



# Integrating socio-economic and biophysical data to enhance watershed management and planning



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## SUMMARY

Sustainability has always been considered as one of the main aspects of watershed management plans. In many developing countries, watershed management practices and planning are usually performed by integrating biophysical layers, and other existing layers which cannot be identified as geographic layers are ignored. We introduce an approach to consider some socioeconomic parameters which are important for watershed management decisions. Ganj basin in Chaharmahal-Bakhtiari Province was selected as the case study area, which includes three traditional sanctums: Ganj, Shiremard and Gerdabe Olya. Socioeconomic data including net agricultural income, net ranching income, population and household number, literacy rate, unemployment rate, population growth rate and active population were mapped within traditional sanctums and then were integrated into other biophysical layers. After overlaying and processing these data to determine management units, different quantitative and qualitative approaches were adopted to achieve a practical framework for watershed management planning and relevant plans for homogeneous units were afterwards proposed. Comparing the results with current plans, the area of allocated lands to different proposed operations considering both qualitative and quantitative approaches were the same in many cases and there was a meaningful difference with current plans; e.g., 3820 ha of lands are currently managed under an enclosure plan, while qualitative and quantitative approaches in this study suggest 1388 and 1428 ha to be allocated to this operation type, respectively. Findings show that despite the ambiguities and complexities, different techniques could be adopted to incorporate socioeconomic conditions in watershed management plans. This introductory approach will help to enhance watershed management decisions with more attention to societal background and economic conditions, which will presumably motivate local communities to participate in watershed management plans.

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## 1. Introduction

Accelerated process of natural assets depletion as an impact of inaccurate plans has caused extraordinary changes in land use, water crisis and other environmental challenges in many developing countries. Watershed management programs are usually designed and implemented to correct the negative impacts of such destructive utilization and management procedures.

Watershed management has evolved and passed through several development stages. In the initial stages, it was a subject of forestry and forestry-related hydrology. The involvement of people was not an issue. It was solely an affair of governmental forest departments. During the second stage, it became land resources

management-related, including activities with an eye on economic benefits. At this stage, the focus was on beneficiaries. It is now “participatory and integrated” watershed management, with involvement and contribution of local people (FAO, 2006).

Many problems related to watershed planning occur due to ignoring socioeconomic conditions of impressive and impressed communities (de Lange et al., 2010). Therefore, it is necessary for natural resource managers and policy makers to remark socioeconomic conditions in their decisions and make a balance between ecological and socioeconomic issues. Perceiving socioeconomic conditions for watershed management planning will undoubtedly cause higher accuracy, more efficiency and sustainable utilization. Involvement of social background and local opinions and traditional knowledge about executive plans will provide prerequisites for public participation and will enhance social acceptability of the plans (de Lange et al., 2010).

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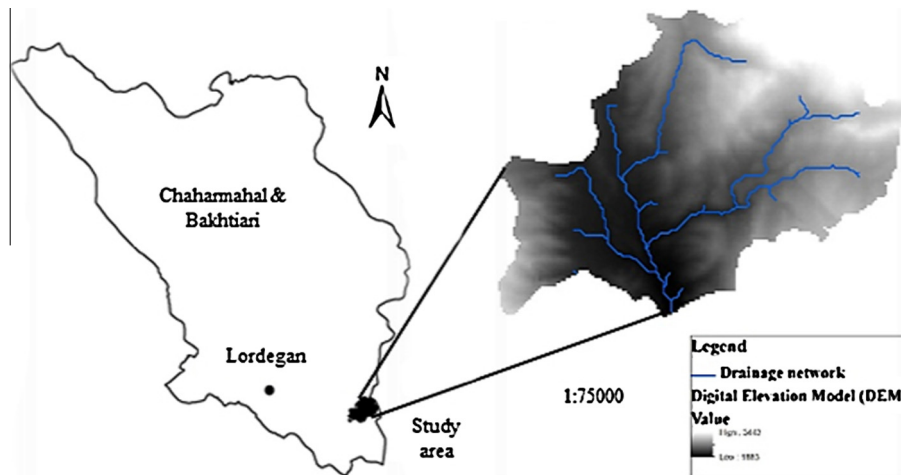


Fig. 1. Study area. This 8389-ha basin is located in Chaharmahal and Bakhtiari Province.

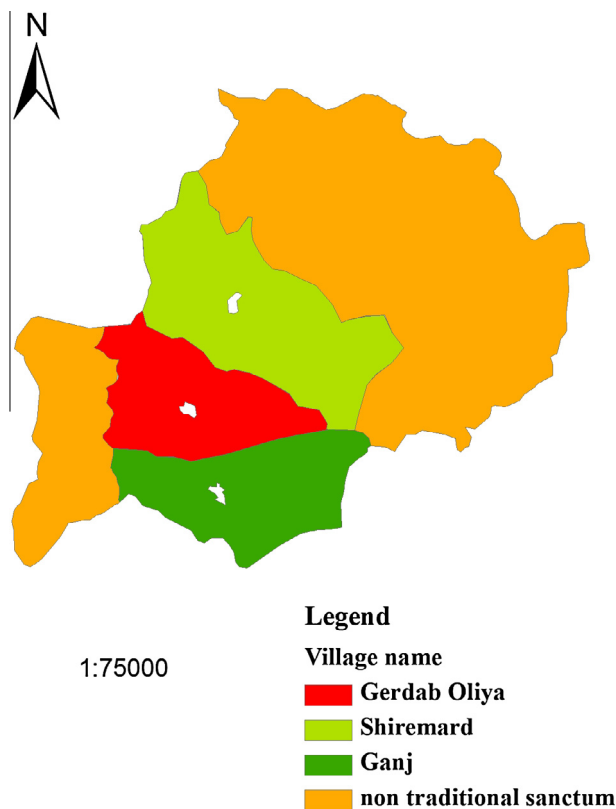


Fig. 2. Traditional sanctums, including Gerdabe Olya, Shiremard and Ganj villages. Red areas are rocky formations categorized as non-traditional sanctum. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

A review of roughly 50 years experience of watershed management sectors in Iran shows the lack of a scientific framework relevant to the structure and dynamism of environmental and socioeconomic systems. This is a critical point for Iran and similar developing countries that watershed management plans are only designed by focusing on biophysical studies and socio-economic background and stakeholders' characteristics are usually ignored despite the evolutions in the viewpoints for watershed management planning.

This situation is in contrast with scientifically and empirically affirmed experiences which emphasize the engagement of socioeconomic indicators to realize strategic self-sufficiency and sustainable development. Many relevant experiences of other countries during the last decades confirm various benefits of this approach (Pery et al., 2013).

A standard and specific framework is required to be employed for integrating biophysical and socioeconomic data (Bunce et al., 2008; Parr et al., 2003). This framework will surely require reliable and long-term data to cover biophysical and socioeconomic fluctuations (Parr et al., 2003; Olsen et al., 1997).

However some socioeconomic factors are usually surveyed in watershed management studies, these features are mostly ignored in the synthesis step of the basic layers. This is also the case for other resource management plans such as irrigation water management (Valipour, 2015a). This technical gap is evident in most scientific studies and executive plans, which convinced us to focus on a sample watershed to introduce an applicable approach for watershed management planning, involving different statistical and Geographic Information System processes to integrate socioeconomic and biophysical data. This approach could also be scaled down to watershed management subprojects such as water resources management (Valipour et al., 2015; Valipour, 2015b, 2012) and wildlife management.

## 2. Methodology

### 2.1. Study area

Ganj basin with an area of about 83.9 km<sup>2</sup> is located in Chaharmahal-Bakhtiari Province, between longitudes 51°9'–51°18'E and latitudes 31°21'–31°27'N. Altitudinal range is between 3437 MASL in the north and 1887 MASL in the southern areas. This area is one of sub-catchments of Karoon basin. Residential points include Ganj, Shiremard and Gerdabe Olya villages. Fig. 1 represents a general picture of the study area. It is worth noting that this basin is geographically and climatically representative for many arid and semi-arid areas and the watershed management challenges are similar to many developing countries.

### 2.2. Current status

Current watershed management in the region is performed based on the studies by Chaharmahal-Bakhtiari Natural Resource

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