

## Article

# The issue of development in mountainous areas and intervention strategies: The case of the Beni Iznassen Mountains (Eastern Morocco)

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**Abstract:** The current state of the Moroccan mountains in general, and the Beni Iznassen Mountains in particular, is the result of a dynamic process that has accelerated in recent years due to rapid demographic growth and the associated pressure on mountain natural resources. This has led to significant degradation, varying in severity across different areas within the Beni Iznassen Mountain range. In the context of these imbalances between natural mountain resources and the daily needs of the local population, there has been an emergence of various challenges, such as poverty and marginalization, affecting the lives of the region's residents and a noticeable decline in socioeconomic indicators. This situation has consequently driven migration towards regions that better meet the population's needs. Therefore, it has become essential to pay attention to this natural area by restoring its residents' livelihoods, breaking their isolation, and rationalizing the use of its land-based natural resources. This has made the region a focus of territorial development efforts by both the state and local stakeholders.

**Keywords:** Beni Iznassen Mountains; territorial development; state strategies; valorization of land-based natural resources

## 1. Introduction

The Moroccan mountainous regions constitute geographically distinct areas endowed with considerable natural, environmental, and cultural capital. These territories are characterized not only by their diverse ecosystems and topographical richness but also by a wealth of ancestral customs and traditions that reflect their sociocultural uniqueness. Nevertheless, such regions—particularly the Beni Iznassen Mountain range—continue to suffer from deep-rooted marginalization. This marginalization stems from multiple structural constraints, including limited infrastructure, poor access to essential services, and inadequate integration into broader national development policies. The Beni Iznassen area, which constitutes the focal point of this study, represents a dynamic space marked by complex socio-economic and cultural patterns (Zerouali et al., 2019). However, persistent spatial disparities and imbalances have hindered its development trajectory, contributing further to the region's socio-economic exclusion. In light of these challenges, it is imperative to adopt a new development paradigm that prioritizes territorial equity and inclusive growth. This necessitates the strategic mobilization and sustainable management of local natural resources. Moreover, promoting endogenous development requires the implementation of an integrated and participatory approach that actively involves local communities, civil society actors, and institutional

stakeholders. Only through such a comprehensive framework can the Beni Iznassen region realize its potential and overcome the structural barriers to its development.

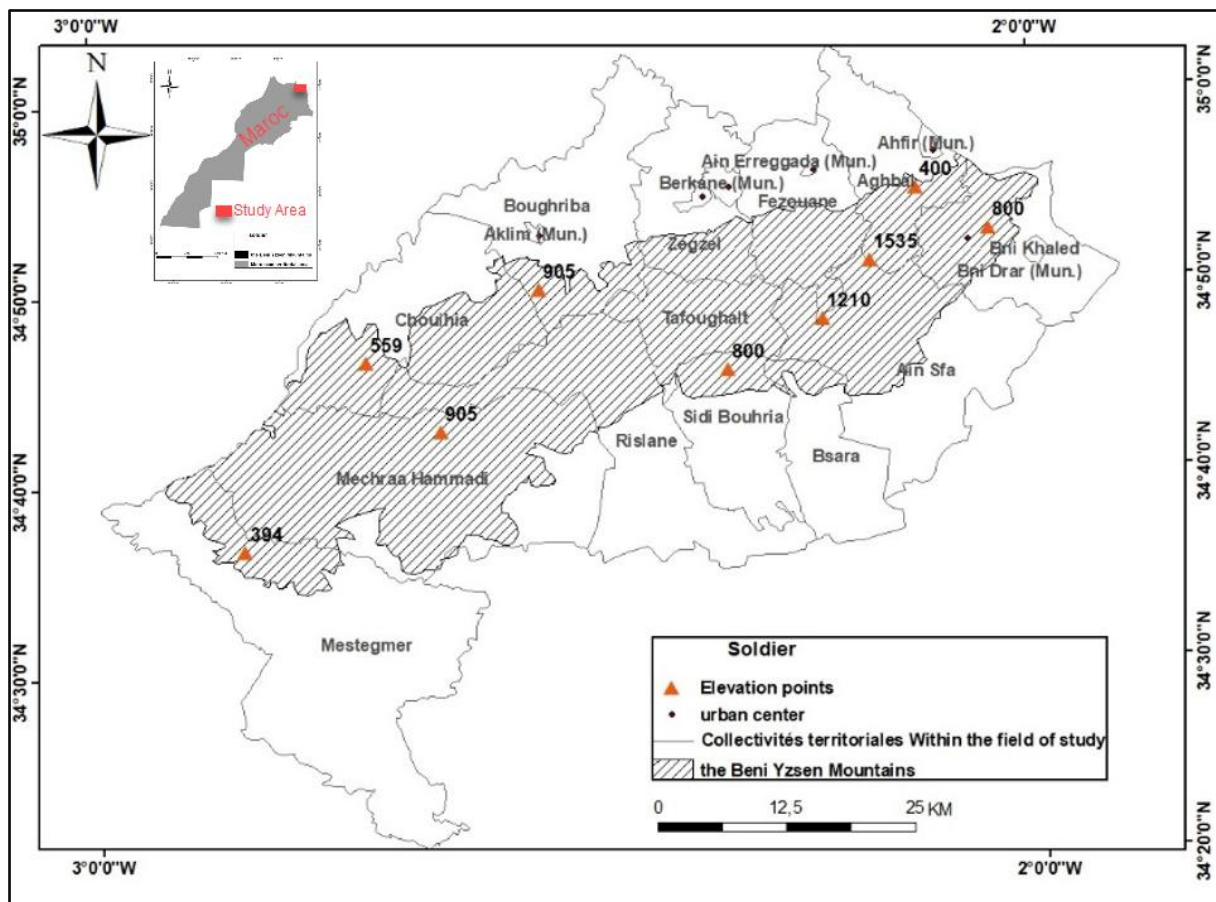
### **1.1. The problem**

The accelerated demographic expansion, coupled with ongoing climate change, has led to significant environmental and social imbalances within the Beni Iznassen Mountain region in eastern Morocco, due to the increasing pressure on its natural resources to the point where these areas can no longer meet the daily needs of their inhabitants (Benchiban, 2022). This situation has prompted the responsible authorities to intervene in these mountainous regions through a series of preparatory programs aimed at achieving balanced territorial development that makes these areas attractive and prevents them from being a source of population outflow.

### **1.2. Geographical location of the study area**

The Beni Iznassen Mountains are located in eastern Morocco, specifically in its northern part, forming an important mountain range. As for the latitude and longitude, it is located between the latitudes 34°20' and 35°00' north, and the longitudes 2° and 3° west, as shown in **Figure 1**. The Beni Iznassen Mountains stretch over a length of 85 to 95 km and a width of 15 to 20 km. This range is characterized by several valleys such as the Moulouya River, Zegzel River, and Ksob River. The elevations in this mountain range vary from 400 m at Mount Agil to 1535 m at Mount Fougall. To the north, the Beni Iznassen Mountains are bordered by the Tarfaya Plain, to the south by the Oujda-Taourirt pass, to the east by the Krouis Pass, and to the west by the Moulouya River (**Figure 1**). This is confirmed by Moulières, who said, the main range, which the natives call Jebel Beni Iznassen, runs from east to west, ending in the south as well as the north, with hills covered with villages and green spaces. These secondary elevations are usually given the name of the grove in which they are located, the most famous of which is Jebel Tafoughalt (Mountain of Beasts or Unripe Fruit) (Moulières, 1895). The Beni Iznassen Mountain range comprises a variety of geological formations dating back to the Paleozoic and Mesozoic eras. Among these are granite, which is limited to specific levels within the range, as well as limestone and dolomitic rocks, most of which are attributed to the Jurassic period (Ghazal Mohammed, 2007).

The Beni Iznassen Mountains are known for their significant geological and climatic diversity, which is reflected in the type of vegetation cover found in the area. Additionally, the northern part of this range is influenced by Mediterranean maritime moisture. Despite this natural diversity, the local population views these environmental conditions as constraints, especially when it comes to their agricultural activities.



**Figure 1.** Geographical Location of the Beni Iznassen Mountain Range and the Municipalities Belonging to This Range. **source:** The topographic maps 1/50,000 (Ahfir, Berkane, El Aioun, Mcherâa Hammadi, Zaio) and the administrative division of 2015.

The Beni Iznassen Mountains are formed above two large faulted geographical units located on both the northern and southern sides. The northern unit consists of a large syncline and a subsiding depression, represented by the Triffa and Sabra plains. To the south lies the Oujda-Taourirt corridor. This southern section is higher in elevation compared to the Triffa and Sabra depression.

Between these two units, along an east-west axis, lies the Beni Iznassen massif, which reaches an altitude of 1535 m at Ras Foughal, with an average elevation ranging between 900 and 1000 m, in the center and east, and less than 900 m in the west (Boumeaza, 1985).

## 2. Data and methods

### 2.1. Significant natural and human diversity in the Beni Iznassen Mountain range

The Beni Iznassen Mountains possess a range of natural and human characteristics that make agricultural activity a fundamental pillar of the local economy in this region. This activity is directly influenced by natural factors. The climate in the Beni Iznassen Mountains, particularly in the northern and eastern sections, is characterized by semi-humid bioclimatic zones, which is reflected in the

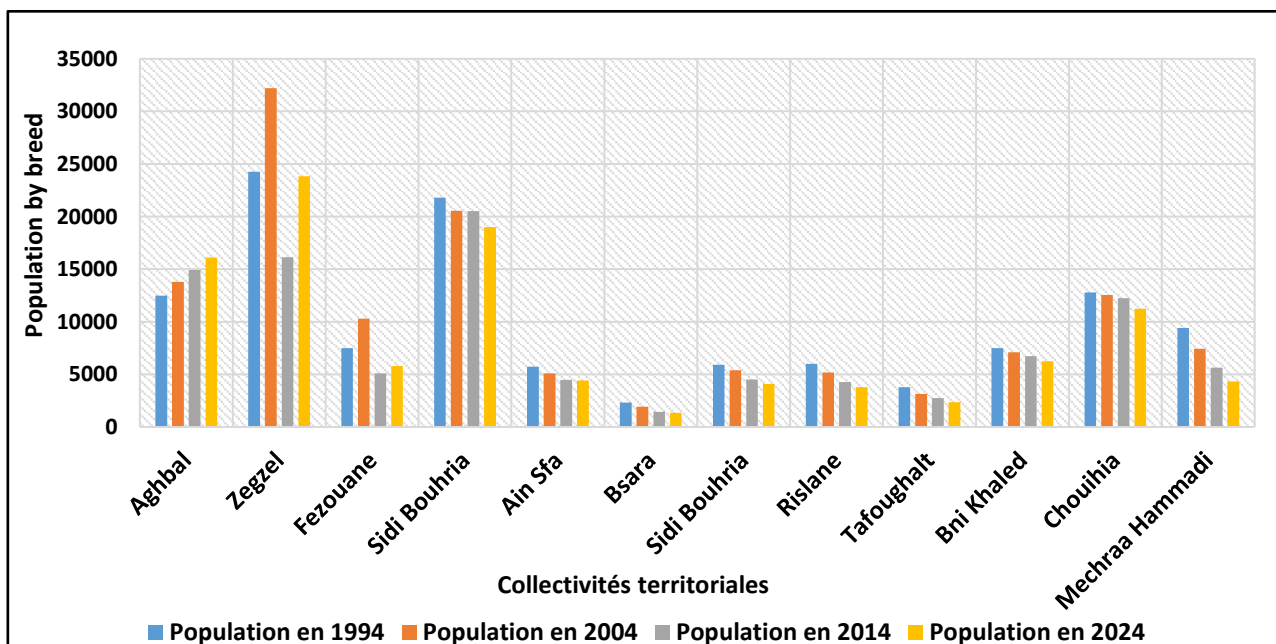
high level of precipitation in these areas. In fact, approximately 83% of the mountainous area is dominated by this type of climate, while the remaining 17% experiences a semi-aride climate. Even though farmers in this region have adapted to these conditions in some extreme cases, agriculture is still closely linked to the environment in which it takes place and its natural conditions.

## 2.2. Ancient human settlement in the Beni Iznassen Mountain range

The ancient settlement in the Beni Iznassen Mountains is primarily attributed to the early colonization of this area by the Zenata tribe. The Beni Iznassen Mountains are composed of a number of tribes that form an important demographic reservoir, including the Beni Khaled, Beni Mankoush, Beni Atik, and the Beni Orimich tribes (Chennouf et al., 2007). Additionally, this region encompasses vast circular boundaries, making it an area with a significant demographic base. It spans three administrative regions: the Oujda-Angad, Taourirt, and Berkane provinces. The Beni Iznassen Mountain range includes 12 rural municipalities and 6 urban centers.

The Zenata tribe, to which the Zenata belong, settled in this region since the 7th century AD. As Louis Foin confirms, the Berbers are divided into two major families: the Sanhaja and the Zenata. The former controlled the coastal region of central and western Morocco, as well as the desert beyond these two areas. The Zenata, believed to constitute the younger branch of the Berber race, were settled in the desert of Tripoli. A number of their ancient tribes had already advanced towards the high plateaus, coming from the Aurès to the outskirts of Moulouya, from where they would begin their westward movement (Voinot, 1912).

Since 1994, the population of the Beni Iznassen Mountains has reached a total of 418,680 people up to the 2024 general population and housing census. The demographic development in the Beni Iznassen Mountains has been marked by instability (Belrhiti, 2020) with a negative demographic growth rate of (−2.09%) for nine (09) rural municipalities between 1994 and 2004 (**Figure 2**). This decline is primarily due to migration to nearby urban centers, along with a decrease in birth rates.



**Figure 2.** Population Growth of the Rural Municipalities in the Beni Iznassen Mountains between 1994 and 2024.**Source:** General Population and Housing Census of 1994–2004–2014–2024.

The population of the Beni Iznassen Mountains has experienced a significant decline from 1994 to 2024, with most of the rural municipalities within the mountain range showing negative growth rates between 0.2% and 2.09% (General Census of Population and Housing: 1994, 2004, 2014, 2024), either partially or fully. The municipality of Mcharra Hammadi recorded the highest rate of decline in 2014 (2.09%). Overall, the study area has undergone significant demographic changes, which have been accompanied by increased pressure on natural resources (El kalouchi Mhammed, 2024), leading to an inability to meet the daily needs of the population. This situation has necessitated the search for new territorial areas that offer more beneficial living resources. In addition to the lack of job opportunities that have become chronic due to drought and scarcity of irrigation water resources, the isolation of housing, the lack of educational and health infrastructure, the shortage of drinking water and electricity supplies, and the absence of means of communication and transportation (Khattabi, 2003).

### 2.3. Abundance of water resources and mismanagement

Water in our country is the cornerstone of the development process and a key tool in structuring the field and society (Belrhiti & El Kalouchi, 2022). The topography is an important factor for the Beni Iznassen Mountains, as it receives significant amounts of rainfall and snowfall, which can contribute to the stability of the local population. Water is an attractive resource in many cases, although it can be the opposite when it is scarce. This mountain range has a number of springs and rivers, some of which are perennial while others are seasonal. Notably, the Kiss River, which is about 20 km long, forms a natural boundary between Morocco and Algeria, with one of its main tributaries being the Agbal River. Additionally, the Sharara River drains into three rivers: the Zegzel River, the Wartas River, and the Beni Kallan River. It is fed by several springs, including the Zegzel Spring. Other important rivers in the region include the Sefrou River, the Ksob River, and the Ain Rkada River, which supplies water to a significant part of the Beni Iznassen Mountains. The Mediterranean character is what distinguishes the climate of this mountainous mass, where rainfall is concentrated at a rate of 85.5% between the months of November and May (Zerouali, 2021).

Undoubtedly, the climatic conditions helped in population stability (Zerouali, 2019). Despite the rugged topography of the Beni Iznassen Mountains, significant agricultural activity has taken place through the use of various techniques and methods that facilitate this vital activity. These include the construction of terraced fields that help stabilize and protect the soil from erosion and create areas suitable for agricultural activities while preventing water infiltration. The people of the Beni Iznassen Mountains also relied on a network of channels to transport water to the fields, with these channels commonly constructed from clay, stone, or concrete (**Image 1**). The dwellings were often suspended from the peaks or on slopes overlooking some small depressions or terraces built to stabilize the soil and water (Zerouali, 2022).





**Image 1.** Cement water channels for water transport in aghbal community.

The agricultural dynamics of the Beni Iznassen Mountains, combined with the traditional methods of water transportation, have led to a decline in water resources due to climate change, poor management, and increasing population growth. This has resulted in a water crisis primarily due to poor water resource management, along with a lack of awareness of the importance of water resources due to the growing demand, particularly for agricultural activities, as well as demographic changes and the intensification of climate change (El Hafid Idriss, 2021). These factors, among others, have significantly contributed to the migration of people from the Beni Iznassen Mountain regions, including farmers, leading to a decline in agricultural productivity and the emergence of nearly degraded landscapes. Thus, the decline in water resources has become one of the major obstacles to population stability and settlement in the Beni Iznassen Mountains.

### **3. Development projects and the constraints faced in the Beni Iznassen Mountains**

Morocco has started implementing a series of development policies, particularly in rural areas (AHROUCH, 2020). along with other programs, to a lesser extent, aimed at mountainous regions. This intervention is evident in the development situation of mountain areas in general, and the study area specifically. Despite all the efforts invested in rural areas, it is noticeable that mountainous regions have not benefited sufficiently to reach a level of development (El Kattamour & Mazour, 2015). The Beni Iznassen Mountain range has suffered from various forms of marginalization and developmental shortcomings. While numerous development interventions have been carried out in the Beni Iznassen Mountains, these efforts have generally been part of comprehensive policies that did not take the specific local characteristics of the region into account. It is important to note that the Beni Iznassen Mountain range has

significant natural and human characteristics that could contribute to regional development.

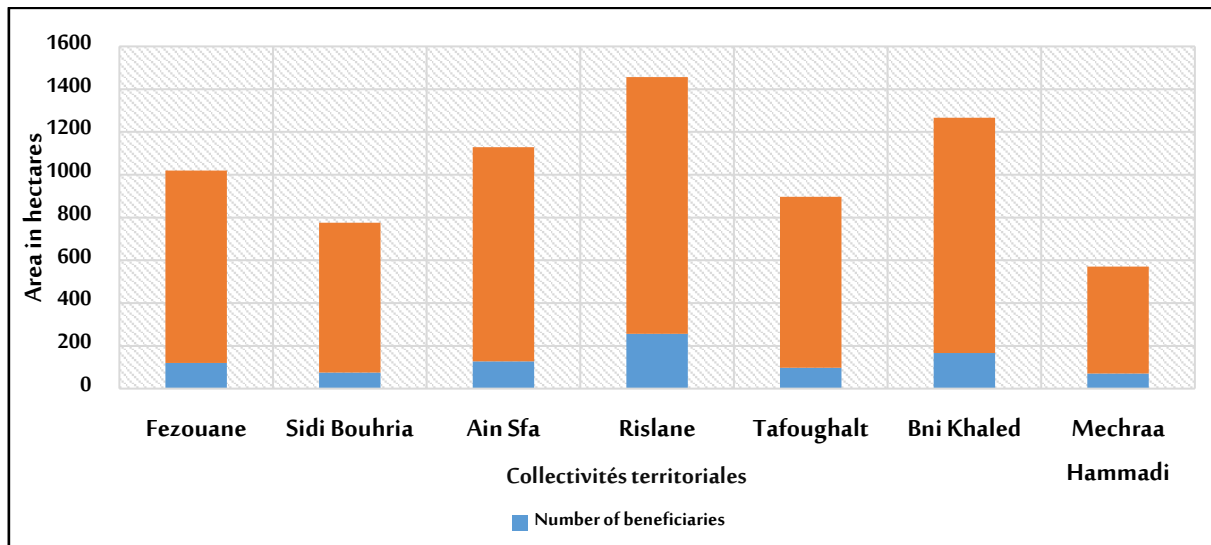
### **3.1. Preliminary projects that included the Beni Iznassen Mountains**

The projects implemented in this region were an attempt to mitigate the worsening vulnerability that has accumulated in the area, on one hand, and to improve farmers' incomes and diversify their sources of livelihood, on the other hand. Agriculture in the Beni Iznassen Mountains is largely dependent on water resources (irrigated subsistence farming). Therefore, these projects aimed to adapt to the climatic conditions by adopting initiatives and programs that align with the specific characteristics of the Beni Iznassen Mountain region. The poverty suffered by the rural population forces them to settle in traditional dwellings on the outskirts of cities. This settlement begins with the occupation of land that often belongs to tribal groups. Furthermore, the weak intervention in preparing the land and equipping it for housing, and the weak state land reserves, have made these preparatory operations unsuccessful in a number of territorial groups in Beni Yznasen (Benlahcen Tlemçani, 2000).

#### **3.1.1. The Almond Production Development Project in the Eastern Region (PROFAO)**

The Almond Production Development Project in the Eastern Region is one of the integrated development projects that benefited the residents of the Beni Iznassen Mountains. It is also considered one of the significant projects for the Beni Iznassen region, through which the state aims to promote rural areas, improve living conditions, rationalize land use, manage natural resources effectively, and ensure their sustainability. This project included 14 rural municipalities distributed across four provinces (Berkane, Oujda, Taourirt, and Jerada). The choice of almond trees was based on their good productivity and their resilience to climatic conditions compared to other crops.

This project seeks to replace seasonal crops with fruit trees to reduce annual fluctuations, increase farmers' income, improve productivity, and enhance the living standards of the local population. It is expected that income will rise from 1760 to 12,500 dirhams per hectare. Several municipalities in the Beni Iznassen Mountains have implemented the project to replace grain crops with fruit trees, with varying investment costs and areas (**Figure 3**). The mountainous areas of Raslan and Beni Khaled, which are part of the Beni Iznassen region, benefited from this project, covering a total of 300 hectares and involving 446 beneficiaries. This was the most significant portion of the almond production development project implemented in the Beni Iznassen region.



**Figure 3.** The Almond Planting Project in the Municipalities Belonging to the Beni Iznassen Mountains. **Source:** Agricultural Consulting Office—Oujda (2017–2018).

In addition, the Almond Production Development Project in the mountainous areas of the Eastern Region, and particularly in the Beni Iznassen region, has achieved significant environmental results. Almond orchards contribute to soil stabilization and reduce erosion, especially given the natural vulnerability of the area due to climatic conditions (semi-arid climate) (Zerouali, 2021) which is exacerbated by population growth and the resulting overexploitation of natural resources. Almond trees are particularly well-suited to water scarcity.

### 3.1.2. The rural development project in Taourirt-Tafoughalt

The imbalances that the Beni Iznassen mountainous areas have been facing necessitated the implementation of the Rural Development Project in Taourirt-Tafoughalt (Hmich, 2023). aimed at addressing and overcoming these challenges and fostering regional development in this area. The broad objectives of the Taourirt-Tafoughalt Rural Development Project are to improve the living conditions of the population and enhance the economic level, particularly by increasing agricultural and pastoral production and ensuring environmental sustainability through the rational use of water resources and the application of more suitable techniques for their utilization. The implementation of these objectives has been overseen by the National Committee, the Joint Regional Committee, and the Local Agricultural Investment Committee.

This project experienced varying levels of success, with relatively positive outcomes noted in the rural communes of Bissara, Chouhiya, and Boghriba due to their challenging social structures, natural characteristics, and climatic conditions. The project focused on rehabilitating and expanding the irrigation network to prevent the loss and deterioration of agricultural land, as well as improving access to drinking water by connecting many villages in the Beni Iznassen mountains to potable water networks. This has contributed to stabilizing the population and reducing rural-urban migration. Additionally, the project included stone removal, known as adding, which involves removing the calcareous crust beneath the soil that hinders plant root growth. This effort improved the productivity of agricultural land in the Beni Iznassen area, which was cleared of stones. The project also led to the emergence of cooperatives



and small to medium enterprises related to agriculture and livestock farming, leveraging the unique characteristics of the Beni Iznassen region to modernize the livestock and beekeeping sectors (Zerouali, 2022). This modernization included distributing beehives, providing technical training, and offering veterinary services for livestock, as well as enhancing and adapting methods for valuing agricultural products, especially olive oil and almond processing (**Image 2**).



**Image 2.** Of set of hydro-agricultural preparation operations concerning the repair of irrigation canals in the territorial commune of Aghbal.

In terms of land development and planting fruit trees, the Taourirt-Tafoughalt Rural Development Project covered a total of 7440 (Zerouali, 2022). hectares in the Beni Iznassen mountains, with an implementation rate exceeding 80%. This included afforestation efforts (such as olive, almond, and carob trees) due to their suitability for the region's conditions, as well as upgrading traditional water channels to prevent the loss of significant amounts of this vital resource.

### **3.2. Challenges faced in implementing preparatory projects in the Beni Iznassen region**

The implementation of these preparatory programs faced a range of natural and human challenges. The Beni Iznassen Mountain range is characterized by significant elevation (1532 m at the peak of Fugal) (Hmich, 2023). which limits the full agricultural use of this environment as arable land decreases with altitude. The topography of the Beni Iznassen region features steep slopes and narrow areas, with most of the land consisting of small agricultural plots (micro-scale), which hinders the

use of modern farming techniques and results in low productivity. Consequently (Tag, 1986). agricultural production in the region is primarily directed towards subsistence for most of the population. This constraint is somewhat alleviated in pastoral activities, as the mountains provide suitable conditions for transhumance, although these practices have decreased for various reasons, including population settlement and the establishment of nature reserves (Zoubir, 2015).

The Beni Iznassen region also suffers from climatic constraints, as it falls within the semi-arid zone. Despite receiving a fair amount of precipitation, it is characterized by irregular distribution over time and space. Additionally, the region does not benefit from the influence of the Atlantic climate due to the barrier created by the Middle Atlas Mountains. As for infrastructure, the topographical nature of the Beni Iznassen Mountain range acts as an obstacle to reducing the isolation of many areas and villages within this region. Moreover, the diversity in land ownership among the local communities belonging to the Beni Iznassen region poses challenges to agricultural use and the implementation of various programs initiated by these communities (Nahraoui, 2000). Another significant issue is soil erosion, both types, resulting from the steep slopes in these areas.

Despite all the preparatory operations carried out by the authorities in the Beni Iznassen region, it is noted that these programs have not reached the desired results. Therefore, activating the development process in these areas and ensuring the sustainability of various resources available in this region is essential. This can be achieved by implementing several measures and actions aimed at valuing and upgrading all the resources that are unique to the region, as well as mobilizing all development stakeholders within this area to address the obstacles and constraints hindering its progress. This should be done within a comprehensive, integrated approach that focuses on the human element as the true capital of any developmental strategy. This includes providing infrastructure and social facilities and developing human capabilities through professional training, as well as rationalizing the management of natural resources, particularly non-renewable ones. The goal is to achieve comprehensive and sustainable development that creates job opportunities for the local population, thereby reducing migration and improving the living conditions of the rural population in the Beni Iznassen region. In this context, special attention should be given to the agricultural sector, which has the potential to significantly enhance the living standards of the population.

#### **4. Results and discussion**

From this study, we conclude that water resources played a central role in local development in the Beni Iznassen region, before it was affected by the scourge of climate change, which had a significant impact on many fields and productive sectors. Water resources also served as a factor to enhance the region's attractiveness during a period of human settlement stability. Thus, while climate and, through it, water resources were once a constructive element, they have today turned into a destructive element for many resources and a driver of population displacement. This has been observed through the 2024 General Population and Housing Census, due to the

population's inability to adapt to the new conditions, which are not a result of poor management or efficient use of water, but rather a result of water scarcity.

In the absence of a development strategy implemented by the state, particularly in mountainous areas such as providing the population with potable water and creating water resource points like water collection stations, this scarcity has become one of the main challenges faced by the residents of the Beni Iznassen Mountains. It pushed a large portion of the mountain's population to migrate towards areas that are more capable of providing means of livelihood and job opportunities, among these areas are the urban centers located near this mountain range (Zerouali Allal, 2001). This led to a demographic decline in some territorial communities, which in turn resulted in the deterioration of a significant portion of agricultural lands after their owners migrated, Despite their continued remote use. However, in reality, mountain agriculture requires constant presence for its maintenance and protection from erosion, especially since it exists in highly sensitive areas. The destruction has not only affected the agricultural sector but also the housing sector, which still bears the marks of the strong urbanization that once characterized this region.

The efforts made and the projects directed towards rural areas in general, and the study area in particular, have not benefited the mountainous communities, which are experiencing significant delays in achieving comprehensive and sustainable territorial development (Otmami, 2015). Therefore, it has become essential to give special attention to these areas, given their rich historical and cultural heritage and diverse, high-value natural resources—elements that are all ripe for enhancement. This would enable them to create new economic activities. Additionally, focusing on mountain tourism could generate new opportunities for the sustainable utilization of resources, providing a fresh dynamic for sectors that produce wealth and create job opportunities (Bouhlal, 2014). As a result, the Beni Iznassen region could become a hotspot for investors.

## **5. Conclusion**

Despite the rich diversity of natural and human resources in the Beni Iznassen mountains, they have not received sufficient attention in terms of benefiting from preparatory programs directed at mountainous areas. This has led to the accumulation of a range of economic, social, environmental, and cultural imbalances. While some projects carried out in this region have contributed to improving the income and living conditions of the population, as well as protecting forest resources and rehabilitating degraded environments, this does not mean that all preparatory efforts have been successful; some have failed to achieve their objectives. Therefore, it is essential to find new ways to value, mobilize, and rationalize the use of territorial resources in this region. This should be done through a strategy developed by various stakeholders, involving local communities, which can contribute to improving living standards, diversifying economic activities, combating poverty and marginalization, and fostering sustainable local development.

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