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Examination of the Temporal-Spatial Distribution of Ancient Sites in the Qezel Ozan River Basin, the eastern region of Kurdistan Province, Iran (1st Millennium BCE), with a Focus on Geographic Information System (GIS)[1]

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Abstract

Background and Objective: Human societies have long enabled settlements by creating habitable environments that are suitable for their surroundings. In archaeology, this approach emphasizes the significant role of environmental factors in evaluating settlements within each period. Besides identifying the extent of environmental impacts, this perspective reveals the degree of adaptation of habitats to prevailing environmental conditions. As spatial tools have advanced, GIS archaeology has evolved, allowing the visualisation of ancient settlements and the analysis of changes in spatial use over time.

Methodology: This study uses environmental factor analysis to examine the settlement and distribution patterns of 161 ancient sites in the Qezel Ozan Basin with a GIS information system. After the analysis of GIS maps, it assesses and distributes these settlements in relation to the natural environment, focusing on water resources, altitude, slope, and land use.

Results and Findings: Since the 1st millennium BCE, the foothills and plains have seen an expansion in the dispersion of communities. 2. The 1st millennium BCE villages are mostly found at elevations of -2000 m, with an average slope of 5-10. They are situated less than -500 m from rivers, and the choice of land type has been made. A decrease in population and the type of seasonal deployments is indicated by altitude, steep slopes on riverbanks (plains to foothills). 3. Land use: The distribution of ancient sites in the Qezel Ozan river basin is indicated by the rise and development of agriculture, transportation routes along water resources, trade exchanges, and regional and interregional links.The evolution of settlements in the East Kurdistan region from the Chalcolithic to the Islamic era demonstrates the adaptation and competition of inhabitants with the natural environment in the Qezel Ozen basin. It also provides insights into the complex social development of the region.

Keywords: "East Kurdistan", "Qezel Ozan Basin", "Ancient Habitats", "Environmental Factors", "GIS".

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EXTENDED ABSTRACT

Introduction

The impact of human activities on environmental change in human societies is a complex and challenging scientific issue (Hoffmann et al,2010; Marchant &Hooghiemstra,2004; Mercuri,2008; Wu et al.,2010). One solution is to select a representative area with both human activities and natural environmental evolution. Human societies in prehistoric times relied heavily on the physical environment, so ecological changes may have been among the most important factors influencing the development of ancient cultures (Hoelzmann et al.,2001; Haug et al., 2003; Gao et al., 2007; Wu et al., 2010; Polyak & Asmerom, 2001). The history of human life can be summarised as the search for ways to adapt to the global environment. Therefore, the interaction between ancient sites and ecological diversity is important in shaping human-environment interaction in the present and future. The spatio-temporal distribution of ancient sites exemplifies the complex interaction between the physical environment and human societies (Li et al.,2013). In this context, the geographic information system is a powerful tool for researching and analysing archaeological data. The analysis of topics such as environmental data, spatial analysis, statistics, and modelling is a valuable and essential resource for archaeological studies. For several decades, the geographic information system (GIS) has been an inseparable part of archaeological practice. Its many advantages and applications in the visualisation and management of archaeological data have been discussed and examined from a critical-theoretical perspective (Llobera, 2011). Furthermore, the change and evolution of human settlements, regional population fluctuations, the relationship of ancient sites with the environment and natural resources, and the effects of environmental factors on human activities at the geographical area level, which play a fundamental role in shaping these activities and determining their form and structure, can be explained by analysing GIS maps. Archaeological studies that analyse settlement patterns require data on natural factors and environmental variables such as altitude, slope, soil type, geology, access to water resources, vegetation, and land use (Ellis, 2003). Understanding the relationship between humans and the environment is very important, as it helps archaeologists analyse archaeological sites and their connection with the environment. The information provided by maps prepared using GIS in the study of archaeological sites shows that the formation of an archaeological site does not follow a random distribution pattern. Instead, humans adapt to their environmental conditions and choose their residence based on factors such as landform and access to water resources (Conolly & Lake, 2006). The studied area is one of the most important geographical and climatic regions of Iranian Kurdistan, which, in geomorphological classification, forms part of the Eastern Kurdistan unit along the Sanandaj-Sirjan axis. In terms of natural landscape, with vast plains surrounded by a mountain barrier, it is situated in the central part of the Zagros mountain range. Its distinctive topographic conditions set this province apart from other regions (Najafi, 1990: 47). The Kurdistan East-Iran region possesses various advantages due to the large number of settlements and the unique conditions of the Qezel Ozan and Talvar river basins associated with this area. The branches of these rivers originate from the highlands of the eastern Kurdistan counties (Bijar, Divandarreh, Qorvehand Dehgolan). Considering the biological and environmental conditions, there is a significant impact on the type of settlement in the region. The importance of this subject lies in the fact that, according to archaeological studies, a large number of sites from the 1st Millennium BCE (Iron Age I, II, III) have been reported in this region. However, a comprehensive understanding and explanation of the influence of environmental factors on the settlements of human societies during this period has not yet been achieved. Many questions and ambiguities remain in this regard. Therefore, this research addresses the analysis and parameters of the influence of environmental and human factors on settlement and livelihood patterns.

Methodology

This study employs field methods, library research, and archaeological reports, using a descriptive-analytical approach based on archaeological data, to present the locations of 1st Millennium BCE sites. By interpreting GIS maps, it examines a set of environmental parameters (elevation, slope, geology, water resources, and land use) and their impact on the location of ancient sites in the Qezl Ozan River basin, East Kurdistan.

Results and Findings

Examination of the developments and complexities of the Iron Age in the second half of the 1st millennium BCE and the 1st millennium BCE in western Iran reveals cultural, economic, social and political changes, In the first half of the 1st millennium BCE, a major political transformation took place in the central Zagros region, which progressed slowly at first and then rapidly, and was accompanied by significant changes in the political structure of western Iran from the middle to the end of the Iron Age III(Lavine 2001). Generally speaking, the political and social history of the south-west in the late second millennium and the first half of the 1st millennium BCE saw conflicts with neighbouring countries over the acquisition of resources, despite the presence of powers such as Assyria, Babylon, Urartu, Mana, Media, and Elam. Meanwhile, the lands of eastern Mesopotamia, as important and valuable territories, especially mineral resources, became the cause of conflicts over the acquisition of these resources in the Zagros region and the northwest, and we witnessed conflicts and the presence of western neighbours such as the Akkadians, Simuromians, Babylonians, Assyrians, and Urartians. According to historical evidence and archaeological research, major parts of the western half of Iran were the scene of conflicts and clashes between Mesopotamian invaders and the Zagros peoples from the third millennium BCE to the first half of the 1st millennium BCE (Levine 1937, 1974).In this respect, the study of the Iron Age in the central Zagros region is not very comprehensible without the study of the historical geography of the region. Knowledge of the historical geography of these areas is very useful, also in terms of settlement patterns, the location of settlements, and the area of sites. However, the lack of coherent basic information about the Iranian West Iron Age and our lack of knowledge of the cultural materials have led to a relative dearth of knowledge about the sites of this period. Therefore, considering the importance of this period for understanding the cultural and social development of the western region of Iran, we should try to identify the cultural materials of this period and also examine the political, economic, and social developments of this period in a cultural-geographical direction. On the basis of archaeological Field surveys and the interpretation of GIS maps of the study area, settlements were established in three phases of the Iron Age (I, II, III) in the 1st millennium BCE, sometimes in a single period (Iron Age: 37 sites) and in several phases. Iron Age III: 144 sites, Iron Age II: 10 sites, Iron Age I: 7 sites. These habitats have been formed on substrates with agricultural potential, gardens, suitable vegetation, pastures, and animal husbandry. The review of the environmental factors affecting the formation of the sites of the 1st millennium BCE clearly shows that the settlement of ancient sites is directly related to water resources, vegetation, land use, slope, altitude, transport links, site area, etc., indicating the state of settlement and lifestyle patterns of ancient societies. The way the sites are located is different in each geographical situation. There are important features such as rivers flowing through East Kurdistan, including the Qezel Ozan, whose main branch is the Sefid Rud, and the Talvar River is also one of its branches, the Qom Chay River, the Shor River, the Tahmasb River, and the permanent Yul Kashti River, which flow in the study area. The geographical location of the region is a link between cultural, economic, and political interactions. Kurdistan East is located between the central, northern (north-west) Zagros and

northern Mesopotamia. These conditions created the basis for the establishment of numerous settlements in the plains and foothills. Although archaeological research into the Iron Age in the province of Kurdistan is not very extensive, mention can be made of the excavation of the cemetery and settlement area of Kul Tarikeh Divandarreh of East Kurdistan, which is of great importance in antiquity due to its geographical and strategic location in the Zagros region.
The architectural structure and cultural materials in the study area show that the Ziwiye Plain was a settlement area at a certain time (1st millennium BC) (Rezvani, 2001). Due to the suitable habitat beds and water resources in the Iron Age III, the Ziwiye Plain witnessed dense settlement in the Qaplanto cemetery areas, north of the Qaplanto mound settlement area, Malamche cemetery, Abdulmomen cemetery, Ziwiye cemetery, and Sufi Hajji castle, Changbar cemetery, Sanjal cemetery, Vaz cemetery, and... in the immediate vicinity (cemetery density) around Ziwiye Castle and the Qaplanto settlement area, as well as dozens of other peripheral and satellite cemetery and settlement areas in the 1st millennium BCE. This resulted in the region harbouring a large population in the Late Iron Age II, III (Mohajerinezhad 2014). The Zagros cemetery at Sanandaj can also be attributed to the Iron Age I and II. It belongs to the Iron Age people who, at the height of the region's development, were neighbours with the peoples of Lorestan, Kermanshah, Ilam, and Azerbaijan and, on the other hand, with the Babylonian and Assyrian civilisations in the west and received mutual influences from each other's way of life (Tohidi 2008). In the Kangavar plain, too, fundamental changes in the Iron Age III, new settlements and resettlements in the plain and in the Babajan area indicate the continuation of traditions from the pre-iron age. The presence of numerous Iron Age III cemeteries in Pish Kuh of Lorestan and the burial practices also indicate the resumption of contact with neighbouring cultures such as Elam in the plains of southwestern Iran, and also Mesopotamia. The north-west, with its climatic and environmental conditions, has attracted the attention of societies from different eras and has witnessed the emergence of human settlements. The presence of the Aras River in the north and Lake Urmia in the south-east of the region was a factor in linking cultural, economic, political, and commercial interactions, and relatively regular settlement patterns were established around permanent and seasonal rivers. Sites where Iron Age settlements have been found together with architectural remains and cemeteries include Hasanlu IV, V, Kord-lor Tepe (Lippert 1976), Haftwan Tepe V (Burney 1973), and Dinkhah Tepe II (Muscarella 1974). Cemeteries or sites where only the graves of Iron Age people have been found, and which are probably seasonal settlements. Given the topography, historical and economic geography of the 1st millennium BCE in north-west Iran, defensive-military fortifications, seasonal and nomadic settlements, and customs stations determined the use of mountain settlements. The Takht-e-Suleiman site is considered one of the most important factors for the emergence of settlements in different periods, including the 1st millennium BCE, given its natural conditions and its special geographical location, the presence of permanent water resources (Aman Allahi 2015).

Conclusion

The main objectives of this study are the interaction of environment and culture, geographical factors, and archaeological analyses in the settlements of the 1st millennium BCE in East Kurdistan. The analysis of the settlement type of the ancient sites from the 1st millennium BCE and the correlation of environmental variables such as altitude above sea level, distance to water sources, slope, and land use were of great importance for the formation and distribution of the sites. The altitude above sea level and water sources are two important factors for the settlement of the sites in the study area. Most of the sites are located at medium altitudes between 1.700-2.000 m above sea level (53/4./.). This altitude range is determined by the climatic conditions, the location of the lands as a combination of plains and foothills and an

average slope of 10-5 (41/6./.) on gentle slopes and alluvial terraces as well as access to water sources, the presence of springs, rivers (permanent and seasonal) at a distance of 500-100 m (43/4./.).The analysis of the land use strata of the region has shown that most of the sites are located within open pastures (moderate to good vegetation cover) and arable rainfed lands. This factor emphasises the role of livelihood activities such as rainfed agriculture, suitable vegetation for seasonal grazing (livestock), and access to natural resources (stone, etc.) in site selection .When analysing the settlement indicators, the study of the area of the sites and their relationship with the location, function, and type of settlement shows that, based on an area of less than one hectare (65.2/.), these sites are probably small sites with a specific or temporary function and related to small populations or a simple social structure. Often located in places close to natural resources (springs, pastures, etc.), and some of these sites have a function (hunting grounds- seasonal settlement).ites with an area of 1-5 hectares (8.29 ./.), mostly with suitable conditions, have an economic cycle that includes agriculture, permanent settlements and cemeteries, a number of these sites have strategic positions as defensive or military castles, examples of the relice of these castles are evident in Field surveys of the study area. The limited number of sites + 5 hectares (9.4/.), probably based on a limited administrative and commercial role, is indicated. In general, the region of East Kurdistan in the first millennium BC. According to cultural artefacts such as pottery, metal objects, architecture (castle-cemeteries), etc., it was located on an important communication route between the central Zagros and the central plains of western Iran. This region was a bridge between the civilisations of the northwest (Urartian-Manas) and the central regions (Mades), and this location has led to a cultural diversity in the archaeological data of the region under study. The Iron Age is associated with the emergence of local communities and power structures and the formation of regional networks in western Iran.

Declarations

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Authors' Contribution

This article was conducted jointly by the authors. Both authors actively contributed to the conceptualization, data collection and analysis, and writing of the final manuscript.

Conflict of Interest

The authors declare no conflict of interest.

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