



## **DETERMINATION OF EXPLANATORY FACTORS OF THE DYNAMICS OF LAND OCCUPANCY IN THE COMMUNITY OF DJIDJA**

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### **Abstract**

The population explosion and the intensification of economic activities have led populations to occupy the land in different ways and for different reasons. The objective of the study is to determine the explanatory factors of the dynamics of the land occupation in the municipality of Djidja.

The research methodology is based on data collection, manual and statistical processing of data and analysis of results. Surveys are made from 271 heads or representatives of households and resource persons.

From this field work, it appears that the expansion of charcoal and firewood production activities is widespread throughout the municipality of Djidja. The total annual production of wood for the whole commune is 113 91, 2704 m<sup>3</sup> of wood which corresponds to 50,889,515 kg equivalent of wood, or 175,203,222 tons of wood equivalent. The factors of land-use dynamics are natural, socio-economic and political. The evaluation of the dynamics of the land occupation in Djidja Commune in 1986, 2000 and 2016 revealed a regression of natural formations in favor of mosaics of fields and fallows and agglomerations even inside the two classified forests of Atcherigbe, Dan and the communal forest of Kolobi which practically no longer exists. Deforestation and extensive degradation of vegetation occur in these forests and deserve special attention. The practice of activities such as agriculture, livestock, logging has been indexed to explain the degradation of natural formations in the Kolobi forest. This forest is mainly exploited by the population mainly for wood energy and secondarily for timber. In the locality of Kolobi and surroundings, 54% of those surveyed use forest resources as firewood or charcoal. With respect to softwood lumber, there are 33% of those surveyed who use these woods. While 10% of those surveyed are looking for species for handicrafts.

**Keywords:** Djidja, land use, logging.

### **Introduction and justification of the subject**

The West African countries, which are endowed with a very diversified but fragile environment, are currently undergoing rapid changes on many levels: climatic, natural resources, agronomic, demographic, political and socio-economic. (Akpassounouet al., 2006,). For centuries, humanity has played a negligible role in the environmental equation, but this role has changed dramatically and gained importance during the 20th century, especially over the last 50 years. As West Africa

enters the 21st century, environmental changes are expected to accelerate with unknown but potentially serious consequences for both people and the environment. Of all the regions of the Earth, West Africa stands out as a particularly vulnerable region, subject to climate variability (Hulme, 2001,) and driven by one of the highest global population growth rates (2, 7% per year (CILSS, 1999). Land resources are limited and changing at unprecedented rates, now that we have realized that humans are responsible for the majority of earth-wide changes in Earth's resources. At the global, regional and local levels, it is up to us to begin to follow this rapid evolution of the types, rates and amplitudes of the changes as well as the driving factors.

A better understanding of evolutionary processes is indeed essential to any ecological restoration approach through land management (Akpassounou et al., 2006, Lambin et al., 2006).

The commune of Djidja, knows today a spatial extension. The habitat of men today dominates its landscape and threatens the survival of urban or peri-urban agriculture and consequently poses part of the problems of high dependence on food. These facts are more attractive than they may seem, concerns that it is desirable to reflect upon and to explain, since they generate environmental problems other than natural erosion and unhealthy conditions (Sagbo, 1998). 2003) in the commune, because they also affect the forests and soils involved. In addition to the reasons that have just been mentioned, the requirements of decentralization have made land the first communal resource currently in great demand by the local population and power of Djidja commune. The pressure on the latter is becoming increasingly important every day especially with the entry into play of private actors who are already a financial stake projected in the medium and long term given the current level of development of the municipality and its various assets . The purpose here is to make a two-way assessment, which can show the difficulties and advantages associated with this exploitation, with the aim of a rational management of the reserves and the currencies that it brings back. This will prevent land diversion or dispossession, conflict, and waste of resources, which in extreme cases can compromise the productive and economic potential of society (Deininger, 2005). So, what are the direct determinants of the dynamics of the environment? What are the factors of the dynamics of the occupation of the lands in the Commune of Djidja? These are all questions to be answered by the study whose objective is to determine the explanatory factors of the dynamics of land occupation in the commune of Djidja.

### **Data and methods**

It is presented here, data used for research as well as methods of collection, data processing and analysis of results.

### **Data used**

The research is both qualitative and quantitative. Given its objectives, several types of data are used to know:

- Data on demography and human constructions from INSAE statistics which made it possible to assess the evolution of the population from 1979 to 2013 on the one hand and the evolution of the buildings on the other hand;
- Data on the state of plant formations (specifically forests), soils, shallows, and natural drainage corridors in relation to development, occupancy and land issues;
- Socio-anthropological data from field surveys. These data relate to stakeholders in the urban planning and living environment sector, the management mode, the constraints, the problems faced by these actors and the suggestions made by them on the basis of a pre-established questionnaire.

## **Data collection techniques**

The data collection techniques used are documentary research and fieldwork.

### **Literature search**

Literature research is essential for data collection (M-O. Safon, 2017, p.4). In the case in point, it consisted in visiting the documentation centers and exploring the reference websites on the theme of the dynamics of the land occupation for the consultation of some general and specific works, memoirs, journals and articles dealing with the subject. The information from the literature search made it possible to take stock of the progress made on the explanatory factors of the dynamics of the occupation of the grounds and to feed the discussion.

### **Field phase**

The field phase marks the effective presence in the municipality of Djidja for data collection. It breaks down into several stages:

#### ➤ **Pre-survey**

Pre-survey is a crucial step in collecting field data; it makes it possible to situate the object of study in a global context and to formulate general hypotheses (Salès-Wuillemin, 2006, p.8). It was essential to the present research because it made it possible to get to know the research environment before proceeding with the actual data collection.

#### ➤ **Field survey**

This phase marks the actual presence in the field of research. The field survey was rigorously conducted in the twelve (12) arrondissements of the commune of Djidja. The target groups targeted by this research consisted of households, women's groups / associations whose activities impact the dynamics of occupation of the villages. lands in the municipality of Djidja. In fact, the choice of the target group surveyed met the following criteria: avoir au moins 30 ans révolus pour retracer l'évolution du phénomène dans le temps ;

- have once experienced the effects of the urbanization phenomenon in the study area;
  - have resided in the Commune for at least the last thirty (30) years before the investigations.
- The sample size was deduced from the Schwartz (2002) method. It was calculated with a 95% confidence level and a margin of error of 5% using the formula opposite:

$$N = \frac{Z\alpha^2 \cdot PQ}{d^2}$$

Where N = sample size per rounding;

Z $\alpha$  = deviation fixed at 1.96 corresponding to a degree of confidence of 95%;

P = number of households in the district / number of households in the municipality;

Q = 1 – P ;

d = margin of error equal to 5%;

Then, a rate of 15% is applied to this sample to determine the exact number of households surveyed.

In total, the sample size is two hundred and seventy-one (271) households distributed in the twelve (12) arrondissements that account the Commune and traveled. In addition to this target, the interviews are directed towards 13 municipal authorities, 24 resource persons, wise and notables and 06 groups / associations.

## **Methods**

### **Tools, materials and techniques for collecting field data**

Tools and materials for data collection include the observation grid, the interview guide, the questionnaire and a digital camera. These tools made it possible to collect information using appropriate techniques, in particular:

- the questionnaire survey collected data from households, municipal officials, the CeRPA Tax, Water and Forests Department, subdivision committee members, religious and customary leaders, Notable and wise people and public works agents concerning the different forms of pressure exerted by the population on the natural environment and the management of the living environment with a view to ensuring sustainable local development in the research sector;
- direct observations have been based on the types of management that have been made and the different forms of pressure exerted by the population on natural resources in the research area;
- the interview is carried out by means of an interview guide with local authorities and the persons in charge of the management of natural resources on the one hand, land and urbanism on the other, in the sector of research ;
- The focus group was conducted using a maintenance guide. It is a technique that consists of bringing together a group of people who are willing to share their knowledge related to the topics in the interview guide. As part of this work, nearly twenty people (photo 1) were gathered to discuss the issue of this research.



**Photo 1:** Focus Group realized in the Agouna and Monsourou districts

**Shooting:** Avocèvou L., October 2017

Photo 1 shows the focus group technique used in this research. Indeed, it allowed to take the opinion of one and the other. Also, it allowed to reach directly, the groups, in order to collect the information at their level on the topic.

### **Data processing**

The questionnaires were the subject of a manual recount. Thus qualitative data from field surveys were captured using the Word 2010 software. Responses to each question were categorized. Then, the different categories of answers were inserted in the Excel 2010 spreadsheet for the calculation of the proportions and the realization of the graphs and tables.

The demographic projection is based on data from the 1979, 2002, 2002 and 2013 censuses using the formula:

$$P_n = P_{n-1} (1 + r)^n$$

With:  $P_n = P_{n-1} (1 + r)^n$  respectively the projected populations and a known previous period and  $r$ , the growth rate and  $n$ , the time between the periods considered.

Response rates (Tr) were calculated. They express themselves by the formula:  $Tr = \frac{ni}{Ni} * 100$

With Tr: Response rate; ni: the number of respondents and Ni the total number of respondents.

## **Results and Discussion**

The diachronic type of analysis was used to better appreciate the evolution of the identified relationships. Also, to be able to identify, to regroup and to establish logical relations between the different parameters which the spatial dynamics of the municipality of Djidja use. A second method of analysis that fits into the concept of the PEIR model (Pressure, State, Impact and Response) was also used. The interest is to arrive from this model, to link the extensive spatial dynamics and its factors, to the land and environmental problems in the municipality of Djidja.

### **Direct determinants of the dynamics of the environment**

The direct determinants of land-use dynamics are activities that directly affect the structure and composition of land-use units. These concern agriculture, logging, carbonization, breeding and hunting.

### **Characteristics of agriculture in the municipality of Djidja**

Agriculture is the driving force of the economy, thus the base for the development of most African countries, which for the most part have more than 75% of rural populations (Kossou et al., 1996). For this purpose, agriculture is the main activity practiced in the municipality of Djidja by more than 70% of the active population. This activity is a proven source of soil degradation. According to the Forester's Memento (1995), about 7.5 million hectares of dense forests (0.62% of the current area) and 3.8 million hectares of forest (0.52%) are cleared. every year, especially for agricultural needs in the tropical zone; which corresponds to an annual disappearance of 11.3 million hectares of natural forests (0.58%). Indeed, the cultural practices developed in the municipality of Djidja are of several types and take into account mainly traditional and modern culture practices.

### **Practical traditional culture developed in the municipality of Djidja**

In the study area, the practice of shifting cultivation is still used by most farmers. In fact, more than 8% of farmers practice the method of clearing with incineration, when it is a new land or a land left fallow (Plate 1).



**Plate 1:** Technique of itinerant slash and burn culture developed in Setto

**Shooting:** Houssou, C., October 2017

Shifting cultivation is practiced when the farmer abandons his field as soon as fertility declines to deforest new areas by clearing by fire to prepare the ground for future seed. It is predominant with the use of rudimentary tools characterized by a greater or lesser reduction in the fallow period.

**Practicing plowing and ridging**

These practices are more used on soft soils and especially in the pineapple and tomato crops. They consist of moving the soil to facilitate the development of the root system of plants. Plate 2 presents respectively a plowing operation and mounds of a field in the municipality of Djidja.



**Plate 2:** Plowing of a field at Setto and Buttes of yams at Agouna

**Shooting:** Houssou, C., October 2017

In this mode of land preparation, it is the muscular energy that is used. All production and even processing work is manual. However, this technique contributes to the degradation of vegetation and soil. The practice of deep plowing prevents the regeneration of trees and causes water and wind erosion of soils. The manufacture of mounds meanwhile, accelerates the erosion of soils and the phenomenon of infiltration by which the debris of chemical fertilizers will be deposited in the waters and pollute them.

**Modern techniques of land development**

The vulnerability of agriculture to climate variability and the pressure of the market economy imply the emergence of new crops and farming techniques favorable to the intensification of production. With the introduction of new crops such as pineapple and Nerica rice, agriculture needs the input of agricultural machinery such as tractors. In the municipality of Djidja, machines are widely used and this on a large scale from clearing to harvest. The use of modern agricultural tools is not yet widespread in the study area. It is still at an embryonic stage because it is used by few producers (5%). Investigations have shown that this low utilization rate is due to lack of financial resources and partners in agricultural development.

**Charcoal manufacturing and firewood production activity**

The expansion of charcoal and firewood production is widespread in all areas of Djidja and is a real threat to the environment. Today, with population growth and the growing economic needs

of the population, pressure on resources is increasing with accelerated exploitation of plant and animal resources, leading to the degradation of the entire environment (Sagbo, 2004). The activity of carbonization is more practiced in the districts of Dan and Atchéribé which shelter the two large classified forests of the commune. The most used species in the exercise of this activity are the *Tectona grandis* (called teak in French and in fungus), the *Acacia auriculiformis* (called Acacia in French and in fungus), the *Acacia siamea* (called Acacia in French and in fungi) and *Gmelina arborea* (called Omérina in French and in fungus). The annual global production of wood energy, that is to say the quantity exportable annually without destroying the forest capital, for the whole of the commune, is 113 91.2704 m<sup>3</sup> of wood which corresponds to 50 889 515 kg wood equivalent, or 175 203,222 tonnes of wood equivalent.



**Plate 3:** Preparation and storage of charcoal in the district of Setto

*Shooting:* Houssou, C., October 2017

### **Breeding and hunting**

Livestock and hunting have also been seen as direct determinants of the deterioration of land use in Djidja commune. The third direct determinant of land-use dynamics in the study area, livestock are practiced throughout the study area. There are two types: small livestock and livestock. Small livestock are small ruminants, poultry and are associated with agriculture. Livestock, meanwhile, is composed of herds of cattle and is the main activity of transhumant Fulani, most of them coming from Niger. With its extensive character, livestock is a threat to the occupation of the lands of Djidja Commune. . Indeed, the extension of cultivation areas, considerably reduces pasture, compelling livestock farmers to transhumance. With the dynamics of transhumance observed in the communes of the Department of Zou, there is an accelerated degradation of plant formations. The herbaceous layer is dominated by grasses that are asphyxiated by the trampling related to overgrazing. Also, we note a compactness of the surface layer of the soil, the formation of gullies and gullies of erosion which cause the physical degradation of the soil. In short, the exploitation of herbaceous and aerial pastures greatly contributes to the degradation of the plant cover and exposes the soil to any form of erosion.

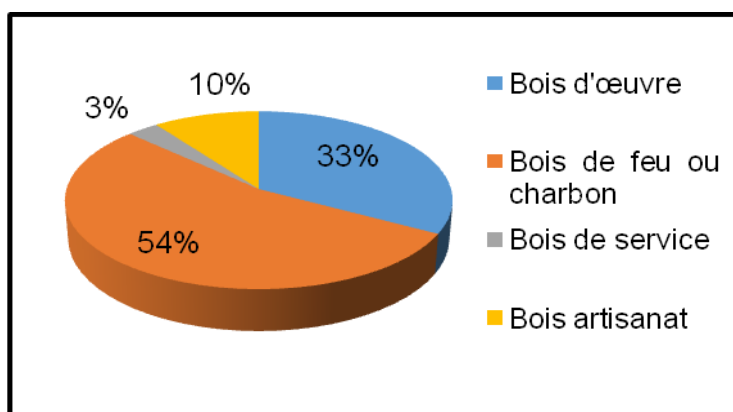
As for hunting, it is perceived by local populations as a determinant of vegetation degradation. In fact, this activity is mainly used by young people who practice hunting on the hunt where hunters put fires in the vegetation during the dry season, in order to get the game out of their refuge. Also, hunters seeking to make game areas accessible cause wildfires that are powerful determinants of vegetation degradation. Indeed, the fire, under the effect of the wind spreads in the vegetation and destroys it.

## Factors of land-use dynamics in Djidja Commune

In this section, the natural, socio-economic, political and administrative factors are analyzed in relation with their possible nesting in the commune of Djidja.

The evaluation of the dynamics of land occupation in Djidja commune in 1986, 2000 and 2016 revealed a regression of natural formations in favor of mosaics of fields and fallows and agglomerations even inside the two classified forests of Atcherigbe, Dan and the communal forest or reforestation site of Colobi. Deforestation and extensive degradation of vegetation occur in these forests and deserve special attention. The practice of activities such as agriculture, livestock farming and logging has been indexed by several authors (Arouna 2002, Mama 2013, Issiako 2015) to explain the degradation of natural formations in the Alibori classified forest. Superior. Beyond considering these activities as the drivers of deforestation and the degradation of vegetation cover, it is opportune to question the foundations that can explain the practice of these activities in the commune of Djidja in general and in the forests. classified by Atcherigbe and Dan in particular. These two forests still have a management plan that is qualified as participatory. In the Colobi forest, there is a net increase of about 1 ° C in average air temperatures since 1995 and a decrease in precipitation (Boko et al., 2012). This forest shelters an important biological diversity with savannah formations traversed by forest galleries. It is a reserve of energy wood and pasture. With the streams that pass through it, it constitutes a fishing zone that can improve the income of the neighboring populations. It also has many other economic assets whose value should bring some extra income to villagers and reduce poverty. However, this forest is subject to significant land pressures that could eventually lead to a considerable reduction in its area. Houses, Peulh camps and fields of yam, maize and other crops are settling in a fast and scattered way.

The Colobi forest is mainly exploited by the population mainly for wood energy and secondarily for timber. In the locality of Colobi and surroundings, 54% of the people surveyed use the resources of the forest as firewood or coal. With respect to softwood lumber, there are 33% of those surveyed who use these woods. While 10% of those surveyed are looking for species for handicrafts (Figure 1).



**Figure 1:** Use of Forest Species as Timber, Fuelwood or Coal, Service Wood, Wood Crafts

The planned reforestation works have not been carried out in violation of the provisions of the simplified development plan being updated.



In fact, of the 494 ha of plantations planned, only 100 ha of full planting have been carried out. This plantation is reforested with 40% *Acacia auriculiformis* and 60% *Gmelina arborea*. It should be noted that this plantation is poorly maintained with a lot of mortality (photo 2).



**Photo 2:** Reforestation of the Colobi Forest by *Gmelina arborea*

*Shooting:* Houssou, C., October 2017

With the population explosion and its corollaries of increased need for arable land coupled with the prohibition of access to classified forests without the means to enforce it, the path of free access to the lands of these two classified forests (Atcherigbe et Dan) was opened. The appropriation of all the forests classified by the State and the exclusion of the neighboring populations, often made in the name of the general interest, have legitimized the devastating practices within these classified forests. The State, through the forest administration, only exerts a superficial control without development and monitoring activities in these two classified forests of the municipality of Djidja (Djogbénouet al., 2011). The two classified forests of the municipality of Djidja then became the scene of several human activities which are: agriculture, breeding, logging, poaching, wildfires. It was then gradually introduced the "tragedy of the commons" (Hardin, 1968), symbolizing the degradation of the environment following the concurrent use of a resource by several users, each seeking to make the most profit.

### **Implications of land-use dynamics on flora and vegetation**

The characterization of the flora and vegetation revealed that the values of the specific diversity parameters are lower in the gallery forests. A low value of a specific diversity index, notably the Shannon index, is a sign of a very unstable environment (Dajoz, 1985). The gallery forests of Djidja commune are then disturbed. The most abundant forms of life are the phanerophytes strongly competed by therophytes in most plant formations (Arouna et al., 2016).

Thus, the abundance and dominance of phanerophytes show the high representativeness of ligneous plants in almost all plant formations. This strong presence of the phanerophytes constitutes a hope to reconstruct the degraded natural formations. However, the remarkable presence of therophytes in open forests, wooded savannahs, tree savannas and shrubs is a clear sign of a disturbance of these natural formations (Arouna 2012, Gbessoet al., 2013).

#### **➤ Economic stakes of plant formations in Djidja Commune**

The vegetal formations of the commune of Djidja shelter an important biological diversity with savannah formations traversed by forest galleries. It is a reserve of wood energy and pasture.

With the rivers that cross them, they constitute a fishing zone that can improve the income of the neighboring populations. They also have many other economic assets, the value of which should bring some extra income to the villagers and reduce poverty.

However, these plant formations are subject to significant land pressures that could eventually lead to a considerable reduction in its area. Houses, Peulh camps and fields of yam, maize and other crops are settling in a fast and scattered way.

➤ **Environmental issues**

This part presents the environmental stakes of the management of the Colobi communal forest.

• **Vulnerability analysis**

The communal forest of Colobi is located in the commune of Djidja, which like the other municipalities of Benin knows a net increase, of the order of 1 ° C, average air temperatures from 1995 and a decrease of the precipitations (Boko et al., 2012). According to the IPCC Fourth Assessment Report, climate change is now a potentially major threat to the environment and sustainable development.

Thus, poor communities are the most vulnerable because of their limited adaptive capacity and their high dependence on climate-sensitive resources such as water resources and agricultural production systems. Climate change is manifested in floods, droughts, high winds, heat waves, and the appearance of new plant and animal species (crickets destroying crops).

In addition, the rainfall instability is characterized by the excess or the rainfall deficit, the late installation of the rains characterize the climatic changes in the commune. The results of the village and commune assemblies carried out in the commune of Djidja reveal the major climatic risks which are the late and violent rains, the pockets of drought, the bad distribution of the rains, the violent winds, the excessive heat and the floods.

These major climatic risks were collected by participatory diagnosis with social groups. They are similar to those in the existing literature (UNEP, 2006, PDC, 2010, LoCALe Initiative, 2013, etc.). The characteristics of these risks are summarized in Table I.

**Table I:** Characterization of climate risks in the municipality of Djidja

Major climatic hazards	Fréquence	Étendue (Affected areas)	Intensité	Duration or period of occurrence
Blood and late rains	Very common (occurs almost every year)	All the Commune	Very strong	April June
Drought pockets	Very frequented	All the Commune	Very strong	April June
Vents violents	frequent	All the Commune	Strong	April-May and November
Excessive heat	Very frequented	All the Commune	Strong	February to May
floods	frequent	Central districts of the municipality	Very strong	Mid-August to mid-September

**Source:** Field Investigations, June 2017

Late and violent rains are the most frequent climatic hazard. This risk is a major threat to the livelihoods of smallholder farmers. Pockets of drought occur almost every year even in years of flooding. Indeed, the delay in the start of the rainy season, combined with the irregularity of the rains leads to prolonged dry periods. The rains expected for the month of April arrive only in May or June. In particular, the Colobi communal forest is subject to spatio-temporal variability of rainfall and rainfall deficit, high winds, and high temperatures. Rising temperatures and the increasing unpredictability of rainfall increase the vulnerability of forests to disease, fire and water stress that would retard tree growth and severely impact stand maturation.

In addition to these natural hazards, Colobi's communal forest is subject to strong anthropogenic pressures. These include deforestation for agricultural purposes and the production of wood energy and, secondarily, timber, cyclical transhumance and the pollution of permanent and temporary watercourses that irrigate it. Deforestation contributes to the continued fragmentation and decline of forest biological diversity and consequently increases its vulnerability to the adverse effects of climate change.

#### • **Mitigation and adaptation measures**

Plant formations are at the heart of the fight against climate change. Improving forest management and land use reduces vulnerability and contributes to both greenhouse gas (GHG) emissions mitigation and climate change adaptation (Boko et al. , 2012).

Thus, the establishment of a sustainable management plan for plant formations is the first strategy for mitigating and adapting plant resources to climate change. The activities planned in the vegetation management plans will reinforce their resilience to natural disasters (warming, extreme events, droughts, fires and diseases) and to climate change, while improving the quality of the air and water. water, soil richness and biodiversity.

In fact, it is a matter of properly implementing technical measures relating to silvicultural management and favoring the diversity of species. Other adaptation measures could be advised in the implementation of the simplified management plan. This involves taking into account the orientation of the winds for the marking of thinnings in enrichment plantations; the establishment of a system of surveillance and fire protection and the realization of early thinnings at the planting level to increase the stability of the stands.

The Colobi communal forest in the Agouna district is a carbon sink in the process of combating climate change and thus contributes to the regulation of runoff and the fight against erosion in the area. It will also offer a particular microclimate to this area of high agricultural production.

Finally, the natural forest habitats of the site still harbor a rich biodiversity, both plant and animal. The conservation of the natural ecosystems of this forest is therefore of great interest for the preservation of biodiversity for the municipality of Djidja in particular and for Benin in general.

Sustainable management of plant formation resources will also enhance social resilience by providing diversification of income sources through the exploitation of non-timber forest products and other benefits from forest exploitation, and will also allow capacities of local and national institutions in sustainable forest management. Photo 3 shows a tree planting session.



**Photo 3:** Tree planting session in Djidja

*Shooting:* Houssou, C., October 2017

To reduce the pressure of populations on plant formations, it could be envisaged as part of the implementation of the development plan, the promotion of improved stoves and Alternative Income Generating Activities (AGR) for the benefit of local populations, the training of different socio-professional groups in techniques aimed at adopting practices that reduce wood losses (promotion of energy-efficient kilns, practices that reduce logging during the operation).

#### ➤ **Social issues**

The rational management of the forest will provide income that can be used for the creation of social and community infrastructure and community amenities on the one hand and the improvement of the living conditions of neighboring populations of other share.

Silvicultural and other work will make it possible to use a paid local labor force, thus injecting important resources into the local economy and, by extension, contributing to the reduction of poverty in the area.

#### **Conclusion**

Regarding the main determinants of environmental dynamics in the Djidja Commune, direct factors and indirect factors are noted.

Regarding direct factors, they are composed of activities that directly affect the structure and environmental components that are mainly agriculture, logging, carbonization and livestock. The importance of direct determinants of vegetation and soil dynamics according to the perception of local populations was assessed from the importance value.

As for the indirect determinants of environmental dynamics, they are underlying factors that control direct determinants. In Djidja Commune, the indirect determinants identified during the field surveys are: population growth and climatic disturbances. Indeed, the ever increasing increase in the population observed in the study area is causing an increase in the food needs of the populations whose satisfaction induces adverse effects on the environment.

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