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Full Length Research Paper

Participatory Preparation and Implementation of the Land use Plan- A Case Study from Iran

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Abstract

Watershed management is an intricate process encompassing various components whose specific roles are to be identified in order to attain sustainability. This systematic perspective of a given watershed is the approach opted by the "Sustainable Management of Land & Water Resources in Hablehroud Basin" (SMLWR) Project, an ongoing joint Project of UNDP and Forests, Ranges and Watershed Management Organization of Iran, in its 2nd phase. Hablehroud watershed with an area of 1.2 million acres is located across two central provinces of Iran, viz., Tehran and Semnan. It is a good indicator of the diversity and complexity and to some extends the fragile state of Iranian climate, was selected as the pilot site of SMLWR Project. The Project's agenda for the 2nd phase was to develop and implement the Land Use Plan and the Integrated Watershed Management Plan. Considering the participatory approach of this Project on attending the viewpoints of all stakeholders for the management and utilization of the watershed, its Land Use Plan was prepared and approved by all pertinent stakeholders in 2012 and its implementation phase was started in 2013. Currently, this Project is being implemented in various parts of the watershed.

Keywords: *Land Use Planning, Evaluation of Ecological Carrying Capacity, Watershed Basin, Systematic Approach, Participation.*

Introduction

While being considered as a complicated process, the management of a watershed area consists of different components each of which should be taken into account to assure the sustainability of the watershed area. Each and every component of a watershed area, as an integrated element of a dynamic and living system, plays a unique role in the function of watershed. Thus the instability or poor performance of each component disrupts the functionality of the whole (Wang, 2001). Such a systematic view of a watershed basin and its components as well as its inputs and outputs was opted by the *"Sustainable Management of Land and Water Resources"* Project (SMLWR) of Hablehroud Basin, the joint Project between the Iranian Government and UNDP, during the first two years of its second phase.

Encompassing 1.2 million hectares, Hablehroud watershed lies between two central provinces of Iran, Tehran and Semnan. This basin is bordered by Alborz mountain range to the north, the prosperous ranges to the middle, and the alluvial plains of Gharmsar with agricultural lands at the periphery of desert to the south. This basin is selected as the pilot site, since it properly represents the climatic diversity and fragility of Iran as a whole.

For a long time, this basin has been affected by anthropogenic activities. Human manipulations could be seen all over the area including excessive grazing at the upstream and midstream, intense soil erosion, flooding and sedimentation, alterations in land use especially at the upstream of the basin from the ranges to the farms, unequal water distribution between the upstream and downstream, mining and excavation activities with detrimental effects on the landscape of the watershed area, excessive use of underground waters at the downstream (Hamshahri Newspaper, 2013), and migration from rural to urban areas. These threats necessitate an all-inclusive and comprehensive perspective. Such a systematic approach is sought by the SMLWR Project in order to be designed and implemented in its second phase.

In order to address the above-mentioned threats with the aid of ecological and socio-economic capacities of the basin, the Land Use Plan of Hablehroud Basin was developed and approved by various expert groups during a one-year period. The steps taken to implement this plan and the ensuing results are provided below.

Materials and Methods

Study area

In the preparation of Land Use Plan of Hablehroud Watershed Plan, the results of research conducted by Rouyan Company in 1996 (Rouyan Consulting Engineers Company, 1996) and Shafiei studies in 2001 (Shafiei, 2011) as well as the works of other pertinent watershed experts on the development of vegetation coverage and land use maps of 2000 and 2001 were utilized. However, all the previous data were verified in this research and the required modifications were made in order to attain a cohesive and applicable data bank.

Moreover, it is important to point out that evaluation of ecological carrying capacity of the region is conducted for major land uses including range management, agriculture, gardening, urban, rural and industrial development, recreation and tourism, conservation and aquaculture, planting trees and waste disposal (Makhdum, 2014). The method used in this study is the integration of computerized Multi Criteria Evaluation (MCE) (Bell et al, 2007) and if needed, the statistical analysis of data is weighted using Analytical Hierarchy Process (AHP). Meanwhile, the standard and fuzzy functions are utilized on raster images with 30 meter pixels (Delden et al. 2005). The optimization method in this research is the Multi Objective Land Allocation (MOLA) as shown in Figure1. All the data are gathered in the UTM-39N reference system with WGS-84 datum. The studied area encompasses Hablehroud Basin with an area of 1,266,220 Hectares.

The various stages of preparation, approval and implementation of the Land Use Plan of Hablehroud Basin are shown in Figure2. The baseline data of the watershed basin are updated with the cooperation of technical consultants from different institutions and are subsequently analyzed. The baseline data includes:

- Analysis of surface and ground waters
- Analysis of vegetation coverage
- Analysis of soil conditions
- Analysis of wildlife status
- Analysis of economic conditions
- Analysis of social conditions
- Review of the upstream plans and actions of other sectors

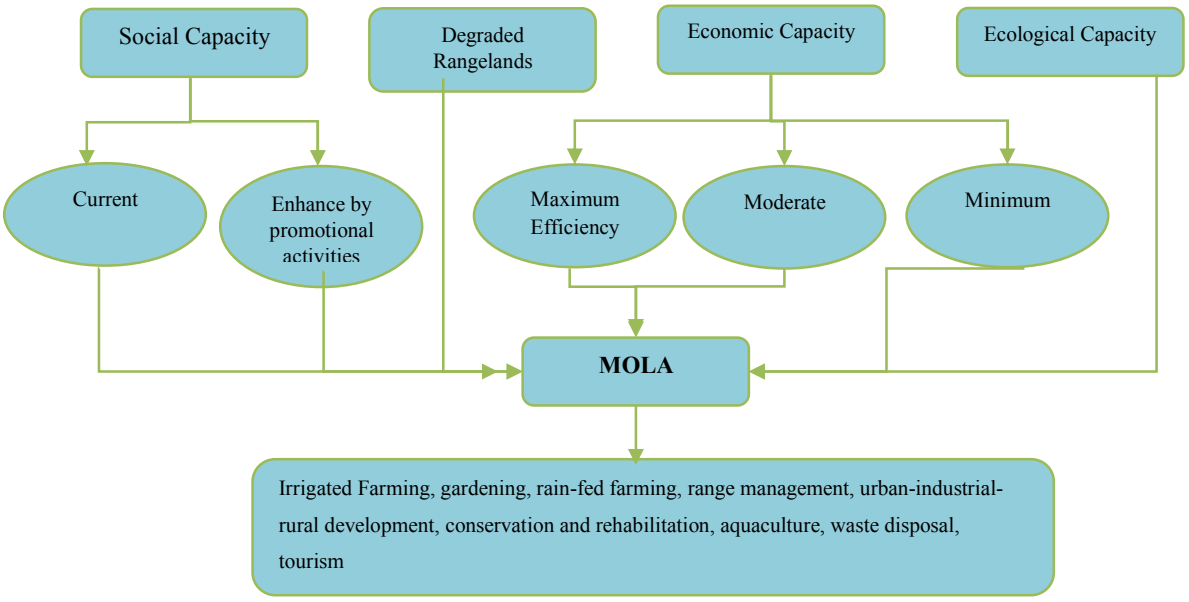

Fig 1. The analytical and data integration process for the development of the land use plan of Hablehroud Basin

Subsequently, these baseline data were analyzed according to the following sub-topics and the Multi Objective Land Allocation method as shown in Figure1:

- Determine the location, nature and intensity of land degradation phenomena
- Analyze the root causes of land degradation phenomena
- Analyze the strengths, weaknesses, opportunities and threats of land usage at the basin
- Develop the prioritization model of the basin

- Divide the basin into homogeneous regions
- Provide spatial scenarios for sustainable management
- Determine the pilot basin based on the hydrological boundaries

Forty nine parameters are used in the analysis of data in relation to the major topics like rangeland conditions, pedology, geology, erosion, sedimentation, climate, hydrology, land use, topography and vegetation coverage. These parameters are classified with the aid of fuzzy method and then are optimized by MOLA.

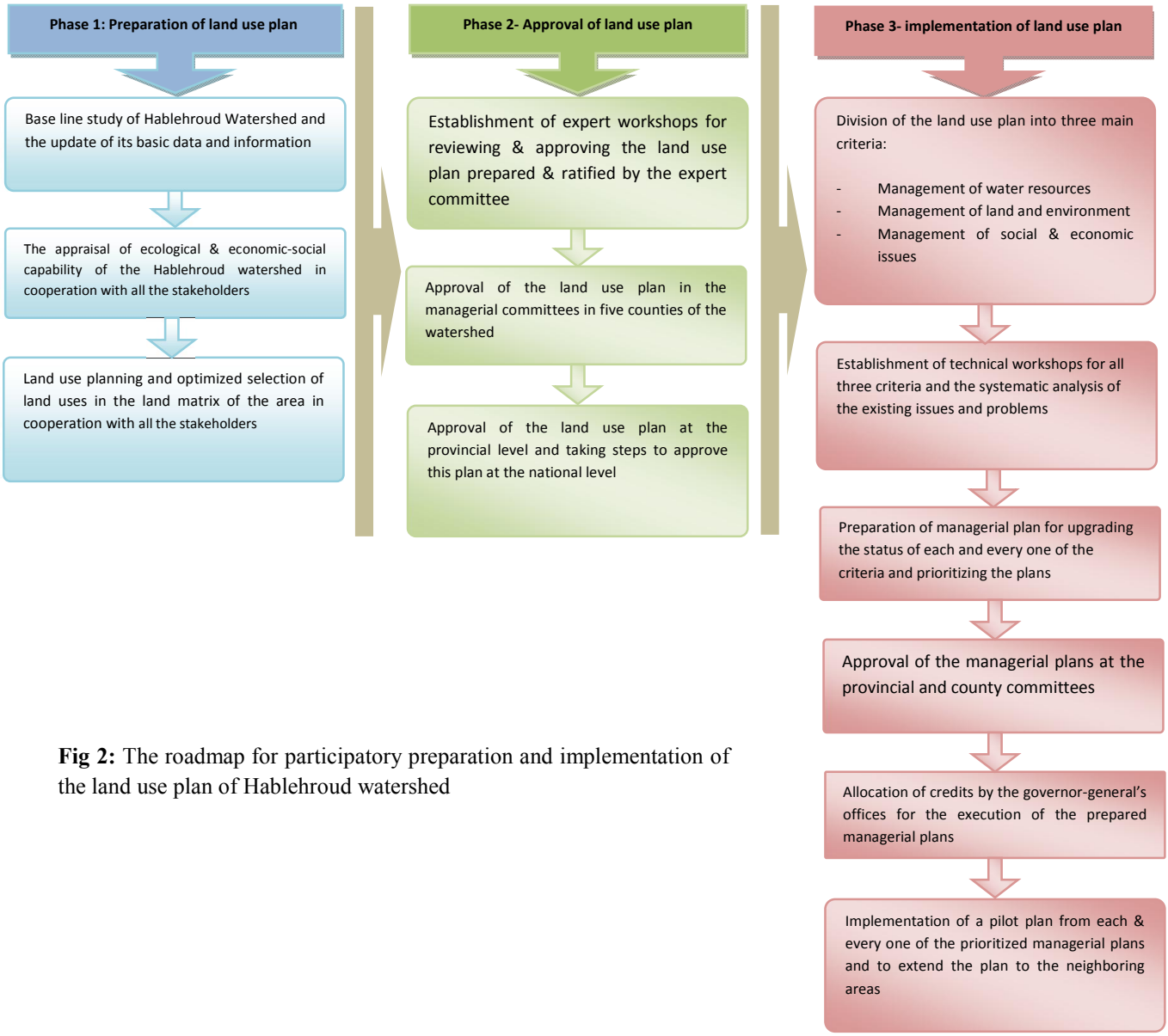

Fig 2: The roadmap for participatory preparation and implementation of the land use plan of Hablehroud watershed

Results and Discussion

After updating the data on the current status of Hablehroud Basin and the synthesis of results, several scenarios were recommended for the implementation of the plan. Various appropriate land uses could be identified by MOLA method and their suitable areas could be recommended for sustainable management scenarios. As an example, five scenarios considered for the implementation of the plan are mentioned below:

1. Implement every action identified by MOLA in the final map of optimized land uses,
2. Implement half of the actions identified by MOLA in the final map of optimized land uses, based on their compatibility with the integrated map of ecological, economic and social conditions
3. Implement one third of the actions identified by MOLA in the final map of optimized land uses, based on their compatibility with the integrated map of ecological, economic and social conditions
4. Implement one fourth of the actions identified by MOLA in the final map of optimized land uses, based on their compatibility with the integrated map of ecological, economic and social conditions

5. Implement one fifth of the actions identified by MOLA in the final map of optimized land uses, based on their compatibility with the integrated map of ecological, economic and social conditions

For example in the One-Half Scenario, the prioritized land use map is derived from the MOLA map and each land use and coverage is matched in the integrated capacity map. Then, the best pixels in the One-Half Scenario is selected and added to the 2010 land use map. As a result, the scenario for the implementation of MOLA method based on one-half capacity is obtained. The same procedure is used for the other scenarios. After the execution of MOLA method, the results are implemented on the Majority Filter. Subsequently, this layer is combined with the layers produced by the previous implementation of MOLA in order to prepare the final land use map of the region.

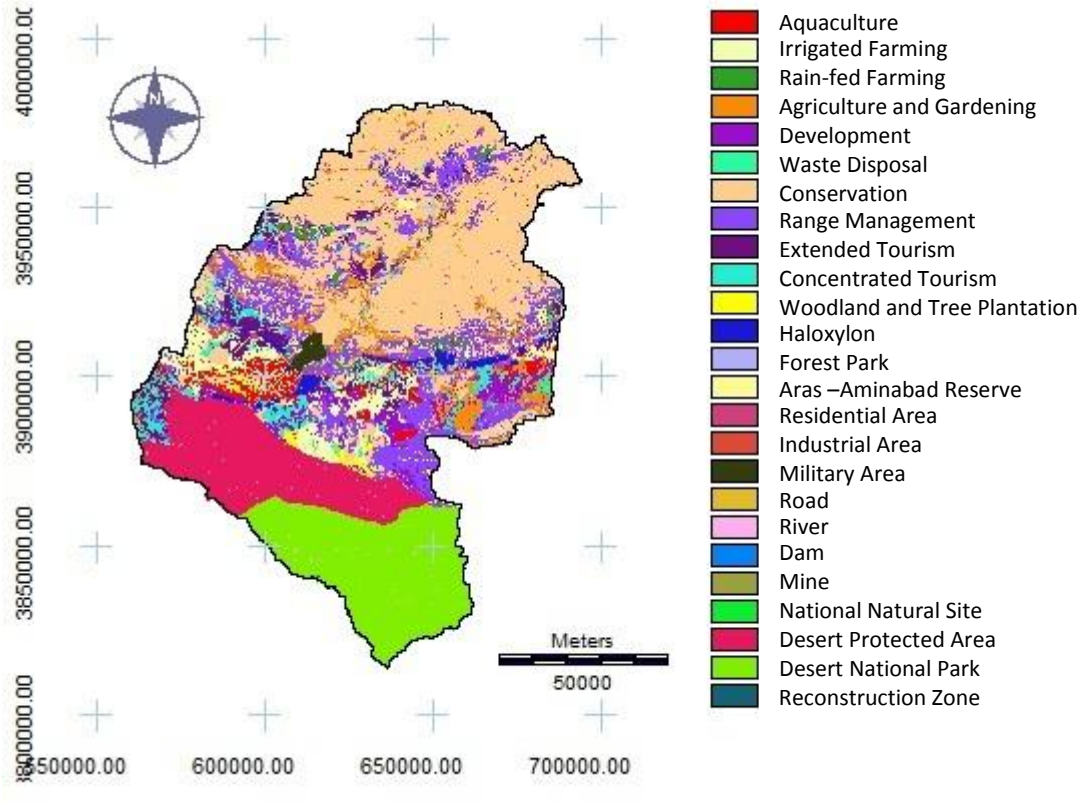

Fig 3: Implementation results of Scenario1 at Hablehroud Basin

Another example is the map produced by the implementation of Scenario1 as shown in Figure3. Meanwhile, the results of implementing this scenario for various applications and their percentages are presented in Table1. As it is mentioned in the table, the most recommended application is for conservation and range management with the land use percentages of 31 and 13, respectively.

Conclusion

The management of a watershed basin is consists of various components and pertinent institutions and stakeholders, which requires a cohesive interaction of all the related factors in order to attain sustainable development. The planning methods for a watershed are based on considering all the parameters involved in the basin. Meanwhile, a meaningful interaction between the upstream and downstream is to be ensured and their hydrologic connection is to be taken into account. These methods in watershed engineering and environmental sciences are generally called land use planning, regional planning, spatial planning or similar terminologies. However, all of them are established based on optimized land use in various locations of the basin. Site selection of land uses are presented on landscape matrix illustrating their interactions. Moreover in its advanced phases, the carrying capacity of each application is shown in the recommended landscape matrix (Christou et al. 2006).

The Hablehroud land use plan has optimized land usage based on ecological, economic and social capacities of the watershed basin. This plan has taken the first step towards the attainment of sustainable development at the basin through the preparation of a land use plan for the subsequent approval and implementation by the pertinent institutions and authorities. The participatory experience of developing the aforesaid land use plan indicates that integration of scattered data with the participation of all stakeholders during a short term period could result in tangible outcomes. Currently, this plan is being considered at the highest levels of provincial planning

and hopefully the effective participation of pertinent institutions and stakeholders has paved the way for its successful implementation at the watershed basin.

Table 1. Area and percentage of each selected land use for the implementation of Scenario1 at Hablehroud Basin

Row	Land Use	Area (Hectare)	%
1	Aquaculture	35713.52	2.82
2	Irrigated Farming	74949.76	5.92
3	Rain-fed Farming	11868.51	0.94
4	Agriculture and Gardening	59688.68	4.71
5	Development	33244.83	2.63
6	Waste Disposal	7522.80	0.59
7	Conservation	392464.98	31.00
8	Range Management	168751.89	13.33
9	Extended Tourism	49027.93	3.87
10	Concentrated Tourism	41373.45	3.27
11	Woodland and Tree Plantation	10420.27	0.82
12	Haloxylon	13942.44	1.1
13	Forest Park	335.53	0.03
14	Aras –Aminabad Reserve	1210/09	0.1
15	Residential Area	3199.51	0.25
16	Industrial Area	1920.48	0.15
17	Military Area	6486.6	0.51
18	Road	2962.99	0.23
19	River	8191.08	0.65
20	Dam	0.18	0.00001
21	Mine	15.12	0.001
22	National Natural Site	157.15	0.01
23	Desert Protected Area	150902.51	11.92
24	Desert National Park	187262.44	14.79
25	Reconstruction Zone	4607.43	0.36

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