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Factors of PONASI Ecological Complex Resource Degradation

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Abstract

PONASI ecological complex abounds with fauna and floristic species. But these resources are in a phase of degradation. The aim of this study is to analyze the main factors contributing to the degradation of the PONASI ecological complex. In order to assess the degradation factors, a systematic approach was used. It is an approach that takes into account the various phenomena responsible for degradation and the interactions. Data collection techniques focused on documentary research, interviews, field surveys, the use of the snowball sampling method, and the processing of some climatic parameters. For this research, a total of twelve (12) villages were surveyed. The results showed that anthropogenic and climatic factors contribute to the degradation of the resources of the PONASI ecological complex. The anthropogenic factors consist of vegetation fires, excessive wood cutting, grazing, and picking immature fruit, and agricultural front. These factors are exacerbated by the limits of governance which result in a lack of legal texts' application, a weak appropriation of the decentralization policy by the local authorities. The results of this study have demonstrated that there are a multitude of factors that contribute to the degradation of the PONASI ecological complex. It is urgent to take the necessary measures to reverse this trend of degradation.

Keywords: Governance, factor, degradation, decentralization

Introduction

In Burkina Faso, the forest domain consists of seventy-seven (77) classified areas, including sixty-five (65) classified forests (MECV, 2007). Within these classified forests, there are several factors of anthropization of classified forests, the most important factor of which is agricultural exploitation, followed by the construction of socio-economic infrastructure. This phenomenon is observed in more than 50% of classified forests. In addition to this illegal activity, there are also climatic conditions, excessive cutting of green wood, vegetation fires, overgrazing, and poaching, which contribute to a degradation of classified forests at 71 to 77% (MECV, 2007).
PONASI ecological complex is part of the Burkina Faso forest domain. It is located in the south-central region of Burkina Faso. It is made up of five large ecological entities, which are National Parc Kaboré Tambi, Nazinga wild game ranch, the classified forest of Sissili, and two corridors. The Nazinga wild game ranch and the classified forest of Sissili are located in the Central-South of Burkina Faso, on the border of Ghana between the cities of Po in the East and Leo in the west. The map below shows the five important ecological parts of the complex.

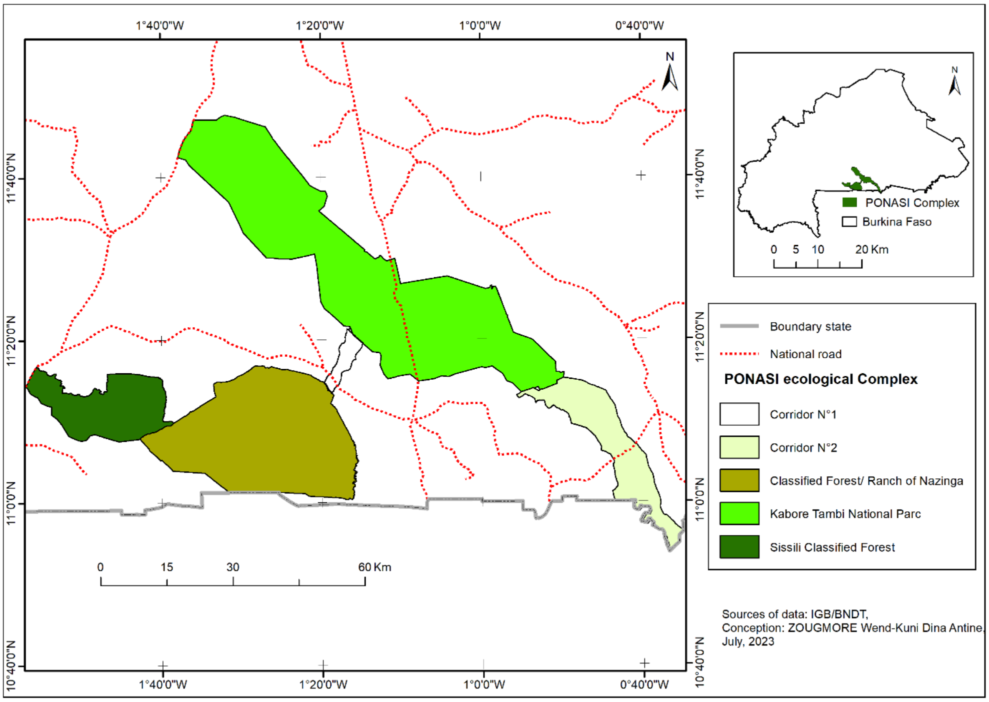


Figure 1: PONASI ecological main entities

It straddles three regions of Burkina Faso and it constitutes a reservoir of diversity of animal and plant species.

Burkina Faso's main natural resources are land, water, forestry, wildlife, fisheries, pastoral and mining resources (MECV, 2005). But these resources are in a state of advanced degradation. The causes are mainly anthropogenic (MECV, 2005; MEEVCC, 2018). The aim of this study is to analyze the factors linked to resource degradation in the PONASI ecological complex.

Its statutes, although different, give it different but complementary modes of operation. In order to help reverse the degradation trend, this study opted for a methodological approach based on a systemic approach.

Evolution of modes of governance of natural resources in Burkina Faso.

Traditional management was based on the use of natural resources and followed the rules and conventions established by custom. This mode of management was devoid of texts and took place thanks to codes enacted by cultures and societies.

The introduction of certain prohibitions such as sacralization has been shown to be effective in the conservation of resources (MECV, 2007). The advent of colonization was a factor in the disruption and weakening of ancestral management methods (Belemsobgo *et al.,* 2010).

Colonial management was repressive, centralized, and regulatory and excluded local populations (MECV, 2007). Riparian populations were perceived as indigenous peoples (Belemsobgo *et al.,* 2010). Management at that time was not taking into account the sustainability dynamic in order to meet the needs of future generations. It was rather based on utilitarianism to make available the immediate needs of the metropolis (Garané *et al.,* 2006). The restrictive management of natural resources began in 1980 (Belemsobgo *et al.,* 2010). Subsequently, it became operational through the implementation of tripartite management of protected areas with the involvement of the State, the private sector and the local population in the management of protected areas in 1995. This tripartite management allows implement participatory management. One of the objectives of decentralization is to involve and encourage the participation of people in the development of their territories (IUCN/PACO, 2012). Several laws have been adopted for the effective implementation of decentralized management of forest resources. According to Garané *et al.,* (2006), the participatory approach has several concepts like community management, partnership management and co-management.

Thus, several laws have been adopted in favour of the decentralized governance of natural resources, including the constitution, the guidance texts on decentralization and the general code of territorial authorities. The

“Code Général des Collectivités Territoriales (CGCT)” is a general legal framework in Burkina Faso that gives rural and urban municipalities the right to:

- participate in the conservation and management of renewable natural resources of regional or national interest;
- participate in the protection and management of wildlife resources in classified forests and natural wildlife forests;
- Protect and manage wildlife resources in protected forests.

Materials and Methods

The systemic approach

The methodology used in this study was based on the systemic approach. It is a method that takes into account all biophysical and human components and their interactions (Dipama, 2011). This approach has been relayed by techniques and tools for collecting and processing data related to surveys and spatial analysis (Kaboré and Dipama, 2014). It has been applied in this study because it takes into account the interconnection between biophysical parameters such as rainfall and temperature (Dipama, 2014).

It is an approach based on epistemology and a transdisciplinary methodology that is based on the concept of a system. This system represents a set of elements with enough interrelationships to form a relatively coherent and homogeneous whole.

This study supposes that there are several factors, including the mode of governance, climate, population growth, and anthropogenic factors that are responsible for forest dynamics, and these factors interact with each other. This justifies the adoption of the systems approach to analyze the interconnections between several factors to explain the causes of this degradation. The analysis of the factors that are at the origin of the dynamics of forest resources was made over a period of thirty (30) years.

Sampling methods

For this research, a total of twelve (12) villages were surveyed. In the urban municipality of Po, the villages of Bourou, Tiakané and Yaro were surveyed. In Guiaro, which is a rural municipality, the survey was conducted in Kollo, Oualem and Saro. In the urban municipality of Sapouy, the study was undertaken at Baouiga, Gallo and Tiakouré. In the rural municipality of Nobéré, the survey was carried out in the villages of Seloghin, Soulougré and Tamsé.

In each village, 10% of households were surveyed, totalling 228 households surveyed using the snowball method.

The interviews were held at municipal, departmental, regional and national levels with the administrative authorities and local elected authorities.

Interview guides

The interview guides were used to conduct individual interviews with the stakeholders involved in the governance of the PONASI forest resources of the ecological complex at the national, regional, communal and village levels.

The questionnaires

Questionnaires were sent to the sample of people interviewed in twelve (12) villages bordering the ecological complex PONASI. To carry out this study, surveys were carried out in two urban and rural municipalities adjacent to the ecological complex PONASI.

Data processing tools

- The Excel 2016 software: This software was mainly used in the processing of statistical data and the design of some graphs.
- Sphinx V5 software was used to process the qualitative data collected during the survey.
- QGIS 2.18 software was used to design the map.

The Results

The results of this research reveal that there are direct and indirect factors that are responsible for the degradation and deforestation of PONASI'S forest resources.

Several anthropogenic indices were observed through many surveys on different dates. These include farms, footprints of cattle, direct contact with livestock, facilities and the presence of basic infrastructure (health centres, schools, drinking fountains, cabins or houses, trails), pedestrian tracks, bicycle tracks and other gear (NatuDev, 2018; Bouché, 2005).

Anthropogenic factors

Wildlife and floristic species are now threatened by the persistence of constraints such as poaching, overgrazing, degradation of wildlife habitat by wildfires and the collection of building materials (sand, gravel, stubble, etc.), cutting wood for construction, cutting wood for carbonization and as firewood… (MECV-PNKT, 2006). Rural activities such as vegetation fires, agriculture, pastoralism, and hunting are also sources of degradation of natural resources (Dipama J-M., 2011).

Vegetation fires

According to 80% of the surveyed households bordering the ecological complex PONASI, vegetation fires are the primary factor in the degradation of forest resources. According to them, the fire is often caused by breeders to facilitate the regrowth of young herbs. Inventory work conducted as part of the PAGEN project also confirms the presence of active fires and late burns in the PNKT (Bouché, 2005). Poachers often use this practice to remove small game from their habitat. These fires reduce the capacity of the production of non-timber forest products. This is also exacerbated by the level of competition between humans and wildlife for the use of these same products. Several indications of poaching have been observed in Corridor N°1. These include contact with poachers, animal carcass remains, dog tracks (NatuDev, 2018). The photos below are illustrative photos of the presence of vegetation fires within the complex.

Photo : Traces of fire passage within the FCRGN in the part that borders the ZOVIC of Koumbili

Photo credit: ZOUGMORE Wend-kuni Dina Antine April, 2019

Excessive cutting of wood

Cuts and piles of wood were observed in some places, especially in the south of the site. Some coal piles were observed in the north and south of the site.

Photo: Wood Cutting at PNKT and FCRGN

Photo credit: ZOUGMORE W. Dina Antine

The cutting of dead wood is authorised in order to meet some domestic energy needs of the riparian population. Beyond this, there is the cutting of green wood, which is strictly prohibited within the limits of protected area,s but these forbidden practices are observed and are very common within the complex protected areas of the complex.

Grazing and picking immature fruit

The PONASI complex is faced with a strong presence of livestock within it. Wildlife inventory conducted in 2018 within the corridor revealed the presence of livestock in the corridor (NatuDev, 2018). Another inventory dating back to 2005 enabled to observation of several farm animal species in the PNKT. The presence of these livestock in these ecological entities creates competition between them and wild animals for the use of non-timber forest products. The riparian population that also exploits these same resources contributes to exacerbating this competition. According to 40% of the households surveyed, harvesting immature non-timber forest products is the third most important offence.

The photo below illustrates the presence of livestock in the Corridor N°1.

Photo credit: Cattle herd in Corridor N°1.
Photo credit: ZOUGMORE W. Dina Antine June, 2020

According to the breeders, the complex is a favourable area for grazing activities. Land pressures are very strong outside the PONASI ecological complex, and this does not allow them to graze their herds outside the complex. Also, this choice allows them to avoid conflicts with farmers, especially during the rainy season.

The agricultural front

The boundaries of Corridor N°1 are adjacent to several agricultural fields. Large areas of ZOVIC are being converted to agriculture. This poses significant threats to the conservation of key ecological entities such as the PNKT and the FCRGN.

Photo: Proximity between corridor N°1 and the field

Shooting : ZOUGMORE W. Dina Antine, avril, 2020

Photo: Proximity of FCRGN boundaries to a field

Shooting : ZOUGMORE W. Dina Antine avril, 2020

The first photo was taken on the Po-Guiaro axis. To the right, the limit of corridor N°1 and to the left, the limit of an agricultural crops field.

The last photo was taken between the borders of the FCRGN and the ZOVIC of Koumbili, part of which has been reconverted to the benefit of cultural practices. On the left and right are the FCRGN and the ZOVIC of Koumbili, respectively. These pressures are quite widespread between the FCRGN, the corridor and the ZOVIC. These photos serve as an illustration of the land pressures facing the PONASI ecological complex. This calls for urgent measures to be taken for the conservation of the boundaries of the PONASI ecological complex.

Climate Factors

Rainfall and temperature are two main parameters for analysing changes in climate conditions over time (Ouédraogo, 2012; Karambiri, 2017). But temperature is the most sensitive parameter in the assessment of the climate. It is the one that influences the evolution of vegetation. They are also the climatic parameters whose dynamics are easily discernible by the population (Dipama, 2014; PANA, 2007). For the analysis of some climatic parameters, the data of the synoptic scale were retained for several reasons.

Rainfall trends from 1989 to 2019

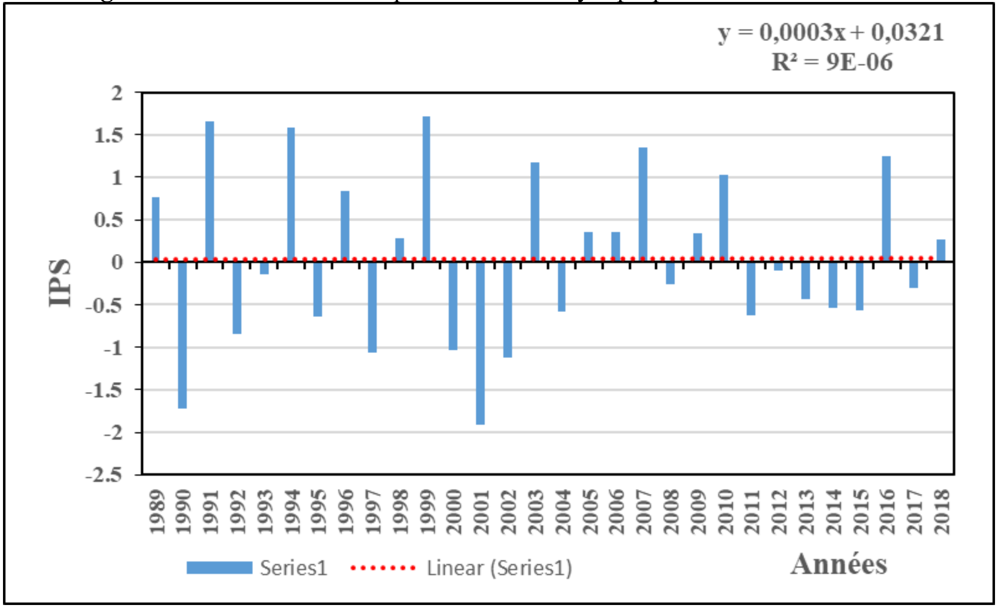
The Standardised Rainfall Index (SPI) and the shadow thermal diagram are tools for characterizing rainfall (Ouédraogo, 2012; Karambiri, 2017).

Standardized Rainfall Index (SPI)

The SPI highlights inter-annual variability and rainfall trends by distinguishing the rainy season's surplus and deficit. The surplus and deficit rainy seasons are above and below axis 0, respectively (Ouédraogo, 2012). The figure below shows the rainfall trends of the Po synoptic station from 1989 to 2018. The blue bars above axis 0 represent positive SPI values and reflect years of rainfall surpluses. However, the bars below axis 0 are negative SPI values and correspond to years of poor rainfall. The analysis of this figure shows a succession of years of excess and deficit rainfall. First, from 1989 to 1999, the years of excess and deficit rainfall alternate, with a continuation of the rainfall deficit over a period of two successive years from 1992 to 1993. From 2000 to 2018, the alternation of years of excess and deficit rainfall was confirmed with a succession ranging from two to three years in a row.

1999 was the year with the largest rainfall surplus and 2001was the year with the largest rainfall deficit. The trend curve is almost confused with axis 0 and is almost stationary. This reflects the fairly frequent succession and the equal number of years of excess and deficit rainfall.

Figure 2: Indice Pluviométrique de la station synoptique de Pô de 1989 à 2019



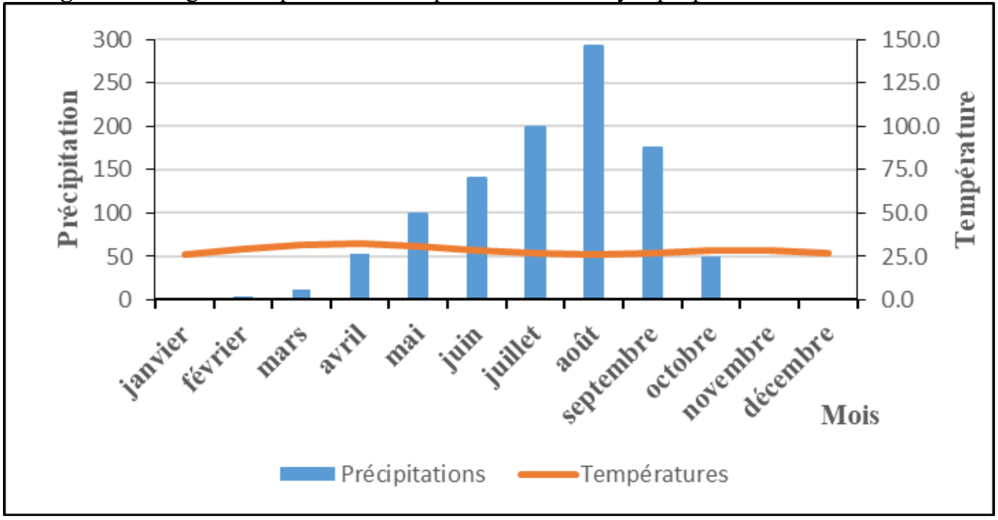
Data Sources: National Meteorological Agency of Burkina Faso, 2019

The Storm-Thermal Diagram

The dry season can be determined by defining the dry month, which corresponds to the month in which the monthly sum of precipitation in millimetres is less than or equal to twice the monthly average temperature in degrees centigrade. The formula is P < 2T, which allows to draw up BAGNOULS and GAUSSEN thermal shading diagrams.

In this type of diagram, the dry month is considered.

Figure 3: Diagramme pluvio-thermique de la station synoptique de Pô de 1989 à 2018



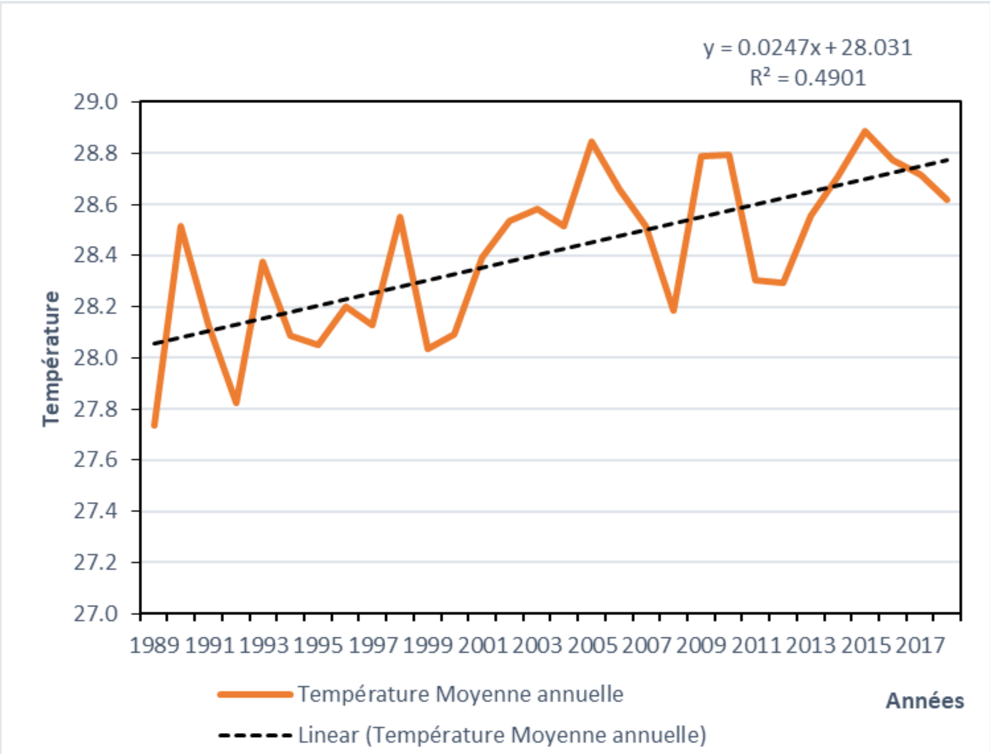
Data Sources: National Meteorological Agency of Burkina Faso, 2019

The figure indicates that the months of January, February, March, April, October, November, and December are dry months. Therefore, it can be deduced that during the period of 1989 to 2018, the dry season was generally spread over a period of seven (7) months on the area which is covered by the Po synoptic station. On the other hand, the rainy months are those of May, June, July, August, and September. The rainy months are therefore lower than those that are arid.

Temperature

The curve below has been plotted using data from the monthly average temperatures of the Po synoptic station from 1989 to 2018. It reflects a fairly large increase in inter-annual variability. The trend line confirms this because its growth is continuous throughout the analysis period. In 1989, the trend line indicates that the annual average temperature value is between 28, 0 and 28, 1°C. It continued to oscillate and reached almost 28, 8 in 2018. This upward trend in temperature contributes to the wilting of vegetation (Dipama, 2014).

Figure 4: Annual average evolution of temperatures of the Po synoptic station from 1989 to 2018

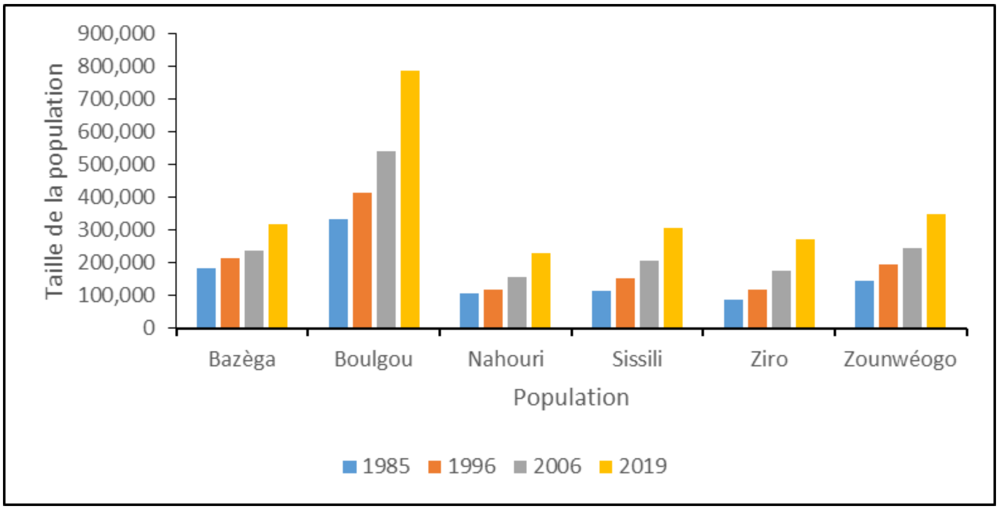


Data Sources: National Meteorological Agency, 2019

Demographic factors

The following figure summarizes the population growth of the six (6) provinces bordering the PONASI ecological complex between 1985 and 2019.

Figure 5: Population change in provinces bordering the PONASI complex from 1985 to 2019



Sources of data: INSD 1985, 1996, 2006, 2019

This graph shows that the population sizes of the six (6) provinces bordering the PONASI ecological complex increased steadily from 1985 to 2019. On average, the size of these populations has doubled in some areas. Resource degradation is linked to behaviour and practices (Kaboré and Dipama, 2014).

Non-native populations who are looking for better living conditions are the main actors responsible for the change in land use (Kaboré *et al.,* 2015). Through Aboriginal people, non-native people benefit from donations, loans, or land rentals. Thus, this method of land management contributes to the increase of arable land for the needs of agricultural production (Kaboré *et al.,* 2015).

The logic of non-native populations underlies cash crop farming. These new behaviours contribute significantly to the reduction of areas occupied by plant formations.

The logic of migrants is to switch from subsistence agriculture to cash crops farming in order to increase their incomes increase. These new behaviours contribute significantly to the emergence of new areas occupied by plant formations (Kaboré and Dipama, 2014).

Discussion

Local perceptions of natural resource degradation factors can be categorized as direct and indirect (Arouna, 2012). Direct factors are those whose effects directly contribute to the degradation of plant resources. These factors include agriculture, carbonization, which contribute to degradation (Odum, 2024). These activities negatively affect forest ecosystems (Sawadogo, 2009; CBD, 2010). The indirect factors of deforestation and forest degradation are factors that promote the appearance of one or more direct factors (MEDD, 2012). They can be summarized as the constant increase of a poor rural population, the lack of capacity of actors and land use planning tools, the low level of capitalization of good forestry practices, and difficulties in applying the legal and regulatory frameworks of the forestry sector.

Indirect factors can include political, institutional and technological factors (Odum, 2024).

Climate change can be a barrier to the harmonious development of trees in the forest. It could manifest itself in increased drought waves, floods, variations in temperature of rainfall quantities and durations (Dipama *et al.,* 2011).

Rainfall deficits and their unequal distribution have negative consequences on the evolution of natural vegetation (Bernard, 2012). The analysis of the rainfall data reveals that the dry season has been extended over the years and therefore causes the delay of the rainy season.

Climate change negatively influences forestry production through variations in bioclimatic factors. The rising level of CO_2 in the air contributes to the increase in gross photosynthesis and biomass. But rising of temperatures and reduced rainfall levels or even increased drought can be a barrier to the harmonious development of tropical forests (Bernard, 2012). The variation in temperature is felt by the population through increased heat, dust winds, destruction of vegetation cover, reduced soil fertility, early river drying-up (Dipama *et al.,* 2011).

Climate influences the distribution of animal and floristic species. Indeed, there is a negative correlation between temperature change and rainfall. For example, for the drought period above a threshold, high temperature variations are followed by low rainfall (Dipama, 2009). Climate variability may be a factor that vulnerabilities the ability of protected areas to provide the necessary conditions and be appropriate for species conservation (Deshaies, 2014). They contribute to the degradation of plant and wildlife resources (Dipama, 2016).

Uncontrolled vegetation fires are factors that contribute to limiting the ability to regenerate, produce shrubs and grass mats (Dipama, 2011). Rainfall deficits and their unequal distribution have negative consequences on the evolution of natural vegetation (Bernard, 2012). Climate change is negatively affecting forestry production. The lengthening of periods of drought accompanied by temperature increases helps to reduce the forestry potential (Arouna, 2012).

Pastoral practices are unfavourable to the conservation of plant resources because there is increasing pressure due to the large number of livestock. This is a source of overexploitation of plant resources and induration of plant soils (Kaboré and Dipama, 2014). Population growth leads to increased demand for farmland (Bouko *et al.,* 2007). The shift from subsistence to cash crops has resulted in an increase in area planted. This exacerbates land pressure and contributes to the degradation of plant resources (Dipama, 2015; Bouko *et al.,* 2007). Increased agricultural activity is the main cause of deforestation (Bouko *et al.,* 2007).

The local committees within the municipalities responsible for environmental protection are often not very functional and have few resources to manage forests efficiently.

The Forest Investment Programme (PIF), Tree Aid, Naturama, International Union for the Conservation of Nature (IUCN), NatuDev Association are structures that intervene strongly in forest management within the communes of Po, Guiaro, Sapouy, Nobéré.

Municipal five-year mandates may be a barrier to the harmonious development of natural resources in general. A classified forest in the name of the municipality may be decommissioned by a mayor whose forest resources conservation does not have major importance in his program. Land pressures are very strong in the area of the PONASI complex the cultivation lands are increasingly demanded by the same electoral populations. Thus, in order to increase the chances of re-election, some municipal officials may make the decision to satisfy the requests for the decommissioning of certain protected areas for the benefit of agriculture.

Protected areas, in the dynamics of sustainable development, integrate the concepts of conservation and development of socio-economic activities for the benefit of local communities. But in reality, it is rather the preservation of biodiversity that is implemented. The delineation of protected areas is perceived by local communities as a source of displacement and the displacement of populations from several villages. Around the 1970s, this resulted in a loss of legitimacy of conservation areas whose management excluded riparian communities (Dipama, 2009).

Beginning in the 20th century, participatory management began to emerge with the aim of helping local people to emancipate themselves in the management of their environment. Thus, in the 1990s, there was the implementation of projects that promote local participation in decision-making sessions. After more than a decade of implementation, the results of participatory projects remain very mixed (Dipama, 2009). The decentralization of management powers to local communities consists of taking into account local and regional authorities in the distribution of benefits resulting from resource development activities in protected areas (Binot, 2011). The allocation of these financial allocations may not be in favour of local communities, especially since they do not have the skills or capacities to get involved in financial control. Decentralization is very limited in terms of the actual transfer of authority, management power and powers from the central government to local communities.

The current implementation of decentralization does not allow local communities to effectively take over the management of natural resources (Dipama, 2011). Some village organizations that have formed through the regrouping of part of the local population often lack legitimacy within the same community and customarily. Within the same country, there may be interference with policies and laws related to natural resource management (Binot, 2011). The limits of governance and the lack of enforcement of laws contribute to illegal exploitation of forest resources (Bérenger *et al.,* 2015). The lack of secure property and resource rights is also a significant factor in degradation and deforestation. Public ownership has been a source of forest decline (Siry *et al.,* 2015).

The effective involvement of local and regional authorities in the management of forest resources is confronted with the lack of effective transfer of responsibilities for the management of natural resources from the State to local and regional authorities. Anticipatory measures are poorly taken by municipalities because they are poorly equipped in terms of human, financial and material resources (Dipama, 2011). Unclear property and resource rights are causes of deforestation and degradation. Clear and secure tenure is necessary to make some investment in forestry and create better conditions to make decisions for forest protection (Siry *et al.,* 2015).

Conclusion

Climate, vegetation and man are important elements of the environmental system. Spatial-temporal changes in vegetation can be explained by several direct factors such as economic activities and indirect factors such as demographic, political, economic, social, cultural and technological.

The management of protected areas faces political, human, financial, institutional, legal, regulatory and communication challenges among local residents. At the level of the forestry sector, there is a lack of municipalities, partnerships, or collaboration between the different categories of actors that does not promote the harmonisation of common interests.

The results of this study have demonstrated that there are a multitude of factors that contribute to the degradation of the PONASI ecological complex. It is urgent to take the necessary measures to reverse this trend of degradation.

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