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The Admine Argan Forest: Conservation of a Pristine Ecosystem under Economic Expansions Pressures

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ABSTRACT

Recent evidence suggests that anthropogenic factors are increasingly contributing to environmental degradation, creating new challenges that require innovative management and conservation strategies. This study emphasizes two fundamental characteristics of the Admine forest. First, the forest's instability and limited control, as the Argan ecosystem remains fragile and constantly changing, making its future evolution difficult to predict. Second, the forest plays a crucial role in the local economy by providing essential natural resources and supporting the livelihoods of local residents. The transformation of the Admine forest reflects the complex interactions between ecosystem processes and economic development. As it evolves from a natural environment to a human-influenced landscape, it illustrates how environmental change can support economic growth. However, such transformation can also lead to significant changes in biological systems, creating a new environmental context with uncertain consequences.

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1. INTRODUCTION

The Admine Forest, in particular, offers two distinct forms of wealth, with the second being a derivative of the first. The primary wealth is the natural Argan tree, which is widely recognized. The secondary wealth, however, requires analysis through the lens of local human dimensions, as it pertains to the Souss territory and has implications for the Argan areas within the Argan biosphere (El Moussaoui, E. H., et al, 2025). It is important to note that this secondary wealth serves as a pretext for the concept of a desired resource, as humans tend to exploit resources to their fullest potential. Consequently, the local population has implemented protective measures, which have proven successful, as evidenced by the continued presence of this natural resource alongside the cultural heritage essential for the sustainability of the local rural population.

The social, political, and economic benefits are intertwined with environmental, biological, and heritage advantages, yet the challenge of protecting the Admine Reserve is complicated by these triple benefits (social, political, economic). The biological (environmental) system, encompassing all human social systems, is shaped by the fluctuating natural phenomena of the reserve. These phenomena, which include degradation, desertification, and fires, are not the primary concern for the Argan Admine Reserve, as they are predictable. Instead, the focus is on the human conditions mentioned above, as they are the primary drivers of forest development in Admine. This development has been influenced by intensive human intervention in primary natural forests. (Anggusti, 2025; Vimal, R , 2010).

1.2 Contextual Literature

The utilization of the Admine Forest in economic development facilitates the application of environmental conservation as a practical measure. Field studies on protectionist measures reveal human dominance and control over the Admine system and its natural development. As an essential addition to the existing literature (Expansionist-economic), this pattern is not explicitly mentioned in the research. However, the research has enabled a connection between conservation and the sustainability of productive economic sectors. This latter factor has been imposed upon the initial elements of conservation and environmental sustainability over time, as Admine has been influenced by the expanding economic factor within its domain.

2. METHODS

This study employed geographical methodologies consistent with the nature of scientific research in the field of geography. We connected the Admine Forest to several concepts and theories, with a particular focus on spatial planning as a complex theory, as well as planning and field as distinct concepts, in an effort to define and integrate them with the research problem, which is the Admine Forest, also known as the "Admine Reserve". Our approach enabled us to gather results through geographical analysis based on both quantitative and qualitative human and natural data within the study area, the Admine Argan Forest. We positioned the Admine Forest as a model forest that reflects the characteristics of other Moroccan forest systems, sharing similar biological, ecological, and human-specific attributes.

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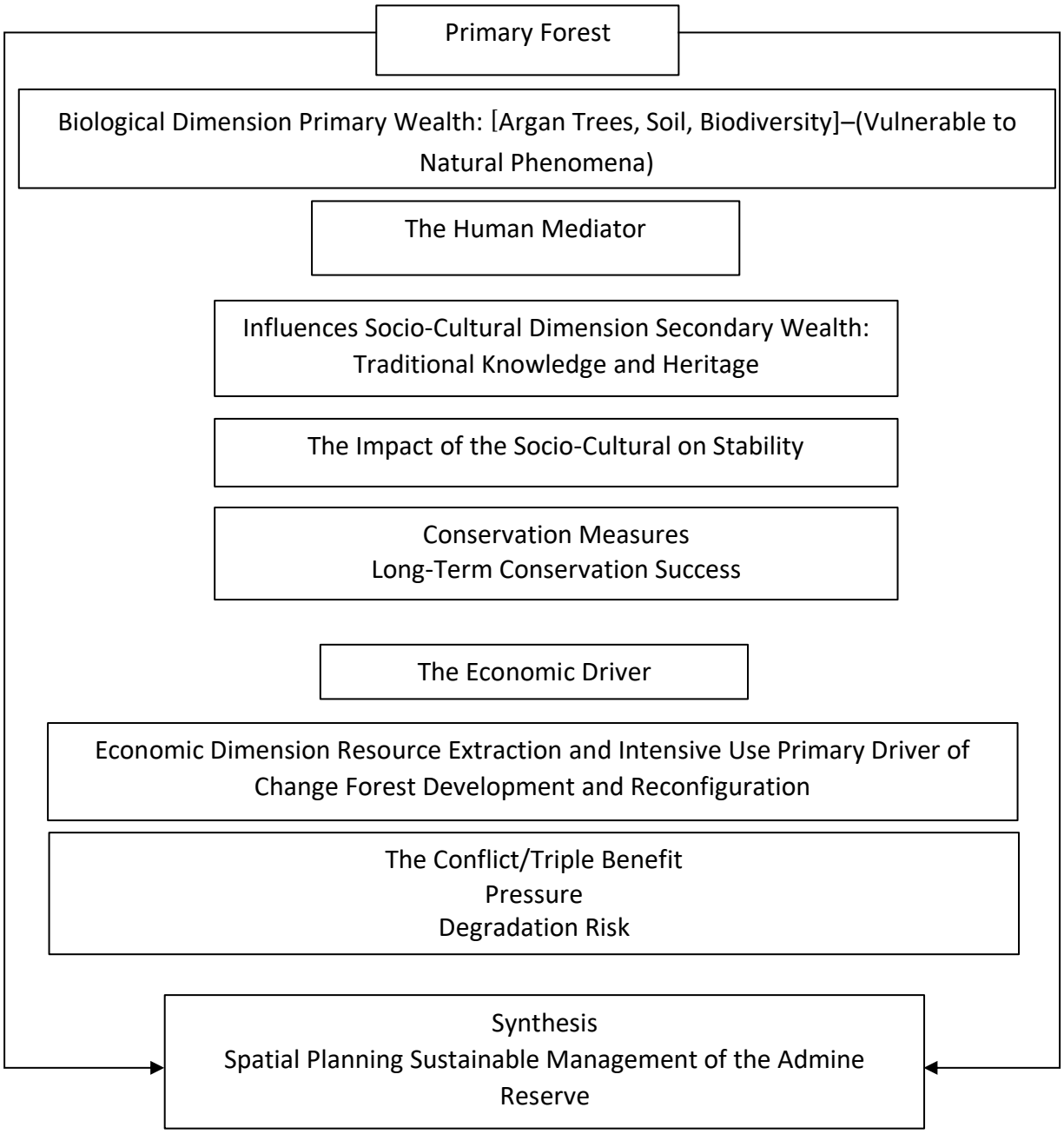


Figure 1. Flow Chart of Integrated Spatio-Temporal Framework of Conservation and Economic Pressures in the Admine Argan Forest.

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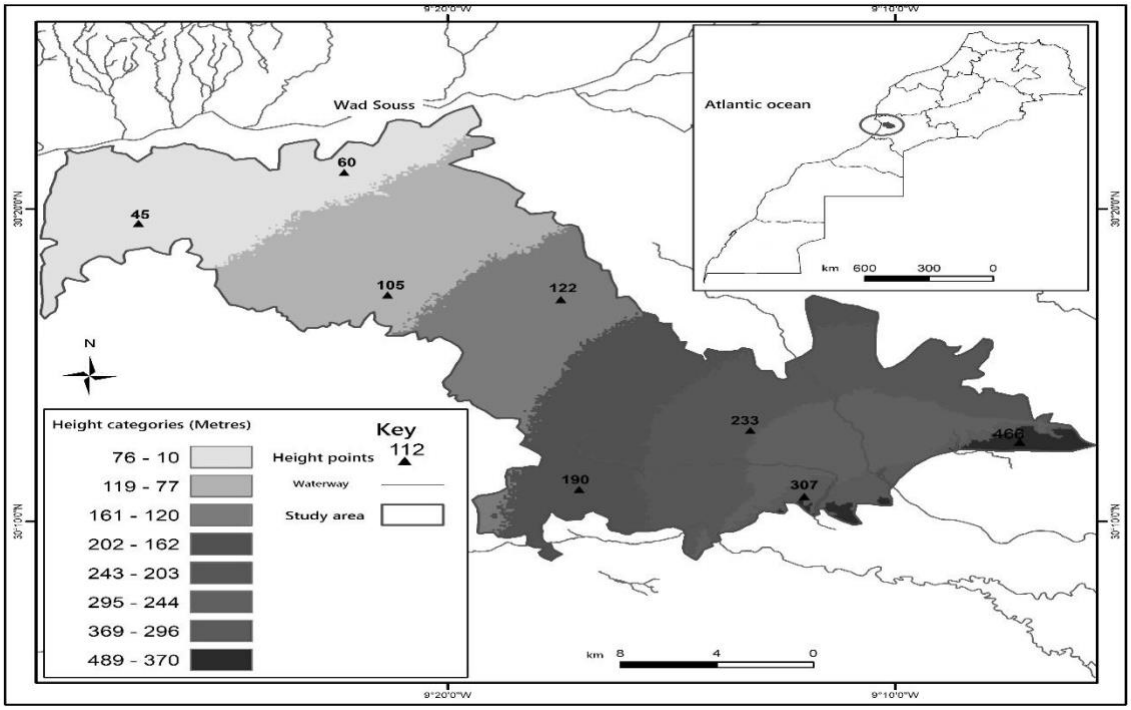


Figure 2. "Admine Forest" Admine Argan Reserve Study Area and sampling Distribution.

The Admine Forest is situated in the plains region, forming a lowland forest within the expansive Souss plain, covering an area of 26,417 hectares at 19°30' north latitude and 20°9' west longitude. The Souss plain, characterized by predominant agricultural activity since the 1980s, supports a well-established economy.



Figure 3 and 4. Photographic Documentation of the Environmental Features of the Admine Biological and Ecological Site.

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3. RESULTS AND DISCUSSION

Conservation of the forest relies on cumulative effects, specifically the degree of negative impacts resulting from human behavior. Conservation within the Admine Forest is manifested through a "secondary nature" of protective measures (Brock, 2014). This concept, previously mentioned but reserved for later discussion, is derived from expansionist economics, which is an absolute trend. Under the current system, all intensive uses of Admine are justified, yet this system encounters comprehensive conservation challenges for two admins. From another perspective, the environmental balance is nearly lost due to the expanded agricultural economy (Msanda et al., 2021). Our most recent findings indicate a conflict in the Souss Plain over water resources: in recent months, underground farm water has been depleted, particularly in the agricultural estates in the far southern part of the Admine Forest and the Souss Plain, due to illegal management practices occurring at night (as reported by field witnesses).

Table 1. Agriculture Production in the Admine Forest 2023

Production as grains		
Irrigated Production	689.6t	617h
Mullet Production	572t	520h
Olive Trees	t44	163h
Almond Trees	4.7t	470h

Over the past 20 years, agriculture in the Admine Forest has been developed through the introduction of modern high yields.

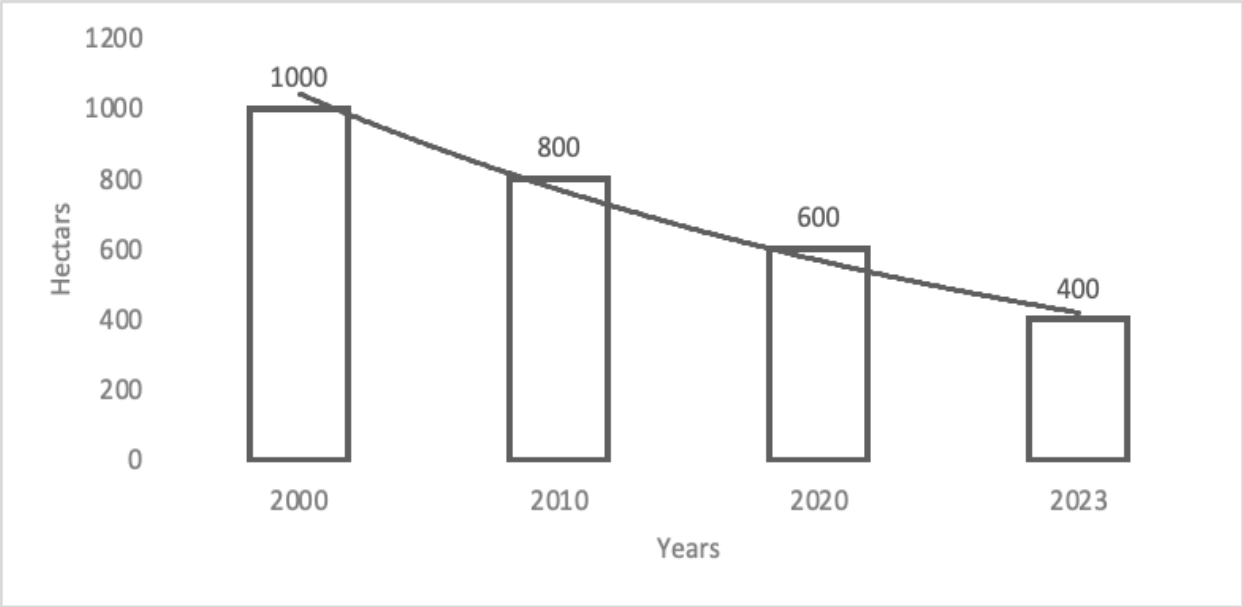


Figure 5. The Size of Agricultural Land in the Admine Forest Graph 2000 to 2023.

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The adoption of fertilizers and pesticides has become a prevalent practice among farmers, contributing to increased soil and water pollution and thereby exacerbating the degradation of natural resources and biodiversity (Astari, A.J et al, 2021; Giakoumi, S et al., 2025). This issue is particularly evident in the Souss plain, where the Argan ecosystem has suffered due to the proliferation of modern agricultural practices and cultural shifts. Over the past two decades, the Argan forest has experienced a significant decline in groundwater levels, with depths decreasing from 10-15 meters to 150-200 meters, and in some areas, even reaching 300 meters. As previously mentioned, the Souss Plain is characterized by an economy heavily reliant on agriculture and industry. However, this discussion will focus on agriculture, which has notably impacted the Admine forest, resulting in pronounced effects and even spatial conflicts between the two.

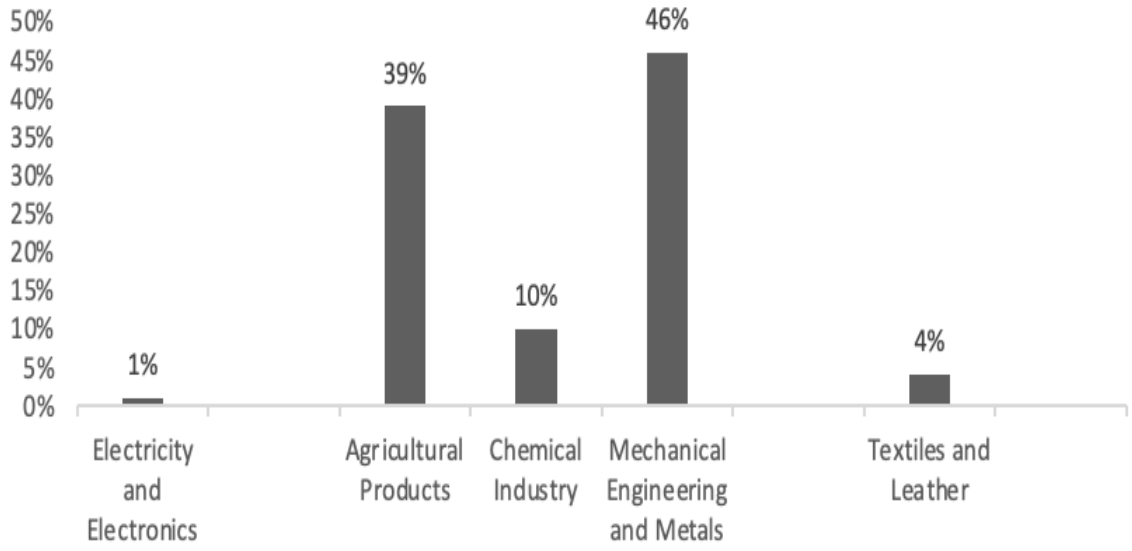


Figure 6. The Largest Dominant Industries in Grand Agadir 2023.

Over the past three decades, Agadir has witnessed significant and diverse industrial expansion in the Ministry of Spatial Planning, Water and Environment, 2004. In the Trade and Industry delegation - Agadir, 2024, This growth includes large and small industrial units, especially in the food, metal, plastic and leather sectors, according to the latest statistics. Notably, the food industry plays a pivotal role in the region, enhancing the value of agricultural and marine products, alongside the chemical and construction industries, as previously discussed in the section on urban development. In The Ministry of Territorial Planning, Water and the Environment, 2004, This sector is responsible for 80% of industrial employment.The region hosts four industrial hubs: the first is among the largest in Morocco, particularly in the southern part, followed by the Tasila industrial district, as well as Anza and Batouar. However, these hubs face challenges related to spatial planning, the distribution of industrial activities, and the allocation of clusters to industrial centers, as illustrated in the figure above, with specific reference to the districts of Ait Melloul and Tassila (Ministry of Territorial Planning, Water and the Environment, 2004). A commonality between industrial neighborhoods and the Admine forest is spatial planning, which suggests that spatial planning in both urban and forest areas generates patterns. This is attributed to the significant demographic and industrial growth, which has been somewhat haphazard. Another

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contributing factor is the lack of analysis and prediction regarding the future landscape of Admine, particularly in integrating natural and urban dimensions between human development and industrial districts. Over the past ten to thirty years, agricultural land in the Admine forest has diminished by over 50% (High Commission for Water, Forests and Combating Desertification of Morocco, 2024). This decline is primarily due to urbanization, with some agricultural areas being converted into real estate reserves and others subdivided into real estate plots in the Admine forest area, driven by a threefold increase in the local population. Additionally, the deterioration of soil quality and the consequent loss of fertility have rendered the land unsuitable for cultivation.

It is important to acknowledge the intricate interrelationship between the Admine forest, agriculture, and water resources, which significantly impedes the region's development due to limited water availability. The scarcity of rainfall adversely affects surface water resources, necessitating reliance on groundwater to meet the increasing demands of intensive agriculture. However, this groundwater resource is progressively diminishing each year. According to the Ministry of Finance, the threat to grain crops is escalating in the current months of 2024, with yields anticipated to not exceed 25 million quintals, indicating that Morocco is experiencing a dry season. Furthermore, the economic growth rate is projected to not surpass 2.1% (High Commission for Water, Forests and Combating Desertification of Morocco, 2024).

3.1 Environmental Conservation within the context of and Expansion-Oriented Economic Development

Conservation and expansionist-economic strategies are contingent upon cumulative effects, specifically the degree of negative impacts resulting from human activities. Within the Admine reserve, conservation has manifested in the form of "secondary nature," a concept previously mentioned but elaborated upon here (Brock, 2014). This "secondary nature" is a consequence of expansionist economics, which is an absolute orientation that justifies all intensive uses within Admine. This system confronts comprehensive conservation efforts for Admine. From another perspective, the ecological balance is nearly lost due to the expansionist agricultural economy. The latest conclusion reached is the conflict in the Souss plain over water resources: In recent months, groundwater has been depleted, particularly in farms located in the southernmost part of the Admine forest and the Souss plain, as a result of illegal measures conducted at night (statements by witnesses in the same field). It is essential to emphasize that conservation extends beyond the Argan resource to encompass natural resources, including groundwater. The issue at hand is broad and comprehensive: the conservation of the Admine forest. The intense competition for it, both presently and in the future, indicates that Admine is classified as a forest "outside the basic function". The primary function pertains to the ecology of plants and animals, and there is significant concern that the Admine forest is approaching the brink of environmental sustainability (Brock, 2014).

3.2 Forest Conservation as a Structural Component of Sustainable Land-Use Planning

The use of the Admine forest for economic development hinders the practical implementation of environmental conservation within the Admine nature reserve. Field studies examining protection measures have determined that human domination and control over the Admine ecosystem and its natural development are key influencing factors. Although not explicitly addressed in existing research, our study has identified a link between

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conservation, sustainability, and the productive economic sector. This latter factor has historically constrained the first two elements: conservation and environmental sustainability. The Admine reserve has been impacted by the expansionist economy in its entirety. Our analysis of the hegemony and control over vital areas has led us to conclude that there is a correlation between economics and land use planning (Afi, C et al., 2024). According to Willis (1980), discourse on economics and planning commenced in the Western world over two decades ago, coinciding with the burgeoning international interest in ecosystems. Economic development has often occurred at the expense of land resources, leading us to conclude that forest conservation in the Admine Reserve is influenced by land use planning, particularly in terms of urban engineering. Historical studies indicate that the origins of land use planning are rooted in engineering, as engineers have historically shaped both the internal structure and external landscape (Afi, C et al., 2024).

3.3 Forest Conservation in Structure of Intensifying Competition over Land Resources

The conservation of reserves surpasses the capabilities of programs solely dedicated to ecology. In this context, conservation represents a competition between land resources and economic interests (Sinsin, T. E. M., et al, 2020). The significance of spatial planning lies in its ability to regulate areas at both environmental and social levels, thereby reinforcing the internal land structure (Allen, C et al., 2018). Spatial planning not only ensures conservation but also contributes to the conservation of the forest in terms of both species diversity and total forest area. Human pressure does not pose a significant challenge to the implementation of forest development and, consequently, territorial development. Our analysis of the data from our field study indicates that forest development and territorial development are distinct yet balanced entities. Specifically, the economic advancement of the region, primarily through agriculture, represents one aspect, while the balance is relative, as planning has facilitated the preservation of a designated area exclusively conserved as a park.

3.4 The Protecting of Admine Argan Forests amid Economic and Environmental Conflict

The transformation of Argan forests from indigenous ecosystems to recreational natural parks, such as park, is attributed to the commercialization of these areas. Specifically, the natural landscape has become a market entity in itself (Afi, C et al., 2024). Land Market. This phenomenon is prevalent in Moroccan forests, with the Argan forests (Admine) serving as a pertinent example for analyzing this trend. Consequently, our conclusion regarding the Admine forest (reserve) is grounded in realism: the commercialization of Admine is driven by objectives that diverge significantly from environmental goals. Similarly, planning within the study area is undergoing incidental changes. This prompts the inquiry: is the protective measure a form of prediction or control? To elucidate the presence of forest conservation in Admine, and if so, at what cost? Prediction and control, conservation encompasses both according to our geographical analysis “our results” (prediction, conservation, and the Admine forest) (Santoro et al., 2023; Perry, 2020).

The primary alteration is the failure to comprehend the environmental impacts on other essential foundations. The nature of control indicates that agriculture is the most vital sector in Admine, as is the case throughout Morocco. The land of the Admine forest was repurposed for agricultural activities as part of a development plan, leading to the financial valuation and trading of Admine's land (the land of the Souss plain). This is what is referred to as the land

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market/total productivity (land characteristics and control of natural resources or the environment) according to Ricardian Theory David Ricardo (Afi, C et al., 2024).

Regulating the intensity of (economic) development in favor of forest conservation offers advantages in terms of ensuring protective measures, yet the conclusion reached in the previous paragraph has erected a substantial imaginary barrier, rendering environmental conservation in Admine exceedingly costly. Determinism and causality, the wealth characterizing Admine, have given rise to several fundamental developmental aspects for the region's advancement in industry and agriculture. This has facilitated regional improvements in attracting projects. With a dynamic population and a proclivity for entrepreneurship (Hamman et al., 2023), it has contributed to the development of the natural forest area to the extent that it has surpassed its inherent characteristics

3.5 The Admine Reserve as a pristine Primary Natural Environment within a Human-Influenced Biosphere System

Regarding the temporal aspect specific to the Admine forest, it has transitioned from a primary natural environment to a human-modified environment, developed on the periphery of several factors, including economic ones. In other words, the spatial organization of production and the creation of a distinct market within the local culture and identity. This production signifies a revolution in generating economic value from natural resources and transforming them into an economic industry created by the land.

Conversely, it is the resource that generates the land (Pereira, S. N., 2021), leading us to conclude that the economic sphere and resources form an integrated network, each contributing to the creation of value and geographical identity for the other, and ultimately, the internal structure (Pereira, S. N., 2021). This framework elucidates the ideal network between the population and the living environment. Humans inherently possess land to exploit, initially utilizing natural resources that are progressively transformed into economic elements benefiting both the individual and those beyond the Argan space, and subsequently through production, which is then commercialized.

We conclude that individuals residing in a specific area derive benefits from its resources in two distinct ways: by exploiting them as resources per se and through the financial returns following their sale. The primary focus is on the connection that facilitated the transformation of the natural landscape into developed land, converting it from a natural component into a human resource. This argument, which has been extensively examined, is crucial in elucidating the power of the "individual" actor as a social concept proposed by Ratzel: "It is impossible to conceive of man without land, just as it is impossible to conceive of the individual without territory, one of man's greatest achievements: the state" (Pereira, 2021).

"Wherever new states are founded, they always grow on the same economic basis... They require the space necessary to house, feed, and defend themselves. Therefore, in all cases, the task of the state is to preserve the integrity of these spaces" (Pereira, 2021).

It is noteworthy that humans have contributed "absolutely" to the discovery of the philosophy of nature, a philosophy that translates into territorial ownership, enabling the creation of a human space that transcends the primary natural element. The transformation of the Admine forest exemplifies the significant departure from the law of nature, as it has transitioned to human law, which is predicated on making changes in accordance with economic trends, as previously articulated by Ratzel.

These changes are attributable to the urban practices established by humans since settling in the natural environment, resulting in transformations that have converted natural

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environments into more complex human spaces within the framework of spatial organization for territorial development (Meskour, B., et al., 2025). The concept of territory, which has evolved since the 1970s, is grounded in a comprehensive understanding of its multifaceted functions: biophysical, economic, and social (Perlik, 2019) under the three dimensions of material, ideal, and organizational (Ma, J et al., 2018; Iceri, V et al., 2018).

3.6 The Role of Human Planning in Shaping the Admine Ecological Reserve

Planning represents a structured approach when considering the design of the Admine Forest, which is perceived as inequitable to Admine's natural resources. To elucidate this, it is important to note that the natural environment is often utilized for human activities, particularly in arid regions. However, in the Admine forest, this utilization occurs in a particularly aggressive manner due to the geomorphological characteristics of the flat terrain and soil, some of which is suitable for agriculture while the remainder is allocated for construction (Benhsain, 2022).

It is crucial to acknowledge that human planning cannot be categorically deemed positive or negative, as critical thinking emphasizes the continuity of both human existence and the natural environment. These two elements cannot be equated, given the increasing necessity to exploit nature's limited and unlimited resources, particularly in the context of the Admine Forest's finite resources.

According to the director's plan for Grand Agadir, the reserve holds ecological significance that must be preserved, especially considering the heritage value of Argan (Urbane Agency of Agadir, 2014). However, field and bibliographic research indicates that the Admine Forest has not undergone traditional urbanization like other villages.

This is attributed to the nature of urbanization, which has been haphazard, as exemplified by "Ikhourban," located east of the Admine Forest near the airport. The plan advocates halting the expansion of this residential area towards the airport and redirecting growth within the forest.

The prevailing approach to large-scale spatial planning aims to serve the public interest, primarily by addressing demographic growth. The question arises: Do administrative plans prioritize ecological interests? (Pecl et al., 2017).

To address this question, it is essential to recognize that prioritization is the key determinant in deciding which plans should be discontinued, not only in the Admine Argan reserve but also within the broader Moroccan natural environment (Fassih et al., 2025), as is common in developing countries. Given that the ecological environment is considered the economic capital of these nations, particularly in Africa, it is anticipated that the Admine Forest will transition from a vast forest, as has already occurred, to mini-recreational parks. Currently, this human impact is becoming evident. While it may initially appear beneficial, it entails realities that necessitate further reduction of forest areas to accommodate the dual pressures of demographic and economic growth. In conclusion, causality has facilitated the development of an environment that is progressively diverging from its original natural state (Afi, C et al., 2024).

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4. CONCLUSIONS

Argan biological reserves typically transition from their initial state to a secondary, transformed state. This phenomenon is well-documented and accepted by geography researchers, as evidenced by historical accounts of the Admine Forest's transformation from a natural habitat to a predominantly human-influenced environment. The changes observed in the Admine Forest are not incidental but rather indicative of human expansion in the region. This study underscores the issue of control, as spatial planning in the area has significantly influenced forest sustainability. Our research suggests that demographic factors have contributed to the transformation of the Admine Forest from a primary environment to one with expanded economic dimensions, including agriculture and infrastructure. However, it is not solely demographics that have influenced this transformation; urbanization, particularly following the Agadir earthquake in the 1960s, and the green economy during the French colonial era in Morocco, have also played a role. During this period, the study area was considered part of the less valuable regions of Morocco, a division that served the interests of the colonizers while neglecting those of the colonized.

The findings reveal the impact of colonial planning on the current economic orientation, both regionally and internationally, which elucidates the typical behavior observed in the Argan biological system. Our research concludes that the planning undertaken in the Admine Forest has commodified the forest itself, a process that began during the French colonial period when land was sold at low prices to foreigners. The results, when compared to institutional economic frameworks, indicate that the transfer of ownership to foreigners has led to the fragmentation of ownership.

From this perspective, it is evident that the changes in the forest system are more profound than the current environmental issues, as our historical reference methodology has allowed us to understand the relationship between the Admine Forest and the expanded economy as a concept and systematic policy. Regarding the classification of the Admine Forest as a legally protected biological area, it may serve other objectives, particularly since regulation and conservation strategies may be employed to achieve economic goals unrelated to environmental conservation.

5. RECOMMENDATIONS

Supporting the Admine forest presents significant challenges, as the findings indicate notable strengths in the local economy but weaknesses in the forest's biological aspects. The challenges exceed the forest's capacity to withstand them, not due to natural limitations, as the forest is inherently resilient, but because the recommendations for economic development outweigh our research-based recommendations concerning forest conservation. Nevertheless, a park has been established within the forest as a strategic initiative to protect and emphasize local species.

However, one of our recommendations is to preserve the forest in its original state rather than transforming it into an urban green park, given the Admine forest's unique natural characteristics. It is imperative to recognize that the forest, in its original form, constitutes the heritage and identity of the region, and any alteration inevitably results in a transformation of the natural heritage as an open landscape, both ecologically and socio-economically. The Argan urban park, which hosts numerous Argan trees, serves as a space that seeks to prevent efforts to uproot these trees.

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