

## **GENERAL INTRODUCTION**

Societies with weak institutions and limited resources are the most vulnerable to shocks and stresses. Especially residents of small island states and developing countries, who are threatened by rising sea levels, water pollution, and crop failures, forcing entire communities to migrate. In this worsening situation, the number of “climate refugees” is likely to increase. This is why it is important to understand these impacts and seek scientific and sustainable solutions to preserve the balance of the environment and ensure the sustainability of human livelihoods, both ecologically and economically.

Interest in examining the impact of climate change on human life began in the 1990s at the global level, but research on the topic has not gone beyond its general spatial and structural levels. With regard to the spatial level, research on the impact of climate change is still limited to the regions most threatened by warming or global warming, especially desert and arid regions or those suffering from water scarcity, whether in sub-Saharan Africa, such as Malawi, Cameroon, Mali..South Asian countries such as Thailand and some Latin American countries facing development issues, such as Nicaragua. At the structural level, the interest in impacts still addresses general levels of human life, such as the impact of climate change on agricultural activity or the impact of these changes on food production and nutrition in areas threatened by famine and malnutrition in African and South Asian countries.

Research on the relationship between climate impacts and social issues is still new. It received attention in the early years of the 2000s as part of research projects sponsored by the United Nations Organization and the World Bank to investigate the consequences of these variables in the countries most affected by global warming.

Initial studies examined the impact of climate change on the expansion of poverty and the deepening of social inequalities in countries facing the threat of global warming.

The natural characteristics of the two areas to be studied differed. Qalaat al-Andalus is part of a humid, rainy, and water-rich coastal area during the 1980s and 1990s, while AlUla is a semi-arid, water-deficient basal area that is affected by climate fluctuations between winter and summer. But we were also able to identify similarities in location, with Qalaat Al-Andalus located on the banks of the Wadi Majrada delta and AlUla on the banks of Wadi Jabas. However, the impact of the location is different between the two areas. Qalaat Al-Andalus has benefited from it in the past, as the valley's load contributed to the expansion of irrigated agricultural lands with rich soil and a high water table. This enabled the diversification of agricultural activities, and land was allocated for fodder cultivation, which contributed to the development of the cattle herd and the emergence of the region within the milk belt surrounding the capital. On the other hand, the AlUla region was exposed to many risks due to its location, such as water and wind erosion, which led to a decline in cultivated areas and grazing areas, as we have already explained. One of the similarities between the two regions is the use of family farming as the dominant economic activity, with a slight difference in Qalaat Al-Andalus represented by the development of artisanal industries, mainly associated with the zarbia industry. The main role of women in the production process is also noticeable.

On the other hand, climatic changes have changed the socio-economic situation and deepened the phenomenon of vulnerability in these two regions. This has contributed to the reluctance of young people to engage in agricultural activities, especially in the Alula region, which has been witnessing a growing phenomenon of displacement, especially towards the Sahel region, in addition to engaging in the informal economy based mainly on smuggling.

These researches, although useful in understanding the specificities of the areas to be studied, did not address the research question that concerns us, as they did not go deep enough and did not analyze the changes in climate and its consequences on the regions of Qalaat al-Andalus and Ala, including the economic and social aspects, nor did they address the economic and social vulnerability in these two regions and the dialectical relationship between climate change and vulnerability in these areas.

This study seeks to dig into previously unexplored shadow areas, and attempts to deconstruct the hidden links and connections between the various variables that have made Qalaat Al-Andalus and Al-Ala areas vulnerable to the impact of climate change, which has led to a number of social issues that have exacerbated the situation.

Building on this foundation, and seeking to fill knowledge gaps related to the research topic, this study looks to shed light on climate shifts and how they may affect the Qalaat Al-Andalus and Al-Ala regions economically and socially. These two regions were chosen based on a geographical contrast, as the former belongs to the coastal strip, while the latter is considered a continental basin. This choice was made because it allows for a clearer view of the effects of climate change in diverse regions.

On the other hand, this research seeks to examine economic and social vulnerability in both AIUla and Qalaat al-Andalus, and to determine the relationship between climate change and vulnerability in these two regions and the possibility that engaging in various forms of migration may be related to these changes. This study will also help us understand the hopes and aspirations of the citizens of the two regions to improve their socio-economic conditions, level the playing field with other regions, and minimize the negative effects of climate change.

Many regions in Tunisia are witnessing the manifestations of accelerated climate change with potential environmental, economic, and social impacts. However, this impact may vary from one region to another depending on the degree of severity and adaptive capacity. In this context, it is important to examine the case of AIUla and Qalaat Al-Andalus, as they face multiple challenges as a result of climate change. These challenges may increase the levels of economic and social fragility in these two regions, which may exacerbate the phenomenon of migration as a solution to cope with the current context. Therefore, this pivotal inquiry reflects our willingness to investigate the following question:

**Is climate change a major factor in deepening socio-economic vulnerability in AIUla and Qal'at al-Andalus? If so, what are the aspects of this impact? Which socio-economic groups are most affected by these changes? To what extent have residents of these two regions adopted migration as a solution to adapt to these changes?**

In light of the above, the following research questions were identified: What are the changes in the climate in the Qalaat al-Andalus and AIUla regions? How does climate change affect these two regions at the economic and social levels? How can we analyze and understand the level of economic and social fragility in the two regions? What is the relationship between climate change and the level of economic and social fragility? What are the proposals and solutions to deal with the environmental, economic and social challenges caused by climate change in AIUla and Qal'at al-Andalus? What effective recommendations can be taken to improve economic and social conditions in these two regions and mitigate the effects of climate change?

To understand the relationship between climate change and socio-economic vulnerability in AIUla and Qalaat Al-Andalus, the following hypotheses were proposed for verification in this study:

- **It is hypothesized that there is a negative correlation between climate change and the socio-economic status of residents of AIUla and Qalaat Al-Andalus.**
- **It is hypothesized that vulnerable groups, including women, are the most affected by climate change due to their low level of income and education, as well as their limited resources.**
- **It is hypothesized that internal or external migration may be an adaptive strategy to mitigate the impacts of climate change-induced vulnerability.**

Dealing with an issue research, as in this study, is not only related to its importance or uniqueness and the scarcity of works that have addressed it, but also to the added value it may achieve, especially since it will be accompanied by a set of proposals, solutions and recommendations not only by experts but also by the participation of respondents who are closely related to their regions, which contributes to the enrichment of interpretation and understanding. This collaborative approach enhances the effectiveness of the study and contributes to deepening the understanding of the economic and social impacts of climate change, enabling the development of sustainable and applicable recommendations to mitigate the effects of climate change on the environmental, economic, and social levels. It also democratizes the research process, as the respondents are considered active partners in the formulation of the study and not just subjects of the sociological study.

On this basis, we decided to adopt a mixed approach that combines quantitative and qualitative approaches, based on the gender reading, because it is consistent with the nature of our issue and enhances our understanding of the phenomenon under investigation. The quantitative approach enables us to measure the phenomenon and investigate the relationship between independent and dependent variables, relying on statistical data in which hypotheses are tested using specific procedures such as experimental design or comparative causal procedures, among others.

As for the qualitative approach, it aims to understand the phenomenon under study closely, in a way that allows us to know the attitudes and beliefs of individuals and groups, understand the ways of their growth and development, and help explore representations that cannot be reached through quantitative research, which contributes to analyzing and understanding the social and cultural context that surrounds the phenomenon.

**Quantitatively**, the results of the statistical research indicated that the two regions of AlUla and Qalaat al-Andalus, the subject of the study, although they differ in terms of location, the first being an inland region in the center-west, while the second is located in the north, specifically on the coastal strip, share the prevalence of fragility, which can be detected through several technical indicators such as high rates of unemployment and poverty and deteriorating infrastructures. This crisis may have been exacerbated by climate change, which makes this research important because it will examine climate change and its relationship to deepening economic and social vulnerabilities and ways to address these impacts and create sustainable development.

## **1. Results of the quantitative study**

First, we attempted to determine a sociological profile, based on the research sample and a gendered reading of the results. It turns out that we are dealing with individuals with a secondary education, married, nuclear families, living in independent houses connected to electricity and potable water networks (more than 90% and 80%, respectively). The only electrical appliances they own are a stove, a refrigerator, and a television. They work in agriculture and fishing (the latter is specific to Qalaat Al-Andalus) and earn wages of no more than 500 dinars, yet they consider themselves to be middle class. At the same time, they do not enjoy social and health coverage.

Residents of these two areas face a number of challenges in their daily economic activities, the most important of which are financial issues, such as lack of capital and

state support, lack of investment, and low daily or monthly wages. And they are getting worse.

Regarding the climate situation in the two regions, the results revealed a close correlation between climate change and the effects of global warming, such as rising temperatures, fluctuations in rainfall levels and interruptions in recent years, increasing droughts, and decreasing water resources. This situation is a serious precedent in the history of both regions. The climate crisis has had a significant impact on the agricultural sector. The arable and grazing areas have been reduced, and agricultural and maritime production levels have decreased, leading to increased unemployment and poverty, given that the local economy is primarily dependent on the agricultural sector.

These impacts have been exacerbated by the weak state intervention and discharge of its duties, such as setting environmental, economic, and social policies appropriate to these changes, exercising a monitoring role against industrial and residential violations, sensitizing citizens to the risks of climate change, and involving them in an action strategy to minimize its effects.

As for the investigation of the effects of climate change and its relation to the prospects of migration in all its forms, it turns out that only a small percentage of them have found themselves forced in recent years to change their place of residence, whether inside or outside the municipality or even outside the country's borders, as a result of the effects of climate change. This ratio shows that there is no direct causal relationship between internal or external migration and climate change. However, in the long run, the results of the study reveal a clear concern about the impact of climate change and the consideration of migration in both formal and informal forms as possible scenarios for future adaptation to this crisis.

At a second level, based on the gender analysis of the data, we detect a pattern of traditional sexism that negatively affects women's inclusion in the labor market. The results show that half of the women in the sample fulfill traditional roles as homemakers. Their participation in the labor market is influenced by multiple factors such as gender stereotypes, level of economic empowerment, and social prejudices. This highlights the urgent need to develop policies that promote gender equality and

contribute to changing the socio-cultural paradigm in order to build a just and equal-opportunity society.

On the other hand, many issues are a major concern for men to a greater extent than for women. Lack of health insurance, social security, demarcation, and unionization are prominent challenges for men. Men show a similar interest in labor issues and financial and administrative corruption. These gender differences are attributed to men's traditional roles as breadwinners, exacerbating women's precarious economic situation and deepening the economic gender gap, especially among the less privileged and most vulnerable groups.

Separately, when looking at the relationship between migration and climate change, the data did not show significant differences between men and women regarding their attitude towards staying in their current place of residence. However, men appear to be more willing to stay in the local community and refuse to migrate, while women show a slight edge in willingness to migrate as a result of climate change. These dynamics raise important questions about the social, economic and political implications. On the other hand, there are no significant gender differences in the perception of regular migration as a solution to climate change, but men are more likely than women to approve of irregular migration as a response to climate change.

## 2. Qualitative Study Findings

**Qualitatively**, the results of the interviews and focus groups explained how residents of the two regions experience environmental changes and their economic and social impacts. They can be systematically categorized as follows:

Manifestations of environmental changes:

AlUla and Qalaat al-Andalus are experiencing increasing negative impacts as a result of the climate change crisis, which is manifested in noticeable changes. The two regions have witnessed a continuous rise in temperatures and humidity levels in recent years, and suffer from a severe lack of rainfall, sometimes for long periods of time. Climate change has also disrupted the ecosystem, as evidenced by the absence of the natural cycling of seasons, low water levels in valleys and dams, and declining groundwater reserves. This in turn has exacerbated desertification, reduced agricultural areas, and loss of biodiversity.



### The economic impacts of this change:

The AIUla and Qalaat al-Andalus regions are suffering from worsening issues in the agricultural and planting sector, and the repercussions of this crisis can be seen in the decline of grain and olive crops in particular, as a result of rainwater retention and the decline in the water table level. In addition, groundwater has become increasingly saline and is no longer suitable for agricultural use. On the other hand, these difficult conditions are affecting farmers, especially small farmers, who have been forced to sell their livestock due to the skyrocketing prices of fodder. This challenge is also reflected in the local economy in general, reducing the region's share of the wealth generated by the agricultural sector and affecting other related sectors.

### The social impacts of this change:

The climate change crisis has caused a deterioration in the social status of the residents of AIUla and Qalaat al-Andalus, as it led to a decrease in agricultural production, income, purchasing power, and economic quality of life. This resulted in increased rates of unemployment, displacement, and fractured family relationships. The collective psyche has also been severely affected by the drought, creating a climate of stress, which can be seen in the rise in the number of people suffering from depression. Women farmers, who used to earn income from their agricultural activities, were not spared, as they are now unemployed due to the scarcity of job opportunities. The negative effects are not limited to this, but have also caused tribal conflicts over water sources, especially in AIUla.

### Manifestations of economic and social vulnerability:

Residents of these two regions face a number of challenges in their daily economic activities, the most important of which are financial issues, such as lack of capital and state support, lack of investment, low daily or monthly wages, and deteriorating purchasing power. These difficulties are exacerbated in the case of women working in the agricultural sector, where they face negative wage discrimination compared to men. In addition, they face additional challenges as a result of physical and psychological violence, further complicating their economic and social context. Overcoming these difficulties requires the intervention of various parties such as the authorities and civil society organizations.

The two studied areas suffer from high levels of economic and social vulnerability, which affects the quality of life and activities of their inhabitants.

Economically, the residents of these two regions face a number of challenges during their daily economic activities, the most important of which are the low productivity and contribution of the agricultural sector to local output, in addition to the lack of investments and economic projects. This situation is reflected in the level of unemployment and poverty, as the suffering of the population increases due to the lack of job opportunities and low purchasing power. This is due to the lack of adequate support from the state and the absence of economic empowerment strategies that contribute to the creation of a local economy capable of creating wealth.

Socially, the residents of these two regions are exposed to a number of social challenges, foremost among which is the weak agricultural production, which constitutes the backbone of the local economy, resulting in many residents losing their jobs and joining the unemployment reserve. It is worth noting that many people in the region have sold their land and livestock because they are now a burden to them. Due to these conditions, poverty has been widespread in these areas, which has negatively affected education and family life, as school dropouts and family tensions have increased. Some residents have been forced to migrate in search of employment opportunities. These difficulties are exacerbated in the case of women working in the agricultural sector, who face negative wage discrimination compared to men. In addition, they face additional challenges as a result of physical and psychological violence against them, further complicating their economic and social context.

#### Climate change and its relationship to economic and social fragility:

This study found a correlation between climate change and economic and social fragility, as it shows that the effects of the climate crisis are penetrating deeply into the economic and social fabric of the AlUla and Qalaat al-Andalus regions. The agricultural sector has been severely affected by climate change, witnessing a reduction in the areas dedicated to agriculture and grazing, leading to a significant drop in agricultural and maritime production levels. As a result, GDP declined, and unemployment and poverty rates increased. This deterioration negatively affected the purchasing and consumption capacity of the poor class in both regions, as they struggled to meet basic expenses as a result of rising prices. The effects of climate change have hit the poor

the hardest, further complicating their socio-economic situation. It has become more difficult for these individuals to meet their basic needs, and they no longer have the ability to be self-sufficient. This economic pressure has led many children from these families to drop out of school and enter vulnerable professions (girls work as domestic helpers).

### 3. Suggestions/Solutions:

This table summarizes the suggestions and solutions formulated by the residents of the two areas, which stem from their actual needs.

Axis	AlUla residents' suggestions and solutions	Suggestions and solutions from Andalusia Castle residents
<b>The problem of poverty</b>	<p>Creating special recreational, educational and cultural projects.</p> <p>Supporting agro-biological projects to promote sustainable agriculture.</p> <p>Improve infrastructure to promote sustainable development and improve quality of life.</p> <p>Utilize sustainable agricultural techniques.</p> <p>Changing the character of some agricultural lands and converting them into industrial zones.</p> <p>Changing the character of state-owned agricultural land and encouraging the construction of industrial enterprises.</p> <p>Relying on investment in the agricultural sector to contribute to strengthening the local economy.</p> <p>State intervention in improving agricultural infrastructure and facilitating procedures for obtaining licenses to drill wells.</p>	<p>Exploitation of all the region's wealth, including fisheries and agriculture.</p> <p>Proper utilization of the entire maritime strip.</p> <p>Renovation and modernization of the seaport.</p> <p>Establishing a producer-to-consumer sales unit.</p> <p>Providing financial support to affected farmers.</p> <p>Intensifying cooperation between the government and farmers to combat climate change.</p>
<b>Climate Change</b>	<p>The country must consider the climate change crisis when developing new agricultural policies to minimize its risks.</p> <p>Utilize traditional agricultural techniques such as organic farming and reliance on local seeds.</p> <p>Promote the use of traditional water storage techniques.</p> <p>Finding alternative solutions for irrigated agriculture.</p> <p>Utilizing wastewater, filtering and refining it and using it for irrigation</p>	<p>Construction of a seawater treatment plant.</p> <p>Promote the use of traditional water storage techniques.</p> <p>Maintenance and cleaning of dams to enhance the effectiveness of water resources management.</p>

## GENERAL OBSERVATIONS AND RECOMMENDATIONS:

The solutions from the focus groups and interviews are centered around:

- ✓ Promote research and development in agriculture, water management and marine utilization, with a focus on developing sustainable and effective solutions.
- ✓ Collaboration and coordination between the government and the local community should be strengthened to identify needs and solve local issues related to climate change and economic vulnerability. This can be achieved by establishing mechanisms for continuous dialog and promoting community participation in decision-making.
- ✓ Scientific research should be geared towards finding effective solutions to achieve a balance between environmental sustainability and local economic development.
- ✓ Government policies should encourage projects that integrate environmental and economic considerations to ensure the long-term sustainability of economic growth.

## Recommendations

<b>Region / Agencies Recommendations</b>	
AIUla residents' recommendations to	
<b>The state</b>	<p>Working to improve the condition of national and regional roads that connect AIUla to the rest of the state.</p> <p>Connecting rural areas to the “Rural Sonad” project.</p> <p>Facilitate procedures for obtaining licenses to drill wells.</p> <p>Conducting effective monitoring of the work of water associations to ensure integrity and efficient use of resources.</p> <p>Initiating projects in agricultural areas based on more sustainable farming methods.</p> <p>Investing in agricultural production, such as relying on the region's agricultural riches such as planting olive trees, working on projects to export olive oil, as well as exploiting prickly pear crops.</p> <p>Intensifying awareness campaigns for citizens about the seriousness of climate change and how to deal with it</p>
<b>Civil society</b>	<p>Intensify efforts to attract young people and encourage them to actively participate in public affairs, especially given the almost total absence of associations and non-governmental organizations in the region.</p> <p>Conducting training courses to sensitize the population about climate change and its dangers to humans and all other forms of life in the region.</p> <p>Intensify efforts to ensure that these training courses reach the widest segments of society, with a special focus on the youth to increase understanding and effective participation in addressing the challenges of climate change.</p> <p>Lobbying the government to improve infrastructure in the interior regions.</p> <p>Cooperate with state institutions in implementing environmental and social projects.</p>
<b>Resear chers</b>	<p>Conducting several studies and research on the challenges of climate change in the region, with the aim of developing effective solutions that can contribute to minimizing its effects, especially in the agricultural sector, which constitutes the cornerstone of the local economy.</p> <p>Conducting scientific research that contributes to the development of strategies to combat climate change.</p>

Recommendations from residents of the Andalusia Castle area to

<p><b>The State</b></p>	<p>Work to find quick and radical solutions to the water shortage, and push for the adoption of irrigation techniques that preserve water stocks.</p> <p>Encourage the establishment of water conservation projects and improve water treatment techniques to contribute to environmental sustainability and improve the management of water resources.</p> <p>Modernizing the agricultural field to ensure that efforts and resources are directed effectively.</p> <p>Develop training in alternative farming and design sustainable development policies that are compatible with modern technologies in this sector.</p> <p>Providing material support to those working in the agricultural sector to help them adapt to environmental and economic challenges.</p> <p>Providing fodder for farmers to maintain their livestock and enhance their agricultural production.</p> <p>Providing support to local associations to enhance their role in promoting community participation and implementing environmental and economic projects.</p> <p>Monitor and follow up on the work of the 'skimmer'.</p> <p>Conducting training courses for young people in the field of ecotourism and supporting rural and mountain tourism as a means of boosting the local economy and preserving the environment.</p>
<p><b>Civil society</b></p>	<p>Intensifying training courses for youth to enhance their skills in the field of modern agriculture, with a focus on adopting modern agricultural techniques and practices.</p> <p>Working to revive cultural life in the region by organizing cultural and artistic events.</p> <p>Establishing agricultural associations to help protect the rights and interests of farmers.</p>
<p><b>Resear chers</b></p>	<p>Participate in the preparation of assessment studies to understand the impacts of climate change on the region and identify effective adaptation plans.</p> <p>Conducting scientific research that seeks to analyze the expected impacts of climate change on environmental, economic and social aspects, and attempts to formulate early preventive solutions.</p> <p>Disseminate the results of research and studies to raise awareness among citizens about the effects of climate change and the need for early action to address future challenges.</p>

## Expert recommendations

**AIUla  
region**

**For citizens:**

Sensitization and awareness-raising at the educational level in relation to pollution and excessive fuel use.

**For the State:**

Cooperation/networking with neighboring countries in relation to climate change as it is not only a local/national issue.

**Civil society:**

Coordinate and work with the state to find solutions.

**For researchers:**

Contribute to the production of quality research and approach the media.

**Andalu  
sia  
Castle  
area**

**Recommendations for citizens:**

Raise awareness of the dangers of excessive water use.

**Recommendations for the state:**

The state must not only develop strategies and laws without implementing them.

Create a culture of environmental citizenship

Engage all parties, including citizens and civil society organizations, in addressing environmental challenges.

**Recommendations for civil society:**

Network and work with the state.

**Recommendations for researchers:**

Researchers should approach the topic from multidisciplinary perspectives, including agricultural, industrial, and human rights.



Through this study, we tried to explore a new field of research and approach a complex research question by explaining and understanding why and how climate change affects economic and social realities in Tunisia. To achieve this, we adopted a complex quantitative and qualitative field methodology, comparing two regions where climate change and economic vulnerability intersect, namely Al Ola and Qalaat al-Andalus.

We also found that this situation will have short-, medium-, and long-term future implications. In the short term, poverty and unemployment rates are likely to rise. In the medium term, internal and external migration rates are likely to increase, both regular and irregular, as a result of the damage caused to the agricultural sector by the escalating drought crisis. In the long term, the hypothesis is that social tensions will increase and the state's ability to continue to play a central role in achieving economic and social balances will decline, which could undermine the principles of social peace in the country.

Climate change is one of the most prominent challenges facing the world in the 21st century, with multiple and intertwined impacts on the environment, economy, and society. This study validates our hypotheses that climate change causes a decrease in agricultural and maritime production, a rise in unemployment and poverty levels in the AlUla and Qalaat Al-Andalus regions, and a deterioration in the social and health status of the poor and middle class. Therefore, all stakeholders must intervene effectively and in a coordinated manner to minimize the impact of this crisis by adopting strategies that are dedicated to the principles of sustainable development, strengthening the resilience of communities to climate change, and supporting initiatives that aim to improve the food, water, health, and social security of affected populations.

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