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RESEARCH ARTICLE

An Analysis of Spatial Distribution Patterns of Parthian Sites in Dargaz Plain, Khorasan

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Abstract

Considering special geographical location of Dargaz Plain in Razavi Khorasan province, identifying the cultural evolution there during the Parthian period can answer many questions about this relatively unknown historical era of Iran. Besides, it can help us better understand the origin of the Parthian culture in Northeast Iran. This research was carried out in the form of a reconsideration project during the field studies of Dargaz Plain. In this regard, Dargaz Plain was surveyed during one season, and as a result, 84 sites belonging to the Parthian period were identified. The main purpose of the research was tfo study the distribution patterns of Parthian settlements and their spatial relations with each other based on environmental variables. The most important environmental indicators in explaining the settlement patterns were analyzed via attributes such as altitude, water resources, slope, communication routes, vegetation, and land use, as well as the characteristics of the sites, including size and chronology using the geographic information system (GIS) and the cluster analysis method. The results indicate that during the Parthian period, the area witnessed an increasing growth in the nomadic population compared to permanent settlements, and in general three settlement patterns were identified: small and large villages, an urban center, and nomadic and seasonal settlements.

Keywords: Parthian Period; Dargaz Plain; Pastoral Nomad; GIS; Spatial Distribution.

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Introduction

Dargaz Plain is one of the mountainous areas located in Turkmen highlands of Razavi Khorasan province. This plain with dimensions of 50-55 km (east-west) × 30-35 km (north-south) is limited to foothills of Kopet Dag or Itak in the north, and separated from the Karakum Desert by the low mountains of Zarineh-Kuh (Kohl and Heskel, 1980: 172). The most important rivers that flow in Dargaz Plain are Zanglanlu and Dorungar, which originate from Allahu Akbar and Hazar Masjid mountains. Seasonal and permanent branches of these two rivers flow almost throughout the plain. Archaeological studies identify the existence of many settlements belonging to different cultural periods on this plain along the banks of permanent rivers and their seasonal branches. Prehistoric sites were carefully and scientifically investigated in previous studies, but there is scant research related to the historical era, especially the Parthian period. Northeast Iran definitely witnessed various political events during the Median, Achaemenid, Seleucid, Parthian, and Sasanian periods, unfortunately, we are not aware of many of them today. Therefore, our understanding of the historical era in this strategic area that acted as a bridge between East and West is insignificant. The important point is the location of Dargaz Plain which is on the northeastern borders of Iran and besides it was the origin of the Parthian dynasty. It seems that due to its special geographical location and favorable environmental conditions and potentials, Dargaz Plain played an effective role in the settlement of these tribes and the process of the Parthians gaining power.

Literature Review

During the 19th century, several travelers and tourists passed through Dargaz Plain and described it geographically. One of the travelers who provided a relatively detailed geographical description of Dargaz Plain was "Captain Napier". Further, Sir Henry Rawlinson mentioned this area in a book entitled "Roads to Merv" (Kohl and Heskel, 1980: 171). The first archaeologist who shed light on ancient artifacts from Dargaz Plain was Henry Frankfurt. In 1924, he visited archeological sites of Dargaz Plain and compared the pottery fragments of this area with Tepe Anau in southern Turkmenistan and considered these two areas to have a similar pottery industry (Kohl and Heskel, 1980: 163). After him, Izat-Allah Negahban identified and studied a number of ancient mounds and sites in northern Khorasan under the North East Survey Program in 1966 (Garajian, 1998: 2). Then, two other archaeologists, Philip Kohl, and Dennis Heskel (1980: 69-106), made a preliminary visit to Dargaz Plain in 1978 and published a brief report in the journal Iran.

After the Islamic Revolution, Mehdi Rahbar conducted eleven-season archaeological excavations between 1994 and 2006 at the Bandian site, which contains a Sasanian-era palace (Rahbar, 2006). The survey and identification of Dargaz Plain were also done by a team from the Cultural Heritage Organization of Khorasan Province under the supervision of Bakhtiari Shahri in November 1996. Further, in 1997, a supplementary program for survey and identification of Dargaz Plain (prehistoric period) was conducted by Garajian (1998: 2). Since there were not many references to the

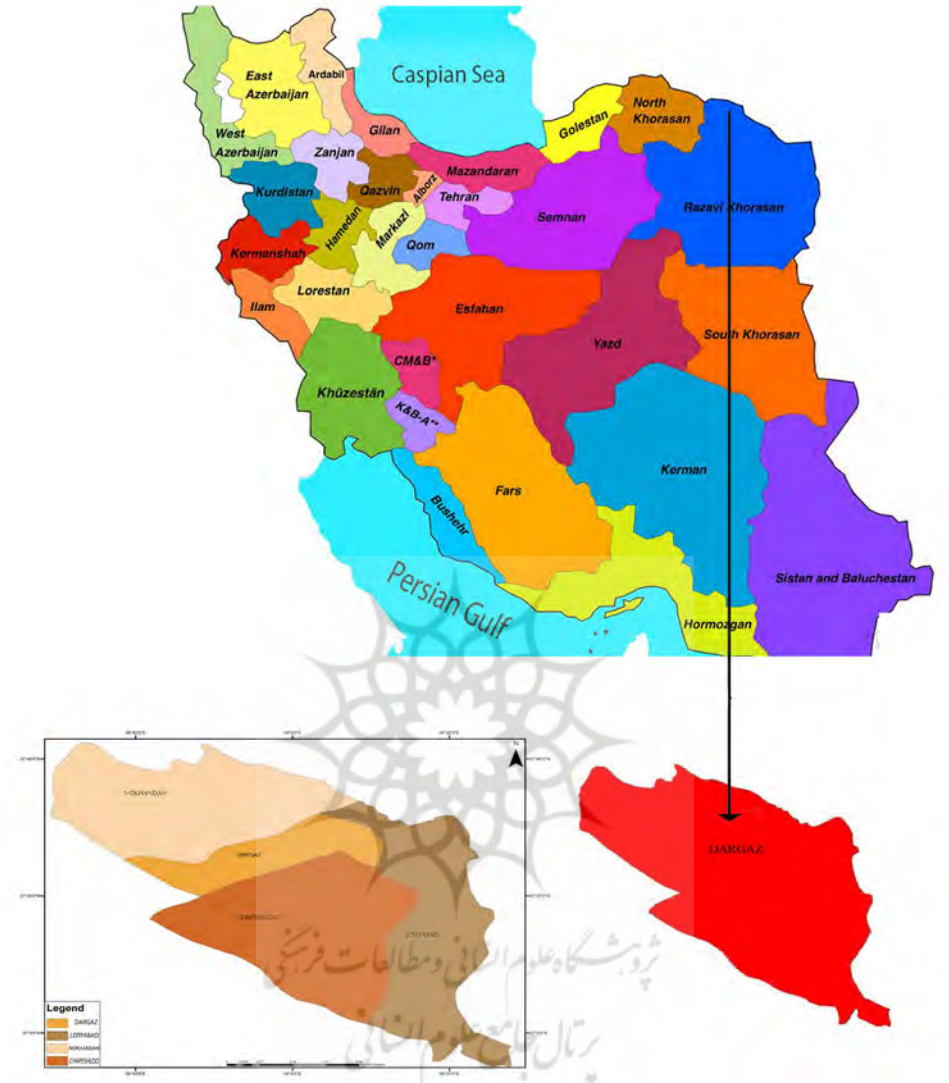

Fig. 1. The Political Geography of Dargaz Plain.
The Map of Dargaz Country Divisions (Yousefi Zoshki and Baghizadeh, 2012: 9).

Parthian sites of this area, the present research, with the study and analysis of Parthian settlements in Dargaz Plain, can be helpful in better understanding of this relatively dark historical period in Iran and especially in this area. Besides, it will contribute to understanding the cultural evolution of Northeast Iran during the Parthian period.

Materials and Methods

Choosing each of the data collection methods in archaeological surveys depends on the regional conditions as well as theoretical and practical goals of the research (Ammerman, 1981; D'Agostino & Orsi, 2015). The archeological survey of Parthian settlements in Dargaz Plain was carried out systematically in an area of

more than 4194 km². In this method, firstly, using topographical maps of 1/25000 and satellite images, the landscape was investigated in terms of geological features and environmental resources. Considering the geographical location of the study area and an emphasis on past studies and surveys, as well as limited budget and time, the major part of the fieldwork was carried out by the extensive survey method. Some areas (high plains) were studied by the intensive survey method due to the special geography and more suitable environmental conditions compared to other studied areas. In this research, 84 archaeological sites belonging to the Parthian period were identified, with many of them being devoid of the material culture of the Parthian period, had cultural materials from other periods. However, some sites identified in this field survey were single-period and only belonged to the Parthians.

In this research, the environmental study on the sites was done with the help of the ArcGIS software. This system is used to analyze all geographic information (Huxhold, 1991). The use of GIS in archaeology is a necessity due to theoretical frameworks about the role of the environment in the formation of cultures. Further, this system has the ability to clarify the relationship between archaeological data and environmental context. The study of settlement patterns deals with understanding how humans behave in the environment (Schreiber, 1996: 636). In other words, the analysis of the theoretical basis of settlement pattern (by the ArcGIS software) is based on the fact that the creation of permanent habitats by humans is not a random distribution model because human behavior is often purposeful and modelable. Therefore, settlements have been selected according to the landscape, soil, vegetation, water resources, and other characteristics (Warren & Asch, 2000: 6). Based on this, the relationship of each of the sites and clusters to the environmental variables will be measured in this research.

Geography and Climate of Studied Area

Dargaz is one of the northern counties of Razavi Khorasan province, which is situated at 37°26′44″N 59°06′28″E (Papoli Yazdi, 1988: 244) and Dargaz City is located in the center of Dargaz Plain. This area is divided into four districts of Nokhandan, Markazi, Lotfabad, and Chapeshlou according to the national divisions. Nokhandan and Lotfabad, are located in the northwest and southeast, respectively (Fig. 1) (Saeidian, 2000: 419, 768, 853). Dargaz Plain is bounded from the south by the Kopet Dag mountain range and Hazar Masjid, and from the north by the Karakum Desert. Geographically, these two factors have important effects on the climatic conditions of Dargaz (Geographical Organization of the Armed Forces, 2005: 7-8) so that the temperature increases from west to east (Velayati, 1991: 97). According to the meteorological data of Dargaz, the maximum temperature in this area is 42°C and the minimum temperature is -17°C. As such, the temperature difference in this area is 59°C (The Geographic Culture of Country's Villages, 2005: 8). The amount of precipitation in different parts of this land depends on the topography and altitude. For this reason, the precipitation is about 400 mm in the heights and the foothills

Table 1. Number and Chronology of Sites Identified in Previous Studies

Research	Period	Number of Sites	Total
American Archaeology Team Survey in 1987 (Kohl & Heskel, 1980)	Chalcolithic	2	32
	Bronze	2	
	Achaemenid	18	
	Sasanian Period	18	
	Islamic	21	
Survey of Khorasan Cultural Heritage Organization in 1996 (Bakhtiari Shahri, 1996)	Prehistoric	18	111
	Historical	54	
	Islamic	49	
Specialized studies of prehistory in 1997 (Garajian, 1998)	From the Neolithic to the Bronze Age	22	-
New studies in 2011 (Yousefi Zoshk & Baghizadeh, 2013)	Neolithic	2	35
	Early Chalcolithic	4	
	Middle & Late Chalcolithic	6	
	Bronze	17	
	Yaz I & 2, Achaemenid	6	

Table 2. The Number and Percentage of Sites Identified in Districts

District	Points	Percentage of Points
Central	40	47.05%
Nokhandan	20	23.52%
Chapeshlu	15	18.82%
Lotfabad	9	10.58%
Total	84	100%

of Hazar Masjid, and in the north and in the lowlands, due to the influence of the Karakum Desert and the low altitude, the precipitation decreases (The Geographic Culture of Country's Villages, 2005: 9). In terms of the water resources of Dargaz Plain, it is a part of the Karakum subbasin. There are many seasonal rivers flowing in this area, which are not very important, but its main rivers are Dorungar, Zanglanlu, and Lainsu. Three aquifers have also been identified in this area, which are separated from each other by limestone heights. These aquifers are (a) the underground water table along the Dorungar River, (b) the underground water table between the Dargaz-Quchan road in the east and around "Taj-o-din village" in the west, (c) the underground water table around the Chapeshlu District (Velayati, 1991: 100-101).

Geologically, this area is considered a part of the sedimentary region of Kopet Dag. This zone, 600 km long and 200 km wide, was formed as a result of organic movements after the Middle Triassic and after the joining of Iran and Turan plateaus to each other (Velayati, 1991: 96-115).

Morphologically, it is in its young stage and topographically, it has a direct relationship with the geological formations. Anticlines have formed the mountains, and synclines have created most of the intermountain plains (Afshar Harb, 1994: 9). In general, Dargaz Plain has three prominent and legible morphological features: The foothills that surround the plain from all sides with a gentle slope and can be cultivated only on the banks of the seasonal rivers and places where the spring water reaches the level of the plain; Another feature is the river valleys, the most important of which is the Dorungar River valley, which is located in the center of the plain; The third feature is plain, which covers the distance from the river banks to the foothills (Yousefi Zoshk *et al.*, 2012: 8).

Parthian Sites of Dargaz Plain

As mentioned, this research was carried out in the form of a reconsideration project during the field studies of Dargaz Plain in order to clarify the Parthian cultural evolution. 84 sites belonging to the Parthian period were identified, many of which were multi-period and some were single-period. It is noteworthy that in previous studies, there was not much mention of the Parthian sites in this area.

The surveyed area consists of four districts. The largest number of sites was found in Central District with 47.05% and in second place was Nokhandan District located in the south of Central District.

The relative chronology of the sites was based on typology and comparative studies of pottery, and referring to archeological studies in Northeast Iran and neighboring areas in southern Turkmenistan, Afghanistan, and Pakistan. It is noteworthy that in this area, due to several reasons, including the lack of detailed scientific studies on the pottery of different historical periods, it is very difficult to accurately distinguish the periods. Of course, the prehistoric pottery of this area is relatively well known, but from the beginning of the Yaz period to the end of the historical period, there is a serious problem in recognizing and classifying the pottery. Based on internal research and scientific studies conducted over the past few decades outside the borders of Iran (southern Turkmenistan and Central Asia), it is possible to get a brief understanding of the characteristics of the pottery of each period. Therefore, the separation of periods requires excavation and stratigraphy because several factors are effective in distorting the data in field surveys. However, based on past studies and classifications, the sites are divided into the following 4 groups:

a) 20 sites (16.80%) belonging only to the Parthian period.

b) 49 sites (33.58%) (41.17%). with evidence of the Parthian and pre-Parthian periods. In most of these sites, Parthian settlements were formed temporarily and in the high part of ancient mounds. For example, in the site of Yarim Tepe, which was systematically surveyed, evidence of the Parthian period was identified in two squares of the upper part of the mound (Sheikh, 2014).

c) 37 sites (31.09%) have evidence of the Parthian period and the periods before and after. These sites usually

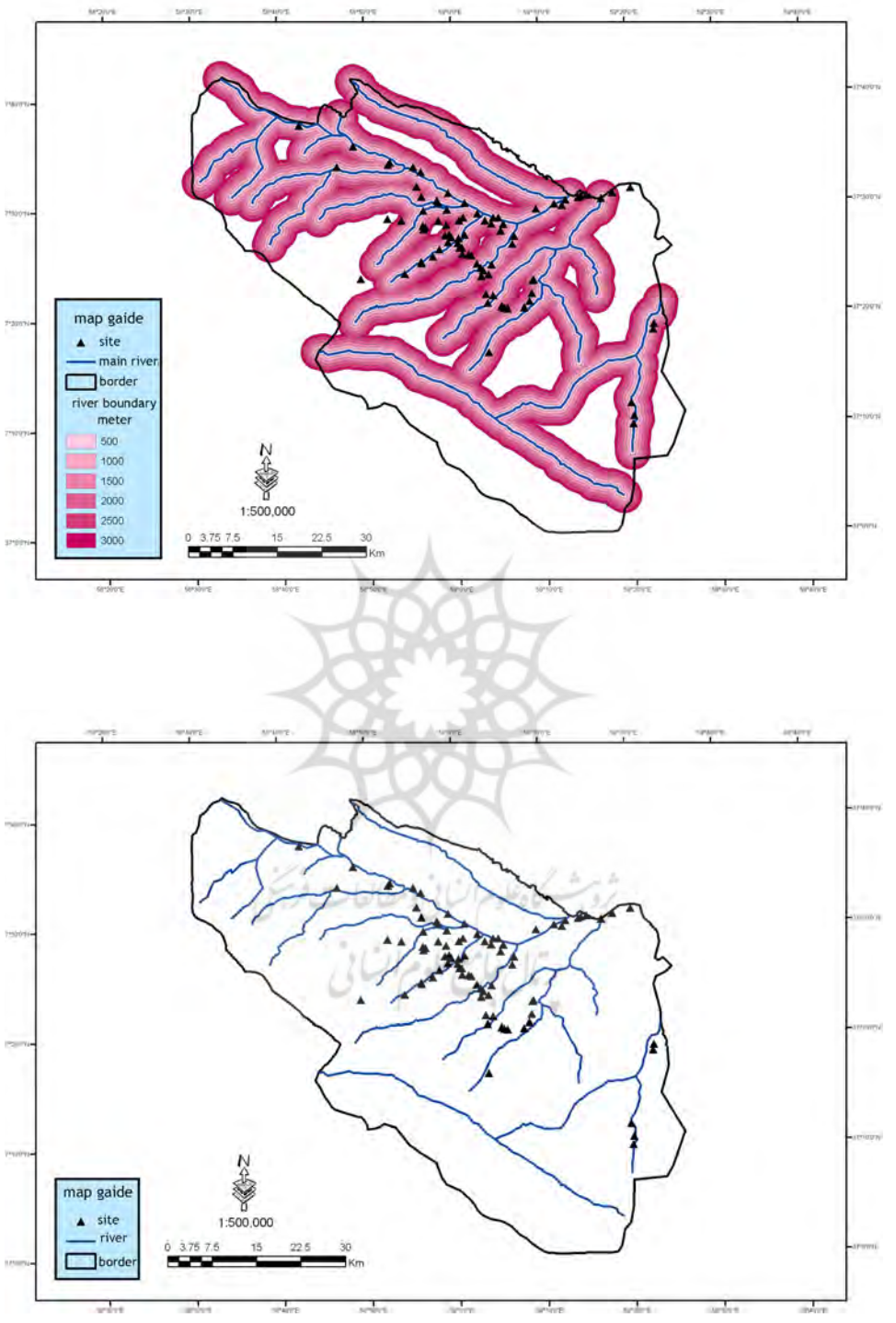

Fig. 4. Location of Sites in Relation to Rivers and Altitudes
a) Location of Sites in Relation to Boundaries of Rivers; b) Location of Sites in Relation To Main Rivers

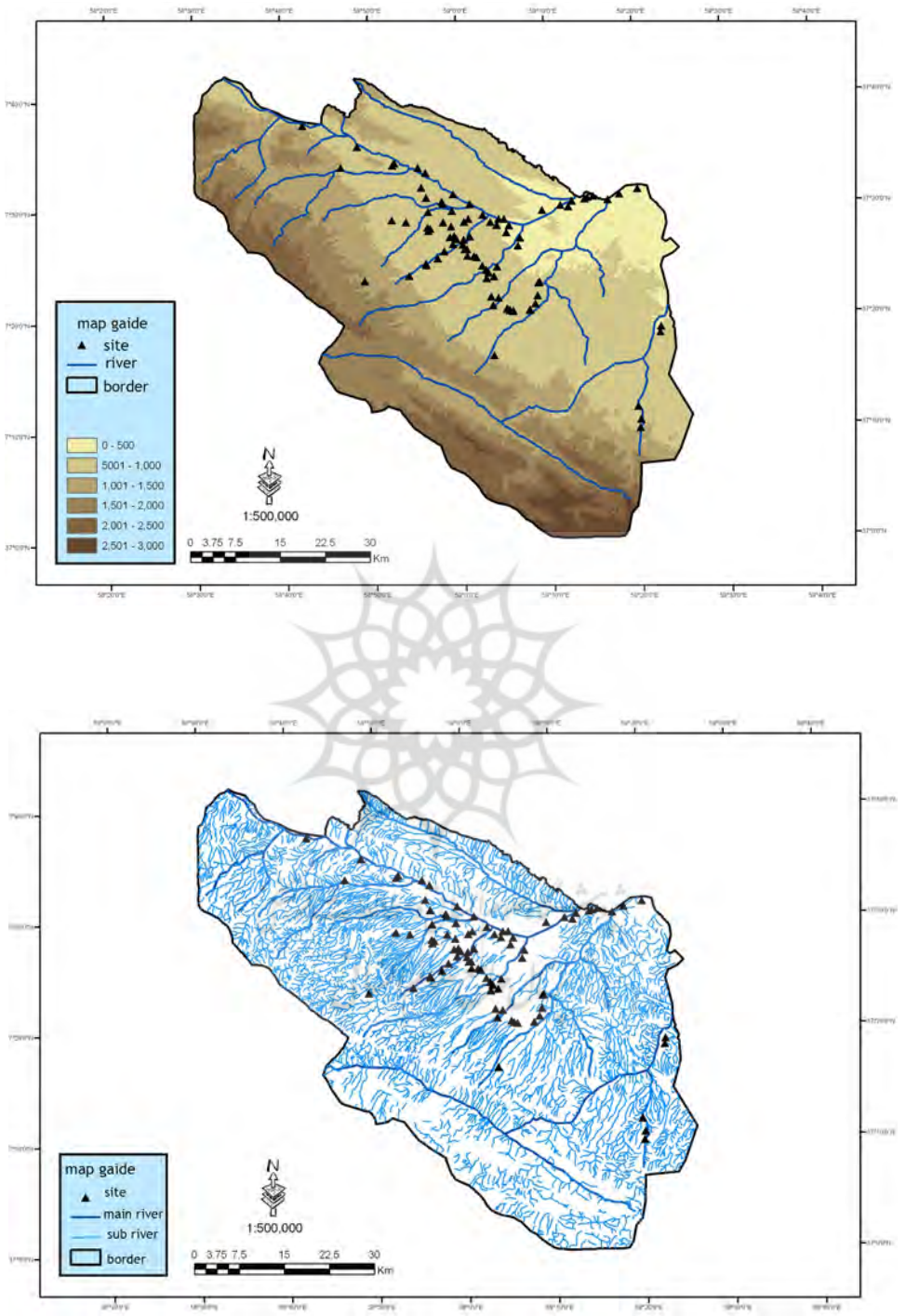

Fig. 4. Location of Sites in Relation to Rivers and Altitudes
c) Location of Sites in Relation to Main Rivers and Altitudes; d) Location of Sites in Relation To Small

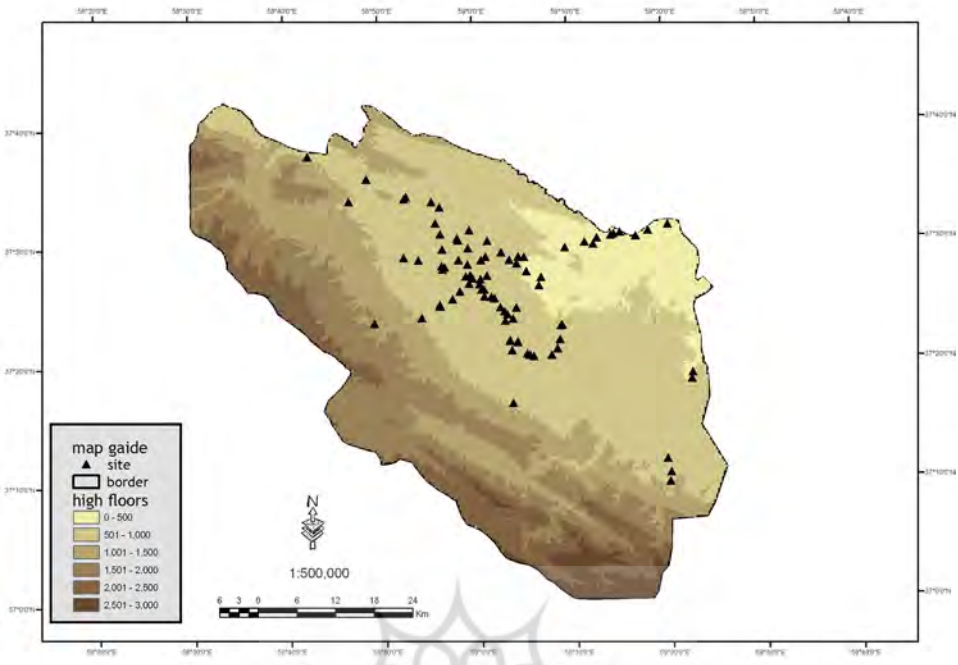

Fig. 5. Location of Sites in Terms of Altitude

have a sequence of stratigraphy from prehistoric times to the Islamic era.

d) 13 sites (10.92%) have evidence of the Parthian period and later periods such as the Islamic era. In some cases, there is evidence of the Sasanian period, which cannot be easily distinguished due to the lack of sufficient knowledge.

Area of the Parthian Sites

According to various surface finds belonging to different cultural periods, not the total area can be attributed to the Parthian period. Most of the Parthian sites contain settlements that were inhabited in different periods, and sometimes modern villages formed around them. Therefore, the area parameter cannot be used to analyze the Parthian settlement patterns in Dargaz Plain. The Parthian sites, in terms of area, are divided into the following groups:

1. Smaller than 5000 m²: 27 sites
2. Between 5000 and 15000 m²: 20 sites
3. Between 15,000 and 30,000 m²: 19 sites
4. Between 30,000 and 60,000 m²: 14 sites
5. Larger than 60,000 m²: 3 sites. In this group, 2 sites are smaller than 10 ha and only one site is larger than 60 ha.

Spatial and Environmental Analysis of the Parthian Sites

In this research, a series of variables and influential factors were investigated to analyze the spatial distribution patterns of the Parthian sites in an environmental context. The variables include the loca-

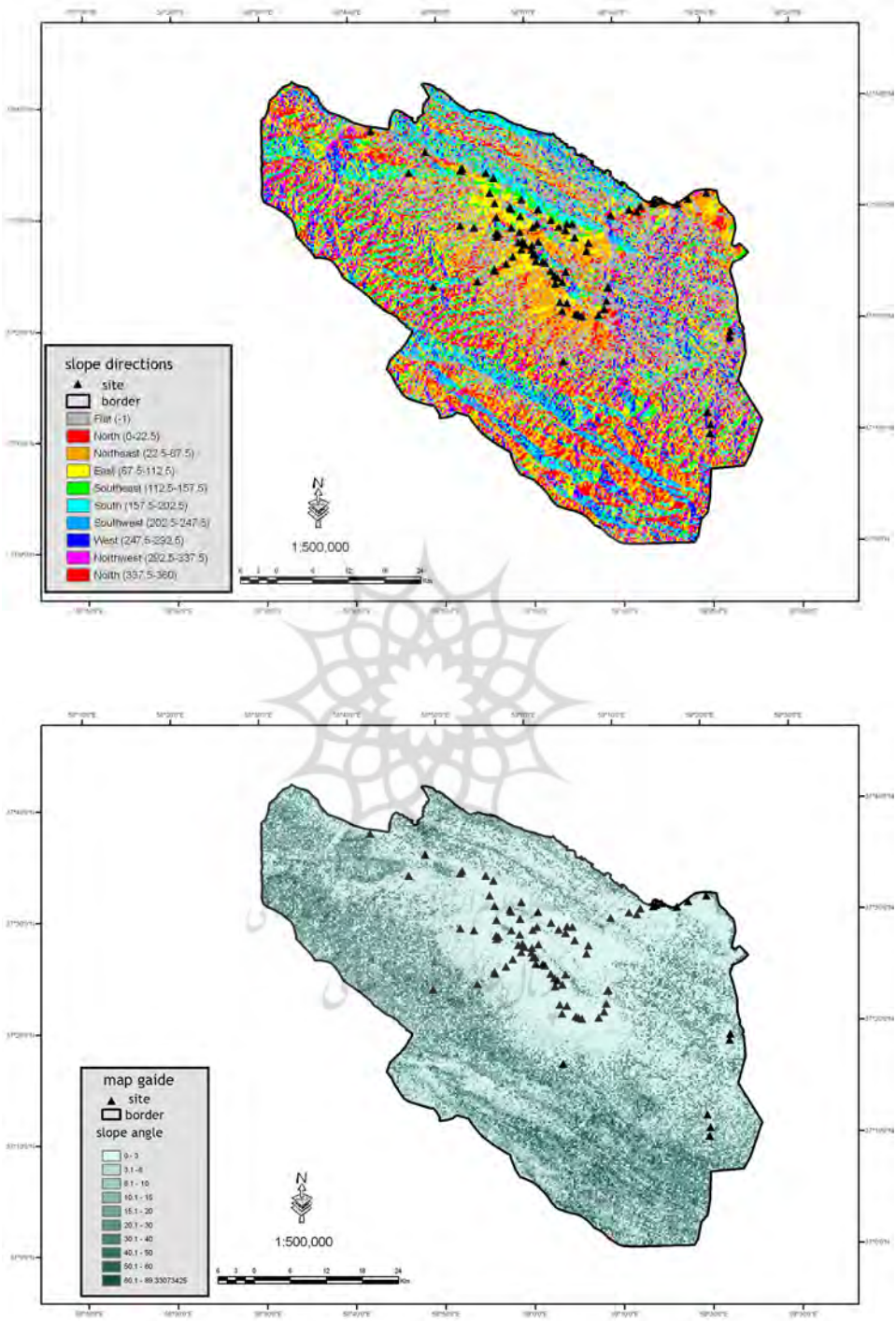

Fig. 6. Location of Sites in Terms of Slope Angle
Location of Sites in Terms of Slope Direction

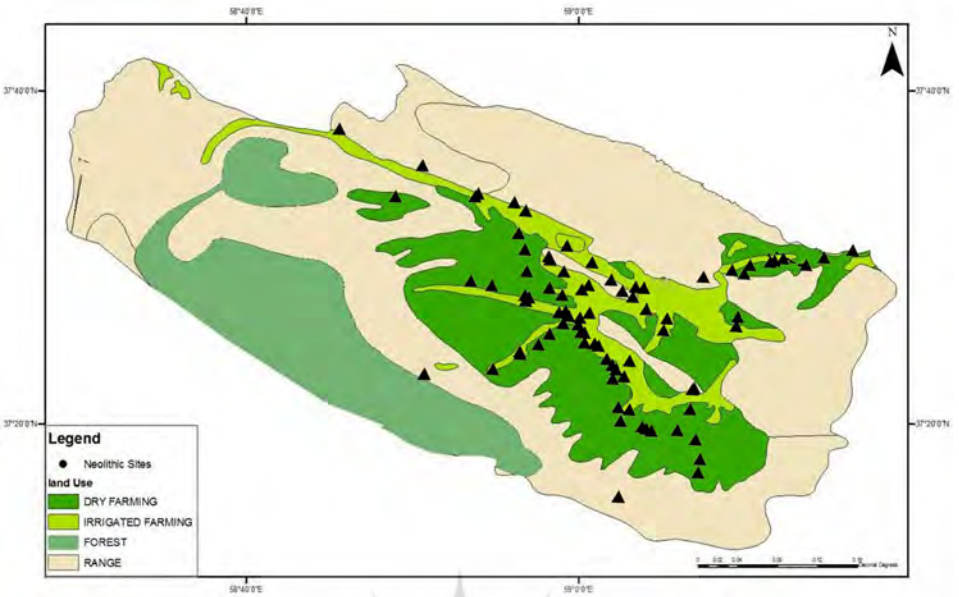

Fig. 7. Location of Sites in Terms of Land Use

tion of sites in relation to water resources and communication routes, altitude, land use, the potential of agriculture, and land slope which have played an important role in the formation of settlements and cultural evolutions.

Location of Sites in Terms of Access to Water Resources

Water resources and ease of access to water have been among the most important reasons for the formation of settlements from the past to the present day. Considering the climatic and geomorphologic conditions, the studied area benefits from the rich surface and underground water resources. Therefore, Dargaz Plain has relatively good conditions in terms of access to water. Besides Daroungar and Zangelanlu rivers and their branches, it is also rich in underground water resources. In this area, all settlements have depended on water including permanent and seasonal rivers, springs, wells, and aqueducts. In general, the characteristics of water resources played an important role in the formation, location, area, and expansion of settlements, as well as the sequence of cultural materials, and considered most important factors in determining the spatial distribution patterns of archaeological sites in this plain.

The distance of sites from water resources is divided into the following groups:

a) 30 sites at a distance of less than 500 m;
b) 18 sites (21.42%) at a distance between 500 and 1000 m;
c) 11 sites at a distance between 1000 and 1500 m;
d) 14 sites at a distance between 1500 and 2000 m;
e) 4 sites at a distance of 2500 m;
f) 4 sites at a distance of 3000 m;
g) 3 sites at a distance of 3500 m;

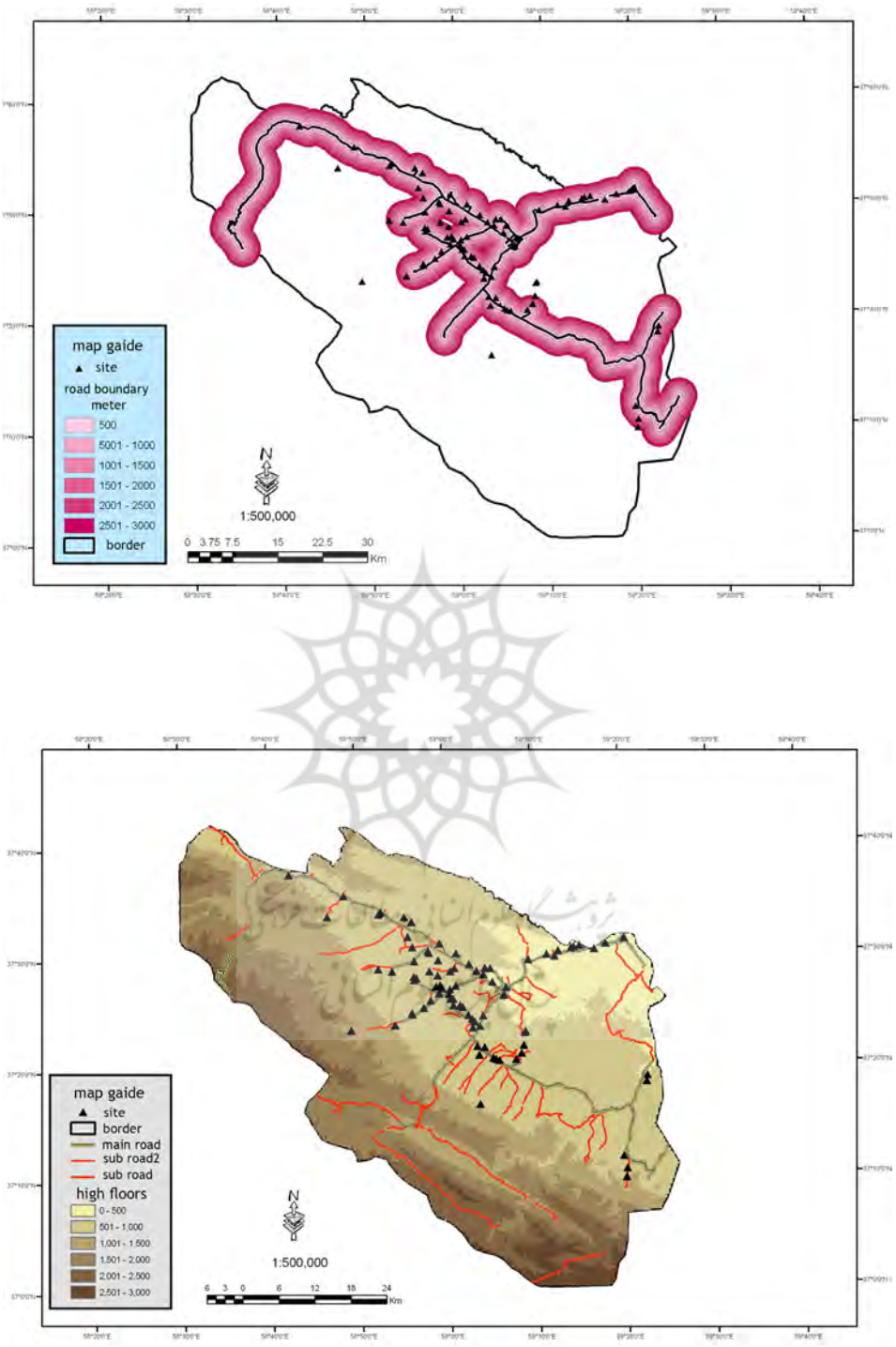

Fig. 8. Location of Sites in Relation to Communication Routes.
Location of Sites in Relation to Certain Distances from Communication Routes

h) 2 sites at a distance of more than 3500 m.

Considering the location of the sites in relation to water resources and in terms of their characteristics, there are 19 sites (22.61%) located on the banks of the Dorungar River, 5 sites on the banks of the Zanglanlu River, and 60 sites (71.42%) on the banks of permanent and seasonal branches of these two rivers (Fig. 2).

Location of Sites in Terms of Altitude

The altitude factor has always played an important role in the formation of habitats and settlements because temporary settlements of pastoral nomads are usually formed on high altitudes and villages on low altitude areas and plains. The altitude of Parthian sites in Dargaz Plain varies between 276 and 1200 meters above sea level (masl). Therefore, the location and distribution of the sites in terms of altitude are as follows:

Areas in the altitude range between 276 and 600 masl are considered important population centers and agricultural areas of the plain. 32 sites are located in this altitude range, which includes 39.09% of all sites. 49 sites (33.58%) are located in the altitude range between 601 and 900 masl, which are topographically in the foothills and plains. Only 3 sites (3.57%) are located at an altitude between 901 and 1200 masl, which includes relatively high areas with steep slopes and folded heights. Therefore, the highest percentages of sites are located between 276 and 600 masl. In this part, there were favorable environmental conditions for the formation of settlements in the Parthian period. In other words, this altitude range was suitable for the pastoral nomad subsistence system in the Parthian period, besides it had the best conditions for access to water resources, limited irrigated farming, and rainfed agriculture (Fig. 3).

Location of Sites in Terms of Slope

The location of the sites in different slopes is as follows:

a) 5 sites were identified in areas with a slope of 0 to 3 degrees, i.e. r sedimentary lands.

b) On a slope between 3 and 6 degrees, 73 sites, that is, the largest number of settlements was identified because these areas have both agricultural capabilities and pastures. Among the sites found on this slope, 37 are located on the plateau and upper terraces, and 36 in the plains.

c) 5 sites (95.5%) are located on a slope between 6.1 and 10 degrees, which includes hills and low mountains.

d) No site was found on a slope between 11 and 24 degrees.

e) Only one site was identified on a slope of 25 degrees, which is considered a relatively high area.

In terms of slope direction, most of the sites, i.e. 65.47% (55 sites) are located in eastern and northeastern directions and 34.52% in other directions. Therefore, the distribution and number of sites can also be investigated in terms of the angle and direction of the slope (Fig. 4).

Location of Sites in Terms of Vegetation

Types of land, soil, and vegetation have

Fig. 9. Aerial Map of the Shahr Tepe Site (Google Earth, 2023)

been important factors in choosing the location of settlements. According to the classification of Khorasan Razavi Pastures and Land Affairs Organization, the lands of this area are divided into several groups:

1) The first group is the ones that are currently used for agriculture and are usually located on the banks of rivers or their main branches. In the division, this group is named "very suitable for irrigated agriculture and gardening".

2) The second group is suitable for rainfed agriculture and not possible for irrigated agriculture. In the past, such lands had good pasture conditions, but due to excessive grazing, their capabilities have been reduced so that today they are only capable of rainfed cultivation. This group is called "dry agriculture".

3) The third group "land with moderate capacity for controlled grazing", is located in higher areas.

4) The fourth group is "forest lands".

In this research, the lands of the second and third groups were combined with each other because both have favorable pastures and suitable conditions for herding and meeting the needs of nomads. In general, 41.66% of all the sites are located in lands that are currently suitable for irrigated farming (first group). 32 sites are located in the second group and 16 in the third group. In total, 48 sites (57.14%) are located in lands that had been of interest to pastoral nomadic communities in the past and today due to having suitable pastures. The two sites named Rajaba Castle and the site of Zelzeleh-Kharab-Qozloq are also located in rocky and mountainous areas (Fig. 5).

Location of Sites in Terms of Communication Routes

The communication routes, from which, the distance of the settlements is measured make communication within the plain possible. The main road, which is located in the center of the plain, due to its topographical conditions connects Dargaz Plain with inside and outside of

Iran. In other words, it is a natural passage for entry and exit. Cameron (1976) believes, through the natural passages and from the northern and northeastern borders of the Iranian plateau, despite several mountain ranges, people with the Mousterian culture (Middle Paleolithic) went to Turkmenistan and Central Asia or entered the Iranian plateau from through Khorasan. Based on archaeological findings and ancient texts, it can be inferred that this situation continued in later periods as well. About three thousand years ago, the Aryans started their migration from the plains of southern Siberia along certain routes to warmer lands, and a group of them passed through Bactria and entered the plateau of Iran through Merv, Sarakhs, and Tous (Pirnia, 1991: 25).

In general, according to historical sources and archaeological evidence, as well as the topography of the region, it seems the modern road that passes through the center of Dargaz Plain and provides the possibility of connecting this plain to the neighboring areas such as the plains of southern Turkmenistan in the north and Mashhad and Quchan plains in the south and west, respectively, is probably a similar model of the ancient roads which has been used since the past with minimal changes. A look at the distribution of ancient sites from the Bronze Age to later periods, especially the Parthian period, and even modern urban areas and villages clearly confirms this similar pattern.

The distance of the sites of Dargaz Plain from the communication routes is between 500 and 3000 m and 35 sites (41.66%) are located at a distance less than 1500m from the main routes. This shows the important role of these routes in cultural exchanges and interactions and the flourishing of civilizations in this area. Moreover, it confirms the arrival of Parthians through these communication routes.

Analysis of Settlement Pattern Based on Research Findings

As mentioned, the main issue of this research is the study of the spatial distribution of Parthian settlements and their relationship with each other and with the environment based on variables, which leads to the recognition of settlement patterns of the Parthian-era geographical region. One of the best methods for measuring the similarity of the environmental conditions of ancient sites is cluster analysis. A cluster refers to a set of data that are similar to each other. In the cluster analysis, the units of a homogeneous group are similar to each other and have the most different from the units of other groups (Akbari and Zahedi, 2008: 257). This method in habitat clustering, determination of inter-regional cultural boundaries, and chronology of ancient sites is of special importance. Archaeologists apply the technique and statistics of cluster analysis for such purposes (Kettenring, 2006). In this method, certain predictions should be considered, which are explained as follows:

1. Each unit must belong to only one cluster. It means that none of the clusters have a common unit.
2. The clusters must have units belonging to the statistical society. None of the clusters must have more than the members of the statistical society.

3. All clusters must be distinct from each other, that is, there must be no overlapping or deletion of units (Taleie, 2002: 194).

The cluster analysis is used to measure the similarity of Parthian settlements through environmental conditions, types of sites, and their extent. In this way, each of the clusters determined by this analytical method can represent a settlement pattern.

Group A

This group with 57 sites constitutes about 67.85% of the total sites of the Parthian period in the study area, which includes small and large villages with a linear pattern along the main rivers and their tributaries. The settlements have been formed on fertile and alluvial lands that have suitable conditions for agriculture. Another feature is the location of the sites at a distance of 500 to 3000 m from the main communication routes of the region, which existed in the center of the plain and parallel to the Daroungar River, and provided the possibility of entry and exit, and cultural and commercial exchanges.

In terms of altitude, some sites of this cluster have had the lowest height above sea level. These sites are at an altitude between 276 and 700 masl and on the flat part of the plain with a slope of less than 6 degrees. Having the most fertile sources (alluvial soils) and also being close to relatively rich water resources (Fig. 2) made these sites very suitable for agricultural activities. However, there has been no possibility of extensive animal husbandry due to the lack of suitable pastures. It is worth mentioning that today's villages are also formed on the banks of main rivers and their branches, and their subsistence economy relies more on agriculture. There is also limited animal husbandry. This issue illustrates the continuity of human behavior in relation to the environment. On the other hand, due to favorable environmental conditions, all the sites of this group are multi-period and have been inhabited since prehistoric times. In most of these sites, temporary Parthian settlements exist on the elevated part or around.

Group B

This cluster with 28 sites (33.3%) is related to the high and uneven areas. These are located at an altitude between 600 and 1200 masl and at a slope between 5 and 25 degrees, in pasture lands with relatively low to semi-dense vegetation. The sites of this cluster are on the flat terraces of the banks of the main branches of rivers, originating from Allahu Akbar Heights, and on the Daroungar River. These sites were certainly related to nomadic communities of the Parthian period because most of them are single-period and sometimes temporary settlements that were formed on natural beds in a superficial and extensive way. These areas have favorable conditions with regard to access to water resources and pastures for pastoral nomads and also today attract pastoral nomadic communities. Some of these areas are located in lands that are currently used for rainfed cultivation. The sites of this group are mostly large, with an average area of 25,283 m2. The largest site of this group is Kejdar I with an area of 8.6 ha and the smallest is Tepe Palkanlu I with an area of 0.2 ha.

Group C

This cluster includes only site called Shahr Tepe, which is the largest settlement identified in Dargaz Plain with an area of 60.4 ha. Shahr Tepe is located at a distance from two seasonal branches of the Dorungar River, on low natural mounds. The remains of the city wall can be clearly identified in some places, and probably, river branches located on both sides of the city were effective for its defense and security. This large site is located at an altitude of 699 masl and the slope is between 3 and 6 degrees. This area has favorable conditions for agricultural activities due to suitable soil and access to water resources. Shahr Tepe was a city belonging to the Parthian era and it seems that its oldest artifacts are related to the Middle and Late Bronze Periods (Garajian, 1998: 107). The map of the city is in the shape of an irregular triangle and in some places, the remains of architecture and large mud bricks can be clearly seen, which indicates the special application of architecture in regular urban spaces (Fig. 7).

Conclusion

The analysis of the information from this survey shows that environmental factors such as distance from water resources, soil type, altitude, slope, and distance from communication routes played important roles in the formation of Parthian settlements in this area. Spatial distribution patterns of settlements have also been strongly influenced by these environmental factors. Meanwhile, water resources are considered the most important factor as it had important role in the site selection, formation, size, and expansion of settlements, as well as the sequence of cultural layers. The location of the Parthian sites in this area, in terms of water, is different from sites belonging to the previous and later periods. Only 24 sites are located on the banks of the permanent rivers of Daroungar and Zangelanlu, and 60 sites (71.42%) are on the banks of permanent and seasonal branches of these two rivers. In terms of altitude, the output maps show that more sites, i.e. 58.33%, are located in the foothills. These parts have the best conditions for accessing water resources, rainfed cultivation, limited irrigated cultivation, and grazing animals and so were suited to the subsistence system of Parthian nomads. Besides, in terms of the location of the sites in relation to the type of land use and vegetation, the outputs indicate the formation of the highest percentage of settlements in pasture lands. These lands from the past up to now, due to having suitable pastures, have attracted pastoral nomadic communities.

In order to better understand settlement patterns, the analysis of similar clusters was used. In general, three settlement patterns were identified: (1) small and large villages, (2) nomadic and seasonal settlements, and (3) an urban center.

The first cluster is located with a linear pattern along the main rivers and their branches, as well as the communication routes, in the fertile and alluvial lands of the river banks. These areas have suitable conditions for agriculture and limited animal husbandry. All the settlements of this group are multi-period. Today's villages have also been formed next to these water flows, which

shows, the continuity of human behavior in this landscape.

The sites of the second cluster were formed in pasture lands and usually on the flat terraces of the banks of the main branches of the rivers. These sites are often single-period and sometimes temporary settlements on natural beds and were probably related to nomadic communities of the Parthian period. Currently, these areas are still considered suitable for pastoral nomads.

The third cluster includes a site called Shahr Tepe, which is a city belonging to the Parthian era due to factors such as its location, size, fortifications, and surface evidence.

In general, studies illustrate that this area had seen an increase in the population of pastoral nomadic communities and the formation of settlements suited to this subsistence pattern.

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