Iran's territorial divisions from a bioregional perspective

A case study of Western part of Khorasan Razavi province – Iran

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To date, weakness and inefficiency of Iran's regionalization system to develop a territorial coherent space based on local potentials has seriously challenged integrated management of space disrupting country's potential for sustainability. Tackling these problems has necessitated the identification of a new approach drawing on territorial complexity act as a base to determine sustainable units as a context for territorial unity. Therefore, in the light of bioregionalism approach - a framework capable of improving synergic relationships,

Introduction

Geographically speaking, Iran is a vast country characterized by a broad diversity of natural features such as vastness, environmental variation and many other economic and human factors including diverse cultures, languages, and ethnic groups. "Given all these factors, there has been an increasing need for dividing the national space into subdivisions to organize territorial differences toward

cohesion and capacity- the current study aims to determine spatial units called bioregions as the most congruent purlieu of cultural, ecological, historical and socio-economic integrity. To map bioregions in this case study of western part of Khorasan Razavi consisting of an area of seven counties having limited ecological capacities, the cartographic design was adopted as the methodological approach. With this in mind, 10 original data layers were collected and converted to shapefiles in Arc GIS. The land was divided into 17 bioregions. Research findings show how these bioregional boundaries significantly mismatch the state-created ones and this necessitates dramatic changes in current boundaries to match the principles of place and ecological criteria. To reach critical mass and create capable communities, bioregions were classified into 3 categories: Macro, Meso, and Micro bioregions. In practice, the congruency of bioregions provides a context for integrated spatial management that will lead to developing regional synergy aimed at creating territorial coherence and enhancing the biological capacity of the country in the long run.

achieving *Territorial Cohesion* and planning to improve management of governmental affairs and proper utilization of natural resources across the country" (Ahmadipour, 2002, p.24). As Karimipour & Mohammadi (2009) believe:

"in Iran, the system of land divisions goes as far back as 5th Century B.C. when Darius, an Achaemenid ruler divided his territory into 30 units or Satrap (same as the country or city)". Thus, for Iranian administrators the idea of regionalization has not only a long tradition but has also been thought of as a key mechanism to manage responsibilities and achieve territorial integrity in a vast country extended over 1.600.000 square kilometers.

Having studied the macro-scale classification projects in Iran the researchers found that Iran's regionalization system was predominantly based on four main categories:

1. The first group of divisions is associated with planning approaches among which *Setiran spatial arrangement plan* and *Bttele regionalization plan* are the most well-known
2. The second group called 'functional divisions' was recommended by executive organizations based on their goals and objectives. For example *Iran Grid Management Company Zoning* and *The divisions of National Iranian Gas Company*.
3. The third category is that related to political and administrative requirements. *State divisions* is a representative of this approach to territorial divisions.

4. And the final category includes those focused on natural characteristics of land like *Jamab regionalization plan*. Out of these, the current study primarily focuses on the third group.

In the final part of a master thesis Mirshekarian (2007) states: "Despite its long history, weakness and inefficiency of Iran's regionalization system to develop a territorial coherent space based on local potentials, poses an obstacle to the process of sustainable national development"(p.101). So that, continual divisions of national space into subdivisions has significantly disrupted the process of integrated management of space, leading to spatial fragmentation over districts and seriously challenged integrated management of land resources. Tackling these problems has necessitated the identification of a new approach drawing on broad biological diversity, vast area, and the complexity of culture and history on the one hand and ecological limits on the other which act as a base to determine spatial homogeneous units. Broadly influenced by sectorial planning system of Iran, most of the macro-scale projects in this field have only been carried out on the basis of limited factors. While *Jamab Plan* has divided the surface of the country based on only natural factors including 'watersheds', *Battel Plan* classified Iran into 11 macro-region with establishing economic integrity through the country as its main goal. The current form of Iran's state divisions is also a mono-factor based model mainly focused on population parameter, which is sometimes accompanied by a political consideration factor.

If the starting point for sustainable development is assumed to be a local process then land units would have a different foundation for integration aimed at developing community participation in regional synergy. To further develop prior works and to bridge the existing gap in this field of study, this paper will address the following question:

Given Iran's territorial complexity what kind of division could possibly organize sustainable units creating a homogeneity acting as a basis for territorial cohesion across the country?

In light of new approaches to regional development, the current research aims to determine spatial units as the most congruent limitation of cultural, ecological, historical and socio-economic integrity holding a bioregional perspective – a framework that has the potential to improve synergic relationships, cohesion, and capacity. Having this in mind, we take 'Bioregion' – the physical manifestation of bioregionalism – as introducing a sustainable framework for territory divisions in which the unity of people and land take place around the core concepts of natural resources and communities.

The remainder of this paper is organized as follows: the first part gives a descriptive account of the history of main national classification schemes which have recently

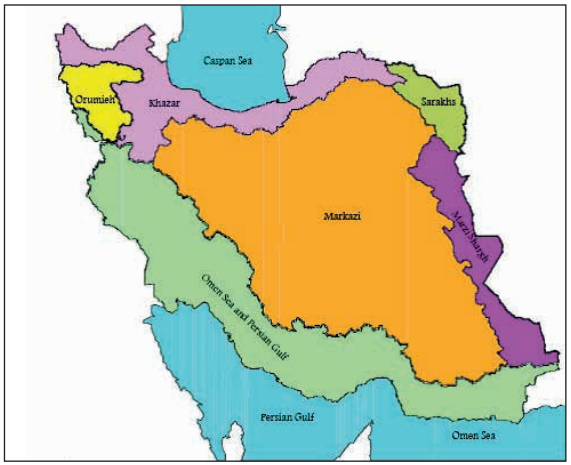
been the center of hot debates, to clarify their functional criteria and objectives. The second part begins with laying out the theoretical dimension of the research – Bioregionalism, followed by a brief overview of a couple of projects by leading bioregional divisions across the world. Section three describes the methodology of the project. Section four gives a summary of the results as well as a description of the process of design and synthesis of thematic maps in more detail. Discussion section gives some insight into how bioregions stand against political borders to organize sustainable units and facilitate the process of spatially integrated management. And finally, the paper is summed up with a conclusion.
Back to the regionalization systems, while a considerable body of national research has been conducted on determining optimal homogenous units, the current paper sheds light on two main national projects which have often attracted considerable attention.

An overview of two significant national regionalization projects in Iran

Jamab Regionalization: Research such as Water Resources Development Project, a watershed-based plan conducted by Jamab consultant engineers aimed to determine the current status of water resources and the related consumption, estimating needs and different types of water consumption, correspondingly the feasibility of water resources development in the long run in order to organize integrated water resources management in basins.
Another objective of the plan was to manage the balance between local water resources and resources consumption. Still another objective of the plan was to establish multi-purpose development, not in a specific watershed but throughout the country using different pieces of equipment and implementing optimal policies, besides the optimal use of potential water resources in order to meet economic and social needs through basins.
According to this study, the surface of the country is divided into 6 main basins and 31 sub-basins. They have been identified in terms of runoff based on topographical information as follows:

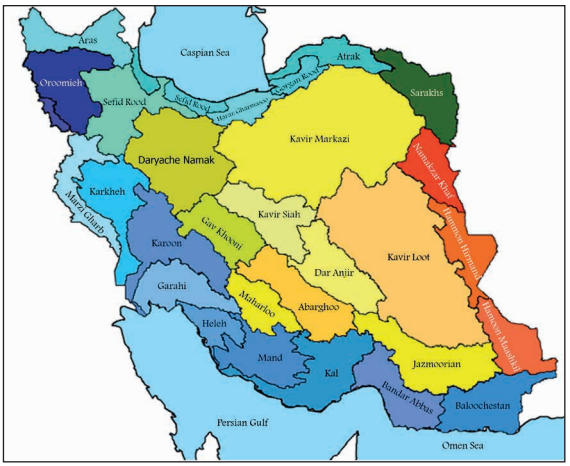
- Caspian Sea Watershed
- The Persian Gulf and Oman sea Watershed
- Oroomieh Lake Watershed
- Central Plateau Watershed Of Iran
- Eastern Watershed
- Qareqoom Desert Watershed (Figures 1, 2). (Jamab Consultant Engineers, 1991).

State Divisions **:** Several studies such as comprehensive plan on state division and the other individual sources (Comprehensive Plan on State Division, 2002; Ahmadipour et.al., 2009) have revealed that the division of state aims at dividing a territorial entity into smaller units in order to make the administration easier so far as its management, security, planning,



Six Main Basins of Iran

Fig. 1
Source: Jamab Consultant Engineering Company



31 Sub-Basins of Iran

Fig. 2
Source: Jamab Consultant Engineering Company

and development dimensions are concerned, while the ultimate purpose of this, is to provide an appropriate ground for facilitating balanced regional development and developing territorial integrity.

"[...] state division as a hierarchical structure of the administrative system determines the spatial establishment of different administrative apparatus, volume of manpower, distribution of financial resources among different sections, national and cultural interactions and the system of management assigning powers to the lower levels centralization and decentralization" (Karimipour, 2003, p.11).

From national security viewpoint Iran's Ministry of Interior (2007) maintains that a national regionalization system will be effective when it is efficient and simple, stimulating the least tension and the most cooperation possible among the districts. The experience of political unrests, especially in ethnic provinces and sensitive areas of the country has explicitly shown that what happens in practice is not in line with the optimal ideals of Iran's administrative divisions.

Based on the last changes in Iranian regionalization system, the country is constituted of 32 provinces (Figure 3) that is, it is divided into several counties which are, in turn, subdivided into districts and sub-districts. The dominant trend in the current divisions' pattern is based on population parameter, which is sometimes associated with a political factor, that is, political forces or pressures (Mirshekarian, 2007). The political and non-organic lines drawn on the landscapes of the continent have made the true nature of the land invisible. In 2013 Ahmadipour & Mirshekaran published a paper in which they pointed out: "in such circumstances, the relative stability of political units not

The latest version of state divisions of Iran
Fig. 3
Source: Jamab Consultant Engineering Company

only becomes insignificant with unstable administrative boundaries but also it becomes counterproductive and a challenge for national development". (p. 23)

Literature Review

3.1 The Principles of Bioregionalism

"Being concerned with the necessity to deal with the environmental challenges through establishing a different and more profound correlation with their landscape, environmentalists in California and US west coast put forth the notion of bioregionalism for the first time in the late 1960s and early 1970s" (Scott Cato 2013, p.11).

"From the mid-nineteenth century, in response to oppositions raised against the conventional understanding of development concept, a new philosophy entitled *Bioregionalism* was mainly proposed in North America in which development in a region takes center stage" (Sarrafi, 1998, p. 88). Taylor (2000) regards bioregionalism as "an environmental movement and social philosophy" that helps manipulate political boundaries in favor of the interests of the decentralized community that opts for liberty within political boundaries amended to mirror the natural lines of diverse ecosystem types. According to Gray (2007) bioregionalism has origins in two American idealist schools of thought under the influence of environmentalism and American regionalism movements in the United States. It has features in common with eco-socialism, eco-anarchism, and deep ecology, although it is not in exact accordance with any of them.

According to bioregional perspective due to the arrangement of physical features or life forms the earth can be sectionalized into perceptible ecological regions (Ryan, 2003). Advocates of bioregionalism hold that know the earth is via different regional presentations. In fact there

Knowledge Gap	Research Aim Determining Bioregions as spatial integrated land units	Methodology		Contribution
	Research Objectives			
Gap 1 Lacking a theoretical layout in previous studies.	**Objective 1** Considering Bioregionalism as a theoretical basis.	**Stage 1** Collecting criteria based on bioregional perspective		**Classification bioregions** Macro Bioregions Messo Bioregions Micro Bioregions
		Step 2 Elicit 10 most important bioregional factors	Step 1 Investigate the previous bioregional studies.	
Gap 2 Lacking a comprehensive collection of criteria.	**Objective 2** Providing spatial factors ranging from ecological to historical ones.	**Stage 2** Exporting descriptive features to shapefiles.		**Discussion**
		Step 1 GIS as a tool.	Step 2 Converting descriptive features to GIS polygon layers.	
Gap 3 Lacking a systematic method to identify boundaries.	**Objective 3** Identifying cartographic design system to overlay data layers.	**Stage 3** overlaying thematic polygons to design six separate zones.		
		Step 1 *Three composite maps* •Ecological Zone •Economic zone •Topographical zone	Step 2 *Three single maps* •Historical zone •Climatic zone •Cultural zone	
Gap 4 Lacking spatial integrated unit as a base for cohesion	**Objective 4** Identifying Bioregions as integrated land units.	**Stage 4** Overlaying six different zones to introduce final bioregions.		

Research Framework

Fig. 4

is no single way in which we can recognize the life system on the earth instead there are many different regional integrations called bioregions (Berry, 1988).

Advocating bioregionalism also entails attaching importance to the fact that the way human beings put their dealings with the environment into order should be dictated or influenced by natural ecosystems and cultural contexts. The gist of this idea is what we know as a 'bioregion' (Ankersen et al., 2005). When we speak of a bioregion we mean a 'life space' which is a distinctive region in that the criteria for establishing its boundaries are of natural and not political nature which takes into account geographic, climatic, hydrological and ecological character which has the capacity to serve special human and non-human living communities (Thayer, 2003).

A generally accepted definition of the bioregion is a place recognized by its forms of life, its topography, and its biodiversity, and not by what is dictated by humans so such a region is naturally governed and not under the rules and standards of governmental bodies (Sale, 1985). It is not an easy task to give a straightforward definition of a bioregion and we need to first agree on the criteria, some of the most cited

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Sale, 1985

ones used to differentiate among bioregions are as follows: 'biotic shift, watershed, land form, cultural/phenomenological concerns, spirit presences, and elevation' (Dodge, 1981). Mc Ginnings (1999) regards Bioregions as components of a culture and community and not something of a biogeographical certainty. He believes that it is the dwellers' interactions and reaction to the place where they live that set up the boundaries. We can cope with conflicting interests by trying to come up with a transparency of the region and establishing a convenient relationship between native people and the political sphere (H-y. Schelluhuber et al., 2001).

3.2 An overview of international bioregional divisions

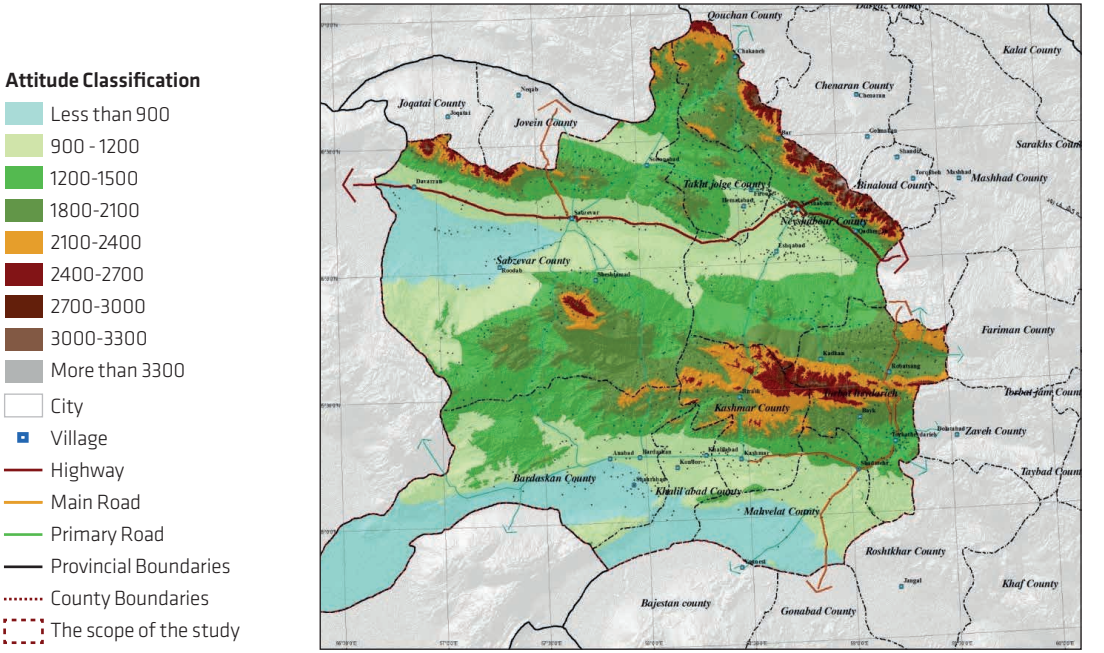
National Bioregional Planning Framework in Australia

Several studies investigating the feasibility of applying bioregionalism have been carried out on determining bioregions in different parts of the world. Australian federal government is a pioneer in implementing a bioregional plan to manage the Terrestrial biodiversity toward a society based on principals of ecologically sustainable development.

Protection of biological diversity and maintenance of ecological processes and systems is considered to be a major concern for The National Strategy for the Conservation of Australia's Biological Diversity. In order to reach the aims and objectives, a mechanism has been devised to realize biodiversity conservation through bioregional planning (Lambert et al, 1995, p.11).

The most important thing here is to determine gaps in the existing reserve system and set priorities for further measures. In view of the Interim Biogeographic Regionalization for Australia (IBRA) it underpins the bioregional structure for building an arrangement of secured zones that is powerful under climate change (Australia's Strategy for the National Reserve System, 2009, p.7).

The most recent adaptation, IBRA7, groups Australia's scenes into 89 huge topographically particular bioregions in view of basic atmosphere, geography, landform, local vegetation and species data. The 89 bioregions are further refined to shape 419 sub-districts which are more confined and homogenous



The seven-county area in Western Khorasan Razavi

Map 1

Source: Planning and Budget Organization, Office of regional planning

geomorphological units in every bioregion (Australia's Bioregion Framework, 2015).

Bioregional divisions in California

The condition of California comprises of a gigantic assortment of physical topographies. Five noteworthy atmosphere sorts – Mediterranean, highland, steppe, desert, and cool interior (California Resources Agency, 2003) – collaborate with topographic and latitudinal slopes to make a mind boggling mosaic of natural and environment designs. Such differences have increased the requirement for arranging the state into peculiar parts.

To oversee such biodiversity, the Interagency Natural Areas Coordinating Committee (INACC) depicted 10 noteworthy bioregions (tied for the slightest of the five plans). They depend on the physiographic components of the state, albeit some are changed to incorporate area administration limits (Huber, 2008, P.13). Elsewhere Huber mentions: "the particular component of this plan is the division of California's Central Valley into smaller autonomous districts: the Sacramento Valley, San Joaquin Valley, and Bay Area/Delta" (Ibid, 2008, P.15). In 1991 The California Biodiversity Council (CBC) was shaped to enhance coordination and participation between the

different asset administration and ecological protection associations at government, state, and local levels (CBC, 2009).
The point of the chamber, dissimilar to the case from Australia, was neither to begin new activities nor to include another layer of organization. It had the announced motivation for helping the improvement of methodologies and supportive strategies for preserving biodiversity (Ball, 1999, p.168).

Materials and Methods

4.1 Methodology

To date, a variety of methods are used to design regional and inter-regional boundaries: The *Weighted index Number* and *Factor Analysis Method* are often introduced to determine homogenous Regions. The boundaries of Functional Regions are also designed by *Follow Analysis* and *Gravitational Analysis*.
Out of different methods of determining boundaries, 'Cartographic Design' was adopted for this investigation to allow a graphical presentation and analysis of a large amount of GIS-based data layers simultaneously.
Maps and Mapping have been central to the development and activities of the bioregional movement since its inception (Carr 2004, p.139). Correspondingly Cartographic Regionalization Method is a method of defining regions by drafting and then superimposing a series of maps showing the distribution of important areal characteristics. The procedure may be used to divide a large area into smaller regions or to delimit a single region within a much larger area (Smith, 1995 p.15).
Flowingly, using overlay technique in Geographic Information System as one of the best software which facilitates presentation and spatial analysis of big data gathered from multiple spatial database models to determine bioregions, makes it possible to combine the characteristics of several databases into one.
It is clear that bioregional lines are rarely as sharp as administrative boundaries. That is, they are fuzzy to a large extent with flexible nature and can, therefore, be drawn in a multiplicity of ways. Moreover, determining bioregional lines is strongly related to unique characteristics of a nation. Unique historical and cultural context and a variety of socio-economic factors of each nation are at the heart of our understanding of determining bioregional boundaries.

4.2 Case Study Area

To examine the practical application of bioregional planning principles a case study was conducted. The region for this study was a seven-county area located in western Khorasan Razavi province, one of the most geographically diverse provinces of Iran.
The case area is composed of seven border cities including Neyshabour, Sabzevar, Kashmar, Torbat Heydarieh, Feyzabad, Bardaskan, and Khalil Abad (Map 1). It has a total area of

about 47241, 43 square kilometers with a total population of about 1,298,013.

The Natural Characteristics of the Case Area

In what follows, general natural characteristics of the whole study area are adopted from a number of basic maps designed by executive and research organizations in Iran.

Investigating the ecological map designed based on 'DOMARTON' system, the study revealed that the whole of the case area is located in the arid or semi-arid area (Table 1).

As shown in the table flood and piedmont plains cover 27% of the area while 38% of the region is covered by mountains and hills (Table 2).

According to the data, soil with limited agricultural capability covers about 80% of the surface area which could result in a severe limitation of production potentials and settlements as well (Table 3)**.**

As shown in the table, poor land, and poor pastures cover nearly 70 percent of the whole of the area (Table 4).

According to the table, the case area was located in two major basins: Kalshoor basin, Kavire markazi basin (Table 5).

All these factors that indicate the ecological weakness of the area and show a shortage of water resources are by far the most important limiting factor in regional development process.

4.3 Introducing GIS-based Data Layer

To import collected data into Arc GIS geodatabase properly they were converted to shape files format readable by Arc GIS, then the layers were overlaid to present new divisions. Mapping bioregions was conducted in two separate phases. Below the basic layers used to create six different zones were briefly presented:

- *Watershed Subdivisions layer* **:** Established by JAMAB (1991) was decided to be used as one of the most contributing factors which provide an explanation of the form and structure of settlements in Iran through history.
- *Iran's Climate Divisions layer:* As another important factor, this category is sufficient to characterize the climate conditions. Its items are based on the average rainfall over a period of 30 years. Climate map was created by Planning and Budget Organization in 1990.
- *Layer of Divisions of Soil:* In general terms, the characteristics of soil play a big part in agricultural capabilities. As for Iran, the basic physical features of human settlement are strongly affected by the variety of soil properties. The soil survey divisions introduced by *Soil and Water Research institute* include four groups classified in terms of agricultural preparedness.
- *Topographic Divisions layer:* They are used as a basic map developed by National Mapping Organization. They are classified in four altitude groups: Less than 1000m, 1000-1800m, 1800-2000m, and over 2000km.
- *Land Type layer:* From a geological viewpoint,

Climate	Area (Hectare)	Percent
Arid	2850441.11	68.31
Semi-Arid	1314007.93	31.55

Climate
Tab. 1
Source: Planning and Budget Organization

Land Type	Area (Hectare)	Percent
Mountain and hill	1584108.25	38.04
Plateaus and Upper Terraces	568659.62	13.65
Plains	1139733.60	27.37
Lowland and Desert	79158.70	1.9
Fan	390484.27	9.36

Land Type
Tab. 2
Source: Forest Range & Watershed Management Organization

Soil	Area (Hectare)	Percent
Limited potential soil for agriculture	1548681.32	37.19
Limited potential soil for grassland	1756258.27	42.16
Soil with no potential for agriculture	555492.06	13.34
Soil with potential for grassland	304017.39	7.30

Soil
Tab. 3
Source: Soil and Water Research Institute (SWRI)

Land Cover	Area (Hectare)	Percent
Gardens and irrigated farming	1136942.09	27.30
Rainfed agricultural land	106663.14	2.56
Poor Pastures	1742965.83	41.85
Poor lands	1177877.96	28.27

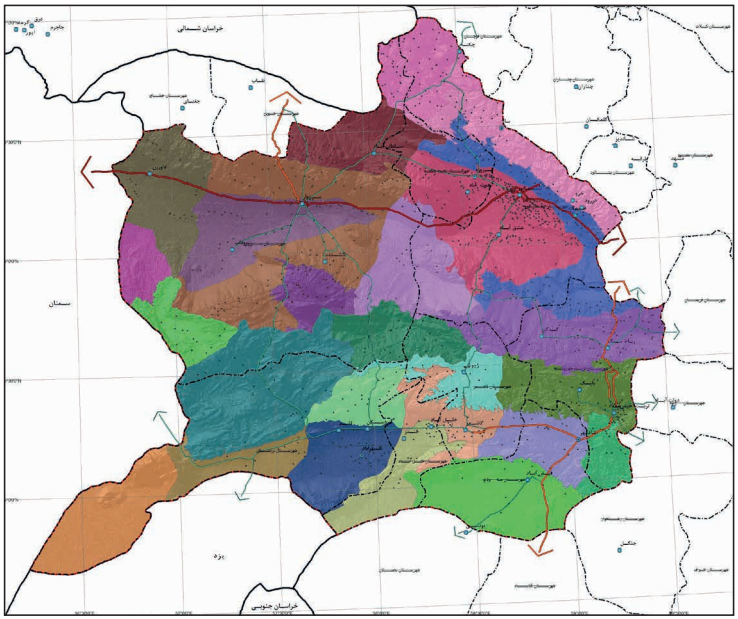
Land Cover
Tab. 4
Source: Soil and Water Research Institute (SWRI)

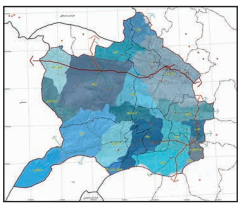
37 watershed divisions	Area (Hectare)	Percent
Kavir Markazi Watershed	4098510.57	76.35
Kaal shoor Watershed	1242536.7	23.25

Watershed
Tab. 5
Source: Soil and Water Research Institute (SWRI)

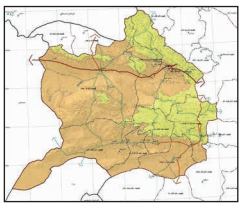
different forms of the land including mountains, hills, deserts, and plains influence local geography in such a way that a degree of settlement limit is imposed by different forms of the land.

- *Shopping patterns of rural consumers' layer:* Clearly, rural population movements into the large urban area for shopping play a key role to determine the sphere of urban areas. The required data was provided by the statistical center of Iran.
- *Climatic Classification of Iran layer:* According to the 'DOMARTON classification', the climate of the land was divided into two

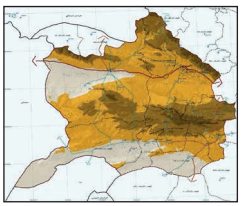




Watershed
Subdivisions layer



Iran's Climate
Divisions layer



Topographic
Divisions layer

Ecological zones across the case study area

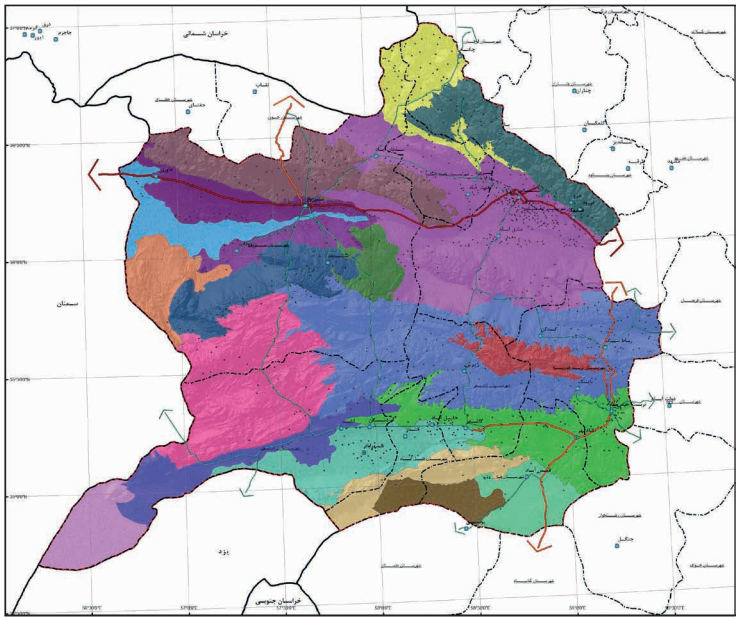
Map 2
Source: Research Findings

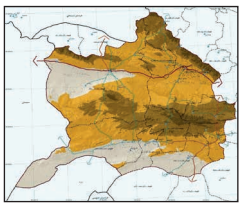
major climates: arid and semi-arid climatic zones by JAMAB consultant engineering Company in 1999

- *Cultural layer:* Given to cultural traits a cultural homogeneity was founded across the area. Persian, for example, is the dominant language the dominant religion is Shiite. Indeed, there are not any ethnical groups throughout the region.
- *Land cover layer:* distribution of land cover is an important factor in understanding the structure and arrangement of land-use activities in the area. As it can be seen, agriculture is supposed to be the major activity and agricultural land use is the most important cover.
- *Historical layer:* Tracing borders is one of the most significant ways to identify bioregional boundaries. Whereas, tested area has a rich historical background, determination of historic blocks patterns was designed based on historical data from a historical atlas of Iran.

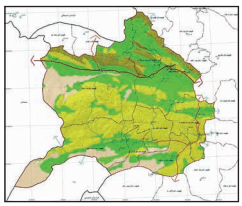
After entering spatial information into GIS and creating the primary layers, the 'Overlay Technique' is required to be applied in two steps:

- The first step *involves* the initial composition of 10 primary data layers to define the scope of each zone separately. So, in this step six zones

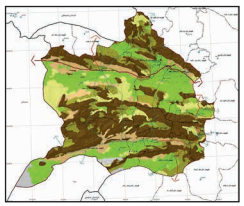




Topographic Divisions layer



Divisions of Soil layer



Land Type layer

Topographical Zones across the case study area

Map 3
Source: Research Findings

(three single and three compound zones) were produced. In this stage, using 'Overlay technique' and, given all differences, a 'Micro Zoning' map was produced as the first presentation of bioregions. After that, the principles of proximity necessitated joining smaller parts to larger districts in order to present more homogeneous districts.

- In the second phase, the six produced layers were combined to come up with the final image and determine the fuzzy boundaries of possible bioregions across the case area (Figure 5).

Results

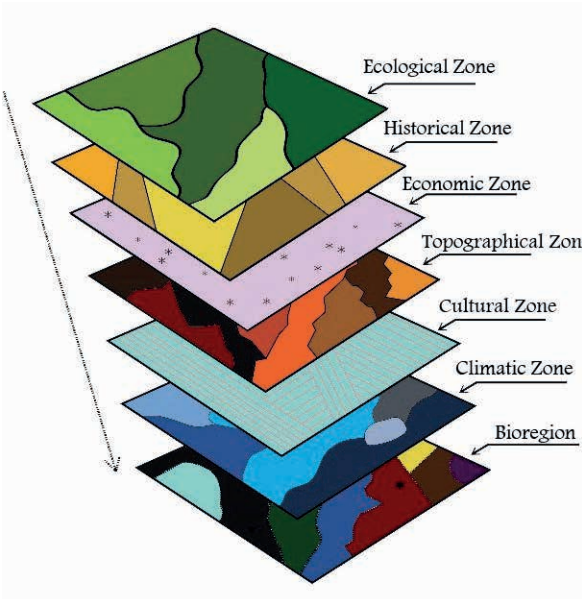
5.1 Basic Procedure and Design of Thematic Maps

Ecological Zone

Is a combination of three primary natural features which depict the main ecological characteristics of the whole area (Map 2).

Topographic Zone

This region is a combination of three major factors which portray the main topographic features of the region (Map 3).



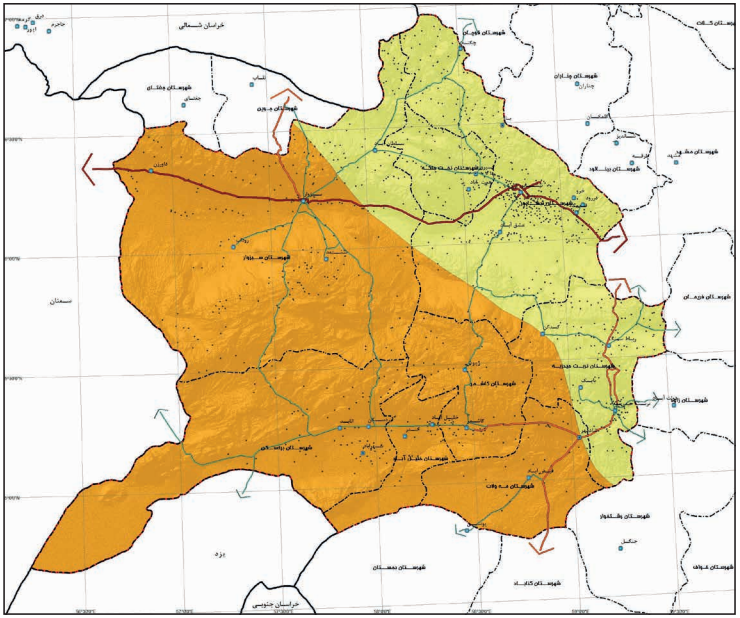
The process of overlaying six initial zones
Fig. 5

Climatic Zone
It generally represents prevailing weather conditions of the region.
Climatic Classification: According to the 'DOMARTON classification', the climate of the land was divided into two major climates: arid and semi-arid climatic zones by JAMAB consultant engineering Company in 1999 (Map 4).

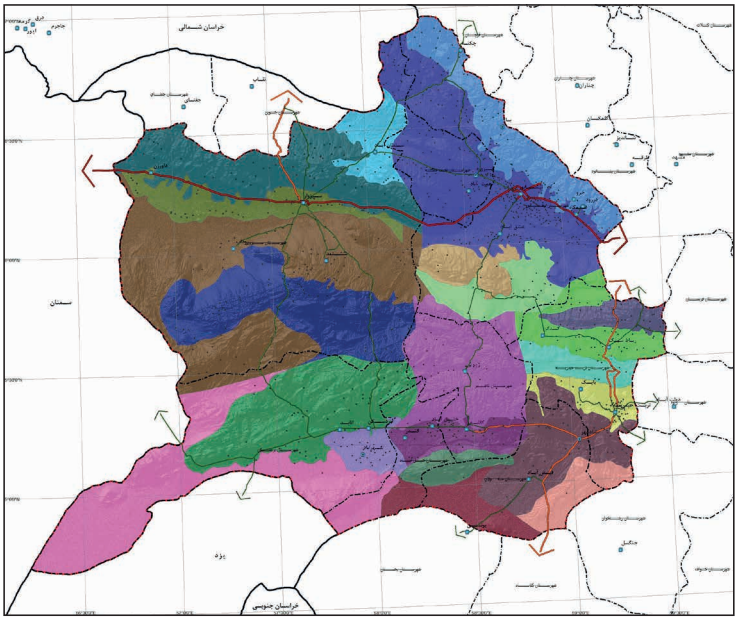
Economic Zone
highlighting the role of the local economy and putting emphasize on self-reliance concept, it plays a leading role in bioregional principles, and economic zones therefore it was shaped based on rural shopping patterns and land use (Map 5).

Historical Zone
Tracing borders is one of the most significant ways to identify bioregional boundaries. That's beyond the scope of this paper to review and address the process of changing the boundaries through history. However; it is clear that stepping back in history the clarity of historical boundaries declines, but the ancient names on historical maps provide us with a great opportunity to make assumptions about the fuzzy historical lines (Map 6).

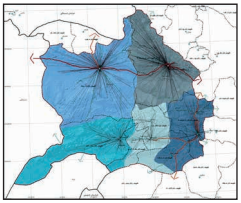
Cultural Zone
As far as the cultural characteristics of the region are concerned, there is a cultural homogeneity across the area with regard to some cultural traits. Persian, for example, is the



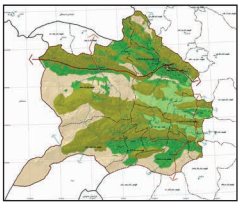
Climatic Zones across the Case Area
Map 4
Source: Jamab Consultant Engineering Company



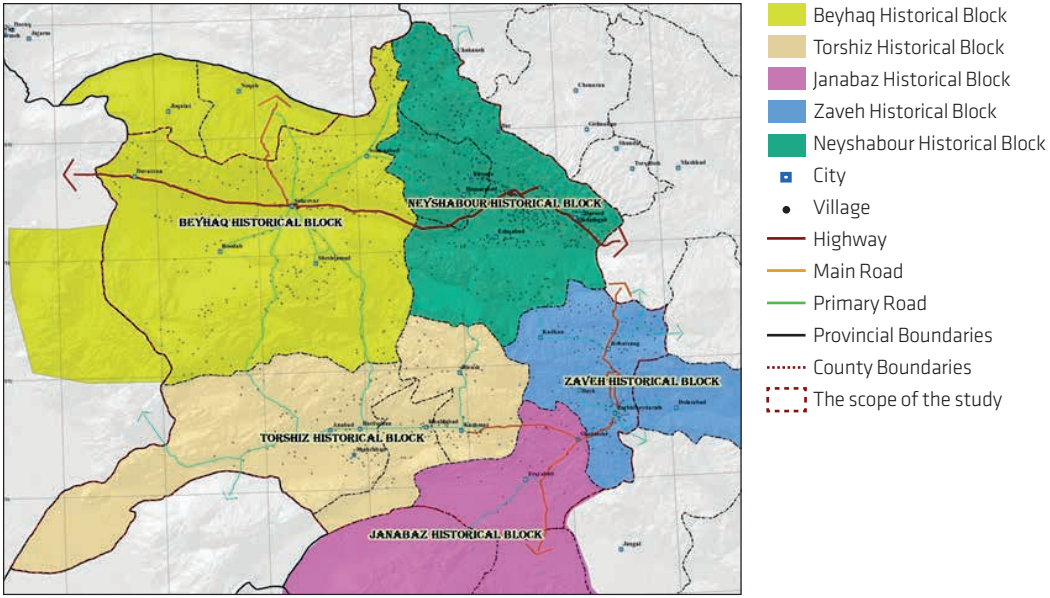
Economic Zones across the Case Area
Map 5
Source: Research Findings



Shopping patterns of rural consumers' layer



Land cover layer



Historical districts and approximate historical boundaries

Map 6

Source: Research Findings

dominant language the dominant religion is Shiite. Indeed, there are not any ethnical groups throughout the region (Map 7).

5.2. Final Combination of six main Zones to Delimit Bioregional Boundaries

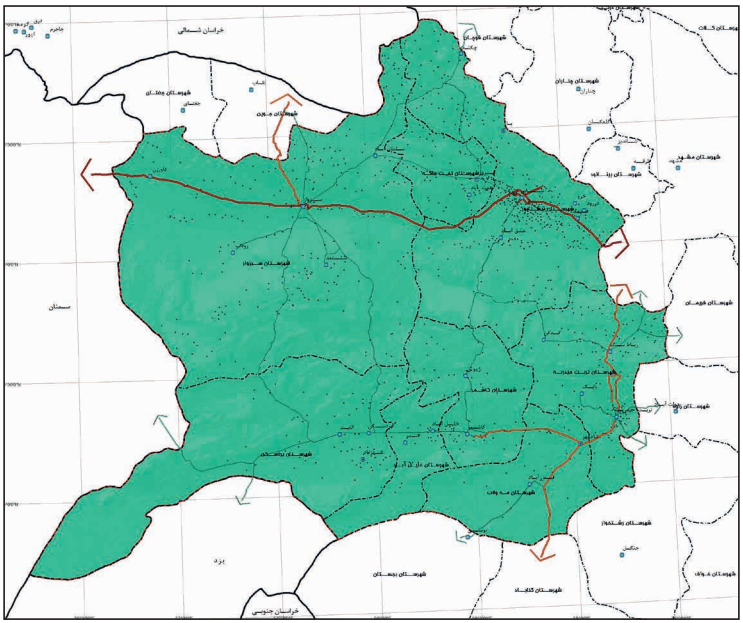
The results obtained from the preliminary analysis of bioregions across the area are shown in map 8. As can be seen on the map the surface of the land was divided into 17 bioregions each with a certain set of unique properties compared with the other one.

To reach critical mass several smaller units must be combined to make a larger level. So, given the importance of historical borders in this area according to historical neighborhoods, 17 bioregions were categorized into four main groups called 'Mezzo Bioregions' in which we determined four 'Bioregion Cores' in terms of population, capacity and area as listed in the table below (Table 6).

(Map 9). Taking advantage of our experience and knowledge of the place, we recommended that three class of bioregions be considered in a hierarchical classification chart to support a structural frame. In the following chart (Table 6), Classification model comes in three parts.

- Macro Bioregion
- Meso Bioregion
- Micro Bioregion

It is evident that 'Micro Bioregions' are the smallest parts enjoying unique characteristics presenting exclusive opportunities to identify



Homogenous cultural zone
Map 7
Source: Research Findings

each area in detail. 'Macro Bioregion' is also composed of "Meso and Micro Bioregions" in the lower levels.

Discussion

The present study was undertaken to determine the spatial units as the best purlieu of integration in the economy, community, nature, and culture in the complex geographical context of Iran.

Lack of efficacy of different regionalization systems in Iran, especially the state divisions system, in establishing a convergent and coherent space, encouraging regions to use local capabilities to reach infill development, and consequently applying human and natural scales in determining borders prompts substantial rethinking of current policies and top-down inter-organizational relationships currently applied to regionalization systems. Thus, in the light of an eco-centred approach and with emphasis on the importance of bottom-up development approaches, the present paper included a comprehensive collection of ecological, historical, and economic criteria, showing the necessity of widespread changes in the current boundaries to make them adjusted to the nature of a place and ecological principles. The findings of this study also show a significant mismatch between bioregional boundaries and the state administrative ones.

If the main goal of the state administrative divisions is supposed to be developing

Area (Hectare)	Population	Bioregion Core	Micro Bioregion	Meso Bioregion	Macro Bioregion
1465481.362	330196	Sabzevar	6	I	
900466.8345	455595	Neyshabour	3	II	
822898.8813	256079	Torbat Heydarieh	3	III	
972282.4171	256143	Kashmar	6	IV	

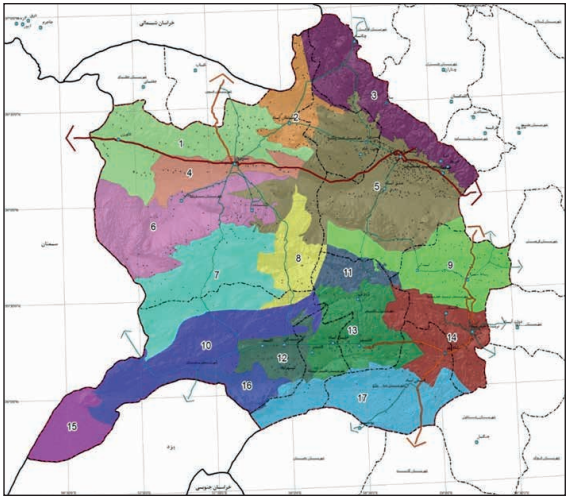
Characteristics of bioregions in details and proposed classification

Tab. 6
Source: Research findings

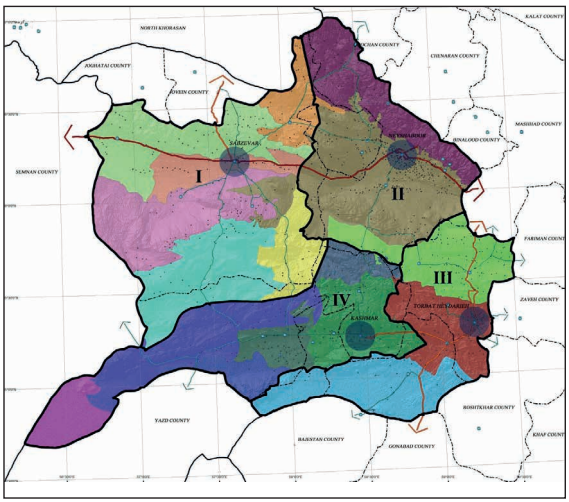
territorial integrity, sustainable development, and national security, the experiences of recent years with continuous changes in provincial and county boundaries either initiated on local officials' demands or based on political foresight of central government has led to spatial segregation across the country.
However, in the demonstrated bioregions:

1. If ecological sustainability is considered to be a key factor to move toward sustainability, the coherence and homogeneity that exist within the bioregional boundaries provide the best terrorialization criteria to be applied to integrated management strategies of natural resources.
2. Living in an area with common cultural-historical backgrounds strengthens socio-cultural bonds and expands the sense of place among its inhabitants, which, specifically, promotes community development across the area.
3. Creating an atmosphere of the feeling of territorial belonging among local residents is associated with having a 'common fate' that is generally based on their own common land and resources. Besides, decreasing negative eliminating and reductive competitions among the cities and regions ensures the security of a region and sustainability of its natural resources over time.

The result of the three factors mentioned above redefine the long-established ecological links between urban areas and their peripheral environment, while identifying bioregions as the best scale for sustainability at regional-local level, a common area in which the convergence of a set of economic, social,



The First Phase of Bioregional divisions across the study area
Map 8
Source: Research Findings



The Final Presentation of Bioregional divisions across the study area
Map 9
Source: Research Findings

and ecological factors could lead to regional synergy as a result of the facilitation and expansion of interaction between micro-bioregions. In the long run, this will result in developing regional synergy aimed at creating coherence and enhancing the biological capacity of the country.

Conclusion

Presenting a new pattern of delimiting geographical space based on 'bioregional tenet', the current study has, to some extent, paved the way to enhance our understanding of territorially integrated development and prompted a substantial rethinking of how a society could be prepared to move toward the goal of sustainability.

Widespread climatic, cultural, and historical diversity in a vast territory like Iran makes bioregions the best model for deploying local-regional potentials to reach a developmental and spatial balance at the local level.

Contrary to most of the currently existing regionalization systems which have been formed vertically and influenced by top-down relations in Iran's centralized planning system, divisions derived from bioregional boundaries promote a new form of regionalization, in which the integrity existing inside the smallest bioregional units, i.e. micro-bioregions, provides the smallest scale for local sustainability.

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