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RAINFALL VARIABILITY AND ANTHROPOGENIC ACTIVITIES INFLUENCING LAND USE IN KORHOGO (NORTHERN CÔTE D'IVOIRE) FROM 1986 TO 2015

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INTRODUCTION

CONTEXT

Studies on climate change and variability are of interest to the global community(Sircoulon, 1976; Cantat, 1995, Kouassi *et al.*, 2012).

Côte d'Ivoire is experiencing problems of environmental change as a result of lower rainfall and rising temperatures (Goula et *al*, 2006, Brou, 2010).

Accelerated population growth and increased food needs in various agricultural products and energy (firewood and charcoal) leading to increasing pressure on its northern zone.

Northern Côte d'Ivoire remains largely dependent on climatic conditions and more particularly on rainfall variability.

Correlatively to this climatic variability, we observe a change in the dynamics of the vegetation cover.

OBJECTIVE

This study aims to analyze rainfall variability and the anthropogenic disturbances impacts on spatial and temporal dynamics of land use in the sub-prefecture of Korhogo in Northern Côte d'Ivoire
from 1986 to 2015

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STUDY AREA

SOUS-PREFECTURE OF KORHOGO

STUDY AREA

- Region of Poro,
- longitudes 5°29’10 and 5°52’30 N
- latitudes 9°21’40’’ and 9°45’O;
- Senoufo: 61% , Malinké 24%, (peulh, haoussa, maliens, etc.) 15% (INS, 2014);
- 453.006 hbts (INS, 1998), 536 851 hbts (INS, 2014) ;
- Annual average growth rate is 3.18% (INS, 2014);
- Dry tropical climate (26 ° C to 35 ° C), annual rainfall average of 1000 to 1200 mm / year;
- Rainy season: from May to the end of October with a peak of rainfall in September.

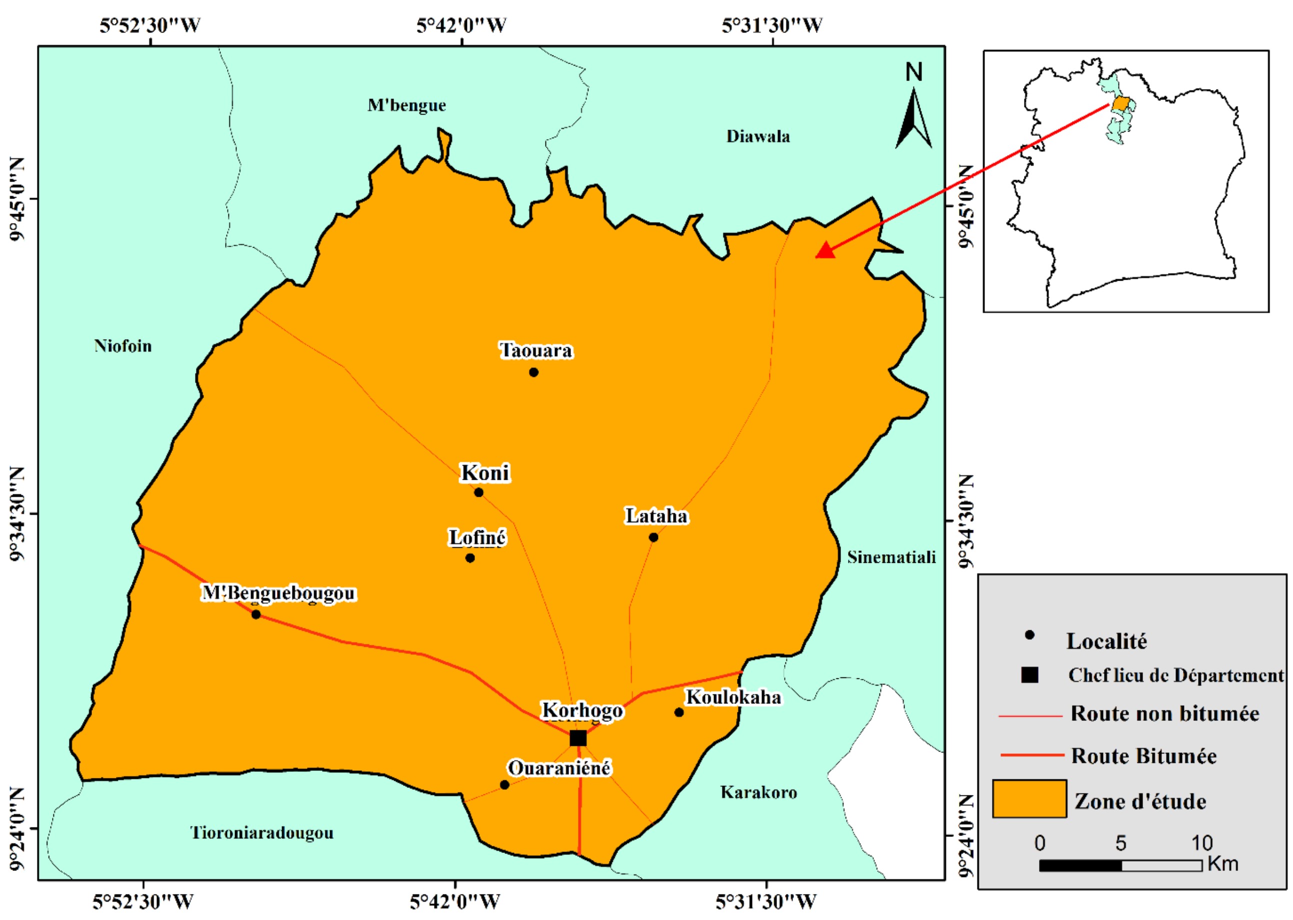

Figure 1 : Study area

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MATERIAL AND METHODS

RAIN DATA

MATERIAL

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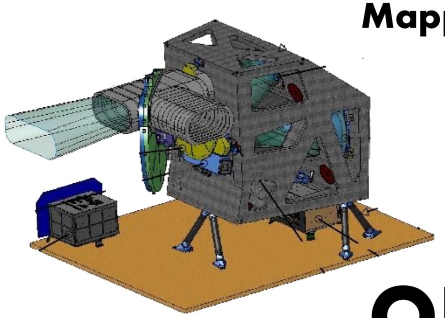
Monthly rain data provided from the Aeronautical Development and Exploitation, Airport and Meteorological Company (SODEXAM) to calculate rainfall index,
Korhogo weather station from 1983 to 2014

MATERIAL

SATELLITE DATA



SYSTEMES	SCENES	DATE	Bandes SPECTRALES	Spatial RESOLUTION
TM (Thematic Mapper)	197-53	16/11/1986	Bleu Green Red NIR Shortwave IR(SWIR-1) TIR Shortwase IR (SWIR-2)	30 30 30 30 30 120 30
ETM + (Enhance Thematic Mapper)	197-53	02/10/2000	Blue Green Red NIR SWIR-1 TIR SWIR-2 PAN	30 30 30 30 30 60 30 15
OLI (Operational Land Imager)	197-53	31/01/2015	Aerosols Blue Green Red NIR SWIR-1 SWIR-2 PAN CIRRUS	30 30 30 30 30 60 30 15 30

EQUIPMENT AND SOFTWARE

MATERIAL

GROUND INVENTORY EQUIPMENT

GARMIN ETREX

CAMERA

NOTE PAD

SOFTWARES

IMAGES PROCESSING

- ENVI 5.1

CARTOGRAPHY

- ArcGis 10.2.1

PAINT

- Finalise maps

MICROSOFT EXCEL

- Storage and processing of data

EVALUATION OF CLIMATE EVOLUTION

METHODS

Nicholson Index allows highlighting excess and deficit periods within a time series (highlights the degree of humidity or drought in the environment)

$$Ip = (Pi - Pmoy) / σ$$

With **Ip**: Rainfall index; **Pi** : value of the annual rain of the year i (mm);

Pmoy : inter-annual average value of rain on the studied period (mm);

σ : standard deviation of inter-annual rain value over the studied period.

- $Ip > 2$, extreme humidity; - $1 < Ip < 2$, high humidity ;

- $-1 < I < 0$,moderate drought; - si $-2 < I < -1$, high drought ;

- if $SPI < -2$, drought is described as extreme

LAND USE MAPPING

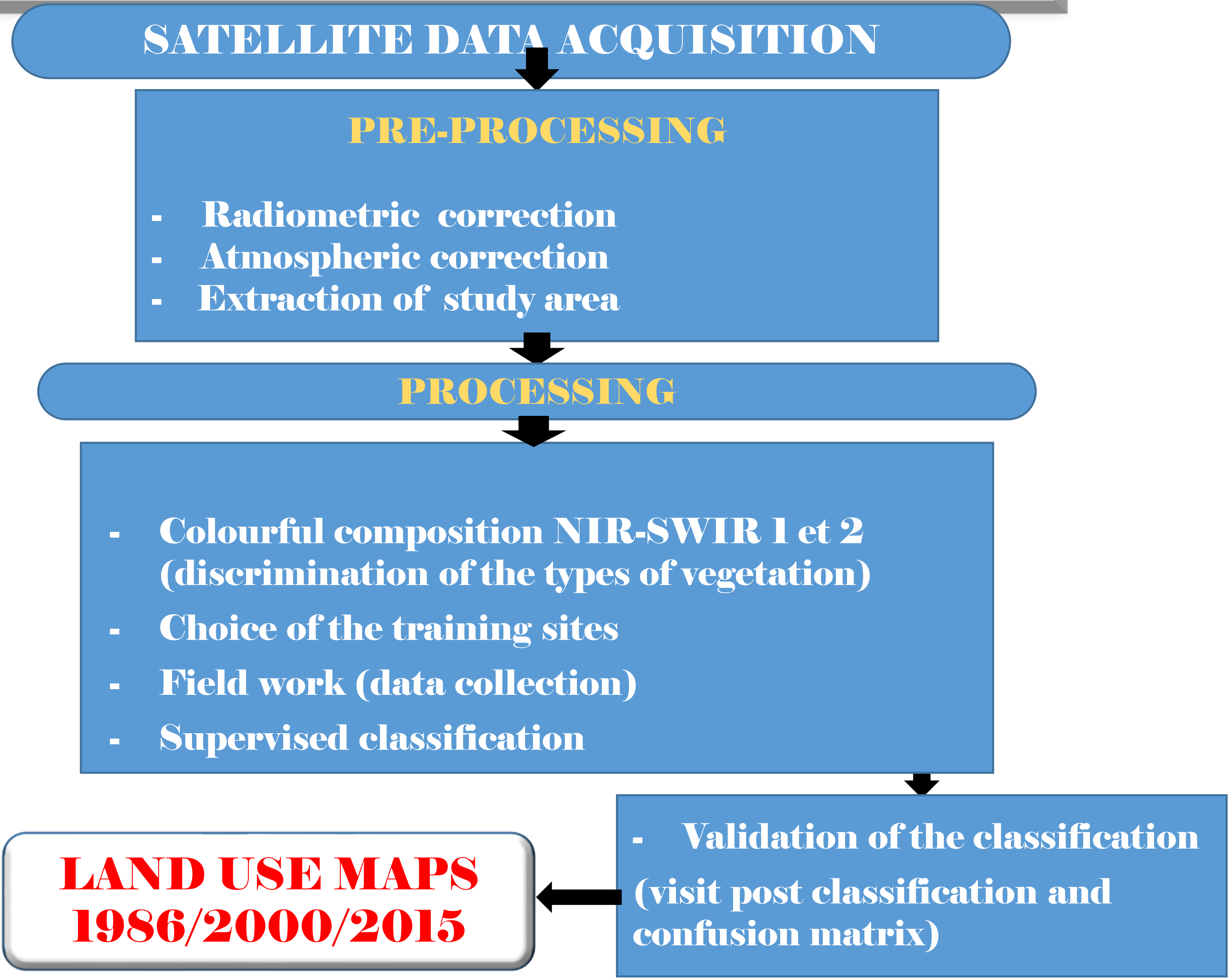


Figure 2: Synthesis of the methodology used to study the land use

INTERVIEWS AND FOCUS GROUPS

Interviews and focus groups organized to get people's perceptions about the impacts of rainfall variability on the environment and crops.

3

RESULTS
ET DISCUSSION

RESULTS

ANALYSIS OF CLIMATE EVOLUTION

Two periods with contrasting tendencies emerge:

- 1: Positive indexes (0 and 2), wet period (from 1984 to 1986 and from 2008 to 2014). It is characterized by moderate to high humidity. And there is a resumption of rain from 2009.

- 2: Negative indexes (-1 to -2), drought period (from 1987 to 2007). So a moderate to severe drought with extreme drought in 1983 and 2000-2001.

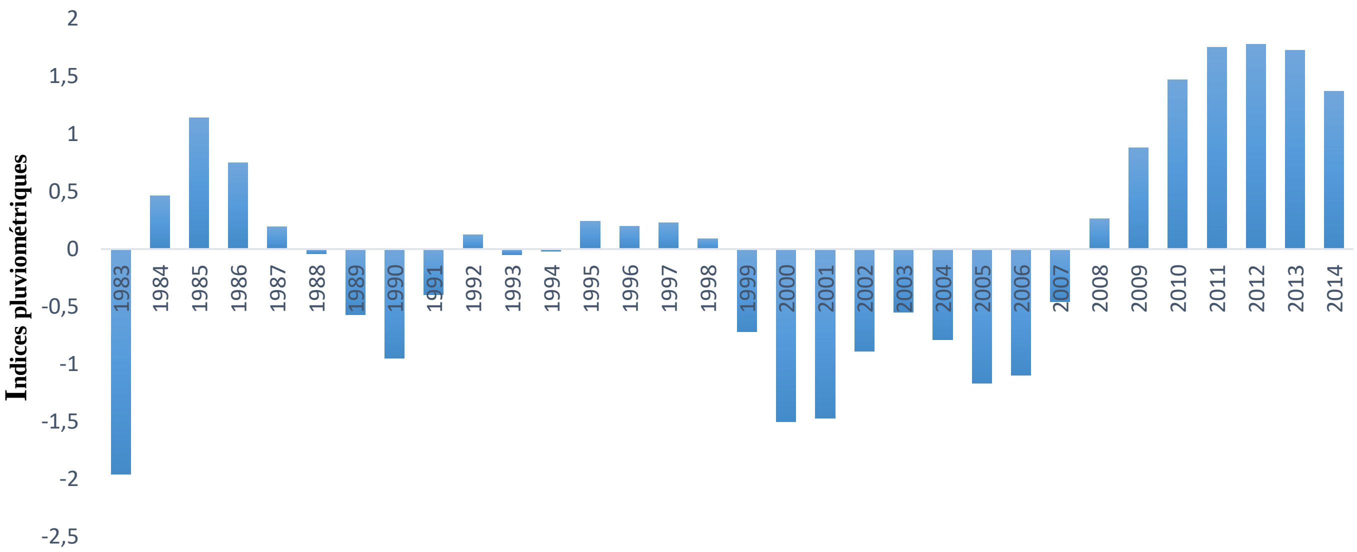


Figure 3: Annual rain index at Korhogo weather station

RESULTS

LAND USE OF 1986

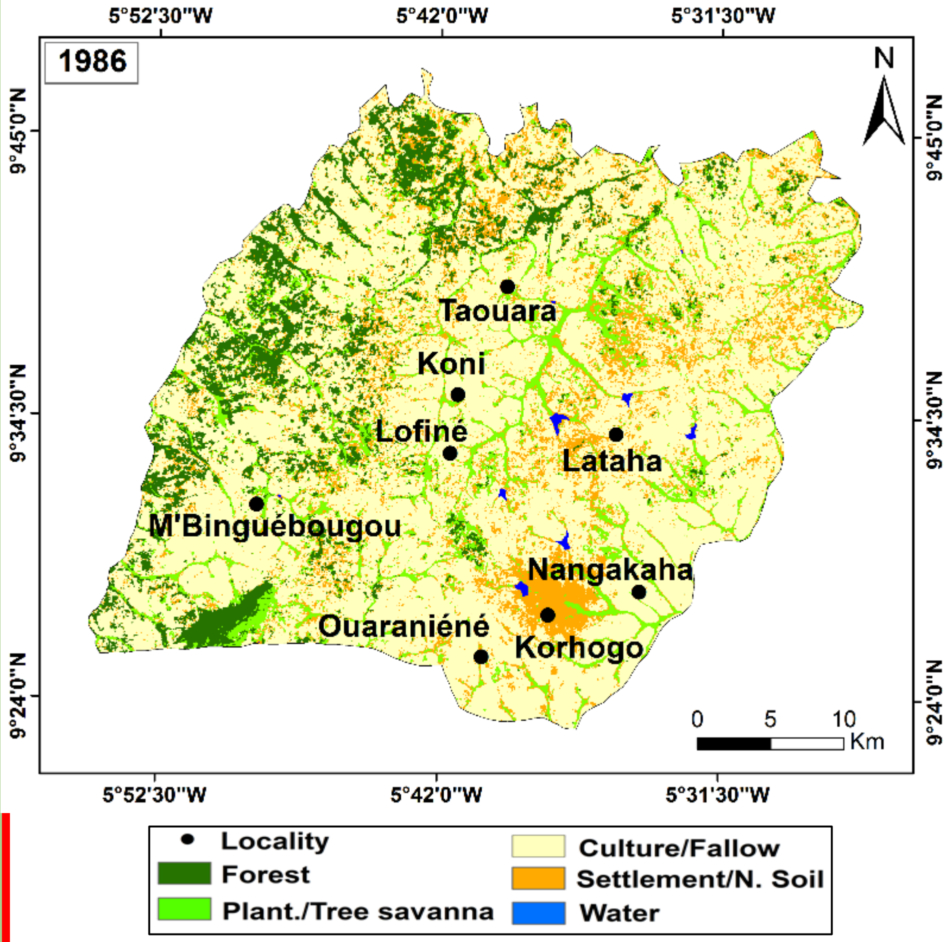


Figure 4 : Land use of 1986

Table 1: Confusion Matrix (1986)

Classes	Forest	Plantation/ Tree savanna	Culture/Fallow	Settlement/Naked soil	Water
Forest	100	1,11	0,00	0,00	0,23
Plantation/Tree savanna	0,00	69,93	0,00	0,00	8,75
Culture/Fallow	0,00	23.99	98.38	0,87	1,17
Settlment/Naked soil	0,00	4.98	1,62	99,13	1,87
Water	0,00	0,00	0,00	0,00	87,98
Total	100	100	100	100	100

Overall accuracy: 84.63%
Kappa : 0.78

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RESULTS

LAND USE OF 2000

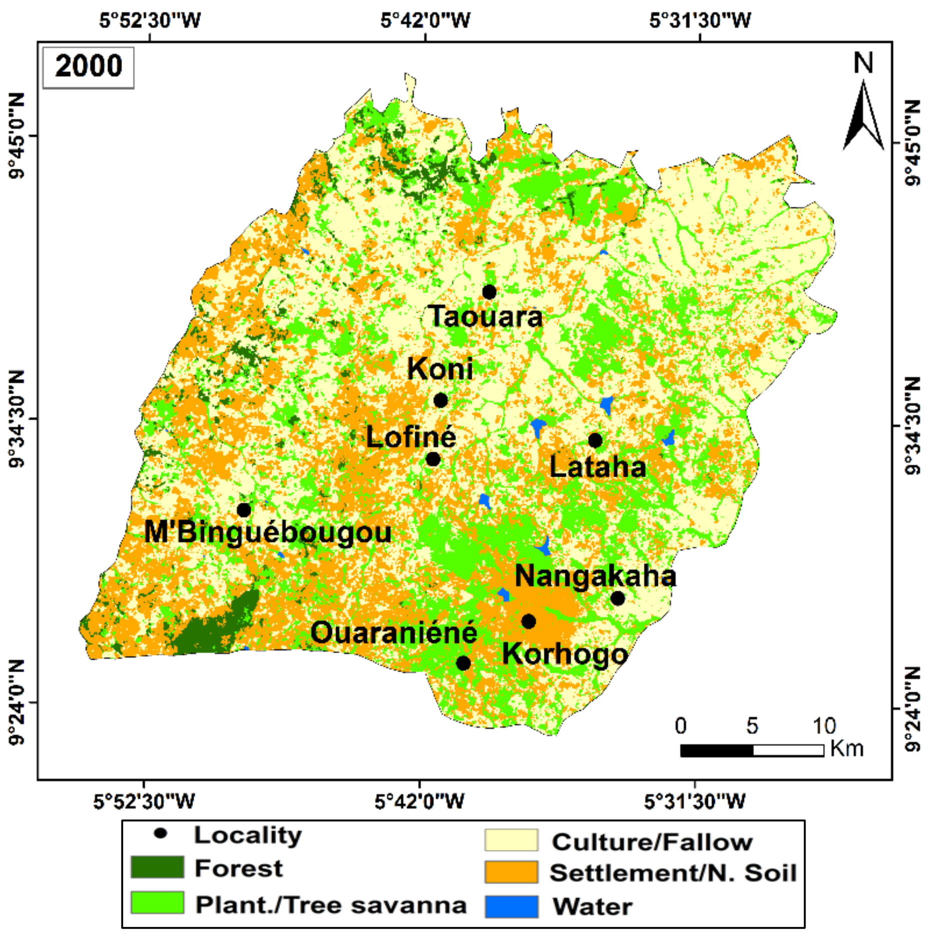

Figure 5 : land use of 2000

Table 2: Confusion Matrix (2000)

Classes	Forest	Plantation/Tree savanna	Culture/Fallow	Settlement/Naked soil	Forest
Forest	**100**	**0,00**	**0,16**	**0,00**	**0,00**
Plantation/Tree savanna	**0,00**	**44,65**	**5,78**	**0,32**	**0,00**
Culture/Fallow	**0,00**	**16,05**	**86,23**	**0,32**	**0,47**
Settlement/Naked soil	**0,00**	**39,30**	**7,84**	**99,36**	**0,00**
Water	**0,00**	**0,00**	**0,00**	**0,00**	**98,53**
Total	**100**	**100**	**100**	**100**	**100**

Overall accuracy: 87.04%
Kappa: 0.75

R E S U L T S

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LAND USE OF 2015

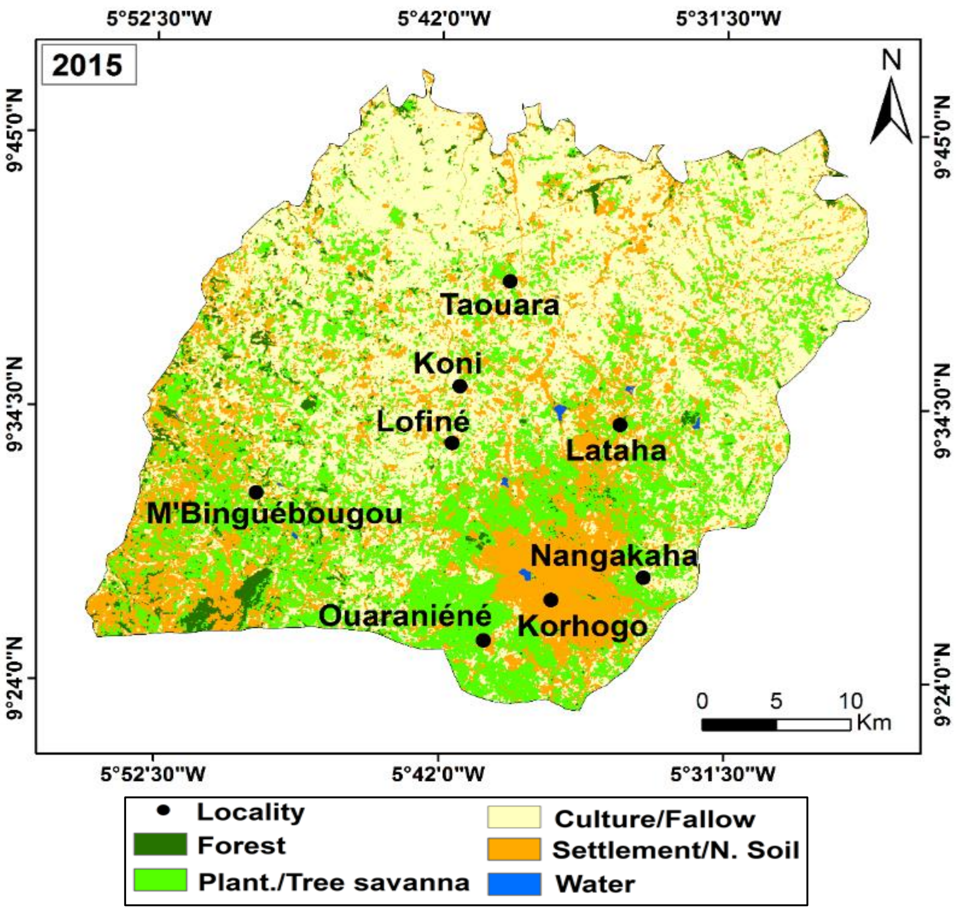

Figure 6 : land use of 2015

Tableau 3: Confusion Matrix (2015)

Classes	Forest	Plantation/Tree savanna	Culture/Fallow	Settlement/Naked soil	Forest
Forest	**99,77**	**0,00**	**0,03**	**0,00**	**0,00**
Plantation/Tree savanna	**0,00**	**99,26**	**0,11**	**0,00**	**0,00**
Culture/Fallow	**0,00**	**0,55**	**98,05**	**1,63**	**1,17**
Settlement/Naked soil	**0,23**	**0,18**	**1,81**	**98,37**	**0,00**
Water	**0,00**	**0,00**	**0,00**	**0,00**	**98.83**
Total	**100**	**100**	**100**	**100**	**100**

Overall accuracy: 98.03%
Kappa: 0.96

LAND USE DYNAMICS FROM 1986 TO 2015

RESULTS

Changes operated in different landscapes.

- Decrease of the areas of:

- ✓ Forest: from 153.5 to 43.2 km2
- ✓ Growing areas or fallow land: from 1005.3 to 702 km2

- Significant increase in areas of:

- ✓ Plantation area or tree savanna: from 141 to 392.3 km2
- ✓ Settlement/necked ground: from 196.7 to 359.9 km2

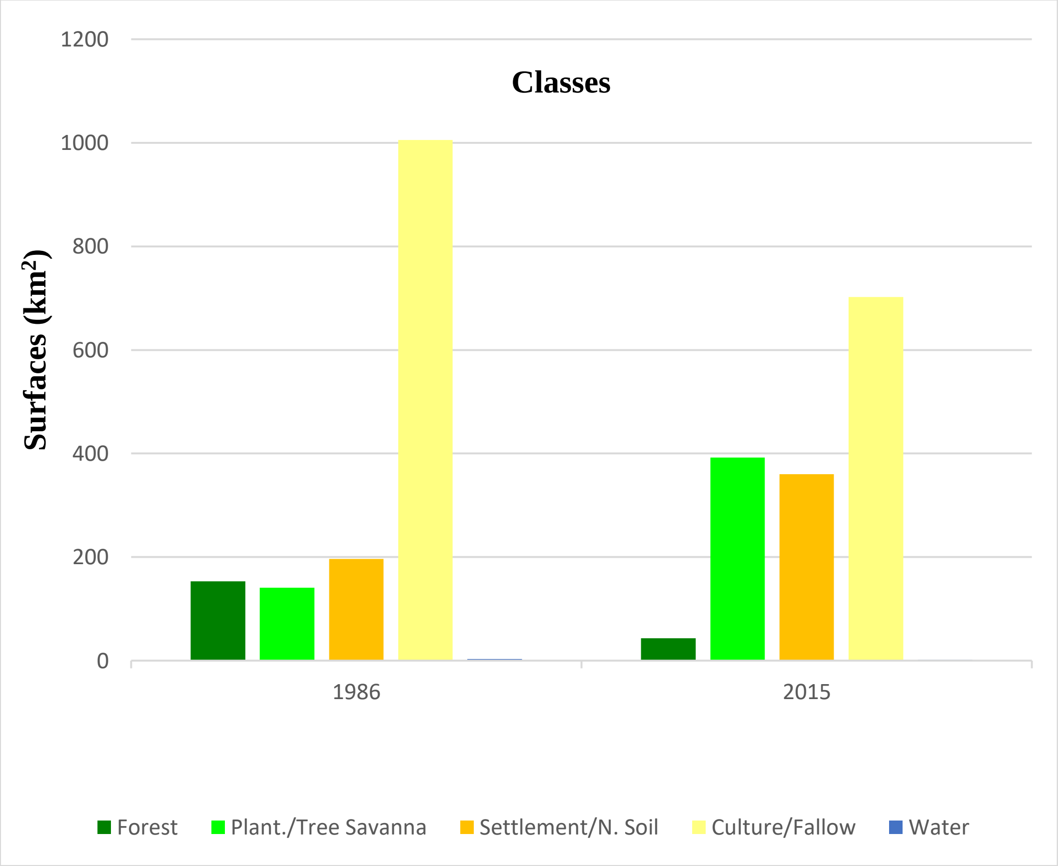

Figure 7: Areas of change observed between 1986 and 2015

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CHANGE IN THE ENVIRONMENT

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Increase in the area occupied by the city of Korhogo following a strong demographic growth

Increased vegetation, mainly related to the development of teak plantations (reforestation policy and also cultivated by some farmers), the cultivation of cashew (Côte d'Ivoire, first in production), that of mango and the creation of sacred forests (figure 6).

Introduction of these new crops (cashew nuts).

Favorable conditions for the development of these crops. This plant stand is visible on the 2015 land cover map.

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DISCUSSION

REGRESSIVE EVOLUTION OF RAINFALL

Rainfall recession generally observed in West Africa and particularly in Côte d'Ivoire (Ardoin et *al.*, 1990; Ardoin, 2004; Brou, 2010).

SATELLITE IMAGES CLASSIFICATION ACCURACY

Global accuracy: 84.63% (1986); 87.04% (2000); 98. 03% (2015)

GIRARD et GIRARD (1999) GA=80% .

The results of an image analysis with a Kappa value greater than 0.50 are good and usable(Pontius, 2000)

Confusion errors are acceptable to the extent that none of these errors is above 70% which is the limit value (Mama et Oloukoi, 2003)

CHANGE OF LAND COVER BETWEEN 1986 AND 2015

Increase in the City of Korhogo in 2015

A return of vegetation around the city of Korhogo and inhabited areas in 2015 reflecting the development of perennial crops

CONCLUSION

CONCLUSION

- Rainfall indices from Korhogo station over the period 1984-2014, reveal a wet period (from1984 to 1986 and from 2008 to 2014) and dry period (1987 to 2007).

- Thematic maps produced highlight a dynamic vegetation cover that reflects a transformation of the landscape.

- Anthropic pressures (rural and urban exodus) and rainfall droughts led, during the period 1986-2015, to a change in vegetation cover in the Korhogo Sub-Prefecture.

THANK YOU FOR YOUR ATTENTION !