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Evaluation of Ecological Capability of West and North West of Tehran for Ultimate Urban Development

J. Nouri and [1]S.A. Jozi
Department of Environmental Health Engineering, School of Public Health,
Tehran University of Medical Sciences, Tehran, Iran
[1]Department of Environmental Science, Islamic Azad University,
Science and Research Branch, Tehran, Iran

Abstract: The goal underlying the process of evaluating ecological capability of district 22 of Tehran as the main part of west and north west of Tehran is to realize the potential capability of land within practical application to achieve communication and interaction between human activities, society and the land potential to gain land preparation. To do so, in first place, an area of 5700 hectares, as district 22, was specified, maps of sustainable ecological resources (including physiography, type of soil, type and density of vegetation, geology and petrology) and unsustainable resources (including maps for water resources, wild life habitats) were prepared. On second stage the maps of land form units by using geographic information system (GIS) were provided by the over laying maps of slope, direction and elevation level. The environmental unit maps were prepared by overlapping the soil type and vegetation maps. In the next stage the ecological models of different stratum the environmental information included in the tables were adjusted, coded and were then confirmed with the ecological models of land applications in Iran and the ecological models of different classes of application were prepared for district 22 through a mathematical model and subsequently, the maps of application classes via GIS was prepared. The findings of the ecological potentials of district 22 shows that except the hillside parts, the region has potential classification 2 for urban development. For an outdoor recreation, the entire region is in class 1 (suitable) and has first and second potential for indoor recreation. For agriculture and animal husbandry the region has the potential 5 and only in a part of the region due to depth of the soil, it has potential 4 for agricultural and animal husbandry development. The region has potential 4 for supported woods application, the reason of this figure is low amount of water reserve and special physiography of the region.

Key words: Ecological capability, environmental conservation, geographic information system, urban development, ecotourism

Introduction

Environmental evaluation is a kind of valuing a quantity with undefined function and evaluation of the ecological capability of a land means realization of the potentials of the land with applicable uses (Makhdum, 1996). Evaluation of ecological capability is used all over the world as a basis for decision making and planning to use the land. The reason lies in the necessity to have an optimized selection and use of the land in an environmental planning and management to achieve a sustainable development (Effie *et al*., 1996; Field and Ingman, 2000; Laghaei and Roudgarmi, 1999; Wright, 1984). The importance of evaluating ecological capability of the land is so that if a land lacks suitable potential for a particular application (even if there is a socio-economic need to that application), the execution of the plan not only does not lead to an improvement in the environmental situation of the region, but also will bring along more destruction in the environment (Dasman, 1984; Elraey, 1997; Rossi, 1996; Tabibian, 1998).

In the recent years, evaluation of ecological capability has been raised in Iran as a necessity in the planning made for land use planning. This issue has been reflected in the national economic and social development plans. Taking the ecological capability and potential of the land into account along with planning and priority in land application can be a joining point of the two economic and environmental views that govern the activities of modern man which is a strategy with "sustainable development" value or development with minimum destruction (Cleveland, 2001; Fillion, 1999; Tabibian, 1998). With respect to the expansion of the ecological variables range, lack of sufficient knowledge on the cause and effect relations, the constituting factors of ecosystems and lack of records on the evaluation of ecological capability (particularly ecological capability evaluation in urban regions), multi-factor evaluation method was selected among the current methods of evaluation for the region subject of study.

Materials and Methods

The study has been performed in municipality of Tehran District 22 on the West and Northwest of Tehran, in 2002.

The study area is limited to Kan river in east, a curve with 1400 square meter in north, along Tehran-Karaj Free road in south and to a 25 (Km) limit of the Detailed Plan of Tehran in the west. The region is in 51°, 5′, 25″ longitude to 51°, 22′, 30″ in east and 25°,43′, 10″ in longitude in north (Fig. 1). According to the revision and detailed plan, the area of the land is 5700 hectares and consists of 6 municipality districts. According to the data of Statistics Center of Iran, the census of 1996 estimated the population of the region to be 56,020 people with 64 persons per hectares of land. In the revision plan, the base population of the district 22 is estimated to be 686,000 people and by encouraging factors, it can increase to 885,000 (Bavand, 1998).

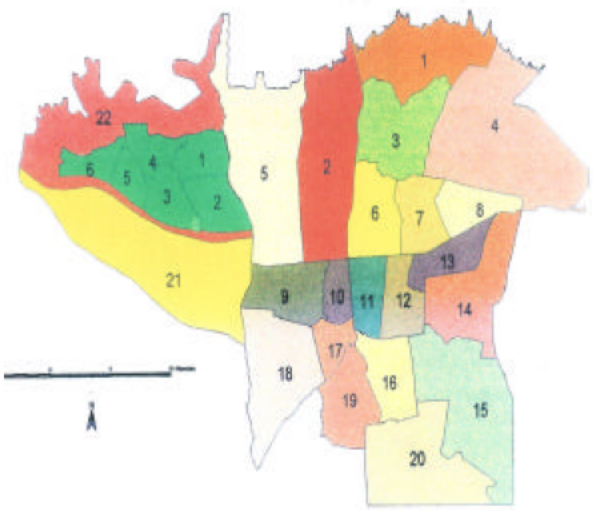

Fig. 1: Geographical location of district 22 of Tehran city

The climate of the region in the climatic classification in Domartin's method is of semi dry cold one and in Amberge's method, is of dry cold. The type of stones in the region are alluvium, conglomerate, tuff or external volcanic ones.
The structure of the soil is of loam, sandy loam, or clay loam. The depth of the soil varies from deep to very deep. The soil is weak to suitable in terms of drainage and the passage of faults in some blocks requires special arrangements due to the seismological characteristics of the region (Cers, 2001).
The annual rain of the region varies from 225 to 231 mm and the average daily temperature (in one year) varies from 7.2 to 44 Celsius (Cers, 2001). In hydrological terms, the region has few basins with some sub-basins, each consisting a number of hydrology units made of main and subdivided rivers and streams. The range subject of study has several streams and wells, particularly in the northern part of 1400 meter balance line. The waters of these resources are used for providing drinking water of residential areas, arboriculture and agriculture. Electrical Conductivity (E.C.) of these waters is low; that is, they do not contain high amount of soluble slats and thus, the water has suitable quality for drinking purpose; however, due to lack of hydrological potential of the water which is allocated to the region for forecasted use, shortage of water has been suggested as the most important factor in limiting the suggested plans (Cers, 2001; Sabeti, 1996).
The present usage of the region includes 31 percent uncultivated, 21 percent military, 22 percent wood plantation and gardens, 8 to 10 percent residential, 6 percent sports and around 4 percent farms. Rah Ahan, Olympic, Laleh, Shahrak Jihad, Zibadashtak Baala, Zibadashtak Paein, Cheshmeh, Amir Kabir, Peykanshahr, Azadshahr, Shahrak Daneshgah Sharif University of Technology and Shahid Seyed Hossein Kharrazi townships are the most important settlements of the region.
To carry the studies for determining ecological capability of district 22 of Tehran, the physical, biological and socio-economical resources were identified in the first place, to prepare 1:25000 scale maps of each source (including preparing maps of the slopes, direction, elevation, type of soil, land resources, geomorphology, petrology and fault, hydrology and water resources, climate, type of vegetation and wild life habitats). The data taken from GIS was used to prepare maps. The unit maps of the land shape were prepared by the topography-base maps of the region (taken from GIS Center of the Municipality) and using "Idrisi" software. The ecological maps for sustainable and unsustainable resources were prepared by specialized software in GIS system and benefiting from the information and data given by the meteorological stations, sampling, completion of family questionnaires (to collect economic and social data) and using satellite pictures of the region. The maps of environmental units of the region were prepared in the above-mentioned scale by using a multi-factor assessment method and the related information on each bioenvironmental unit was arranged. After this stage, analysis, coding and deduction to assess the characteristics of land usage potential were carried out and the concerned maps of application potential classes in the area of urban development, services, industrial, centralized recreation centers, expanded recreation centers, supportive wood plantation, agriculture, range management, lake establishment, aqua culture and environment preservation in the prepared and the classes which had application potential were extracted (Makhdum, 1996)

Results

Evaluation of ecological capability is an appropriate tool for predicting and recommending the suitable land use pattern of expected capabilities. In this study, evaluation of the expected seven land uses in west and northwest of Tehran has been performed. In accordance with this goals the recognization and classification of assessment elements has been done. These elements are divided into physicochemical resources, biological resources and socio-economical resources (Makhdum, 1996).

Identification of physico-chemical resources: These factors are divided into two classes containing durable and endurable resources (Table 1).
The slope factor includes three classes, first class 0-8% is the best choice for urban land use development. The direction factor is divided into four classes which the south direction is of the most value among the mentioned classes.
Because of the west-east location of study area, the elevation factor was recognizable only in two classes of 1200-1300 and 1300-1400 m which both are appropriate choices in the urban development concept. The map preparation of slope, direction and elevation classes has been performed via the Idrisi software. Among the other durable physicochemical factors and media, the soil type, abrasion class, petrology and faults are remarkable. The results of soil profile analysis related to one site of the study area are indicated in Table 2. According to the soil depth, soil horizon type, soil texture, soil penetrability and also the condition of each environmental unit in the view point of fault, abrasion susceptibility existence or vise versa and the mother rock type, the procedure of decision making in order to dedicate each unit and related capability to each of recommended land use choices have been facilitated.

Identification of biological resources: It has to be noted that due to serious uses of lands by population in the subjected region and other region than limited parts in Chitgar planted wood, Khargoush Darreh and National phytology garden of Iran, do not have important natural plants or habitats. According to the vegetation studies, the subjected region can be divided into three classes: developing regions (developed or developing) with the vegetation of low density, farmlands (about 4.4% of total area of region) and woody areas.
These classes are shown in Table 3, encoded as "Vg". Due to the vegetation scarcity human activities and existing construction projects, the subjected region is devoid of natural wildlife habitats. The wildlife classes are presented and encoded as "Fn", (Table 3) and also include following 2 categories: relatively valuable habitats, which mostly are located in wood regions and habitats of low value.
In the meantime, there are no plants or animals in the region which might be in danger of extinction.
Identification of socio-economic resources: The socio-economic characters and the needs of beneficiary communities are the most important in the evaluation of ecological capabilities especially in terms of land use planning. For investigation of economical and social studies there were 260 economical and social questionnaires which were filled by the population in regions 1, 2, 5 and 6 (Table 6).

Table 1: Classification of slope, direction and elevation

Map	Class	Specification	Class	Specification	Class	Specification	Class	Specification
Slope	1	0-8%	2	8-30%	3	>30%	*N.M.	N.M.
Slope direction	1	North	2	East	3	South	4	West
Elevation	1	1200-1300 m	2	1300-1400 m	N.M.	N.M.	N.M.	N.M.

* Not Measured = N.M.
(1) The first soil horizon, (2) The upper layer of the second soil horizon, (3) The lower layer of the second soil horizon, (4) The third soil horizon.

Table 2: Soil analytical data of west and northwest of Tehran, Profile No: 1, Soil series: 1

Depth (cm)	Horizon	Soil particle percentage (mm)			Texture	Saturation (%) (SP)	Electrical conductivity (ECe $\times 10^3$)	pH	Organic carbon percentage (OC %)	Gravel (%)
		Sand 2.0–0.05	Silt 0.05–0.002	Clay <0.002						
0-10	A	40	40	20	Loam	26	1.4	8.0	0.27	15-20
10-30	BW	60	20	20	Sandy loam	33	1.0	8.1	0.17	20
30-55	BK	40	45	15	Sandy	35	1.9	7.1	0.05	20
55-150	C	60	30	10	Clay loam	28	2.2	7.7	0.05	20

Depth (cm)	Total N (%)	Adsorbed P (ppm)	Adsorbed K (ppm)	Neutral $CaCO_3$ (%)	Exchangeable Na	Gypsum $CaCO_3$	Capacity exchange oil cations (CEC)	Exchangeable Na (%) (ESP)	Na adsorbed ratio (SAR)	Soluble Na (%)
					meq/100 gr. soil					
0-10	*N.M.	12.5	390	10.5	N.M.	N.M.	5.0	N.M.	N.M	N.M.
10-30	N.M.	8.2	366	15.5	N.M.	N.M.	N.M.	N.M.	N.M	N.M.
30-55	N.M.	6.5	394	20.0	N.M.	N.M.	9.5	N.M.	N.M	N.M.
55-150	N.M.	3.7	260	14.5	N.M.	32.68	6.0	N.M.	N.M	N.M.

Table 3: Specification of stratums, physical and biological resources and ID. codes

	Specification										
	1	2	3	4	5	6	7	8	9	10	11
Elevation (E)	1200-1300 m	133-1400 m	*N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
Slope (S)	0-8%	8-30%	>30%	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
Direction (A)	North	East	South	West	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
Plant type (Vg)	Urban land with low plant cover	Farm land	Under plantation	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
Soil type (Pd)	(1)1/1	(2)2/1	(3)2/2	(4)3/1	(5)3/2	(6)4/1	)7(5/1	(8)6/1	(9)6/1	(10)7	Residual soils
Mother rock (J)	Alluvium 1	Alluvium 2	Alluvium 3	Conglomertae	Tuff	Extern. volcanic	N.M.	N.M.	N.M.	N.M.	N.M.
Soil texture (T)	Loam	Sandy loam	Loamy sand	Clay loam	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
Soil structure (St)	No structure	No changed Structure	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
Depth of soil (d)	Low deep	Deep	Very deep	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
Penetrability (P)	Low	Fair	Fast	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
Geomorphology (Ph)	Upper cone	Old cone	High valley	Mis. Alluvium Plain	Mid cone	Hillside	River bed	N.M.	N.M.	N.M.	N.M.
Drainage (dr)	Suitable	Relatively suitable	Poor	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
Water erosion (Er)	Low	Fair	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
Water resource (H)	Suitable	Almost suitable	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
Geology (G)	Hezar Darreh Constructor	North Tehran constructor	C-structure	Young cone	Volcanic & destruct. rock	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
Climate (C)	Dry cold	N.M	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
Fault (F)	High seismology potential	Fault limit	Fault limit	Low seismic	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
Wild life habitats (Fn)	Relatively valuable habitat	Low value	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.

* Not Measured

(1) xeric, sandy_skeletal, thermic
(2) xeric torrionthents, loam, skeletal, thermic
(3) xeric torrionthents, sandy loam, skeletal, thermic
(4) xeric haplocalcide, loamy, skeletal, mixed, thermic
(5) xeric haplocalcide, clay loam, mixed, thermic
(6) xeric torrionthents, fine skeletal, mixed, thermic
(7) xeric torrifluvents, fine loamy, mixed (calcareous), thermic
(8) typic haplocalcide, fine loamy, mixed (calcareous), thermic
(9) typic haplocalcide, clay loam, mixed (calcareous), thermic
(10) xeric calcigypside, mixed, thermic

Table 4: A model of table of the characteristics of environmental units

Ecological units code	Plant type code (Vg)	Soil type code (Pd)	Elevation (E)	Slope (S)	Direction (A)	Mother rock (J)	Geology (G)	Fault (F)	Depth of soil (D)	Soil texture (T)	Soil structure (St)	Drainage (Dr)	Pene-trability (P)	Erosion (Er)	Water supply potential (H)
12	1	5	1	1	2	1	1	2	1	1	1	2	2	1	1
13	1	5	1	1	3	3	2	2	1	1	2	2	2	1	2
14	1	5	2	1	4	2-5	3	3	2	1	2	2	2	1	2
15	1	8	2	2	2	2-5	1	1	1	2	2	2	2	2	2

In providing of above data, introduced resources codes were applied from Table 3.

Table 5: Specifications of different classes of environmental potentials of district 22 of Tehran for different applications

Types of application	Potential rank of region	Specifications
Urban, service and industry	2	The region is suitable for urban, service and industrial development, limited slop (more than zero and less than 8 percent), seismic limitation and restriction in water supply. However, it might be said in general that this region is suitable for development.
	3 (unsuitable)	The region is not suitable for urban, service and industrial development. Limitations of slope, seismic characteristics, soil texture, soil structure, soil depth, lack of water and unevenness are among the most important problems of this reason.
Outdoor recreation	1	There is no limitation for expanded tourism or if any limitation, it can be ignored.
Indoor recreation	1	The place has most suitable condition for indoor tourism and developing tourism facilities and installations.
	2	The place has potential for indoor tourism and developing facilities and installations; however limitation in the soil depth, unevenness of the land and slope limitation exist in a permissible range.
Supportive wood plantation	5	The region has much limitation for industrial wood plantation.
Agriculture and range management	4	The land has suitable potential for range management and dry farming (feed and horticulture). There might be dry farming with or without range management. The region has low to fair potential for orchard, animal husbandry centers, poultry and apiculture.
	5	The region has fair potential for range management and dry farming. The place has low to fair potential for orchard with or without irrigation, animal husbandry poultry and apiculture.
Environmental conservation	1	Land preservation should be made for sustaining and improving quality of environment. It is necessary to carry out land administration for places which are sensitive to earthquake, abrasion, slide, flood, severe drought and environmental pollution.
Lake and aquaculture establishment	1	By taking some measures such as providing suitable bed in the lower horizon of the soil and sufficient water resources, the lands with less than 8 percent slow can be used for this purpose (by observing other environmental factors)

Table 6: Results of analysis made on social-economic studies of family in district 22 of Tehran

	District 1		District 2		District 5	District 6		Final conclusion-socio-economic study of region		
	Frequent.	Percent	Frequent.	Percent	Frequent.	Percent	Frequent.	Percent	Frequent.	Percent
Number of filled questionnaires	120	-	40	-	40	-	60	-	260	-
Population of samples	546	-	172	-	152	-	264	-	1124	-
Gender										
Men	280	51.28	94	54.65	72	47.27	136	51.52	582	51.32
Women	266	48.72	78	45.35	80	52.63	128	48.48	552	48.68
Education										
Literate	440	94.14	152	96.51	124	84.11	204	93.18	920	81.13
High school diploma	216	39.56	86	50	62	40.79	106	40.15	470	41.45
University degrees	120	21.98	42	24.42	32	21.5	68	25.76	262	23.10
Children 0-6 years	74	13.55	14	8.14	20	13.16	42	15.91	150	13.23
Illiterate	32	5.86	6	3.49	8	5.3	18	6.82	64	5.64
Disabled (Mental-physical)	4	0.073	6	3.49	0	0.0	2	0.76	12	1.06
Religion (Islam)	546	100.00	172	100	152	100.0	254	96.21	1124	99.12
Employment										
Employed	112	20.51	32	18.6	22	14.47	44	16.67	210	18.52
Retried	40	7.33	14	8.14	10	6.58	14	5.3	78	6.88
Student	178	32.6	58	33.72	44	28.95	94	35.61	374	32.98
Unemployed	60	10.99	28	16.28	26	17.11	36	13.64	150	13.23
Housekeeper	82	15.20	26	15.12	30	19.74	34	12.88	172	15.17
Income status										
Good	10	8.33	4	10	4	10	16	36.67	34	13.08
Average	84	70.00	30	75	30	75	34	56.67	178	68.46
Poor	26	21.67	6	15	6	15	10	16.67	48	18.46
Immigration status: (former places)										
Cities	18	15.00	6	15	12	30	22	36.67	58	22.31
Other regions of Tehran	86	71.67	32	80	24	60	34	56.67	176	67.49
District 22 of Tehran	16	13.33	2	5	4	10	4	6.67	26	10.00

* District 22 of Tehran has 6 sub-districts, the third and fourth sub-districts were not considered in the study due to lack of proper population.

In addition to those corrected data as gender, age, educational condition, employment and migration, people were questioned about income status, estate ownership, existing deficits in regions in the view point of people. The measurable differences concluded from the results can be used in assessment, decision making and management of subjected regions.

Data analysis and collection: The concept of data analysis as combing the classes of all ecological resources, in the process of ecological potential assessment of the region, was in a way that one could ultimately reach homogenous environmental units.
Accordingly it was necessary to overlay the slope, direction, height from sea, vegetation and soil map in order to produce the environmental units.
The acquired units are the most simple and stable units of sustainable ecological resources, that are the cornerstone of our subjected district.
In the subjected region, 58 environmental units have been produced. All the acquired data from, physico-chemical, biological and socio-economic was analyzed and encoded through the most simplistic way (Table 3). Thus, instead of calling each characteristic of land, the combination of code and the class number is taken into account. Encoding the land characteristic is a helpful means to use descriptive and qualitative information in the format of brief and quantitative data in the computerized systems (Table 4).
The process of environmental units evaluation includes two stages:

Stage 1: Comparison of environmental units respectively to the ecological land use models of Iran are included.
The results indicates that the urban development land use has solely the second class (medium capability) over 94% of the subjected area and also has the third class (unsuitable) over the 6% of region.
The existing limitation in the region are in a level that handicaps us to find a first class (suitable) part for urban development over the subjected land.
We have first class capability for outdoor recreational land use, over almost all of the area.
For indoor recreational land use, 85% of area has the first class capability (suitable) and the rest 15% has the second class capability (medium). Since the subjected region is almost in danger, it could be dedicated to the environmental conservation choice.
The supportive wood plantation due to the water limitation and the lack of natural and intact parts, has the capability of 5 (almost low).
The agricultural and range management have the same conditions. Due to the severe limitation of agricultural water resources the capability class is 5 for agricultural use.
Since the range management needs less amount of water, the capability is 4 (intermediate). Despite constructing an artificial lake, none of environmental units has a suitable capability of this choice. It has to be said that only in the case of considering necessary facilities especially in terms of appropriate bed building, only some limited districts will have suitability for this choice. One of recommended utilities in this lake is the establishment of aquaculture,. The characteristics of evaluated land uses are presented in Table 5.

Stage 2: In order to identify the areas of assessed capabilities in previous stage on the land use map, the encoded durable and endurable ecological resources characteristics of each environmental units have been calculated according to linear mathematical equations and the means of geographical information system (GIS).
These models would be able to compare the identified and encoded resources (Table 3) with descriptive land use class characteristics and enable it in the format of a perceptible language for computer systems. To ensure the efficiency of the models, the model reliability test was performed.

Mathematical model for using classes 2 and 3 of urban, service and industrial:
U = Application for urban, service and industrial development
U2 = Second class for urban development
U3 = Unsuitable class
U2: E(1,2)+S(1,2)+A(1,2,3,4)+Pd(1,2,3,4,5,6,7,8,9,10)+J(1,2,3,4,5,6)+T(1,2,3,4)+St(1,2)+d(1,2,3)+P(1,2,3)+Ph(1,2,3,4,5)+d(1,2,3)+G(1,2,3,4,5)+F(2,3)+Vg(1,2,3)
U3 = S(3)or Pd(11)or Ph(6,7) or F(1).

Model of outdoor recreation application:
Ot = Application of outdoor recreation
Ot: E(1,2)+S(1,2,3)+A(1,2,3,4)+H(1,2,3)+C(1)+Pd(1,2,3,4,5,6,7,8,9,10)+Ph(1,2,3,4,5,6)+T(1,2,3,4)+J(1,2,3,4,5,6)

Model of application of classes 1,2 of indoor recreation:
OI = Application of indoor recreation
OI1 = First class for indoor recreation
OI2 = Second class for indoor recreation
OI 1: E(1,2)+S(1)+A(1,2,3,4)+ J(1,2,3,4,5,6)+ Pd(1,2,3,4,5,6,7,10) +Ph(1,2,3,4,5,6)+T(1)
OI2: E(1,2)+S(1,2)+A(1,2,3,4)+J(1,2,3,4,5,6)+Pd(1,3,4,5,6,7,8,9,10)+Ph(1,2,3,4,5,6)+T(2,4)

Mathematical application model of environmental conservation:
Cn = Environmental conservation
Cn:E(1,2)+S(1,2,3)+A(1,2,3,4)+Pd(1,2,3,4,5,6,7,8,9,10,11)+F(1,2,3)+Ph(1,2,3,4,5,6,7)+dr(1,2,3)

Mathematical model of application of supportive wood plantation (class 5):
Fo = Supportive wood plantation
Fo5 = Fifth class for supportive wood plantation
Fo5: E(1,2)+S(1,2,3)+A(1,2,3,4)+Vg(1,2,3)+Pd(1,2,3,4,5,6,7,8,9,10,11)+J(1,2,3,4,5,6)+G(1,2,3,4,5)+T(1,2,3)+dr(1,2,3)+Ph(1,2,3,4,5,6,7)

Mathematical model for agriculture and range management administration application (classes 4 and 5) (if water is provided):
Ag = Agriculture and range management administration application:
Ag4 = Fourth class for agriculture and range management
Ag5 = Fifth class for agriculture and range management
Ag4: E(1,2)+S(1,2)+A(1,2,3,4)+Vg(1,2,3)+Pd(1,2,3,4,5,6,7,8,9,10)+J(1,2,3,4,5,6)+T(3)+St(1,2)+d(1,2,3)+Ph(1,2,3,4,5)+d(1,2,3)+G(1,2,3,4,5)
Ag5: E(1,2)+S(1,2)+A(1,2,3,4)+Vg(1,2,3)+pd(1,2,3,4,5,6,7,8,9,10)+J(1,2,3,4,5,6)+T(1,2,3,4)+St(1,2)+d(1,2,3)+Ph(1,2,3,4,5)+H(1,2,3)+G(1,2,3,4,5)

Mathematical model for application in establishing lake and aquaculture:
Lk = Application in establishing lake and aquaculture
LK: E(1,2)+S(1)+A(1,2,3,4)+Pd(1,2,3,4,5,6,7,8,9)+J(1,2,3,4,5,6)+T(1,2,3,4)+(3)+H(1,2)+G(1,2,3,4,5)+F(2,3)+Ph(2,3,4,5)+P(1,2)

Discussion

To assess the ecological potential of district 22 of Tehran city, in first place, the sustainable and non-sustainable ecological sources were identified and social-economic studies were carried out for the region. In next stage, the sources were analyzed by GIS and then the land shape unit maps as well as environmental maps were prepared for the region. Last stage consisted of coding the information and data in the tables of environmental units and to accord them with the applied ecological models for Iran and subsequently, special ecological models were suggested for different classes of usage in the form of a mathematical model. In continuation, the data, table and models were fed into GIS and the maps of different application classes were prepared.

The results show that the region has a potential 1 (desirable) in terms of outdoor recreation and visiting usage and potentials 1 and 2 in terms of indoor recreation and visiting attraction. Thus, district 22 can be considered as a potential recreation and visiting place. In terms of urban development, services and industrial, only the hillsides of Chitgar and west hills of the region with 8-30 percent slope has potential 3 (unsuitable) for urban development and the remaining part of district 22 has a potential 2(relatively suitable) in this respect. The region is the passing point of faults and thus, the faults limits are not suitable for construction of high buildings (more than 6 floors). In the meantime, it is essential to observe contents of the by-laws approved for one to six floor buildings in the form of resistance structures against earthquake hazards.

The region has mainly the potential 5 in agriculture and range management terms. The type of soil, limitation of water and low rainfall (less than 400 ml), are the reasons for this characteristic. It is only in district 3 that due to deep soil and relatively suitable water potential, there is a potential 4 for agriculture and range management.

The region has potential 4 for wood plantation. In the applied ecological models of wood plantation and administration in Iran, potentials 1,2 and 3 are suitable for industrial wood plantation while the region lacks this capability due to its environmental limitation.

It might be possible to use parts of districts 2 and 3 (lands with less than 8 percent slope) for aquaculture and lake establishment by providing measures such as preparation of suitable bed in the lower horizon of the soil to make the soil impenetrable and also, by supplying sufficient water resources.

In order to manage and improve the priority of assessed land uses for steadiness in each of environmental land unit, it is necessary that in socio-economical conditions of the communities and also type of use from the land, noticed at present. This affair within limitation studies (land use planning) area by article's authors is doing.

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