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RESEARCH PAPER

# Climate variability and fall army insect invasion: Implications for sustainable Corn yield in Emohua local government area, Rivers state, Nigeria

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**ABSTRACT**

The study assessed the invasion of scavenger insects on corn yield in Emohua Community, Rivers State, Nigeria. Laboratory results identified the insects as Fall Armyworm (*Spodoptera frugiperda*). The result shows monthly and annual variations in rainfall and temperatures from January 2012 to December 2016. The monthly rainfall in 2012 picked late January (0.24mm) and increased to 400mm in September and declined in November (79 °C). The maximum and minimum temperatures from 2012 to 2016 are 29 °C to 34.5 °C and 22 °C and 23 °C respectively. Therefore, the average annual maximum temperatures recorded 2012 (31.6 °C), 2013 (31.5 °C), 2014 (31.4 °C), 2015 (31.4 °C), and decrease by 29.4 °C in 2016. While the average annual minimum temperature was 2012 (22.8 °C), 2013 (22.6 °C), 2014 (22.6 °C), 2015 (22.6 °C), and increase by 23.2 °C in 2016, showing temperature variation. The increase in average annual minimum temperature of 10 °C was due to unusual heat wave or heat trend caused by global warming, which resulted in rainfall decline in 2015. This led to almost four months of prolong drought from November 2015 to late March in 2016. The four months of drought and / or dry air temperature made way for the migration of fall armyworms across the study area, which resulted in poor harvest of maize in 2016, 2017, 2018, and 2019. Urgent intervention is needed to avert the scavengers on sustainable maize and other plants.

Keywords: corn, climate change, fall armyworm, temperature, community, Nigeria

## 1. INTRODUCTION

The anthropogenic activities have created an unstable climatic system and threat to human and nature. The rise in global average temperature and ozone depletion results in physical changes in natural events. Nigeria has witnessed the impacts of extreme weather events in flooding, long durations of sunshine causing energy demand, diseases, etc. Ibe (2017) affirmed that the year 2016 was the hottest year ever since scientific measurement began [1]. It is also observed that the last three decades are warmer as compared to earlier decades. Food and agricultural organization (FAO) (2008)

predicted that all the four dimensions of food securities (food insecurity, food utilization, food systems stability) will surely have an impact on human health, livelihood assets, distribution channels, as well as economic growth, employment, and social stability [2]. Historically, the rural farmers solemnly rely on nature and self-ideas on the type of plant or crop suitable for a particular soil without any application of either fertilizer or genetically modified plants/crops. But today, the farmers lose the ability on local weather prediction techniques, losing potentials and interest in growing many crops especially less profitable crops.

The invasion of strange insects started by early 2016, it caused substantial loss to maize harvest in the Emohua Community. The invasion of insects was first discovered in Central and Western Africa and later in the whole of mainland Southern Africa (except Lesotho and the Island States) [3-4]. It was most common in tropical and subtropical regions and migrated long distances on prevailing winds and breed continuously in climatically suitable areas [3]. The species massively move from farm to farm, damaging crops. The larvae stage feeds on more than 80 plant species of monocots and dicots plants [5] (FAO, 2018). The scavenger's species took everyone at unawares as the rural farmers in the study area lamented bitterly over huge losses to maize. Survey research shows economic loss resulting in poor yield, poor distribution, and utilization of maize across the study area.

Maize (*Zea mays* L.) is widely used as one of the most important cereal crops in the human diet as well as for livestock. Over the last five years count on world production, maize on average out ranked wheat (*Triticum aestivu*) and paddy rice (*Oryza sativa*) [6]. Maize is rich with 10% of protein (body with amino acid), 3.5% of crude fibre, 80% of carbohydrate, 2% mineral and vitamin and ether extract providing large amount of energy [7-8].

The maize is rich with vitamin B-complex which is good for hair, heart, skin, brain, and proper digestion. It also prevents the rheumatism as it improves the joint motility. The presence of vitamins A, C, and K with beta-carotene and selenium helps in improving the functions of thyroid gland and immune system [6].

The invasion of insects heavily effected the maize production. Due to poor yield, the farmers went home with little quantity of spoiled corns for family consumption while selling the unaffected quality of corns help meet the expenses and other family needs. Thousands of rural farmers in Nigeria are affected, claiming that in each of the acquired farm plots, corn yield alone provides about 70% of their expenses from cultivation to grass weeds. Climate change has added more problems that propel pressure on the traditional farming system to local/family farmers in Nigeria. This problem lead to the decline of corn's market supply from the year 2016-2020, it not only affected farmers but also consumer's budget. In Nigeria about five corns sold for 400 Naira compared to past years when fifteen to twenty corn ears were sold for the same price.

## 2. METHOD AND MATERIAL

*2.1. Study Area*

Emohua Community is in Emohua Local Government Area of Rivers State, and it lies between 64º` and 65 º5` East and 44 º5` and 51 º5` North. The study took place in five villages in Emohua Community as Isiodu, Mgbuetanwo, Mgbueto, Rumuakundi, and Rumuche.

The area has a unique feature and the soils in the region are mainly sandy loams, hummus, alluvium, and the outer belt of saltwater swamps, clay, and mud.

*Sample*

A total of twenty (20) samples of larvae were obtained from the newly cultivated farms acres from five (5) villages (where maize is cultivated), aseptically.

*Sample collectionand identification*

The larvae of different sizes were collected and took to the Animal and Environmental Biological Laboratory, University of Port Harcourt for species identification. Rainfall and temperature data for five years were obtained in the study to determine the annual variations and comparison to the migration of the scavengers.

Egg ⟶ Larvae ⟶ Pupae ⟶ Adult
6days 5days 9day

## 3. RESULTS AND DISCUSSION

The soils in the study area are rich in phosphorus because of nutrients from the volcanic parents' materials [9]. The insect's larvae were collected and conveyed to a laboratory for identification, and after nine (9) days of incubation, the insects changed from larva to adult. The survived insects were identified as fall armyworm as scientifically classified as belonging from order: Lepidoptera- and named *Spodopte frugiperda*

The fall armyworm (*Spodoptera frugiperda*, FAW) is native to the Americas where it is known to be a pest of numerous crop [10]. Fall armyworms are not similar both in size and color based on their stages. The insects laid their

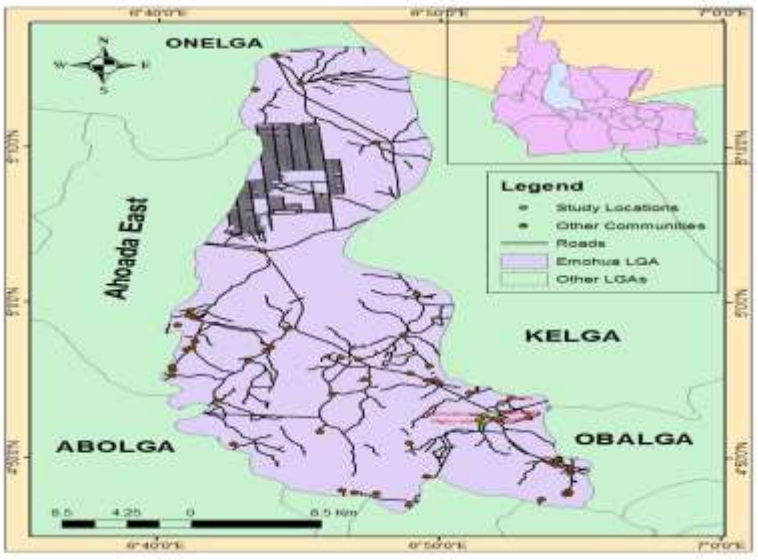


**Image 1**. Emohua LGA locating Study Area

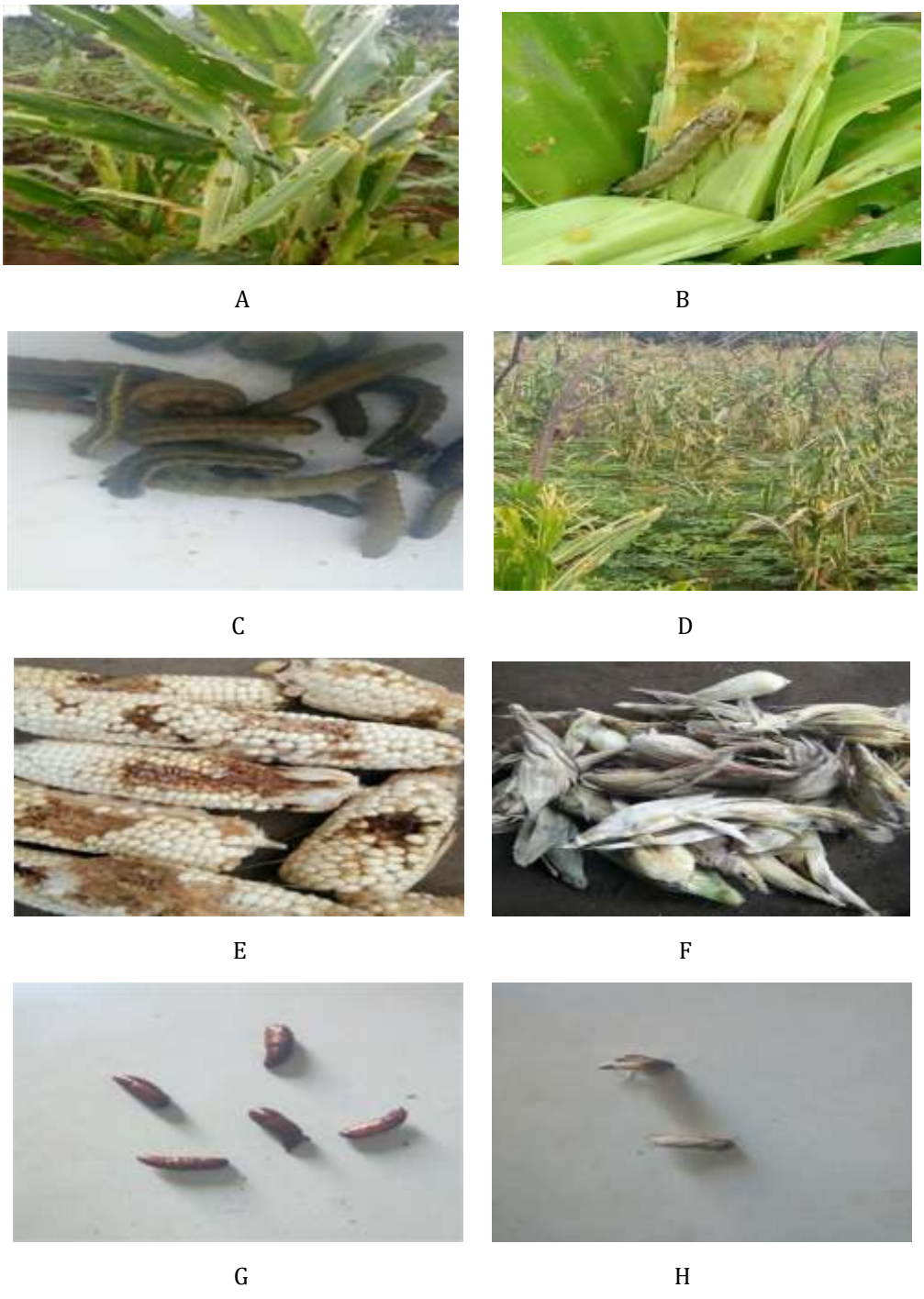


Figure 1. A, B, C, D, E, F, G and H represents the different stages of larvae and collection and identification

eggs in clusters of 37 in a single layer on maize foliage. The eggs are dome-shaped and have dirty white to grayish scales over the egg mass, giving it a hearing or moldy appearance [10]. The egg hatched after eight days as monitored. A few days later, it began to feed on dry and burnt surfaces. The next day they were found on maize logs climbing to feed on the leaves tissue (figure 1a, 1b, 1c and 1d). The larvae destroy the whorl of the maize plant, affecting the maize

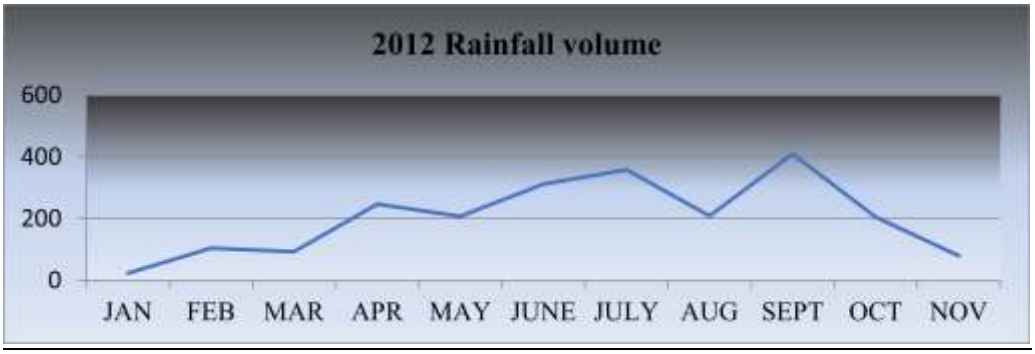


**Figure 2**. Monthly Rainfall Variation in 2012

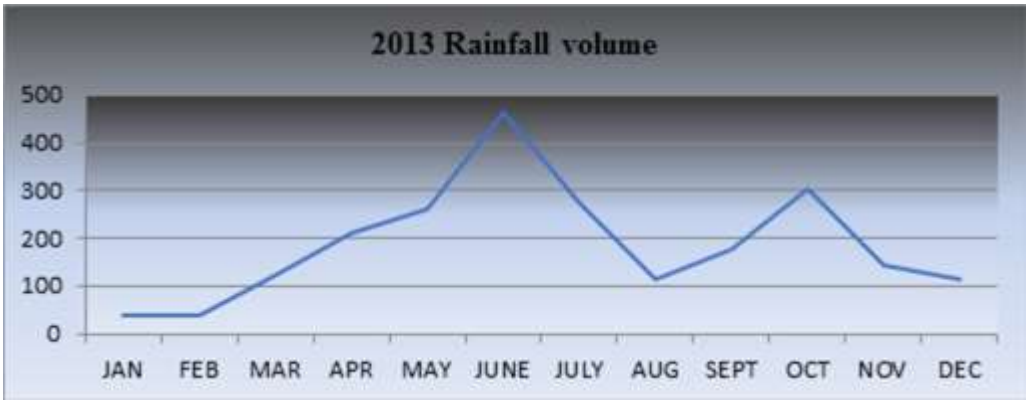


**Figure 3**. Monthly Rainfall Variation in 2013

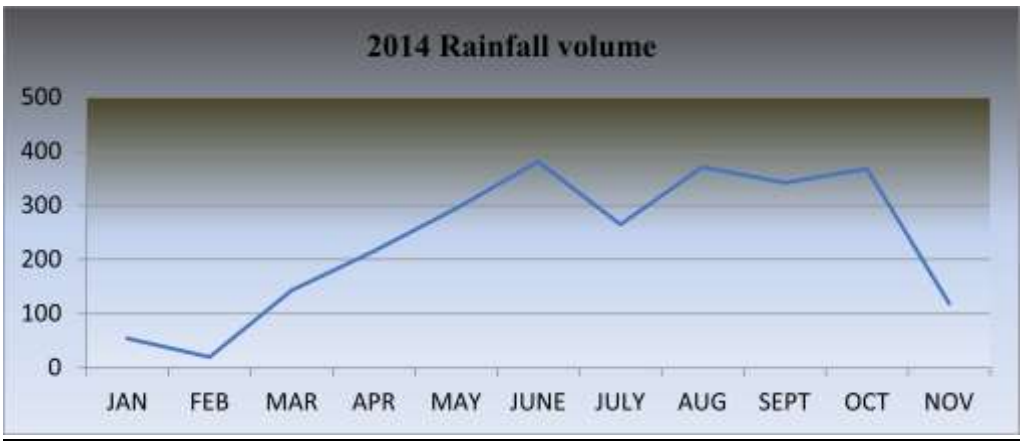


**Figure 4**. Monthly Rainfall Variation in 2014

production system. As the insects go beyond deforming the maize ear, tassel, and silk, it then affects the cob of the corn (figure 1e and 1f) causing a reduction in yield. The fully grown larvae are about 1.25 to 1.5 inches in length, and all sizes collected were pupated with the number of 5days (figure 1g and 1h). Only the matured pupated larvae survived the adult stage after 9days of monitoring at the moderate temperature (figure 1g and 1h). Three adults were seen flying inside the laboratories and escaped through the Laboratory windows while two were found dead due to hunger. The survey research conducted in the study area shows that fall armyworm climbed plant in the third week after planting and germination of maize.

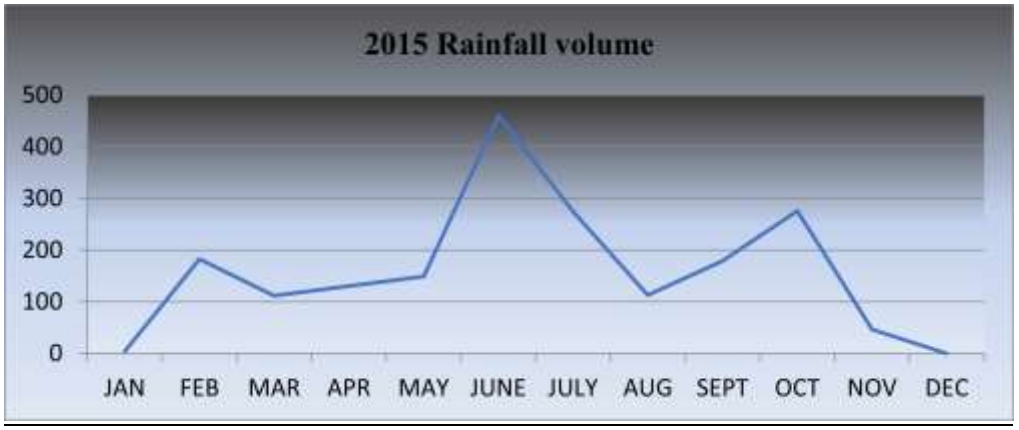


**Figure 5**. Monthly Rainfall Variation in 2015

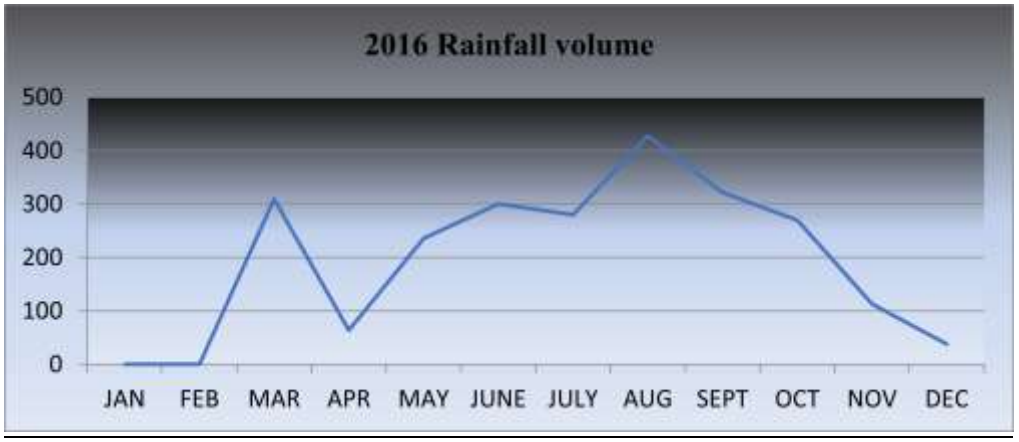


**Figure 6**. Monthly Rainfall Variation in 2016

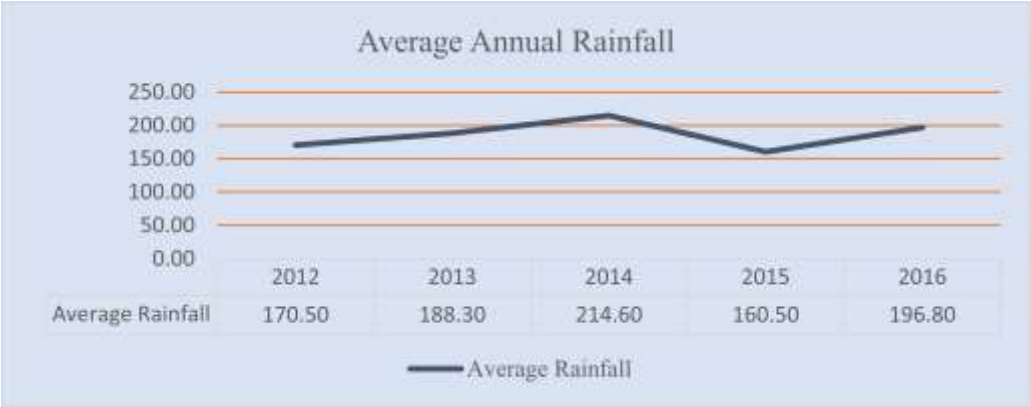


**Figure 7**. Average Annual Rainfall

The result shows variations in rainfall from January 2012 to December 2016. In 2012 rainfall picked from January (0.29mm) to September (400mm) and dropped in December (0.0mm). In 2013 January (0.52mm) and February (0.43mm) were observed with the highest rainfall in June (450mm) and reduced in November (150mm) and December (100mm). In 2014 January (0.50mm) and February(0.23mm) with chain rainfall picked up in March(148mm), June (378mm) to October (365mm) but cut off in December, affecting Month of January (0.6mm) 2015. Between January and December in 2015 witnessed poor

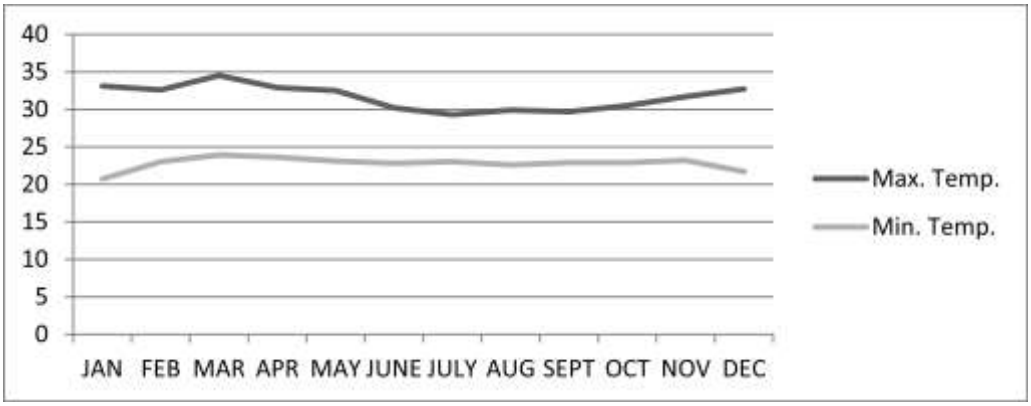


**Figure 8**. 2012 Monthly Temperature

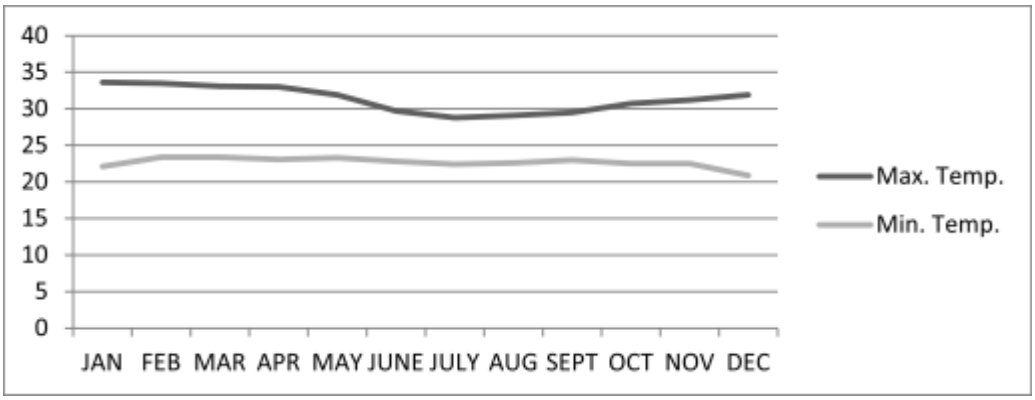


**Figure 9.** 2013 Monthly Temperature

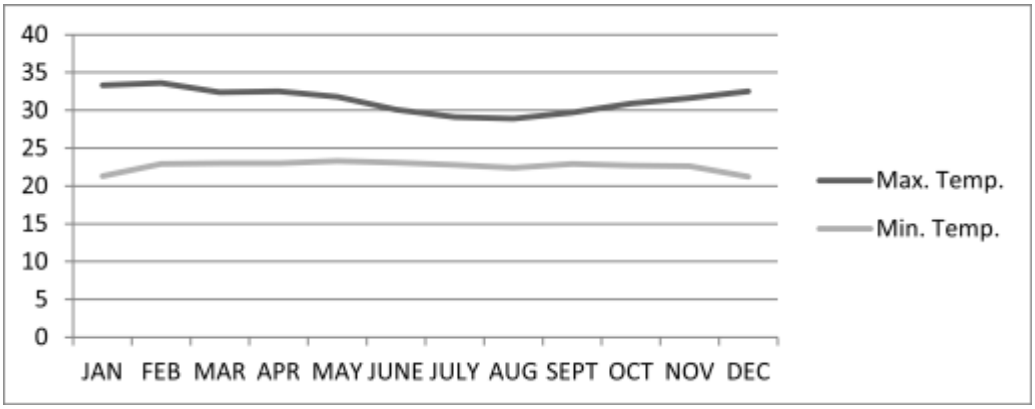


**Figure 10**. 2014 Monthly Temperature

rainfall. June had the highest rainfall of 453mm with 0.47mm in November and 0.2mm in December cut across January (0.0mm) and February (0.0mm), 2016. Figure 7 shows an average annual rainfall of 170.50mm in 2012 rise to 188.30mm in 2013 and increased to 214.60mm in 2014, then decreased in 2015 by160.50mm and 196.80mm in 2016.

The maximum and minimum temperatures from 2012 to 2016 in the chart shows that figure 2 had maximum temperature of 29 °C to 34.5 °C with minimum temperature of 22 °C and 23 °C. While figure 3 recorded maximum temperature of 28.8 °C to 33 °C with minimum temperature of 22 °C and 23 °C. In figure 4 maximum temperature is between 28 °C to 33 °C with minimum temperature of 22 °C to 23 °C in 2014,

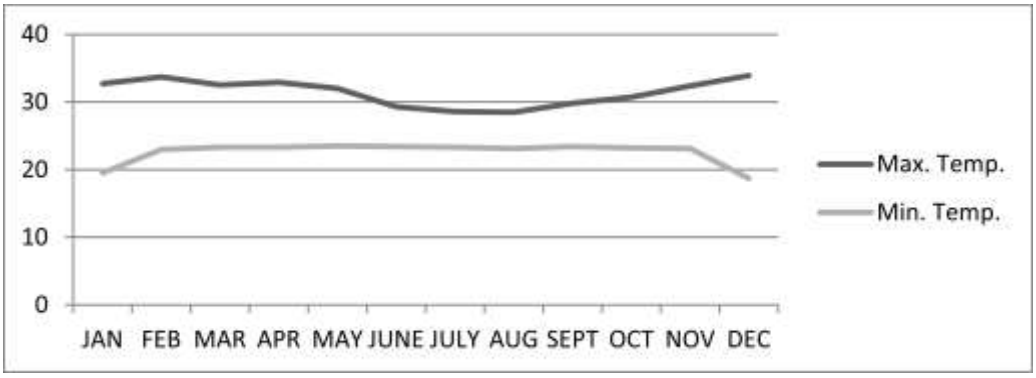


**Figure 10**. 2015 Monthly Temperature

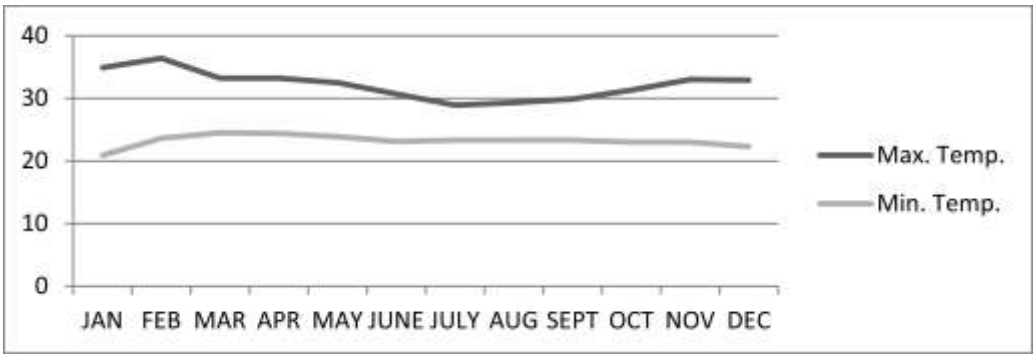


**Figure 11**. 2016 Monthly Temperature

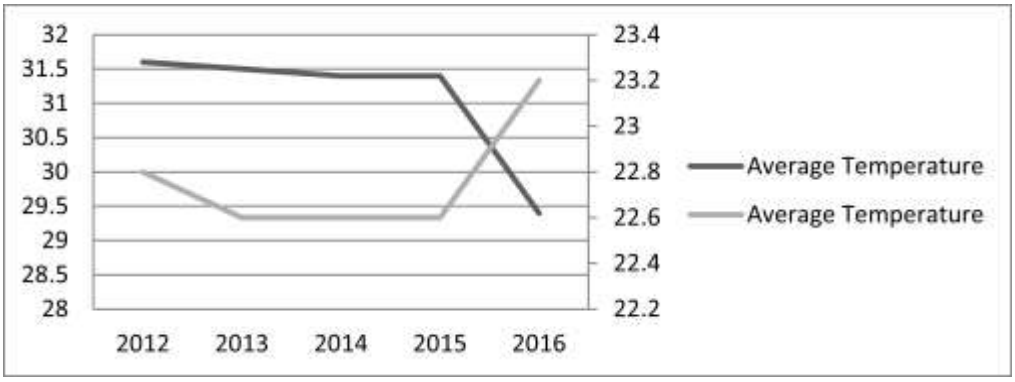


**Figure 12**. Average Annual Maximum and Minimum Temperature

while figure 5 recorded 28 °C to 33 °C with constant minimum temperature of 23 °C throughout 2015. Maximum temperature in figure 6 28 °C to 36.4 °C with minimum temperature ranging from 20.9 °C to 24 °C.

The average annual maximum temperatures in figure 7 were 31.6 °C, 31.5 °C, 31.4 °C, and 31.4 °C from 2012 to 2015 and decreased by 29.4 °C in 2016. While the average annual minimum temperatures were 22.8 °C, 22.6 °C, 22.6 °C, and 22.6 °C from 2012, 2013, 2014, and 2015, and increased to 23.2 °C in 2016 by 1 °C. Fiqure 7 shows that 2015 recorded changes in average annual decrease in maximum and increase in minimum temperature [11-12], due to heat wave or heat trend, due to global warming which triggered drought between November 2015 to late March 2016 [1, 13]. The four months of warmed air temperature made way for the migration of Fall armyworms across the

study area, which resulted in poor harvest of maize in 2016, 2017, 2018, and 2019 by the rural farmers.

## 4. RECOMMENDATIONS

To improve farmer practices with high income earning and supply of quality and quantity farm products in the Market commodities requires improvement and adaptation to changing climate.

- Sensitization programmes and awareness campaign to the rural or local farmers about climate change and the implications on sustainable resources.
- Government should assist the rural or local farmers by extending weather station service to help obtain data at farm levels.
- The Advisory Committee for Agricultural Resilience in Nigeria (ACARN) should not focus their attention only on small holders farmers, but extending service to the rural farmers were voices are not and /or less heard.

## 5. CONCLUSION

The study assessed the invasion of scavenger's insects on corn yield in Emohua Community, Rivers State, Nigeria. The insects were identified as Fall armyworm, which massively find their way to the study area in the early 2016. The decrease in rainfall in 2015 triggered an early rainfall break from November to the middle of March 2016. The decline in average annual maximum temperature with increase in average annual minimum temperature due to unusual heat wave that lasted for four months in the region made way for Fall armyworm migration.

## 6. ACKNOWLEDGEMENT

NA

## 7. CONFLICT OF INTEREST

The authors have declared that there is no conflict of interest.

## 8. SOURCE/S OF FUNDING

NA

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