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Influences of Historical and Anthropogenic Factors on the Dynamics of Reconstitution of Post-Cultivation Vegetation in the Sub-Sudanese Zone: The Case of the Department of Dianra, North-West Côte D'ivoire

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ABSTRACT: Prior knowledge of vegetation dynamics, including post-crop recovery dynamics, is necessary for rational and sustainable management of land assets. This study was initiated to assess the influence of historical and anthropogenic factors on post-cultivation reconstitution in the Dianra Department. To this end, information on the history and post-cultivation human activities was collected from farmers. The Phytoecological and dendrometric data were collected using the surface botanical method in the post-cultivation plots. In total, 105 plots of 400 m² were planted in post-cultivation plots between 1 and 32 years old. The influence of historical and anthropogenic factors was assessed using an Analysis of Covariance (ANCOVA), in which the functional traits of the species and the structural attributes of the plots were considered as the variables to be explained and the historical and anthropogenic factors as the explanatory variables. This analysis shows that post-cultivation reconstitution in the sub-Sudanese environment is subject to the influence of several factors, the most perceptible of which are: age, number of years of cultivation, grazed area, cultivation history, groundnut cultivation as the last crop, and cultivation technique by horse and cart. The age, groundnut cultivation as the last crop and the Open Forest/Wooded Savannah cultivation history favoured reconstitution. In contrast, a high number of years of cultivation, grazing and ploughing by horse and cart were unfavourable to reconstitution.

KEYWORDS: Dynamics, Dianra, Côte d'Ivoire, Historical and anthropogenic factors, Post-cultivation reconstruction.

I. INTRODUCTION

Land use is considered to be one of the processes at the root of fragmentation, which is causing a major loss of diversity and is currently taking on a major role throughout the world, particularly in the tropics **(Fahrig, 2003; Enonzan, 2010).** In Côte d'Ivoire, it has been observed that the country's forest area is shrinking. Estimated at over 15 million hectares in 1960, it had shrunk to less than half by 2000 **(FAO, 2001).** The most recent estimates put it at 3,401,146 ha in 2015 **(FAO, 2017)** and 2.97 ha in 2021 **(IFFN, 2021).** Like much of the tropics, the landscape of Côte d'Ivoire has become increasingly heterogeneous in recent decades, with an increase in the area of cultivated land and post-cultivation vegetation in various stages of reconstitution. This post-cultivation reconstitution represents the return of a disturbed ecosystem to its natural or climatic state **(Martineau, 2004).** The various stages that characterise it are referred to as secondary successions and constitute temporal, linear or cyclical sequences of plant communities **(Kassi et al, 2011).** According to **Fournier et al (2001)**, these stages or steps in the process of post-cultivation succession are reflected in the variability of physiognomies and floristic compositions and their modalities, which are a function of environments and regions. However, these temporal and spatial variabilities are controlled by various factors, some of which are linked to human activities. In addition, it is generally accepted that, if forest cover is to be properly managed, it is essential to understand the process of plant reconstitution and the factors that contribute to it. The interest in the subject has led the scientific world, in general, and Ivorian researchers, in particular, to take an interest in it through scientific studies. One of the main areas of research is the analysis of the floristic diversity of disturbed ecosystems **(Kassi, 2006; Vroh, 2013; Koffi, 2016; Adingra, 2017, Goze, 2022).** Very few studies have analysed the influence of historical and anthropogenic factors on this reconstitution. Moreover, those that have dealt with it have taken place in the forest zone of Côte d'Ivoire **(Kassi et al., 2012; N'Guessan, 2018)**. Thus, studies dealing with the resilience or post-cultivation reconstitution capacity of vegetation in the sub-Sudanese sector in general, and in the Dianra

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administrative district in particular, are practically non-existent. However, it is a fact that the Dianra area has undergone profound changes to its landscape in recent decades as a result of population growth, coupled with the expansion of perennial crops and transhumance livestock farming, which are now the main activities in the area **(Dugué et al., 2004)**. This has led to a reduction in arable land and a shortening of the post-cultivation recovery period, which is at the root of many land conflicts. It would therefore seem necessary to establish a policy for the sustainable management of the area's rural land. This requires an analysis of post-cultivation reconstitution and the factors influencing it. The present study was initiated for this purpose. Its aim is to assess the influence of historical and anthropogenic factors on the post-cultivation reconstitution of the Dianra Department.

Furthermore, in order to evaluate the various changes in state, or modifications in the functioning of the rural environment, induced by natural disturbances and above all by human intervention, the observer most often resorts to measuring or evaluating simple parameters, attributes and characteristics of the ecological system under study **(Pontanier & Floret 2002).** In this study, we set out to assess the influence of historical and anthropogenic factors on the area's floristic diversity. Specifically, the aim was to assess the influence of these factors on: (1) floristic richness and diversity, (2) floristic composition and (3) coverage of vertical vegetation strata.

II. MATERIAL AND METHODS

A. Study site

The Dianra department, to which the study area belongs, is located in the north-west of Côte d'Ivoire, in the Béré region (Woroba district) between longitudes 6°46' and 5°58' west and latitudes 8°23' and 9°19' north (Figure 1). The site investigated comprises the rural areas of the villages of Ouahiéré, Manadougou, Sienkounon, Djémé, Gominasso, Lokolo and Fila-Faraba, in the sub-prefecture of Dianra.

B. Collection of phyto-ecological and environmental data

Data was collected in two distinct stages: a survey of farmers and a botanical inventory. The first stage consisted of collecting information on the history of the fallow, such as the age of the plots, the cultivation history (the original plant formation), the number of years of cultivation, the last cultivation, and the cultivation technique used (ploughing or manual cultivation). In addition, the second stage took into account anthropogenic factors, such as the removal of trees after fallow and the grazed area, which were collected in the plots during the botanical inventory. The botanical inventory was carried out using the surface survey method. This involved setting up square plots of 400 m^2 (20 m×20 m) each in the post-cultivation plant formations identified. The data collected concerning the dendrometric parameters of the plant species are the species name, the Diameter at Breast Height (DBH) greater than or equal to 2.5 cm at 1.30 m from the ground, the height and the overall cover of the different strata (arborous, shrubby and herbaceous) estimated according to **Bene and Fournier (2014).**

A total of 105 plots of 400 m² were planted in the different post-cultivation vegetation classes, equivalent to a sampling area of 42,000 m² or 4.2 hectares. By fallow class, these were: 14 plots of young fallow (0-5 years), and 19 plots of intermediate fallow (6-9 years). For the old fallow category, there were: 17 plots of 11-15 years, 19 plots of 16-20 years, 18 plots of 21-25 years and 18 plots of 26-30 years.

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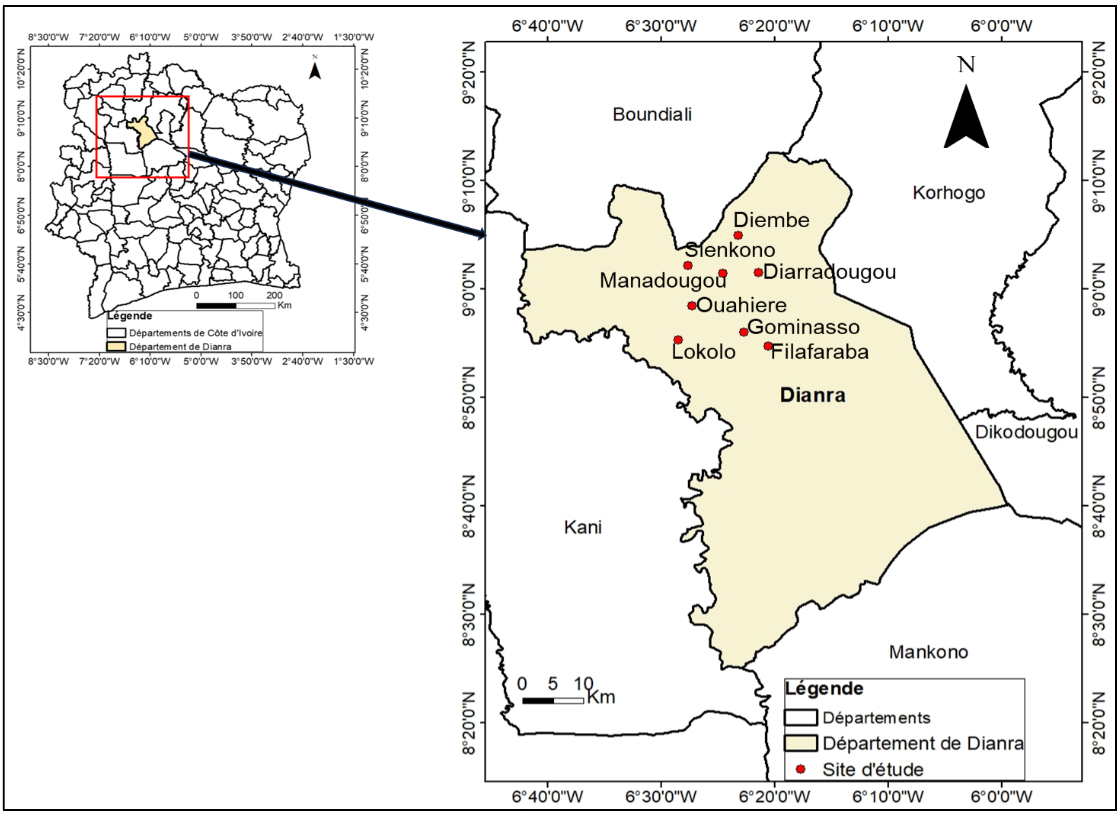

Figure 1: Map showing the location of the study area

C. Assessment of the influence of historical and anthropogenic factors on post-cultivation reconstitution

The various changes in state, or modifications in the functioning of the rural environment, induced by natural disturbances and especially by human intervention, are often assessed by measuring or evaluating simple parameters, attributes or characteristics of the ecological system under study **(Pontonnier and Floret, 2002).** Similarly, according to **Bangirinama et al (2010)**, biological indicators or bio-indicators are the tools most commonly used to assess the effects of human activity on natural resources. According to these authors, the best indicators are those that are simple and easy to observe, less dependent on local variability and therefore closer to universality. To this end, the influence of historical and anthropogenic parameters on post-cultivation reconstitution was analysed. The age of the fallow, historical and anthropogenic parameters are the explanatory variables (Table III), while structural attributes and functional traits are the variables to be explained. Structural attributes are the components of vegetation that reflect its structure, such as species richness, Shannon diversity indices and Piélou equitability indices. A functional trait, on the other hand, is defined as a morphological, physiological or phenological characteristic that can be measured at the scale of the individual, from the cell to the whole organism, without reference to the environment or any other level of organisation **(Violle et al., 2007)**. They can be considered as descriptors of a species' ecological niche **(McGill et al., 2006).** Those used in this study are deduced from floristic composition, such as biological types and phytogeographical types as defined by **Lebrun (1960)** and **Aké-Assi (2001, 2002)** and used by **Bangirinama et al. (2010)**.

The significant effect of these parameters on the reconstruction was tested using a multivariate analysis of variance. In the case of this study, where the explanatory variables are made up of quantitative and qualitative variables, analysis of covariance (ANCOVA) is the type of analysis we chose. Several hypotheses were tested to ensure that the conditions for the analysis were met. These were: the assumption of linearity, the homogeneity of regression slopes, the normality of residuals and the homogeneity of variances.

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Table 1: List of historical and anthropogenic factors; explanatory variables for post-cultivation reconstitution

Variables	Definition	Modalities	Units
Age of fallow	Number of years since the field was permanently abandoned	-	Year
Duration of cultivation	Number of years of cultivation	-	Year
Grazed area	Proportion of plot corresponding to grazed and trampled area	-	m²
Last crop	Last crop before fallowing	Groundnut	-
		Cotton	-
		Yam	-
		Maize	-
		Rice	-
Cultural background	Vegetation existing before the crop was planted	Open forest/wooded savannah mosaic	-
		Wooded savannah	-
		Fallow	-
Cultivation technique	Equipment used for planting the crop	Harnessing by animals	-
		Manual (hoes)	-
Tree cutting	Sampling of individual plants within the plot	Presence	-
		Absence	-

III. RESULTS

Impacts of historical and antropogenic parameters on fallow dynamics

The ANCOVA results indicate that several variables associated with cropping practices and post-cultivation human activities significantly influence post-cultivation recovery.

Thus, growing groundnuts as the last crop favours an increase in floristic richness, whereas this richness is low when the plot has been cultivated for a long time and when no trees have been removed from the site after it has been left fallow.

In terms of floristic diversity, few practices have an impact on this diversity. In this respect, the diversity of the environment increases insignificantly when the number of years of cultivation is high and when cultivation is carried out by harness. On the other hand, the lack of disturbance of the environment by removing trees leads to a reduction in diversity. With regard to the distribution of individuals between species, the practice of harnessing during cultivation contributes strongly to equipartition, whereas there is a dominance of certain species, with a weak effect, when cultivation has been established in a mosaic of open forest and wooded savannah, a fallow, or when no trees have been removed from the fallow (Table II).

In terms of phytogeography, the number of Guineo-Congolese species (GC) decreases sharply when the site is grazed. On the other hand, the number of Guineo-Congolese species increases when the cultivated area is a mosaic of open forest and wooded savannah.

The abundance of GC-SZ transition species is mainly linked to the last crop grown and the cropping history. They are abundant when the crop was planted on a mosaic of open forest/wooded savannah and when the last crop was groundnuts. On the other hand, their number decreases to a lesser extent when the site is grazed, no trees have been removed and when the last crop is maize (Table II).

As for SZ species, the variables influencing their abundance are the duration of the cropping episode and the cropping history. The number of SZ species increased when the cropping period was longer and decreased when the cropping history was a mosaic of open forest and wooded savannah.

With regard to the influence of factors on biological types, two trends emerge, for both herbaceous and woody stratum categories (Table III). Most of the biological types in the herbaceous stratum (hemicryptophytes, pyrophytic hemicryptophytes) are generally more influenced by the historical variables of the cropping period. The duration of the cropping episode and the cultivation of yams favour their abundance, while cotton cultivation has a negative influence on the abundance of hemicryptophytes. The

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pyrophytic hemicryptophytes are also at a disadvantage in plots resulting from a mosaic of open forest and wooded savannah. As for therophytes, their proliferation is very significantly linked to the grazing effect, and to groundnut and yam crops to a lesser extent. No variable significantly favoured the abundance of nanophanerophytes. Moreover, they are poorly represented in environments where no trees are harvested. The phanerophytes of the woody stratum are essentially influenced by post-cultivation activities and the cultivation history. To this end, these biological types proliferate significantly in plots resulting from the open forest/wooded savannah mosaic and have been the subject of groundnut cultivation in the particular case of mesophanerophytes. On the other hand, these biological types are very much at a disadvantage in plots that have been grazed after abandonment.

In terms of cover, cultivation by hitching and the age of the plot significantly favoured tree cover (Table IV). On the other hand, cultivation by hitch-hiking very significantly inhibited the development of shrub cover. The herbaceous cover is mainly linked to the age of the plot. It decreases with the age of the fallow; the length of the cropping period has only a very slight effect on this cover.

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Table I: Summary of correlations between explanatory variables, structural attributes and functional traits of post-cultivation stages of reconstitution

Structural attributes and functional features		*Year*	*Years of cultivation*	*Grazed area*	*Last crop*					*Cultural background*			*Cultivation techniques*		*Tree harvesting*	
					Groundnut	*Cotton*	*Yam*	*Maiz*	*Rice*	*Mosaic of open and forest Wooded*	*Fallow*	*Arborescent savannah*	*Hitch*	*Manual*	*Absence*	*Presence*
Specific richness		0,08^{NS}	**3,09***	**-3,69****	**3,15****	-1,76^{NS}	0,76^{NS}	**-2,70***	0	1,67^{NS}	-0,13^{NS}	0	-0,53^{NS}	0	**-3,90****	0
Diversity	**Shannon**	0,43^{NS}	**2,37***	-1,47^{NS}	1,47^{NS}	-1,27^{NS}	1,39^{NS}	**-2,35***	0	-0,61^{NS}	-1,30^{NS}	0	**2,61***	0	**-2,97****	0
	Pielou	0,21^{NS}	1,05^{NS}	0,50^{NS}	0,46^{NS}	-0,19^{NS}	0,30^{NS}	-1,49^{NS}	0	**-2,20***	**-1,81***	0	**4,52*****	0	**-1,79***	0
Phytogeography	**GC**	-1,58^{NS}	1,23^{NS}	**-3,52*****	1,62^{NS}	-1,65^{NS}	0,37^{NS}	**-2,87***	0	**3,69****	0,23^{NS}	0	-0,07^{NS}	0	**-3,73****	0
	GC-SZ	-0,30^{NS}	0,99^{NS}	**-2,48***	**3,54*****	-1,31^{NS}	-0,08^{NS}	**-2,45***	0	**3,82*****	-0,61^{NS}	0	-0,13^{NS}	0	**-2,13***	0
	I	-0,17^{NS}	-0,49^{NS}	-1,15^{NS}	**2,83****	0,55^{NS}	0,35^{NS}	-0,14^{NS}	0	-1,09^{NS}	1,03^{NS}	0	0,18^{NS}	0	0,01^{NS}	0
	SZ	**2,70****	**4,57*****	**-2,29***	1,36^{NS}	-0,75^{SN}	1,42^{NS}	-0,13^{NS}	0	**-4,67*****	0,22^{NS}	0	-0,84^{NS}	0	**-2,91****	0

Significance: NS: test not significant (P ≥ 0.05); *: test significant (P < 0.05); **: test highly significant (P < 0.01). ***: very highly significant test (P < 0.001).
Phytogeography: GC (Guinéo Congolaise); GC-SZ (Guinéo Congolaise-Soudano Zambézienne); I (Introduced); SZ (Soudano Zambézienne)
Correlation: + (positive correlation); - (negative correlation)

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Table II: Correlation between explanatory variables and biological types

Structural attributes and functional features		*Year*	*Years of cultivation*	*Grazed area*	*Last crop*					*Cultural background*			*Techniques Cultivation*		*Tree harvesting*	
					Groundnut	*Cotton*	*Yam*	*Maiz*	*Rice*	*Mosaic of open forest and Wooded Savannah*	*Fallow*	*Arborescent savannah*	*Hitch*	*Manual*	*Absence*	*Presence*
Biology	***Ch***	0,44^{NS}	0,56^{NS}	-0,70^{NS}	**2,47***	0,78^{NS}	**3,18****	-0,24^{NS}	0	**2,50***	1,71^{NS}	0	0,56^{NS}	0	0,73^{NS}	0
	Ep	1,06^{NS}	-0,09^{NS}	0,99^{NS}	-0,19^{NS}	1,20^{NS}	0,26^{NS}	**2,80****	0	-1,06^{NS}	-1,07^{NS}	0	-1,1^{NS}	0	-1,29^{NS}	0
	G	-1,40^{NS}	0,84^{NS}	-0,86^{NS}	**2,99****	-0,92^{NS}	-0,65^{NS}	-1,69^{NS}	0	**2,67****	0,36^{NS}	0	**-2,23***	0	**-3,03****	0
	H	-1,16^{NS}	**3,09****	0,06^{NS}	-1,20^{NS}	**-2,90****	**2,97****	-2,04^{NS}	0	-1,66^{NS}	-0,08^{NS}	0	-1,62^{NS}	0	-1,1^{NS}	0
	HyP	**2,52***	**2,92****	-1,46^{NS}	-0,57^{NS}	-0,87^{NS}	1,39^{NS}	0,74^{NS}	0	**-4,73*****	0,83^{NS}	0	-0,83^{NS}	0	-1,31^{NS}	0
	mp	1,82^{NS}	**2,61***	**-5,3*****	**2,37***	-0,60^{NS}	-0,51^{NS}	**-2,16***	0	0,34^{NS}	-0,48^{NS}	0	0,75^{NS}	0	**-3,06***	0
	mP	-0,4^{NS}	0,76^{NS}	**-3,74*****	**4,06*****	-1,3^{NS}	-1,90^{NS}	-2,08^{NS}	0	**4,47*****	-0,65^{NS}	0	0,57^{NS}	0	-0,52^{NS}	0
	MP	-0,29^{NS}	0,18^{NS}	**-3,38****	0,54^{NS}	-1,95^{NS}	-1,41^{NS}	-1,63^{NS}	0	**2,87****	-1,58^{NS}	0	0,95^{NS}	0	-0,55^{NS}	0
	np	-1,13^{NS}	1,10^{NS}	0,84^{NS}	0,97^{NS}	-1,03^{NS}	**2,04***	-1,07^{NS}	0	0,42^{NS}	0,27^{NS}	0	-0,78^{NS}	0	**-3,58*****	0
	Th	-0,68^{NS}	0,37^{NS}	**3,41*****	**2,16***	0,2^{NS}	**1,98***	0,41^{NS}	0	0,79^{NS}	0,87^{NS}	0	-0,76^{NS}	0	-0,22^{NS}	0

Significance: NS: test not significant ($P \geq 0.05$); *: test significant ($P < 0.05$); **: test highly significant ($P < 0.01$). ***: very highly significant test ($P < 0.001$).

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Biology: Ch (Champhyte); Ep (Epiphyte); G (Geophyte); H (Hemicriptophyte); HyP (Pyrophytic Hemicriptophyte); mp (Microphanerophyte); mP (Mesophanerophyte); Np (Nanophanerophyte); Th (Therophyte)**.**
Correlation: + (positive correlation); **-** (negative correlation)

Table III: Correlation between explanatory variables and different overlaps

Structural attributes and functional features		*Year*	*Years of cultivation*	*Grazed area*	*Last crop*					*Cultural background*			*Techniques Cultivation*		*Tree harvesting*	
					Groundnut	*Cotton*	*Yam*	*Maiz*	*Rice*	*Mosaic of open forest and Wooded Savannah*	*Fallow*	*Arborescent savannah*	*Hitch*	*Manual*	*Absence*	*Presence*
Recovryment	*Tree cover*	**4,25*****	1,95^{NS}	**-3,19***	-0,02^{NS}	0,36^{NS}	0,56^{NS}	-0,82^{NS}	0	2,19^{NS}	0,16^{NS}	0	**3,41****	0	1,50^{NS}	0
	Shrub cover	1,15NS	-0,34^{NS}	-1,07^{NS}	1,36^{NS}	0,55^{NS}	-1,26^{NS}	1,95^{NS}	0	-0,85^{NS}	0,84^{NS}	0	**-4,82*****	0	-0,50^{NS}	0
	Grass cover	**-4,32*****	**-2,75***	0,50^{NS}	0,44^{NS}	-0,54^{NS}	-1,21^{NS}	0,14^{NS}	0	0,57^{NS}	-1,59^{NS}	0	0,15^{NS}	0	-1,44^{NS}	0

Significance: NS: test not significant ($P \geq 0.05$); *: test significant ($P < 0.05$); **: test highly significant ($P < 0.01$). ***: very highly significant test ($P < 0.001$).
Correlation: + (positive correlation); - (negative correlation)

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IV. DISCUSSION

Post-cultivation vegetation: A resilient environement subject to the influence of historical and anthropic post-cultivation factors

Analysis of the influence of historical and anthropogenic factors on post-cultivation reconstitution has highlighted the impact that certain factors have on the speed of reconstitution of post-cultivation vegetation.

The factors identified as having a significant influence on the reconstitution process were the age of the plot, the number of years of cultivation, the area grazed, the cultivation history (original plant formation), the cultivation of groundnuts as the last crop, the cultivation technique using draught power and the absence of tree removal. Grazing, the duration of the cropping episode and the fallow cropping history had a negative effect on post-cultivation reconstitution. The influence of some of these factors on fallow reconstitution has already been mentioned by several authors **(Mitja, 1990; Donfack, 1993; Floret and Pontanier, 1993 and Randriamalala et al., 2007)**.

In terms of the number of years of cultivation, repeated ploughing of a plot favours the development of ruderal species to the detriment of ligneous plants, which will see their stumps torn up more and more over the years of cultivation, leading to their disappearance and delaying the reconstitution of the vegetation. Growing a crop on an especially young fallow plot has the same effects as many years of cultivation. The slash-and-burn cultivation technique used in the area results in the elimination of woody plants. Consequently, when fallow that has not been able to recover is re-exploited, its post-cultivation recovery will be even slower. **Fournier et al (2001)** arrived at the same results, noting that the duration of cultivation has a particularly strong impact on the dynamics of the woody layer. According to these authors, if the cultivation phase is short, the woody plants maintained in the form of stumps in the field will play an active role in the recovery of vegetation after cultivation has been abandoned.

Grazing on abandoned plots also has a negative impact on recovery. This activity has a twofold impact on the plots grazed. Grazing, preferably practised on savannah and fallow **(Djibril et al., 2015; Ballouche et al., 2016; Ayantunde et al., 2017)**, has a lasting effect on the reconstitution of the plant cover of fallow because once the herbaceous layer has been eliminated, the bare soil is subjected to compaction caused by the recurrent passage of herds. In addition, this state of emptiness also encourages erosion of the surface layer, which is accompanied by the elimination of the seed bank buried in this soil horizon and the emergence at the surface of the gravel layer, which encourages the phenomenon of armouring. The same observation was made by **PRIPODE (2006)** in Burkina Faso, which noted that the transhumance of animals and the development of cotton growing were serious factors in environmental degradation. Our observation corroborates the findings of **(Kessler and Geerling, 2006)**, who mentioned that overgrazing reduces the natural regeneration of woody plants, reduces herbaceous cover, leaves the soil bare and hardens it. The combined effect of all these factors prevents any possibility of vegetation recovery.

In a similar vein, **Cesar and Coulibaly (1993)** assert that permanent pastoral exploitation appears to be the decisive factor in the reconstitution of fallow since it blocks progressive natural evolution and maintains fallow at a level of extreme degradation that prevents reconstitution.

Fournier et al (2001) have shown that the effect of grazing is not easy to demonstrate, as it is a factor that is difficult to quantify in non-experimental situations. They also maintain that the methodological difficulties and imprecise results to which they generally lead certainly underestimate the influence of this factor, which should be studied in other ways. We support this assertion because, although we have highlighted the impact of grazing in this study by assessing the area grazed, we feel that this approach has not enabled us to identify the full influence of the phenomenon. For example, we think it would be wise to take into account the number of years grazing has been going on since the land was set aside and the combined effect of grazing and the age of the fallow. Although it has not been demonstrated statistically, it seems to us that the disadvantages of grazing are more marked when this activity begins in the years following abandonment, as emphasised by **César and Coulibaly (1993).**

In contrast, factors such as age, groundnut cultivation and the Open_Forest/ Wooded_Savannah (OF/WS) cultivation history favour reconstitution. These factors favour the development of Guineo-Congolese species (GC) and Guineo-Congolese species and Sudano-Zambesian (GC-SZ) species as well as woody cover.

The Open Forest/ Wooded Savannah (OF/WS) cropping history had a greater influence on recovery than the other factors. In our view, this is justified by the characteristics of this plant formation. It is dominated by fast-growing species such as *Uapaca togoensis*, which also have the ability to develop from stumps and root buds. The seed bank also demonstrates this state of affairs. As soon as there is a cover that is likely to lead to their recovery, the seeds will develop and encourage recovery. We were able to observe in the field that plots resulting from the OF/WS mosaic recovered after the cultivation episode while still being dominated

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by the same forest species, which would favour more rapid recovery. This result is confirmed by the arrangement of the fallow plots. We were able to see that the stage 4 plots, most of which are from the OF/WS mosaic and are almost the same age as the stage 3 plots with a tree and shrub savannah antecedent, are closer to the OF/WS mosaic. However, other factors may inhibit this reconstitution. The existence of plots with an OF/WS antecedent within stage 3, which is dominated by plots with a tree and shrub savannah antecedent, proves this.

The study also showed that cultivation by hitch-hiking has a negative impact on shrub cover, whereas it favours tree cover. This finding can be explained by the fact that when preparing the land, farmers eliminate the shrub layer and only spare a few feet of trees, which have very little influence on the crops. In addition, when ploughing is carried out by horse and cart, the stumps of these shrub species are also cleared to make ploughing easier. The combined effect of removing the stems and stumps of shrubs contributes to their disappearance, hence the negative correlation between hitching and shrub cover. This phenomenon can be amplified by a long cultivation period.

V. CONCLUSION

At the end of this study, we can conclude that post-cultivation reconstitution in the Department of Dianra, in particular, and in the sub-Sudanese environment, in general, is subject to the influence of several factors, the most perceptible of which are: the age of the plot, the number of years of cultivation, the grazed area, the cultural antecedent (original plant formation), the cultivation of groundnuts as the last crop, the cultivation technique using draught animals and the absence of tree removal. Among these factors, age, groundnut cultivation as the last crop and the open forest/wooded savannah cultural history favoured reconstitution. In contrast, many years of cultivation, grazing and ploughing by hitch were unfavourable to reconstitution.

Furthermore, an assessment of the combined effect of several factors at the same time would make it possible to better appreciate their influence and deduce the best conclusions for better management of cultivated areas.

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