

## Explaining the Implications of Climate Change and the Associated Farmers' Risk Preferences in Nigerian Agricultural Economy

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**Abstract:** Climate change is a change in the statistical distribution of weather over periods of time that range from decades to millions of years. Agriculture however, is extremely vulnerable to climate change. Higher temperatures eventually reduce yields of desirable crops while encouraging weed and pest proliferation. Managing climate risk is especially important in agriculture not only for the direct impact that climate has on production, but also because most farmers tend to be risk averse. The fore knowledge that farmers' are mostly risk averse therefore calls for re-opening of an enabling policy environment that effectively considers the farmers perception of risk. This therefore provides a basis for making policy option towards adaptation to climate change given their characteristic socio-economic environment.

[Salimonu, K.K. Explaining the Implications of Climate Change and the Associated Farmers' Risk Preferences in Nigerian Agricultural Economy. Journal of American Science 2011;7(8):784-787] (ISSN: 1545-1003). <http://www.americanscience.org>.

**Keywords:** Implication; Climate; Farmer; Nigerian; Agricultural Economy

### Introduction

Agricultural development and sustainability in Nigeria as could be obtained in other countries of the worlds is indeed a function of climate among other important factors. Invariably, climate has effects on what, when and where to produce as well as the level of output achieved. The multiplier effects of climate change are therefore recorded not only in the economic growth; food self sufficiency but the farmers' welfare who are the units from where decisions about food production activities are actually taken. Unfortunately, studies have severally shown that these farmers are characterized as poor and lack adequate resources for production. Hence, the farming households tend to obey a safety – first principle that assumes the individual's objective is to minimize the probability of experiencing a short fall in income below a certain initial level (Roy, 1952). For instance, overtime farmers have experienced severe losses or failure in their cropping activities. When these occur, the household's livelihood becomes threatened and subsequent investment in farming may be affected. Such household may reduce the scale of operation in the subsequent planting season, switch to another farming enterprise or embark on non-farm activities (Gordon and Craig, 2001).

### Climate Change, Causes and Effects

Climate change is a change in the statistical distribution of weather over periods of time that range

from decades to millions of years. It can be a change in the average weather or a change in the distribution of weather events around an average (for example, greater or fewer extreme weather events). Climate change may be limited to a specific region, or may occur across the whole Earth (Wikipedia, 2010). Climate change is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. This is in line with Odjugo (2007) that identified two factors as the causes of climate change. These are natural processes (biogeographical) and human activities (anthropogenic).

Climate change is one of the most important global environmental issues of our generation. It is distinct from natural climate variability in that it exists because of human activities that have altered the composition of the Earth's atmosphere. In his study, Odjugo (2007) described the trend in Temperature and Rainfall in Nigeria from year 1901 to 2005 (Fig 1 and 2). It was discovered that the temperature trend in Nigerian since 1901 shows increasing pattern (Fig 1). The increase was gradual until the late 1960s and this gave way to a sharp rise in air temperatures from the early 1970s, which continued till 2005. The mean air temperature in Nigeria between 1901 and 2005 was  $26.6^{\circ}\text{C}$  while the temperature increase for the 105 years was  $1.1^{\circ}\text{C}$ . This is obviously higher than the global mean temperature increase.

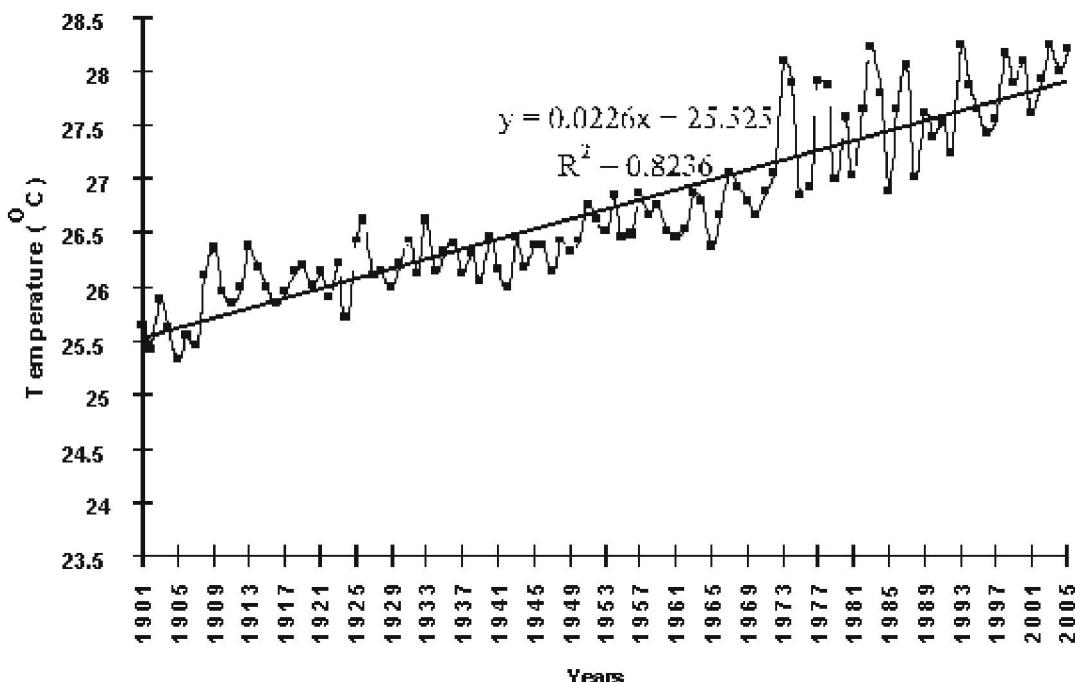


Fig. 1. Air temperature distribution in Nigeria between 1901 and 2005  
Source: Odjugo (2010)

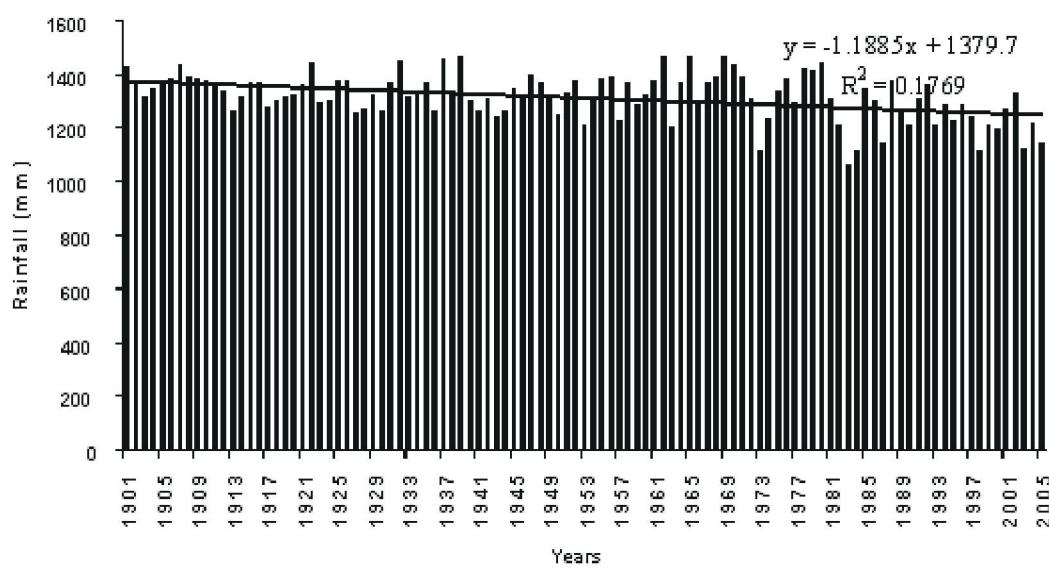


Fig. 2. Rainfall distribution in Nigeria between 1901 and 2005  
Source: Odjugo (2010)

Climate change can lead to desertification, more intense storms, melting of the polar ice caps, and rising sea levels, changing the physical face of the Earth and the pattern of our everyday lives. While the possible consequences of climate change are alarming, there are many ways for every individual to take part in preventing these consequences from reaching their most dangerous potential (Economii, 2010).

Agriculture however is extremely vulnerable to climate change. Higher temperatures eventually

reduce yields of desirable crops while encouraging weed and pest proliferation. Changes in precipitation patterns increase the likelihood of short-run crop failures and long-run production declines. Although there will be gains in some crops in some regions of the world, the overall impacts of climate change on agriculture are expected to be negative, threatening global food security. A number of empirical studies (Oyekale, et al 2007; Apata et al 2009; Ajetomobi and Biodun 2010 and Salimonu et al 2010) have been

carried out in recent times in Nigeria establishing the effects of climate change on agricultural production. The chorus is that of negative effect/impact.

Odjugo and Ikuoria (2003) observed that Nigeria north of 12°N is under severe threat of desert encroachment and sand dunes are now common features of desertification in states like Yobe, Borno, Sokoto, Jigawa and Katsina. The migrating sand dunes have buried large expanse of arable lands, thus reducing viable agricultural lands and crops' production. This has prompted massive emigration and resettlement of people to areas less threatened by desertification. Such emigration gives rise to social effects like loss of dignity and social values. Oyekale, et al (2007) studied the effects of climate change on cocoa production in Ondo state Nigeria. The study concluded that majority of the cocoa farms examined had declining yield with unfavourable climate changes. Low outputs from farms in south western Nigeria, as a result of low rainfall and increased temperature were also detected in the study of Apata *et al* (2009). Farmers in the study area were also abandoning monocropping for mixed farming in order to cope with losses in the earlier years. An in-depth analysis carried out by Ajetomobi and Biodun (2010) in Nigeria recently also revealed that Climate change has negative impacts on cowpea productivity in Nigeria over the years reviewed.

### Risk Preferences among the Farmers

Risk is defined as a condition in which the results of any decision or course of an action are not definitely known but will probably fall within a known range (Montana and Charnov, 1987). It is also defined as the uncertainty of outcomes (Hardaker, 2000). It is a measure of the effect of uncertainty on the decision maker. It also refers to variabilities or outcome, which are measurable in an empirical or quantitative manner (Olayide and Heady, 1982).

The expected utility model has been used extensively to investigate behaviour under risk. The expected utility model views decision making under risk as a choice between alternatives. Decision makers are assumed to have a preference ordering defined over the probability distributions for which a number of axioms hold (Joost and Philip, 2001).

Attitudes towards risk can be divided into three types: risk averse, risk preferring and risk neutral (Henderson, 1980; Boehlje and Venon, 1984). Risk averters, or avoiders, are characterized as more cautious individuals with preferences for less risky sources of income or investment. In general, this individual will sacrifice some level of expected return in order to reduce the possibility of a loss. A person who is considered risk averse will likely have a low risk bearing ability. Their situation would be such that

a large income loss would seriously disrupt or end the business.

Risk preferring individuals are characterized as more adventuresome with a preference for more risky business ventures. Risk preferers will select the alternative with some probability of a higher outcome. In order to get this higher income, the individual must also accept a probability of a lower outcome compared to the risk averter. The individual likely has a greater risk bearing ability and therefore is less concerned with the increased probability of a lower outcome and primarily focuses on the higher outcome potential. The risk neutral person is the limiting case between the risk averse and risk preferring individuals. He will select the alternative with the highest expected outcome, regardless of the probabilities associated with potential gains or losses. This person will have acceptable levels of risk bearing ability such that large losses are not of concern but at the same time, achieving the highest outcome is not the focus either. A number of studies (Adubi, 1992; Olarinde, 2004 and Salimonu, 2007) in Nigeria however submitted that majority of the farmers were highly risk averse.

### Climate Change and Farmers Risk Preferences-The Nexus

Temperature and rainfall among others constitute major determinants physical nature and element of climate whose variation could have significant effects and impacts on agricultural productivity over time. The foregoing rather suggests climate change as a significant source of risk to the agricultural economy in particular. The IPCC (Intergovernmental Panel on Climate Change) in its 2001 assessment had grouped key vulnerabilities into five main 'reasons for concern' about climate change. These are: the risk to unique and threatened systems (ecosystems and human populations), the risk from extreme weather events, the (uneven) distribution of impacts, the global aggregate impacts, and finally the risks of large scale singularities (the 'big' or extraordinary events that would cause global-scale damage, such as loss of the Greenland ice sheet, or a shutdown of the Gulf stream).

Managing climate risk is especially important in agriculture not only for the direct impact that climate has on production, but also because most farmers tend to be risk averse. Risk aversion implies that farmers do not optimize their farm-plan for an upcoming season with average market and climate conditions; instead, they manage for adverse conditions (Rosenzweig and Binswanger, 1993). Thus, reducing uncertainties of seasonal climate forecasts may help farmers select more profitable farm management strategies. The fore knowledge therefore calls for re-opening of an enabling policy environment that effectively considers the

farmers perception in making policy options towards climate change. This becomes expedient given the farmers socio-economic characteristics that govern their environment. The fact remains that, even if "human" causes of climate change are controlled; the environment is still much bewildered with other natural processes leading to climate change (especially temperature and rainfall; humidity) and the aftermath effect on the agricultural economy.

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6/13/2011