DUST HAZE AND THE ENVIROMENT IN DRY SEASOPERIOD.

(A CASE STUDY OF RIJAU AND ITS ENVIROMENT)

BY

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PGD/GEO/2000/2001/127

MARCH 2002.

CERTIFICATION

This project has been read and approved as meeting the requirements for the award of a post graduate diploma in Environmental Management, Federal University of Technology Minna.

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DEDICATION

This project is dedicated to almighty ALLAH, my wife and children.

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ACKNOWLEDGEMENT

Sincere thanks and gratitude to Almighty Allah that guided to this stage and enable me write this project.

Also my sincere thanks to Dr. Peter Shola Akinyeye my Project supervisor his relentless efforts in reading through the manuscript, guiding me and making useful suggestions, Dr, M.T. Usman Head of Geography Department for his moral support, Adamu Danladi Director Works Wushishi Local Government, Wushishi Local Government Council, Local Government service Commission for their sponsorship and the entire staffs of Geography Department for their skill and ability to impact additional knowledge on me.

Finaly, I am most indebted to my Wives (Suwaiba and Mairo Ibrahim), children, and brother – Alh. Gambo Na - Makwa

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ABSTRACT

Harmattan Dust Haze particles are very fine particles which can remain airborne of a considerable period of time.

Data used for it this study were obtained from various from sources. The Harmattan dust haze data covering 27 years were obtained from the Meteorological Department at Minna International airport Minna. Minimum and Maximum temperature were also obtained.

Geographically derived methods were employed in carrying out the data analysis, the maximum Harmattan dust haze (hourly, daily, monthly or annually) was extracted from the main data set which covered 1980 to 1990. These maximum Harmattan dust haze serve as the thick dust haze.

The minimum Harmattan dust haze also extracted from the main Harmattan dust haze were also regarded as the slight dust haze.

The combination of these extracted data sets serve as the trends of Harmattan dust haze in Rijau. Graph were plotted to indicate periods thick and slight dust haze.

From what has been done so far, it is clearly seen that Harmattan dust haze is on increase, and the study area always recorded the highest thick dust haze between 0900 and 1200 hours of the day.

CHAPTER ONE

1.0 INTRODUCTION

Rijau is situated in the Northern part of Niger State. Due to its location in the country and State around the area is usually very poor in the dry season. Mostly between the month of December the February due to dust haze. This is as a result of the dust being transported into country from the neighboring State (Sokoto and Kebbi) in particular and from Sahara desert in general.

The period is usually cold and dusty as the prevailing winds are the North – East winds. Dust haze occurrence, in terms of frequency, intensity and duration is not uniform through out the months. There are hours of the day in any particular month that dust haze could be thick and at others slight. However, it has been observed in Rijau, that dust haze come in to for two or three days. There are however, times during which one occurrence may last for as long as a week. The duration of spell depends on the wind "speed "particularly in the friction layer" as well as sourcing characteristics.

In other words, if the source is from a point source is from a point source, the spell dies out quickly as against when it is from a line "line source" (More than single point)

Available information suggests the source to be in desert plains of Mid – West to North – Western Sudan. It has been observed that two dust sources produce

particles of different colours. The former produces whitish while the latter produces brownish particles.

More intensive studies will however be required to ascertain the true nature of the latter phenomenon. Meanwhile, it is important to mention that not all the dust haze witnessed in the country comes from outside her borders, some of the dust are raised locally from the abundant and increasing supply of loose top soil as a badlands use practices. The intensity of atmospheric dustilines in term of dust concentrations in West African has been found to decrease Southwards probably as a result of increasing moisture content of the atmosphere towards the Coast or simply as a result of setting over space and time.

In the dust series the third quarter of every year (July – September) is devoid of dust haze while the highest frequency is always recorded in the first quarter of the year (January – March).

1.1 PROBLEM STATEMENT

In Nigeria a principal source of air pollution is the extensive and often violent dust and sound storm that originates in the desert mainly in connection with remnants of extratropical cold fronts moving rapidly and with strong winds equatoward (HARMATTAN). However, more limited dust storms can originate at any time the year. Satellite photograph show the dust trials clearly from Sahara across the Atlantic ocean in the Northern summer.

This could therefore leads to direct treats to human health, most obviously through the aspect of environmental deterioration under the term pollution. Pollutant reach us through number of ways, could be through food, water, air, sound and daily movement and activities.

Death rate are above normal where air pollution occurs. For may human being pollution has already affected them, number of very old and the very young and those with aliment is accelerated.

The influence of Harmattan dust haze is very obvious because most of the bodily changes in the physiology of man towards climatization or basal metabolism.

Respiration diseases is generally high throughout the area under study, due to the dust haze. The Federal Government of Nigeria in the

Past years had been spending huge sums of money in the health sector embarking on various health programmes and campaigns to achieved the health for all, but this seems unrealistic because according to 1990 world population estimate of 118.8 million. Crude death rate 17 per 1000. This indicate that the intensity of occurrence of Harmattan dust haze months (the dry seasons). It has been estimated that respiratory disease contribute to a significant percentage of death rate in Nigeria.

It is also know to bring the aircraft transportation as stake to the occurrence of thick dust haze which reduces visibility to a lower level, such that aircraft could not move.

1.2 JUSTIFICATION

In Rijau and its environs, it is clear that the issue of haze forecast, are, ability to discern when dust is going to be raised, and to know how the dust (once raised) is going to be distributed in space and time. In the case of the former, a lot has already been achieved and the materials mentioned in this review, attest to that fact.

Unfortunately for the latter case which is perhaps more important, nothing tangible has been achieved. In this cast concentrations in the atmosphere in space and time, provide an indicator to dust distribution. No comprehensive study has, however been conducted on dust concentrations. According to Umoh (1991), an attempt has been made to compute and subsequently forecast the mass of the dust in suspension. This is sold to involve the estimation first of all, of the volume of dust in suspension by multiplying the appropriate surface area cover by dust, and by the height of the dust layer (to be given aircraft pilots).

The density of the dust is said to be approximated by using the equation of state, which relate pressure, volume, temperature, and density. The mass will then be estimated by multiplying the density by the volume, however, abandoned as a result of the lack of cooperation on the part of local pilots who always failed to provide information on the height of dust layer even when they are suppose to do so. In future such attempts will needs to be received to improve dust forecasts for the country.

For the study area, there is need to improve dust forecast for the purpose of accident especially during the dry months period, where the dust could reduce visibility to as 200 metres for about 7 days in some month of Harmattan periods.

1.2 AIM AND OBJECTIVE

The specific objectives of the study are:

- To provide specific information on Harmattan dust haze occurrence and some of its implications in the study.
- To examine variation trends in Harmattan dust haze over Rijau area.

1.3 SCOPE OF STUDY

The scope of the study is limited to Rijau area for some period of years, using monthly dust haze occurrence for 26 years from 1970 – 1997.

CHAPTER TWO

2.0 STUDY AREA

2.1 LOCATION

Rijau metropolis lies at the northern part of Kontagora. The town also lies on the bounder of the two main geological features of Niger State – the base complex to the North – East the NUPE Sandstone to the South – West.

It lies 11^0 22/N and 50^0 29 / E on the boundary between the Nupe sandstone to the South – West and the base complex to the North – East. FIG 2.1 Showing the Regional Location of Rijau

2.2 DRAINAGE SYSTERM:

The town sits on the catchement boundary of three separate river systems the Beri River catchment area lies to the South and East and drains into Kaduna River about 15 kilometers South of Wushishi. The Rijau River drains into Kontagora River, which inturn drains into the South –West and joins the Kainij Dam. Finally the Malendo River catchment drains to the Niger River near Yauri at the northern end of Kainji reservoir. The town is thus well drained with large developable areas along the watershed.

The main centers of activities are now concentrated on the old traditional centre based the Emirs palace, with associated offices for local government and nearby market at the western side of town. A third centre is also established at the Far Western edge of the town around the junction, where the main road to Sokoto branches to the northwest. This is basically serving the distance transport between Lagos and Sokoto.

Sahara, (natural or man-made), is of potential significance for the regional and global climate.

Taking the geological perspective, it is known, that some of the most fertile soils, originated from wind-borne materials which are caught in suitable vegetation.

Talking of aviation, harmattan dust haze have a very serious effect, because, it reduces visibility to a large extent. It sometimes stop aircraft from taking off. Transportation through air are to be at stake. This is also risky during the Harmattan dust Haze. At the harmattan period the aviation ministries need to be very careful on when to travel and when not to travel.

Figure 5.2 illustrates the pattern of respiratory related diseases during harmattan period. For Rijau the minimum occurrence of respiratory disease of the common aliments is skin dryness, crack lips, catarrh coughing and ruining nose, was between mid April and July. This is the raining season at the Sahel region which agreed with the fact that we have late onset and early sensation at this zone compared to the forest of Nigeria.

There is the occurrence of dusty atmosphere which is usually accompanied by an extremely cold weather condition as a result of intrusion of cold air from the middle latitudes into the tropical latitudes across the Mediterranean.

Intense dust haze tends to cause suffocation. Some dust particles are imitating to respiratory passages which causes coughing.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSIONS

Inspite of all the researches from the foregoing, it is clear that the issues at stake in dust haze forecasts, and ability to (discern) have the knowledge and experience of when dust is going to be raised, and the ability to know how (once raised) is going to be distributed in space and time.

The result obtained in this forecast experiment, have justified the trail of some ability to forecast thick dust haze frequency and slight dust haze frequency and ability to know the difference in trends between the year of the study from 1970-1997, which are however, susceptible to certain errors based on their individual natures and ability to prevent some effect of our health hazards.

However, improvement can be made to obtain the use of additional parameters on the synoptic scale. When this becomes possible through the improvement in data collection, it would be appropriate to use a model to forecast not only seasonal but also actual visibility on a daily basis since this more relevant to the planning of daily activities.

However, despite the high occurrence of harmattan dust haze and difficulties in identifying the exact period of the harmattan onset. The study/research is to indicate that for forecast of thick dust haze frequency one or two reasons could be used to determine a reliable estimate of thick dust spread and intensity in the season. This is also very relevant in planning.

6.2 RECOMMENDATION

From what has been done so far, it is clearly seen that harmattan dust haze is on the increase and Rijau area always records high thick dust haze between 0900 and 1200 hours of the day.

It is therefore recommended that the federal Government takes the following steps:

Through the use of media-radio and television, improve weather forest, by producing and broadcasting weather information, on hourly basis daily to public. The federal Government should order people to always have weather conscious in them.

The Federal Government should introduce the use of instrument called visual landing system, by providing the instrument to various organization, will enable, forecasting of dust haze, visibility below 1000m will not be of serious problem to prevent accident of aircraft and other vehicles.

There is the need for health sector to be aware of this shortcoming during the dry season mouths. Efforts most be made by the state and Federal government through programmes that highlight on health hazards associated with dust transport. Inhabitants of Rijau or generally savanna/Sahel Region of Nigeria should avoid direct exposure during period of intense dust haze occurrence.

Primary health care should be extended to all local Government area in the region to tackle with these respiratory ailment at early stages.

Effective monitoring techniques of harmattan dust haze pollutants should be devised, investigators should study the component of transported dust and possible

effects of each of the components our human health. Long period of study in needed to reveal delay and climate effect.

The effective media Radio and television should improve weather forecast in their daily programmes, through announcing weather condition at time interval each day and if possible hourly basis, because this will be of tremendous help to health planners who are interested in controlling seasonal diseases of harmattan dust haze.

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2.3 LANDSCAPE – (LOCAL TOPOGRAPHY)

Due to lack of updated aerial photography and contour information outside the immediate built – up area, only general assessments of local topography of Rijau may be given at present. The Rijau main valley runs due Westwards and development right up to the valley which is some 3 meters deep and 50 to 60 meters wide. The headwater streams of the Beri River catchment to the South fan out areas but the main valleys flow due South. There is small group of basement complex out crops rising South –West ward.

Since the town lies astride a waterside, a large area of land to the South of the town East – West ward.

2.4 CLIMATE OF THE STUDY AREA

Rijau has a mean annual rainfall of 117 mm taken from a good record of 40 years (Max lock Nig. Ltd Final Report 2000) the highest mean monthly rainfall is in September. The rainy season commences on average between 25th April and 5th and last between 170 and 180 days. The mean monthly temperature is highest in March and April and lower in August.

2.5 PEOPLE AND POPULATION OF THE STUDY AREA

The Rijau is originally inhabited by Kambaris, however, the ruling class is Hausa which came into ruling after the conquest by their fore – fathers who were Jihadists.

Since then there has been other ethnic groups such as the Hausa – Fulanis, Dukawas, Kamukus, Dakarkaris and other Nigeria ethnic Gwaris, Ibos Yorubas and even some Foreign Nationals for example the Zabarmas from Niger Republic.

The main base data in 1952 census, following by 1963 census both of which should be reasonably comparable because Rijau town is fairly tight defined area, with few nearby outlying settlement. In 1973 planning consultants to the then Northwestern State Government made an estimate of 25,000 for 1970. However, the area is not defined but assumed to build up urban area. In 1980 Max Lock Group Nigeria made a detailed field and sample survey and estimated a resident population of 42, 180 including the army. The economic planning Division have been using the official national standard method of taking the 1963 census as a base and applying a 5% per annum growth rate resulting in an official published population of 34,282 for 1980. The same economic planing division planning figure to be about 100,000 approximately by the year 2000.

In summary then, the existing population for Rijau is shown in **Table 2.1** Rijau TOWN: Existing Population Data

Table 2.2: Rijau Town: Annual Growth for Existing Population Data.

YEAR	DATA	ANNUAL RATE %
1952 - 1963	Census – Census	+9.27
1952 – 1970	Census – NWS Consultants	+8.61
1963 – 1970	Census- NWS Consultants	+7.61
1952 - 1980	Census – Economic Planing	+6,65
1963 - 1980	Census – Economic Planing	+5.00

2.6 AGRICULTURE

2.6.1 ARABLE FARMING

Much investment has been put into agricultural projects around Rijau and its environ farm service centers and vetenary of approximately 60 and 10 hectares of land receptively along Kontagora road and also large clearing schemes have taken place on good agricultural soils along the South –West of the Town the land within Rijau is under considerable pressure form the town's inhabitants for small scale farming even on less productive soil of the Town. it is reasonable to except that farming even on the less productive soils the Town. Is reasonable to except that farming methods will become more sophisticated and the more intensive use of Fadama and particularly some of the Valleys to the South of the Town fed by the perrennial springs will aid agricultural development. Agricultural Development Project (ADP) 200

CHAPTER THREE

3.1 LITERATURE REVIEW

In Nigeria, a lot of studies have been undertaken on the composition of Sahara dust. Some these dwelt on, the mineralogical analysis of Sahara dust samples, a microscopically analysis of the Harmattan dust and the nature of the Sahara Sub – Soil, among others.

It was among the studies undertaken that Adefoalu, (1968), and Aina (1972) stated that materials published on forecasting Harmattan over West African, have concentrated on evolving forecast techniques for the onset and dispersion of the Harmattan, primary for civil aviation purpose. However such approaches have been to a large extent, unreliable. Recent works on the dust problem discussed among others, low – level jet techniques for the forecasting of the emission and subsequent Southward advection of the dust, the existence and characteristics of African dust plume and production of synoptic model for the successful forecasting development, persistence and dispersion of dusty atmosphere with r without evidence of air – borne dust in the desert source region and the transport of the Saharan dust across, West African.

It is observed during research that one of the simplest and easily applicable quantitative approaches to dust sourcing forecast, is the one developed by Nurms (1960). He established a relationship between pressure gradient (between and Sabha and Abeche) and occurrence of dust haze at Faya – largeou. He was also able to

ascertain that once the dust is raised at the source region, Kano has a grace period of about 24 hours before it experience the haze.

Improvements can, however, be obtained by adopting the use of additional parameters on the synoptic scales. When this becomes possible through improvements in data collection, it would be appropriate to use such a model to forecast not only seasonal but also actual visibility on the daily basis since this is more relevant to planning of daily activities.

It has been observed that dust haze come into the country and spread out, depending on its speed and its point of source. In future therefore, such attempts should be made to be revived to improved dust forecasts for the country.

During the Harmattan months it is not only visibility that is observed being dangerous, and pollution considered as a source of health hazards. There is also a very dangerous appearance of air; dangerous air that do occur during Harmattan months as (Down burst) that is vertical sending of air down with full force that could be very destructive meeting with an object.

This project is talking within the range of years that is between 1970 – 1979, because 1970 mark the middle of the most severe drought experienced in African, and is still of record up till date.

However, having said that, no forecasting approach is complete without any ideal of the history of the phenomenon being forecast especially where it is seasonal as well as exhibit a ramdom nature.

It has been observed since 1980 that the intense occurrence of Harmattan dust, by which the ambient air, is usually very dry when the Harmattan is prevalent. The significance of these characteristics and trends is in relation to dust pollution and since suspended dust rises to 1500 meters or more above surface due to turbulence missing or connective currents resulting from thermal healing and usually reaches the Nigerian boarder about 24 hours after leaving Faya Lageau source regions,(Burns, 1961).

As earlier started Harmattan dust reduces visibility and reduction of horizontal visibility marks the onset of spell which often lasts up to 3 – 5 days.

But some spells may persist for up to 10 days, when the adduction of dust is from "line"rather than "point"source.

Junge (1977) also suggested that some of the desert dust may be produced by crystaline breakage of salting grains, the production of dust is related to variables of surface soil texture, wind speed, vegetation, surface roughness, soil aggregate size distribution and soil moisture.

From what have been said so far Harmattan dust haze occurrence and transportation, the method of collecting the information about the Harmattan dust, method to be used to observed, and forecast data, has to be accurate and available. When the available information is insufficient to make accurate forecast of prediction would be very difficult and therefore the best that may be possible to make the most use of what is available.

There is the ability to acquire and handle large data set, but possible only through the use of computers, which shows that there is the hope that this can be said about meteorological data acquisition and analysis in Nigeria. The March towards attaining the goal of accurate quantitative Harmattan haze forecast on daily basis would have been achieved if data is available.

Due to the data already gotten for Harmattan dust haze for Rijau, it is evident that the occurrence and incidence of Harmattan dust haze is on the increase and that dust haze would continue to pollute the atmosphere thus endangering human health.

Umoh (1991), found out during his research work that in Nigeria during the dry months November to March, North – East trades transport Sahara dust South wards, also dust haze is of small particles derived from mobilization of Soil particles in the form of dust from the arid and semi – aid area of Bilma and Faya Largeau area which are located at latitude 16^0 N Longitude 12^0 e and Latitude 18^0 n Longitude 19^0 E respectively.

Wilson (1971), during this research on Harmattan dust haze was able to found out that, there are several source areas for the Saharan dust. But the one that is responsible for the existence of dusty atmosphere over Nigeria and the adjoining West African Countries is the Bilma Largeau area. He also observed that fine dust particles are lifted and held in suspension in the air for weeks or even months by wind of low velocity, finally observed that particles give rise to what usually referred to as Harmattan Dust Haze.

According to Kalu, (1979), dust haze is composed of opalescent particles of size 0.1 – 2.0mm which is capable of polluting and rendering atmosphere inefficient for use. He also said that during the Harmattan month, most parts of the country the influence of dry tropical continental air mass (Ct) which originated form the Sahara deserts.

CHAPTER FOUR

4.0 DATA AND COMPUTATIONAL METHODS

4.1 DATA COLLECTION

Data used for this study were obtained from various sources. The harmattan dusts haze data, were obtain from the meteorological Department at the branch office in Birnin Kebbi and Kontagora.

Harmattan dust haze data for about 27 years were collected for the station, temperature reading were also collected, these include both the minimum and maximum temperature.

A lot of materials for the essay were also extracted from other various sources as the work of Kalu (1997), Kowal and Kaube (1972), Adefolalu. (1968), Aina (1972), Umoh (1991) and Usman (1995). Materials were also obtained from papers presented during seminar or conferences.

4.2 ANALYSIS OF DATA

Extracted Tables are employed in carrying out the data analysis, the maximum harmattan dust haze (hourly, daily, monthly or annually) was extracted from the main data set which covered 1970 to 1997.these maximum harmattan dust haze serve as the thick dust haze.

The minimum harmattan dust hazes were also extracted from the main data set and for the same period. These minimum harmattan dust haze were also regarded as the slight dust haze.

The combination of this extracted data set serves as the trends of harmattan dust haze in the study area. Graphs were plotted to indicate periods of thick and slight dust haze.

CHAPTER FIVE

5.1 DISCUSSION OF RESULT

The harmattan dust particles are very tiny particles which are so many that they can remain airborne for a considerable length of time. Most especially when it appears to be thick, harmattan period between 1970 and 1971 shows the average occurrence of thick dust haze at different hours of the day. These also show that variation in occurrence of the dust at different hours of the day (fig. 5.1a). The figure reveals that the maximum average of thick dust haze is at 0900z and the minimum average of the haze at 0000 hours (0.0) (fig.5.1a) (mouth 3).

The maximum thick dust haze is recorded at 0900 with average values of about 2.86 and the minimum dust haze is recorded at 0000 with average values of about 0.86.

At 0900, 1200, and 1500 hours harmattan dust haze are 2.86, 2.14 and 0.86 respectively. At 2100 hours, the dust haze were 0.71 and 0.286 respectively (fig.5.1a). In 1970/71 dust haze season, the table shows that the study area experience on average dust haze period or less than 1.00 at most period. The study area experience high thick dust haze between 0900 hrs and 1200 hrs

The intensity of atmospheric dustiness in terms of dust concentrations around Rijau area has been found to decrease south ward of the study area probably as a result of the atmosphere or simply as a result of setting over space and time (Umoh, 1991).

However, all the dust haze seasons from 1970/71 to 1996/97 show that there are thick dust haze maxima around 09.00 hour at the day. There are periods

with variations in dust haze in the study area. These therefore indicate that the intensity and duration of harmattan dust haze is not uniform throughout the day, there are hours of the day, when dust haze could be thick and at other hours slight.

The thick dust haze period is a period when visibility has been reduced to about one kilometers or less. The number of thick dust occurrence varies from one dust season to the other. Table 5:1 shows this variations.

Table 5.1-Dust year and its number of occurrence

S/No	Year (Dust) Season	No of Occurrence	S/No	Year (Dust) Season	No of Occurrence
I	1970/71	25	14	1983/84	15
2	1971/72	24	15	1984/85	25
3	1972/73	40	16	1985/86	22
4	1973/74	30	17	1986/87	33
5	1974/75	32	18	1987/88	16
6	1975/76	30	19	1988/89	32
7	1976/77	48	20	1989/90	32
8	1977/78	30	21	1990/91	35
9	1978/79	30	22	1991/92	31
10	1979/80	35	23	1992/93	35
11	1980/81	30	24	1993/94	31
12	1981/82	27			
13	1982/83	35			

Source: compiled by the author.

The number of times thick dust haze occurred in 1970/71 was 25. This was followed by 24 times in the following year 1971/72. The highest number at times of thick dust haze occurrence during the study period in the study area was 40 times (1972/73) this indicates that the thick dust haze for 1972/73 dust season was frequent.(This is very dangerous for aviation industry, since most of the times. Flight has to be re-scheduled) in 1973/74,(the following dust season).the number of thick dust haze occurrence had reduced to 30. The thick dust haze reduced to 22 and 20 in 1974/75 and 1975/76 respectively. 1976/77 witnessed an increase in thick dust haze occurrence. The number of times occurs in 1976/77 was 38 (Table, 5.1).the thick dust haze occurrence between 1977/78 and 1985/86 were below 30. The lowest thick dust haze occurrence was witnessed in 1983/84. This was followed by 1987/88. (Table 5.1). The thick dust haze occurrence between 1989/90 and 1993/94 were above 30.

Table 5.2: comparative Analysis of thick dust haze between 1970s and 1980s.

Dust haze occurrence in the 70s		Dust haze occurrence in the 80s	
Year	Occurrence	Year	Occurrence
1970/71	25	80/81	29
71/72	24	81/82	17
72/73	40	82/83	25
73/74	30	83/84	15
74/75	22	84/85	25
75/76	20	85/86	32
76/77	38	86/87	33
77/78	20	87/88	16
78/79	20	88/89	22
79/80	24	89/90	32
Total	**263**	**Total**	**237**

Source: compiled by the author.

Table 5.2 shows the occurrence of thick dust haze in the 1970s and 1980s. Thick dust haze occurrences were frequently in the 70s than in the 80s. for instance, in 1972/73 dust haze season. The number of occurrence was 40 while that of the 1982/83 dust season was just 25. In 1973/74 dust season, thick dust haze occurs 30 times whereas in 1983/84 dust season, thick dust haze occurred only 15 times:

In 1976/77, dust season, the thick dust haze occurs 38 times while in 1986/87 dust season thick dust haze occurs 33 times, the total number of thick dust haze occurrence in the 70's was 263 times while that of 80s was 237 times. This indicates that there are more periods in the 70s when flights were probably re-scheduled than in the 80s.

Dust hazes reading are normally taken at various hours of the day. The most appropriate hourly readings of dust haze are 00,03, 0600, 0900, 1200, 1500, 1800 and 2100 hrs. In 1970/71 dust season, the highest average of thick dust haze was witnessed during the 0900 with an average record thick dust haze of ?.86.This was followed by an average recorded 2.14 of thick dust haze. Other average readings of thick dust haze in 1970/71 dust season were below 1.0.

Table 5.3 thick dust haze of 0900 and 1200 hours in Rijau

S/No	Year (dust season)	Average 0900	Reading at 1200
1	1970/71	2.86	2.14
2	1971/72	2.86	1.17
3	1972/73	4.43	3.30
4	1973/74	3.86	2.86
5	1974/75	3.14	1.86
6	1975/76	1.86	0.71
7	1976/77	6.14	4.0
8	1977/78	1.86	1.14
9	1978/79	2.71	1.3
10	1979/80	3.28	2.42
11	1980/81	2.0	1.86
12	1981/82	2.86	2.0
13	1982/83	4.43	4.0
14	1983/84	2.14	1.43
15	1984/85	4.3	2.8
16	1985/86	2.7	1.86
17	1986/87	3.86	2.71
18	1987/88	2.14	1.0
19	1988/89	5.3	4.14
20	1989/90	5.3	4.71
21	1990/91	2.43	2.14
22	1991/92	5.6	5.3
23	1992/93	3.14	2.43
24	1993/94	5.0	3.0

Source: compiled by the author.

Table 5.3 shows the extracted thick dust haze at 0900 and 1200 hour in the study area. These are the period of the day when thick dust haze is at maximum. At 0900 hours and 1200 hours dust haze is always thick in the atmosphere. The reason for this is that, in any location maximum atmospheric dustiness is experienced at about 0900z.this is due to the dust that is bought down by thermal turbulent mixing of the different layers of the atmosphere.

During the period (1970/71) and 1991/92), the highest average reading at 0900 hr.was recorded in 1976/77 dust season (table 5.3). In 1982/85,the recorded average thick dust haze reading at 0900 hr were below 4.0 (table 5.3). The average readings of thick dust haze at 1200hr in most cease are lower than those of the 0900hr. For instance, in 1971/72 dust season, the average thick dust haze reading at 1200hrs was 1.76 as against 2.86 at 0900hr. of the same year (dust haze season). The highest average thick dust haze at 1200hrs was 5.3 in 1991/77, dust season. This was followed by 4.0, 4.14 and 4.71 in 1976/77,1988/89 and 1989/90 dust season. All other reading of average thick dust haze taken at 1200hrs were below 4.0.

It is to be noted, however, that the study area also have variations in slight dust haze period. Slight dust haze also varies from one season to another, as can be seen in Appendix 2. It is noted however that slight dust haze does not pose much treath to motorists that are very careful

5.2 IMPLICATION OF THICK DUST HAZE

Dust hazes do not only appear at a time and disappear at a time. It has some implication along with it, because it seeps into nooks and comers of household and major aviation problem as reduces visibility handicaps, on aircraft pilot during his expedition. It also has some ecological effects, household problems and human health implication. These are environmental deterioration, commonly known as the term air pollution.

Pollution reach us through the air we breath, water we drink, food we eat and the sound we hair. Air pollution due to harmattan dust has already proven to be dangerous to human health. Death rate are above normal where air pollution and dust haze occurs. The number of very old and young and those with respiratory ailment is accelerated due to the particles of the dust haze

Harmattan dust haze has become more intense (dust worse) especially since 1980. The ambient air is usually very dry when the harmattan is prevalent. However, the significance of these characteristics and trends is in relation to dust pollution and diseases since suspended dust is a major carrier of vectors.

Harmattan dust also has an effect on human health with particular reference to respiration disease and mortally within Nigeria

It become clear that the Sahara is a very important source and appreciable variations in its strength could have significance implications on the regional and global burden of mineral dust. This implies that changes in the dust output from the

		APPNDIX 1					
			THICK DUST HAZE				
1970							
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	1	0	1	0	0	0.286
3	0	0	0	0	0	0	0	0
6	0	0	0	0	2	0	0	2.86
9	2	2	6	3	2	3	3	2.86
12	3	1	4	3	1	2	2	2.14
15	3	0	1	1	1	0	0	0.86
18	1	0	1	0	3	0	0	0.71
21	0	0	1	0	1	0	0	0.286
1971								
HOURS	0							
0	0	N	D	J	F	M	A	MEAN
3	0	0	1	0	0	0	0	0.143
6	1	0	0	0	0	0	0	0
9	2	0	2	0	1	2	0	2.86
12	3	5	11	0	0	2	0	1.71
15	2	3	5	0	0	1	0	1
18	1	2	2	0	0	1	0	0.86
21	0	1	2	0	0	1	0	0.57
1972								
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	1	2	2	1	0	0.86
3	0	0	1	2	1	0	0	0.57
6	2	0	3	2	3	3	0	1.86
9	4	9	5	4	4	5	0	4.43
12	4	5	4	2	3	5	0	3.286
15	1	2	3	3	2	5	0	2.286
18	0	2	2	3	2	3	0	1.71
21	0	1	1	3	2	2	0	1.286
1973								
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	3	3	1	0	0	0.57
3	0	0	1	1	1	0	0	0.286
6	0	2	2	2	4	0	0	1.143
9	0	5	10	10	5	1	2	3.86
12	0	3	9	9	5	1	1	2.86
15	0	1	7	7	4	0	1	1.86
18	0	1	6	6	3	0	0	1.57
21	0	0	3	3	1	0	0	0.57

		APPNDIX 1						
			THICK DUST HAZE					
1970								
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	1	0	1	0	0	0.286
3	0	0	0	0	0	0	0	0
6	0	0	0	0	2	0	0	2.86
9	2	2	6	3	2	3	3	2.86
12	3	1	4	3	1	2	2	2.14
15	3	0	1	1	1	0	0	0.86
18	1	0	1	0	3	0	0	0.71
21	0	0	1	0	1	0	0	0.286
1971								
HOURS	0							
0	0	N	D	J	F	M	A	MEAN
3	0	0	1	0	0	0	0	0.143
6	1	0	0	0	0	0	0	0
9	2	0	2	0	1	2	0	2.86
12	3	5	11	0	0	2	0	1.71
15	2	3	5	0	0	1	0	1
18	1	2	2	0	0	1	0	0.86
21	0	1	2	0	0	1	0	0.57
1972								
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	1	2	2	1	0	0.86
3	0	0	1	2	1	0	0	0.57
6	2	0	3	2	3	3	0	1.86
9	4	9	5	4	4	5	0	4.43
12	4	5	4	2	3	5	0	3.286
15	1	2	3	3	2	5	0	2.286
18	0	2	2	3	2	3	0	1.71
21	0	1	1	3	2	2	0	1.286
1973								
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	3	3	1	0	0	0.57
3	0	0	1	1	1	0	0	0.286
6	0	2	2	2	4	0	0	1.143
9	0	5	10	10	5	1	2	3.86
12	0	3	9	9	5	1	1	2.86
15	0	1	7	7	4	0	1	1.86
18	0	1	6	6	3	0	0	1.57
21	0	0	3	3	1	0	0	0.57

		APPNDIX 1					
		THICK DUST HAZE					
1974							
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	0	0	0	1	0	0.143
3	0	0	0	0	0	1	0	0.143
6	0	0	0	2	0	1	0	0.43
9	0	8	3	8	0	3	0	3.143
12	0	3	2	6	0	2	0	1.86
15	0	1	2	4	0	2	0	1.286
18	0	1	0	2	0	2	0	0.71
21	0	1	1	1	0	1	0	0.43
1975								
HOURS								
0	0	N	D	J	F	M	A	MEAN
3	0	0	0	0	0	0	0	1.286
6	0	0	0	0	0	0	0	0.143
9	0	0	3	1	1	0	0	0.57
12	0	2	7	3	1	0	0	1.86
15	0	1	4	2	1	0	0	0.71
18	0	2	2	2	1	0	0	1.286
21	0	2	1	2	1	0	0	1.286
	0	0	0	2	1	0	0	0.71
1976								
HOURS	0	N	D	J	F	M	A	MEAN
0	0	2	2	0	0	1	1	0.86
3	0	2	1	0	0	2	0	0
6	0	1	2	1	3	10	3	71
9	0	2	7	8	7	16	3	2.86
12	0	2	4	5	7	11	0	6.143
15	0	2	5	3	6	7	3	4
18	0	2	1	2	0	2	2	3.71
21	0	1	1	0	0	0	1	1.286
								0.43
1977								
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
6	0	0	3	1	1	0	0	0.57
9	0	2	7	3	1	0	0	1.86
12	0	1	4	2	1	0	0	1.143
15	0	2	2	2	1	0	0	1
18	0	2	1	2	1	0	0	0.86
21	0	0	0	2	1	0	0	0.286

			THICK DUST HAZE					
1978								
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	0	1	0	0	0	0.143
3	0	0	0	1	0	0	0	0.143
6	0	2	0	1	1	2	0	0.71
9	0	7	3	5	0	3	0	2.71
12	0	3	1	2	0	3	0	1.286
15	0	0	0	2	0	4	0	0.86
18	0	0	0	2	0	3	0	0.71
21	0	0	0	1	0	1	0	0.286
1979								
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	1	0	0	0	0	0.142
3	0	0	0	0	0	0	0	0
6	0	0	1	0	2	0	0	0.428
9	0	3	6	2	7	4	1	3.28
12	0	2	3	0	6	3	3	2.42
15	0	1	1	0	3	1	1	1
18	0	1	1	0	1	0	0	0.428
21	0	1	1	0	0	0	0	0.286
1980								
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	2	0	1	0	0	0.428
3	0	1	2	0	1	0	0	0.57
6	0	1	4	0	3	0	1	1.28
9	0	2	4	3	4	0	1	2
12	0	2	3	2	4	1	0	1.86
15	0	1	4	1	2	0	0	1
18	0	1	2	2	2	0	0	1
21	0	0	2	0	2	0	0	0.57
1981								
HOURS	0	N	D	J	F4	M	A	MEAN
0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
6	0	6	0	0	3	1	0	1.428
9	0	9	1	0	5	5	0	2.86
12	0	7	0	0	4	3	0	2
15	0	2	0	0	2	1	0	0.71
18	0	1	1	0	2	1	0	0.71
21	0	0	0	0	0	0	0	0

		APPNDIX 1					
		THICK DUST HAZE					
1982							
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	1	0	0	0	0	0.143
3	0	0	0	0	0	0	0	0
6	0	0	2	10	2	0	0	1.86
9	2	3	2	19	2	3	2	4.43
12	1	3	2	17	3	2	1	4
15	0	3	1	8	3	2	0	2.57
18	0	3	0	4	2	0	0	1.143
21	0	0	1	0	0	0	0	0.143
1983								
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
6	0	0	0	6	0	0	0	1
9	3	1	1	8	0	0	0	2.143
12	1	0	0	7	2	0	1	1.43
15	1	0	0	4	2	0	0	1
18	0	0	0	3	1	0	0	0.57
21	0	0	0	0	0	0	0	0
1984								
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	0	0	0	0	0	0
3	1	0	0	0	0	0	1	0.286
6	1	1	3	6	0	0	2	1.86
9	4	2	7	10	0	4	3	4.286
12	2	0	4	9	0	4	1	2.85
15	1	0	1	4	0	1	0	1
18	0	0	1	1	0	0	0	0.286
21	0	0	0	1	0	0	0	0.143
1985								
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	0	0	0	0	0	0
3	0	3	0	0	0	0	0	0.443
6	0	5	1	1	0	0	0	1
9	1	8	3	3	3	3	0	2.7
12	1	6	3	2	1	1	0	1.86
15	0	4	0	2	0	0	0	0.86
18	0	3	1	1	0	0	0	0.71
21	0	1	3	0	0	0	0	0.57

		APPNDIX 1					
		THICK DUST HAZE					
1986							
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	0	1	0	0	0	0.286
3	0	0	0	1	0	0	0	0.286
6	0	0	5	3	0	1	4	1.71
9	0	3	10	3	3	2	6	3.86
12	0	3	6	3	3	2	2	2.71
15	0	1	5	2	2	2	1	1.86
18	0	1	3	2	1	2	0	1.286
21	0	0	2	1	1	1	0	0.71
1987							
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	0	0	0	1	0	0.286
3	0	0	0	0	0	1	0	0.286
6	1	0	0	1	0	2	0	0.71
9	0	0	3	6	3	3	0	2.143
12	0	0	1	4	3	2	0	1
15	0	0	0	2	2	1	0	0.43
18	0	0	0	2	1	0	0	0.286
21	0	0	0	0	1	0	0	0
1988							
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0.286
6	0	0	3	9	1	0	0	2.86
9	1	0	3	18	3	2	0	5.286
12	0	0	3	12	0	3	0	4.4143
15	0	0	3	9	0	1	0	2.71
18	0	0	2	7	0	1	0	1.57
21	0	0	0	1	0	0	0	0.143
1989							
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	0	0	0	0	0	0.286
3	0	0	0	0	0	1	0	0.143
6	2	0	0	3	5	5	0	2.71
9	6	5	5	3	6	9	0	5.286
12	4	3	3	3	8	5	0	4.71
15	2	2	2	3	2	1	0	2
18	1	1	1	2	1	0	0	1.143
21	0	1	0	0	0	0	0	0.71

		APPNDIX 1					
			THICK DUST HAZE				
1990							
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	0	1	0	0	1	0.286
3	0	0	0	1	0	0	1	0.286
6	0	0	0	4	1	1	0	0.86
9	1	0	1	9	2	3	1	2.43
12	1	0	1	6	2	3	2	2.143
15	1	0	1	2	1	1	2	1.286
18	1	0	1	2	1	1	1	1
21	0	0	0	1	1	1	1	0.57
1991								
HOURS	0	N	D	J	F	M	A	MEAN
0	0	0	2	3	0	0	0	0.71
3	0	0	2	3	0	0	0	0.71
6	0	3	0	13	9	2	1	4
9	0	8	0	13	11	4	3	5.6
12	0	6	5	13	9	3	1	5.3
15	0	4	6	9	3	0	0	3.143
18	0	0	4	7	1	0	0	1.71
21	0	0	2	1	1	0	1	0.71
1995								
HOURS	0	N	D	J	F	M	A	MEAN
0	0	2	0	1	3	0	0	0.86
3	0	1	0	1	2	0	0	0.57
6	0	2	0	1	2	2	0	1
9	1	7	0	4	6	2	2	3.143
12	2	5	0	2	3	4	2	2.43
15	0	3	0	2	3	2	1	1.286
18	0	3	0	2	2	1	1	1.143
21	0	2	0	1	4	1	0	
1996								
HOURS	0	N	D	J	F	M	A	MEAN
0	0	1	1	0	0	0	0	
3	0	0	1	0	0	0	0	0
6	0	5	1	2	7	0	0	0.143
9	2	8	1	4	17	3	0	5
12	1	4	1	3	9	3	0	3
15	0	3	2	2	6	3	0	2.57
18	0	3	2	2	2	0	0	1.286
21	0	1	1	0	6	0	0	1.143