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ABBREVIATIONS AND ACRONYMS

ACGS	Agriculture Credit Guarantee Scheme
ADP	Agriculture Development Program
ATA	Agriculture Transformation Agenda
CAADP	Comprehensive Africa Agriculture Development Program
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GHS-Panel	General Household Survey Panel
LSMS-ISA	Living Standard Measurement Study- Integrated Surveys on Agriculture
NALDA	National Agricultural land Development Authority
NBS	National Bureau of Statistics
NGO	Non-Government Organization
RBP	Rural Banking Program
RES	Rural Electrification Scheme
SGRP	Strategic Grains Reserves Programs
WDR	World Development Report

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AGRICULTURE AND RURAL POVERTY IN NIGERIA: OVERVIEW

1. **This report focuses on the characteristics of the agricultural sector and rural households in Nigeria, and their implications for poverty.** The descriptive sections present the characteristics of rural households and their economic activities, with particular attention paid to agriculture and the incidence of rural poverty. The analytical sections examine the determinants of agricultural productivity and its link to poverty. Most studies conducted on the determinants of agricultural productivity and the linkages to rural poverty in Nigeria are region or crop specific, with very few nationally representative studies. This report examines the relationships using nationally representative data from the General Household Survey Panel (GHS-Panel), 2010/11.

2. **We find an elasticity of poverty reduction with respect to agricultural productivity of between 0.25 to 0.3 percent implying that a 10 percent increase in agricultural productivity will decrease the likelihood of being poor by between 2.5 and 3 percent.** This is a sizeable effect suggesting that improvements in agricultural productivity could be an effective means to reduce rural poverty. We also find that income from wages and other nonfarm activities have a larger effect on poverty reduction than agriculture. However, this does not diminish the importance of agriculture for poverty reduction in Nigeria. Agriculture is still the dominant sector for many households in Nigeria, particularly in rural areas where it employs almost 84% of households and accounts for 56 percent of rural net income. To increase agricultural productivity, we find that land, labor, fertilizer, agricultural advice, and diversification within agriculture are the most important factors.

3. **As commonly found in the literature, we observe the inverse-land size productivity relationship.** More specifically, we find that a 10 percent increase in harvested land size will decrease productivity by 6.6 percent, all else being equal. Even though households with larger farm sizes have a higher value of harvest in general, larger farms are not as intensely cultivated as smaller farms, and are therefore underutilized. In a simulation exercise where we assume that land quality is constant across small and large holdings, we find that if farms in the top land quintile had half the median yield per hectare of farms in the lowest quintile, production of the top quintile would be 10 times higher. Land sizes range from 0.9 hectares in the lowest quintile to 3.1 hectares in the highest with average of 1.1 in general. The higher values from larger land sizes are more likely due to cultivation of larger expanses of land rather than from efficient production. However, the lower harvest value associated with larger land holdings could also be due to differences in climate. Plots are generally larger in the north where the semiarid climate allows for a much shorter growing season (70-180 days) than in the subhumid south (180-270 days).

4. **It should be noted that having larger land sizes in itself is not positively correlated with a lower likelihood of being poor.** This is not to say that having larger land sizes is not important for farming, but rather it indicates that increasing efficiency is the more important need that could lead to poverty reduction. We find positive, albeit low, returns to modern inputs like fertilizer and herbicides, and this could indicate inadequate use of, and/or low quality of available inputs such as adulteration of fertilizer. Non-poor households appear to have more access to agriculture advice than poor households, which could be a targeting issue. Increased access to inputs, particularly labor and fertilizer, for poorer households could increase agricultural productivity and in effect, bolster poverty reduction of these households.

AGRICULTURE AND RURAL POVERTY IN NIGERIA

I. INTRODUCTION

1. **The Nigerian labor force, like that of many countries in Africa, is heavily concentrated in agriculture.** The sector employs about 60 percent of the labor force and contributes over 40 percent to GDP. Despite its importance, the agricultural sector in Nigeria is far from reaching its full potential. The agricultural sector has the highest poverty incidence in the country (Phillip et al., 2009); to reduce poverty, it is critical for households to earn more from their income generating activities. The World Development Report (WDR, 2008) emphasized the importance of agriculture for poverty reduction and growth in Africa. Improving the agricultural sector in Nigeria is vital to increasing food security and reducing poverty, especially in rural areas. Most farming in the country is still done at the subsistence level with minimal commercialization.

2. **According to World Bank reports, the agricultural sector in Nigeria grew by about 6.8 percent annually from 2005-2009.** However, these relatively high growth rates were not due to increased efficiency in the sector, but rather can be attributed to population growth and the farming of larger expanses of land most likely by commercial farmers. Given the importance of the sector, there is a great need to improve efficiency, especially for smallholder farmers in order to push them beyond farming at the subsistence level. Increased agricultural productivity can translate into higher incomes and lower poverty in the sector. Towards this end, the government has recently launched the Agriculture Transformation Agenda (ATA) which stresses the importance of growth in agriculture as a path out of poverty, particularly through increased commercialization among small holder farmers.

3. **This report focuses on the characteristics of the agricultural sector and rural households in Nigeria, and their implications for poverty.** Agriculture in Nigeria is varied across regions, and, not surprisingly, most households involved in the sector reside in rural areas. The report starts with a brief description of selected agricultural programs in section 2 and the targets of government expenditure in the sector in recent decades. Section 3 follows with a detailed profile of rural households and the composition of their economic activities– with a particular focus on agriculture. Most studies conducted on the determinants of agricultural productivity and the linkages to rural poverty in Nigeria are region or crop specific, with very few nationally representative studies. This report examines the relationships using nationally representative data from the General Household Survey Panel (GHS-Panel), 2010/11. Section 4 examines the determinants of agricultural productivity, and highlights the factors (land ownership, input use, labor, plot management, land tenure, and household characteristics) most important for small-holder productivity. The analysis will also investigate differences in the determinants of agricultural productivity between small and large land-holders, as well as poor and rich agricultural households – while poverty and landholdings are correlated, they are not synonymous. Section 4 continues by examining the linkages between agricultural productivity and rural poverty, using a simple Logit model. Increased agricultural productivity is expected to result in lower poverty, but at the same time, poverty contributes to lower agricultural productivity through poor access to inputs and credit. Section 5 concludes.

II. BACKGROUND AND DATA

4. **The agricultural sector in Nigeria consists mostly of smallholder farmers who operate at the subsistence level.** Despite concerns about the sector's performance, it remains an important source of rural employment and income. There are many constraints facing the agricultural sector in Nigeria, and one of the main constraints is the low rates of input use, particularly fertilizer which is also commonly of poor quality due to adulteration². In their review of constraints to agriculture productivity in Nigeria, Philip et al. (2009) attribute the low levels of input use to high transport costs, poor distribution channels, absence of private sector participation, significant import risk, and inconsistent government policies. Access to agricultural credit and efficient coordination of agricultural extension services can have beneficial spillover effects on the adoption of farm technologies, and these are also found to be lacking in the Nigerian agricultural sector (Philip et al., 2009). Poor access to input and output markets (largely due to poor rural infrastructure), land degradation, and low investment in agricultural research have also been identified as significant constraints to productivity in the sector (Philip et al., 2009; Ogunlela and Ogungbile, 2006). Agriculture research has been identified as a vital component of productivity-boosting strategy, and could play a crucial role in devising ways to improve farming practices (thus increasing farm income), generate employment, reduce food prices and secure food availability (Ogunlela and Ogungbile, 2006).

5. **Like many countries in Sub-Saharan Africa, agricultural funding sources in Nigeria are a combination of government and private spending, and loans and grants from development partners.** On average, the government spent about five percent of the total federal government budget on the agricultural sector from 1999-2008, a total of over ₦700 billion (\$4.5 billion), (NITAG, 2009) and in more recent years, it has been about 3 percent (IFPRI 2011). A substantial part of government investment in agriculture in the past decade focused on reducing rural poverty through efforts to increase productivity, ensure food security, and develop rural communities through direct agriculture programs such as the National Special Program for Food Security, the National Fadama Development Project, Community-based Agricultural and Rural Development Program, Community-based Natural Resources Management Program, and the Root and Tuber Expansion Project (NITAG, 2009). Other areas of focus include rural infrastructure and support services, livestock and fisheries, input supply, and market support. There have also been contributions to the agricultural sector from development partners. However, until recently, direct agriculture programs³ only accounted for three percent of the total number of projects and one percent of total grants by development partners between 1999 and 2007 (NITAG, 2009).

6. **Some of the broader national development programs have also focused specifically on the agricultural sector such as, Agriculture Development Program (ADP), Agricultural Credit Guarantee Scheme (ACGS), Rural Electrification Scheme (RES), National Agricultural Land Development Authority (NALDA), Strategic Grains Reserves Programs (SGRP), and Rural Banking Program (RBP) (Ogwumike, 2003).** There were also other programs such as Operation Feed the Nation (1977) and green revolution (1980) to boost

² See Liverpool-Tessie et al. 2010 for an assessment of fertilizer quality regulation in Nigeria

³ Direct agriculture programs are those targeted specifically to the sector as opposed to projects that indirectly affect the agricultural sector like rural infrastructure projects, for example.

agricultural production and improve the general performance of the agricultural sector (Ogwumike, 2003). There were some successes reported with these programs, but while many were not sustainable, some did not benefit the intended population. In the 2000s, the government implemented a set of Presidential Initiatives to increase food availability and industrial raw materials, and also generate foreign exchange (Phillip et al., 2009). The Presidential initiatives were announced to encourage the production of cassava, rice, vegetable oil, tree crops, livestock, and aquaculture products. In general, the initiatives suffered significant setbacks and were not deemed successful. There have also been various fertilizer subsidy programs targeted at increasing productivity, but these programs were not very successful either. In many cases they were seen as distorting the input market, while failing to reach the smallholder farmers who were the intended beneficiaries (Phillip et al., 2009; Eboh et al., 2006; Takeshima et al., 2012). The subsidy programs were also very expensive to implement and proved not sustainable for the government (Phillip et al., 2009).

7. **In spite of the many problems encountered by agriculture programs, there have been some successes.** One such program is the National Fadama Development program (ADF, 2003; Ayanwale and Alimi, 2004; Ike, 2012). There have been three phases of the Fadama program in Nigeria. The first and second phases focused on selected states in the North, but the third phase covered all 36 states and the Federal Capital Territory, Abuja. The objective of the programs was to increase farmers' income and contribute to food security and poverty alleviation by developing small-scale irrigation through the extraction of shallow groundwater with low-cost petrol-driven pumps (Adubi, 2012). The programs were designed to reduce the dependence of farmers on unpredictable rainfall patterns, and thus allow farming to be done more consistently throughout the year. Ike (2012) found on average an increase in the real income of beneficiaries from the third phase of Fadama that could be attributed to participation in the program.

8. **Increased government expenditure that is well targeted to increase productivity and reduce poverty for households employed in the agricultural sector, could address the persistent weaknesses (Nwafor et al., 2011).** Even though the Nigerian government has increased agricultural expenditure in recent years, the budget allocation to the sector still falls short of the recommended 10 percent of the total government budget proposed by the Comprehensive Africa Agriculture Development Program (CAADP).⁴ As important as it may be to increase agriculture-related expenditure, it is probably more important to properly target the funding. Nwafor et al. (2011) examined the cost effectiveness of various public expenditure programs on agriculture in Nigeria as a means of reducing poverty for agricultural households through increased productivity. The authors concluded that, given budget constraints and the numerous demands on government funds, agricultural spending aimed at increasing productivity and income should be targeted at the products which provide the highest returns in terms of productivity and poverty reduction. As a result, the Nigerian government has initiated a renewed effort to increase productivity in the agricultural sector through the Agriculture Transformation Agenda (ATA), which is designed to boost the competitiveness of selected high-value crops including rice, cassava, sorghum and cocoa (FMARD, 2012).

⁴Comprehensive Africa Agriculture Development Program (CAADP) developed from a commitment made by African governments in 2003 at the African Union Summit in Maputo to increase public expenditure on agriculture to at least 10 percent of total government budget. The objective of CAADP is to improve performance of the agriculture sector through better policies, increased investment in agriculture, and improved sector efficiency.

9. **This study presents a point-in-time look of the status of rural households in Nigeria, particularly agricultural households, using cross-section data from the 2010/11 agricultural season.** The contents of the descriptive sections will focus on the characteristics of rural households and their economic activities, with particular attention paid to agriculture and the incidence of rural poverty. The analytical sections further examine the determinants of agricultural productivity and their link to poverty.

Data

10. **The analysis in this report uses data from the first wave of the General Household Survey-Panel (GHS-Panel) conducted in 2010/11 by the Nigeria National Bureau of Statistics (NBS) in collaboration with the World Bank Living Standard Measurement Study - Integrated Surveys on Agriculture (LSMS-ISA).** The GHS-Panel survey is modeled after the Living Standard Measurement Study (LSMS) surveys and is representative at the national, zonal and rural/urban levels. The total sample consists of about 5,000 households covering all 36 states in the country and the Federal Capital Territory, Abuja. The sample is a subsample of the larger GHS cross-section survey that was fielded by NBS at the same time. These 5,000 panel households are being revisited in 2012/2013 for the second wave of the survey.

11. **One of the main objectives of the GHS-Panel is to improve agriculture data collection in Nigeria by collecting information at disaggregated levels (crop, plot, and household levels), and linking such data to non-agricultural aspects of livelihoods.** To this end, the GHS-panel is unique as it combines very detailed information on farming with consumption-based poverty measures, non-farm income sources, and other socioeconomic conditions of households in Nigeria. All households were visited at two points in time: right after planting (post-planting visit) and right after harvest (post-harvest visit). During the visits, information was gathered on demographics, education, labor, assets, and farm and nonfarm income generating activities. Of the 5,000 households in the survey, just over 3,000 were agricultural households producing a wide variety of crops. For agricultural households, detailed data was collected on crops grown, land size, inputs, yields, and other plot characteristics. This report focuses on the sample of rural households in the GHS-Panel (3,316) with specific focus on the rural household involved in farming or livestock activities (2,892).

III. PROFILE OF RURAL HOUSEHOLDS

12. **This section presents detailed descriptive statistics and profile of rural households in Nigeria, with particular emphasis on their agricultural activities and links to poverty.** Since the GHS-Panel data is nationally representative, all estimates are weighted for national estimates. In nearly all instances, national estimates are decomposed based on household land size quintiles as well as national consumption quintiles. While the land size quintiles are determined within the sample (and appropriately weighted), the consumption quintiles are based upon national estimates that include nonagricultural households. Breaking estimates up in this way will

highlight the differences between small and large land holders, as well as poor and non-poor households.⁵

13. **Table 1 provides a general overview of household demographics and dwelling characteristics in Nigeria by urban and rural status.** As expected, the majority of household heads are male; female headship is less common in rural areas than in urban areas. On average, household heads in urban areas tend to be older when compared with heads of rural households, and heads of poor households are also older than those of non-poor households. The average years of education for rural household heads is five years compared with almost nine years for urban household heads, and almost 80 percent of urban heads are literate compared with 56 percent of rural heads.

A. Economic activities of rural households

14. **In this subsection we look at the income generating activities of rural households in Nigeria.** For the country as whole, 57 percent of households are engaged in farming. The incidence of farming is higher in rural areas with a 78 percent participation rate compared with urban areas, which have a 26 percent participation rate. Figure 1 shows the share of households that participate in the farm⁶ and nonfarm⁷ sectors only, as well as those that engage in both. Urban households are included for comparison.

15. **Although, most households in rural areas are involved in the agricultural sector, many have diversified into the nonfarm sector.** Two fifths of all rural households combine farming with non-farm income activities. Farming is not exclusively a rural activity; 40 percent of households in urban areas engage in farming. Table 2 shows the regional disaggregation. In some regions (North East and North West), about half of urban households engage in farming. This pattern of urban farming is observed in other countries in Sub-Saharan Africa (Cofie et al., 2003; Drechsel and Dongus, 2010), and reflects, in part, how urban areas are defined by the statistical office. Since rural households make up about 60 percent of households in Nigeria, overall, 81 percent of farming households are in rural areas. Thus, as expected, a large share of Nigerian households are involved in agriculture and most households reside in rural areas. Male-headed households are more likely to be engaged in farming (63 percent of male headed compared with 44 percent of female headed) and are more likely to draw income from both non-farm and farm sources (45 percent to 25 percent). These gaps exist in both urban and rural areas.

⁵Poverty is defined based on consumption expenditures and a defined national poverty line as released by the National Bureau of Statistics (2012). Poverty status was determined using per adult equivalent household expenditures. The national poverty threshold value as determined in the Harmonized Nigeria Living Standards Survey (HNLSS) in 2009/2010 was 54,113.14 Nigerian Naira.

⁶ Farm participation refers to whether the household grew crops in the 2010/2011 agricultural season, regardless of whether any crops were sold or only for home-consumption, raised any livestock, or has a fishing activity. There are very few households with livestock only (1.4%) and fishing only (0.2%), so these households are not examined separately here.

⁷ Nonfarm activities include operation of a nonfarm enterprise run by the household in the last 12 months, nonagricultural wage/salary work in the last 7 days of either survey visit (regardless of whether the non-farm enterprise or wage work was formal, informal or the number of hours), remittances, savings/interest income, and rental income.

16. **Table 2 also shows the activities of households by agro ecological zones.⁸ Nigeria contains four primary agro-ecological zones: tropic-warm/semiarid, tropic-warm/subhumid, tropic-warm/humid, and tropic-cool/subhumid.** Southern Nigeria is predominantly classified as tropic-warm/subhumid with some pockets of tropic-warm/humid in the extreme south. Northern Nigeria falls largely within the tropic-warm/semiarid zone. The conditions are more favorable for agriculture in the South with more rainfall and longer growing days than the North. The first three of zones cover most the country (99 percent of the sample) while the latter covers a much smaller portion (1 percent of the sample). Despite the small portion of the population in the tropic-cool/subhumid zone, it is included in all tables for completeness. The tropic-warm/semiarid zone has the largest agriculture participation rate at 83 percent of all households while about half of households in the remaining three zones were engaged in agriculture.

17. **The relative income share from farm and nonfarm activities are shown in Table 3. On average, agricultural income makes up 40 percent of household income amongst all households.** As expected, agricultural income is more important for rural households (56 percent of income) than urban households (12 percent of income). In general, agricultural income makes up a larger portion of household income in the northern zones than the southern. This is also largely reflected in the estimates by agroecological zone whereby the agricultural income makes up 60 percent of total income in the tropic-warm/semiarid north and only 26 percent in the tropic-warm/humid south. The relative share of agricultural income is remarkably similar between male and female headed households.

18. **Figure 2 provides more detail on the types of farm and nonfarm activities of rural households.** Most rural farm households are involved in staple crop farming with a 78 percent participation rate, while almost 20 percent grow at least one cash crop.⁹ Livestock is very common among rural households with a 54 percent participation rate, while fewer than 2 percent of households are engaged in fishing. Almost 52 percent of households are wage earners in the agricultural sector.

19. **In all zones (Table 4), staple crop farming is still the most common farm activity; however, we observe some other regional differences.** Cash crop participation (excluding groundnuts) is highest for the South West (28 percent) and the South East (25 percent) zones. Livestock activities are much more common in the North compared to the South. The North East has the highest share of households with livestock with a 75 percent participation rate followed by the North West and North East with 66 and 63 percent, respectively. In the South, the South East zone has the highest share of households with livestock activities with a 58 percent participation, while the South West and the South South have participations rates below 25 percent. The South West has the highest participation in fishing, although it is still not a main

⁸ Three broad components define these zones: temperature, moisture, and elevation. For temperature, all of Nigeria falls in the tropics zone where the average monthly temperature is greater than 18°C for all 12 months. The four moisture zones (arid, semiarid, subhumid and humid) are all defined according to the length of the growing period. The semiarid zone has a 70-180 day growing period, subhumid 180-270 day, and humid over 270 days. Lastly, areas are classified according to elevation where cool zones have greater than 1200m elevation and warm zones less than 1200m. See Figure 12 in the Appendix (Section IV) for a map representing the agroecological zones in Nigeria

⁹Cash crops include groundnut, cotton, cocoa, rubber, cotton and oil palm. The averages are significantly lower in the North without the inclusion of groundnuts (which has the lowest market value of all the cash crops included).

activity for the zone, with only 5 percent of households engaged in the activity. Cash crop production in northern zones and the tropic-warm/semiarid zone is highly concentrated in groundnuts. In the south, groundnuts production is much rarer.

20. **As mentioned earlier, diversification of income-generating activities has become more common for rural households with 70 percent of rural households involved in a nonfarm activity.** Half of rural households have both a farm and a nonfarm activity. The most common nonfarm activity for rural households is running a nonfarm enterprise with 60 percent of households, followed by nonfarm wage with a 22 percent participation rate. The nonfarm enterprise is usually some type of retail trading activity on a very small scale i.e. what is sometimes called microenterprises or the informal sector, as the vast majority are not registered or employ workers. Ownership of nonfarm enterprise is most common in the North West (67 percent) followed by the South West (65 percent) and the South South (64 percent). Nonfarm wage is most common in the South South with 35 percent of households with a member earning wage income in the non-agriculture sector.

21. **Participation rates only tell part of the story. Table 5 contains relative income shares from each economic activity for rural households.** On average, crop production contributes the largest portion (40 percent) followed by nonfarm enterprises (29 percent), livestock (16 percent), and nonfarm wages (10 percent). Across the six zones, crop production makes up the highest percent of income in the South West and North West (both 58 percent) and lowest in the North Central and South East (9 and 23 percent) zones. However, livestock makes up a much larger share of income in these two zones at 54 percent in North Central and 25 percent in the South East. Livestock income makes up the largest portion of income in the tropic-warm/subhumid zone (27 percent) with all other zones falling below 10 percent. Amongst nonfarm income, that from nonfarm enterprises is relatively similar across zones ranging from 23 to 37 percent.

B. Poverty Incidence of Rural Households

22. **In this subsection we examine the poverty incidence of rural households (with urban households included for comparison), disaggregated by type of economic activity.** Figure 3 shows the poverty incidence of rural households for the different regions and by gender of household head. Table 6 shows the poverty classification of rural compared to urban households. Poverty levels are generally higher in rural areas compared to urban areas. Among rural households, 32 percent fall in the poor group compared to 10 percent of urban households.

23. **A larger share of male-headed households are poor, at 24 percent, while 15 percent of female-headed households are poor.**¹⁰ However, the difference is higher in rural areas: 33 to 19 percent for male and female-headed households respectively. Looking at the regions, the North has a higher poverty incidence than the South. The highest poverty incidence is in the North East at 39 percent, followed by the North West with 34 percent and the North central region with 29 percent. The South West has the lowest share of households in poverty at only 13

¹⁰ Female headship is not always correlated with poverty in developing countries and could depend on the choice of poverty measure (see for example Buvinic 1997, Rajaran 2009, and Oginni et al. 2013). The relationship between poverty and female headship for rural agricultural households in Nigeria will be explored in a separate paper.

percent. Across agroecological zones, poverty is concentrated in the tropic-warm/semi-arid zone with a rate of 37 percent. Poverty rates in the other two major zones is less than half this rate at roughly 16 percent. The higher poverty rate in the tropic-warm/semi-arid zone likely reflects the high concentration in agricultural activities in conjunction with a much shorter growing period (70-80 days) than the subhumid (180-270 days) and humid (over 270 days) zones.

24. **Figure 4 shows the poverty classification of rural households by their economic activity.** Many households diversify beyond agriculture to supplement farm income and possibly as a risk management tool or coping strategy (Barett et al. 2001). Diversification also helps reduce their likelihood of being in poverty. The poverty incidence is highest for households which are only engaged in a farm activity (40 percent) and lowest for those with only a nonfarm activity (26 percent). Households which engage in both the farm and nonfarm sector have a poverty incidence of 30 percent. Table 7 shows the poverty incidence disaggregated by region, agroecological zone, and gender of household head. When we look at gender differences, female headed households that are only involved in agriculture have a lower incidence of poverty compared to male-headed households. The same is true for those that have both farm and nonfarm activities, as well as those with a nonfarm activity only.

25. **We examine the poverty distribution of agricultural households in rural areas in Figure 5 and Table 8 with urban agricultural households included for comparison.** Amongst the rural agriculture households, 34 percent are poor compared with 16 percent of urban agriculture households. In general, there are more poor people in rural areas than in urban areas, regardless of activity. We also observe some differences across regions. A larger share of rural agriculture households in the North are poor compared with those in the South. The North East zone has the largest share of farm households in poverty (47 percent) while the South East zone has the lowest share of farm households in poverty (21 percent). A smaller share of female headed households engaged in agriculture falls in the poor group when compared to the share of male headed households. The high poverty rate in the tropic-warm/semi-arid zone is largely only among rural households at 43 percent. The poverty rate for urban households (17 percent) is still the highest across the three major agroecological zones but is much closer in magnitude.

26. **Even though many rural households are diversifying into nonfarm activities, agriculture still remains an important source of income for rural households because it is the main activity for many.** This supports the government agenda to reduce poverty in rural areas by increasing agricultural productivity beyond subsistence levels, as this could lead to increased incomes for rural households. Thus, the rest of the section focuses on agricultural households in rural areas by examining the characteristics of these households, their factors of production, assets, and output.

C. Rural Farm Households

Characteristics of farm households

27. **Table 9 provides an overview of the demographics of farm households in rural Nigeria.** As expected, a majority of the households are male-headed with only about 10 percent with female heads. Poor farm households have 3.3 years of education on average, while non-poor is higher with 4.3 years of education in the household. About 60 percent of rural farm

household heads are in a monogamous marriage, while 28 percent are in polygamous marriage. Incidence of divorce is higher for non-poor households compared with poor households. Also, poorer farm households have a larger family size compared with better-off rural farm households.

28. **When we examine the characteristics of rural farm households by land quintiles (Table 9b), we find that households with larger farm sizes have fewer years of education, on average.** In fact, we find that households at the top land quintile have the least number of years of education and those in the lowest land quintile have the most years of education. This likely reflects that the more years of education households have, the more likely they are to find employment in the nonfarm sector and less likely to be engaged in the farm sector. And for those more educated households that engage in agriculture, they may do so at very small scales, suggesting that farming is a side activity rather than the main activity for such households. Households with larger farms sizes also have more household members which lend credence to the idea that the need for farm labor could be a factor. In Table 9c where we examine the characteristics by consumption expenditure quintiles, we find that education increases as households go up in consumption quintile, while household size decreases.

29. **In this subsection, we see a link between poverty and larger family and land sizes, less education, and cultural practices (polygamous versus monogamous marriage).** Poor households tend to have bigger family sizes for several reasons (Owuamanam and Alowolodu 2010; Okogu, 2011, Akpotu, 2008) such as poor information about family planning and low education levels (Akpotu, 2008). For farm households, especially poorer households, labor supply could be a major factor for having larger family sizes (Okogu, 2011). In our sample, we see that households with larger farm sizes have more children, on average. Poorer households are also less educated and education has been shown to have an inverse relationship with the size of the family (Akpotu, 2008). Cultural practices could also play a role in family size; polygamy is more common among poorer farm households and those with larger farm sizes, but less common in richer households. Consequently, polygamous homes are more likely to have larger families since each wife is likely to have her own children (Akpotu, 2008). Polygamy is more likely in the North where 28 percent of household heads are in polygamous unions compared to 9 percent in the South. As discussed earlier, the agro-ecology in the North means less conducive conditions for agriculture as evidenced in the higher share of rural poor households. Thus, the link between polygamy and poverty could just be capturing the relation between poverty and the more difficult agro-ecological conditions in the North where polygamy is more common.

30. **Despite the fact that households with larger family sizes are more likely to be poor, they also tend to have larger land sizes.** It should be noted that households in the top land quintile have the lowest per capita and per adult consumption expenditure, indicating that land size and poverty in Nigeria are not positively correlated. This is probably related to the method of land acquisition in the country where a large share of land is acquired through family or community distributions (see Table 12). Land acquisition very rarely requires purchase or rental, both of which will require cash and/or access to credit. How land shares are decided within families and communities in Nigeria is beyond the scope of this report but future research into the workings of land markets in Nigeria could shed light on this.

Characteristics of farm managers

31. **In many instances, different members of the household manage different plots.** One of the advantages of the GHS-Panel data is that it collects information disaggregated at the plot level, and allows for the identification of household member(s) managing each plot. This information makes it possible to identify the characteristics (gender, age, education) of the manager of each cultivated plot. Figures 6-8 present information on rural plot managers. On average, rural farm households have two plots (see Table 10). As expected, most plot managers are male, with only 15 percent of plots managers being female. About half of plots manager have some education but hardly beyond primary school and are generally between ages 35-54. Non-poor households are more likely to have plots managed by females than poor households.

Land, inputs and other factors of production

32. **Endowments play a large role in the performance of households in any economic activity, and consequently will affect their poverty status.** In agriculture, endowments such as land, physical inputs like fertilizer, labor and access to credit and services are key factors of production (Nkonya et al, 2010). In this sub-section, we present information on the agriculture land cultivated by rural households, the types of crops they grow, their access to labor and non-labor inputs, their agriculture capital base and access to credit and extension services.

Land holdings and tenure system

33. **Farm households cultivate, on average, two plots (Table 10) with an average plot size of 0.6 hectares.** About 50 percent of households cultivate more than one plot and this is more common in the North. The average size of total farm land held by farm households is 1.1 hectares. Female-headed households have, on average, less than one quarter (0.34 hectares) of the average land size of male headed households (1.1 hectares). In general, farm households in the North¹¹ have more agricultural land compared to those in the South except for the South West zone. Households in the North East have the most farm land with an average of 2.2 hectares, followed by North Central and South West with 1.2 hectares each. Farm sizes are much smaller in the South East which has the lowest with only 0.1 hectares, on average. The cultivation of larger land sizes in the North could also be linked to the less favorable agroecological conditions (low rainfall) that make it necessary for household farms to be larger to produce enough food for subsistence.

34. **We are also able to determine the means of acquisition for all plots.** A large share of both male and female-headed household plots are acquired through family or community

¹¹The GHS-Panel data also collected coordinates of household plots using handheld GPS devices. With this information we are able to link the GHS-data to external geo databases. One of the geovariables linked with the GHS-Panel data is land quality. This is a measure of soil quality based on nutrient availability. The variable is derived from the food and agriculture organization (FAO) harmonized world soil database (<http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/>). It is a categorical variable with seven classifications (0=Ocean, 1=No or slight constraint, 2=Moderate constraint, 3=Severe constraint, 4=very severe constraint, 5=Mainly non-soil and 6=Permafrost. In our analysis, we classify 1 and 2 as good quality and others as bad quality. Using this measure, we find that households in the South have slightly better land quality than those in the North. The North East region has the smallest share of household plots classified as good with 77 percent.

distribution (Table 11)¹². About 77 percent of rural households acquired their land through family and community distribution, while 9 percent use their land free of charge. Very few households purchase (7 percent) or rent-in (6.5 percent) their cultivated plots¹³. While non-poor households are more likely to buy their land compared with poor households, the difference is small (Figure 9). We also observe some regional differences worth noting. South West (18 percent) and South South (14 percent) regions have the highest share of land acquired through renting while the North West report the highest share of farm land purchased. It should also be noted that free use rights are more common in the South West (26 percent) and North Central (13 percent) regions. A more detailed look into the land markets for these specific regions could improve our understanding of these findings.

35. **In general, households farming larger land areas and wealthier households are more likely to have purchased or rented-in their land compared with those in the lower quintiles (Table 12).** Land rental is lowest for households in the lowest consumption quintile. However, we don't observe a clear pattern for rented-in and purchase plots along the land and consumption quintiles.

Primary crops grown by agricultural households

36. **Table 13 below displays the top ten crops grown by farm households in rural Nigeria.** These crops are identified based on the frequency with which they were planted by the households during the 2010/2011 main agricultural season. The most prevalent crops are sorghum, maize, cowpeas, and yams. There are substantial regional differences observed. Very few households in the South grow sorghum. This is mainly a Northern crop with the highest incidence in the North West (82 percent of households growing). The most common crop in the North Central region is yams (56 percent), while beans (62 percent) and sorghum (61 percent) are very popular in the North East. In the South East, yams are the most commonly grown crops with 71 percent of households cultivating it. Cassava is popular in the South South where it is grown by 60 percent of households and also in the South West with 42 percent of households involved. Cash crops¹⁴ are mostly grown in the South East (21 percent) and South West (42 percent).

37. **The most common crops for female-headed households are yams, maize and cassava with participation rates of 47 percent, 35 percent and 39 percent respectively (Table 13b).** Amongst male-headed households, sorghum is the most common crop with 48 percent, followed by maize and beans with 37 percent and 35 percent of households, respectively. Variation in crops across the agroecological zones (also in Table 13b) largely mirror regional variation. Sorghum, beans and millet the most common crops in the tropic-warm/semiarid zone whereas in the tropic-warm/subhumid zone the common crops are yams, maize, and cassava.

¹² Table 12 examines plot acquisition by householdship status which is not to be confused with male/female managed plots.

¹³ Amongst households with multiple plots, few (13 percent) have plots within the household with different means of acquisition.

¹⁴ Cash crops include cotton, rubber, cocoa, tobaccos, oil palm, and nuts. We also include nuts separately from the group because it is one of the top ten crops grown by households.

38. **Disaggregating by poverty status (Figure 10), Sorghum is the most common crop for both poor and non-poor households.** Non-poor households are more likely to grow cassava and yams than poor households. When looking at household land size quintiles (Table 14a), 50 percent of households in the lowest quintile grow yams, followed by maize with 29 percent of households. As noted earlier (Table 9c), households in the lowest land quintile have a higher per capita consumption expenditure than households in the higher land quintiles. These households are also more likely to be in the South where land sizes are smaller but with better agroecological conditions such as higher rainfall. In addition, the lowest land quintile households are less likely to be poor. This is an indication that richer households tend to grow yams and maize. We also see evidence of this in Table 14b when we examine crops grown by consumption quintile. Yams (42 percent) and maize (37 percent) are the most common crops grown by households in the highest consumption quintile.

39. **For the largest land holders (who also have the lowest per capita consumption), sorghum is most prevalent at 55 percent followed by maize with 50 percent and beans with 36 percent of households.** The distribution across consumption quintiles shows that poorer households are more likely to grow sorghum, maize, beans, and millet. From this analysis, we can fairly say that sorghum, maize and millet are popular amongst poorer households and also amongst farmers with bigger farm sizes while yams and maize are more commonly grown by richer households. Maize seems to be the one crop common amongst poor and non-poor households. Not surprisingly, cash crops (excluding nuts) are more common amongst richer households than poorer households. Incidence of growing cash crops increases as we go up consumption quintiles and are also highest for the lowest land quintile.

40. **Table 15 presents harvest estimates for the ten most common crops grown in Nigeria.** The average land area harvested is highest for rice (2.26 hectares), beans (2.24 hectares), and nuts (1.95 hectares), while smallest for pumpkin (0.26 hectares), cocoyam (0.41 hectares), and yams (0.96 hectares). However, for crop value per hectare, pumpkins were the highest with about ₦6.5 million, followed by yams with almost ₦4.7 million per hectare and lowest for beans/cowpeas, with a value of about ₦400 thousand per hectare. Since yams are commonly grown by richer households, the findings support the theory that wealthier households in agriculture probably farm on a smaller scale and as a side activity to a nonfarm activity. Although yams are among the crops with the lowest harvest area, it has one of the highest values of harvest per hectare. This suggests that while richer households may be farming on a smaller scale, they are selective in their crop choice.

41. **Although a large share of crops harvested by most households are for their own consumption, part of the harvest is utilized for other purposes.** These estimates are presented in Table 16. Two of the most common crops grown by poorer households (Sorghum and Millet) also have the lowest share being sold. Yams, which are commonly grown by richer households, have the highest share saved for seeds and about 11 percent of yams are sold. Given that pumpkin has the highest value of harvest per hectare, it is not surprising that it also has the highest share sold and second highest processed.¹⁵ As expected, other cash crops (excluding nuts) have the highest share sold. Cassava has a high share being sold (21 percent) and processed (29

¹⁵ It should be noted that households could process crops for own consumption as well as for sale.

percent). A large fraction of harvest remains in stock (the residual of the table row from 100), reflecting that the interviews took place shortly after the harvest period.

Agriculture inputs

42. **Table 17 presents estimates of input use for all households and by poverty status, land and consumption quintiles.** About 24 percent of households used purchased seeds¹⁶ for planting and it appears that poorer households are more likely than non-poor households to purchase seeds. This could be because non-poor households have more left over seeds than poor households. It could also be that the more educated and less poor households have smaller farm sizes and thus, need smaller quantities of seed. This trend is similar for land and consumption quintiles. Small holders and households in lower consumption quintiles are more likely to use purchased seed compared to those in the larger land quintiles and higher consumption quintiles.

43. **The estimates suggest that fertilizer was used by 48 percent of households, pesticide by 18 percent, herbicide by 23 percent, and animals by 31 percent of households.** Even though a larger proportion of poor households are more likely to use fertilizer, the quantity of fertilizer used by non-poor households is higher. We don't observe a particular pattern in the use of fertilizer, and pesticide across land quintiles. However, the use of herbicide increases as we go up and quintiles. Input use is fairly consistent across consumption quintiles, though poorer households were more likely than richer households to use animals on their plots. Estimates for the intensity of use for each input are also included. These estimates only reflect the average among plots farmed by the households where the respective input was used. By mass, fertilizer was more intensively used on plots than herbicide or pesticide. The intensity of fertilizer use is higher for non-poor households compared with poor households. Small land holders used each input much more intensely than larger land holders but intensity of input use appears to exhibit a U-shaped relationship with consumption quintile for all inputs listed here.

Agriculture labor

44. **Table 18 shows estimates for hired and family labor used on the household plots.** Overall, labor was hired by 46 percent of households, with 42 percent hiring men, 21 percent hiring women, and 6 percent hiring children. Non-poor households are more likely than poor households to use hired labor, and also have more days of hired labor. Small land holders were generally less likely to hire workers for their plots than larger land holders, which is to be expected as they will need more labor to cover the larger expanse of land. We find little variation across consumption quintiles. Among households where laborers were hired, about 78 days of male labor were hired per hectare, 38 days of female labor per hectare, and 22 days of child labor per hectare. Across land size quintiles, small holders tend to have fewer days of female and male labor, but more child labor than larger land holders. Intensity of labor use was higher for small land holders than for large land holders, but was generally smaller for households in the lower consumption quintile compared with those in the higher consumption quintiles.

45. **Estimates for family labor employed on plots are also presented.** Non-poor households use less family labor compared with poor households. On average, 183 days of

¹⁶ Use of purchased seeds does not necessarily imply use of improved seeds. Farmers were only asked if they purchased seed and not what type of seed was purchased.

family labor was used on household plots. The average household had about 2.2 family members working on the plots with an average of 1.8 adults, 0.2 children, and 0.3 seniors. Households with larger farm sizes have more days of family labor and generally more household members working on the farm. This reflects our earlier finding that household with larger farm sizes also have larger family sizes. On the other hand, the number of family members (including children) working on plots decreases as we go up the consumption quintile ladder. This supports the theory that poorer households may have larger family sizes (and more children) to ensure farm labor. Also, total days of family labor declines as we go up the consumption quintile. This is probably due in part to the smaller family sizes of richer households.

Agriculture capital

46. **Next we look at agricultural assets owned by the household (Table 19).** About 26 percent of agricultural households own traction livestock, 5 percent own a plough¹⁷, 5 percent own a sprayer, 12 percent own a wheelbarrow, 88 percent own a cutlass, and 98 percent own a hoe. Ownership of livestock, ploughs, and sprayers is lower for small land holder households but ownership of wheelbarrows, cutlasses, and hoes was higher. Looking at consumption quintiles, richer agricultural households are more likely than poorer agricultural households to own a wheelbarrow and sprayer, but less likely to own livestock. It is apparent that most agricultural households own the least expensive agricultural assets. As expected, non-poor households have a higher value of agriculture capital compared with poor households. The average agricultural household owns ₦4,299 worth of agricultural capital. The value increases across land ownership quintiles. For consumption quintiles, the value of agricultural capital is generally higher for the richer households than for the poorer households.

Ownership of livestock

47. **As mentioned previously, about 57 percent of farm households own livestock, and could be a significant source of income.** In Table 20, we present the types of animals owned by farm households by zone and gender of head. The most commonly owned animals are goats (47 percent) and chickens (46 percent), followed by sheep owned by 22 percent of households. In general, livestock ownership is more common in the North than in the South. Male headed households are also more likely to own livestock than female headed households.

48. **Table 21 shows the breakdown of animal types by poverty status and land and consumption quintiles.** For almost all livestock types, poorer households are more likely to own the animal than non-poor households. A clear pattern is not observed across consumption quintiles. Households in the top land quintiles are more likely to own the different livestock types than those in the lower land quintiles.

Access to credit, insurance and extension services

49. **We examine access to credit and extension services for agriculture households in Figure 11 and Table 22.** About 15 percent of agricultural households received some agricultural advice from fellow farmers, the government, an NGO, or other organization. Non-poor

¹⁷ Although 31 percent of household report using animal on plot, there is an active rental market with 16 percent of households reporting rental of animal traction equipment.

households appear to have more access to agriculture advice than poor households which could be a targeting issue. Looking at land quintiles, households in the lowest land quintile and in the highest land quintile are least likely to receive advice compared to the middle quintiles. One could assume households with larger land sizes are more knowledgeable about farming and thus have less need for extension services. Those in the lowest land quintile may not be as involved in the agriculture sector to the extent that they get extension services. Households in the highest consumption quintile are the most likely to receive advice, but there is no clear pattern across consumption quintiles.

50. **Credit access from formal institutions is estimated to be very low for farm households in general, with only 3 percent granted credit from a formal lending institution.** Access to formal credit has been cited numerous times in the literature as one of the main obstacles to agriculture production (Nkonya et al, 2010). However, there is substantially more access to informal lending sources, with 39 percent of households granted credit from these sources. About 3 percent sought credit, but were refused. Non-poor households have more access to credit than poor households, as expected. This is probably due to their higher likelihood of being able to provide collateral against the credit. In general, smaller land holder households were less likely to have received credit than large land holder households. This could be due to the finding that households in the lowest land quintile have tended to be richer. Only 1.4 percent of agricultural households have insurance with the households in the highest consumption more likely to have insurance (3.8 percent) than households in the lowest quintile (1.1 percent).

IV. AGRICULTURAL PRODUCTIVITY AND POVERTY

51. **In recent decades, the international development community has emphasized the importance of improved agricultural productivity as a path out of poverty and to rural development for developing countries (WDR 2008; Anríquez and Stamoulis, 2007).** The centrality of agricultural production in the lives and livelihoods of rural households in Nigeria highlights the importance of a thorough understanding of the determinants of agricultural productivity in the country, as well as the relationship between productivity and economic outcomes. Low agricultural productivity can contribute to rural poverty at the farm level and can be viewed as one of the main causes of rural poverty (Kiresur et al., 2010). Diao et al. (2009) found in their study that if the agriculture targets set by the Nigeria government can be achieved, the country will achieve a significant reduction in poverty.

52. **As mentioned earlier, most studies examining the determinants of agricultural productivity and the link to poverty in Nigeria are region or crop specific (Anyaeibunam et al., 2012; Nwafor et al., 2011; Ike, 2012; Igwe, 2011).** In this section, both of these linkages will be examined using nationally representative data from the GHS-Panel survey. First, the determinants of agricultural productivity are analyzed in order to identify which factors are important for farming in rural Nigeria. The key factors of agricultural production identified commonly in the literature are included as covariates (see Odhiambo et al., 2004; Reardon et al., 1997; Nkonya et al., 2010). The analysis will also explore differences in the determinants of agricultural productivity between small and large land-holders, as well as poor and rich agricultural households. Second, the relationship between agricultural productivity and the poverty status of households is investigated. This linkage could have important implications for policies aimed at reducing rural poverty in Nigeria.

53. **Data from the GHS-Panel are used in the analysis that follows.** However, the primary focus of the analysis is on rural agricultural production, and thus the sample is limited to rural farm households. The household is the primary unit of analysis in all instances and therefore all crop and plot level variables are aggregated to the household level. The sample was also limited to households with non-missing data for regression variables. Table 23 lists the variables used in either the determinants of agricultural productivity regressions or the poverty regressions. The first column in Table 23 contains mean values for the full sample. The second and third columns contain sample means amongst households not in poverty¹⁸ and households in poverty, respectively. The asterisks in the fourth columns of table 2 denote the significance of Wald (weighted mean) tests between mean values for poor and non-poor households. The overall regression sample contains 2,086 rural agricultural households with 1,379 non-poor households and 707 poor households.

54. **Our measure of agricultural productivity is the value of all crops per harvested hectare in Naira.**¹⁹ All input amounts will also be in per hectare form. According to Table 23, the average total value of household harvests was about ₦160,000 and the average per hectare value is over ₦850,000 per hectare. Both measures were lower for poor households indicating that poor households had lower production and productivity than non-poor households. The log of the per hectare harvest values²⁰ are used in the analysis that follows. The average harvested area within the sample is 1.2 hectares with poor households having a higher and statistically significant value than non-poor households. Also when looking at the distribution of land sizes between the two groups, poor households were less likely to be in the bottom two deciles and more likely to be in the eighth and ninth deciles.

55. **The amounts (in kilograms) of three physical inputs²¹ are included in the determinants of agricultural productivity regressions: fertilizer, pesticide, and herbicide.** The average household in the sample used 184 kilograms of fertilizer, 10 kilograms of pesticide and 24 kilograms of herbicide. While the incidence of input use is not significantly different between poor and non-poor households, richer households use significantly more fertilizer and pesticide per hectare than poorer households. The natural log of all input amounts are used in the regressions below. Calculating the log of these amounts poses a problem since not all households used every input and thus there are observed values of zero. To overcome this hurdle, the method

¹⁸Poverty status was determined using per adult equivalent household expenditures. The national poverty threshold value as determined in the Harmonized Nigeria Living Standards Survey (HNLSS) in 2009/2010 was 54,113.14 Nigerian Naira. Using this measure, the in-sample poverty rate is 33.8 percent.

¹⁹ Respondents were asked to estimate the value of each crop's harvest. To arrive at an estimate of the total value, the crop level value estimates were aggregated to the household level. The total household harvest value was then divided by the total harvested area to obtain value per hectare.

²⁰ The total area harvested by the household was calculated through a multi-step process. The GHS Panel data contains both farmer estimates and GPS measures of plot size. However, each plot can have more than one crop grown on it. Farmers also report the area of the plot where the crop was harvested. To take advantage of the GPS measures of plot size, the percent of the plot where each crop was harvested was calculated by taking the self-reported crop harvest area and dividing by the self-reported plot size. Multiplying the GPS measured plot size by this percent yields a GPS based harvested area for each crop. Crop harvested areas were then aggregated to the household level. Weighted land size deciles were then calculated based on this measure.

²¹ The data contains information on the amounts of these inputs used on each plot. The amounts used on harvested plots were converted to kilograms where necessary and then aggregated to the household level.

laid out in Battese (1997) is applied here whereby the log of numeric variable X_i is calculated according to the following function:

$$\ln X_i = \ln(\max[X_i, D_i])$$

where D_i is an indicator for zero cases (i.e. takes a value of 1 when $X_i=0$ and zero otherwise). In addition to physical inputs, the amounts of both hired and family/household labor²² were included in determinants of agricultural poverty regressions. Similar to physical inputs, there are observed zero values for all labor inputs and thus the Battese (1997) method is also applied to labor variables when calculating natural log values. While poorer households use significantly more adult male and female family labor on their farms compared with richer households, there is no significant difference in per hectare terms. In contrast to family labor, non-poor households used significantly more hired female and child labor than poor households in the sample even in per hectare terms. There is no significant difference between the days of hired male labor between poor and non-poor households. For both family and hired labor, male labor was used/hired more than female and child labor both in terms of total days and days per hectare.

56. **The value of agricultural capital owned per hectare by the household was also incorporated.** Agricultural capital included in this measure are ploughs, sprayers, wheelbarrows, cutlasses, hoes, and other animal equipment. As might be expected, non-poor households owned more agricultural capital in total value and value per hectare. Crop selection may also play a role in agricultural production and poverty (Nkonya et al., 2010). To assess the importance of crop selection, an indicator for whether the household grew any cash crops (consisting of cotton, rubber, groundnuts, cocoa, tobacco, and palm oil) as well as the number of unique crops grown by the household are included in the analysis. The total land size owned by the household was also included in poverty regressions. The average household in the sample owned 0.7 hectares and poor households have significantly more farm land holdings than non-poor households

57. **Socioeconomic characteristics are also incorporated.** These include the sex, age, and years of education of the household head, whether the household head is married and is non-Muslim. On average, non-poor household heads are younger, better educated, less likely to be male, less likely to be married, and more likely to be Muslim. Also included are household composition variables such as the number of male and female working-age adults in the household and the number of dependents. As would be expected, poor households generally have more dependents as well as working aged males and females. Indicators are also included for whether the household was granted credit (informal or formal) and for households that have at least one member with insurance. While insurance was relatively rare amongst sample households at only 1.4 percent, access to credit (mostly from informal sources) was more wide spread with 41 percent of households receiving some form of credit.

58. **Participation in other economic activities may also play an important role in agricultural production and rural poverty (Barrett et al., 2001; Oseni and Winters, 2009).** Therefore indicators of nonfarm enterprise ownership, external wage work, and rental and/or

²²Hired and family labor were separated into male, female, and child (under 15 years of age) labor days hired/used. The GHS asks farmers about labor used for harvesting only and thus the values do not reflect labor used for planting or crop maintenance. All labor inputs are observed at the plot level and were aggregated to household totals.

investment income as well as per capita incomes from these sources are included in the poverty regressions below. Over half of all sample households operated a nonfarm enterprise, but only 12 percent had at least one nonagricultural wage earner and only 4 percent had rental or investment income. Non-poor households were more likely to have any of the nonagricultural income sources than poor households. As would be expected, per capita income amounts from these sources were higher for poor households though the difference was not significant for nonagricultural wage income per capita.

59. **The effects of two geographic variables are also estimated in the determinants of agricultural productivity regressions.** These include the distance to the nearest market and the nearest major road (both in kilometers). Poor households lived farther from major roads than non-poor households, on average. As the descriptive analysis has shown in the previous section, there are large differences in agriculture across the agroecological zones of Nigeria. In the regression sample, 44 percent of households were in the tropic-warm/semiarid zone in the north and 50 percent in the tropic-warm/subhumid zone farther south. Households in the semiarid zone are more likely to poor while those in the subhumid zone are less likely.

Methodology

60. **In order to assess the determinants of agricultural production and productivity, a simple household level OLS specification is estimated.** The specification is of the following form:

$$\ln Y = \beta_0 + \beta_1 L + \beta_2 L^2 + \sum_i \alpha_i \ln P_i + \sum_j \gamma_j \ln D_j + \Omega X + \lambda + \varepsilon \quad (1)$$

where Y is the measure of production, L is the total land size harvested by the household, P_i and D_j represent the amounts of physical and labor inputs (respectively) used by the household, X is a vector of other household characteristics, state fixed effects are captured by λ , and ε is the idiosyncratic error term.

61. **In addition to being estimated for the whole sample, the agricultural productivity model will be estimated for three pairs of subsamples: the bottom versus top land size quintiles, the bottom versus top consumption quintiles, poor households versus non-poor households.** The land size quintiles are calculated from total land harvested by the household and is determined within the sample. Comparing the top to the bottom quintile will indicate whether the determinants of agricultural productivity are different for small and large farmers. The consumption expenditure quintiles are calculated from per capita household expenditures and are nationally determined (i.e. not within the sample). Comparing the top and bottom consumption quintiles will indicate whether there are appreciable differences between the richest and poorest agricultural households. Poverty is as defined above. Comparing the results for poor and non-poor will indicate whether the determinants of agricultural productivity vary with **poverty status**.

62. **The relationship between agricultural productivity and poverty status is estimated using a Logit model of the following general form:**

$$P = \Theta \ln Y + \sum_{i=1}^3 (\omega_i \ln I_i + \rho_i P_i) + \Phi Z + \lambda + \varepsilon \quad (2)$$

Where P is equal 1 if the household's per adult equivalent expenditures fall below the national poverty line and zero otherwise, Y is harvest value per hectare (agricultural productivity). Therefore, Θ will reflect the relationship between agricultural productivity and poverty, *ceteris paribus*. The terms in the summation capture the effect of three nonagricultural income sources: nonfarm enterprise (NFE) ownership, nonagricultural wage work, and rental or investment income. The set of I_i are per capita incomes from these three sources (profits in the case of NFEs) whereas the P_i are indicators for participation in these three nonagricultural activities. P_i is equal to 1 if the household participated in nonagricultural activity i and zero otherwise. All other household characteristics are contained in Z while λ again captures state fixed effects.

63. **While equation 2 represents the general model to be estimated, three slightly modified specifications were also estimated.** First, the model was estimated excluding the per capita nonagricultural income values (I_i). This will provide a better understanding of the relative importance of participation in these activities and the amount of income received from them in terms of poverty status. Secondly, the two models (with and without I_i) were also estimated using zone instead of state fixed effects. This variant was estimated because of a single state²³ where all households were non-poor and therefore the indicator for that state perfectly predicted poverty. This resulted in the ten households from that state being dropped from the estimation. Zone fixed effects were employed to retain these households in the regression sample.

Determinants of agricultural productivity

64. **Table 24 presents the log value of household harvest per hectare (our proxy for agricultural productivity) results²⁴.** Column 1 contains estimates for the the full sample. The results indicate harvested land size has a negative relationship with productivity. More specifically, the coefficient implies that a 10 percent increase in harvest land size will decrease productivity by 6.6 percent. Therefore, it appears that households with larger farm sizes are not as productive as those with smaller farms, *ceteris paribus*. This is the common inverse relationship found between land size and productivity (Carletto et al., 2011). Oftentimes, larger farms are not farmed as intensely as smaller farms and thus are underutilized. The intensity of fertilizer and herbicide use (kilograms per hectare) had positive and significant effect on harvest value per hectare. The estimates suggest that a 10 percent increase in the amount of fertilizer or

²³All households in Abuja fell in the non-poor category.

²⁴ The estimates reflect how an increase in the regressor variable affects the total value of crops harvested per hectare by a household. However, since the dependent variable is in log form, the interpretation of coefficients will vary. For regressors not in log form, the coefficients can be roughly interpreted as the percent change in harvest value per hectare that results from a one unit increase in the explanatory variable. For explanatory variables in log form, the coefficients can be interpreted as elasticities.

herbicide used per hectare will increase agricultural productivity by 0.4 to 0.5 percent. While coefficients on the amount of pesticide used per hectare and whether animal traction was used were positive, both were not statistically significant. We also find the number of male labor days per hectare contributed by family members or hired in were positively related to productivity. The coefficients suggest that on average, a 10 percent increase in male labor days used per hectare increased productivity by 0.4 percent for family labor and 0.8 percent for hired labor. Female and child labor days per hectare did not significantly affect productivity.

65. **The results for other agricultural characteristics were mixed.** The number of plots, value of agricultural capital, and whether the household received agricultural advice from extension services were all positively related to productivity. Not surprisingly, the higher the variety of crops a household grows on their farmland, the higher the value of output per hectare. What is surprising is how large the effect is on productivity. We find that it increases productivity by 29 percent. The value of agricultural capital per hectare also is positively associated with agricultural productivity though rather small with an elasticity of 0.04. Households that received agriculture advice through extension services have higher value of yields than those who did not receive any. The estimates suggest that harvest values per hectare were 13 percent higher for households that received agricultural advice. We also find value of agricultural capital to have a significant positive effect on productivity.

66. **Almost all household characteristics had no significant relationship with agricultural productivity.** Only the number of working age males and being were positively associated with productivity. The estimate for working age males indicates that each additional male leads to a 5 percent increase in agricultural productivity.

67. **The second and third columns present model estimates for the lowest and highest land size harvested quintiles.** Comparing these results will highlight any differences in the determinants of productivity between smaller and larger farmers. We observe the landsize-productivity inverse relationship for both samples. There are however differences in how the use of different inputs affects productivity. For larger farmers, fertilizer, family child labor, as well as male labor days hired per hectare were all positively related with productivity. Only pesticide use was significant for small land owners. The effect of animal traction, though marginally significant, was positive for both large and small holder households though the point estimate was higher for small holders. The number of crops grown was positive and significant for both samples. Agricultural capital was only significant for larger farmers.

68. **Columns 4 and 5 contain estimates for the lowest and highest national consumption expenditure quintiles.** Although the effect of land size was similar, there are again some differences in the effect of input use between the two samples. For the lowest consumption quintile, fertilizer use per hectare was positively associated with agricultural productivity while for the highest only hired male labor per hectare had a positive effect on productivity.

69. **The results for agricultural households in poverty and not in poverty are presented in the last two column of Table 25.** There are some notable differences in the results for these two subgroups. While fertilizer use per hectare is positively associated with productivity for both poor and nonpoor households, use of traction animals as well as the amount of herbicide, hired

male labor per hectare, and male family labor days were only positive for nonpoor households. These results likely reflect very low or improper input use of inputs among poor households.

Poverty and agricultural productivity

70. **Table 25 shows the results of the Logit model employed to examine the relationship between agricultural productivity and poverty.** The results contained in the table are the average marginal effect across sample observations. The estimates reflect the change in probability of being poor caused by a one unit increase in the relevant explanatory variable. Columns 1 and 2 present estimates using state fixed effects while the results in columns 3 and 4 reflect estimations using zone fixed effects.

71. **For all four regressions, the value of harvest per hectare reduced the likelihood of being poor.** The estimates indicate that a ten percent increase in productivity reduced the likelihood of being poor by between 2.5 and 3 percent²⁵. This is a sizeable effect suggesting that improvements in agricultural productivity could be an effective means to reduce rural poverty.

72. **The results also show that having additional income sources also reduces poverty incidence.** Having a nonfarm enterprise reduced the likelihood of being in poverty by 8.5 percent. The effect was larger for external wage work as well as rental or investment income ranging from a 8 to 17 percent decrease in the likelihood of being in poverty according to the results in columns 1 and 3. The results in columns 2 and 4 verify that in addition to participation in a nonagricultural income activity, the amount of income received from these sources also significantly reduces poverty. We find that amount of farm land owned by the households is not significantly correlated with poverty. Again, emphasizing that size of farm land in Nigeria is not based on wealth mostly because the most common method of acquisition is through family or community distribution.

73. **Several household characteristics also reduced the likelihood of being poor.** Not surprisingly, the more members there are in a household, the higher the probability of being poor. This is especially true for the number of working age males and the number of dependents. Some characteristics of the head also show an impact on poverty. A married household head is more likely to be poor than a single head of household. Households that have a head with more education and with better access to credit are less likely to be poor as well.

V. CONCLUSION

74. **This report provides a detailed look into the activities of rural households, especially their agriculture activities and its link to poverty using nationally representative data.** We find that a one percent increase in agricultural productivity will decrease the likelihood of being poor by between two and three percent. This shows that improvements in agricultural productivity could be very important for reducing poverty. Our results also indicate that income

²⁵ This result is calculated from the marginal effect estimates using the following equation:

$$\Delta p(y = 1) = 0.1\bar{x} \frac{\partial y}{\partial x}$$

Where x is log harvest value per hectare, y is poverty status, $\frac{\partial y}{\partial x}$ is the marginal effect, and $\Delta p(y = 1)$ is the change in the probability of being in poverty resulting from a 10 percent increase in x (from the mean).

from wages and other nonfarm activities have a larger effect on poverty reduction than agriculture. However, this does not diminish the importance of agriculture for poverty reduction in rural Nigeria, as this is still the main activity for many households in the sector.

75. **In our examination of the determinants of agricultural productivity, we find that the use of fertilizer and pesticide as well as labor (particularly male labor) are positively related to increased productivity.** Land ownership is quite important for farm households, and households with larger farm sizes have higher value of harvest in general. However, we observe decreasing returns to scale in land size. It appears that large farms are not cultivated as intensely as smaller farms and are therefore underutilized. If farms in the top land quintile had half the median yield per hectare of farms in the lowest quintile, production of the top quintile would be 10 times higher.

76. **Diversification is also important for rural households within and outside agriculture.** Within agriculture, we find that households that grow a variety of crops have a higher productivity compared with those that only grow one crop. Diversification outside agriculture is also quite common for many rural households with about 50 percent of rural farm households also engaged in a nonfarm activity and our analysis shows that having a nonfarm activity reduces the likelihood of being poor. Improved access to credit could increase the ability of households to diversify by engaging in other activities within agriculture and outside of agriculture. In our analysis, we find a significant positive relationship between access to credit and lower likelihood of being poor.

77. **Without a doubt, agriculture is an important activity for rural households in Nigeria and the performance of the agricultural sector has implications for rural poverty.** Nigerian agriculture appears to be characterized by small holder farmers, employing very basic technology in their production activities. Land and labor (particularly male labor), with very little specialization, are the key determinants of production. We find positive, albeit low, returns to modern inputs like fertilizer and herbicides, and this could indicate inadequate use of inputs and/or low quality of available inputs. Lack of information on proper use of these inputs could also be a factor. Increased access to inputs, credit, and information about proper farming practices for poorer households could increase agricultural productivity and in effect, rural incomes. **Although, we cannot ascertain causality between agriculture and rural poverty in this analysis, we are able to show a strong link between increased agricultural productivity and lower likelihood of poverty in rural Nigeria.** We also show that diversification is important for rural activities. Thus, policies favorable to increasing agricultural productivity and encouraging diversification of income generating activities both within and outside agriculture could reduce rural poverty.

Figure 1: Farm and nonfarm participation of households, and by sector

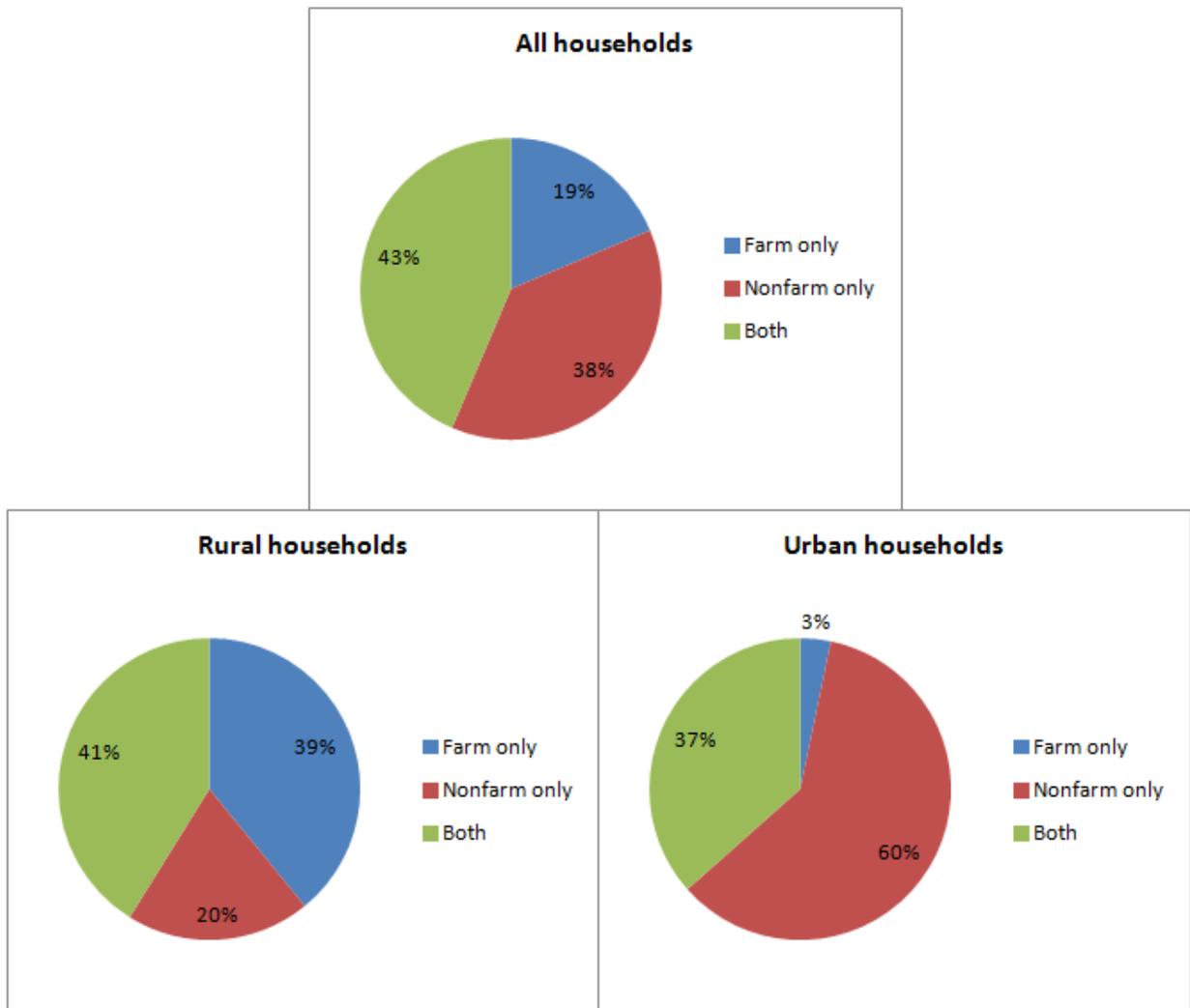


Figure 2: Activities of rural households by zone and gender of household head

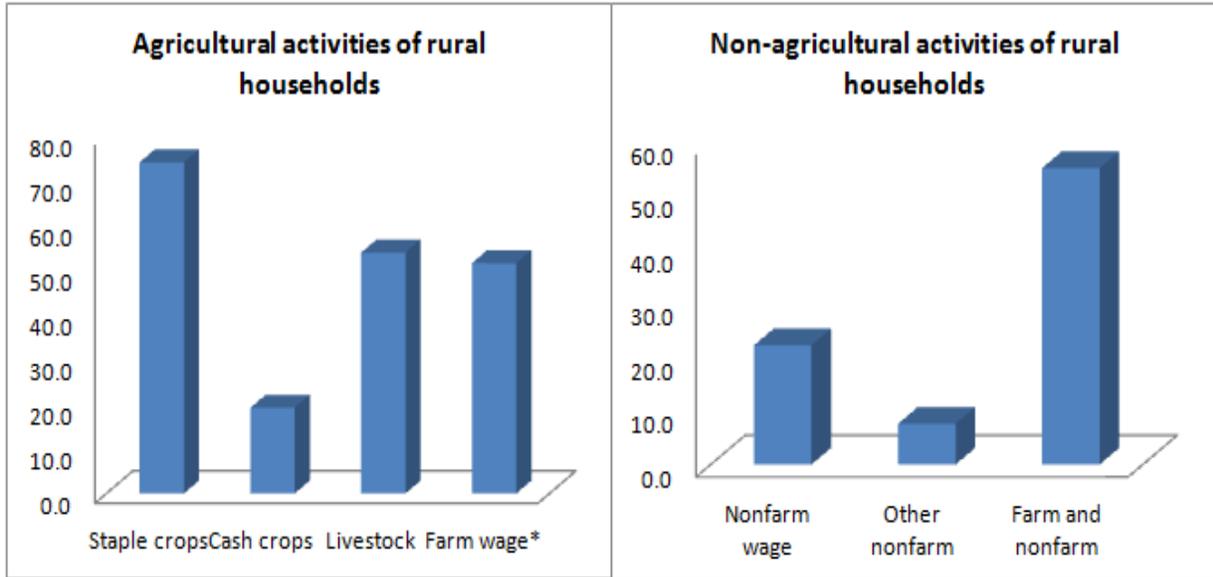


Figure 3: Poverty incidence of rural households by zone and gender of household head

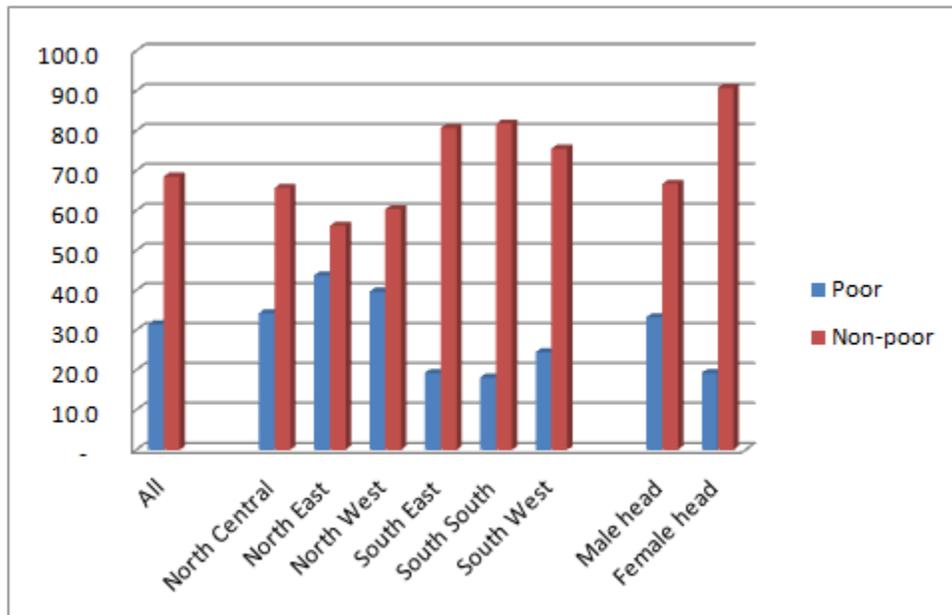


Figure 4: Poverty incidence of rural households by activity

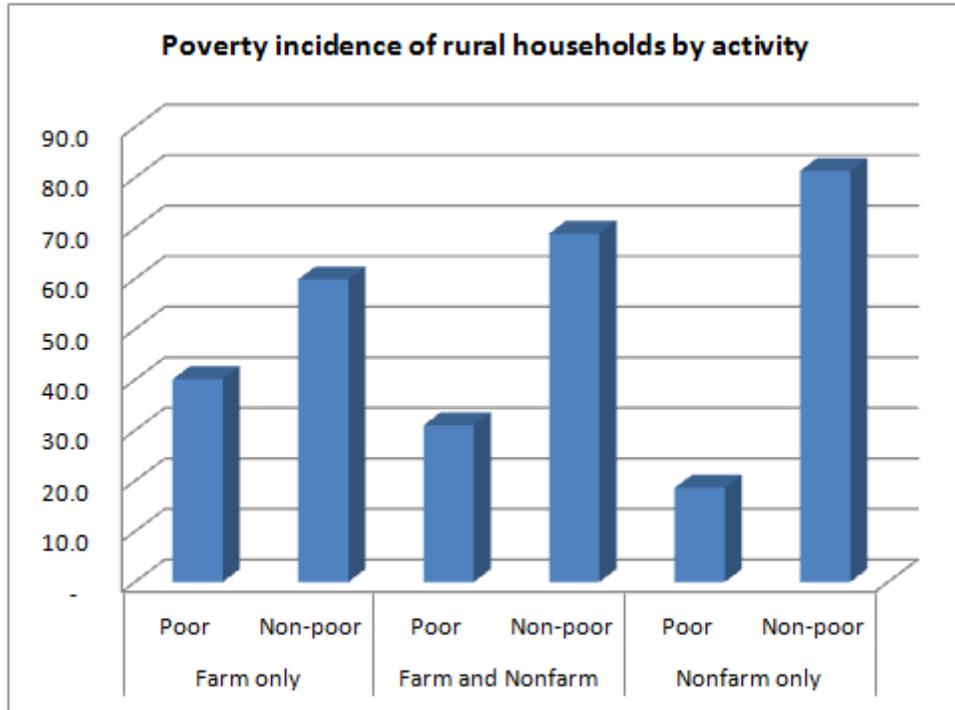


Figure 5: Poverty incidence of rural agriculture households

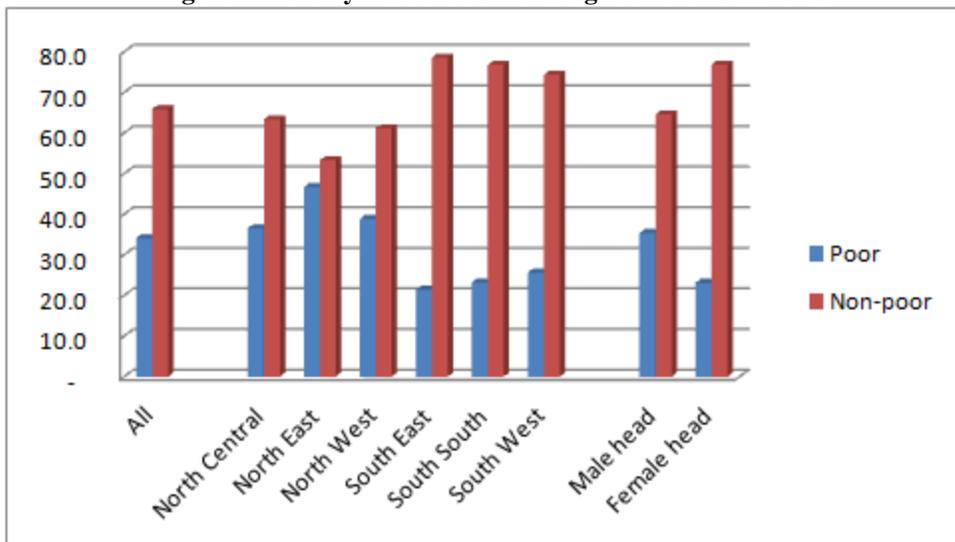


Figure 6: Gender distribution of plot managers

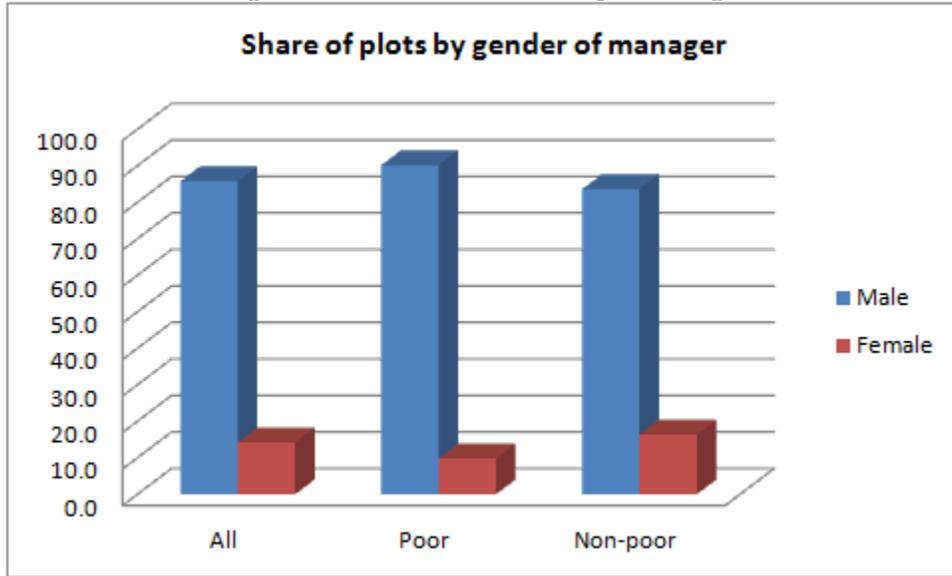


Figure 7 : Age distribution of plot managers

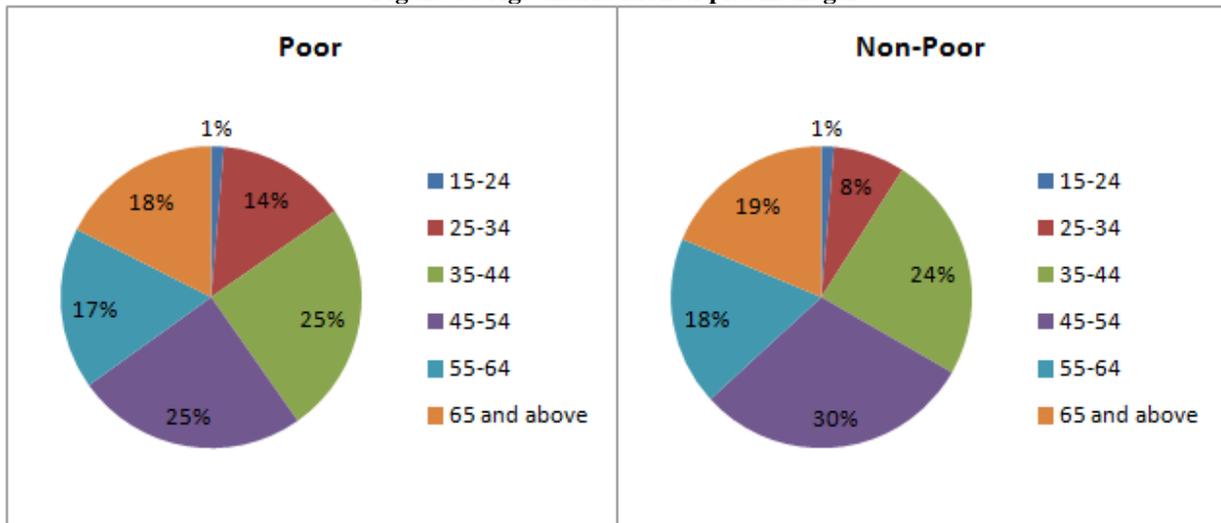


Figure 8 : Education distribution of plot managers

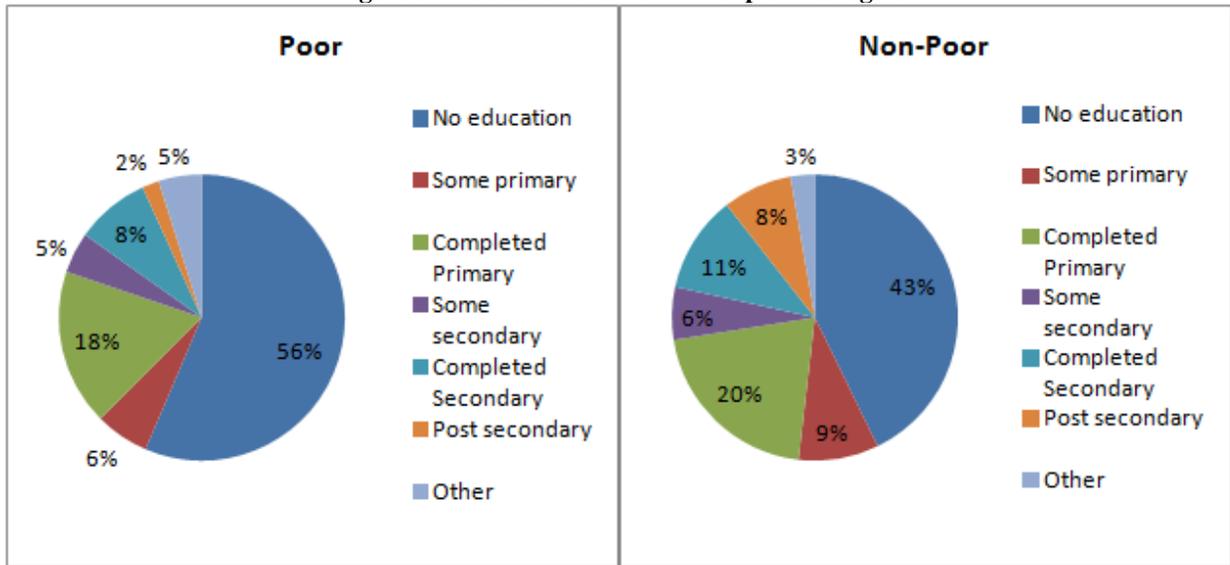


Figure 9 : Land acquisition by poverty incidence

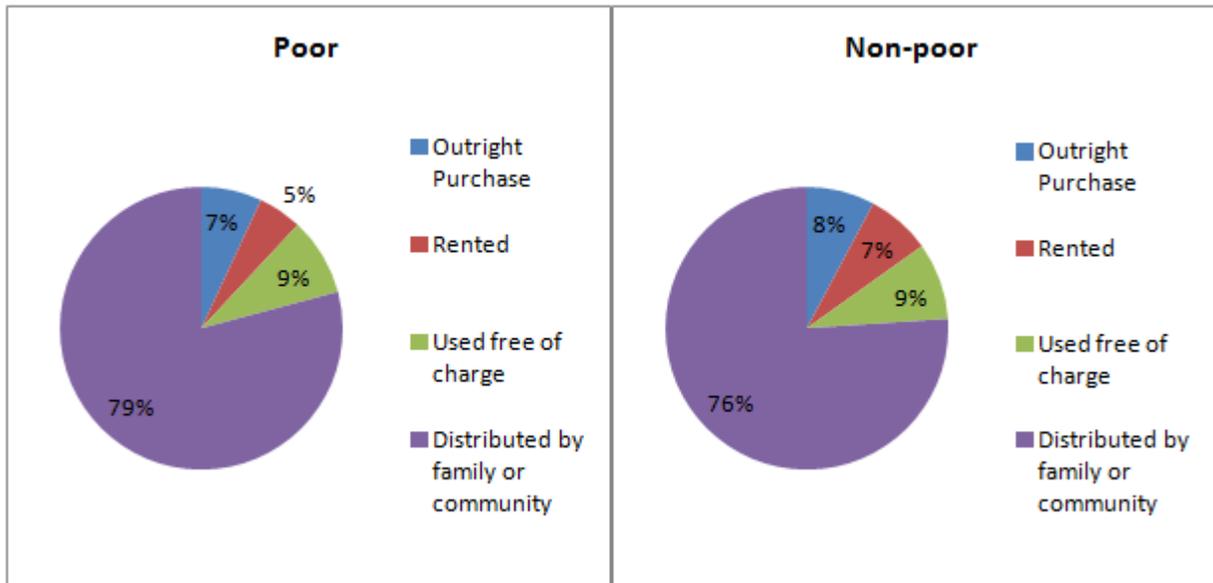


Figure 10: Main crops by poverty incidence

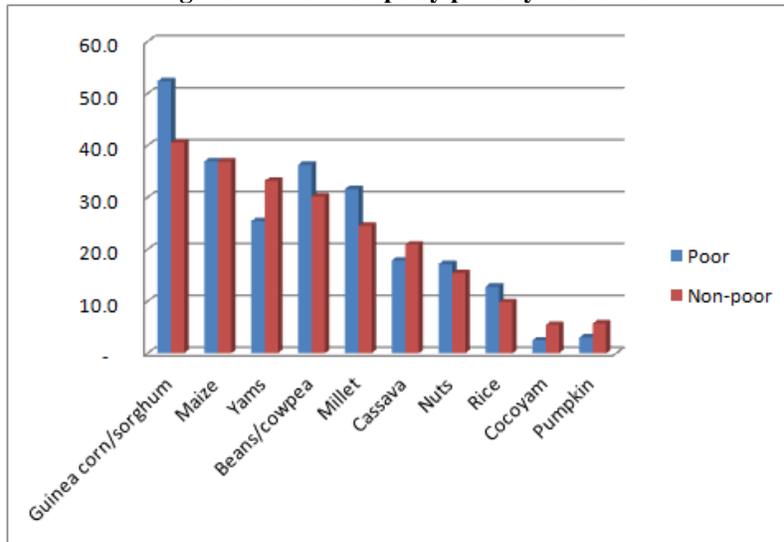


Figure 11 : Access to credit and extension service by poverty incidence

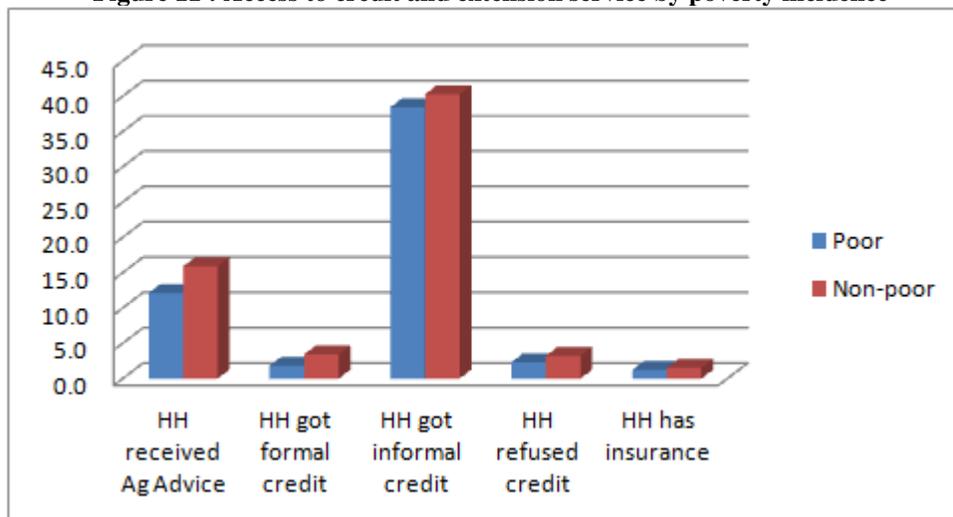


Table 1: Household characteristics by sector and poverty incidence

	Nigeria			Rural			Urban		
	All	Poor	Non-poor	All	Poor	Non-poor	All	Poor	Non-poor
Household Characteristics:									
Household head is male	85.3	90.5	83.7	86.9	92.0	84.5	83.0	84.0	82.9
Age of household head	45.9	51.7	44.2	43.4	51.0	39.8	49.6	54.7	49.0
Average year of education of head	6.5	4.2	7.2	5.1	3.8	5.7	8.7	6.1	9.0
Household head is literate	65.8	49.9	70.6	56.3	47.3	60.5	79.6	61.6	81.7
Average year of education in household	5.8	3.9	6.4	4.4	3.4	4.9	7.8	5.8	8.0
Household head in monogamous marriage	61.3	58.0	62.3	58.5	56.1	59.7	65.4	66.5	65.3
Household head in polygamous marriage	19.4	32.1	15.6	24.7	35.6	19.5	11.8	16.6	11.2
Household head was formerly married	15.3	9.6	17.0	14.6	7.9	17.8	16.2	16.7	16.1
Household has never been married	4.0	0.3	5.1	2.1	0.3	3.0	6.6	0.2	7.4
Total household size	5.7	7.4	5.2	6.1	7.4	5.4	5.1	7.2	4.9
# of individuals under 5 years	0.9	1.2	0.8	1.0	1.2	0.9	0.7	1.0	0.7
# of individuals aged 5 to 11	1.2	1.8	1.0	1.3	1.8	1.1	0.9	1.5	0.8
# of individuals aged 12 to 60	3.3	4.1	3.1	3.4	4.0	3.1	3.2	4.3	3.1
# of individuals 61 and older	0.3	0.4	0.3	0.3	0.4	0.3	0.3	0.4	0.3

Table 1 cont.

	Nigeria			Rural			Urban		
	All	Poor	Non-poor	All	Poor	Non-poor	All	Poor	Non-poor
Household Ownership:									
Household owns dwelling	65.5	81.9	60.6	80.8	87.6	77.6	43.3	57.4	41.7
Roof of dwelling predominantly made of iron sheets or concrete	76.6	65.8	79.9	70.4	61.4	74.6	85.7	85.2	85.7
Walls of dwelling predominantly made of concrete	48.3	26.9	54.8	31.0	19.0	36.6	73.4	61.3	74.9
Floor of dwelling predominantly tile or cement	70.8	50.6	76.9	57.2	42.8	64.0	90.5	84.9	91.1
Average number of rooms in home per capita	0.78	0.58	0.83	0.82	0.59	0.93	0.71	0.54	0.73
Main source of lighting and cooking fuel is electricity	56.4	31.3	63.9	35.2	21.1	41.7	87.2	76.2	88.5
Household Income and Expenditure									
Per capita consumption expenditure	98,647	29,729	119,508	77,387	29,042	100,032	129,594	32,732	141,111
Per adult equivalent consumption expenditure	124,047	38,299	150,003	98,275	37,554	126,716	161,561	41,553	175,831

Table 2: Farm and nonfarm participation by zone, sector, and gender of household head

	All Households			Rural Households			Urban households		
	Farm only	Nonfarm only	Both	Farm only	Nonfarm only	Both	Farm only	Nonfarm only	Both
All	18.2	36.8	42.5	28.4	14.4	55.2	3.7	68.3	24.4
Zones									
North Central	27.0	26.4	45.5	37.4	10.6	51.3	2.5	63.5	31.8
North East	24.2	12.2	61.9	28.5	6.0	64.4	3.3	43.3	49.6
North West	21.7	17.7	59.3	26.3	8.5	63.7	6.5	48.4	44.5
South East	29.5	23.8	43.0	39.7	8.5	48.6	9.3	53.8	32.1
South South	12.6	46.4	38.3	17.9	35.3	43.8	4.4	63.5	29.9
South West	7.0	66.7	22.0	23.5	20.5	52.9	2.0	80.5	12.8
Agroecological zone									
Tropic-warm/semiarid	23.8	15.3	59.4	27.9	8.2	62.5	6.7	44.8	46.8
Tropic-warm/subhumid	17.0	45.8	34.1	32.3	14.6	51.0	3.2	73.8	19.0
Tropic-warm/humid	11.7	44.6	41.5	16.8	34.2	46.2	3.8	61.0	34.1
Tropic-cool/subhumid	3.3	46.1	44.1	9.2	3.0	87.8	-	-	-
Gender of head									
Male	17.9	34.8	45.5	27.9	12.4	58.3	3.2	67.9	26.5
Female	19.6	48.1	25.0	32.3	27.6	34.8	5.9	70.3	14.3

Table 3: Farm and nonfarm net income shares by zone, sector, and gender of household head

	All Households		Rural Households		Urban households	
	Farm	Nonfarm	Farm	Nonfarm	Farm	Nonfarm
All Zones	39.3	60.7	56.5	43.5	12.2	87.8
North Central	49.9	50.1	64.5	35.5	13.1	86.9
North East	55.0	45.0	61.1	38.9	23.7	76.3
North West	51.5	48.5	60.8	39.2	19.7	80.3
South East	47.8	52.2	59.0	41.0	19.5	80.5
South South	28.3	71.7	36.0	64.0	16.4	83.6
South West	17.8	82.2	53.9	46.1	5.9	94.1
Agroecological zone						
Tropic-warm/semiarid	53.1	46.9	60.0	40.0	23.0	77.0
Tropic-warm/subhumid	35.4	64.6	59.3	40.7	10.0	90.0
Tropic-warm/humid	26.5	73.5	33.5	66.5	15.4	84.6
Tropic-cool/subhumid	17.3	82.7	41.5	58.5	-0.6	100.6
Gender of head						
Male	39.5	60.5	56.9	43.1	11.7	88.3
Female	38.4	61.6	54.1	45.9	15.2	84.8

*Note: Income data was not available for 5 percent of rural households. Income shares are calculated using net income which can be negative. Therefore shares can be negative or greater than 100.

Table 4 : Activities of rural households by zone and gender of household head

	Agriculture						
	Any Agriculture	Staple crops	Cash crops	Cash crops (excluding nuts)	Livestock	Fishing	Farm wage*
All Zones	83.7	74.2	19.2	7.8	53.9	1.8	51.6
North Central	88.6	78.5	14.2	4.7	62.8	0.9	36.8
North East	92.8	87.7	28.4	1.0	75.1	2.4	61.7
North West	90.0	76.2	20.7	1.6	65.8	2.2	60.1
South East	88.3	88.0	25.6	24.6	58.0	0.3	46.8
South South	61.7	53.3	3.6	3.0	23.7	1.1	40.1
South West	76.4	60.2	28.0	25.8	22.9	4.3	62.8
Agroecological zone							
Tropic-warm/semiarid	90.4	77.4	23.0	1.5	67.8	2.3	58.0
Tropic-warm/subhumid	83.2	76.7	20.4	14.5	50.5	1.4	49.5
Tropic-warm/humid	63.0	53.1	3.2	3.2	20.8	1.6	40.1
Tropic-cool/subhumid	97.0	92.8	9.2	0.0	75.8	0.0	26.6
Gender of head							
Male	86.2	76.5	20.2	7.5	56.9	1.8	53.1
Female	67.1	58.6	12.6	9.7	34.0	1.6	41.2

Table 4: Cont.

Non Agriculture				
	Any Non Agriculture	Nonfarm enterprises	Nonfarm wage	Other nonfarm
All	69.6	60.0	22.2	7.6
Zones				
North Central	61.8	53.2	20.9	6.6
North East	70.4	60.0	24.3	6.1
North West	72.3	66.5	17.6	2.6
South East	57.1	45.1	22.0	7.1
South South	79.1	64.1	35.6	12.9
South West	73.5	65.1	12.0	16.1
Agroecological zone				
Tropic-warm/semiarid	70.7	63.6	19.2	3.9
Tropic-warm/subhumid	65.6	55.2	20.7	8.7
Tropic-warm/humid	80.4	65.5	37.4	14.6
Tropic-cool/subhumid	90.8	74.5	31.5	15.2
Gender of head				
Male	70.7	61.2	23.1	7.6
Female	62.4	51.8	16.1	7.4

*Note: Farm wage includes households where at least one individual reported working in the agriculture sector but *not* as an unpaid family worker.

Table 5: Net income shares of rural households by zone and gender of household head

	Agriculture					Non Agriculture			
	Total Agriculture	Crop	Livestock	Fishing	Farm wage	Total Non Agriculture	Nonfarm enterprises	Nonfarm wage	Other nonfarm
All	56.3	39.8	16.4	1.3	1.2	43.7	29.5	10.6	1.7
Zones									
North Central	64.5	9.0	54.5	0.9	0.5	35.5	23.8	10.8	1.1
North East	61.1	48.5	9.0	1.8	1.0	38.9	30.9	9.2	0.5
North West	60.8	57.5	5.8	0.7	0.4	39.2	29.5	6.2	0.4
South East	58.2	23.1	25.2	0.0	2.0	41.8	37.5	8.1	1.8
South South	36.0	37.6	-2.1	1.3	1.6	64.0	30.6	26.1	5.3
South West	53.9	58.2	8.4	4.4	3.3	46.1	24.6	2.8	1.8
Agroecological zone									
Tropic-warm/semiarid	60.0	47.9	8.4	1.1	0.6	40.0	34.9	7.2	0.5
Tropic-warm/subhumid	59.1	33.6	27.0	1.5	1.6	40.9	25.9	9.6	1.2
Tropic-warm/humid	33.5	35.5	0.5	1.4	1.6	66.5	28.8	25.7	7.3
Tropic-cool/subhumid	41.5	74.5	15.2	0.0	4.2	58.5	-24.2	22.9	4.6
Gender of head									
Male	56.9	38.0	19.9	1.2	1.2	43.1	28.0	10.7	1.6
Female	52.2	52.5	-7.9	1.8	1.2	47.8	39.7	10.6	2.2

*Note: Income data was not available for 8 percent of rural households. Income shares are based off of net income which can be negative. Therefore shares can be negative or greater than 100.

Table 6: Poverty distribution of households

	All		Rural		Urban	
	Poor	Non-poor	Poor	Non-poor	Poor	Non-poor
All	22.6	77.4	31.5	68.5	10.2	89.8
Zones						
North Central	29.0	71.0	34.3	65.7	16.4	83.6
North East	39.1	60.9	43.8	56.2	15.8	84.2
North West	34.4	65.6	39.7	60.3	16.8	83.2
South East	15.0	85.0	19.3	80.7	6.4	93.6
South South	14.7	85.3	18.2	81.8	9.3	90.7
South West	11.6	88.4	24.5	75.5	7.8	92.2
Agroecological zone						
Tropic-warm/semiarid	37.1	62.9	42.0	58.0	16.8	83.2
Tropic-warm/subhumid	16.4	83.6	25.1	74.9	8.6	91.4
Tropic-warm/humid	16.0	84.0	21.5	78.5	7.5	92.5
Tropic-cool/subhumid	35.6	64.4	27.6	72.4	40.0	60.0
Gender of head						
Male	24.0	76.0	33.3	66.7	10.3	89.7
Female	14.6	85.4	19.3	90.7	9.5	90.5

Table 7 : Poverty distribution of rural households by farm and nonfarm participation

	Farm only		Farm and Nonfarm		Only nonfarm		All farm households	
	Poor	Non-poor	Poor	Non-poor	Poor	Non-poor	Poor	Non-poor
All	40.1	59.9	31.0	69.0	18.6	81.4	34.1	65.9
Zones								
North Central	41.4	58.6	33.1	66.9	17.5	82.5	36.6	63.4
North East	56.6	43.4	42.3	57.7	4.7	95.3	46.7	53.3
North West	50.9	49.1	33.9	66.1	46.9	53.1	38.9	61.1
South East	24.9	75.1	18.6	81.4	4.5	95.5	21.4	78.6
South South	23.2	76.8	23.2	76.8	10.6	89.4	23.2	76.8
South West	29.2	70.8	24.1	75.9	23.9	76.1	25.7	74.3
Agroecological zone								
Tropic-warm/semiarid	55.7	44.3	36.8	63.2	36.2	63.8	42.6	57.4
Tropic-warm/subhumid	30.2	69.8	25.5	74.5	16.3	83.7	27.4	72.6
Tropic-warm/humid	28.4	71.6	29.3	70.7	8.8	91.2	29.1	70.9
Tropic-cool/subhumid	33.3	66.7	27.9	72.1	0.0	-	28.5	71.5
Gender of head								
Male	43.5	56.5	31.5	68.5	20.4	79.6	35.4	64.6
Female	20.7	79.3	25.4	74.6	13.2	86.8	23.2	76.8

Table 8: Poverty incidence of agriculture households

	All Agriculture		Rural Agriculture		Urban Agriculture	
	Poor	Non-poor	Poor	Non-poor	Poor	Non-poor
All	30.7	69.3	34.1	65.9	16.1	83.9
Zones						
North Central	34.0	66.0	36.6	63.4	18.1	81.9
North East	43.8	56.2	46.7	53.3	18.1	81.9
North West	35.7	64.3	38.9	61.1	17.0	83.0
South East	19.7	80.3	21.4	78.6	12.4	87.6
South South	21.6	78.4	23.2	76.8	17.3	82.7
South West	21.4	78.6	25.7	74.3	14.9	85.1
Agroecological zone						
Tropic-warm/semiarid	39.4	60.6	42.6	57.4	16.9	83.1
Tropic-warm/subhumid	24.5	75.5	27.4	72.6	15.1	84.9
Tropic-warm/humid	25.4	74.6	29.1	70.9	16.0	84.0
Tropic-cool/subhumid	34.3	65.7	28.5	71.5	50.0	50.0
Gender of head						
Male	31.9	68.1	35.4	64.6	16.6	83.4
Female	20.8	79.2	23.2	76.8	12.5	87.5

Table 9: Household characteristics of farm households**Table 9a: Household characteristics of farm households by poverty status**

	All	Poor	Non-poor
Household head is male	90.4	94.1	88.6
Age of household head	49.8	51.2	49.1
Average year of education of head	4.5	3.6	5.0
Household head is literate	52.1	44.5	55.8
Average year of education in household	4.0	3.3	4.3
Household head in monogamous marriage	59.5	56.0	61.3
Household head in polygamous marriage	27.7	37.2	23.0
Household head was formerly married	11.4	6.5	13.8
Household has never been married	12.8	6.8	15.7
Average household size	6.4	7.7	5.8
# of individuals under 5 years	1.1	1.3	1.0
# of individuals aged 5 to 11	1.4	1.9	1.2
# of individuals aged 12 to 60	3.5	4.2	3.2
# of individuals 61 and older	0.3	0.4	0.3
Household land holdings (ha)	0.65	0.76	0.60
Per capita consumption expenditure	56,805	30,943	69,542
Per adult equivalent consumption expenditure	87,312	37,789	111,703

Table 9b. Household characteristics of farm households by land quintile

	Land Size Quintile				
	1	2	3	4	5
Household head is male	79.1	86.5	92.2	95.6	97.4
Age of household head	54.5	51.6	47.4	48.8	47.2
Average year of education of head	5.1	4.1	4.5	4.3	4.5
Household head is literate	63.0	48.3	52.2	50.4	47.7
Average year of education in household	5.2	3.8	3.9	3.6	3.3
Household head in monogamous marriage	59.9	55.6	63.3	59.0	59.7
Household head in polygamous marriage	15.9	28.0	24.3	32.5	36.3
Household head was formerly married	22.4	15.1	11.1	6.6	3.4
Household has never been married	24.2	16.4	12.5	8.5	4.0
Average household size	5.7	6.0	6.1	6.9	7.1
# of individuals under 5 years	0.9	1.0	1.2	1.2	1.3
# of individuals aged 5 to 11	1.1	1.3	1.3	1.6	1.8
# of individuals aged 12 to 60	3.2	3.4	3.4	3.9	3.8
# of individuals 61 and older	0.5	0.4	0.3	0.3	0.3
Household land holdings (ha)	0.02	0.10	0.25	0.55	2.20
Per capita consumption expenditure	61,613	54,842	60,587	54,676	52,873
Per adult equivalent consumption expenditure	93,237	85,205	94,381	84,130	80,420

Table 9c. Household characteristics of farm households by consumption quintile

	Consumption Quintile				
	1	2	3	4	5
Household head is male	92.1	91.4	90.5	87.9	89.9
Age of household head	51.2	49.6	50.9	48.8	47.4
Average year of education of head	3.1	4.0	4.3	5.1	7.4
Household head is literate	39.0	47.6	54.9	55.2	72.7
Average year of education in household	2.9	3.4	3.8	4.6	6.1
Household head in monogamous marriage	55.9	58.0	59.6	60.1	67.6
Household head in polygamous marriage	35.9	31.9	27.7	22.8	13.2
Household head was formerly married	8.1	9.3	12.2	15.2	13.4
Household has never been married	8.2	10.1	12.7	17.1	19.2
Average household size	7.5	6.9	6.4	5.5	5.0
# of individuals under 5 years	1.4	1.3	1.0	1.0	0.7
# of individuals aged 5 to 11	1.8	1.6	1.4	1.1	0.9
# of individuals aged 12 to 60	3.9	3.7	3.6	3.1	3.1
# of individuals 61 and older	0.4	0.3	0.3	0.3	0.3
Household land holdings (ha)	0.63	0.69	0.68	0.62	0.64
Per capita consumption expenditure	24,881	39,369	53,247	72,226	126,191
Per adult equivalent consumption expenditure	37,534	59,695	84,215	116,046	184,229

Table 10 : Number and size of plots by zone and gender of head

	Average number of plots per household	Households with multiple plots (%)	Average plot size (ha)	Average farmland per household (ha)
All	1.76	50.6	0.63	1.06
Zones				
North Central	2.19	71.5	0.57	1.21
North East	2.32	72.7	1.04	2.24
North West	1.38	32.9	0.65	0.89
South East	1.73	54.4	0.08	0.14
South South	1.37	29.2	0.43	0.57
South West	1.51	38.9	0.83	1.21
Gender of head				
Male	1.78	51.5	0.67	1.13
Female	1.61	42.0	0.21	0.34

Table 11 : Land acquisition by zone and gender of household head

	Outright Purchase	Rented	Used free of charge	Distributed by family or community
All	7.5	6.5	8.8	77.1
Zones				
North Central	2.2	5.5	13.3	79.1
North East	8.6	5.7	8.5	77.1
North West	16.0	3.0	4.9	76.0
South East	1.7	7.0	2.9	88.4
South South	3.5	13.5	6.9	76.0
South West	7.8	18.1	25.6	48.5
Gender of head				
Male	8.0	6.1	8.7	77.2
Female	2.4	10.7	10.6	76.3

Table 12 : Land acquisition**Table 12a. Land acquisition by land quintile**

	Land Size Quintile				
	1	2	3	4	5
Outright Purchase	5.1	7.6	8.5	9.4	6.5
Rented	3.9	7.3	5.6	5.6	8.7
Used free of charge	6.0	5.9	7.7	9.0	12.3
Distributed by family or community	84.9	79.2	78.2	76.0	72.6

Table 12b. Land acquisition by consumption quintile

	Consumption Quintile				
	1	2	3	4	5
Outright Purchase	6.4	7.7	7.1	8.1	8.5
Rented	4.8	5.3	8.4	7.6	6.6
Used free of charge	8.1	8.7	8.3	10.8	8.1
Distributed by family or community	80.6	78.3	76.2	73.4	76.8

Table 13 : Main crops by zone, gender of household head, and agroecological zone**Table 13a: Main crops by zone**

Crop Type	All	Zone					
		NC	NE	NW	SE	SS	SW
Guinea corn/sorghum	44.5	40.1	61.3	82.3	-	-	3.1
Maize	37.0	44.6	52.2	35.4	30.1	18.1	25.9
Yams	30.6	56.1	2.8	4.0	71.3	52.2	32.1
Beans/cowpea	32.2	25.0	61.6	52.5	-	0.2	3.6
Millet	26.9	7.9	35.9	60.4	-	-	-
Cassava	19.9	35.2	6.0	3.5	18.1	60.2	42.0
Nuts	16.0	11.9	29.2	26.0	0.6	1.9	3.4
Rice	10.8	17.2	22.3	9.7	3.8	1.3	-
Cocoyam	4.5	1.0	0.2	0.4	19.6	6.8	5.0
Pumpkin	4.9	-	0.2	0.2	25.0	9.0	-
Cash crop (excluding nuts)	7.9	2.8	1.2	2.1	18.4	5.2	38.8
Cash crop (including nuts)	23.4	14.0	30.4	27.0	19.0	7.1	42.3
Other noncash crop	27.5	40.9	19.7	22.2	27.3	17.2	45.5

Table 13b: Main crops by gender of head and agroecological zone

Crop Type	Gender of head		Agroecological Zone			
	Male	Female	Tropic-warm /semiarid	Tropic-warm /subhumid	Tropic-warm /humid	Tropic-cool /subhumid
Guinea corn/sorghum	48.3	7.9	76.1	22.3	-	11.0
Maize	37.2	34.7	37.0	36.8	27.2	100.0
Yams	28.9	47.2	0.2	56.5	41.4	-
Beans/cowpea	35.0	5.4	60.5	11.1	-	25.5
Millet	29.5	2.0	56.4	4.4	-	7.3
Cassava	17.9	39.0	3.1	31.5	52.8	-
Nuts	17.2	4.5	28.1	7.3	-	10.9
Rice	11.5	4.4	12.5	10.7	-	-
Cocoyam	3.6	12.7	0.2	7.5	10.7	10.8
Pumpkin	4.0	13.0	0.2	7.4	20.4	-
Cash crop (excluding nuts)	7.4	12.5	2.0	13.1	7.7	-
Cash crop (including nuts)	24.1	17.0	29.3	20.2	7.7	10.9
Other noncash crop	27.7	26.3	20.6	32.1	31.0	89.2

Table 14: Main crops**Table 14a. Main crops by land quintiles**

Crop Type	Land Size Quintile				
	1	2	3	4	5
Guinea corn/sorghum	25.8	44.9	49.9	44.0	55.7
Maize	28.5	29.7	38.5	36.9	49.6
Yams	50.4	26.5	26.0	26.9	25.3
Beans/cowpea	18.0	32.8	35.6	36.8	36.2
Millet	18.3	32.6	29.7	28.6	24.6
Cassava	20.3	24.5	17.6	20.8	16.9
Nuts	12.5	14.9	16.9	13.9	21.5
Rice	2.9	4.5	9.1	12.6	23.5
Cocoyam	15.5	4.1	1.7	1.7	0.5
Pumpkin	15.8	8.3	0.8	0.4	0.5
Cash crop (excluding nuts)	15.0	5.2	7.6	5.5	6.7
Cash crop (including nuts)	26.5	20.0	23.7	19.2	27.8
Other noncash crop	30.3	24.2	26.8	28.6	27.9

Table 14b. Main crops by consumption quintiles

Crop Type	Consumption Quintile				
	1	2	3	4	5
Guinea corn/sorghum	52.2	47.5	47.2	38.6	29.8
Maize	37.9	35.9	37.7	36.3	37.0
Yams	23.1	27.6	32.0	33.5	42.2
Beans/cowpea	36.6	37.0	32.0	29.7	20.0
Millet	32.3	29.4	26.1	26.8	14.5
Cassava	15.1	19.6	23.7	19.0	23.2
Nuts	16.8	18.6	17.1	14.0	10.9
Rice	10.8	12.6	11.1	9.2	9.8
Cocoyam	2.8	3.6	3.3	6.7	7.8
Pumpkin	2.3	4.0	4.6	6.3	9.1
Cash crop (excluding nuts)	5.4	6.1	7.9	9.4	12.9
Cash crop (including nuts)	22.2	24.1	24.2	23.0	23.5
Other noncash crop	20.8	29.1	29.4	28.8	30.7

Table 15 : Harvest for main crops by region

Crops	Average land area harvested per crop (ha)							Value of crop harvest per hectare (naira/ha)
	Zone							
	All	NC	NE	NW	SE	SS	SW	
Guinea corn/sorghum	1.90	2.02	3.63	1.15	-	-	1.66	2,020,035
Maize	1.76	2.06	3.27	1.06	0.23	1.08	2.01	597,775
Yams	0.96	1.47	4.40	0.73	0.26	0.76	1.83	4,690,454
Beans/cowpea	2.24	2.09	4.04	1.16	-	0.24	1.40	416,108
Millet	1.83	2.20	3.88	1.14	-	-	-	464,851
Cassava	1.07	1.22	4.55	0.88	0.22	0.63	1.12	413,974
Nuts	1.95	1.98	3.48	1.01	0.03	0.56	2.38	1,031,810
Rice	2.26	2.13	3.20	1.62	0.47	0.64	-	1,572,936
Cocoyam	0.41	0.61	1.59	2.61	0.07	0.30	2.04	1,862,798
Pumpkin	0.26	-	1.04	0.69	0.20	0.45	0.84	6,501,190
Other cash crop	1.03	1.73	2.04	0.58	0.13	2.12	1.64	31,800,000
Other noncash crop	1.85	2.19	3.76	1.47	0.21	0.47	2.62	6,247,712

Table 16: Crop utilization during the 2010/11 season

Crop utilization for the 2010/11 season							
Crop Type	Sold	Processed	Saved for seed	Wages in kind	Gifts	Post-harvest loss ²⁶	
Guinea corn/sorghum	4.7	16.7	10.1	0.1	3.3	0.9	
Maize	13.8	12.3	9.6	0.3	2.9	1.5	
Yams	11.1	8.3	21.6	0.4	1.5	1.0	
Beans/cowpea	17.4	10.1	8.4	0.1	2.1	1.9	
Millet	3.6	18.6	8.4	0.1	3.8	0.9	
Cassava	20.7	28.9	1.7	0.0	1.3	0.9	
Nuts	17.0	4.6	10.0	0.1	1.8	0.8	
Rice	19.8	9.1	8.0	0.4	1.8	1.2	
Cocoyam	9.9	13.0	16.2	0.0	0.9	1.9	
Pumpkin	30.3	24.8	1.2	0.0	4.7	0.1	
Other cash crop	46.3	18.7	1.3	0.0	1.0	0.3	
Other noncash crop	30.9	10.1	4.7	0.1	1.3	0.8	

Table 17 : Input use by poverty incidence**Table 17a. Input use by poverty incidence**

	All	Poor	Non-poor
Purchased seed used on plot (%)	23.6	26.2	22.4
Used fertilizer on plot (%)	48.3	50.7	47.2
Used pesticide on plot (%)	17.8	17.5	17.9
Used herbicide on plot (%)	23.3	20.0	24.8
Fertilizers kgs used per hectare	531.9	481.5	558.5
Pesticide kgs used per hectare	30.1	24.1	33.0
herbicide kgs used per hectare	31.3	26.4	33.2
Used animal on plot (%)	31.3	40.2	26.9
Animal days used per hectare	12.5	10.6	13.9
Plot is irrigated (%)	3.5	4.6	3.0

Note: Quantities are conditional on any use, so 0s are excluded.

²⁶ These are calculated using reported loss amount (kg) divided by total harvest (kg). Although almost 20 percent of observations have some loss, the loss reported is almost always small. Looking at those that report loss, the conditional mean loss is only 5 percent and the 90th (conditional) percentile is only 12 percent.

Table 17b. Input use by land quintiles

	Land Size Quintile				
	1	2	3	4	5
Purchased seed used on plot (%)	30.9	24.0	26.9	21.3	16.0
Used fertilizer on plot (%)	41.2	48.0	51.7	51.4	48.7
Used pesticide on plot (%)	12.0	19.4	19.6	17.4	20.0
Used herbicide on plot (%)	7.8	12.2	20.6	28.2	44.7
Fertilizers kgs used per hectare ²⁷	-	569.2	392.6	201.7	111.8
Pesticide kgs used per hectare	111.5	30.7	27.5	13.8	3.2
Herbicide kgs used per hectare	167.8	66.7	34.5	16.9	8.8
Used animal on plot (%)	16.0	32.3	36.7	32.6	37.3
Animal days used per hectare	63.5	13.2	7.8	6.0	2.7
Plot is irrigated (%)	1.3	3.2	3.2	5.3	4.4

Note: Quantities are conditional on any use, so 0s are excluded.

Table 17c. Input use by consumption quintiles

	Consumption Quintile				
	1	2	3	4	5
Purchased seed used on plot (%)	29.7	21.4	23.4	21.1	21.9
Used fertilizer on plot (%)	50.2	48.0	48.6	49.1	44.1
Used pesticide on plot (%)	15.4	18.6	20.2	16.5	18.0
Used herbicide on plot (%)	17.5	20.8	23.7	26.1	32.2
Fertilizers kgs used per hectare	462.8	529.6	623.4	551.5	446.5
Pesticide kgs used per hectare	23.2	40.3	33.3	24.3	22.7
Herbicide kgs used per hectare	23.3	36.5	36.3	33.3	22.8
Used animal on plot (%)	41.9	35.8	33.4	22.3	15.0
Animal days used per hectare	11.5	14.2	15.5	7.0	9.7
Plot is irrigated (%)	3.2	4.8	4.0	2.9	1.8

Note: Quantities are conditional on any use, so 0s are excluded

²⁷ The quantities of fertilizer reported for the lowest land quintile were exaggerated and could not be corrected through common imputation and outlier check methods.

Table 18: Farm labor by poverty incidence**Table 18a. Farm labor by poverty incidence**

	All	Poverty status	
		Poor	Non-poor
Used hired labor on plot (%)	45.6	43.1	46.8
Hired men (%)	42.1	40.4	42.9
Hired women (%)	20.9	18.1	22.2
Hired children (%)	6.3	4.0	7.5
Number of man days hired on the plot	26.4	23.9	27.6
Number of woman days hired on the plot	10.5	7.2	12.0
Number of child days hired on the plot	4.2	1.8	5.3
Hired man days per hectare	78.0	80.8	76.8
Hired women days per hectare	37.9	19.2	46.4
Hired child days per hectare	21.8	6.8	28.6
Total days of family labor used on plot	179.2	206.3	165.8
Number of family workers (capped at 4)	2.1	2.3	2.0
Number of adults aged 12 to 60 working on plot	1.6	1.8	1.5
Number of kids under 12 working on plot	0.1	0.2	0.1
Number of seniors aged 61 and older working on plot	0.3	0.3	0.3

Note: Quantities are conditional on any use, so 0s are excluded.

Table 18b. Farm labor by land quintiles

	Land Size Quintile				
	1	2	3	4	5
Used hired labor on plot (%)	28.9	45.0	50.1	49.8	52.2
Hired men (%)	26.7	42.1	47.7	46.7	45.9
Hired women (%)	13.0	21.0	23.2	23.7	22.6
Hired children (%)	4.9	7.6	8.2	5.9	5.0
Number of man days hired on the plot	22.0	22.3	22.2	29.9	32.5
Number of woman days hired on the plot	11.3	9.8	9.5	11.9	10.2
Number of child days hired on the plot	6.4	8.5	2.5	2.4	3.1
Hired man days per hectare	324.5	98.0	44.1	34.7	13.8
Hired women days per hectare	177.7	42.8	20.8	12.8	5.1
Hired child days per hectare	113.2	32.8	5.3	2.8	1.6
Total days of family labor used on plot	116.7	149.2	155.6	238.8	225.5
Number of family workers (capped at 4)	2.1	1.9	1.9	2.2	2.4
Number of adults aged 12 to 60 working on plot	1.6	1.4	1.5	1.8	2.0
Number of kids under 12 working on plot	0.1	0.1	0.2	0.2	0.2
Number of seniors aged 61 and older working on plot	0.4	0.3	0.2	0.3	0.2

Note: Quantities are conditional on any use, so 0s are excluded.

Table 18c. Farm labor by consumption quintiles

	Consumption Quintile				
	1	2	3	4	5
Used hired labor on plot (%)	43.3	43.6	51.2	43.6	45.6
Hired men (%)	40.5	40.4	47.6	39.3	42.2
Hired women (%)	20.1	18.4	23.3	20.8	22.0
Hired children (%)	3.5	4.6	9.3	9.3	3.9
Number of man days hired on the plot	21.9	25.3	25.8	30.0	31.7
Number of woman days hired on the plot	6.2	10.7	11.9	9.1	16.3
Number of child days hired on the plot	1.4	2.4	6.5	8.1	1.4
Hired man days per hectare	75.8	81.9	95.9	58.4	67.1
Hired women days per hectare	16.2	44.6	57.3	24.1	41.4
Hired child days per hectare	3.5	29.0	36.9	24.2	3.6
Total days of family labor used on plot	182.9	199.1	174.5	179.5	144.7
Number of family workers (capped at 4)	2.2	2.2	2.1	2.0	1.8
Number of adults aged 12 to 60 working on plot	1.8	1.7	1.7	1.6	1.4
Number of kids under 12 working on plot	0.2	0.2	0.2	0.1	0.1
Number of seniors aged 61 and older working on plot	0.3	0.3	0.3	0.3	0.2

Note: Quantities are conditional on any use, so 0s are excluded.

Table 19: Ownership of agriculture capital by poverty incidence**Table 19a. Ownership of agriculture capital by poverty incidence**

	All	Poor	Non-poor
Multiple plot managers in the household	4.4	4.9	4.1
Household owns livestock	73.0	77.1	71.1
Household owns traction livestock	26.4	30.2	24.6
Household owns nontraction livestock	70.0	73.6	68.2
Owens a plough	4.8	4.9	4.7
Owens a sprayer	5.3	4.1	5.9
Owens a wheelbarrow	12.0	8.9	13.5
Owens a cutlass	88.4	80.8	92.1
Owens a hoe	98.0	98.7	97.7
Value of Ag Capital by HHID (Naira)	4,299	3,866	4,512

Table 19b. Ownership of agriculture capital by land quintiles

	Land Size Quintile				
	1	2	3	4	5
Multiple plot managers in the household	6.7	3.8	3.8	2.3	5.3
Household owns livestock	68.8	70.8	70.2	75.5	79.2
Household owns traction livestock	18.4	25.0	30.2	24.8	32.5
Household owns nontraction livestock	67.1	67.4	67.0	72.6	75.2
Owns a plough	2.8	3.5	4.3	6.6	6.4
Owns a sprayer	1.3	2.4	3.0	9.0	10.2
Owns a wheelbarrow	27.1	9.6	8.6	9.9	6.2
Owns a cutlass	95.7	85.7	85.5	87.3	88.4
Owns a hoe	98.2	96.8	98.1	97.9	99.0
Value of Ag Capital by HHID (Naira)	4,072	3,360	3,453	4,805	5,680

Table 19c. Ownership of agriculture capital by consumption quintiles

	Consumption Quintile				
	1	2	3	4	5
Multiple plot managers in the household	4.7	3.5	3.4	5.2	6.0
Household owns livestock	74.5	78.9	72.7	71.4	63.0
Household owns traction livestock	29.9	30.1	28.0	24.4	13.7
Household owns nontraction livestock	70.6	76.3	68.8	68.7	61.6
Owns a plough	4.1	4.3	4.0	6.0	6.1
Owns a sprayer	3.2	3.9	4.6	5.3	13.0
Owns a wheelbarrow	8.1	9.4	10.7	13.9	22.9
Owns a cutlass	76.0	84.1	94.2	95.7	95.4
Owns a hoe	98.3	99.0	97.0	97.3	98.8
Value of Ag Capital by HHID (Naira)	3,959	3,832	4,367	4,871	4,709

Table 20: Livestock ownership by region²⁸, gender of head, and agroecological zone

Table 20a: Livestock ownership by zone

Type of livestock	Zone						
	All	NC	NE	NW	SE	SS	SW
Calf Female	3.7	5.1	6.5	4.8	-	-	1.2
Calf Male	3.4	4.1	5.9	4.8	-	-	1.2
Cow	12.0	10.5	17.7	20.9	0.6	-	2.8
Bull	9.7	5.9	17.9	17.1	-	-	1.2
Ox	7.0	0.9	16.9	12.5	-	-	-
Goat	46.8	39.4	62.7	62.3	40.5	19.4	8.5
Sheep	22.1	8.1	39.1	40.8	3.6	1.9	2.2
Chicken-local	45.9	52.1	54.6	41.5	54.0	30.8	29.3
Duck	3.4	7.0	7.0	2.8	-	-	0.6
Guinea Fowl	4.1	1.6	2.7	10.1	-	-	1.9
Other livestock	12.5	15.1	15.4	14.4	7.0	8.7	8.4

Table 20b: Livestock ownership by gender of head and agroecological zone

Type of livestock	Gender of head		Agroecological Zone			
	Male	Female	Tropic-warm /semiarid	Tropic-warm /subhumid	Tropic-warm /humid	Tropic-cool /subhumid
Calf Female	4.1	-	4.6	3.3	-	3.7
Calf Male	3.8	-	4.1	3.3	-	-
Cow	13.2	-	19.4	6.6	-	22.0
Bull	10.7	0.3	17.9	3.8	-	-
Ox	7.8	-	15.2	0.7	-	-
Goat	48.5	29.9	64.7	34.2	19.1	44.1
Sheep	24.2	2.4	42.8	6.4	0.9	18.4
Chicken-local	46.0	44.5	43.1	49.7	31.5	52.7
Duck	3.7	0.8	4.1	3.3	-	-
Guinea Fowl	4.5	0.6	8.2	1.1	-	-
Other livestock	13.1	6.8	14.0	11.1	8.7	47.6

²⁸ Livestock ownership is very limited in the South beyond small livestock like chicken and goats. See Figure 13 in the Appendix (Section IV) for a map of livestock in Nigeria from FAO.

Table 21: Livestock ownership by poverty incidence**Table 21a. Livestock ownership by poverty incidence**

Type of livestock	All	Poor	Non-poor
Calf Female	3.6	3.4	3.9
Calf Male	3.3	3.4	3.2
Cow	11.7	12.8	9.9
Bull	9.4	11.9	5.7
Ox	6.8	7.7	5.3
Goat	46.9	51.5	40.1
Sheep	21.7	24.7	17.2
Chicken-local	46.2	47.6	44.1
Duck	3.4	3.6	2.9
Guinea Fowl	4.0	4.3	3.6
Other livestock	12.7	12.1	13.6

Table 21b. Livestock ownership by land quintile

Type of livestock	Land Size Quintile				
	1	2	3	4	5
Calf Female	1.3	2.5	4.8	3.2	5.8
Calf Male	1.2	2.2	3.6	3.3	6.0
Cow	7.4	8.8	11.9	14.6	14.9
Bull	3.8	7.3	12.7	8.2	14.4
Ox	4.8	5.0	7.3	7.2	9.2
Goat	44.8	48.0	43.6	49.1	48.9
Sheep	13.4	21.7	25.0	22.6	24.7
Chicken-local	46.0	40.7	44.6	46.8	52.5
Duck	1.3	2.0	2.0	3.8	7.3
Guinea Fowl	4.4	4.0	3.4	3.5	4.8
Other livestock	10.0	11.5	12.5	15.3	13.8

Table 21c. Livestock ownership by consumption quintile

Type of livestock	Consumption Quintile				
	1	2	3	4	5
Calf Female	2.6	3.4	4.9	4.6	2.6
Calf Male	3.4	2.7	4.9	3.3	2.0
Cow	10.3	13.4	13.6	13.1	7.3
Bull	16.8	9.1	9.3	6.2	4.8
Ox	7.6	9.5	7.2	6.2	2.5
Goat	48.8	52.2	48.3	44.9	33.3
Sheep	25.8	23.8	23.4	21.6	11.2
Chicken-local	42.8	51.2	43.0	48.5	42.8
Duck	2.3	4.6	3.8	3.5	2.7
Guinea Fowl	2.0	4.7	5.9	5.9	0.7
Other livestock	12.0	10.8	13.5	12.8	14.5

Table 22: Access to credit and extension service by land quintiles**Table 22a. Access to credit and extension service by land quintiles**

	Land Size Quintile				
	1	2	3	4	5
Household received agricultural advice	10.5	18.3	16.7	16.8	10.9
Household granted credit from a formal source	2.7	2.4	2.9	2.7	3.6
Household granted credit from an informal source	34.2	34.7	43.3	45.4	40.1
Household sought credit but was refused	4.4	3.9	2.3	1.3	3.0
At least one household member has insurance	1.2	1.1	2.9	1.3	0.6

Table 22b. Access to credit and extension service by consumption quintiles

	Consumption Quintile				
	1	2	3	4	5
Household received agricultural advice	11.5	14.2	12.3	17.4	21.2
Household granted credit from a formal source	0.4	2.5	3.3	2.9	7.2
Household granted credit from an informal source	38.5	42.6	40.7	37.1	38.5
Household sought credit but was refused	2.3	3.0	3.4	3.4	2.3
At least one household member has insurance	1.1	0.9	0.6	1.7	3.8

Table 23: Summary statistics and test of mean differences by poverty status

	Full	Not in pov	In pov	Difference
Production:				
Value of total harvest (Naira)	158,956	174,952	126,479	***
Value of harvest per hectare (Naira/ha)	878,612	1,079,647	470,427	***
Log value of harvest per hectare	11.94	12.08	11.67	***
Poverty:				
Poverty: below HNLSS Poverty Line (%)	33.0	0.0	0.0	
Harvested land size:				
Harvested hectares	1.1	1.0	1.2	***
Harvested hectares squared	4.0	3.5	4.9	
Physical inputs:				
Used fertilizer (%)	48.3	47.2	50.7	
Total fertilizer used (kg)	184.2	180.8	190.6	
Fertilizer used (kg/ha)	531.9	558.5	481.5	
Used Pesticide (%)	17.8	17.9	17.5	
Total pesticide used (kg)	10.2	10.4	9.7	
Pesticide used (kg/ha)	30.1	33.0	24.1	
Used herbicide (%)	23.3	24.8	20.0	***
Total herbicide used (kg)	23.6	25.4	19.1	
Herbicide used (kg/ha)	31.3	33.2	26.4	

Table 23 cont.

	Full	Not in pov	In pov	Difference
Family and hired labor:				
Used family labor (%)	94.0	94.2	93.6	
Labor days contributed by HH's males 12 and older	63.2	54.7	80.4	***
Labor days contributed by HH's females 12 and older	34.0	31.0	40.3	*
Labor days contributed by HH's children	6.5	6.0	7.5	
Male family labor days used per hectare	268.0	274.1	255.6	
Female family labor days used per hectare	230.6	251.2	188.4	
Child family labor days used per hectare	17.7	19.4	14.2	
Hired in labor (%)	54.4	53.2	56.9	
Number of man days hired on the plot	26.4	27.6	23.9	
Number of woman days hired on the plot	10.5	12.0	7.2	***
Number of child days hired on the plot	4.2	5.3	1.8	***
Male days hired per hectare	78.0	76.8	80.8	
Female days hired per hectare	37.9	46.4	19.2	***
Child days hired per hectare	21.8	28.6	6.8	***
Other agricultural characteristics:				
Used animal (%)	31.3	26.9	40.2	***
Household owns livestock (%)	73.0	71.1	77.1	***
At least one plot purchased (%)	9.7	9.9	9.4	
Household received agricultural advice (%)	14.7	15.9	12.1	**
Value of Ag Capital (Naira)	4,299	4,512	3,866	**
Value of agricultural capital owned by the household per hectare	36,945	45,420	19,737	***
Other agricultural characteristics:				
Household grew at least on cash crop (%)	23.5	23.7	23.0	
Number of unique crops grown by the household	2.8	2.8	2.8	
Household land holdings (ha)	0.7	0.6	0.8	***
Socioeconomic characteristics:				
Sex of household head (% Male)	90.4	88.6	94.1	***
Age of household head	49.8	49.1	51.2	***
Age of household head squared	2,704	2,649	2,816	**
Years of education of head	4.5	5.0	3.6	***
Household head is married (%)	87.2	84.3	93.2	***
Household is nonmuslim	48.9	52.6	41.6	***
# of males aged 12 to 60	1.7	1.5	2.1	***
# of females aged 12 to 60	1.8	1.7	2.1	***
Number of dependents 0 to 11 or older than 60	2.9	2.5	3.5	***
Household granted credit (%)	40.8	41.5	39.4	
At least one household member has insurance (%)	1.4	1.5	1.2	

Table 23 cont.

	Full	Not in pov	In pov	Difference
<i>Nonagricultural income</i>				
Household owns/operates a nonfarm enterprise (%)	56.5	58.1	53.1	*
At least one member of household received external wages (%)	11.9	14.0	7.5	***
Household had rental and/or investment income (%)	4.3	5.5	2.0	***
Per capita profits from nonfarm enterprise(s)	15,224	20,510	4,490	*
Per capita wage income	10,934	15,452	1,760	
Per capita rental and investment income	321.8	461.4	38.2	***
<i>Geographic characteristics:</i>				
Distance to nearest market (km)	69.6	70.1	68.6	
Distance to nearest major road (km)	18.3	17.4	20.2	***
<i>Agro-ecological zone</i>				
Tropic-warm/semiarid (%)	43.6	39.4	52.3	***
Tropic-warm/subhumid (%)	50.2	54.4	41.6	***
Tropic-warm/humid (%)	5.3	5.3	5.3	
Tropic-cool/subhumid (%)	0.9	1.0	0.8	
Observations (same for all variables)	2,086	1,379	707	-

Note: Weighted sample means with Wald test results. * p<0.10, ** p<0.05, *** p<0.01

Table 24: Determinants of Agricultural Productivity, Value of Output (Naira)/Hectare

	BASE	LAND 1	LAND 5	CONS 1	CONS 5	IN POV	NOT IN POV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Land size:</i>							
Log harvested hectares	- 0.658*** (0.036)	- -0.368 (0.228)	- 0.681*** (0.257)	- 0.776*** (0.092)	- 0.461*** (0.131)	- 0.743*** (0.067)	- 0.608*** (0.044)
Log harvested hectares, squared	0.004 (0.009)	0.039 (0.033)	0.030 (0.094)	-0.020 (0.030)	0.038 (0.029)	-0.012 (0.021)	0.018 (0.011)
<i>Physical inputs:</i>							
Log of fertilizer used (kg/ha)	0.042*** (0.012)	0.028 (0.028)	0.057** (0.024)	0.069*** (0.021)	0.061 (0.043)	0.043** (0.017)	0.045*** (0.016)
Log of pesticide used (kg/ha)	0.013 (0.027)	0.161*** (0.059)	0.045 (0.065)	-0.104 (0.065)	0.072 (0.104)	-0.085** (0.041)	0.050 (0.036)
Log of herbicide used (kg/ha)	0.051** (0.026)	0.045 (0.065)	0.082* (0.046)	-0.002 (0.054)	0.084 (0.141)	0.025 (0.053)	0.056* (0.030)
Used animal on plot	0.116 (0.084)	0.560* (0.307)	0.290* (0.174)	0.220 (0.219)	-0.103 (0.447)	-0.064 (0.172)	0.230** (0.097)
<i>Labor inputs:</i>							
Log of male family labor days used per hectare	0.036** (0.018)	0.041 (0.033)	0.026 (0.050)	-0.006 (0.045)	0.021 (0.053)	0.006 (0.037)	0.051** (0.021)
Log of female family labor days used per hectare	-0.007 (0.017)	-0.011 (0.039)	0.007 (0.041)	0.018 (0.033)	-0.015 (0.060)	0.005 (0.027)	-0.015 (0.022)
Log of child family labor days used per hectare	0.010 (0.017)	0.022 (0.038)	0.077* (0.043)	0.016 (0.030)	-0.062 (0.110)	-0.007 (0.025)	0.020 (0.023)
Log of male days hired per hectare	0.084*** (0.020)	-0.013 (0.050)	0.181*** (0.050)	0.026 (0.042)	0.175*** (0.067)	0.051 (0.035)	0.106*** (0.026)
Log of female days hired per hectare	0.002 (0.030)	0.012 (0.076)	-0.047 (0.085)	0.059 (0.065)	-0.001 (0.085)	0.021 (0.053)	-0.004 (0.035)
Log of child days hired per hectare	0.012 (0.037)	0.002 (0.061)	0.013 (0.081)	-0.099 (0.092)	-0.031 (0.116)	0.039 (0.072)	-0.008 (0.045)
<i>Other agricultural Characteristics</i>							
At least one plot purchased	-0.066 (0.090)	0.017 (0.318)	-0.280* (0.160)	0.141 (0.210)	-0.072 (0.404)	0.058 (0.144)	-0.152 (0.117)
Number of crops on plot	0.289*** (0.024)	0.240*** (0.067)	0.265*** (0.046)	0.264*** (0.055)	0.236** (0.093)	0.262*** (0.043)	0.294*** (0.029)
Household grew at least on cash crop	0.034 (0.072)	0.071 (0.205)	0.167 (0.124)	0.048 (0.139)	-0.017 (0.267)	0.097 (0.106)	-0.007 (0.096)
Household owns livestock	0.103 (0.084)	0.171 (0.172)	- (0.147)	0.004 (0.210)	-0.019 (0.209)	-0.031 (0.167)	0.151 (0.100)
Log of the value of agricultural capital owned by the household (Na/ha)	0.038* (0.020)	-0.005 (0.065)	0.081 (0.050)	0.019 (0.045)	0.052 (0.068)	0.040 (0.038)	0.030 (0.023)
Household received agricultural advice	0.135* (0.074)	0.292 (0.270)	-0.035 (0.115)	0.279* (0.157)	0.218 (0.249)	0.234* (0.136)	0.083 (0.090)

Table 24 cont.

	BASE	LAND 1	LAND 5	CONS 1	CONS 5	IN POV	NOT IN POV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Household characteristics:</i>							
Sex of household head	0.064 (0.191)	-0.413 (0.359)	1.004 (0.645)	0.006 (0.384)	-0.001 (0.481)	0.448 (0.375)	-0.104 (0.214)
Age of household head	-0.001 (0.010)	-0.008 (0.031)	0.000 (0.024)	0.018 (0.024)	-0.029 (0.034)	0.005 (0.017)	0.000 (0.013)
Age of household head squared	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)
Household head is married	0.161 (0.154)	0.414 (0.284)	0.019 (0.198)	0.512** (0.251)	0.298 (0.331)	0.284 (0.227)	0.178 (0.178)
Years of education of head	-0.010 (0.007)	-0.016 (0.019)	0.019 (0.014)	-0.030 (0.025)	-0.026 (0.021)	-0.026 (0.018)	-0.007 (0.007)
# of males aged 12 to 60	0.046** (0.024)	0.060 (0.075)	0.032 (0.042)	0.030 (0.047)	0.134* (0.072)	0.042 (0.037)	0.061* (0.034)
# of females aged 12 to 60	-0.000 (0.026)	-0.078 (0.078)	0.004 (0.048)	0.053 (0.048)	-0.132 (0.113)	0.036 (0.035)	-0.027 (0.039)
Household granted credit	0.029 (0.062)	-0.156 (0.156)	-0.181 (0.116)	0.009 (0.133)	0.133 (0.205)	0.015 (0.107)	0.039 (0.080)
Household owns/operates a nonfarm enterprise	0.070 (0.080)	-0.003 (0.170)	0.041 (0.120)	0.147 (0.158)	-0.120 (0.303)	0.099 (0.136)	0.041 (0.100)
Household has other nonfarm activity	0.011 (0.102)	-0.065 (0.247)	0.024 (0.206)	0.089 (0.258)	-0.252 (0.322)	0.050 (0.225)	0.019 (0.118)
<i>Geographic variables:</i>							
Distance to nearest market (km)	0.001 (0.001)	-0.000 (0.004)	0.002* (0.001)	0.002 (0.002)	-0.003 (0.004)	0.002 (0.002)	0.000 (0.001)
Distance to nearest major road (km)	-0.002 (0.002)	-0.005 (0.006)	-0.004 (0.003)	-0.004 (0.005)	0.008 (0.008)	-0.003 (0.004)	-0.000 (0.002)
<i>Agro-ecological zone</i>							
Tropic-warm/subhumid	0.223 (0.156)	-0.453 (0.545)	0.133 (0.229)	0.187 (0.416)	1.856** (0.910)	0.297 (0.318)	0.145 (0.176)
Tropic-warm/humid	0.002 (0.293)	-0.338 (0.694)	0.933 (0.644)	-1.144* (0.682)	1.558 (1.250)	-0.410 (0.534)	0.383 (0.369)
Tropic-cool/subhumid	0.859*** (0.283)	-0.911 (0.792)	1.511*** (0.564)	0.887 (0.752)	2.346** (1.183)	0.804 (0.520)	0.704** (0.324)
Constant	8.691*** (0.415)	11.801*** (1.240)	8.185*** (0.864)	8.699*** (0.972)	8.755*** (1.273)	8.786*** (0.787)	8.582*** (0.470)
Observations	2086	376	490	479	242	707	1379
R-squared	0.511	0.489	0.489	0.516	0.586	0.535	0.518

Note: OLS point estimates with robust standard errors in brackets. Results for state fixed effects not shown. Significance denoted * p<0.10, ** p<0.05, *** p<0.01.

Table 25: Poverty and Agricultural Productivity

	(1)	(2)	(3)	(4)
<i>Productivity:</i>				
Log yields (Naira/ha)	-0.021** (0.009)	-0.020** (0.009)	- 0.026*** (0.007)	- 0.026*** (0.007)
<i>Other sources of income:</i>				
Log per capita profits from nonfarm enterprise(s)		-0.008** (0.004)		-0.005* (0.003)
Log per capita wage income		-0.072** (0.030)		-0.062** (0.025)
Log per capita rental and investment income		-0.069* (0.038)		-0.070** (0.034)
Household owns/operates a nonfarm enterprise	- 0.085*** (0.026)	-0.048 (0.031)	- 0.080*** (0.020)	-0.053** (0.026)
At least one member of household received external wages	-0.087** (0.043)	0.614** (0.288)	- 0.107*** (0.036)	0.497** (0.242)
Household had rental and/or investment income	-0.174** (0.069)	0.326 (0.277)	-0.144** (0.057)	0.364 (0.249)
<i>Other agricultural characteristics</i>				
Household owned land (ha)	-0.004 (0.010)	-0.003 (0.010)	-0.006 (0.008)	-0.005 (0.008)
Household owns livestock	-0.024 (0.030)	-0.022 (0.030)	-0.013 (0.024)	-0.012 (0.024)
Household grew at least one cash crop	0.008 (0.029)	0.008 (0.029)	-0.008 (0.023)	-0.009 (0.023)
<i>Household and head characteristics:</i>				
Average year of education within household	- 0.018*** (0.007)	-0.017** (0.007)	-0.013** (0.006)	-0.013** (0.006)
# of males aged 12 to 60	0.081*** (0.011)	0.081*** (0.011)	0.068*** (0.008)	0.068*** (0.008)
# of females aged 12 to 60	0.027** (0.010)	0.026** (0.010)	0.023*** (0.009)	0.023*** (0.009)
Number of dependents 0 to 11 or older than 60	0.046*** (0.006)	0.045*** (0.007)	0.038*** (0.005)	0.037*** (0.005)
Household is nonmuslim	0.098** (0.041)	0.098** (0.041)	0.052* (0.030)	0.050* (0.030)
Household head is male	-0.104 (0.084)	-0.094 (0.083)	-0.068 (0.072)	-0.061 (0.071)

Table 25 cont.

	(1)	(2)	(3)	(4)
<i>Household and head characteristics (cont.):</i>				
Age of household head	0.002 (0.005)	0.002 (0.005)	0.006 (0.004)	0.007 (0.004)
Age of household head squared	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Household head is married	0.171** (0.076)	0.166** (0.074)	0.134** (0.066)	0.132** (0.064)
Years of education of head	-0.008** (0.004)	-0.008** (0.004)	-0.006** (0.003)	-0.006* (0.003)
Household granted credit	-0.069*** (0.025)	-0.069*** (0.025)	-0.021 (0.020)	-0.021 (0.020)
At least one household member has insurance	-0.079 (0.125)	-0.088 (0.125)	-0.023 (0.104)	-0.040 (0.106)
<i>Agro-ecological zone</i>				
Tropic-warm/subhumid	-0.030 (0.070)	-0.041 (0.069)	-0.062 (0.042)	-0.066 (0.042)
Tropic-warm/humid	0.166 (0.128)	0.152 (0.127)	0.067 (0.071)	0.064 (0.071)
Tropic-cool/subhumid	-0.102 (0.130)	-0.119 (0.130)	-0.021 (0.098)	-0.033 (0.098)
State fixed effects	Yes	Yes	No	No
Zone fixed effects	No	No	Yes	Yes
Observations	2076	2076	2086	2086
Pseudo R-squared	0.123	0.130	0.134	0.139

Note: Estimates for Logit fixed effects estimation with standard errors in parenthesis. Significance denoted * p<0.10, ** p<0.05, *** p<0.01.

APPENDIX

Figure 12: Map of agro-ecological zones

Nigeria - Agro-ecological Zones

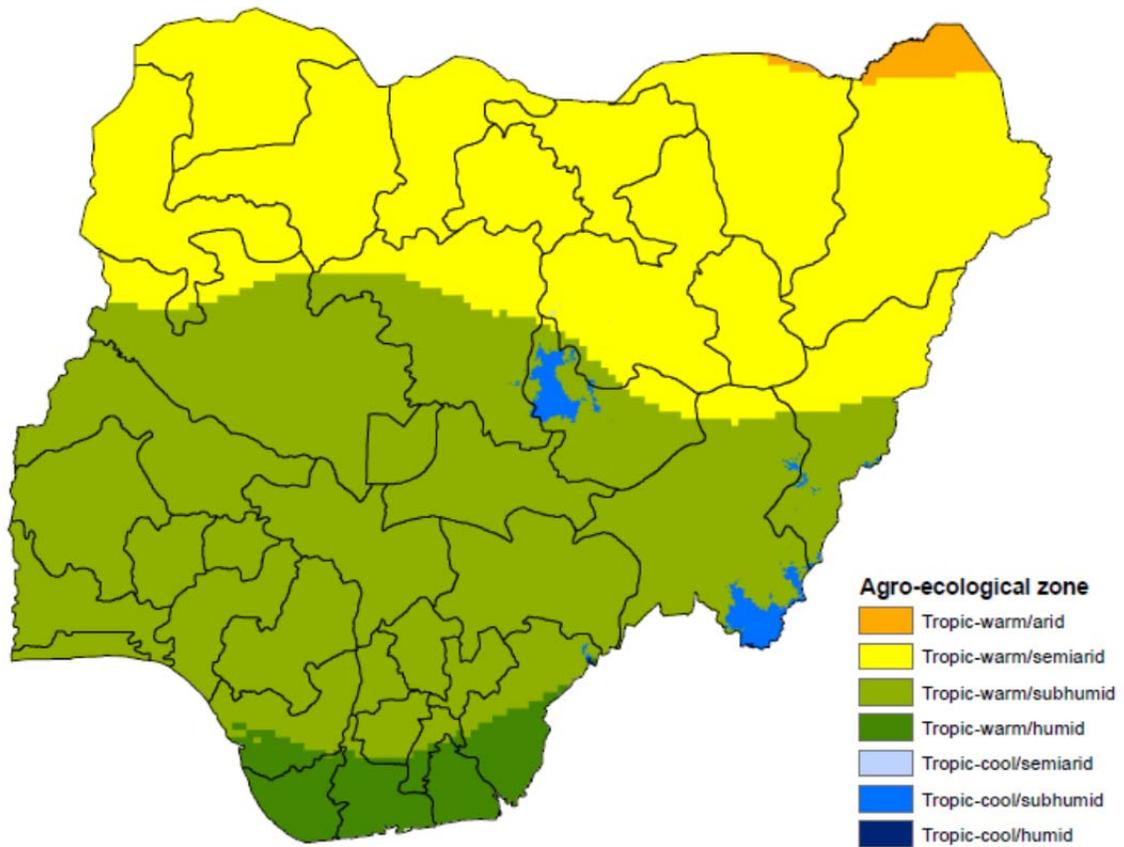
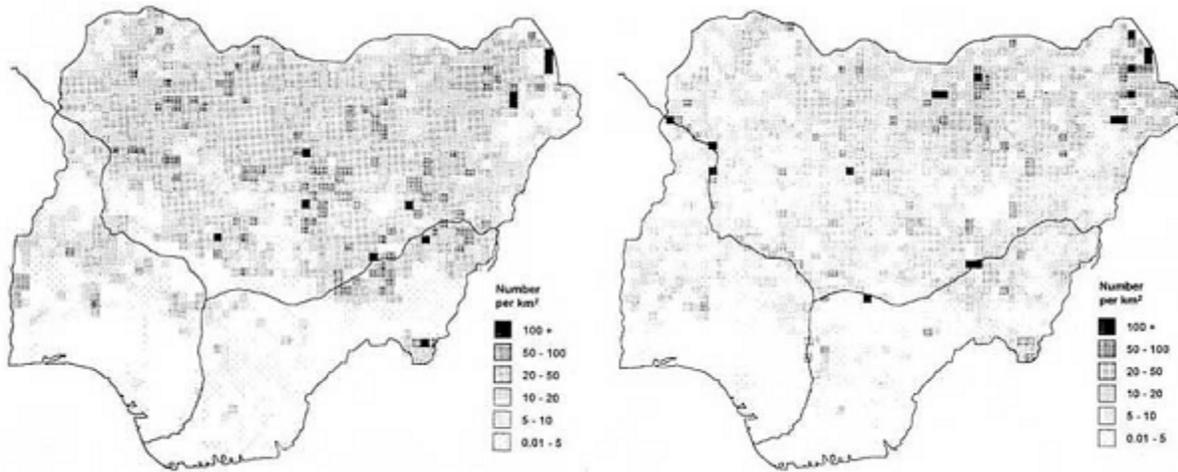


Figure 13: Wet (left) and dry (right) season distribution of Cattle



Source: Bourn, D., Wint, William, Blench, R. and Woolley, E. (1994). Nigerian livestock resources survey, *World Animal Review*, 78(1):49-58

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