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## VEGETATION IN THE DADES BASIN AND THE CHALLENGES OF CLIMATE CHANGE

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Vegetation is one of the most important natural resources in human life, and plays important roles in the continuation of life above Earth. But there are some geographical locations above the Earth that suffer from scarcity of this vital resource. This study aims to determine the impact of extreme natural factors on the diversity and distribution of vegetation in the Dades Basin, located in the southeast of Morocco. In the data collection process, he relied on field research and bibliographic reading, to inventory and classify some plants and to know the reasons that led to their decline. This study concluded that climate variability contributes to the scarcity and increasing decline of vegetation cover.

Key words : Dades basin, Vegetation, Climate change.

## Introduction

Natural factors are considered the main determinant of the distribution of vegetation on earth. The change of natural factors is reflected in plant formations by either declining or flowering.

In the Dades basin various plant formations are spread. They can be distinguished between plants that spread in pastures and are dominated by thorns, then the short grasses and are usually found near waterways. These different plant species are in constant decline, some of which are threatened with extinction, due to overexploitation, drought and scarcity of water resources. This study addresses the problem of the decline of natural vegetation cover in the Dades Basin due to the drought factor. The focus will be on the natural factors that led to the decline of some plant formations. In order to take note of the subject in its various aspects, fieldwork was adopted to find out what species of plants were declining. In addition to bibliographic work, and cartographic tools.

## Natural characteristics of the Dades Basin

The Dades Basin belongs to the dry regions of southeastern Morocco, characterized by poor rainfall and poor vegetation cover.

## Geographical location of the Dades Basin

The Dades Basin is located in southeastern Morocco, between the longitudes of 30'  $5^{\circ}$  and  $6^{\circ}$  west of the Greenwich Line and latitudes of 30'  $31^{\circ}$  and  $31^{\circ}$  north of the equator (Map 1). The basin is bordered to the north by the High Atlas and to the south by the Small Atlas. This geographical location of the Dades Basin with its various natural characteristics has led to the distribution of various plant formations. The oasis has a semi-arid desert climate. This situation prevents humid northern currents from crossing from the north, while the oasis in the south opens up to dry desert influences coming from the Sahara Desert. In the Dades Basin, there is a major valley called Wade Dades that receives important water resources from the High Atlas and the Small Atlas.

Due to the geographical location of the Dades basin, there are plant formations, especially in pastoral areas and in the valley, and most of them are spiny plants that tolerate drought factor.

## Natural characteristics of Dades Oasis

Morocco is located between  $21^{\circ}$  and  $36^{\circ}$  latitudes north of the equator. And between the longitudes  $1^{\circ}$  and  $17^{\circ}$ , west of the line.



Map 1: Location of Dades Oasis. Source: Google Earth Images 2020, Digital Altitude Images, 2020.

Greenwich. Morocco belongs to the subtropics characterized by relative heat and is far from the cold polar region (Map 2). Hot tropics are characterized by poor plant life. These areas are characterized by plants that have great specificity, as they are characterized by their resistance to drought. It resists the lack of rainfall resulting from the desert continental climate. The majority of tropical plants are spiny.

Morocco has a Mediterranean climate in the northern part, and a dry and semi-arid desert climate in the southern part, which includes the studied area (Dades Basin). These climatic factors control the widespread plant species.

## The relationship of climate to plant diversity

Climate, topography and soil affect vegetation in terms of type, size and density. Climate is an essential element of vegetation and helps it grow. The climate provides moisture through rainfall and if the latter are available periodically and regularly, plant life is revived. As for the importance of the terrain factor in the diversity of vegetation cover, it appears through the difference in the height factor, as plants that grow in high areas differ from plants that grow in low areas. Fertile soil helps plants grow densely, while poor soil usually leaves a bare surface of plants.

**Poor rainfall :** The amount of rainfall received by the Dades Basin varies between the high basin and the bottom of the basin. Where the mountainous areas in the high receive important rainfall, such as the Talmi, Amsmerir and Ait Sidrat of the lower and upper



Map 2: Location of Morocco in orbital displays. Source: Farida Ouzdi Achievement 2024.

mountains. In mountainous areas, due to the steep slope, it is difficult for water to settle into the soil, because the rains are in the form of strong torrents that activate the erosion process. If we head downwards, we notice a decrease in the rainfall rate in Boumalne Dades, Souk El Khemis Dades, Kalaat M'Gouna and Ait Sedrate of the eastern plain. This variation in the amount of rainfall affects the growth and distribution of vegetation.

The Dades basin is characterized by a continental climate, in which the temperature intensifies in summer, sometimes exceeding 40 degrees Celsius and the temperature in winter drops below zero and the basin receives little amounts of rainfall, due to its geographical location, as the High Atlas Mountains in the north prevent the leakage of humid air currents coming from the north. The vegetation cover of the Dades Basin is characterized by random distribution, such as desert and semi-desert areas due to low rainfall and high evaporation (White *et al.*, 1986).

In the South High Atlas, a dry climate prevails and rainfall is significantly reduced in quantity and regularity. It is noted that the Dades basin receives rainfall mainly in the winter, but it is characterized by irregularity in the year, as this season knows important precipitation, compared to its absence in others. In addition to the high percentage of evaporation due to the long hot periods. Precipitation is characterized by fluctuation and significant change, and the general characteristic is permanent scarcity because its distribution within the year is irregular and very concentrated, and the majority of the months of the year remain either completely dry or semi-dry (Akdem Ibrahim, 1983). Rainfall is mostly characterized by concentration in a few days and a short time and a great scarcity during the summer.

**High temperature :** The Dades Basin knows a harsh temperature due to the large variation between the minimum and maximum temperature. The absolute minimum temperature recorded in Boumalne Dades is 9.6 degrees, below zero in January, while the maximum reached 42.2 degrees Celsius in July, a difference that widens even more in the mountain stations (Ait Hani and Amsmerir). So the area is exposed to frequent acute heating and cooling (Akdim, 1983).

The predominance of weak soil in the oasis : The Dades Basin has poor soil in terms of organic matter, with high salinity because the amount of rain is insufficient to dissolve salts from the surface layer of the soil, especially in high areas. In low-lying areas near the valleys, fertile soil prevails that provides moisture, and in these areas subsistence agriculture is prevalent. As for the soil of the mountain ranges, it is limestone rocks, on top of varying red soil, covering a vast area. Along the Dades Valley, there is a fine alluvial and sandy clay soil carried by flood or wind water, and this soil is considered developed and its presence is linked to special climatic conditions.

## Forms of plants in the Dades Basin

The natural properties of the Dades Basin play a role in the distribution of climate-adapted plant formations.

## Types of plants distributed in the Dades Basin

#### **Drought-resistant plants**

Droughts are widespread within the Dades Basin in pastoral areas, which are widespread plants, due to the dry and hot climate. These plants adapt to hot climates and tolerate heat and poor humidity. These plants belong mostly to the family of spines, and this type of plant tolerates the harsh climatic conditions, and is noted for its spread in mountain foothills, mountain areas and depressions. This type of plant varies in length between short plants and dwarf trees (Plate 1).

For example, Thymus capitatus, Artemisia herba alba, Echinops spinosus, Anabasis setifera, Apparis spinosa, Diplotaxis acris, Peganum harmala, Tuber magnatum, Ziziphus lotus, Emex, Launaea



Plate 1 : Types of spiny plants. Source: Field Research, 2024.

arborescens, Cirsium vulgare, Lotus edulis, Haloxylon scoparium, Halogeton, Bupleurum spinosum, Genista tinctoria, Citrullus colocynthis, Ranunculus, Convolvulus buschiricus, Stipa capensis, Vaccaria.

### Plants that need moisture

Some types of plants in the Dades basin need water humidity. These types of plants are distributed near water sources, are special and some are short in length. Some plants grow near waterways, and they do not tolerate drought. Vegetation in dry areas weakens for most of the year, due to lack of rainfall and high evaporation. Herbaceous plants grow when rain falls, and wither at the frequency of a dry period. In areas close to water sources, whether eyes, legs or valleys, we find dense grass growth. Then, when heading towards the east of the Dades basin or towards its west, where the water sources are far away, these herbs decrease, while thorny plants appear. This leads to clear differences in the field, in addition to the heterogeneity of the distribution of the vegetation cover. Plants such as chrysanthemums, dandelions, reeds, dandelions, mushrooms and oleander grow near water sources (Plate 2). The following are some of the plants that grow near water sources :

Origanum majorana, Boletus Satanas, Tanacetum officinale, Cichorium intghus, Nerium oleander, Caltha palustris, Sonchus, Mentha aquatica, Reseda, Rosa corymbifera, Taraxacum arcticum.

The Dades basin has a diverse vegetation cover, but it is limited and weak, and it is distinguished by spiny and herbaceous species that are widely spread and rarely find natural trees scattered in the basin. The vegetation spread across the Dades Basin reflects climatic and natural conditions in general, and these conditions allow only the growth of weak vegetation. However, the successive drought conditions in the Dades Basin have led to an increase in the vulnerability of vegetation, which is already scarce. Climate variability has significantly reduced vegetation cover. Human use of some plant species, whether for heating, consumption or treatment, has also caused their degradation. However, in this article, we will focus on the natural causes that led to the decline of vegetation cover in the Dades Basin and led to its decline, especially the climatic causes.

## Degradation of vegetation due to climate variability

Climate variability is a natural phenomenon known in different regions of the world, which directly affects natural environments, including dry or semi-dry ranges. And Semi-arid areas are known for high temperatures against poor rainfall, which reflects negatively on the local



**Plate 2 :** Types of plants growing near water sources. Source: Field Research, 2024.

environment. Climate variability has resulted in the frequency of dry years, which has directly affected vegetation cover and led to its decline.

## Impact of drought on vegetation

The dry periods of the Daddis Basin led to local ecological transformations. And vegetation is a natural element that has been significantly affected by climate variability, because rainfall provides water sources for vegetation growth and persistence. Due to successive droughts, water resources have become scarce, and therefore vegetation cover has declined. The Dades Basin belongs to the semi-arid regions that are characterized by weak rainfall, and the exacerbation of this phenomenon with the succession of years of drought compounds the negative effects of these harsh climatic conditions. The drought in the Dades Basin has led to the development of desertification and the reduction of biodiversity. The Climate variability, with its different determinants, has contributed to the impact on the basin's biodiversity and natural resources through drought. A number of plant formations that were affected by the frequency of drought years were lost. In addition to climatic heterogeneity, there are other factors that led to the decline of vegetation cover, such as population growth and increasing exploitation of natural resources and this contributed to their depletion and thus decline. Some plant species have disappeared completely in most areas of the periphery, such as the Sidra Ziziphus Lotus, Artemisia herba alba, thyme Thymus capitatus, Apparis spinosa and others, especially south of the Daddes Basin.

## Strategies for protecting plant diversity

The protection of biodiversity, especially plant diversity within the Dades Basin, requires a precise strategy that works to take measures to adapt to all developments within the field, especially natural transformations. And work to achieve climate adaptation for plants by providing different sources of water resources. And the Dades Basin needs:

- Benefit from rainwater that is lost in periods of abundance through the construction of hill dams, which is to preserve water resources from loss and benefit from them for as long as possible. Thus, the presence of water and the feeding of the underwater mattress can be ensured;
- Confronting the phenomenon of drought through alternative strategies to address this phenomenon and reduce its negative repercussions on the environment;
- Preparation of a database of plant diversity in the Dades Basin, disaggregating it according to its characteristics;
- Spreading environmental awareness and the importance of maintaining vegetation for its important roles in the ecosystem in general, by stabilizing and preserving the soil and protecting the soil surface in general from drift and erosion, strong winds and reducing desertification, in addition to the medical and economic importance of plants ;
- Support adaptation to climate variability and successive drought years;
- The importance of vegetation in biodiversity and maintaining ecological balance.

Harsh climatic conditions, lack of water resources, poor soil and poor vegetation cover complicate the perpetual struggle between man and the environment for daily food. It is a conflict further complicated by numerous interventions and population densities that threaten to destroy what remains of a fragile ecological balance (Akdim, 1983). Through this study, a new problem can be identified that addresses the issue of human impacts on vegetation along with climate impact. To identify the relationship of influence between man and the natural environment in which he lives, through overgrazing, passive and indiscriminate logging.

## Conclusion

Vegetation is one of the key factors in improving environmental quality and conservation, as it plays an important role in conserving soil and water, providing food and medicines, and mitigating the negative impacts of climate change. Vegetation also contributes to the carbon balance in the air. And loss of vegetation can significantly affect the environment and economy, so understanding the importance of vegetation is essential to developing effective conservation policies and strategies and ensuring its long-term sustainability.

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