensing and GIS efficacy in soil erosion studies*," M.S thesis, department of environmental resources, Tarbiat Modares University, 1992.
[5] A. Sourinejad, "*Exhaustive design of Hormozgan province development*," Hormozgan Governor General, the collection reports of physiography, meteorology, hydrology, vegetate coverage, geology and geomorphology of Mashanagi watershed, 1999.
[6] Sh. Hakimkhami, "*A review on studies and thesis conducted on experimental PSIAC model in Iran and faults on then for preparation of a guideline*," Doctoral seminar, Tehran University, 2002.
[7] A. Jalalian, "Qualitative and quantitative studies in soil erosion in Northern watershed of Karun river," *the third congress of Iran's soil sciences, Agriculture department*, Tehran University, Agriculture ministry research institute of water and soil studies, 1992.
[8] H. Gh. Refahi, "Water erosion and its management," *Tehran University Publications*, 1996.
[9] H. R. Sadeghi, "The comparison of several estimations of erosion and sediment in UzunDareh watershed the comparison of several estimations of erosion and sediment in UzunDareh watershed," *The collection papers of national seminar in policies and optimum using methods of land*, 1993.
[10] K. B. Clark, "*An estimate of sediment yield for two small watershed in a Geograghic Information System*," M.S. Thesis, Geography University of New Mexico, 1999.
[11] Z. Gavrilovic, "The use of an empirical method (erosion potential method) for calculating sediment production and transportation in unstudied or torrential streams," *International Conference of River Regime*, Wallingford, England, May 1988, pp. 411-422.
[12] R. F. Hadley, and D. E. Walling, "Measuring and predicting soil erosion and sediment yields some methods of measurement and modeling," *GeoBooks*, Norwich, UK.1984, pp. 1-14.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 867-870

Structural role of regional flood analysis in vegetate coverage protection: a solution for sustainable development of environmental resources (case study of Jaqtoo River watershed)

Abuzar Niknam, Emad Fahim, Hossein Mohsenizadeh, and Hasan Vagharfard

***Abstract*—**The discharge of design and its assigning according to the instantaneous peak discharge of the given region is a vital parameter. In order to analyze floods, at first the limitations of time series data of peak discharge in two hydrometric stations located in Jaqtoo watershed, W-Azerbaijan, Iran adjusted. Then, by use of Haifa Software, the most proper probability distribution of the region (log-Pearson type iii), peak discharges with different return periods estimated. The results of structures evaluation indicate that assigning the design discharge according to flood analysis results in a better protection of vegetate coverage of the region.

***Keywords*—** flood analysis, Jaqtoo watershed, natural resources development, vegetate coverage, watershed structure.

I. Introduction

THE term "sustainable development'' coined by Brant Land in 1987.this term broadly encompasses the concept of management and optimum using of natural, financial and human resources to gain a proper pattern of consumption in combination with technological and structural facilities to meet the present and future generations needs in a satisfactory way. In fact, sustainable development is a balanced trend between environment and development, which includes four aspects: sustainability in natural resources, political, economic and social sustainability of which the natural resource has the greatest importance. Mother Nature provides a plenty of endowments on which the survival of human being and other animals depend. In our country, natural resources, basically refers to renewable resources. Iran, with regard to its strategic stand, is in a specific period of time and development stage that calls for a precious addressing of food security as a part of sustainable development. The realization of this objective mainly depends on natural resources protection and optimum suing of them.

Obviously, water, soil, forest, and pasture resources and optimum using of them is a precondition for sustainable development and agriculture safety. Flood as a destructive phenomenon, results in a lot of life losses, financial costs and soil and vegetate destruction annually around the world. Therefore, knowing the details of this destructive phenomenon and the ability to predict it intensity will be of a great help in its management. Estimation of flood in sub basins in which there is a lack of statistics, is done by regional flood analysis, rational methods and experimental equations based on area such as Creager, Fuller methods, curve number (CN) approach and Push over analysis by use of these methods, the instantaneous peak discharge with variety of return periods is estimated. One solution to estimate flood with given return period, is regional analysis. This method is primarily based on the mean discharge of basin flood, which is calculated by use of different methods as the equation of basin area or relations between discharge and rainfall-runoff and physical feature of the basin.

Several studies conducted on regional flood analysis, based on a specific model designed for eastern rivers of Lake Uremia watershed, in which flood discharge is a function of basin area and mean slope of the watercourse [6]. Arabi [4] investigated synoptic pattern of high intensity seasonal rainfalls of Iran in regional flood analysis. Parandeh Khuzani [2] studied synoptic flooding systems in Dalaki watershed based on basin area. Alizadeh [3] by use of frequency distribution assessed the frequency of incidence and average amount of flooding in a given period of time. In the present

A. Niknam, master student of watershed management in Hormozgan University, Bandar Abbas, Hormozgan, Iran (corresponding author to provide e-mail: abuzarniknam@yahoo.com).

E. Fahim, master student of watershed management in Hormozgan University, Bandar Abbas, Hormozgan, Iran (e-mail:).

H. Mohsenizadeh, master student of watershed management in Hormozgan University, Bandar Abbas, Hormozgan, Iran (e-mail:).

H. Vagharfard, Faculty of Agriculture and Natural Resource in Hormozgan University, Bandar Abbas, Hormozgan, Iran (e-mail:).

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 867-870

study area, there is no inclusive study; therefore, to calculate instantaneous peak discharge, the authors introduced a relation between discharge and basin area.

II. MATERIALS AND METHODS

In this study, the statistics of instantaneous peak discharge of adjacent basins with homogeneous geological conditions, vegetate coverage and topology with almost similar area in the same period of time selected. Following statistical adjustment, data fitted with proper probability distributions and the numbers of different return periods obtained. Then, the discharges made dimensionless by dividing flood discharges of each return period in mean flood discharges. ranking dimensionless discharges in each station, the median of each return period in stations selected and plotted on the dominant distribution of probability paper (in the present study, the dominant distribution is log-Pearson type iii).then, mean discharge of flood transmitted on coordinate system with regard to basin area and mean flood discharge estimated. The peak discharge of the watershed calculated by multiplying mean discharge in dimensionless discharge for a given return period.

III. STUDY AREA

Jaqtoo River is one the Iran's main rivers, rising from Chehel Cheshme Mountains, Qare Elias and Shakhe Rash in Sarshiv county of Saqqez-Iran, parallel with Zarrinehrood, menders slowly towards the North in Lake Uremia. The region of interest includes two hydrometery stations of Qeshlaq and Anian Bridge (for the summary of names and characteristics of the stations, see table 1).

In the present study, the statistics of instantaneous peak discharges collated in a 15-years period based on the latest published statistics.

Table 1 the used hydrometery stations and their areas

Station Code	Station Name	River Name	Area (km^2)
31-037	Anian Bridge	Jaqtoo River	1221
33-003	Qeshlaq Bridge	Jaqtoo River	1300

In this study, data collected based on a 15-years period; the upper basin of each station and its area calculated by use of GIS software.

Regional flood analysis aims to evaluate the intensity of flows by use of former floods statistics and available information. With regard to the prominent effect of flood volume in different return periods on the design and hydrological properties of water structures, the analysis of regional flood is considered very important.

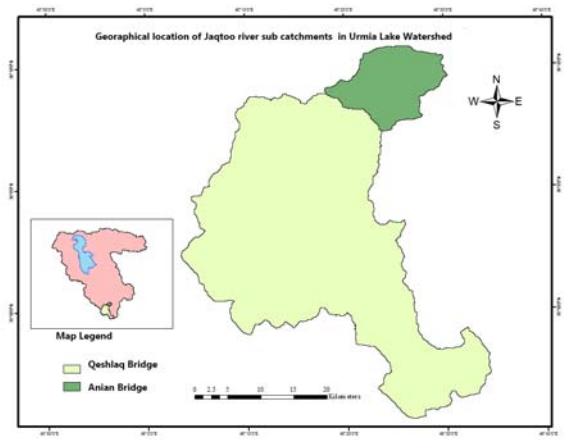


Fig. 1 the geographical location map of Jaqtoo River Watershed

IV. SELECTING RELEVANT DATA

Regarding variability of station in different regions, the proper probability distribution should be selected. To do so, mean of relative error (MRE) investigated in Haifa software outputs. Then, ranking method applied and the output with the least error get the highest score. As a result of the process, the probability distribution with highest score selected as the proper distribution of the stations. Moment and Maximum Likelihood methods used to estimate distribution parameters. It is possible to consider two dominant distributions due to the fact that Haifa software is not compatible with some stations.

Log-Pearson type iii is the most recommended distribution of instantaneous peak discharges. The domain distribution of the study area for estimation of instantaneous peak discharge is log-Pearson type iii. Next, the discharges made dimensionless and this stage added as a column including dimensionless discharge of each station and a median column at the end. A median selected of each return period.

V. INTRODUCING THE RELATIONSHIP BETWEEN BASIN AREA AND SECOND OUTPUT DISCHARGE

In this stage, the relation between area and Q2 of each station created in order to obtain the region Q2. The regression relationship of area and station discharge is as follows.

$$Y = 0.0266x + 39.168 \quad (1)$$

Substituting the equivalent area amount (27.15km^2), the Q2 is calculated as:

$$Q2 = 39.82 \quad (2)$$

Log-Pearson probability paper plotted based on the following table information:

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 867-870

Table 2 the information of probability paper

T	P=1/t	X	y
		q%	QT/Q2
2	0.5	50	1
5	0.2	80	1.86166
10	0.1	90	2.43214
20	0.05	95	2.97936
25	0.04	96	3.15297
50	0.02	98	3.68769
100	0.01	99	4.21851
200	0.005	99.5	4.74735
500	0.002	99.8	5.4451

Fig. 2 shows the log-Pearson type iii probability paper.

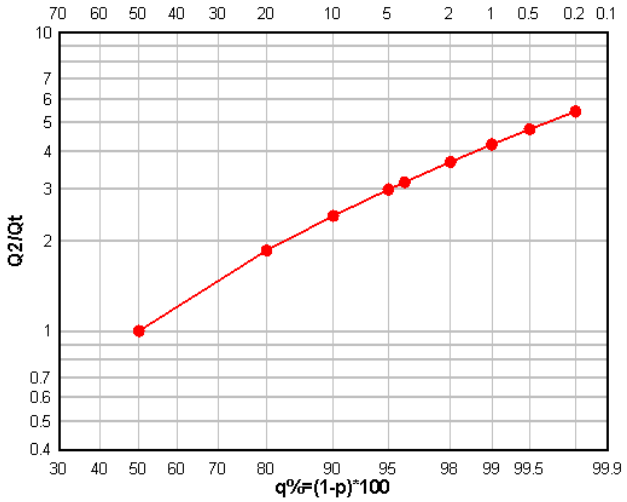


Fig. 2 the diagram of log-Pearson type iii distribution paper

Finally, by use of probability paper and the table, instantaneous peak discharges were read. The second table shows the instantaneous peak discharges with variety of return periods. Based on these findings, appropriate actions can be considered.

Table 3 instantaneous peak discharges with variety of return period

T	P	q%	QT/Q2	QT
2	0.5	50	1	39.89
5	0.2	89	1.861663	74.262
10	0.1	90	2.432142	97.019
20	0.05	95	2.979362	118.85
25	0.04	96	3.152969	125.77
50	0.02	98	3.687691	147.1
100	0.01	99	4.21851	168.28
200	0.005	99.5	4.747348	189.37
500	0.002	99.8	5.445098	217.21

VI. DISCUSSION AND CONCLUSION

due to the information limitations in the study area, authors of the present study by using of available information of homogenous adjacent basins and data analysis , calculated the instantaneous peak discharge (Table 1 and 2) with different return periods. The analysis was intended to gain hydrological models of instantaneous peak discharges of the flood; thus, based on these analysis and estimated flood severity precautions and precious considerations should be taken into account in watershed structures design and conservation plans. the results indicate that well-designed structures help in vegetate coverage protection and its worth to note that underestimation of design discharge in the basin of interest may results in major problems in dam structure and even the structure failure and destruction in severe cases. since the region of the study is categorized as pluvial area with a considerable annual rainfall and discharge in watercourse in one hand, and the high quality pasture and rich vegetate coverage of the area as the main source of cattle feeding on the other, it calls for a more accurate and precious design of structure to protect these environmental resources.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 867-870

REFERENCES

[1] H. Shaban-Ali Fami, "*approaches and incorporative methods of agriculture and rural development*," Tehran: The Institute of Iran's Rural Development Publications, 2004.
[2] A. Paraned-Khuzani, "*Synoptic study of flooding systems in Dalaki river watershed*," M.S Thesis, Tarbiat Modares University, 2008.
[3] A. Alizadeh, "*the applied principles of hydrology*," Imam Reza University Publications, 1995.
[4] Z. Arabi, "*analysis and presenting synoptic patterns of sever seasonal rainfalls during summer in Iran*," PhD. Thesis, Tarbiat Modares University, 1999.
[5] A. Ebrahimi, "the function of vegetate coverage in water source infiltration and flood and drought crisis management," *The First Regional Congress of Optimum Using of Water Resources of Karun and Zayandehrud Watershed*, Shahr-e-Kord University, 2006.
[6] A. A. Movahed-Danesh, "regional foold modelling of Eastern Lake Urmia. the collection of articles in the first national meeting of hydrology," *the collection of articles in the first national meeting of hydrology*, Mahab-e Qods consulting engineering institute, 1989.
[7] J. M. Chunderlik, and T. B. M. J. Ouard, "Regional flood-rainfall duration frequency modeling at small ungaged sites," *J. Hydrology*, 2007.
[8] V. R. Baker, "Stream channel response to floods with examples from central Texas," *Geology of Society*, 1977.

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 871-874

Evaluating the most suitable statistical distribution in estimation of maximum instantaneous and annual average water-flows (Case study: Kur River-Chamriz Station)

AbuzarNiknam, Ahmad Nohegar, EmadFahim, Mohammad Khajeh

***Abstract*—**The operation of any water project depends on forecasting the hydrologic events in future. In hydrology, using physical models in order to forecasting the coming events, is not possible, and it has been welcomed less, and mostly the single models that explain the system by mathematical concepts, are used. One of the common methods for estimating the water-flows with different return periods is statistical distribution. In this research, in order to obtain most suitable statistical distribution for estimating water-flows series with different return periods, instantaneous and average annual water-flows from Kur River-Chamriz Station- Fars Province, were gathered during a 30-year statistical period. After homogenous and statistical adequacy tests by graphical test of SMADA Software and calculating the residual sum squares (R.S.S), they were evaluated and compared. Based on the concluded results from experimental and observational curves for instantaneous maximum water-flow, Gamble distribution with R.S.S of 71.15 and for annual average water-flows, Log-Pearson Type III distribution and after that Gamble distribution with R.S.S of 1.77 and 2.01 show most fitness and conformity respectively.

***Keywords*—**Chamriz, Statistical Distribution, Gamble, Log-Pearson Type III Distribution, SMADA.

I. INTRODUCTION

In hydrology, we cannot determine the occurrence time of a phenomenon such as a floodwater or given water-flow, but we can investigate the previous incidents and obtain their average probability. Calculating the average probability and or average return periods of water-flows and or dehydrations can help to solve many problems. For example, in flood controlling projects, it calculates the annual average damage of floodwater and also design of structures dimensions such as dams overflows, the height of flood walls and bridges height is accomplished with respect to the probability of floodwaters occurrence and their related water-flows [4]. The recorded information and data in the past will help us to obtain some statistical parameters and then by using them we can forecast the possible events, which may take place in the future. In hydrology, using physical models in order to forecasting future events is not possible and has been welcomed less, and mostly the single models that explain the system by mathematical concepts and terms, are used. One of the common methods for estimating the water-flows with different return periods is statistical distribution [2]. Frequency analysis of rainfall and floodwaters amount, the magnitude of these phenomena and also their frequency gives appropriate information for different analysis such as determining the risk standards and reliability in structures designing. This analysis makes it possible to estimate the total frequency of the events that are higher than their observations quantity during the data-recording period. This estimation can be expressed by the concept of event return period [6]. Theoretically, there are various probabilistic functions, which have been calculated and registered empirically. A function that has more conformity with desired data, is selected as the probability distribution function [3]. In a research, among the various studied frequency distributions for a studied region, in order to forecasting the floodwater maximum values, the suitable statistical distributions for a set of 10 to 35 years data and for a set of long period data, more than 35 years, are three parametric Lognormal distribution and Log-Pearson type III distribution, respectively [1]. Based on a study in 91 regions of Australia, the authors found the distributions of General Limit Values, Paretto and Log-Pearson type III, and Bivariate-Lognormal suitable [7]. Most conducted researches are about floodwater flow and the literatures about average and minimum flows are not comparable with floodwater series [5]. In order to designing the water balance of a region, the average water-flows are used, while calculating the water balance using maximum water-flows, indicates the water volume of the region more. In this research, for obtaining the statistical distributions in order to estimating the water-flows

A. Niknam, master student of watershed management inHormozgan University (corresponding author to provide e-mail: abuzarniknam@yahoo.com).

A. Nohegar, master of watershed management board, Hormozgan University (e-mail:)

E. Fahim, master student of watershed management inHormozgan University (e-mail:).

M. Khajeh, master student of dedesertification inHormozgan University (e-mail:)..

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 871-874

series with different return periods, maximum instantaneous and annual average water-flows have been gathered from Kur River, Chamriz Station, Fars Province, during a 30-year statistical period. After homogenous and statistical adequacy tests by graphical test of SMADA Software and calculating the residual sum of squares, they were compared and evaluated.

II. MATERIALS AND METHODS

KurRiver is one of water-filled rivers of Fars province that stems from northwest of the province and from highland of Zagros chain-mountains, consists of Mt Koh-e-Syiah in north, Mt koh-e-Palangi in east, and Koh-e-Ranj in west, and flows toward southeast. This river extends in general direction of Fars province northwest expends toward southeast between the highland of Zagros chain-mountain from Ojan river, and after joining to branches like Khosro-Shirin, Shur-Shirin, Margan and Chubkhaleh, Dezkur, Tang-e-Shul, Tang-e-Bostanak rivers, flows into the Drudzan dam at the Hosein-Abad. Statistical evaluation of crossing flows of Kur River at Chamriz station indicates that although in the number of months (especially in recent years) the flow severely decreases, but never reaches zero, and therefore, Kur River is a permanent river. The Chamriz station is located on 00-54-06 longitude and 00-30-28 latitude and at altitude of 1840 meters above sea level. In terms of equipments; Scale, Limnograph, and cable-waybridge equipped it. Statistics of this station is estimated at a good level. Fig. 1 shows the situation of this region.

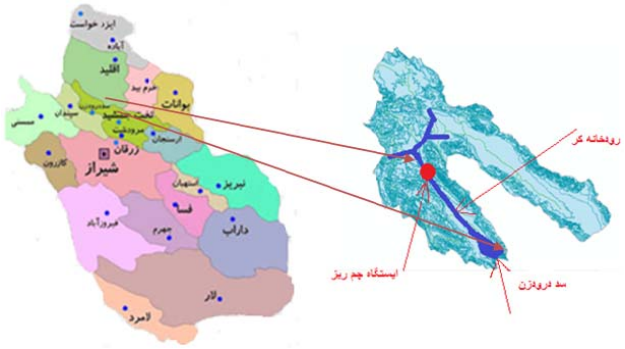


Fig. 1 situation of studied area (Scale: 1:25000)

III. RESEARCH METHOD

In this research, data of maximum instantaneous and annual average water-flows were gathered during a statistical period from 1360-61 to 1391-92, and because used data must have three conditions; adequacy, accuracy and relevance, the data of above-mentioned station has been controlled [4]. For this purpose, due to the presence of possible defects in statistics of used station water-flows, first, the existent defects in maximum instantaneous and annual average water-flows were controlled, rebuilt and prolonged, then finally the homogeneity of data were examined by Run Test method, and the statistics were verified in confidence level of 95%. For achieving to maximum instantaneous and annual average water-flows variations with different return periods, theory probability functions were used. This makes it possible to estimate the water potential of the river at different return periods. In this method, the statistics of maximum instantaneous and annual average water-flows during statistical periods were estimated by SMADA software. Moreover, by comparing the observed (actual) and estimated (forecasted) data, the most suitable statistical distribution was determined. For determining the most suitable statistical distribution, the distribution is found appropriate which has best fitness with forecasted values by the distribution. One of the methods for selecting best distribution and values fitness is calculation of residual sum squares (R.S.S) for each one of the distributions.

$$R.S.S. = \left[\Sigma \left(Q_e - Q_o \right)^2 / (n-m) \right]^{1/2} \quad (1)$$

Where; Q_e is estimated value for each data, Q_o is observed value for each data, n is number of data, and m is the number of used distribution parameters that was equal to 2 for Normal, Lognormal, and Gamble distributions, and 3 for Pearson, Log-Pearson, and three-parametricLognormal distributions. A distribution is suitable that has minimum value of R.S.S and that distribution is selected for determining the data with given return periods [4].

IV. RESULTS

Tables I and II show the estimated values of maximum instantaneous and annual average water-flows for different return periods using different distributions. In addition, the graphical situation of each distribution and fitness of actual and forecasted values for instantaneous maximum and annual average water-flows has been presented in Fig. 1 and Fig. 2 using statistical distributions. Eventually, the values of residual sum squares for different distributions have been presented in table III.

A. Evaluation of statistical distributions for instantaneous maximum water-flow

As observed in Fig. 2, two-parametric Normal and Lognormal distributions show minimum degree of fitness and conformity between actual and forecasted values. In Normal distribution, the negative values have been anticipated, which practically are not logical, and there is no negative values for water-flow in nature. In addition, the above-mentioned distributions have maximum values of R.S.S.; therefore, they are not suitable. Normal, two- and three-parametric Lognormal distributions, outwardly, show relatively suitable fitness and conformity in experimental and estimated curve, but estimated data curve shows negative values that practically

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 871-874

it's not logical. In Log-Pearson distribution, the forecasted values have a good fitness and conformity with observed data, but in high return periods have not suitable fitness with observational curve and because a water-flow with high return period is of boundary data, a distribution that has suitable fitness is used. In Gamble distribution, the forecasted values have a good fitness and conformity with observational data and it has minimum value of R.S.S equal to 71.15 in comparison with other distributions. Therefore, it is the most suitable distribution for estimating the instantaneous maximum water-flows.

Table I values of instantaneous maximum water-flow with different return periods (m^3/s)

Probability distribution	Return period			
	Q_2	Q_3	Q_5	Q_{10}
Normal	464.08	605.22	739.51	833.63
Lognormal-2	379.23	498.78	647.33	856.30
Lognormal-3	438.52	581.87	727.64	894.96
Pearson	427.21	571.67	722.47	899.46
Log-Pearson	369.28	531.18	732	1005.94
Gamble	419.18	561.35	719.01	917.53
Probability distribution	Return period			
	Q_{25}	Q_{50}	Q_{100}	Q_{200}
Normal	1037.26	1136.48	1225.71	1307.36
Lognormal-2	1153.87	1398.97	1663.56	1949.31
Lognormal-3	1086.64	1218.20	1342.03	1460.11
Pearson	1106.23	1250.09	1386.63	1517.65
Log-Pearson	1371.74	1650.80	1930.94	2211.27
Gamble	1168.35	1354.43	1539.13	1723.16

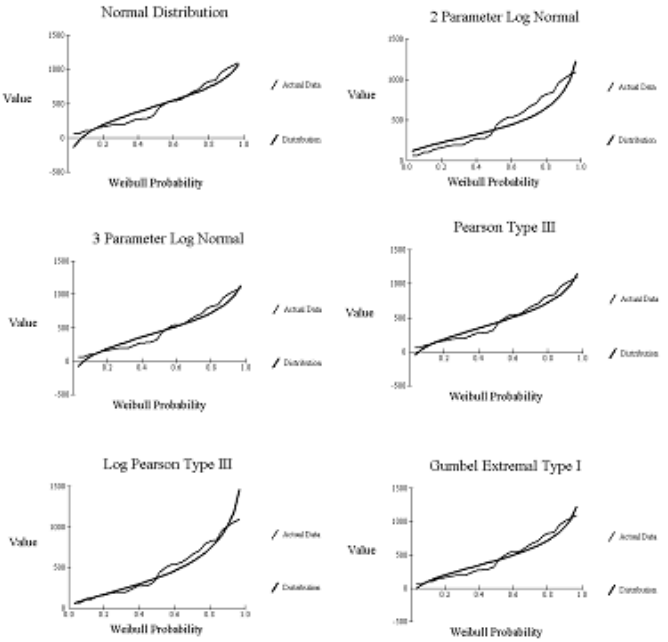


Fig.2fitness and conformity of actual and forecasted values of instantaneous maximum water-flow using SMADA software

B. Evaluation of statistical distribution for annual average water-flow

As it can be seen in Fig. 3, Normal and Gamble distributions, outwardly, show minimum degree of fitness and conformity between actual and forecasted values. In these distributions, the negative values have been estimated that because there are no negative values for water-flow in nature, it is not practically logical. It happens because, firstly, these distributions are two-parametric and the factors of skewness coefficient are not used in calculation of the variation coefficient, and secondly, the data are fitted directly and without taking the logarithm. In three-parametric Lognormal distribution, the experimental and theory curves have suitable conformity, but in this distribution, the negative values also forecasted that practically it is not logical. Fitting the actual and forecasted values of annual average water-flow, using Log-Pearson, Gamble, and Pearson distributions exhibits suitable conformity. Nevertheless, experimental and observational curve in Log-Pearson distribution have maximum overlapping and also, have minimum value of R.S.S equal to 1.77 in comparison with other statistical distributions. Therefore, it is the best distribution for achieving the estimation of annual average water-flow with different return periods.

Table II values of annual average water-flow with different return periods (m^3/s)

Probability distribution	Return period			
	Q_2	Q_3	Q_5	Q_{10}
Normal	25.99	31.64	37.01	42.78
Lognormal-2	23.21	28.50	34.64	42.71
Lognormal-3	24.87	30.61	36.47	43.25
Pearson	24.37	30.15	36.24	43.44
Log-Pearson	23.70	29.97	36.93	45.53
Gamble	24.20	29.88	36.19	44.13
Probability distribution	Return period			
	Q_{25}	Q_{50}	Q_{100}	Q_{200}
Normal	48.92	52.89	56.46	59.73
Lognormal-2	53.39	61.67	70.20	79.05
Lognormal-3	51.07	56.47	61.57	66.46
Pearson	51.92	57.86	63.52	68.97
Log-Pearson	55.99	63.44	70.58	77.47
Gamble	54.17	61.61	69	76.37

ISSN (Online): 2305-0225
Issue 13(4), [Part III], August 2014, pp. 871-874

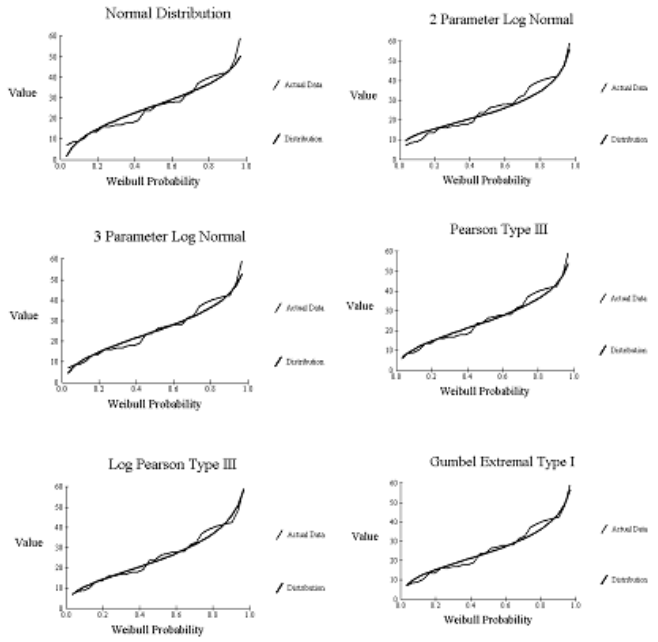


Figure 3 fitness and conformity of actual and forecasted values of annual average water-flow using SMADA software

Table III values of residual sum squares (R.S.S)

Probability distribution	R.S.S	
	Instantaneous maximum water-flow	Annual average water-flow
Normal	88.30	2.83
Lognormal-2	104.53	2.75
Lognormal-3	75.81	2.23
Pearson	71.64	2.09
Log-Pearson	98.41	1.77
Gamble	71.15	2.01

V. CONCLUSION

Estimating the average occurrence probability and or average return period of floodwaters, and or dehydrations can help solving many problems. For example, in flood controlling projects, and also in designing the structure dimensions such as; dams overflows, heights of flood walls, and heights of bridges, with respect to floodwaters occurrence probability and related water-flows. The annual average water-flows are used for designing the water balance plan of a region, while calculating the water balance using maximum water-flows indicates the water volume of the region more. Based on the concluded results from statistical distributions in estimation of instantaneous maximum water-flow with different return periods, the forecasted values have a good fitness and conformity with observational data in Gamble distribution, and also this distribution has minimum value of R.S.S equal to 71.15 in comparison with other distributions. Therefore, it is the most suitable distribution in order to estimating the instantaneous maximum water-flows. In this manner, for estimating the annual average water-flows with different return periods, Lognormal type III distribution and after that, Gamble distribution by the value of R.S.S equal to 1.77 and 2.01 indicate highest fitness and conformity, respectively.

REFERENCES

[1] H. Badvestani, "*Considering the most suitable frequency distribution for forecasting maximum floodwater and rainfall with specific occurrence probabilities in East-Azerbaijan Province*," Final Thesis of Master Degree, TarbiatModares University, 2008.

[2] A. Alizadeh, "*Principles of practical hydrology*," 25th ed., Mashhad: Emam Reza University, 2010, pp. 651-717.

[3] A. Abdi-Kardani, and A. Fakherifar, "Analysis of frequency distribution of river maximum water-flows using linear momentums," *National Congress of Civil Engineering*, Tehran University, 2008.

[4] M. Mahdavi, "*Practical Hydrology*," 6th ed., Vol. 2, Tehran: Institute of Tehran University Press, 2009, pp. 21-119.

[5] M. Mahdavi, A. Salajegheh, A. R. Keshtkar, H. Fahmi, and F. Sharifi, "Considering and fitting of suitable probabilistic distributions for annual flow series using L momentum methods in dry and semi-dry regions," *Iranian Journal of Natural Resources*,Spring 2006, no. 59, pp.75-87.

[6] M. A. Hadiyan-Amri, M. Habibnejad-Rushan, and E. Omidvar, "Evaluation of different statistical distributions in estimation of maximum water-flow of floodwater with different return periods in Tajan watershed basin," *Sixth Iranian National Coanference of Watershed Management Sciences and Engineering*, April 2010.

[7] R. M. Vogel, and N. M. Fennessey, "L-moment diagrams should product moment diagrams," *Water Resources Research*, vol. 29 no. 6, pp. 1745-1752, June 1993.