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Evaluation of environmental ecological power & sustainable development in Ilam province based on systematic analysis models

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ABSTRACT

The interactive effect of sustainable and unsustainable ecological sources reflected as the charactristic of each polygone, effective on each other and the invironment as well, is considered in ecolohgical power evaluation process. Using studies and researches perfomed in the area, and making the information congenial, and by using the suggested ecologicalgical power models in a systemic method in this research, considering environmental conditions of the area and special ecologicalgical charactristics of Zagros, the results have been discussed vigoriously. An area is studied in the current research which contains about 2 milion aicher, which has been devided into 786 polygones. Using the method of coinciding 11 layers, which are the ecologicalgical charactristics of the area, the ecologicalgical power of each polygone (bio-environmental unit) has been specified. Planners can develop the plan according to the power and charactristics which rule over the mentioned area.

Keywords: *Evaluation; Ecologicalgical Power; Systemic Analysis; Sustainable Development; Environment*

INTRODUCTION

Environmental power evaluation (wheather its ecologicalgical or socio-economical power) means the possible use of the land for agricultural, posturaging, forestry, tourism protection, aquation, army, engineering, and civil development, industrial and roral affair purposes, in a framework of agricultural, industrial, and commercial applications. The first step includes evaluation and planning for the resources of ecology. Without resource identification, that is recognition the parameters of the ecology, evaluation and planning for the ecology will be impossible. The methods of recource identification require statistics and sampling, aerial photography, satellite photography, topographical plans, and geographical information system pays much more accuracy and speed to the performance.

Second step is resource analysis evaluation, which includes a large number of information. Third step relates to environmental ecologic power evaluation. This step will be performed after having the specified resources of the environment been analysed and accumulated; and the area is ready to be evaluated. The number and parameters used in analysis and accumulation process; and the quality and selecting a method for evaluating the bio-environmental units of ecological power are affected by the structure of ecological models. Evaluation and classification of the ecological environment ical charactristics, aquiferous, and ecological mois operated through comparision among ecologdels. Sustainable and un sustainable resources of Ilam province, with 2 millions aichers area, have been identified and evaluated in the current research. In this evaluation, the area is devided into 786 bio-environmental units with bio-environmental charactristics; by performing a comparision between charactristics of ecological models, the type of application and ecological power priority have been assigned for each bio-environmental unit.

2. Specifications of the studied area

illam province, having about 20150 sqk, that means about 2 million aichers, is located in south west of Iran. This province is located 31º and 58´ to 34º and 15´ latitude, and is extended with high mountains and parallel to Kabir Koh, from north west to south east, 24 and 45º to 10 and 48º east length.

3. Objectives

1-Preparing various ecological maps, and classification the ecological specifications of Illam Province.
2-Prioritizing the power of every unit of the province land.
3-Resource reconnaissance, and evaluation of the environmental ecologic power of the province.
4-Contribution to the optimum management, and appropriate planning relating to the type of the application.

MATERIALS AND METHODS

Briefly, evaluation of the environmental ecologic power means: determining or anticipating the potential power and/or the natural usage of the land. Therefore, land evaluation is a means to strategic plan, and using the land (Makhdoom, 1372).

To evaluate the environmental ecologic power in land logistics process, a large number of the ecological resources are integrated. So, it is worthy to identify the ecological resource parameters required for evaluation. After that, by statistics and sampling, aerial photography, satellite photography, topographical plans; the land is prepared for evaluation. The middle stage is in fact the land logistics process with enviromental planning, and environment ecologic power evaluation of the land. The method which is used throughout the current research is the systemic analysis (Makhdoom, 1372). To perform this, we require to identify and inspect every resource. Using the geological maps of the area and the current information, the type of the constructors and their lithology have been specified. Identification of the resources is performed by field method, and topographic maps are used also. After analysing the geographical and geomorphologic data (Ahmadi, 1369), climate vegetation and the soil of the area (Bai Bourdi, 1372) have been identified. The soil erosion has been inspected using the slope maps of the rocks sensitivity to erosion and vegetation.

4.1. Ecologic Resources

Land Format: Land format includes natural units of the land. Each unit undergoes the same conditions of climate, weathering, erosion (Refahi, 1375), and sediment of the masses have been developed resulting in the current form. The parameters which characteristic the format of the land include: slope, altitude from the sea level, geographical orientation, channels (Hydrography), and arroyos (M. 1372). In order to identify the land format of the area and preparing its map, floor slopes, floor height, and amplitude orientations are surveyed.

4.2. Land format units map preparation

Land includes natural units. Each unit or section of the land owns a unique three dimensional format. To prepare the map and unit land format, it is required to integrate the slope floor, altitude floor and geographic orientation floor maps, which are its own components. To integrate the three mentioned maps, Iranian environment evaluators use assembly method. Assembly can be performed in two ways: multi-combination and bi-combination (M. 1372).

Bi-combination is used in this research, because the result is accurate, and can be used by the evaluator practically.

4.3. Land format preparatory map formula

$$E = J(I-1) + Ji$$

Formula components:
E= code or the number of the composed unit
J= total sum of the downward floor maps
I= number of the upward floor maps

In the final stage, the land format preparatory map, which is the result of combining the altitude floor from the sea level and slope floor percentage maps, will be conformed on the geographic orientation map, and the land format units will be built using tri-combination formula.

Tri-combination formula and its components:

$$E=[J3(J1((1-J)-1)]+Ji3$$

J3= Total sum of the orientation map floor
J1= Total sum of the altitude map floor
JI1= Number of the altitude map floor
I= slope map floor
Ji3= Number of the orientation map floor

Table .1. Land format units of the surveyed area

Altitude Floors	Orientation Floor	Slope Floor	Unit Code/Number	Altitude Floors	Orientation Floor	Slope Floor	Unit Code/Number
2	2	4	132	1	1	1	1
2	3	4	133	1	3	1	2
2	4	4	134	1	4	2	29
1	1	5	161	1	1	2	41
1	2	5	162	1	3	2	43
1	3	5	163	1	4	2	44
1	4	5	164	1	5	2	45
1	5	5	165	2	3	2	48
2	1	5	166	1	1	3	81
2	2	5	167	1	2	3	82
2	3	5	168	1	3	3	83
2	4	5	169	1	4	3	84
2	5	5	170	1	5	3	85
2	2	5	172	1	4	3	89
3	3	5	173	1	1	4	121
2	4	5	174	1	2	4	122
4	2	5	177	1	3	4	123
1	1	6	201	1	4	4	124
1	2	6	202	2	5	4	125
1	3	6	203	2	2	4	127
1	4	6	204	2	3	4	128
1	5	6	205	1	4	4	129
2	2	6	207	1	5	4	130
2	3	6	208	2	1	4	131

4.4. Bioenvironmental Unit

According the method, land format units map is placed on the soil type map, then those units of the land which have some components in common and concident on each other, are separated; adjusting the environmental units based on the Table (2). As it can be observed through Table (2), each land format unit combined with the various soil types, has created a certain bioenviornmental unit.

Table 2) Bionvironmental Units

Land Format Unit Code	Soil Type Floor	Bionvironmental Unit Code	Land Format Unit Code	Soil Type Floor	Bionvironmental Unit Code
48	1	471	1	3	3
81	3	803	1	4	4
81	4	804	1	7	7
82	1	811	1	8	8
82	2	812	1	9	9
82	3	813	1	10	10
82	4	814	3	4	24
82	5	815	29	4	284
82	8	818	41	4	404
83	3	823	41	6	406
83	4	824	41	7	407
83	7	827	41	8	408
84	3	833	41	9	409
84	4	834	41	10	410
84	7	837	43	3	423
84	8	838	43	4	424
84	10	840	43	7	427
85	3	843	44	3	433
85	4	844	44	4	434
85	8	848	44	7	437
89	5	885	44	8	438
89	8	888	44	9	439
89	10	890	44	10	440
121	3	1203	45	4	444

5. Surveyed Area

5.1. Bioenvironmental Unity

Bioenvironmental unity is in fact the very bioenvironmental unit (sustainable ecology charactristics) combined with unsustainable ecology charactristics. To complete the survey and containing bioenvironmental units, unsustainable ecological sources, which include climate, hydrology, and water and wildlife resources are concided with bioenvironmental units map (sustainable ecology charactristic) to locate the environmental units of the area. Each unit's charactristics are shown in the Tables (3) and (4), titling "The area's bioenvironmental charactristics". Regarding each unity's charactristic, the area can be evaluated, and each unity's ecological power can be identified using application models. In these tables, number of the polygones, space area of every polygone, altitude, geographical direction, slope percentage, floor or soil type, percentage of vegetation density, vegetation type, climatic floor, water resources (hydrology), wildlife class, sensetivity to erosion, and current application of every polygone have been identified based on the preprepared map, and each polygone's ecologic charactristic has been identified in specified culumns in the chractrisic's tables.

Table .3. Ecologic charactristics of the bioenvironmental units of the surveyed area

Land Usage	Erosion	Wildlife Class	Water Resources	Climatic Floor	Vegetation Type Code	Percentage of vegetation density	Soil Type	Geographic Orientation	Slope Percentage	Altitude (meter)	Unit's Area Space (hectare)	Unit Number	No.
Ra	1	1	---	3	---	Weak	3	p	0-2	0-1000	1000	3	1
Ra	1	1	7.5*	3	---	Weak	4	p	0-2	0-1000	6440	4	2
Ra	1	2	0.8	1	---	Weak	7	p	0-2	0-1000	11740	7	3
Df	1	2	Spring	3	---	---	7	p	0-2	0-1000	5620	7	4

Table. 4. Ecologic charactristics of the bioenvironmental units of the surveyed area

Land Usage	Erosion Sensitivity	Wildlife Class	Water Resources	Climatic Floor	Vegetation Type Code	Percentage of vegetation density	Soil Type	Orientation	Slope Percentage	Altitude (meter)	Unit's Area Space (hectare)	Final Unit Number (Bioenvironment)	No.
F	3	2	---	9	9	6-25	1	S	More than 65	1800-2200	3680	2985	784
F	2	1	---	9	9	6-25	5	S	More than 65	1800-2200	1250	2985	785
F	2	1	---	9	11	Less than 5	5	S	More than 65	1800-2200	930	2985	786

5.2. Ecological Models

Iran\s ecological models which have been built by Dr. Makhdom are: forestry applicable ecological model, pasture and agricualtural applicable ecological model, aquaculture ecologica model, environmental ecologica model, tourism ecologica model, centralized recreation and expansive recreation ecologica model; industrial, roral and urban development ecologica model.

The above mentioned models have been classified based on the ecological charactristics,regardingevery bioenvironmental unit, and their coordination and collation with each model, the type of every unit's application or some of the units is identified. Using the models, the evaluation of ecologic power based on priority is specified through the Tables (5) and (6).

Table. 5. Echological Power Evaluation

Urban & Roral Development	Dry Farming	Irrigated Farming	Environment Protection	Expanded Tourisem	Centralized Tourisem	Aquacultury	Pasttury	Forestry	Bioenvironmental Unit code	No.
---	---	---	---	---	---	---	4	---	3	1
---	4	3	1	---	---	2	4	---	4	2
---	5	---	---	---	---	---	4	---	7	3
---	5	---	---	---	---	---	4	---	7	4
---	5	---	---	---	---	---	4	---	7	5

Table. 6. Ecological Power Evaluation

Urban & Roral Development	Dry Farming	Irrigated Farming	Environment Protection	Expanded Tourisem	Centralized Tourisem	Aquacultury	Pasttury	Forestry	Bioenvironmental Unit code	No.
---	---	---	---	---	---	---	6	---	2965	780
---	---	---	---	---	---	---	6	---	2965	781
---	---	---	---	---	---	---	---	1	2965	782
---	---	---	---	---	---	---	---	1	2975	783
---	---	---	---	---	---	---	---	1	2985	784
---	---	---	---	---	---	---	---	1	2985	785
---	---	---	---	---	---	---	---	1	2985	786

DISCUSSION AND CONCLUSION

The interactive effect of sustainable and unsustainable ecological sources reflected as the charactristic of each polygone, effective on each other and the invironment as well, is considered in ecolohgical power evaluation process. Therefore, it is essential to mention that exploitation of the nature in a way that makes the least harm to the environmet, and returns the best result for human is possible provided that all the factors and phenomena involved in environment are considered. Normally, the more the selected factors, and the accurate the classification method, the more difficult the procedures, hence the results are closer to reality and more applicable. The studied area in the current research contains about 2 milion aicher. After a systemic analysis, and considering the ecological charactristics of the region, this area has been devided into 786 polygones. Using the method of coinciding 11 layers, which are the ecologicalgical charactristics of the area, the ecologicalgical power of each polygone (bio-environmental unit) has been specified. Also, using the ecologic power map in a land, and the region's ecologic power tables, the tremendous difference between current land application and future land application has been identified. Currently, a major number of the units, which include thousands hectares of the area space of the province, are exposed to sever erosion; just because of the water resources and slope of the region, which should be protected, the land is used for farming and agricultural purposes, that have not only good products, but also contributes to the more sever erosion and wasting the resources of the region. What the mentioned tables and maps reflect is in fact a kind of classification for each agent, the covered level of every selected floor, and the extension of each diferrent floor on the province. Refference to the maps and tables can guide the users in choosing the performance in the environment, considering the special conditions of a single factor in the environment. The notable point is that the interactive effect of these factors on each other and on the environment, and in some cases, the effect which results from opration process of two or more factors in the environment, produces sometimes different results than the effect of one factor on the environment. In ecologic power evaluation process, what is considered, is the interactive effect of these factors and the results of the mentioned effects on each other and environment. As mentioned previously, the result is the tremendous difference between expectable area spaces of each single factor, and factors collectively. Despite of the overwhelming problems; the ecological resources, natural and physical characteristics, and the land extension of the region have been identified; and it has been tried to perform possible accuracy in identifying the factors quantitatively and qualitatively. Sustainable and unsustainable ecological resources in the surveyed region have been identified in this research. Land format, bioenvironmental unit, with the rulling ecological charactristic have been obtained and determined as the province climatic units in 786 separated polygones. Application and ecological power of every bioenvironmental unit have been determined; and the planners can develop the plan according to the power and charactristics which rule over the mentioned area. The present research aims to contribute the experts and planners in saving huge expenses

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