



Research Article

Forest Management in the face of Poverty and Rural Development Challenges: Study case of the Central Plateau Region, Morocco

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Abstract | Financial crises, wars, global warming and under development infrastructure all these have contributed to ecological vulnerability and resource depletion in rural regions over recent years in the central plateau region of Morocco. This caused to a marked decline in agricultural food productivity in the areas. The region in question is characterized by a varied topography, comprising plateaus and levels situated at different altitudes. To conduct a thorough field study, a preliminary visit was carried out to enables an insight into local realities and to design a contextualized questionnaire tailored to the specific characteristics of the area. This study presents the results of a socio-economic survey conducted in 2022 in the central plateau region of Morocco. The results showed a major difference between the proportion of participants living in a single household and those living in two or more households. A significant difference was also observed between the proportion of participants with access to educational facilities and those without access. In addition, a considerable difference was found between the proportion of participants with access to a health center and those without access. Furthermore, this study reveals that the region's infrastructure remains insufficient to improve the standard of living for its population. For this purpose, forests remain the only viable option for this population to meet their energy needs. Finally, this study proposes some recommendations to be taken into consideration to improve the living conditions of the population and ensure effective management of forest resources in the region.

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Introduction

Forest products are particularly important (Nerfa *et al.*, 2020), as forests represent nearly 1% of Morocco's annual GDP (Chebli *et al.*, 2021).

Furthermore, forests and their associated ecosystems provide a range of ecosystem services that can be converted into economic benefits (Johnson *et al.*, 2021). In Morocco, approximately 7 million people live on or depend directly on forest resources for

their daily needs (Chebli *et al.*, 2018; Moukrim *et al.*, 2019). Forests supply fertile soil that is essential for agriculture, especially in mountainous areas where water is available (Moran *et al.*, 2000). Additionally, silvo-pastoral activities provide between 1.5 and 2 billion forage units per year, accounting for nearly 17% of livestock feed (Chebli *et al.*, 2021).

In Morocco, the cooperative management of agricultural, forestry, and pastoral resources is closely tied to the country's marginal and mountainous zones, where farming populations once had relative autonomy in decision-making compared to the central authority. More recently, the Moroccan State's agricultural strategy, adopted in 2008 as the Green Morocco Plan (GMP), and, in particular, its Second Pillar, focuses on solidarity support for small and medium-sized farmers (Bhattacharya and Innes, 2013; Bui and Hoang, 2021). These modern systems entail a so-called negotiated management of common resources and/or related expertise. Thanks to public initiatives, a process of "opening up" these resources to private investment is being carried out by stakeholders who are frequently not part of the local farming populations.

In 2024, the Royal Institute for Strategic Studies conducted a survey on the sustainable management of Moroccan forests and revealed that the main challenges in this regard are the lack of coordination between the various stakeholders, cited by 81% of respondents, according to the survey conducted to assess the state of Moroccan forest ecosystems, followed by the lack of qualified human resources (69%), poor enforcement of laws (68%), and lack of data (48%) (IRES, 2024). These challenges are evident in the implementation of forestry policies, complicating informed decision-making. The major obstacles encountered in the implementation of forestry policies are, in order of importance, according to respondents' perceptions, pressure from local populations, conflicts of interest between different stakeholders, weak law enforcement, and lack of scientific data. These factors significantly limit the ability of managers to make effective and sustainable decisions.

The decline of forest ecosystems is a critical environmental problem in Morocco (Derak *et al.*, 2018), yet little attention has been paid to the effects of human activities, particularly in rural areas, which

compromise ecosystem reliability and diminish some of the environmental and economic services provided by these ecosystems (Kouba *et al.*, 2018; Alaoui *et al.*, 2020). Recently, there has been a growing awareness of this challenge, thanks to progress in forest research and actions by the Department of Water and Forests (Zidane *et al.*, 2019). The emergence of innovative monitoring methods and readily available satellite imagery has enhanced the capacity of researchers and decision-makers to track and assess forest landscapes and threats, especially in rural areas (Forrester *et al.*, 2021). Studies on alternative sources of income for rural communities have also been conducted, focusing on utilizing forest products to achieve these goals (Moukrim *et al.*, 2018). However, there is a lack of data from field surveys regarding the contribution of forest management practices to improving the living conditions of the population in forest areas. In this context, this study aims to highlight the correlation between forests and poverty through a socio-economic survey conducted in the central plateau region of Morocco.

Materials and Methods

Study area

The region studied is the central plateau of Morocco, which extends from the coast of Rabat to the Atlas chain region of Boulemane, between longitudes 6°49' W and 4°43' W and latitudes 34°00' N and 33°22' N (Figure 1). Altitudes most often vary between 84 m in Rabat and 3326 m. Due to its geographical location, the study area shows a diverse landscape (plateaus, valleys, mountains, etc.), and it extends over two completely different areas: The Mesetian and the Atlas.

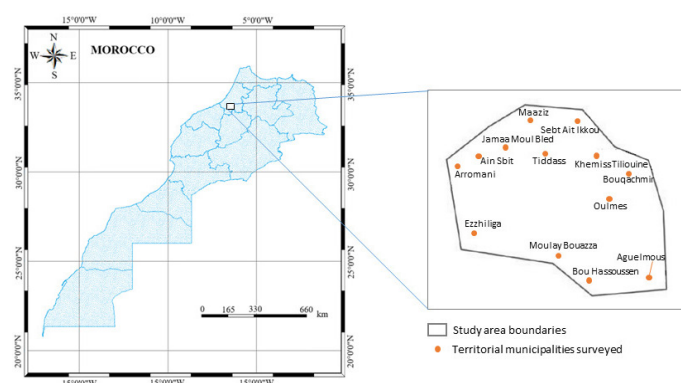


Figure 1: Geographical location of the study area

Conducting the survey

This work is part of a socio-economic study of the

central plateau, which comprises a group of plateaus at different levels. To conduct an in-depth analysis, it is necessary to carry out an initial field visit to better understand the local situation and distribute questionnaires tailored to the specific characteristics of this region. The questions in the survey were carefully designed to address the various dimensions of forestry operations. They cover a wide range of topics, from demographic characteristics, such as population size and age distribution, to socio-economic facilities, such as access to health services, education, and transportation infrastructure. The information was collected following surveys of 350 heads of households from the general population, using questionnaires consisting of a set of questions. It allows the collection of basic data essential to the study: (1) the occupation of rural space: housing, water points, main areas, and routes, (2) basic infrastructure, (3) activities practiced occasionally, (4) the characteristics of the population: number of households, etc.

Statistical analysis of data

As part of this study, a rigorous methodology was followed to process the data collected. First, the data collected through the survey was entered accurately and systematically. Once the data had been entered, a statistical analysis was performed to identify trends and relationships between the variables studied. For this purpose, SPSS software was used, as it offers a range of powerful tools and functions for statistical analysis. The results obtained were then presented clearly and concisely, using tables and figures, to facilitate understanding and interpretation of the results. This rigorous methodological approach ensures the reliability and validity of the conclusions of the statistical study. Parametric tests are statistical methods that assume that the data follow a specific distribution, usually a normal distribution. These tests are used to assess whether there are significant differences between the groups or variables studied. In this study, a Student's t-test was used to compare the means of two independent groups. The results of the parametric tests were interpreted by evaluating the p-values (probability values). If the p-value is less than a predefined threshold (usually 0.05), this suggests that there are statistically significant differences between the groups or variables being compared. In this case, it means that the differences observed are not simply due to chance but are actually influenced by the variables being studied.

Results and Discussion

Age

The age of this population ranges from 20 to 40 years; the table represents the distribution of subjects according to age. It should also be noted that 1.1% of this population is aged between 20 and 29 years, 19.1% is aged between 30 and 39 years, while 79.7% is over 40 years (Figure 2).

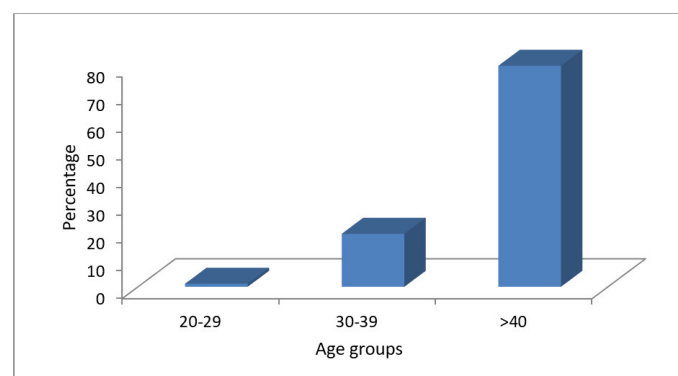


Figure 2: *Distribution of populations according to age groups*

Gender of the head of household

The sample studied comprises 500 respondents, with 90% being men and 10% being women. Figure 3 represents the distribution of subjects by gender.

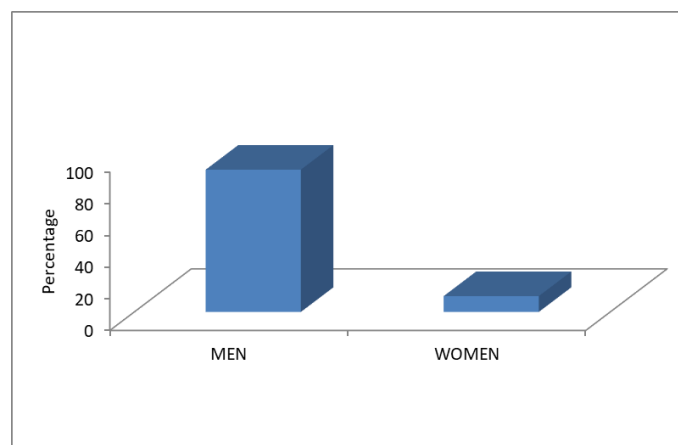


Figure 3: *Distribution of populations according to sex*

So, according to these results, we see that 10% of this population with female heads of household (35) are divorced or widowed. Based on the findings of the 2004 General Population and Housing Census (RGPH), the proportions of the two sexes are almost equal. Males represent 50.5% against 49.5%.

Age distribution according to gender

Studying the population structure by age and gender

(Figure 4) is essential in any demographic survey.

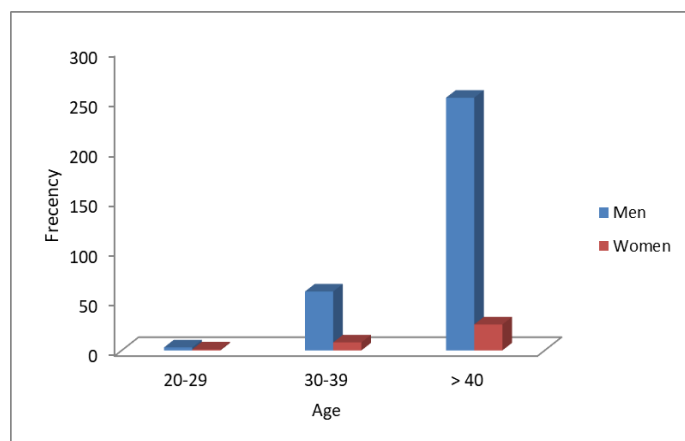


Figure 4: Population structure by sex and age

Based on this investigation, the following findings were made:

- The proportions of the two sexes are different. Men represent 315, while women represent 35, making the male sex very high compared to females in the entire sample.
- The age category of male heads of household is 59 people aged 30-39, and 253 are aged over 40. This study is consistent with the results of the 2004 General Population and Housing Census (RGPH), which show that the theoretical working age category (15 to 60 years) represents 59.5% of the total population surveyed. It is significantly higher than that of the inactive age and therefore represents significant labor potential.

Number of households

In the study population, primary foci account for 99.1%, and secondary foci account for 0.9% (Figure 5). Table 1 presents the distribution of subjects by the number of foci. This increase in the size of households living in the home can be attributed to family solidarity, still prevalent in the area, among household members, as even married brothers often remain grouped in the same home.

Total population in the household

In this study, 11.1% of the population consists of single women, compared to 34% for two or three women, while 18.9% have four women. However, the percentage of households with five women is very low at 1.1%. Additionally, it is noted that households with a single male person account for 18.6%, while households with two male persons account for 35.1%. Households with three men represent 25.7%. The

percentage of households with four men is 20%, and the percentage of households with five men is 0.6% (Table 1).

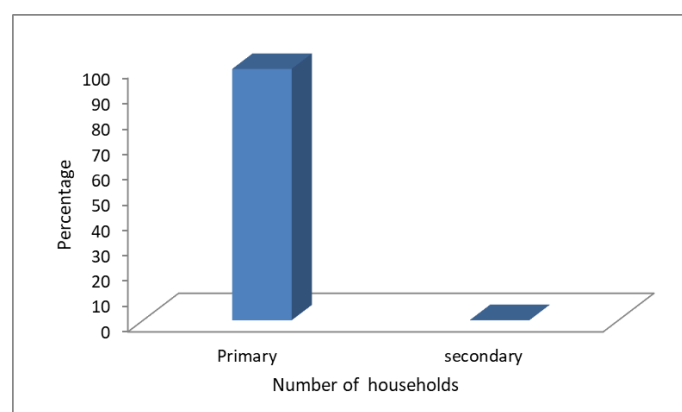


Figure 5: Population structure according to the number of households

Table 1: The total number of the study population according to gender

Number	Women		Men	
	Frequency	Percentage (%)	Frequency	Percentage (%)
One	39	11,1	65	18,6
Two	120	34,3	123	35,1
Three	121	34,6	90	25,7
Four	66	18,9	70	20,0
Five	4	1,1	2	0,6
Total	350	100,0	350	100,0

Socio-economic and school equipment

According to a 2011 study conducted by the Ministry of Economic Forecasting and Planning, a comparative analysis between villages with basic infrastructure and those without enables a better understanding of the impact of such infrastructure on education and literacy indicators. Indeed, the proximity of basic educational establishments, as well as accessibility to community facilities (such as electricity and paved roads), are all factors that influence the rural population's capacity to integrate effectively into the education system. This is how the literacy rate rose from 33.1% in rural areas nationwide to 35.4% in villages with only a primary school, to 40.4% in villages served by a road, and to 43.8% in electrified villages. Literacy levels are significantly higher in villages with multiple social facilities. Figure 6 shows that the percentage of schools in the study area is 88.3%, while 11.7% of these villages do not have a school.

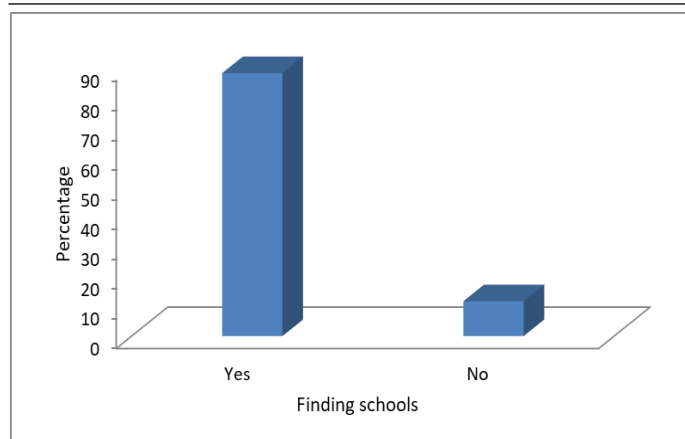


Figure 6: *Percentage of finding schools in the study area*

A survey conducted in rural areas of Morocco showed that dropping out of school is not the result of outright rejection of school, but rather of complex social negotiations between educational aspirations, economic constraints, gender representations, and differing expectations among families. The study highlights specific modes of interaction between families, children, and the school system, shaped by local social conventions. These dynamics help explain why some families ultimately accept school dropout, despite a symbolic recognition of the value of education (Farahi, 2025). The objectives of schooling or formal education are far from being achieved in the study area. This can be explained, firstly, by the precarious economic and social situation of families, and secondly, by the nature of the school curriculum itself, which falls short of preparing citizens to function effectively in their social and economic environment and facilitating their integration. A child who leaves school after four to five years of education often finds himself in a rural environment, from which he may later move to the city, where he lacks the tools necessary to integrate and secure a job. Improving the well-being of the population can significantly encourage household heads to invest in their children's education and explore other sources of employment.

Dispensary

Based on our findings, all the villages included in the study have access to a shared hospital, while 95.4% of the population shares a shared dispensary, leaving 4.6% without access to this dispensary (Figure 7).

Work center

Regarding the work centers, Figure 8 shows that 95.4% of villages have a center, while 4.6% of the

population does not have access to a work center.

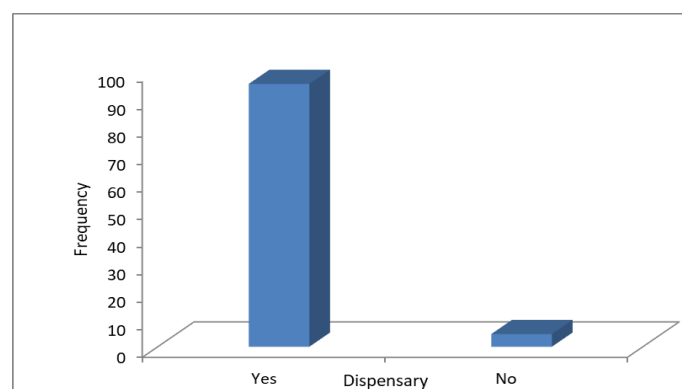


Figure 7: *Distribution of dispensaries*

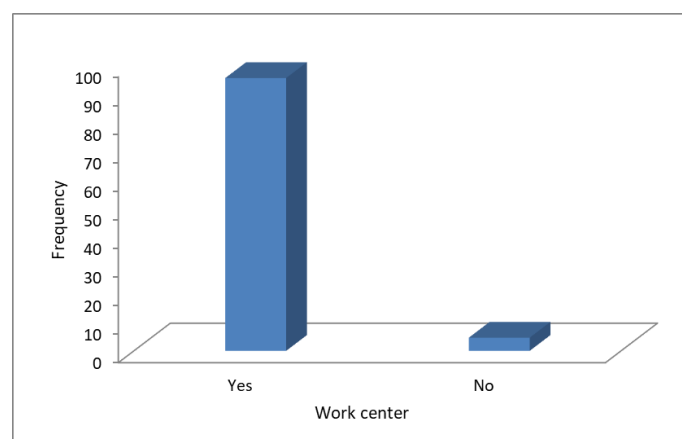


Figure 8: *Work center distribution*

Table 2: *Distribution of tracks and roads*

Village tracks				
	Frequen- cy	Percent- age	Valid percent- age (%)	Cumulative percentage
Yes	339	96,9	96,9	96,9
No	11	3,1	3,1	100,0
Total	350	100,0	100,0	-
Villages road				
	Frequen- cy	Percent- age	Valid percent- age(%)	Cumulative percentage
Yes	279	79,7	79,7	79,7
No	71	20,3	20,3	100,0
Total	350	100,0	100,0	-

Tracks and roads

Rural tracks or country roads are a vital part of the socio-economic life of this study area, as they facilitate the evacuation of agricultural products and the transportation of agricultural means of production. But access to these rural territories is crossed by a weak road network. The population having access to rural tracks is 96.9%, while the villages linked to the road are 79.7% (Table 2). So we must consider

adding that rural roads also promote contacts of all kinds necessary for the social and economic progress of populations (market, visits, diffusion of new ideas, diffusion of new technologies, etc.), harvesting crops, access to goods, and access to public services such as health and education.

Souk and mosque

The souk (market) manifests to the highest degree certain criteria of urbanity, including social heterogeneity, concentration, and differentiation of activities. In this sense, it has often been perceived as the public space par excellence of traditional Arab cities and the privileged place where social differences were managed in their various ethnic, religious, and other manifestations. [Figure 9](#) presents the villages surveyed that have common souks and mosques.

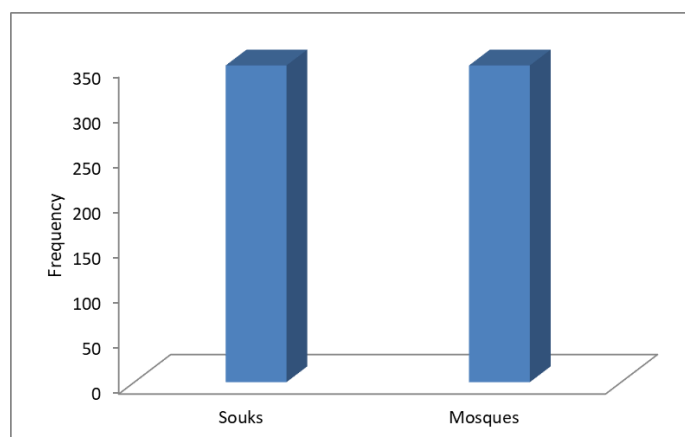


Figure 9: *Distribution of common souks and mosques*

All the villages surveyed have common souks where products are sold and bought. “The souk, for example, is more than a space, it is a system of specific commercial and social practices, a neutral, non-communal meeting place, a place for negotiating differences in the “modesty of communities”, a public space par excellence which can function, almost indifferently, under “medieval” vaults and in modern “Western” architecture ([Yue and Liu, 2007](#); [Jebiwott et al., 2021](#); [Kyere-Boateng and Marek, 2021](#))

Water sources

[Figure 10](#) illustrates the different water sources used by the population. The results show that, of the 350 individuals surveyed, 201 rely on well water (57.43%), while the remaining 149 rely on tap water (42.57%).

Statistical analysis of variables

Comparing the average values of different variables using Student’s test (t-test) revealed the following

([Table 3](#)): First, there is a significant difference between the proportions of participants living in a single household and those living in two or more households. Second, a significant difference was recorded between the proportions of participants with access to school facilities and those without. Third, a significant difference was found between the proportions of participants with access to a health clinic and those without. Fourth, a significant difference between the proportions of participants with access to a souk and those with access to a mosque.

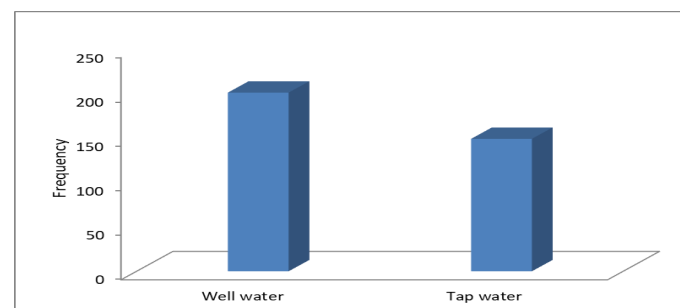


Figure 10: *Water sources of the surveyed population*

Tables 3: *Comparison of averages between various variables in the study population*

Variable		Student test	
		Value	p
Number of households	One	25.52	0.001
	Two		
School facilities	Yes	13.63	0.002
	No		
Dispensaries	Yes	9.72	0.04
	No		
Equipements	Souk	4.64	0.00
	Mosque		

Poverty and lack of economic activities for heads of households in the region, population density, infrastructure, land tenure, education, per capita income, length of residence, migration, and energy prices are factors that force the population to rely primarily on natural resources ([Caplow et al., 2011](#); [Firnkorn and Müller, 2015](#)), making it a major cause of deforestation ([Miller et al., 2021](#)). According to UNEP, “In the last century, the world lost more than 80% of its original forests. Every day, the equivalent of a football field of forest area disappears, and about 2,000 trees are cut down every minute” ([Chen et al., 2024](#); [Dodev et al., 2020](#); [Lee et al., 2019](#)). Forests and tree-based systems play a crucial role in addressing one of the most pressing contemporary issues: alleviating

poverty in a fair and sustainable manner. However, forests and trees are often ignored in policy discussions and actions related to poverty (Brancalion *et al.*, 2017; Bukhari *et al.*, 2019). While preserving biodiversity requires protecting natural forests, strengthening the bio-economy requires increasing wood production from forest cover. This dual approach underscores the necessity of integrated strategies that strike a balance between environmental sustainability and economic development, thereby ensuring that both forest ecosystems and local communities can coexist and thrive (Eyvindson *et al.*, 2018; Potapov *et al.*, 2015; Rybar and Bosela, 2023).

The Moroccan forest was part of the collective property of the tribes that used it. Groups living within or near forest areas have always been considered legitimate owners with sovereignty over the exploitation of common resources. This mainly includes the right to extract wood and graze livestock, provided they belong to the community. Individuals who are excluded from membership do not have the right to exploit the forest unless they ally with the user tribe, generally through the *Jemâa*, which oversees the management of common resources. The *Jemâa* is an assembly of notables (in principle, heads of families), whose number is indeterminate. The *Jemâa* represents the identity of the community and is its decision-making center, particularly concerning forest exploitation and conservation, in accordance with the principle of consultation. Despite free access to forests justified by community membership and pressing needs resulting from poverty, forest exploitation is regulated by a number of traditional institutions imposed on local operators under the aegis of the *Jemâa*. In the event of an incident or event, the *Jemâa* settles issues relating to illegal forest exploitation, timber extraction, and grazing. It has the power to formulate and adopt certain decisions concerning the sustainability of the common resource, such as the seasonal or prolonged closure of certain areas to ensure their regeneration. However, any exploitation or appropriation of land that does not comply with the customary rules recognized by the *Jemâa* is systematically combated. Among the ancestral practices applied in forest management and often placed under the supervision of the *Jemâa* is the *Agdal*. This is a customary practice strongly linked to the religious and spiritual aspects of local populations, particularly in the Moroccan High Atlas. It involves the seasonal protection of a defined area, which allows vegetation to rest, young

seedlings to establish themselves, and plant species reserves to be replenished during the most sensitive period of regrowth (Bourbouze, 2005). Pastoral *Agdal*, therefore, promotes biodiversity conservation by protecting fragile areas. The closure and opening dates are precise and vary from one to three months in the spring. Vegetation density is higher in areas subject to the *Agdal* system. In addition, it covers about 20% of the food needs of herds (cattle, goats, and sheep), and this contribution, in terms of fodder, occurs in mid-summer when other pastures are saturated (Domínguez, 2013).

The management of Moroccan forest ecosystems does not meet the standards of efficiency and sustainability (IRES, 2024). Since 2010, the restructuring of the forestry administration and the reduction of local management units by one third have led to a limited presence of managers in the field. The lack of human resources, both technical and administrative, is keenly felt, compromising the monitoring, follow-up, and supervision necessary for sustainable forest management. Each unit must manage approximately 20,000 hectares, an excessive burden that undermines the quality of interventions. Forestry legislation, particularly the Dahirs of 1916 and 1917, although fundamental, has become obsolete and no longer reflects the country's social and economic developments. Certain provisions, such as those relating to "usage rights," are too vague and difficult to enforce. The 1976 reform, amended in 2009, aimed to integrate local populations into the forestry economy by allocating 80% of forestry revenues to them. However, coordination structures, such as the National Forestry Council, have not been effectively operationalized. Although laws exist to protect ecosystems, their enforcement remains limited. Penalties for forestry violations are too lenient to act as a deterrent. Finally, forest management plans, designed to ensure sustainable resource management, are difficult to implement due to their weak enforceability against third parties, compromising their long-term effectiveness. The sector also suffers from discontinuity in program implementation, with insufficient monitoring and evaluation of past projects and programs, thus limiting the analysis of their effectiveness and efficiency (IRES, 2024).

Conclusions and Recommendations

Findings on the current state of forest resources, in

their ecological, economic, and social dimensions, have enabled us to propose certain recommendations that can guide sustainable development in forest areas. Among these recommendations are, for example:

- Providing alternative sources of income for people living in forest areas by getting everyone involved in forest management to set up local cooperatives that focus on valorizing forest resources to boost their value.
- Supporting and providing local populations with alternative energy sources, such as gas cylinders, instead of relying entirely on forest wood as fuel, would contribute to reducing pressure on forest resources and minimizing the logging issue.
- Continuous reforestation of degraded areas to ensure the sustainability of the region's ecosystem, because the survival of these environments means the survival of the populations that depend on them. As a primary component of the economy, energy and domestic energy use are a central priority worldwide, especially in developing nations where the vast majority of the population relies on wood, charcoal, and agricultural residues for cooking fuel.

Acknowledgements

The authors sincerely thank the inhabitants of the forest areas of the central plateau for the valuable time they devoted to answering the questions in the surveys used in this study.

Novelty Statement

This study highlighted the relationship between forests and poverty in the central plateau region of Morocco and suggested recommendations to improve living conditions and ensure the effective management of forest resources.

Author's Contribution

Mariyam Bouhatta: Conceptualised the research framework and conducted field surveys, wrote the manuscript.

Hassan Boukita: Conducted statistical analysis, helped in data collection, and wrote the manuscript.

Fathalah Elwahab: Helped in manuscript drafting and writing.

Najiba Brhadda: Supervised the study and reviewed

the manuscript.

Rabea Ziri: Supervised the study and reviewed the manuscript.

Generative AI or AI assisted technology statement

The authors declare that no generative AI was used in the creation of this manuscript.

Conflict of interest

The authors have no conflict of interest.

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