

Transportation Module Determination for the Urban Landscapes with Linear Programming Pattern in the Urmia, North-West Iran

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Abstract

Urban landscapes are the crucial key factors in natural human life stability in modern urban civilization. However, despite of the importance of urban landscape, common suitable urban landscape per capita in cities of Iran is between 7 to 12 square meters and the average urban landscape per capita in Urmia metropolis is 6.9 square meters, which indicates a serious gap for 20 to 25 square meters as global standards. On the other hand, the urban landscape growth for achieving global standards causes an increase in vegetation which by itself results in greater demand for water resources. Consideration of arid and semi-arid climate of Iran and limitation in water resources makes urgent need for planning and water allocation. The main purpose of the this study is putting forward a linear programming pattern in the form of transportation model in-order to allocate water optimally from the existing and future water resources (i.e. surface water, ground water and drinking water) to Urmia urban landscape pieces, considering minimization of the cost of supplying water. To achieve the above mentioned model, North-West Corner method, Least Cost method and Vogel Approximation method have been applied and the obtained results have been compared. According to the obtained results, in summary, it can be claimed that Vogel Approximation method, has the higher capacity for optimal allocation of water resources in Urmia urban landscape than that of Least Cost method as well as North-West Corner methods. With regard to the present availability of water resources for every seven months of irrigation, the amount of optimal allocation of water from drinking water is 5400 cubic meters per day for boulevards, 1400 cubic meters per day for nurseries and 1200 cubic meters per day for other landscapes. The allocated optimal amount of water from surface water resources is 6500 cubic meters per day for forest parks. The allocated amount of ground water resources is 5000 cubic meters per day for parks in urban areas and 1600 cubic meters per day for boulevards and 900 cubic meters per day for forest parks. During the hottest month of each year (June 22nd to July 14th), with respect to irrigation, given the above variables in optimal allocation of water resources for urban landscape in the city of Urmia in comparison with that of seven month irrigation, are the same. However from quantity point of view, drinking water and ground water quantity, in some landscapes are less. Also, concerning the optimal allocation of water from future water resources (increment water supply), given variables such as mentioned above are present in the existing conditions. However, the quantity of groundwater usage for some landscapes is more. Finally, through the aforesaid allocation, only a portion of water demand for the pieces of Urmia landscapes has been partially met and the existing water resources would not be sufficient to bridge the gap.

Keywords: Optimal allocation of water; Landscape; Urmia city; Water resources; Transportation model; Linear programming

Introduction

Urmia has many parks and touristic coastal villages in the shore of Urmia Lake. The oldest park in Urmia, called Park-e Saat, was established in the first Pahlavi's era. Urmia's largest park is Ellar Bagi Park (Azerbaijani "People's Garden") along the Shahar Chayi, or the "City River". In most private landscapes in Urmia, water used for irrigation is potable water. As a consequence, poor landscape irrigation performance results in high economic and environmental costs. In addition, the Urmia water act gives the highest priority to urban uses in the case of drought. As a consequence the characterization of landscape water use is a valuable tool to rationalize water consumption in urban environments and in whole river basins. Landscape irrigation can become a key local water use in the presence of water shortages [1,2].

Water is a unique material in nature. It is capable of almost complete return of light waves from its surface. In addition to the water surface being seen, images of surrounding objects may also be reflected. When the surface is calm, extremely clear images of mountains, rocks, trees, wildlife, and at times, the observer him/herself are displayed. If the surface is ruffled by a breeze or by the flow of the water, the reflections lose their sharpness and detail, producing an impressionist's image of the surrounding world. Water requirements for landscapes are calculated taking into account different factors, the two most important being the local climate and the type of species present in the landscape. Other factors include the coexistence of two or more species

in the same area (i.e., turf, trees or shrubs) and factors modifying the climate, such wind exposure. Research work determining landscape water requirements (LWR) usually follows one of three methodological approaches: The first option is to put landscape water requirements at the level of ET₀ values [3]. This comparison is logical if most of the landscape area is turf. The second option is based on direct estimation of landscape water requirements through the use of instruments such as volumetric soil water sensors [4,5] or weighing lysimeters [6]. The last group of authors [7] follows the methodology proposed by Costello et al., developers of the WUCOLS method for determining landscape water requirements. The WUCOLS method is based on ET₀, and uses an ad hoc procedure to estimate the coefficients that replace the crop coefficient by a landscape coefficient [8].

Recently, scientists in hydrology, ecology, geography, pedology, environmental sciences are concerned about the changes in landscape

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composition of watershed, their cumulative impact on water quality, and emerges hundreds of water quality models on non-point source pollution mechanism and nutrient migration and transformation. Of particular concern is the degree to which landscape conditions at watershed scales influence nitrogen, phosphorus, and sediment loadings to surface waters [9,10]. High levels of nutrients and sediment in water can pose significant human health and ecological risks [11]. In watershed scales models, there are the mechanism models based on hydrological processes and empirical models based on the correlative regression analysis between landscape and water quality [12-18]. However, it often occurs that parameters of these models have undefined ecological significance when we models landscape and water quality using these methods, which is the one reason that leads to the limited applying of empirical models.

In arid environment, water is the most limiting factor to plant growth, and the spatio-temporal dynamics of vegetation are therefore largely determined by water availability [19]. Understanding the relationship between water supply and spatio-temporal variations of vegetation and landscape pattern is critically important to developing and implementing strategies for biodiversity conservation and maintenance of ecosystem structure and function in arid regions [20].

Population growth, subsequent urban development, changing lifestyle patterns and increasingly unreliable rainfall have all placed unprecedented pressure on individuals and governance institutions to contend with potable water scarcity throughout the world. In particular, securing water supply for growing residential areas has prompted many countries to investigate and invest in alternative water supply schemes, such as desalination plants, recycled water schemes, and the utilization of existing groundwater supplies [21,22]. Successful and unsuccessful attempts to incorporate alternative schemes have occurred in diverse locations such as Singapore, California, Namibia and Australia, and have led to the recognition that the fate of such projects is largely determined by the local communities [23,24].

Water dramatically influences and shapes the landscape; it can create 'monumental sculptured environments [25]. The nature of the ground materials, the quantity of water, its duration of flow and type and amount of particulates carried determine the sculpturing effects. Where water meets the most resistance it works the hardest. The harder the material, the narrower the area carved. The larger the vertical height differences and the shorter the horizontal distance between the point of origin and the point of termination, the greater the carving forces of water.

Designers have long taken advantage of the many attractive visual and non-visual qualities of water in the landscape. Water can be still or move at various speeds. It can be shallow or deep, reflect the sky, sun, vegetation, and other objects surrounding it. Water can gain various colors, create sounds, and, when touched, cause cool sensation. Water color is associated with other perceptual and experiential characteristics as well. Blue water is associated with coolness, and white water with power and roaring sound [22-27].

The main purpose of the this study is putting forward a linear programming pattern in the form of transportation model in-order to allocate water optimally from the existing and future water resources (i.e. surface water, ground water and drinking water) to Urmia urban landscape pieces, considering minimization of the cost of supplying water.

Materials and Methods

Introduction of urmia

Urmia is a city in capital of West Azerbaijan Province, Iran. Urmia is located on a vast and verdurous plain, which is 70 km long and 30 km wide. The plains of rivers, rich deposits Barandoezchay, Sharchay, Nazloochoaei tea and drink it regularly every year are covered. The cities geographical position 37 degrees 34 minutes north latitude and 44 degrees longitude is located 58 minutes. The area of 7764 hectares and its population according to the 1385 census, 583,255 people. Figures 1-3 shows a view of Urmia.

Analysis of green space per capita address

The source of information for green space Urmia has been divided into four regional divisions of the city. Green area of the city with the last changes in 2010, 4/4006860 obtained m this area contains a variety of green spaces (Parks, Squares, Boulevard, Delta, Trees, Streets, Nurseries and Forests) and 15/5 percent the area includes the entire city. Green spaces in the city include the percentage of the entire city. However, their distribution is such that regions 2 and 3, the lowest level of zone 1 have the highest percentage of green space. Green spaces that do not have the proper distribution of their distribution is as follows Zone 1 with an area of 2774 hectares and a population of 1,434,689 of whom 172,407 square meters of green space. The per capita area of 3/8 sq m has been calculated that a total of 84/1% of the city area and 8/35



Figure 1: Shows a view of Urmia.



Figure 2: Shows of green space area of Urmia.



Figure 3: Shows of green space area of Urmia.

of the total green area of the city, and two fifths of the area are included. Images (2) selection of green space area 1 is shown.

Identification of green spaces urmia

In order to increase the accuracy and efficiency studies, the green spaces of the city identify and profile should be studied and developed. Based on the identification of urban green spaces studied by organizations to identify and develop parks and green space Urmia was prepared in order to come to the table that contains information and specifications of the green space areas are separated Urmia.

Studies on water supply for landscape urmia

Overview: The plain subsurface layers of juicy collector of a vast repository of natural and regulator inlet water from large drainage area, which both operate, provides the storage capacity of water. Regional hydrogeological studies indicate that these reservoirs are located in an area of approximately 868 square kilometers.

Hydrated surface layer comprises an area of 764 square kilometers in area, but with deep moist layer over an area of 868 square kilometers, respectively. Groundwater within the aquifer layers are scattered artesian aquifer water (water contribution Consulting Engineers, 1381).

Optimization of water resources, water resources currently available green space Address

Optimization of irrigation water for an average of 7 months: First, the initial optimal solution using triple northwest corner, at least cost and Vogel approximation provided and the optimality condition using each method (MODI) evaluation and optimization methods is presented.

Results and Discussion

Initial optimal solution using the northwest corner

Table 1 of the optimal solution using the northwest corner of the current landscape (Median 7 months, irrigation) shows. As this table is a fundamental variable allocation of water to urban parks and boulevards, the basic variables are the boulevards and parks and forest allocation of surface water as a basic variable allocation of ground water parks, forest and other the green space of estimated nurseries become at the same time Ghyrasasy variables are estimated by assigning zero. Optimal solution in this case is 15675000 Rials per day.

Optimal solution of the minimum cost method

Table 2 optimal solution of the minimum cost for current green method (Average 7 month's irrigation) shows. This solution differs from the solution obtained from the northwest corner (Table 1). In this method, according to the Table 2 fundamental variables allocation of water to urban parks, boulevards, nurseries and other green spaces, the basic parameters of surface water allocation and forest parks just basic variables allocation of groundwater and boulevards forest parks was estimated at the same time non-fundamental variables are estimated by assigning zero. Optimal solution in this case is 15035000 Rials per day.

Optimal solution of Vogel approximation method

Table 3 of the optimal solution (Initial justification) Vogel's approximation method to the current status of green space (Median 7 months, irrigation) shows. The different responses with the reply obtained from the northwest corner method in the Tables 1 and 2 indicated. In this method, according to the Table 3, the basic parameters of water allocation Boulevard, nurseries and other green spaces, the basic parameters of surface water allocation and forest parks just basic variables allocation of water to urban parks, boulevards parks and forests was estimated at the same time Ghyrasasy variable assignment, are estimated to be zero. Optimal solution in this case is 14035000 Rials per day. Therefore, the optimal solution of the Vogel approximation method with a value of £ 14035000 = Z and the worst of the northwest corner of ways 15675000 Z = is the value of the Rial. But since this is the optimal solution, is not the final completion of the optimization method (MODI) optimality condition for each of the above three methods were tested and the results are presented in the following topics.

Initial feasible solution optimality study using three methods (MODI)

Optimality test procedure included three procedures, respectively. For the northwest corner of the Tables 4-10, for the least expensive method of the Tables 11-13 and the method Vogel approximation of the Tables 4-14 with the average irrigation season (7 months) utilized. In the method northwest corner after three iterations to reach the final optimal solution Tables 4-10, also in the least -cost method of the repetition he obtained their optimal solutions Tables 11-13 and Vogel 's approximation method is finally beginning to provide optimal solutions Table 14. This means that the optimal allocation of water resources availability in the Vogel approximation method for green spaces, more than capable of Urmia least expensive and also the northwest corner of potential methods for water in the current situation mean during. According to the results of the same basic variables Vogel 's approximation method and cost method, the optimal values for green spaces Urmia, according to the basic parameters of drinking water, 5,400 cubic meters per day Blvd 1400 cubic meters per day to 1,200 cubic meters per day nurseries other green spaces and the basic parameters of surface water, 6,500 cubic meters per day to park and forest due to the fundamental variables of water, 5,000 cubic meters per day in urban parks, boulevards, and 900 cubic meters to 1600 cubic meters per day forest Parks on the optimal cost £ 14035000 per day is recommended Tables 13 and 14.

It is showing that high accuracy. Thus, the final optimum solution for water allocation model using three methods above for irrigation 14035000Z = IRR is an average of 7 months. However, how to allocate the northwest corner method is different from the other two methods.

Demand destination										
Supply sources	Urban parks		Boulevards		Forest parks		Nurseries	Other green spaces		a _i
	1700	5000	1500		1700		1300	1200		8000
Drinking water	*1		3000		*2					
	100		100	4000	100	2500	100	100		6500
Surface water										
	270		270		270	4900	270	270	1200	7500
Ground water							1400			
b _j	5000		7000		7400		1400	1200		22000

1*- basic variables

2*- nonbasic variables

X₁₁=5000 X₂₁=0 X₃₁=0

X₁₂=3000 X₂₂=4000 X₃₂=0

X₁₃=0 X₂₃=2500 X₃₃=4900 O.F=Z=15675000 Rial

X₁₄=0 X₂₄=0 X₃₄=1400

X₁₅=0 X₂₅=0 X₃₅=1200

X₁₅=0

Table 1: The initial optimal solution using the northwest corner to the current situation (mean 7 months, irrigation).

Demand destination										
Supply sources	Urban parks		Boulevards		Forest parks		Nurseries	Other green spaces		a _i
	1700		1500		1700		1300	1200		8000
Drinking water	*1	5000	400		*2		1400	1200		
	100		100		100	6500	100	100		6500
Surface water										
	270		270		270	900	270	270		7500
Ground water			6600							
b _j	5000		7000		7400		1400	1200		22000

1*- basic variables

2*- non basic variables

X₁₁=5000 X₂₁=0 X₃₁=0

X₁₂=400 X₂₂=0 X₃₂=6600

X₁₃=0 X₂₃=6500 X₃₃=900 O.F=Z=15035000 Rial

X₁₄=1400 X₂₄=0 X₃₄=0

X₁₅=1200 X₂₅=0 X₃₅=0

Table 2: The initial optimal solution of the least-cost method to the current situation (median 7 months, irrigation).

Demand destination										
Supply sources	Urban parks		Boulevards		Forest parks		Nurseries	Other green spaces		a _i
	1700		1500		1700		1300	1200		8000
Drinking water			*1	5400	*2		1400	1200		
	100		100		100	6500	100	100		6500
Surface water										
	270		270		270	900	270	270		7500
Ground water		5000	1600							
b _j	5000		7000		7400		1400	1200		22000

1*- basic variables

2*- non basic variables

X₁₁=0 X₂₁=0 X₃₁=5000

X₁₂=5400 X₂₂=0 X₃₂=1600

X₁₃=0 X₂₃=6500 X₃₃=900 O.F=Z=14035000 Rial

X₁₄=1400 X₂₄=0 X₃₄=0

X₁₅=1200 X₂₅=0 X₃₅=0

Table 3: The initial optimal solution of the vogel approximation method to the current situation (median 7 months, irrigation).

Optimization of supplying irrigation water, the warmest month (July)

For July, the first response early optimization is done using three methods. Repeat steps similar to the steps for evaluating the optimality condition with an average of 7 months, irrigation frequency on the 4-2-1, here is only to provide the tables were filled, and a final stop.

Furthermore, the initial optimal solution by employing three methods northwest corner, least cost method and Vogel's

approximation method for allocating water resources, green spaces in the Urmia city at hottest months of the year (such as July) represent. Here optimality test indicates greater Vogel approximation method is compared to two other methods, successfully tested on its optimality, the optimal allocation of water from the boulevards of 5100 cubic meters of drinking water per day, 1,600 cubic meters per day to 1,300 cubic meters per day nurseries and other green spaces. The optimal allocation of water from surface water sources, 6,500 cubic meters per day to park and forest allocation of water from groundwater sources,

Demand destination											
Supply sources	Urban parks		Boulevards		Forest parks		Nurseries	Other green spaces		a _i	U _i
	1700		1500		1700		1300	1200		8000	U ₁
Drinking water		5000	3000								
	100		100		100		100	100		6500	U ₂
Surface water				4000		2500					
	270		270		270		270	270		7500	U ₃
Ground water						4900	1400		1200		
b _j	5000		7000		7400		1400	1200		22000	
V _j	V _A		V _B		V _C		V _D	V _E		-	-

$$C_{ij} - U_i - V_j = \bar{C}_{ij} \quad C_{3E} - U_3 - V_E = 0$$

$$U_i + V_j = C_{ij} \quad U_1 = 0$$

$$U_1 + V_A = 1700 \quad V_C = 1500 \quad C_{1C} - U_1 - V_C = 200 > 0$$

$$U_1 + V_B = 1500 \quad V_A = 1700 \quad C_{1D} - U_1 - V_D = -200 < 0$$

$$U_2 + V_B = 100 \quad V_B = 1500 \quad C_{1E} - U_1 - V_E = -300 < 0$$

$$U_2 + V_C = 100 \quad U_2 = -1400 \quad C_{2A} - U_2 - V_A = -200 < 0$$

$$U_3 + V_C = 270 \quad U_3 = -1230 \quad C_{2D} - U_2 - V_D = 0$$

$$U_3 + V_D = 270 \quad V_D = -1500 \quad C_{2E} - U_2 - V_E = 0$$

$$U_3 + V_E = 270 \quad V_E = 1500 \quad C_{3A} - U_3 - V_A = -200 < 0$$

Table 4: The initial optimal solution using the northwest corner to the U_i column and row V_j.

Demand destination											
Supply sources	Urban parks		Boulevards		Forest parks		Nurseries	Other green spaces		a _i	U _i
	1700		1500		1700		1300	1200		8000	U ₁ =0
Drinking water	*1	5000	-0	← 3000							
	100		100	4000	100		100	100		6500	-1400
Surface water	*2		+0		-0	→ 2500					
	270		270		270		270	270		7500	-1230
Ground water					+0	4900	1400	-0	1200		
b _j	5000		7000		7400		1400	1200		22000	-
V _j	1700		1500		1500		1500	1500		-	-

Table 5: Stepping stone path input variable X₁₅.

Demand destination											
Supply sources	Urban parks		Boulevards		Forest parks		Nurseries	Other green spaces		a _i	U _i
	1700		1500		1700		1300	1200		8000	U ₁
Drinking water		5000	1800						1200		
	100		100		100		100			6500	U ₂
Surface water				5200		1300					
	270		270		270		270	270		7500	U ₃
Ground water						6100	1400				
b _j	5000		7000		7400		1400	1200		22000	-
V _j	V _A		V _B		V _C		V _D	V _E		-	-

1*- basic variables

2*- non basic variables

$$C_{ij} - U_i - V_j = \bar{C}_{ij} \quad C_{3E} - U_3 - V_E = 300 > 0$$

$$U_i + V_j = C_{ij} \quad U_1 = 0$$

$$U_1 + V_A = 1700 \quad V_A = 1700 \quad C_{1C} - U_1 - V_C = 200 > 0$$

$$U_1 + V_B = 1500 \quad V_B = 1500 \quad C_{1D} - U_1 - V_D = -200 < 0$$

$$U_1 + V_E = 1200 \quad V_E = 1200 \quad C_{2A} - U_2 - V_A = -200 < 0$$

$$U_2 + V_B = 100 \quad U_2 = -1400 \quad C_{3A} - U_3 - V_A = -200 < 0$$

$$U_2 + V_C = 100 \quad V_C = 1500 \quad C_{2D} - U_2 - V_D = 0$$

$$U_3 + V_C = 270 \quad U_3 = -1230 \quad C_{2E} - U_2 - V_E = 300 > 0$$

$$U_3 + V_D = 270 \quad V_D = 1500 \quad C_{3B} - U_3 - V_B = 0$$

Table 6: Answer northwest corner of the first iteration method.

Demand destination												
Supply sources	Urban parks		Boulevards		Forest parks		Nurseries		Other green spaces		a _i	U _i
	1700		1500		1700		1300		1200		8000	0
Drinking water	-0	5000	1800		*2				*1	1200		
				+0								
	100		100		100		100		100		6500	-1400
Surface water				5200		1300						
				-0		+0						
	270		270		270		270		270		7500	-1230
Ground water	0					6100						
						-0	1400					
b _j	5000		7000		7400		1400		1200		22000	-
V _j	1700		1500		1500		1500		1200		-	-

1*- basic variables
2*- non basic variables

Table 7: Stepping stone path input variable X₃₁.

Demand destination												
Supply sources	Urban parks		Boulevards		Forest parks		Nurseries		Other green spaces		a _i	U _i
	1700		1500		1700		1300		1200		8000	U ₁
Drinking water	*2		6800		*1					1200		
	100		100		100		100		100		6500	U ₂
Surface water				200		6300						
	270		270		270		270		270		7500	U ₃
Ground water		500				1100	1400					
b _j	5000		7000		7400		1400		1200		22000	-
V _j	V _A		V _B		V _C		V _D		V _E		-	-

1*- basic variables
2*- non basic variables

$$C_{ij} - U_i - V_j = \bar{C}_{ij}$$

$$U_i + V_j = C_{ij} \quad U_i = 0$$

$$U_1 + V_B = 1500 \quad V_B = 1500$$

$$U_1 + V_E = 1200 \quad V_E = 1200$$

$$U_2 + V_B = 100 \quad U_2 = -1400$$

$$U_2 + V_C = 100 \quad V_C = 1500$$

$$U_3 + V_A = 270 \quad U_3 = -1230$$

$$U_3 + V_C = 270 \quad V_A = 1500$$

$$U_3 + V_D = 270 \quad V_D = 1500$$

$$C_{3E} - U_3 - V_E = 300 > 0$$

$$C_{1A} - U_1 - V_A = 200 > 0$$

$$C_{1C} - U_1 - V_C = 200 > 0$$

$$C_{1D} - U_1 - V_D = -200 < 0$$

$$C_{2A} - U_2 - V_A = 0$$

$$C_{2D} - U_2 - V_D = 0$$

$$C_{2E} - U_2 - V_E = 300 > 0$$

$$C_{3B} - U_3 - V_B = 0$$

Table 8: Answer northwest corner of the second iteration method.

Demand destination												
Supply sources	Urban parks		Boulevards		Forest parks		Nurseries		Other green spaces		a _i	U _i
	1700		1500		1700		1300	0	1200		8000	U ₁ =0
Drinking water		*2	6800						*1	1200		
	100		100	200	100		100		100		6500	-1400
Surface water			+0		-0	630						
	270		270		270	+0	270	-0	270		7500	-1230
Ground water		5000				1100	1400					
b _j	5000		7000		7400		1400		1200		22000	-
V _j	1500		1500		1500		1300		1200		-	-

Table 9: Stepping stone path input variable X₁₄.

Demand destination												
Supply sources	Urban parks		Boulevards		Forest parks		Nurseries		Other green spaces		a _i	U _i
	1700		1500		1700		1300		1200		8000	U ₁
Drinking water	*1		5400	*2			1400		1200			
	100		100		100		100		100		6500	U ₂
Surface water				1600		4900						
	270		270		270		270		270		7500	U ₃
Ground water		500				2500						
b _j	5000		7000		7400		1400		1200		22000	-
V _j	V _A		V _B		V _C		V _D		V _E		-	-

1*- basic variables

2*- non basic variables

$$C_{ij} - U_i - V_j = \bar{C}_{ij}$$

$$U_i + V_j = C_{ij} \quad U_i = 0$$

$$U_1 + V_A = 1500 \quad V_A = 1500 \quad C_{1A} - U_1 - V_A = 200 > 0$$

$$U_2 + V_B = 1300 \quad V_B = 1300 \quad C_{2B} - U_2 - V_B = 200 > 0$$

$$U_3 + V_C = 1200 \quad V_C = 1200 \quad C_{3C} - U_3 - V_C = 200 > 0$$

$$U_1 + V_D = 100 \quad U_2 = 1400 \quad C_{2D} - U_2 - V_D = 200 > 0$$

$$U_2 + V_E = 100 \quad V_E = 1500 \quad C_{2E} - U_2 - V_E = 300 > 0$$

$$U_3 + V_A = 270 \quad U_3 = -1230 \quad C_{3A} - U_3 - V_A = -200 < 0$$

$$U_3 + V_C = 270 \quad V_A = 1500 \quad C_{3C} - U_3 - V_C = 300 > 0$$

$$C_{3D} - U_3 - V_D = 300 > 0 \quad C_{3E} - U_3 - V_E = 300 > 0$$

Since all values of \bar{C}_{ij} are non-negative. The result in table 9 in the third iteration is optimal. Therefore, the optimal solution values are extracted as follows:

$$\begin{aligned} X_{11} &= 0 & X_{21} &= 0 & X_{31} &= 5000 \\ X_{12} &= 5400 & X_{22} &= 1600 & X_{32} &= 0 \\ X_{13} &= 0 & X_{23} &= 4900 & X_{33} &= 2500 \quad O.F=Z=14035000 \text{ Rial} \\ X_{14} &= 1400 & X_{24} &= 0 & X_{34} &= 0 \\ X_{15} &= 1200 & X_{25} &= 0 & X_{35} &= 0 \end{aligned}$$

Comparison of the optimal solution and improved the northwest corner method, it is concluded that there is a difference between these two amounts of £ 1640000.

Table 10: Answer northwest corner of the third iteration method.

Demand destination												
Supply sources	Urban parks		Boulevards		Forest parks		Nurseries		Other green spaces		a _i	U _i
	1700		1500		1700		1300		1200		8000	U ₁
Drinking water	*1	5000	400		*2		1400		1200			
	100		100		100		100		100		6500	U ₂
Surface water						6500						
	270		270		270		270		270		7500	U ₃
Ground water				6600		900		1400		1200		
b _j	5000		7000		7400		1400		1200		22000	-
V _j	V _A		V _B		V _C		V _D		V _E		-	-

1*- basic variables

2*- non basic variables

$$C_{ij} - U_i - V_j = \bar{C}_{ij}$$

$$U_i + V_j = C_{ij} \quad U_i = 0$$

$$U_1 + V_A = 1700 \quad V_A = 1700 \quad C_{1A} - U_1 - V_A = 200 > 0$$

$$U_2 + V_B = 1500 \quad V_B = 1500 \quad C_{2B} - U_2 - V_B = 200 > 0$$

$$U_3 + V_C = 1300 \quad V_C = 1300 \quad C_{3C} - U_3 - V_C = -200 < 0$$

$$U_1 + V_D = 100 \quad V_D = 1200 \quad C_{2D} - U_2 - V_D = 0$$

$$U_2 + V_E = 100 \quad V_E = 1500 \quad C_{2E} - U_2 - V_E = 300 > 0$$

$$U_3 + V_A = 270 \quad U_3 = -1230 \quad C_{3A} - U_3 - V_A = -200 < 0$$

$$U_3 + V_C = 270 \quad U_2 = -1400 \quad C_{3C} - U_3 - V_C = 300 > 0$$

$$C_{3D} - U_3 - V_D = 200 > 0$$

Table 11: The initial optimal solution of the minimum cost method with column and row U_i V_j.

5,700 cubic meters per day in urban parks, boulevards and 1800 cubic meters per day to 500 cubic meters per hectare is in forest park.

According to the results obtained from the solution of the water allocation model in July, our data suggested that as least-cost allocation model to allocate irrigation during the middle of the flowers and also with the approximation method in proportion to the supply in the July with average from 7 months to irrigation but does not affect the rate of increase in costs.

The final optimal solution (improved) July

Vogel approximation method for evaluating the optimality condition for this conclusion was estimated that the final optimal solution is the same answer to the same basic principles in order to express the optimal solution to the same table method.

Initial feasible solution, this method is limited. However, to achieve the optimal solution in the northwest corner of techniques and treatments and to evaluate the optimality of a repeat procedure cost

Demand destination												
Supply sources	Urban parks		Boulevards		Forest parks		Nurseries		Other green spaces		a _i	U _i
	1700		1500		1700		1300		1200		8000	U ₁ =0
Drinking water	-0	←500	←400	→+0	*2		*1	1400		1200		
	100		100		100		100		100		6500	-1400
Surface water						650				-0		
	270		270		270		270		270		7500	-1230
Ground water	0		-0			900						
b _j	5000		7000		7400		1400		1200		22000	-
V _j	1700		1500		1500		1300		1200		-	-

Table 12: Stepping stone path input variable X₃₁.

Demand destination												
Supply sources	Urban parks		Boulevards		Forest parks		Nurseries		Other green spaces		a _i	U _i
	1700		1500		1700		1300		1200		8000	U ₁ =0
Drinking water			*1	5400	*2			1400				
	100		100		100		100		100		6500	-1400
Surface water						650						
	270		270		270		270		270		7500	-1230
Ground water		5000		1600		900						
b _j	5000		7000		7400		1400		1200		22000	-
V _j	1700		1500		1500		1300		1200		-	-

1*- basic variables

2*- non basic variables

$$\begin{aligned}
 C_i - U_j - V_i &= \bar{C}_{ij} \\
 U_1 + V_B &= 1500 & V_B &= 1500 & C_{1C} - U_1 - V_C &= 200 > 0 \\
 U_1 + V_D &= 1300 & V_D &= 1300 & C_{2D} - U_2 - V_D &= 200 > 0 \\
 U_1 + V_E &= 1200 & V_E &= 1200 & C_{2A} - U_2 - V_A &= 0 \\
 U_2 + V_C &= 100 & V_C &= 1500 & C_{2B} - U_2 - V_B &= 0 \\
 U_3 + V_A &= 270 & V_A &= 1500 & C_{2E} - U_2 - V_E &= 300 > 0 \\
 U_3 + V_B &= 270 & U_3 &= -1230 & C_{1A} - U_1 - V_A &= 200 > 0 \\
 U_3 + V_C &= 270 & U_2 &= -1400 & C_{3E} - U_3 - V_E &= 300 > 0 \\
 C_{3D} - U_3 - V_D &= 200 > 0
 \end{aligned}$$

Since all values of \bar{C}_{ij} are non-negative. Therefore, the optimal solution values are extracted as follows:

$$\begin{aligned}
 X_{11} &= 0 & X_{21} &= 0 & X_{31} &= 5000 \\
 X_{12} &= 5400 & X_{22} &= 0 & X_{32} &= 1600 \\
 X_{13} &= 0 & X_{23} &= 6500 & X_{33} &= 900 & O.F=Z=14035000 \text{ Rial} \\
 X_{14} &= 1400 & X_{24} &= 0 & X_{34} &= 0 \\
 X_{15} &= 1200 & X_{25} &= 0 & X_{35} &= 0
 \end{aligned}$$

Comparison of the optimal solution and improved the northwest corner method, it is concluded that there is a difference between these two amounts of £ 1000000.

Table 13: The essential response of least expensive method of the first iteration.

Jam and final solution to optimize the cost of the solution is obtained by Vogel refused to repeat them here, but due to different allocation northwest corner results in is given.

Conclusions

In conclusion, Urmia city is separated into four regional divisions of the city. Green area of the city with the last changes in 2010, 69/400 hectare park that includes a variety of green space, square, boulevard, street trees, plantations and forest parks and 15/5 % of the total area of the city covers. Figures 1-3 shows the four regions in Urmia city. By linear programming, formulation, modeling and solving models considered and the following results in ensuring optimum water green Urmia identified, assessed and will be supplied. Green spaces of the Urmia city in terms of distribution and area under the international standards and national level not. The current green spaces of city and develop a global standard requires optimal allocation of water. Moreover, irrigation of green spaces Urmia through groundwater resources of 180 liters per second, a rate of 150 liters per second of

water resources and the water resources of 185 liters per second and the supply takes place. And also, green spaces irrigation application efficiency Urmia through gravity irrigation by sprinkler irrigation by 50 percent and 70 percent. Urmia irrigate green spaces in accordance with Table 2 respectively. Ability Vogel approximation method in optimal allocation of water resources for green spaces of Urmia and its availability at low cost way more than the northwest corner of the capability approach. To 7 -month irrigation, optimal water allocation amounts of water, 5,400 cubic meters per day to the boulevards, 1,400 cubic meters per day to 1,200 cubic meters per day nurseries and other green spaces. The optimal allocation of water from surface water sources, 6,500 cubic meters per day to park in the forest. Values for optimal allocation of water from groundwater sources , 5,000 cubic meters per day in urban parks , boulevards , and 900 cubic meters to 1600 cubic meters per day in the park is forested.

The hottest month of July, irrigation, optimal water allocation amounts of water, 5,100 cubic meters per day to the boulevards, 1,600 cubic meters per day nurseries, and 1,300 cubic meters per day to other

Demand destination												
Supply sources	Urban parks		Boulevards		Forest parks		Nurseries		Other green spaces		a _i	U _i
	1700		1500		1700		1300		1200		8000	U ₁
Drinking water			5400	*1	*2			1400		1200		
	100		100		100		100		100		6500	U ₂
Surface water						6500						
	270		270		270		270		270		7500	U ₃
Ground water		5000		1600		900						
b _j	5000		7000		7400		1400		1200		22000	-
V _j	V _A		V _B		V _C		V _D		V _E		-	-

1*- basic variables

2*- non basic variables

$$C_{ij} - U_i - V_j = \bar{C}_{ij}$$

$$U_i + V_j = C_{ij} \quad U_1 = 0$$

$$U_1 + V_B = 1500 \quad V_B = 1500 \quad C_{1C} - U_1 - V_C = 200 > 0$$

$$U_1 + V_D = 1300 \quad V_D = 1300 \quad C_{2D} - U_2 - V_D = 200 > 0$$

$$U_1 + V_E = 1200 \quad V_E = 1200 \quad C_{2A} - U_2 - V_A = 0$$

$$U_2 + V_C = 100 \quad V_C = 1500 \quad C_{2B} - U_2 - V_B = 0$$

$$U_3 + V_A = 270 \quad V_A = 1500 \quad C_{2E} - U_2 - V_E = 300 > 0$$

$$U_3 + V_B = 270 \quad U_3 = 1230 \quad C_{1A} - U_1 - V_A = 200 > 0$$

$$U_3 + V_C = 270 \quad U_2 = 1400 \quad C_{3E} - U_3 - V_E = 300 > 0$$

$$C_{3D} - U_3 - V_D = 200 > 0$$

Table 14: The initial optimal solution of the vogel approximation method to the U_i column and row V_j.

green spaces is estimated. The optimal allocation of water from surface water sources, 6,500 cubic meters per day to park in the forest. Values for optimal allocation of water from groundwater sources, 5,700 cubic meters per day in urban parks, boulevards, and 500 cubic meters to 1800 cubic meters per day in the park is forested.

Results 7 and 8 state that the basic variables in the optimal allocation of water resources for irrigation of green spaces Urmia in during 7 months compared to the average of the warmest month (July), but from the point of view of the same quantity of water for drinking water and, below are some green spaces. The optimal allocation of water resources, drinking water, surface water and groundwater for the future of green spaces in Urmia are present and also, the increased supply of essential variables entered into the basic variables for the average warmest months of the year 7 months and Irrigation (July) in conditions are present. The quantity of groundwater and some have greener spaces. The adequacy or inadequacy of the daily allocation of water for irrigation in the seventh month of each of the various components of green space in accordance with Tables 4 and 5 showed, respectively.

Suggestions

- Water delivered to the green spaces of the city of Urmia, requires a particular database and organized in terms of water volume delivered to the green spaces as well as financial costs them. This can be organized in the future development and management of green spaces in Urmia is very useful.
- The physical constraints of allocation of surface water, groundwater and drinking water in relation to space and time in the range of Urmia, in providing the optimal allocation of a water management plan for green spaces for future research are suggested.
- For a population of 583,255 people, Urmia, landscaping standards require an average of 1300 ha. be added to the existing water resources.
- Work and forested areas as possible, rather than gravity irrigation method used.

- Use plant species need less water than grass to green space for future expansion Urmia recommended.

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