

## FOREST DEGRADATION OF THE CENTRAL PLATEAU (MOROCCO) ON THE SUSTAINABLE DEVELOPMENT OF THE REGION

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### Summary:

In Morocco, forests cover 12% of the national territory and occupy an area of 9 million hectares. Globally, fuelwood represents 30% of the national energy balance, while the total consumption of fuelwood is estimated at 11 million tonnes of which 88% in rural areas, mainly for cooking and heating purposes, for this reason, The State has thought of the development of forests and the distribution of stoves to rural populations to reduce their consumption of fuelwood. In this context, we carried out surveys on the three forest zones of the Central Plateau region in Morocco, in order to assess the effect of this strategy on the intense exploitation of these resources. This study focuses on the comparison of the three types of forests: unmanaged forests (Oued Satour, El kansera, Camp Bataille, Oued El kell, Ouchkett, Oued Beht, Achemach, Houderrane); managed forests (Developed: Zitchoouine, Aït Alla Est, Aït Hattem, Sibara, Khatouat, El Harcha); and managed forests, the population of which has received state gas ovens (Aït Alla Ouest, Aït Ichou Ouest, Aït Ichou Est, Bouregreg). The results obtained show a weak or even negative correlation (-0.026) between the contingency coefficient and R of pearson the chi-square test, therefore the exploitation of forests continues despite the development of forests and the distribution of ovens to rural populations. Only the sharing of responsibilities between the various partners concerned can lead to a sustainable development of the forest ecosystems of the central plateau of Morocco.

**Keyword:** Planning, forests, firewood exploitation, Central Plateau, Morocco.

### Introduction

The conservation of forests and forest vegetation in the Mediterranean basin is a complex problem given their heterogeneity, the multiple uses and anthropogenic pressures practiced by the various cultural entities of the Mediterranean for millennia [1]. Morocco is privileged by a geographical context giving it great biodiversity. The forest estate covers 12% of the national territory and occupies an area of 9 million hectares (5.8 million hectares of forests and 3.2 million hectares of alfatial sheets) [2]. In recent years, several projects have been carried out to reconcile the conservation of forest resources and local development.

The wood-energy strategy carried out by the Department of Water and Forests provides for the distribution of 60,000 improved stoves over 10 years (2015-2024) at a total cost of 60

million dirhams. The objective is to sustainably manage forest resources by reconciling the increase in wood-energy resources with the reduction in consumption and by making the use of wood more efficient and its replacement by other fuels (for example, wood-burning ovens). The idea is to reduce the consumption of fuelwood by improving the energy efficiency of the ovens used by an average of 50%. The use of ovens has also helped to improve the living conditions of the rural population, especially rural women [3]. Wood harvested by the world's population accounts for about 40% of the current global renewable energy supply [4]. In Morocco, the expertise carried out by the High Commission (Law of Finances, 2011) concluded that 4 regions have priority in terms of intervention for the program to reduce fuelwood consumption, namely: Tanger-Tétouan – Al - Hoceima, Fès-Meknès, Béni Mellal-Khénifra and Marrakech-Safi, of which 110 rural communes as well as 300,000 households are concerned (law of Finances, 2011). Our study is interested in the impact of the type of management on the rate of fuelwood consumption, in unmanaged forests, managed forests, and managed forests whose households have benefited from the stoves distributed by the state in order to fight against the anarchic felling of trees. For this, surveys were carried out with the heads of households of the central plateaus of Morocco. These data are used statistically to study the impact of these developments on the exploitation of these natural resources.

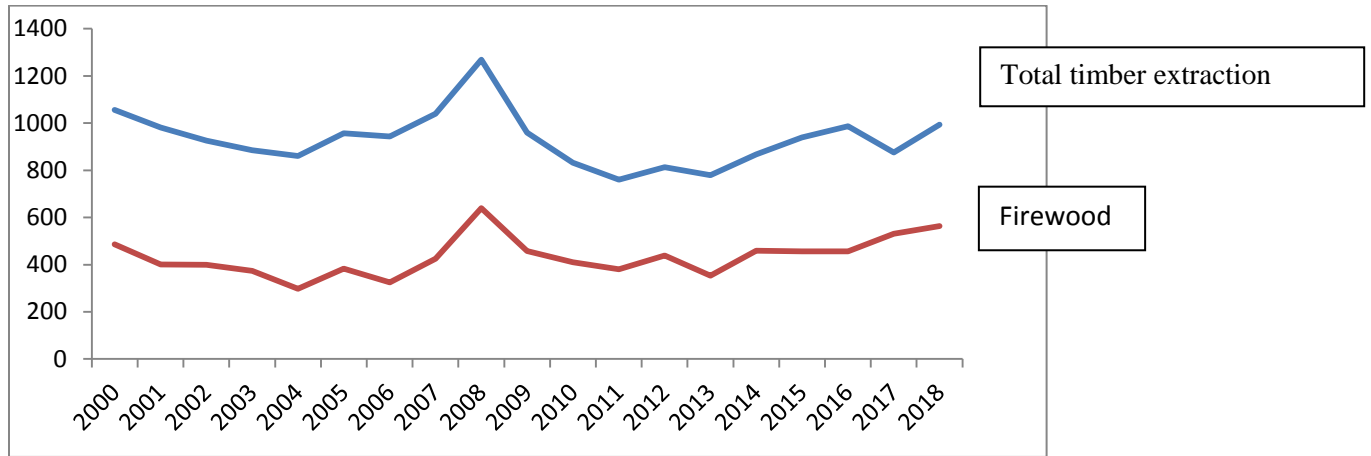
## **I. Evolution of forest management in Morocco**

Forest management in Morocco has gone through several phases: before 1914, the forest was part of the collective goods of user tribes (Agdal, terroir, Jemàa,...). The notion of forest management was almost absent [5], from 1914 to 1975. With the advent of the protectorate, the forest was nationalized and forest management was entrusted to the forest administration which had just been established. Thus, the management of forest resources is governed by a set of laws and regulations that constitute the forest regime which should dynamically manage the relationship between the forest and the rural population [5].

After 1990, Morocco's National Forest Program began the long participatory process of analyzes, reflections and debates relating to the planning of the management and sustainable development of forest resources. This process began with a series of analysis s , reflections and discussions on all aspects of forest management [5].

The programs adopted in terms of management, while taking into consideration the particularity of the categories which benefit from the advantages of the forestry sector.

However, this latter remains subject to an irregular climate and frequent disturbances which cause a certain fragility. This situation is further complicated by the expansion of forest human activities such as agriculture, livestock, and especially the expl intense oitation firewood past two decades despite the efforts of the E state to meadows preserve this wealth (Figure 1).



**Figure 1 : Exploitation of wood forests in Morocco in 1000 m<sup>3</sup> under bark .**

## II. Study zone

The Moroccan Meseta, or Moroccan Central Plateau, is an ancient massif located in the north-west of Morocco, between the Atlantic coast and the Middle Atlas; it covers an area of 8,500 km<sup>2</sup>. Unsymmetrical, the plateau culminates in the south-east (Djebel Mtourzgene, 1,627 m) and falls in a series of steps towards the north-west. It is cut by many valleys, some of which are deep (such as that of the Wadi Grou) which make traffic difficult. The climate is relatively humid, offering a landscape of forests (holm oak) and pastures, the Meseta is sparsely populated by Arab and especially Berber tribes, in the process of sedentarization (Zaër, Zaïane, Zemmour). The Central Plateau is devoted to extensive crops associated with breeding (sheep or cattle). Around Khouribga, the subsoil is rich in phosphates. The few agglomerations (Rommani and Ezzhiliga) (Figure 2), are generally distributed on the outskirts. The Berber tribes of the Meseta lived for a long time in total independence with regard to the central power, folded up on their plateau, which they left only to plunder the neighboring plains [5].

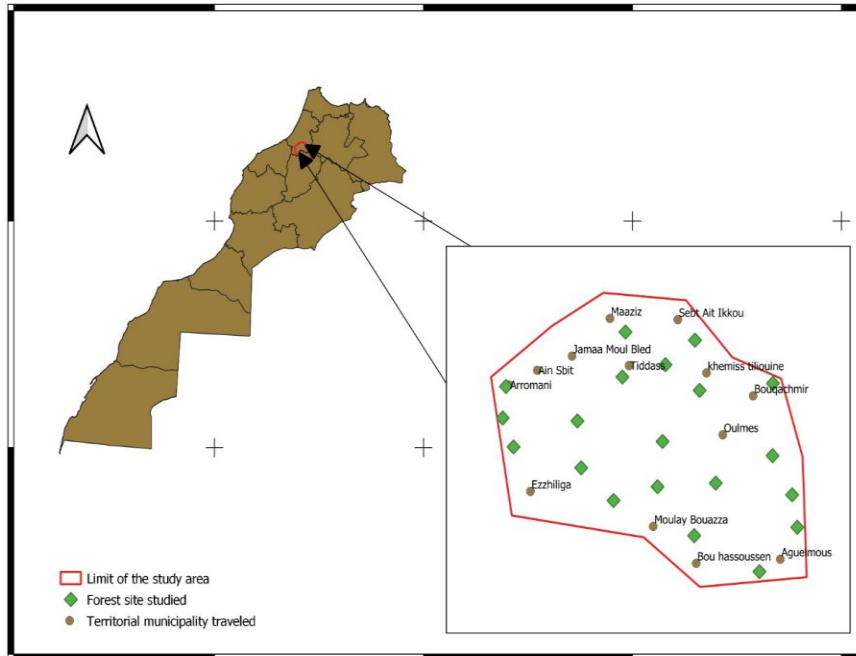


Figure 2: Study zone.

### III-Study methodology

The information was collected following the use of surveys with 350 heads of household in the general population, through questionnaires consisting of a set of questions. The analysis of the data collected made it possible to structure the information sought in the detailed survey sheets by questions more adapted to the local context such as: logging, types of wood used, number of trips and duration of the trip. thus travels the weight of each trip. For the study of the impact of forest management on the distribution of ovens on logging, we collected as much data as possible on the three types of forests in our study area:

- Unmanaged forests (Table 1);
- Managed forests;
- Managed forests whose people use gas stoves distributed by the state.

**Table 1 : States of study zone**

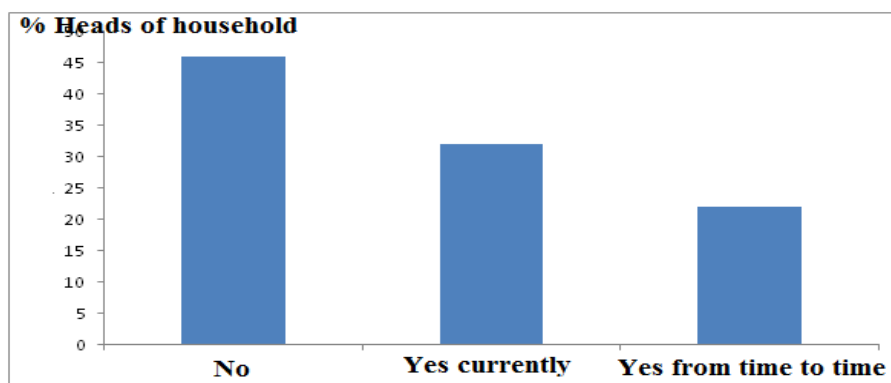
Forest resources development conservation center	forests	Area (ha)	Main species	State of development
Oulmes	Zitchouine	22196	Cork oak + Holm oak	Fitted out
Oulmes	Aït Alla East	5815	Holm oak + Cork oak + Thuja	Fitted out
Oulmes	Aït Hattem	21000	Thuja + Holm oak	Fitted out
Rommani	Sibara	8442	Cork Oak + Green Oak + Thuja + Softwood	Fitted out
Rommani	Khatouat	5767	Cork Oak + Green Oak + Thuja + Softwood	Fitted out
Maaziz	El Harcha	5325	Thuja + Green Oak + C Hene cork + secondary species	Fitted out
Maaziz	Timaksaouine	10139	Thuja + Secondary essences	Fitted out
Oulmes	Aït Alla West	4950	Holm oak + Cork oak	Fitted out Fireplaces with ovens
Oulmes	Aït Ichou West	9723	Holm oak + Cork oak	Fitted out Fireplaces with ovens
Oulmes	Aït Ichou East	2230	Holm oak + Cork oak	Fitted out Fireplaces with ovens
Maaziz	Bouregreg	14949	Thuja + Holm oak + cork oak + Secondary species	Fitted out Fireplaces with ovens
Tiflet	Oued Satour	1580	Thuja + Oleaster	Undeveloped
Khemisset	El kansera	930	Secondary species	Undeveloped
Khemisset	Battle Camp	2330	Secondary species	Undeveloped
Khemisset	Oued El Kell	1388	Secondary species	Undeveloped
Khemisset	Ouchkett	4285	Secondary species	Undeveloped
Khemisset	Oued Beht	10120	Thuja + secondary species	Undeveloped
Khemisset	Achemach	5720	Thuja + secondary species	Undeveloped
Maaziz	Houderrane	6841	Thuja + Secondary essences	Undeveloped

**Statistical Study :** Data entry was followed by statistical analysis, while results were presented in tabular form, and figures using SPSS software.

**IV-Results**

**IV-1- Exploitation of fuelwood in the region**

The population of forest and peri-forest areas depends to a large extent on wood fuels. The most important income is that of wood energy. Fuelwood remains the main fuel in all cold regions (Rif, Middle Atlas, High Atlas, Central Plateau, ...), it remains the main source of energy for all families, even in urban areas. Its replacement by other fuels is expensive, especially in rural areas. The satisfaction of energy needs is achieved through the exercise of right of use and illegal collection in the forest. Fuelwood does not cost more than the cost necessary to collect it. In fact, traveling in the forest to collect the equivalent of 60 kg of fuelwood requires a day's work. Or the equivalent of 55 Dh; i.e. 0.92 Dh / Kg (or 92 Dh/ql) [6]. Figure 3 shows the rate of fuelwood exploitation in the central plateau forests of Morocco by heads of households.

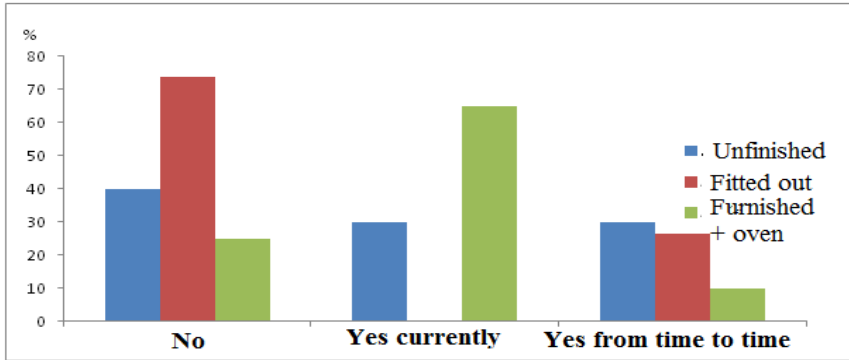


**Figure 3 : Rate of logging status by heads of household.**

According to the results of this survey, logging remains very high among the population of the study area. 32% of household heads currently use fuelwood, 22% household heads use it from time to time. On the other hand, 46% of household heads of this rural population no longer use fuelwood.

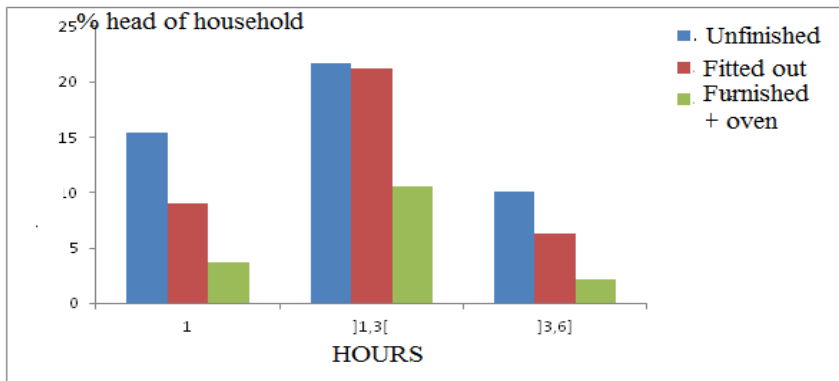
**III.2. Exploitation wood fire in the 3 types of forests**

Figure 4 shows the fuelwood supply by the population, according to the types of forests exploited: unmanaged forests, managed forests and forests, the population of which benefits from stoves distributed by the State.

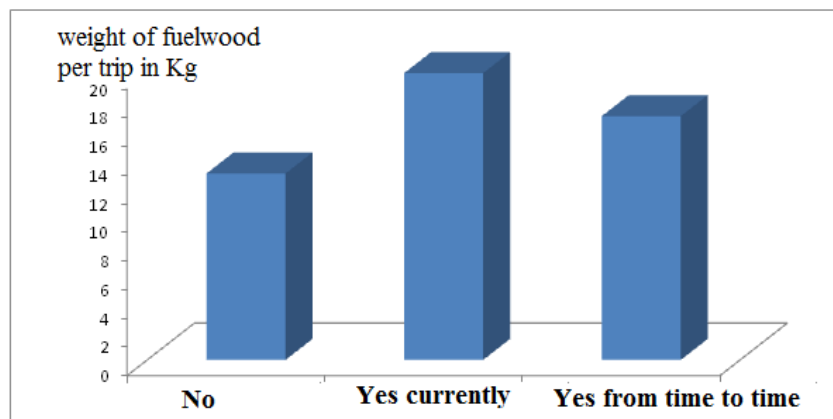


**Figure 4 : Shows the fuelwood supply by the population**

Fuelwood consumption is very high (65%) in households that are close to managed forests, even if they use the improved stoves (Figure 4). The duration of collection and the quantities transported of fuelwood by the heads of household confirm that forest management facilitates their exploitation, the quantities collected (20 kg) in managed forests greatly exceed those (13 kg) from unmanaged forests. or fitted out with improved stoves (Figures 5 and 6), with an average of around 17 kg / trip / household, if we consider that the season of fuelwood use is spread over 6 months from the month of 'October to March. However, this value is taken with precaution, knowing that the duration of use of heating can exceed 6 months by place, and also, the consumption can be differ from one month to another, especially that the average corresponds to the month of March, even milder than the other winter months. On the other hand, in other households the use of fuelwood is permanent throughout the year, to keep the rooms heated during winter, and cooking in summer.



**Figure 5: Duration of fuelwood collection by heads of household.**



**Figure 6 : Weight of fuelwood transported by heads of household in kg .**

The most important fuelwood consumption is concentrated throughout the cold period of the year (on average 100 days/year) and depends largely on the socio-economic factors of the rural population, the practice of harvesting and transport. wood intended for domestic use remains unchanged, storage begins even before the cold period. By the way, with the use of the ovens, we can achieve good results. But before embarking on such an action, one must carefully prepare a vast extension program by the forestry cooperatives concerned, then try to generalize it to the level of all loggers.

### IV.3. Statistical analyzes

According to the results of this test we have chosen parametric or nonparametric tests. Next, we generated a Henry line that runs a hypothesis test to see if the observations follow a normal distribution. For the normality test we have two types of hypotheses:

- The assumptions are H0: the data follow a normal law
- The assumptions are H1: the data do not follow a normal distribution.
- The results show that the significance level which is 0.05 indicates a risk of 5%, therefore the data follow a normal distribution because all the significance values are less than 0.05.

**Table 2 : Tests of normality between the state of the forest and the rate of fuelwood exploitation**

Fuelwood exploitation		Kolmogorov- Smirnov <sup>a</sup>			Shapiro- Wilk		
		Statistics	ddl	Sig .	Statistics	ddl	Sig .
E State	1 No	0.254	28	0 .000	0 .809	28	0 .000
	2 Yes currently	0.438	20	0 .000	0 .580	20	0 .000
	3 Yes from time to time	0.283	13	0 .005	0 .790	13	0 .005



at. Lilliefors meaning correction

Our result with normal distribution then we work with a parametric chi 2 test. Table 3 illustrates the results:

**Table 3 : Chi-square test between forest condition and fuelwood harvesting rate**

	Value	ddl	Asymptotic significance (bilateral)
Pearson's chi-square	20,144 <sup>a</sup>	4	0 .000
Likelihood ratio	24,867	4	0 .000
Linear by linear association	0 .040	1	0 .842
Of valid observations	59		

a. cellulose (33,3%) sur l'effet de l'effet thorium sur le 5e effet minimum de 4,19

The chi2 test sig value less than 0.05 therefore, there is a relationship between the type of forest and the rate of logging. Symmetric chi-square test measurements show that Pearson's contingency coefficient and R show a weak or even negative correlation (-0.026), which confirms that even with forest management and kiln distribution, forest exploitation remains very high (Table 4).

**Table 4: Symmetric chi2 test measurements**

	Value	Standard asymptotic error <sup>a</sup>	Approximate T <sup>b</sup>	Approximate meaning
Nominal by nominal contingency coefficient	0 .504			0 .000
Interval by Interval R by pearson	- 0 .026	0 .119	- 0 .197	0 .844 <sup>c</sup>
Ordinal by ordinal spearman correlation	0 .007	0 .127	0 .049	0 .961 <sup>c</sup>
N d'observations valides	59			

a. The null hypothesis not being considered.

b. Using the standard asymptotic error considering the null hypothesis.

c. Based on a normal approximation.

## V-Discussions

The potential fuelwood production of Moroccan forests is 3 million m<sup>3</sup>/year [7], but the volume of fuelwood actually collected from the forest domain and consumed, reaches 9.6 million m<sup>3</sup>/year, of which 2.4 million m<sup>3</sup> which are informally collected by local rural communities [8]. Several projects have been carried out to improve the forestry sector while trying to ensure local development. According to our survey, the state has developed 110 536 hectares and distributed improved stoves to limit the use of fuelwood. Our results show that the rate of forest exploitation remains very high even with forest management and kiln distribution. This study is consistent with several studies which show the failure of these projects based on technocratic management which has been demanded and envisaged by development operators according to an approach which reconciles the requirements of development with human flourishing, preservation environment and the guarantee of harmonious and sustainable development [9, 10, 11, 12, 13]. To decrease the rate of logging many environmentalists have suggested a different approach to forest preservation, arguing that integrating local people into the process is the most effective way to conserve protected areas. Proponents confirm that with the participation of local people in protected areas, conservation goals are easier to achieve [11, 12, 13]. Thus, numerous studies in developing countries show that people benefiting from conservation projects are more likely to express positive attitudes towards the protection of forest areas [14, 15]. In some cases, the lack of participation of local people in decision-making has a negative effect, which is consistent with previous studies of successful conservation strategies [16]. Many researchers show that the poorest populations are more dependent on natural resources [17, 18]. So the socio-economic background of the household can play a role in decision-making on the management of forest resources [19, 20]. Education remains a key factor in integrating farmers into forest management and conservation [21, 22, 23], in India, participation in forest management forests, revealed that education stimulates social participation. The influence of age on forestry activities is not clear. While Thacher et al. [24] and Zhang and Flick [25] found that age had no effect on forest management, The consumption of fuelwood remains fundamental for this category of households, and as we have seen, remains essentially linked to the total number of households. Population expansion will lead to increased pressure on woodlands to meet local needs and therefore accelerated reported that age is an important variable in explaining the interest of older farmers in protecting forest resources, while younger people are more willing to participate in the decision-making process affecting forest programs. destruction. If the situation continues in this way, we risk witnessing a deterioration in the living conditions of an increasing number of rural people. But there is still time to react in order to avoid the worst. First, if there is a technique that can help solve part of the problem, it is the development of the habitat and the improvement of heating techniques; as well as the adaptation of ovens for cooking purposes. On the other hand, in order to safeguard the forest heritage and avoid an increased shortage in

the near future, reforestation is essential. Programs whose objective must be to meet the needs of rural people must first of all better integrate the management of wooded resources with other rural development activities, which requires a better knowledge of the socio-economic factors which condition the consumption of wood. these quantities of fuelwood. The results obtained enabled us to propose the establishment of a management plan to reduce or even eliminate the consumption of fuelwood by the use of collective ovens, which significantly alleviates the arduousness of the work for women in the exercise of collection and hawking of firewood. To achieve these objectives of rehabilitation and development of forest areas while meeting needs.

### **Conclusion**

The consumption of fuelwood occupies an important place in the total energy balance of the rural population near the forest. This remains largely linked to socio-economic factors, traditional habits and natural conditions. It is also dependent on the number of inhabitants / rural and urban / which grows rapidly and maintains the same relationship with wooded areas. This can harm the future of our forest heritage. Our results have shown that despite the management of forests and the distribution of kilns by the state, the rate of forest exploitation remains very high and consequently the socio-economic stake largely outweighs the technique and that any action should focus on socio-economic factors. Forest management is an instrument for the sustainable management of forest ecosystems by taking into consideration all the components related to the forest sector and its environment, including the effective involvement of the population in the various phases of development. Moreover, only a sharing of responsibilities between the various partners concerned can lead to sustainable development of the forestry sector.

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