EFFECTS OF REDD+ POLITICAL ECONOMY ON AGRARIAN LAND ACCESS IN THE OFFINSO FOREST DISTRICT OF GHANA.

BY

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THIS THESIS IS SUBMITTED TO THE UNIVERSIY OF GHANA IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF PHILOSOPHY DEGREE (MPHIL) IN AGRICULTURAL ECONOMICS.

DEPARTMENT OF AGRICULTURAL ECONOMICS AND AGRIBUSINESS

COLLEGE OF BASIC AND APPLIED SCIENCES, SCHOOL OF AGRICULTURE
UNIVERSITY OF GHANA, LEGON

DECEMBER, 2022

DECLARATION

I, Godfred Wolfgang Michaldo Atanga, do hereby declare that with the exception of my references to literature, which have been duly acknowledged, the work in this Thesis "The Effects of the REDD+ Political Economy on Agrarian Land Access in the Offinso Forest District of Ghana." Is as a result of my research carried out under the most abled supervision of Senior members in the Department of Agricultural Economics and Agribusiness, University of Ghana, Legon, from August 2020 to September 2021. This work, either whole or part has not been presented for another degree in this university or elsewhere.

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05/12/2022

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This Thesis has been submitted for examination with our approval as supervisors.

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DEDICATION

This Thesis is dedicated to the Almighty God for His grace and mercies throughout the entirety of this program.

ACKNOWLEDGEMENT

First of all, I testify to the goodness of the Lord Jesus Christ upon my life for how far He has brought me in my sojourn here on earth. I also wish to extend by sincerest thanks and appreciation to my family and friends (especially, Mr. Mitchris Chapman and Bernard Yaw Ashiadey of the Business & Financial Times) for their immense financial contribution towards the data collection program of this work.

My sincerest thanks also go to Professor Daniel Bruce Sarpong and Professor. Akwasi Mensah Bonsu for their immense contributions to this work as supervisors. I say I am highly privileged to have two of the finest academic brains on the continent of Africa see me through this work. I can only say may God bless them with things that money cannot buy. I also thank all senior members in the Department, especially Dr. Edward Ebo Onumah (for his training in advance mathematics and computer applications-- which have been most relevant to this study) and Dr. John Baptist Jatoe (for arousing my interest in environmental economics that led to the choice of this thesis topic area) for granting me admission and giving me the solid training that equipped me to be able to come out with this work. I say, God richly bless them all.

Finally, I thank Mr. Kobina Adu Baiden, the District Manager of the Offinso Forest District, Mr. Moses Kwesi Yalley, the Assistant District Manager of the Offinso Forestry Commission at Offinso Municipality; Dennis Dei-Kusi, Sampson Baffoe Adjei, Hector Banda, the Range Supervisors in-charge of the Mankrang, Asufu Shelterbelt and Afram Forest Reserves respectively; not forgetting Mr. Joseph Kofi Adjei, the Forest District Cartographer, for their warm reception and immeasurable support accorded me during my field visit and for assisting

me get in touch with the respondents within all 22 forest fringe communities. I can only wish God's guidance and protection for them in their line of duty.

ABSTRACT

Climate change mitigation, security of agricultural livelihoods, and possible carbon financial benefits to forest fringe communities are among the list of benchmarks (known as "safeguards") based on which the *Reducing Emissions from Deforestation and forest Degradation* (REDD+) action would be assessed after implementation in REDD+ countries. However, evidence after decades of the REDD+ implementation in the global south reveal that forest dependent people are being displaced from the forest commons by powerful timber plantation developers who although are beneficiaries of a REDD+ funding window, have competing policy interests, thereby reinforcing the idea of political economy in climate change processes. Meanwhile, some researchers propose that in order to properly diagnose the claim of community forestland struggles due to the REDD+, there is the need to situate the phenomenon within the proper context of political economy, due to the large variety of formal and informal interest groups and actors involved. However, little empirical studies have been conducted in that regard. This study is therefore carried out mainly to ascertain the presence and effect of the REDD+ political economy on agrarian land access within the off-reserve forests. *Principal Component Analysis* is employed together with multivariate Linear Regression to assess the linkage between REDD+ Political Economy and Agrarian Land Access by farmers. The finding reveals that REDD+ political economy is not responsible for displacing farmers from the off-reserve forestlands in the Offinso forest district of the Ashanti Region of Ghana. On the contrary, three socio-economic factors (namely, cost of land, total annual household income and squatting on forestlands) statistically determine a farmer's chances of access to land within the off-reserve. Access to credit was also found to be the most pressing constraint facing farmers within the district. Finally, even though many of the respondents (81%) have never heard of Ghana's REDD+ action, about 100% of the farmers have a very good understanding and appreciation of the need for reducing deforestation and forest degradation, and conservation, sustainable management of forests and enhancement of forest carbon stocks which overlaps entirely with the UNFCCC REDD+ mission and vision. It is therefore the recommendation of this study that apart from Government of Ghana incentivizing Rural and Micro Finance Institutions (RMFIs) to patronize rural financing especially in cocoa growing landscapes, the key outcome of COP26 climate summit in Glasgow, UK in 2021 to honor the 2009 pledge to invest US$100billion in Climate Change mitigation in less wealthy nations such as Ghana be effectuated to help provide financial impetus for securing agricultural livelihoods.

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AgTs.	Agricultural Technologies
ARBs	Association of Rural Banks
CfRN	Coalition for Rainforest Nations
CFA	Confirmatory Factor Analysis
CFI	Cocoa Forest Initiative
CIF	Climate Investment Fund
COP	Conference of the Parties of the UNFCCC
CREMA	Community Resource Management Are
CRIG	Cocoa Research Institute of Ghana
CSOs	Civil Society Organizations
CSR	Corporate Social Responsibility
DGM	Dedicated Grant Mechanism
EFA	Exploratory Factor Analysis
ERL	Emission Reference Level
EU	European Union
FA	Factor Analysis
FAO	Food and Agricultural Organization
FLEGT	Forest Law Enforcement Governance and Trade
GDP	Gross Domestic product
GFC	Ghana Forestry Commission
GHG	Green House Gases
GIPC	Ghana Investment Promotion Center
GPRS I & II	Growth and Poverty Reduction Strategy
GSS	Ghana Statistical Service
HFZ	High Forest Zone

HH	Households
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IDH	The Sustainable Trade Initiative
ILO	International Labor Organization
KMO MSA	Kaiser Meyer-Olkin Measure of Sampling Adequacy
LULUCF	Land Use, Land-use Change, and Forestry
MDBs	Multilateral Development Banks
MDGs	Millennium Development Goals
MLNR	Ministry of Lands and Natural Resources
MOFA	Ministry of Food and Agriculture
MTS	Modified Taungya Scheme
NSZ	Northern Savannah Zone
PCA	Principal Component Analysis
RBCs	Rural and Community Banks
REDD+	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
R-PP	Readiness Preparation Proposal
SDGs	Sustainable Development Goals
SEM	Structural Equation Model
SESA.	Social, Environmental and Strategic Assessment
SPSS.	Statistical Package for Social Sciences
SSA	Sub-Saharan Africa
TNCs.	Transnational Companies
TUC.	Timber Utilization Contracts
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNFF.	United Nations Forum on Forests

UNWCED.	United Nations World Commission on Environment and Development
VIF	Variance Inflation factor
VPA.	Voluntary Partnership Agreement
WBCSD.	World Business Council for Sustainable Development
WRI	World Resource Institute

CHAPTER ONE

1.1. BACKGROUND OF STUDY

Despite seeing a sharp rise in urbanization in recent years, about 60% of Africa's population is still rural and is driven principally by smallholder agriculture (Triki & Faye, 2012). After a steady decline between 2014 and 2019, Ghana's agricultural sector (which includes the forestry subsector) contributed to 18.5% of Ghana's GDP in 2019, with an average nominal GDP contribution of 21.07% from 2010 to 2020. In 2018, Crop (14.5%), livestock (2.7%) and fishery (1.0%) altogether contributed to 92.7% of agriculture's 19.7% contribution to real GDP, whereas forestry and logging represents the remaining 7.3% (Ghana Statistical Service, 2020). Though Ghana's agricultural sector has seen a halving in overall contribution to GDP and employment between 2009 and 2019, the resilient sector employs about 29.75% of the country's economic labor force (Ghana Statistical Service, 2020).

Varying estimates peg the number of households owning or operating a farm plot and/or timber plantation between 44.1% and 51.5%, representing approximately 7.3million people along the agricultural upstream supply chain (Ghana Statistical Service, 2020), hence the need to protect the livelihoods of supply chain actors along the various agricultural value chains in Ghana. The Reducing Emissions from Deforestation and forest Degradation (REDD+) Program initiated by the United Nations Framework Convention on Climate Change (UNFCCC), is targeted at combating climate change through a sustainable forest management system that reduces net Green House Gases (GHG) emissions in the atmosphere of developing countries. Leach & Scoones (2013) and Lyons & Westoby (2014) add that the REDD+ Initiative emerged as a financial incentives-based Climate change mitigation strategy to position forest communities in

Sub-Saharan Africa (SSA) to benefit financially from a climate change mitigation program instituted by the Bretton Woods' *World Bank Group*, the *African Development Bank* and the *International Finance Corporation* respectively in addressing the root causes of Greenhouse Gas emissions due to deforestation and land degradation in developing economies.

The burgeoning concern of reconciling the goals of this new direction of forest conservation through the new Ghana Forest Plantation Strategy (2016 -2040), in which private forest developers also receive funding through a dedicated grant mechanism (DGM) of the Forest Investment Fund (FIP) to engage in sustainable timber production business, with the socio-economic interest of host communities, has become the dilemma of implementers of the REDD+ action in Ghana (Kansanga et al., 2018); and the promise of using this carbon financing window through the forest plantation development program to attain efficient outcomes in forest management in the country has been found by Asiyanbi et al., (2017) and Saeed et al., (2018) to be the reverse after a decade of the REDD+ program implementation.

Due to the increasing number of people that agriculture and for that matter, the forestry sector employs in Ghana, there is the need to pursue policies and programs that efficiently achieve the synergies between improving socioeconomic livelihoods of the rural vulnerable group by securing their access to the forest resource commons as a livelihood source, encouraging private timber producers to practice sustainable timber production while protecting the environment for future generations.

This study thus, examines the claims and findings by previous researchers that farmers of forest fringe communities are either being denied access to farmlands or displaced from their farm holdings within the high forest zone due to a hegemony borne out of the REDD+ institutional action in developing countries such as Ghana.

1.1.1. Definition for Political Economy

Political economy, prior to the segregation between political science and economics in the 1980s was the word for 'Economics'. Jain, (2006) defines it as a study of interactions between political and economic processes in which power and authority of formal and informal institutions influence values, ideas and economic decisions in a society.

The emergence of the REDD+ has introduced new actors into the green economy, whose activities are linked to both the environment and to social justice issues. Forest governance is now being influenced by state actors and non-state actors such as private companies, NGOs, the environmental justice movement at the national level and multilateral bodies and REDD+ implementers at the UNFCCC at the international level who have competing policy interests, which reinforces the idea of political economy within the green economy (Clapp and Dauvergne, 2005). Competition has allowed power play to take center stage in climate change policy processes. Barnett & Duvall (2005) define power play in this context as the production in and through social relation of effects that shape the capacities of actors to determine their own circumstances and fate.

Power as used in green political economy is best defined by Gaventa (2006) as the zero sum where if one set of actors gains power, another set of actors need to relinquish it. Gaventa, (2006) also adds that, using formal rules and processes to deliberately undermine or shortchange local participation in resource governance is a form of power play within the green economy. This study thus defines the opposite of political economy as "Social Capital", which is defined by Richardson (n.d.) as the mutual support, alliances and strengthening of collective power.

According to Bixler et al., (n.d.), Political Economy is being employed by some unsympathetic and unethical human agents and large corporations (aided by the state) hiding behind the pretext of natural resource conservation and sustainability to maximize their parochial private benefits through privatization and exploitation of natural resources from resource commons (originally owned by entire communities), by making other poor and vulnerable groups who equally depend on same commons for survival worse off. The dimensions of this REDD+ Political Economy have been identified from literature to include "Carbonized Exclusion" (Asiyanbi, 2016); "Powers of Exclusion", (Hall, Hirsch, Li, et al., 2011); "Green grabbing" (Osborne, 2011); "Hierarchical Corruption" (Kansanga et al., 2018) and "Exclusion from Procedural rights" (Goldstein & Udry, 2008) which are all extensively discussed below.

1.1.1.1: Carbonized Exclusion

Local farmers (both native and migrant farmers) who are key stakeholders in the REDD+ Program are being displaced and prevented from having access to forestlands by both the Ghana Forestry Commission and private carbon forestry developers (who have become technical owners of forestlands) under the REDD+ Program land titling arrangement, contrary to the REDD+ requirement of farmer participation and mutual benefit to all stakeholders.

Only forest caretakers and tree planters (usually vulnerable local farmers who lost their farmlands to forest plantation developers) who watch over the plantations of these private investors are given small portions of the land for agrarian activities. Thus, the new rules put in place by these new 'owners' have turned many farmers who lived and farmed in the forest for decades into intruders of 'private property'. There have even been instances where local farmers cultivating under state-led integrated forest management systems such as the *Modified Taungya Scheme* (MTS) were evicted from their farms by these new 'owners', instead of living by the REDD+ safeguards to empower them adopt Agroforestry within the *LULUCF*.

This deliberate displacement of poor local farmers to make way for rich private timber producers is what Asiyanbi et al., (2016) nicknamed "carbonized exclusion" in their work at Cross River, Nigeria. And Tobias and Richmond (2014) call "environmental dispossession". Thus, whiles drought and bushfires are responsible for displacing these smallholder farmers from their farms up north (Npong, 2011; Fuseine, 2014), land insecurity due to a political economy of carbon forestry is causing the displacement of smallholder farmers in the middle and southern forest zones. Those farmers who have no access to these private company forestlands resort to illegal cultivation of lands in deep hideouts in the rehabilitated portions of the forest under forest canopies. But such 'illegal' farms when discovered by the GFC taskforce during routine forest patrols get destroyed (Ghana Forestry Commission, 2019).

1.1.1.2: Powers of Exclusion

Decentralized Forest Management (DFM) system in which forest communities are at the heart of decision making in combating deforestation has been reverted by the central government of developing economies and placed in the hands of powerful forest investors due to challenges of meeting the capital requirements of International Funding Agencies to fulfill the country's forest development agenda (Phelps et al., 2010). This reverse in the power of decision-making shifts forest frontier regulation away from local community interest in favor of profit-driven private forest developers who now make new rules to benefit their operations without regard to the livelihoods of local forest communities (Benjaminsen & Bryceson, 2012). This is what Hall et al., (2011) conceptualize as the "Powers of Exclusion" in their work in Singapore, Southeast Asia.

1.1.1.3: Green Grabbing

The "green carbon revolution" currently ongoing in Ghana's forest belt is a profit-making venture for private companies, at the expense of the livelihoods of rural community dwellers; a "savagery of capitalism" in the forest landscape. Nonetheless, in sharp contrast to the Ghanaian

context in which farmers' usufruct rights are being trampled upon and wealth creation activities of private investors reduce farmers into laborers and the environment into a mere input resource under the REDD+ Program (by destroying biodiversity), reports that in Mexico, smallholder rural farmers take advantage of the REDD+ Program to grow their own forest carbon plantations as an alternative source of income, apart from cultivating food crops and cash crops on agro-forestlands they continue to hold formal land rights to (Osborne, 2011).

1.1.1.4: Hierarchical Corruption

In congruent with the constraint of exclusion of local farmers from Ghana's REDD+ Program is what Kasanga et al., (2018) describes as "Hierarchical Corruption": In their desperation to get temporary access to farmlands to cultivate for a particular farming season, many poor rural migrant farmers rely on middlemen. The farmers pay exorbitant monetary inducements to a chain of illegal brokers just to get access to forestlands from forest caretakers and/or other influential community representatives. Hence, farmers who even end up getting access to croplands are not really interested in planting trees or taking care of planted trees but more concerned about meeting their financial obligation to these exorbitant land leases. In any case, land owners (not the farmer) get the lion share of benefits from harvesting any tree that grows on a leased forestland (Kasanga et al., 2018).

1.1.1.5: Exclusion from Procedural Rights

Even though the Readiness-Preparation Proposal (R-PP) of Ghana's REDD+ Program identifies farmers as major stakeholders, the centralized nature of the REDD+ program design excludes decentralized local government, chiefs and farmers from participating in framing district-specific policies, actions and REDD+ measures.

Apart from exclusion from decision making, there is also the problem of information asymmetry borne out of a deliberate attempt to deny host communities crucial information regarding the

nature and scope of the REDD+ program and what they (the community members) stand to benefit. Most communities are unaware of the cash payments that are made to farmers who keep trees on their farms for a certain number of years (i.e. carbon financing).

Finally, apart from exclusion from participating in decision making and lack of a REDD+ awareness campaigns within host communities which has kept the juicy prospects of the REDD+ away from the public, which Spiric et al., (2016) blame on the high cost involved in carrying out these decentralization programs and sensitization campaigns, farmers also do not have access to justice to seek redress for reservations regarding any aspect of the REDD+ implementation.

These altogether is what Goldstein & Udry, (2008) call "exclusion from procedural rights".

1.2. PROBLEM STATEMENT

Although there is not yet an agreement on what should and should not constitute REDD+ safeguards, REDD+ countries are obliged to provide information on country-specific safeguards to the UNFCCC. Ghana, met all the four eligibility criteria to become a REDD+ implementing country to get technical and financial support for reducing emissions from deforestation and forest degradation, while protecting the livelihoods and economic resilience of forest dependent people. The program was initially piloted for cocoa forest mosaic landscape within the country's high forest zone, with a target of removing about 255MtCO_2 from Ghana's atmosphere by 2036. The Offinso Forest District, being one of the 46 forest districts in Ghana, was earmarked for the pilot. Between 2002 and 2010, following the *Expanded Plantation Program* which extended the on-reserve forest sustainable forest management (SFM) activities into the off-reserve forests, the Ghana Forestry Commission (GFC) released forestlands to about 280 private forest investors in 12 forest districts across the country (Insaidoo et al., 2012; Wiersum et al., 2014). The Offinso Forest District was one of the areas in which timber plantation activities were extended into the off-reserve forest.

Majority of these forest developers are transnational corporations whose participation in the local market space according to Insaidoo et al., (2012) weakens the sovereignty and capacity of local developing economies: Some of these private timber plantation developers operating within the Offinso forest frontier include *Portal Limited, FORM Ghana Limited, Mere Plantations Limited, Ecotech Services Limited, Zoil Services Limited, Kwadkoff Company Limited, Logwood Industries Limited and GroTeak Afforestation Limited* (Kasanga et al., 2018). The lacuna in this centralized boardroom decision was the sudden growth in demand for deforested lands within the off-reserve by the burgeoning number of private companies entering the carbon forestry business space to take advantage of the REDD+ Funding windows to cash in. A collusion between the State of Ghana and some powerful private timber developers is what compelled the government to extend the carbon forestry development program from the protected areas into the off-forest (Saeed et al., (2016). With some of the forest developers encroaching beyond the timber plantation frontiers into agricultural lands, by taking over arable lands meant for agricultural activities and converting them into timber farms. The inability of the REDD+ programme implementers in Ghana to reconcile the activities of these profit-maximizing private Investors of the carbon forestry program with the REDD+ Program's core *Cancun safeguards* policy of ensuring that REDD+ initiatives address sensitive welfare (livelihood) issues and social interests of forest fringe community people, defeats the social equity objective of the program in Ghana.

Evidence after a decade of the REDD+ Programme implementation in Ghana reveals that contrary to expert projections that the multiplier effect of the programme would yield sustainable social and economic benefits for rural community dwellers, the programme has encroached beyond acceptable limits and has thus become a bane rather than a blessing for the rural poor (Asiyanbi et al, 2017; Saeed et al, 2018). Such forest-agrarian trade-offs due to the political economy of the REDD+ initiative have been proven by recent studies to be peculiar to developing economies due

to underdeveloped land tenure and unclear property rights regimes, amongst many other gaps (Peskett et al., 2011). The Offinso forest district, with a total forest cover of 40,492ha out of the national total of 2,505,171ha has been identified by previous researchers as a place where the political hegemony within the green economy is prevalent. Some of the issues of concern raised in Ghana's 2012 National REDD+ strategy Readiness-Preparation Proposal's (R-PP's) *Social, Environmental and Strategic Assessment* (SESA) Report (*Ghana REDD + Strategy*, 2016) seem to vindicate the entrenched positions taken by critics of the REDD+ to some extent: Below are some of the problems identified with the REDD+ implementation in Ghana in the 2016 SESA report, of which the Offinso forest district is meant to be no exception:

1. Even though the monetary and non-monetary benefit payments of the Readiness Preparation Proposal (R-PP) in Ghana took into consideration the failures of four (4) pre-REDD+ benefit sharing regimes, namely, *Constitutional Timber Revenue Sharing, Community Resource Management Area (CREMA), Modified Taungya Scheme (MTS)* and *Commercial Plantation* to cater for the livelihoods of vulnerable groups (farmers, land owners and local communities), the R-PP SESA report cites centralized decision making, lack of transparency and accountability, and elite capture as bottlenecks preventing the program from achieving its baseline objective of securing the livelihoods of forest dependent people; this claim is later supported by the findings of Dumenu et al., (n.d.); Lyons & Westoby (2014); Asiyanbi et al., (2017); Beymer-Farris & Bassett (2012).
2. According to the report, backed by findings by Saeed et al., (2018), one other issue fueling the challenges of the REDD+ program in Ghana is key power players such as the International Funding Agencies dictating to REDD+ recipient countries on what to use the REDD+ grants for, without regard to the local constraints facing the recipient countries that need redress. Such interferences make it near impossible to address some country-specific constraints.

3. Meanwhile, the report also points out a collusion between the Ghana Government and some powerful private timber developers (who are funded by the DGM of the REDD+) which has compelled the Government to introduce the "Expanded Plantation Program" to extend the activities of timber plantation companies from the on-reserve into the off-reserve to appease private timber companies. This problem was also alluded to in the work by (Saeed et al., 2018).

From the ongoing, it can be deduced that the Ghana National REDD+ SESA report blames the challenges of the REDD+ implementation in Ghana on the power play (political economy) underpinning the initiative. Hence the need for research to examine the effect of this political economy on agrarian land access by rural farmers within the Offinso off-reserve forest of the High Forest Zone where the REDD+ has been piloted or implemented:

Most studies on REDD+ in Sub-Saharan Africa that assess livelihood impacts of REDD+ are carried out in both protected areas and off-reserve forests, even though the scope of the REDD+ financial incentives-based climate change mitigation strategy on rural livelihoods does not fall within the ambience of the 20% protected areas. Any such study (in both on-reserve and off-reserve activities) will definitely reveal a high number of displaced farmers, informed by displacements from the on-reserve forest (which is a protected area under state control with restricted access) that needs to be protected from encroachment of human activities. The REDD+ policy preserves old growth forests and values standing forests.

This study examines the phenomenon of REDD+ effects on agrarian land access in the 80% off-reserve forest landscape of the High Forest Zone where farming activities are permissible. Peluso & Lund, (2011), Hall, Hirsch, & Li, (2011) and Montefrio (2017) also proposed that in order to properly diagnose the problem of community forestland struggles between the rich (capitalists) and the rural poor, there is the need to situate it within the proper context of political economies

of land access, due to the large variety of formal and informal interest groups and actors involved.

In the light of this, this study proposes the need to situate the phenomenon within the proper context of geopolitics; by assuming that there is nothing untoward about barring anthropogenic activities within Ghana's 20% protected area and wildlife reserves. Since there is the need to protect the country's remaining virgin forest estates, which is currently suffering an annual depletion rate of 31% (Ghana Forestry Commission, 2020). Since the REDD+ Project objective as captured in all REDD+ Ghana country documents emphatically states that the project is to contribute simultaneously to carbon stocks and poverty reduction in the off-reserve areas of the High Forest Zone, any form of assessment of displacement of squatters or denial of access to forestlands other than the off-reserve is misleading.

Secondly, according to Isyaku et al., (2017), the REDD+ implementation in Ghana is overly focused on cocoa landscapes where land tenure insecurity prior to the inception of the REDD+ implementation has always been a major constraint to farmers (especially migrants) who enter various forms of unfavorable land lease arrangements that do not guarantee good returns on their farming investments, thereby leaving them impoverished. Hence, apart from demanding that the phenomenon be examined within the off-reserve context, this study analyzes the multiplier effects due to an already existing tenurial insecurity problem, coupled with the high cost of land acquisition due to market forces of supply and demand (both being non-institutional factors) and other non-REDD+ confounding factors could be engendering the problems of land access that are being blamed squarely on REDD+ hegemony: Bugri et al., (2017) reveals in his study that Africa's underdeveloped land tenure system is principally responsible for the continent's low agricultural productivity, non-tenurial factors such as lack of access to finance, poor soil fertility, over-reliance on rainfed agriculture, pests and disease infestations, deforestation, draught and bushfires are also statistically significant variables determining household livelihoods on the

continent, with finance ranking first and land access ranking 6th.

Thirdly, critics of the REDD+ seem to be treating the REDD+ Program as a unidimensional entity with a "one size fit all" assessment of the phenomenon. This study however finds such wholesale impact assessment misleading, due to the multidimensional (Four phase) and heterogeneous nature of Ghana's REDD+ Strategy. The study proposes an empirical analysis that treats each of the REDD+ dimensions as isolated cases with unique characteristics for a better appreciation and robust empirical analysis of the issues at stake.

Finally, few researchers who have ventured into studies that investigate the causal relationship between political ecology and the problem of environmental ethics in the forest commons generally employ the qualitative approach, which deals with very small sample sizes (due to the data collection methods used--such as in-depth key informant interviews, surveillance and participant observations), and misleading sampling technique, and so do not do a great job at testing causal relationships between the variables of interest.

This work fills that gap with correlational (quantitative) research that uses a relatively larger sample size and operational definitions to translate the non-numerical, abstract and non-observable "REDD+ Political Economy" independent latent constructs (i.e.) and its dimensions into quantifiable variables which is then processed by factor analysis and multiple linear regression to obtain valid estimates for further causative effect analysis between the variable of interest (i.e. REDD+ Hegemony) and rural farmers' access to lands for smallholder crop and/or timber production within the off-reserve forests of the high forest zone, in accordance with the scope and nature of Ghana's REDD+ Implementation plan.

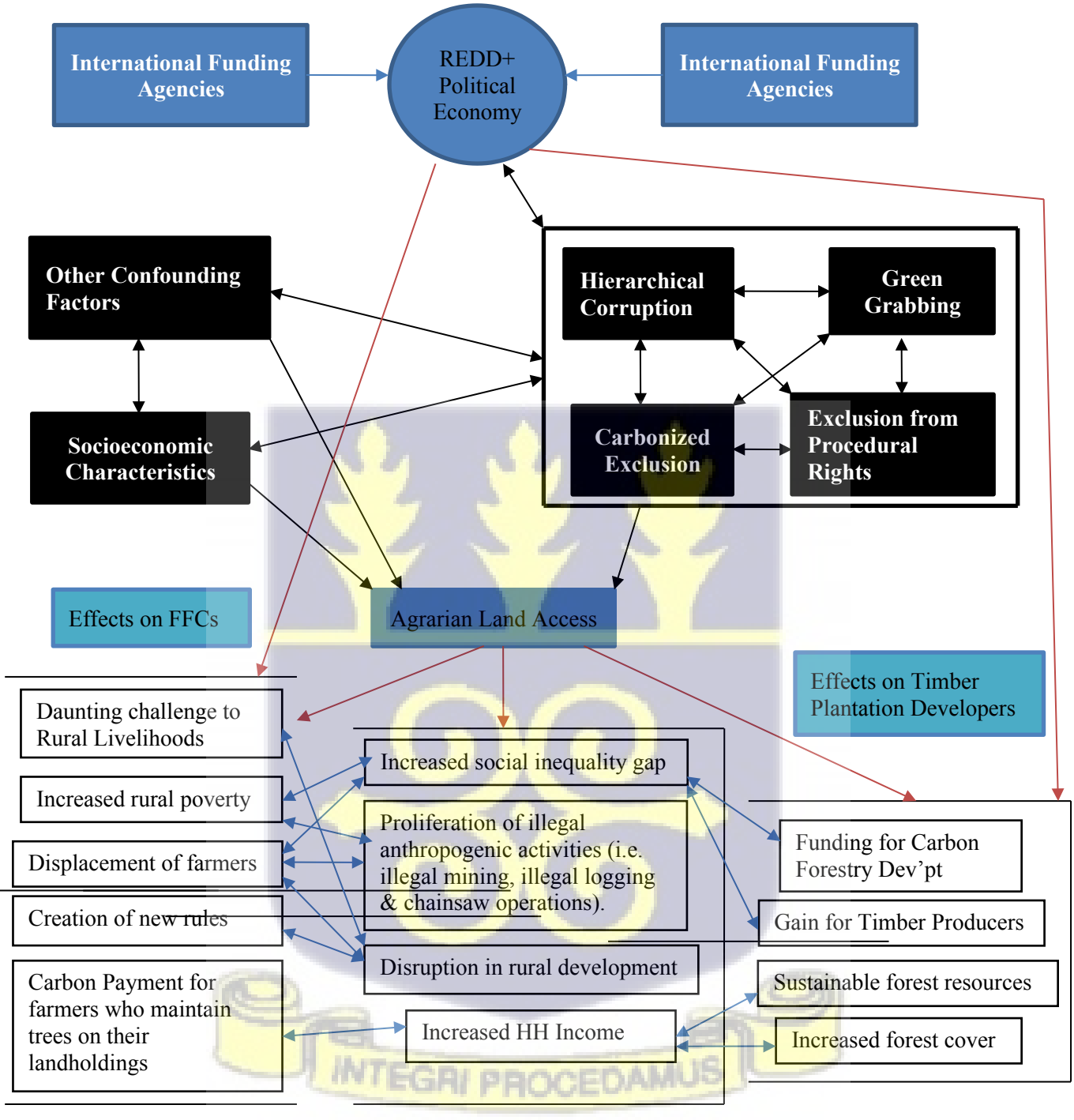
1.3. CONCEPTUAL FRAMEWORK

The central argument of this study is that apart from demographic and socio-politico-economic factors, and other confounding factors, political economy due to the United Nation's REDD+ program does not limit farmers' access to agrarian lands within the off-reserve community forests of the high forest zone (HFZ). Thus, when it comes to compromises in the livelihoods of forest fringe community dwellers operating within the off-reserve, a plethora of factors can be blamed, but not the novel REDD+ action. (Bugri et al., 2017; Lawry et al., 2017; Goldstein & Udry, 2008). Nonetheless, extending the analysis into the "Protected Areas" significantly changes the narrative: Berry (2009) postulates that lands within the on-reserve which were initially demarcated for various livelihood and agroforestry intervention programs are being reclaimed, and farmers evicted due to failure of these interventions to achieve their set objective.

It is therefore the alternative hypothesis of this study that, even within the off-reserve (production forest), removing barriers due to the REDD+ such as "carbonized exclusion", "hierarchical corruption", "green grabbing" and giving household heads access to procedural rights, without enhancing the demographic and socioeconomic portfolio of smallholder farmers within forest fringe communities, as well as removing certain forest governance institutional bottle necks, will still make land accessibility a daunting challenge for forest fringe communities, with precarious consequences on their household food security status and economic livelihoods. According to Feder et al., (1990), land tenure security increases the smallholder farmers' propensity to invest long term in agricultural production on secured croplands, thereby improving their livelihoods and increasing food security, while contributing to rural and national development. This work draws on the experiences, demographics and biophysical activities of 194 rural farmers, with particular emphasis on off-reserve farming activities, and other key forest

stakeholders within the LULUCF such as district forest managers, forest range supervisors and agricultural extension agents, while analyzing reports of the GFC and review of other scholarly works and reports on the REDD+, in order to contribute to the on-going political economy debate championed by (Bryant, 1997), (Stott, 2000); (Ninla Elmawati Falabiba, 2019) and (Makki, 2012) about the effects that the entry of Transnational companies (TNCs) in global resource management (with REDD+ funding), are having on agriculture and rural development of developing nations. Hence, we wish to conceptualize this study with a multi-dimensional tenure causation and land access nexus in **Figure 1.1**:

Figure 1.1. Pictorial Diagram of Conceptual Framework



Source: Author' Conceptualization based on Literature, 2021.

1.4. RESEARCH QUESTIONS

Hence this Study seeks to provide answers to the following questions:

1. What is the linkage between the REDD+ Political Economy and agrarian land access of farmers in the study area?
2. What are the major constraints affecting farmers operating within the Study Area?
3. What is the level of farmers' understanding and appreciation of forest conservation and sustainable agriculture
4. What are the perspectives of the farmers about the nature and scope of strategic corporate social responsibility (CSR) programs undertaken by private timber corporations operating within the study area?

1.5. OBJECTIVES OF STUDY

The main objective of the study is to assess the linkage between REDD+ Political Economy and Agrarian Land Access of farmers in the Study Area. The following specific objectives lend credence to the main objective of study:

1.5.1. Estimate the linkage between REDD+ Political Economy and Agrarian Land Access of farmers in the Study Area

1.5.2. Identify and rank the major constraints facing farmers in the study area.

1.5.3. Examine the level of farmers' understanding and appreciation of forest conservation and sustainable agriculture.

1.5.4. Describe farmers' perspective about the nature and scope of Corporate Social Responsibility (CSR) programs that private forest companies operating within the study area have undertaken in the past 5years.

1.6. RELEVANCE OF THE STUDY

Wealth of literature abounds in Development Economics, Welfare Economics, Environmental Economics and Resource Economics respectively on issues pertaining to sustainable forest resource management at the International level. Howbeit, the focus of most of these scholars only narrowly addresses the very critical issues of environmental ethics (i.e. equity, fairness and social welfare) in Sustainable Forest Management interventions such as the REDD+ Program. The global research concern is mainly about conserving biodiversity, enhancing high carbon sequestration portfolios in the world's forests and maintaining sustainable economic returns on investments made by Private sector players in the green carbon forestry industry, with little or no commitment to studies that assess the impact of these capitalist interventions on environmental processes and the livelihoods of forested community dwellers, especially in developing countries where clearly defined property rights and land tenure security do not exist, and where the inception of the REDD+ Program has led to a reversal in the Decentralized Forest Management system, and forested communities no longer have a say in matters of forest governance, unlike in developed countries where same REDD+ Program has been successful in achieving equitable outcomes (Corbera, 2020)

Secondly, the few researchers who have ventured into studies that investigate the causal relationship between political ecology and the problem of environmental ethics in the commons generally employ the qualitative approach, which deals with very small sample sizes (due to the

data collection methods used--such as in-depth key informant interviews, surveillance and participant observations), and do not do a great job at testing causal relationships.

This work fills that gap with a correlational (quantitative) research that uses operational definitions to translate the non-numerical, abstract and non-observable "REDD+ Political Economy" independent latent construct and its dimensions (namely: Carbonized Exclusion, Hierarchical Corruption, Green Grabbing and Exclusion from Procedural Rights) into quantifiable variables which is then processed by factor analysis and multiple linear regression to obtain valid estimates for further causative effect analysis between the variable of interest (i.e. REDD+ Political Economy) and agrarian land access for crop and/or timber production within the off-reserve forests of the high forest zone, in accordance with the scope and nature of Ghana's REDD+ Implementation plan. This work introduces an econometric dimension to a context-specific (developing country) knowledge on the subject matter, and add to works done by previous researchers to deal with issues bothering on equity, inequalities and structural causes of rural poverty in the forest commons.

Thirdly, researchers such as Aha & Ayitey, (2017) and Boamah & Overå, (2016) who conducted their surveys on the involvement of multinational companies in forest governance in Ghana focused their attention solely on the middle and savanna forest zones, but ignored the conspicuous and pervasive political economy ongoing in the high forest zone where private timber producing companies are purported to be taking over community forestlands designated for agrarian activities.

Other researchers such as Hall, Hirsch, Li, et al., (2011) also theorize the need for local farmers to be included in the REDD+ carbon forestry Program as is the case in some non-African countries. This study's main focus on rural farmers' access to agrarian land within community forests rather than their inclusion in the carbon forestry program is based on the findings of Asiyanbi et al., (2017) that,

allowing the farmers to participate in the REDD+ Program does not necessarily guarantee them access to land and/or any benefit rights. The existing regulatory framework of the Ghana Forestry Commission does not ban local landowners from partaking in the forest plantation business per se. What is imperative is land ownership or usufruct rights: If a farmer gets access to one hectare of land, the decision to participate or not to participate in the timber production business would be entirely their choice to make, and they will do so, based on favorable laws and regulatory framework, funding opportunities and market incentives available to them.

Also, at the national level, the results of this study will contribute to policy on forest governance in the country to help the Ghana Forestry Commission and the REDD+ Program in Ghana achieve economically and socially efficient outcomes that will effectively deal with the quandary of environmental integrity and ecosystem threats without compromise to rural livelihoods:

Meanwhile, the Corporate Social Responsibility policies and recommendations of this research shall help Civil Society Organizations (CSOs) through partnership with key stakeholders to canvass for a reconsideration of existing Corporate Social Responsibility frameworks being embarked upon by multinational corporations operating within the country's natural resource commons to augment the national environmental policies already in place to ensure that the operations of these multinational yield equitable outcomes and conform to global norms.

Thus, the policy recommendations of this study if adopted into the broader national goals and objectives of both the Ghana's Forestry Commission (GFC) and the Ministry of Food and Agriculture (MOFA) and other relevant state agencies will fast-track the achievement of the vision and mission statements of the *Growth and Poverty Reduction Strategy* (GPRS II), by inuring to the benefits of all smallholder farmers within the LULUCF of Ghana's Forest Zone.

1.7. ORGANIZATION OF STUDY

Chapter One encompasses the background, problem statement, conceptual framework, objectives and relevance of the study. The literature review of this study is discussed in Chapter Two (2), whereas Chapter Three (3) captures the theoretical framework, methods of data analysis and data collection method (i.e. sources of data and instruments employed, sampling procedure, interview procedure and study area). Chapter Four (4) outlines the results and discussions of the study, and the summary, conclusions, and recommendations of the study follow in Chapter Five (5).

CHAPTER TWO

LITERATURE REVIEW

2.1. INTRODUCTION

The Agricultural sector in Ghana constitutes about 33% of the country's labor force, 30% of export earnings and 19.7% of GDP (Ghana Statistical Service, 2020). In 2019, 58,000km^2 out of the 136,000km^2 of Agricultural land area in Ghana, representing 24% of the nation's 238,539km^2 total landmass was under cultivation. Agricultural land Area refers to arable lands for annual food crops, permanent croplands for perennial cash crops and permanent pasture for animal grazing (*Food and Agriculture Organization (FAO) High-Level Political Forum 2018*, 2018). This implies that Permanent croplands include parts of the production (off-reserve) forests where non-timber production such as cocoa, oil palm, cashew and rubber take place, but excludes the timber production forest and on-reserve forests where agrarian activities are restricted. According to the Ghana Forestry Commission, (2020), Ghana's current vegetation cover is broadly categorized into three zones as depicted in Table 2.1:

Table 2.1: Ghana's current vegetation cover

Forest Zone	Coverage Area /million Ha
High Forest Zone (HFZ)	1.962
Transitional Forest	0.248
Savanna Forest	3.559

Source: (Author's modification of GFC, 2020)

Thus, the High Forest Zone in the south accounts for a third of the country's land area, whereas the Savanna and transitional zones account for the remaining two-thirds. This data implies that huge chunk of Ghana's agrarian lands lies in the northern part of the country. Howbeit, Climate Change induced factors such as droughts, desertification, floods and bush fires, coupled with low soil fertility in arable lands, aided by the November to March dry harmattan season up north and other harsh biophysical conditions have led to a displacement of an avalanche number of farmers who flee from these hard-to-till farmlands up north into the relatively favorable and fertile lands within the High Forest Zone (HFZ) down south, where they farm under various sharecropping and rental arrangements with native forestland owners (Tabeau et al., 2017).

The expansion of agricultural lands into the forest frontiers due to the entry of these northern migrant farmers has engendered area expansion which has led to losses in Ghana's overall forest cover, with dire climate change consequences for forested communities. According to the Ghana Forest Investment Plan (2019), since 2013, about 794,214ha (7,942km^2) on average of Ghana's forest is lost annually to agriculture and other anthropogenic activities.

The previous State-led *Modified Taungya Scheme* (MTS) which replaced the *Community Resource Management Areas* (CREMAs) in 2002 in which the State granted smallholder farmers (including settlers) access to farmlands within the reserve forests, and in return tend to trees planted by the GFC and all on-farm naturally growing trees, is what attracted most of these migrant farmers into the high forest zone. They built their homes in the middle of their newly acquired farmlands in the deepest parts of the forest, secluded from the rest of the local community, where they stay and work on their cash crop and food crop farms; and occasionally

come to town especially on market days to trade. The native smallholder farmers on the other hand with their superior socio-economic status live in the town and engage in wide range of alternative livelihood activities, apart from farming and leasing out their lands to these migrant farmers under sharecropping and land rental arrangements (Kasanga et al., 2018).

Thus, apart from the sharecropping and land rental arrangements that migrant farmers have with native forestland owners, some migrant farmers also got usufruct rights under the Taungya scheme to intercrop their crops with shade trees in the on-reserve until the trees reach full canopy. Most of these farms from the *Modified Taungya Scheme* were later alienated as admitted farms at the time of gazetting. According to a field survey conducted by the World Cocoa Foundation in 2016 in all cocoa growing Regions in Ghana, 40% of cocoa farmers in the country are migrant farmers from other parts of the country: About 63% of cocoa farms were cultivated by their owners and the remaining 37% farms were managed by migrant farmers: 22.7% *abunu* (50:50 sharing arrangement with owner), 14.5% *abusa* (landowner: farmer: farm cost) and 0.1% rented farms (CRIG, 2017). Howbeit, this growth prospect could be eroded by land tenure and agricultural livelihood insecurities and climate change, if farmers are deprived access to agrarian farmlands within the *Land Use and Land Use change and Forestry* (LULUCF) of the high forest zone.

Occupancy and agriculture are prohibited from taking place in about 1.76million ha (21%) of Ghana's outstanding High Forest biodiversity hotspot, (apart from those farms admitted at the time of gazetting) (GFC, 2020). It is therefore the duty of the Forestry Commission to ensure that the reserves are permanently protected without any further encroachment or area expansion within the on-reserve forest landscape.

2.2. THE ORIGIN AND DEVELOPMENT OF SUSTAINABLE FOREST MANAGEMENT IN GHANA.

Prior to the establishment of the *Joint Framework for Action* of the Ghana/Cote D'Ivoire *Cocoa & Forests Initiative* in 2017, consented efforts have been made in both past and present seeking environmentally and socially sustainable ways of exploiting Ghana's forest resource common (IDH, 2020). The mission of the *Joint Framework for Action,* with partnership from the private sector (i.e. World Cocoa Foundation, IDH [Sustainable Trade Initiative] and 35 leading cocoa and chocolate companies – 855 of global cocoa usage) is to conserve, restore and rehabilitate the country's 21 wildlife protected areas and end deforestation and forest degradation in cocoa growing landscapes through community engagements and social inclusion, to ensure that cocoa productivity is no longer at the mercy of trading off the country's old growth forest for cocoa (IDH, 2020).

The cocoa production frontier alone accounts for 50% of agricultural deforestation in Ghana (Akrofi-Atitianti et al., 2018). Intensive farming systems which maximize farm yields mainly through cropland area expansion and huge application of agrochemicals such as fertilizer, pesticides and herbicides, and the use of genetically modified planting materials to meet the daunting demand pressures of population growth and foreign exchange earnings has been the main driver of cocoa productivity in Ghana: Ghana is the second largest producer of cocoa after Cote D'Ivoire. But the high productivity is due mainly to cocoa area expansion (deforestation) and not yield per hectare per se: Ghana produces on average 330kg/ha of cocoa. Cote D'Ivoire, Indonesia and Malaysia on the other hand, produce 580kg/ha, 770kg/ha and 1,700kg/ha on average respectively (Akrofi-Atitianti et al., 2018). Prior to the CFI, Ghana's development agenda from *Vision 2020*, *GPRS I & II* to the *Ghana Shared Growth, and Development Agenda (GSGDA)*, as part of the country's commitment to the global sustainable development agenda have always prioritized forest conservation:

Following the 2015 replacement of the Millennium Development Goals (MDGs) with the seventeen (17) Sustainable Development Goals (SDGs), in which goal 15 entreats UN member countries to take steps to conserve and restore the ecosystem, halt biodiversity loss, deforestation and land degradation in combating climate change, with target 2 of the goal 15 advocating doing so in a sustainable way, the country has intensified its commitment towards the global agenda, especially with the coming on board of several international funding windows to support member states in that regard (United Nations, 2018).

Before the State got directly involved in the Management of Ghana's forest resources, there were customary Laws dating back to the 18th century that made Chiefs the custodians of forestlands. These forestlands were administered to farmers who had user rights under customary Law (Teye, 2005). The Colonial Government, who had a principal interest in exploiting Ghana's huge forest timber harvesting potential, put in place a Forest Ordinance in 1906 to control commercial tree felling in the colony, and established the Forestry Department in 1908 to transfer the oversight responsibility of stool lands from the Traditional authorities to the modern Authorities. These stool lands were now classified as on-reserve forests to be under the control of the colonial Government (Owubah et al., 2001).

The forest demarcation exercise which begun in 1928, culminated in a Forest Management Policy in 1948 which gazetted about 282 forest reserves and 15 wildlife protected areas, sitting on a 38,000 km^2 (about 16% of Ghana's total landmass) at the time. According to (Owubah et al., 2001), this gazetting was done without consulting with the Chiefs, and without regard to the usufruct rights of the forest fringe dwellers or the long-standing customary land tenure system being practiced by the people. Only about 4,000km^2 of off-reserve forest lying outside the gazetted area were made available to the rural folks for their anthropogenic activities.

Meanwhile, timber production is banned from taking place in the on and off reserve forests of the Northern Savannah Zone (NSZ), which stretch from the five (5) Northern regions to the Greater Accra region and parts of the Central and Volta Regions. Even though anthropogenic activities for domestic consumption are permitted for rural folks in the NSZ forest areas, these forests serve principally as protection for the headwaters of the major rivers flowing into the Volta Basin (GFC, 2006). Thus, timber utilization contracts (TUCs) that give harvesting rights to loggers to grow and harvest timber, only persists in the high forest zone in the Middle and Southern Zones but not in the NSZ. This top-bottom Government–led forest management approach is what has prevailed throughout the decades to this very day. The President of the Republic is today the custodian of Ghana's forest timber. Any person who wishes to harvest timber pays timber dues (stumpage fees) to Government and stool land owner as compensation for privately benefiting from the forest, which is a public property.

Prior to the global MDGs and SDGs, litany of forest, wildlife and trade policies have been instituted by the Ghana Government to enhance the sustainable forest governance portfolio of the country: Chief among these policies are the *Forest Commission Act* of 1960 (amended in 1999); the *Forest Concession Act* of 1962 (amended in 1999—Act 571); the *Land Administration Act* of 1984; the *Control and Prevention of Bushfires Law* of 1990, *Forest and Wildlife Policy* of 1994 (amended in 2001), the *Forest and Plantation Development Act* of 2000 (Act 583 -- that gave private commercial timber producers grant of financial assistance to carry out their forest plantation and harvesting activities). *Forest Protection Act*, 2002 (Act 624); the *Timber Resources Management Act* of 1997, amended in 2002 and 2003, is an amendment of the 1999 *Forest Commission Act* that established the *Timber Utilization Contracts* (TUCs) to ensure that landowners and local farmers from whose forestlands tree are harvested, benefit from harvest proceeds.

It is also the amendment that banned chainsaw operations in commercial tree harvesting and introduced competitive bidding for timber harvesting grants for private sector players. Finally, this *Timber Resources Management Act* policy gave the *Forestry Commission* absolute power to disqualify the harvesting rights of persons who engage in illegal chainsaw operations (Ministry of Lands and Natural Resources, 2014).

Meanwhile, the *Ghanaian Companies Code* of 1963 (Act 179) and the *Private Partnerships Act* of 1962 (Act 152) are the two policies that give loggers the right to fell and harvest trees in Ghana under a Trade Union Corporation (TUC) arrangement.

Finally, the 2008 European Union's Forest Law Enforcement Governance and Trade (FLEGT) *Voluntary Partnership Agreement* (VPA) between Ghana and the European Union is what has ensured that only legally produced timber from Ghana is licensed for the EU market. However, the integrated community forest scheme of the VPA that also seeks to address the issue of unfair benefit sharing and restricted access to forestlands by rural dwellers is yet to be fully realized.

Watts et al., (2018) state that even though the VPA has helped in removing the restriction in the allocation procedure of timber rights and now makes it open to all citizens, the bidding process which excludes many local actors including "Nananom" (the Chiefs) is too expensive, and poor rural farmers are still short-changed. The State in the year 2000 put in place the *Community Resource Management Areas* (CREMAs) to get local actors involved in the forest governance decision making (Watts et al., 2018). This metamorphosed two years later in 2002 into the *Modified Taungya Scheme* (MTS) to place more emphasis on reforestation agenda, through which rural community workforce, acting as the main source of labor would improve their livelihoods (Watts et al., 2018). Under the MTS, deforested lands were given to the farmers

to be used for agrarian activities while tending trees planted on these lands by the Forestry Commission until they attain close canopy usually after 3years. But the scheme for benefit sharing of 40-40-15-5 among the GFC, the gang of farmers (operating in forest compartments), the traditional landowners and the community adjacent to the forest (in that order), made the tree tenure regime unfavorable to the farmers, for which reason they deliberately sabotaged the scheme by not taking proper care of the trees (Acheampong et al., 2016). This eventually led to the displacement of these disgruntled farmers from the on-reserve. Nonetheless, the Modified Taungya Scheme is still ongoing in forest fringe communities in which the program has proven successful.

The failure to address the imperfections of the tree tenure regime, coupled with several other factors (e.g. illegal logging, illegal mining, illegal area expansion of crop farms, etc.) spelt doom for the carbon sequestration profile of the country by turning a once net sink *Land Use Land Use Change and Forestry* (LULUCF) sector into a net emitter, emitting about 42.3MtCO_2e; 25% of the country's total GHG emissions (Kasanga et al, 2017).

A fast depleting biomass due to deforestation leads to very low rate of carbon sequestration, thereby releasing green carbon in the form of GHG into the atmosphere instead of storing them in plant biomass and in the forest floors and soils. When the carrying capacity of the atmosphere is exceeded, the recycling and removal rate of green carbon in the carbon cycle slows down, leading to global warming and its attendant Climate Change adverse effects.

It is for the singular purpose of combating the threat of deforestation through a comprehensive reforestation and sustainable forest plantation development and carbon sequestration plan that Ghana, a member of the United Nations Framework Convention for Climate Change (UNFCCC), signed up for the REDD+ Program in 2010 (Hall, Hirsch, Li, et al., 2011).

In their study to examine how the REDD+ program is addressing agricultural area expansion on forests, Romain Pirard and Karine Belna (2011) in their analysis of empirical results from case studies from five REDD+ implementing countries on the Forest Carbon Partnership Facility, conclude that there is lack of robustness in the Borlaug sparing hypothesis (which states that increases in agricultural productivity per hectare of land leads to decreased area of cultivated land). On the contrary, their study concludes that lack of public support policies to guarantee the efficient working of land reforms in favor of reducing deforestation is a major bottleneck in these implementing countries. Nevertheless, the study failed to examine the role of the effective use of REDD+ funds in ensuring a proper reflection of scientific theories (i.e. Borlaug sparing hypothesis) and policy implementation for reversing deforestation in the tropics.

Ari Rakatama, Ram Pandit, Chunbo Ma and Sayed Iftekhar (2016) in their assessment of 60 unique studies on costs and benefits of REDD+ projects across the world reveal that only 4 out the 60 studies deal with monetary benefits for REDD+ safeguard beneficiaries, with 21 and 23 for transaction and REDD+ implementation costs and total costs respectively. The study proposes that future REDD+ costs and benefits studies capture estimates of all relevant costs and benefits and how these costs and benefits are distributed among various REDD+ stakeholders. Thus, the study points to lapses in REDD+ project design and implementation. This study finds inclusiveness of carbon payments to forest fringe communities as one of those lapses in need of redress.

An empirical assessment of participatory mechanisms, accountability and inclusive decision making in REDD+ implementation in Vietnam, in which the influence of various interest groups and the participation of policy actors in the formulation of REDD+ instruments was studied, reveals the dominant role of government agencies in REDD+ policy making, leaving small space for non-state actors such as CSOs and NGOs (Thuy T. Pham *et al*., 2014). The study however

found evidence of political space given to some non-state actors to propose policy alternatives. Nevertheless, the study admit to a top-down political economy in forest governance in Vietnam. This study favors a more participatory form of decision making which allows community leaders of forest dwellers to be at the forefront of REDD+ implementation. Hence examines the phenomenon of inclusive forest management within the African context.

Data from an empirical study on the relationship between subnational governments and REDD+ in 14 states from 5-member countries of the Climate and Forests Task Force (i.e. US, Brazil, Indonesia, Nigeria and Mexico) show that some state governments have helped in reducing deforestation using different strategies and motives (Fabiano Toni, 2011). The GCF seeks to integrate REDD+ and other forest carbon activities into emerging greenhouse gas compliance regimes. Some governors were pressured by their Government, donor groups and markets at the top, and their constituents at the bottom to get actively involved in REDD+. The study concludes that decentralization stands to benefit from REDD+ action in implementing countries.

2.3. THE ORIGIN, NATURE AND SCOPE OF THE REDD+ ACTION

2.3.1. Definition of Terminology

In 2005, at the 11th session of the Conference of the Parties (COP) of the UNFCCC, Papua New Guinea and Cost Rica, on behalf of the *Coalition for Rainforest Nations* (CfRN) submitted a proposal entitled "*Reducing Emissions Deforestation in Developing Countries*: *Approaches to Stimulate action."* The document, from which the acronym (REDD) was first coined, proposed a discussion on measures to tackling emissions due to deforestation and land degradation in natural forests.

However, it was at the 15th session of the COP's convention in Copenhagen in 2009 that the sustainability and forest carbon sequestration dimensions were included in the scope of the REDD agenda. This led to the subsequent replacement of REDD with the most recent and

elaborate REDD-Plus terminology: Hence, the full meaning of the acronym "REDD+' as defined by the UNFCCC is "reducing emissions from deforestation *and forest degradation* in developing countries on one hand, and the role of *conservation, sustainable management of forests, and enhancement of forest carbon stocks* in developing countries on the other".

2.3.2. Main Elements of the REDD+

The REDD+ seeks to encourage and provide technical and financial support for the fight against climate change at the national level by tasking developing countries to use a variety of sustainable forest management options in removing GHG emissions due to deforestation and land degradation within their forest landscapes, while ensuring that the livelihoods of forest fringe communities are not compromised (Harvey et al., 2010).

Due to the technical and financial support it provides, the UNFCCC has prescribed guidelines on how the REDD+ Program ought to be implemented in developing countries. But to safeguard national sovereignty and subsidiarity, the UNFCCC does not dictate to these nations on how to implement the said mechanism within their respective countries. It only demands for reports (in prescribed format) from implementing countries for review.

For a country to qualify for a REDD+ implementation, the following basic requirements of the UNFCCC must be met:

(a) Must have a national REDD+ Action plan

(b) A national or subnational forest reference emission level or forest reference level.

(c) A transparent and robust forest monitoring system

(d) A mechanism for providing information regarding how the social and environmental safeguards (included in an appendix to the decision) are being addressed and respected throughout the implementation of REDD+ (Pistorius, 2012).

2.3.3. National Policies and Measures for REDD+ Implementation

This refers to the set of legal, administrative and regulatory instruments that parties develop and implement to achieve the objective of the UNFCCC (Saeed et al., 2018). Only policies geared towards sustainable forest management (with particular emphasis on the causes of deforestation and forest degradation), climate change adaptation or mitigation or Carbon sequestration and poverty eradication (through climate smart agriculture) pass as a REDD+ National policy. With forest lands being sinks of greenhouse gases, any policy that enhances the conservation and sustainable exploitation of forest resources is accepted as a REDD+ eligible activity deserving of technical and financial support from the Climate Investment Fund of the UNFCCC (Ochieng, 2010; Chhatre et al., 2012).

2.3.4. Ghana's REDD+ Strategy

Ghana, having met all four (4) requirements of the REDD+ eligibility criteria (i.e. Readiness Organization & Consultation, REDD+ Strategy Preparation and Emission Reference Level (ERL) set up, and the safeguards Monitoring system) have identified the following as drivers of deforestation and land degradation:

Table 2.2: Causes of Deforestation in Ghana

ANTHROPOGENIC ACTIVITY	%
Agricultural Expansion	50
Wood/charcoal Harvesting	35
Population and Development Pressures	10
Mining, sand winning and Mineral Exploration	05

Source: (Author's modification of FIP, 2019)

Ghana opted for the REDD+ in 2010 to reduce emissions from deforestation, forest degradation

by implementing sustainable forest management programs that enhance the country's carbon sequestration portfolio within the forest landscape. Three of such programs have been launched, with three more being developed: The operational REDD+ Programs include:

1. Emission reduction programme for Cocoa forest Mosaic landscape within the high forest zone.
2. Emission reduction programme for shea landscape within the savanna forest zone.
3. Tree tenure and Carbon rights Policy and legislative reforms for enhanced benefit sharing regime.

Other programs still under development include:

4. Emission reduction programme for transitional forest zone.
5. Emission reduction programme for coastal mangroves.
6. Emission reduction programme for the Togo Plateau.

(UNFF, 2018)

Between 2021 and 2036, REDD+ Program Implementation in Ghana is expected to remove 255.0MtCO_2e from Ghana's atmosphere (United Nations, 2018).

2.3.5. Funding Windows for Ghana's REDD+ Strategy

Various Funding mechanisms have been accessed for implementing REDD+ Activities in the country. Some of them include:

7. The Forest Preservation Program that got funding from the Japan Government
8. Forest Carbon Partnership Fund of the World Bank [supported Ghana's REDD+ Readiness Preparation Phase (R-PP)].
9. The Dedicated Grant Mechanism for indigenous peoples and local communities (DGM) (which is an annex of the Climate Investment Fund with support from the Multilateral Development Banks (MDBs). So far, Ghana has benefitted US$5.5m from this fund.

10. Ghana Forest Investment Program which got multilateral funding from the World Bank's Strategic Climate Fund (US$30m), African Development Bank (US$15.33m) and the International Finance Corporation (US$10m).

The International Finance Corporation and the Dedicated Grant Mechanism are the Funding windows engaging the private sector led Carbon Forestry Development Program whose purview, this study falls within. Thus, this study proposes a synergy between optimizing crop yield per hectare and reclaiming deforested lands and reducing emissions within Ghana's forest landscape, while ensuring that farmers already operating within the production forests (which are now a safe haven for migrant farmers displaced by climate change up north) are not shortchanged by the Private sector-led Carbon forestry Initiative being fueled by REDD+ Financiers, but are highly incentivized to adopt Agroforestry practices to augment Ghana's overall carbon sequestration portfolio, while simultaneously and intentionally increasing national food security and economic growth. Ghana joined the REDD+ Programme in 2010 with the principal goal of reclaiming 40% of its degraded forest lands and supporting green carbon forest Plantation Development; while fulfilling the REDD+ safeguards by promoting climate-smart agrarian activities in cocoa growing communities, especially in communities within the *Land use, Land-use Change and Forestry* (LULUCF) of the country's High Forest Zone (World Bank, 2015).

According to Sunderlin et al., (2014) and Lyons & Westoby, (2014), the main purpose of the REDD+ Programme is to incorporate the livelihoods of rural farmers who depend on anthropogenic activities in the forests for their sustenance into the Forest Investment Programme (FIP) of the $8.3 billion Climate Investment Fund (CIF). Thus, climate mitigation, security of agricultural livelihood, and possible financial benefits to smallholder farmers were among the list of benchmarks (safeguards) based on which the REDD+ action would be assessed after implementation (Chhatre et al., 2012).

The Forest Investment Program (FIP) ensures the advancement of REDD+ Programs in developing countries by providing the necessary funds in the form of loans and grants to achieve the synergies of conserving biodiversity, enhancing high carbon sequestration portfolios in the forests, maintaining sustainable economic returns on investment by Private sector players in the green carbon forestry industry, while ensuring that the livelihoods of rural households who depend on these forests for their sustenance are not compromised (World Bank, 2015).

Howbeit, institutional hegemony due to conflict of interest among the key stakeholders within the green economy of the program seems to be blocking the program in attaining socially efficient outcomes. This REDD+ political economy is further substantiated in the chapter that follows. Critics of the REDD+ Program have said amongst other things that the program is meant to pay the world's poorer countries to use their forests as a net carbon sink for absorbing emissions from these richer countries. Also, these critics say that the international cash transfers engendered by the REDD+ action is meant to offshore and privatize forest governance, a phenomenon perceived by development theorists as a new form of colonialism to keep countries dependent and reliant on more powerful countries (Asiyanbi, 2016); Hall, Hirsch, Li, et al., 2011; Osborne, 2011; Kansanga et al., 2018; Goldstein & Udry, 2008). Saeed et al., (2018) in their finding on REDD+ Social Safeguards reveal that even though REDD+ countries are obliged to provide information on safeguards to the UNFCCC, there is not yet an agreement on what should and should not constitute REDD+ safeguards. The gap in the convention in this regard is being exploited by Safeguard designers (who are pro-carbon) to undermine non-carbon land users within the forest commons. (DeShazo et al., (2016) in their book, "*Why REDD Will Fail*" make the rights and justice of forest fringe communities the central theme in their work. That any project that puts the inscription, "out of bounds to farmers, loggers and hunters" at the forest gates, spells doom for the livelihoods of the affected parties who depend on the forest for their sustenance.

2.3.6. The Beginning of the Problem

Between 2002 and 2010, following the *Expanded Plantation Program* which extended the on- reserve forest sustainable forest management (SFM) activities into the off-reserve forests, the Ghana Forestry Commission (GFC) released forestlands to about 280 private forest investors in 12 forest districts across the country (Insaidoo et al., 2012; Wiersum et al., 2014). Majority of these forest developers are transnational corporations whose participation in the local market space who according to Insaidoo et al., (2012) weakens the sovereignty and capacity of local developing economies: Some of these private developers in Ghana's forest plantation development frontier include *Portal Limited, FORM Ghana Limited, Mere Plantations Limited, Ecotech Services Limited, Zoil Services Limited, Kwadkoff Company Limited, Logwood Industries Limited and GroTeak Afforestation Limited* (Kasanga et al., 2018).

The lacuna in this centralized boardroom decision was the sudden growth in demand for deforested lands within the off-reserve by the burgeoning number of private companies entering the carbon forestry business space to take advantage of the REDD+ Funding windows to cash in.

According to Saeed et al., (2016), a collusion between the State of Ghana and some powerful private timber developers is what compelled the government to extend the carbon forestry development program from the protected areas into the off-reserve forest. The inability of the REDD+ programme implementers in Ghana to reconcile the activities of these profit-maximizing private Investors of the carbon forestry program with the REDD+ Program's core *Cancun safeguards* policy of ensuring that REDD+ initiatives address sensitive welfare (livelihood) issues and social interests of forest fringe community people, defeats the social equity objective of the program in Ghana.

Evidence after a decade of the REDD+ Programme implementation in Ghana reveals that contrary to expert projections by Cobera et al, (2017) and Harvey et al, (2010) that the multiplier

effect of the programme would yield sustainable social and economic benefits for rural community dwellers, the programme has encroached beyond acceptable limits and has thus become a bane rather than a blessing for the rural poor (Asiyanbi et al, 2017; Saeed et al, 2018).

Such forest-agrarian trade-offs due to the political economy of the REDD+ initiative have been proven by recent studies to be peculiar to developing economies due to underdeveloped land tenure and unclear property rights regimes, amongst many other gaps (Peskett et al., 2011). The power to ensure a mutual symbiosis between the sustainable forest development activities of private investors and the Agroforestry farming activities of rural households within the *Land Use Land Use Change and Forestry* (LULUCF) has sadly been left by the Government of Ghana in the hands of the private investors whose monetary profit motif goes before their interest in macro-level social interest, thereby undermining the livelihoods and interests of host communities (Asiyanbi et al 2017); apart from discouraging Agroforestry adoption practices which contribute to the REDD+ Program's Agroforestry goals, and a surer climate change adaptive strategy of farmers in the high forest zone (HFZ).

2.3.7. A focus on Migrant Farmers

Although this study encompasses all farmers (both native and migrant) within the study area, in our analysis, particular interest and emphasis is placed on Non-native farmers to ascertain the extent to which power and relations of forest governance in the forestry subsector have restricted their access to forestlands for agricultural activities. Migrant farmers refer to people who migrated from their native homes due to adverse biophysical conditions such as soil infertility, floods, bush fires, desertification, etc., to settle in an area with more favorable climatic conditions to pursue their farming dream. Most migrant farmers in the high forest zone hail from the five (5) northern regions of Ghana (CRIG, 2017). Even though all rural farmers operating within off-reserve forests are somewhat affected by the inability of the program implementers

to enforce the REDD+ Program safeguards, migrant farmers are the most hit by the stochastic disturbance due to this hegemony in Ghana's forest governance structure: Following the *Expanded Plantation Program*, native farmers whose farmlands lie within the off-reserve forests were somewhat compensated to vacate their lands; with some later getting employed as caretakers and tree planters for the private forest developers, from which some managed to get permission to continue with their agrarian activities under new arrangements with the private forest developers.

The settlers or migrant farmers on the other hand, most of whom are without any land ownership rights, lost their farm plots (previously acquired from the state under the Taungya scheme) without any compensation, and were not actively employed to engage in tree planting either (Djagbletey & Adu-Bredu, 2007). They now fall on native farmers and other community representatives (who now act as 'middle men') to get temporal access to forestlands to cultivate their crops albeit at very high cost (Kasanga et al., 2018). Ghana's REDD+ program which focuses on enhancing the carbon sequestration portfolio of the country unfolds in two (2) phases: Phase One (1) deals with restructuring and strengthening Institutions directly linked with the country's forest management system and drawing up forest policy reforms. Phase Two (2) is a multi-dimensional strategy with three (3) principal forest Investment Projects. The REDD+ Program recognizes agricultural lands within forest zones as "Agro-forestlands" and even made provision to incentivize cocoa farm owners to adopt climate smart farming practices such as Agroforestry. This implies that the safeguards of the REDD+ has been catered for on paper by the Ghana REDD+, but the rural farmers are yet to benefit from its full implementation. Agriculture must not be supplanted with timber production within the off- reserve, but be incorporated with forest canopy to enhance productivity. Cocoa in itself is naturally an understory specie plant that thrives well in humid forest ecosystems. **Table 2.3** shows the

three projects of Phase II and their respect strategic goals:

Table 2.3: Phase II Project Goals

PROJECT	STRATEGIC GOAL
1	Enhancing Old Growth (Natural) Forest in Agro-forest landscapes in the corridors of the High Forest Zones (HFZ) through carbon forestry development
2	Tree security and enhancement in cocoa growing and Agroforestry areas within Bono, Bono East, Ahafo, Western and Western North Regions' High Forest Zones and the provision of incentives for climate smart cocoa farming
3	Facilitating reforestation through private sector-led plantation investment on highly degraded lands to improve the carbon stock density of the country.

Source: Author's modification of World Bank, 2015

2.4. GAPS IN LITERATURE ON THE SUBJECT MATTER OF "ACCESS"

The theory underpinning this study is the "theory of access" propounded by Ribot and Peluso (2003). Agrawal & Ostrom, (1999) and Ribot & Peluso (2003) understood 'access' as the right to benefit from a resource and the ability to derive pay-offs from it. Thus, the introduction of the derivation of benefits from a resource [by Ribot & Peluso (2003)] into Agrawal & Ostrom (1999) definition for "Access" implies that the determinants of access to natural resources go beyond socio-demographic and economic characteristics and land tenure security predictor variables to include formal and informal institutional factors whose commissions and/or omissions constrain people's rights and ability to benefit from a resource common such as a community forest. Thus, from the ongoing, we can vehemently conclude that "political economy" is a function of "access". All the possible means by which a person benefits from something is called Access. When the access is backed by law or customs or by an international convention it is called "legal access".

Legal access usually requires an entire community or state to enforce that legitimate claim. Nevertheless, there is always the problem of ambiguity within the law in which rights of access to a particular resource allocated to one party by one govt or traditional authority gets re-allocated to another party either at same or different points in historical periods. There are also instances in which new law or policies do not delineate all the powers associated with particular rights; conflict ensues over the resolution of these ambiguities.

Although the idea of Institutional factors determining agrarian land access in forest governance is multifaceted, this study restrict itself to the activities of the formalized REDD+ Secretariat in the Climate change Unit of the Ghana Forestry Commission, assuming all other institutional factors to be extraneous confounding variables that will not be accounted for in this studies, in order to avoid increases in variance (leading to multicollinearity problems), a zero internal validity problem and the introduction of bias that can all lead to an underestimation or overestimation of the partial estimates of our variable of interest (i.e. REDD+ Institutional factors), leading to a spurious analysis. In this study, we analyze the causative effect between the political economy due to the implementation of the REDD+ and rural farmers' access to agrarian lands for crop and/or timber production within the off-reserve forests of the high forest zone in Ghana. Thus, unlike in most previous studies such as Asiyanbi (2016); Hall, Hirsch, Li, et al., (2011); Kansanga et al., (2018); Osborne (2011); Goldstein & Udry (2008) where the studies were carried out in both protected areas and off-reserve forests, this study seeks to examine the phenomenon solely in the 80% off-reserve forest landscape where anthropogenic activities such as farming, logging and resource exploitation are permissible. This study assumes that there is nothing untoward about barring farming activities within Ghana's 20% protected area and wildlife reserves. Since there is the need to protect the country's remaining virgin forests, which is suffering a fast rate of depletion in recent times; any form of displacement of squatters operating within the on-reserve is

justified. Meanwhile, although the theory of "access" in natural resource governance abounds in literature, its generic definition belittles the status quo in which community dwellers are somewhat included in forest governance but do not derive direct benefit from the community forest itself (Kansanga, et al., 2018; Ribot et al., 2006; Ribot & Larson, 2012; Osborne, 2011): This study, which is based on the definition of "Access" by Ribot & Peluso (2003), who conceptualized it as "the ability to derive benefits from things", makes the case for the smallholder farmers who are unable to derive economic benefits from the forest resource commons due to a REDD+ hegemony. Thus, this study seeks to authenticate the veracity or otherwise of this phenomenon of intrusion of private timber plantation developers (REDD+) into agrarian space exclusively within the off-reserve.

Hall et al., (2011) in their study on 'powers of exclusion' argue that at the theoretical level, who is excluded from accessing a natural resource, how and why they were excluded and the consequences of their exclusion must be emphasized. And since including rural households in the REDD+ does not necessarily amount to guaranteeing them control over the resource commons, this study considers the opposite of Ribot & Peluso's definition of access to be "exclusion"

2.4.1. Definition for Land Access

Based on the theory of access substantiated above, "land access" can be defined as the right to benefit from a land and the ability to derive pay-offs from it. The land referred to in this study is forestland for agrarian purposes. Land access in this context is measured as a continuous variable in hectares. Thus, this study defines agrarian land access as the ability of a rural household or smallholder farmer to have usufruct rights to a parcel of land within the forest, and derives economic benefit from it through ownership, rent, squatting, sharecropping and/or lease for farming activities.

Access to land for agricultural purposes in Ghana by vulnerable groups such as women, migrants

and landless youth is critical for poverty reduction (Osman Alhassan, 2006). As an agriculture-driven country, security of land tenure and access will go a very long in improving productivity and socioeconomic development of both rural households and urban dwellers. With rapid urbanization and population growth, access to land for agricultural activities is fast becoming a daunting task for the government, traditional authorities and smallholder farmers in Ghana. In southern Ghana, allodial title holders are the chiefs and family heads. In northern Ghana, this resides in the skin (chiefs) and "tin dāna" (earth priest). According to Kasanga (2002), matrilineal and patrilineal system of inheritance are used in Ghana to transfer customary ownership and usufruct rights of lands among individuals, families and communities. There are also communal lands for (grazing and fishing activities) that members of a particular community have open access to.

2.5. AGROFORESTRY ADOPTION DECISIONS OF SHARECROP FARMERS UNDER GHANA'S REDD+

Meanwhile, vulnerabilities due to loss of forest cover, over reliance on rainfall, loss of soil fertility, amongst other adverse biophysical factors across the country's forest areas are having a joint deleterious effect on the agrarian activities and food security status of rural households who rely on the forests for their sustenance, and meeting the ever-increasing food consumption demands of Ghana's growing population is fast becoming a herculean task. In their quest to deal with these agro-ecological shocks through land use, land-use change and forestry (LULUCF) activities, these rural farmers resort to adopting effective agricultural technologies (AgTs) to enhance their land productivities, incomes and crop yields, while removing greenhouse gas (GHG) from the forest atmosphere; although, the tree benefit sharing regime after logging on-farm timber does not favor sharecroppers.

Makate et al., (2019) postulate that Agroforestry, which refers to the integration of woody perennial trees into agrarian farming systems, is one of the most effective and resilient AgTs

with socio-ecologico-economic benefits that farmers adopt to deal with agrarian adverse biophysical disturbances due especially to climate change, and for tackling developmental challenges globally. Howbeit, the political economy engendered by the redundancy of the REDD+ safeguards is not only denying farmers access to farmlands within the LULUCF, but the land tenure insecurity and unfair benefit sharing situation that has worsened as a result, has taken away the willingness of sharecropping farmers to adopt Agroforestry practices on scarce farmlands whose usufruct rights no longer go beyond a production season or cycle.

2.6. PREVIOUS FINDINGS ON THE REDD+ IMPLEMENTATION IMPACT ON RURAL SOCIAL WELFARE

Berry (2009) in a research conducted in three (3) West Africa countries (Ghana, Cote D'Ivoire and Benin) concludes that contrary to popular expectation, formal land titling rights given to private forest developers in REDD+ implementation landscapes have rather widened the inequality gap between the rich and poor by displacing vulnerable smallholder farmers and depriving them of their source of livelihoods. He also makes the case that there is more to land tenure security than just mere land titles, and that there are other statistically significant factors influencing land access than demographics and socioeconomic factors.

2.7. CORPORATE SOCIAL RESPONSIBILITY OF PRIVATE FOREST DEVELOPERS

A Corporate Social Responsibility (CSR) study conducted in Ghana by the World Business Council for Sustainable Development (WBCSD) in the year 2000 found that Social Responsibility did not feature prominently on the agenda of businesses in Ghana. The study cited high cost and lack of Government support and control as some of the reasons for the low patronage of CSR. The findings also revealed little pressure from Civil Society Organizations (CSOs) and other key stakeholders on corporations to encourage them to contribute to solving pressing social and environmental problems confronting the communities in which they operate,

in order to augment the national environmental policies already in place, and to ensure that the operations of these multinationals yield equitable outcomes and conform to global norms.

Samantara & Dhawan (2020) also re-echo the lack of national commitment toward CSR by both government and multinational companies in Ghana. And this indifferentism has led to a misconstrued concept of CSR in the country. Vintró et al., 2012) say that the proliferation of foreign direct investment in Ghana, following the structural adjustment program in the 1980s led automatically to a more pronounced CSR regime due to the international standards of legal and environmental protection frameworks set by global regulators of sustainable natural resource management that these multinational companies are obliged to comply with to protect the environment and guarantee the safety and sustainable livelihoods of natural resource host communities.

CHAPTER THREE

METHODOLOGY

3.0. INTRODUCTION

This Chapter discusses the Methodology used for this study. It begins with a discussion of the relevant Theoretical Framework underpinning the study. The Analytical Framework which identifies and describes the major input and output variables follows suit briefly. This is then followed by the Method of Data Analysis for each specific objective. Finally, the Method of Data Collection which spells out the sources of data and instruments employed, sampling procedure, interview procedure and information about the Study Area are briefly outlined.

3.1. THEORETICAL FRAMEWORK

3.1.1. Introduction

The theoretical framework underscores the reasons for the existence of the research problem of the study. Thus, it puts the whole study into perspective. The chain of theories underpinning this particular work lies within the purview of the theory of access already discussed in Chapter Two. Although the theory of access in natural resource governance abounds in literature (Faye & Ribot, 2017; Kasanga et al., 2018), its generic definition belittles the status quo in which community dwellers are somewhat included in forest governance but do not derive direct benefit from the community forest itself: This study, which is based on the definition of "Access" by Ribot & Peluso (2003) who conceptualized it as "the ability to derive benefits from things", makes the case for the smallholder farmers who are unable to derive economic benefits from the forest resource commons due to a REDD+ hegemony. Theoretically, this study sheds more light on the geopolitical dimension of the socioeconomic effects that the REDD+ action has on rural household livelihoods in Ghana. Thus, following the entry of private forest

developers into the forest landscape in the wake of the country's war against climate change after becoming a party to the UNFCCC's *Kyoto Protocol* and *Paris Agreement* respectively, burgeoning literature from critics of the REDD+ pontificate that forestlands originally designated for smallholder cocoa, rubber, cashew, oil palm, food crop and livestock farming within the country's high forest zone are now being supplanted with large timber plantations who make financial drawdowns from a REDD+ funding window; and rural farmers are not only struggling to access land for their agrarian livelihood activities, but that those who initially had landholdings within the forest are being displaced, some with a one-time compensation, others with no compensation at all. This study examines the scope and extent of the displacement endangered by the REDD+ Initiative within the 80% off-reserve of Ghana's High Forest Zone (HFZ).

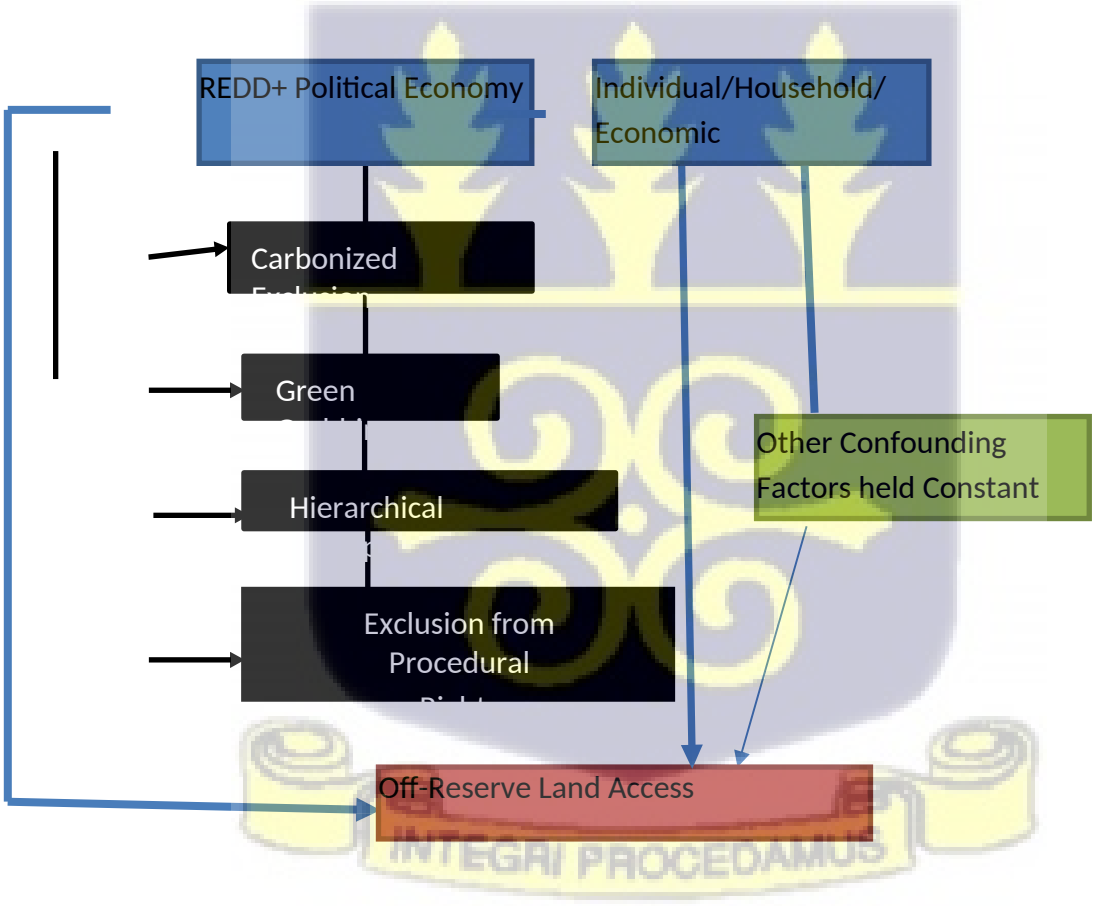
Thus, this study seeks to authenticate the veracity or otherwise of this phenomenon of intrusion of private timber plantation developers (REDD+) into agrarian space exclusively within the off- reserve. Hall et al., (2011) in their study on 'powers of exclusion' argue that at the theoretical level, who is excluded from accessing a natural resource, how and why they were excluded and the consequences of their exclusion must be emphasized. And since including rural households in the REDD+ does not necessarily amount to guaranteeing them control over the resource commons, this study considers the opposite of Ribot & Peluso's definition of access to be "exclusion".

3.2. ANALYTICAL FRAMEWORK

From **figure 3.1**, Access to agrarian land within the off-Reserve forest in the study area is hypothetically being explained by indirect REDD+ Political Economy factors, namely, *Carbonized Exclusion, Hierarchical Corruption, Green Grabbing* and *Exclusion from Procedural Rights* (i.e. Access to REDD+ Information, Participation in REDD Implementation Decisions, access to Justice to seek redress about REDD+ Implementation), apart from socio-

demographic and economic characteristics, ceteris paribus. Thus, for the null hypothesis to be rejected, the aforementioned REDD+ Hegemony factors are expected to be individually and jointly statistically insignificant in explaining the size of landholdings that farmers within forest fringe communities can access within the off-reserve forest. The statistical significance or otherwise of demographic features and economic characteristics are immaterial in this regard, since the variable of interest in the study is the REDD+ Political Economy. However, estimates of confounding factors that strongly explain farmers' access to agrarian land within the district are alluded to in the findings.

Figure 3.1. Author's conceptualization of Analytical Framework



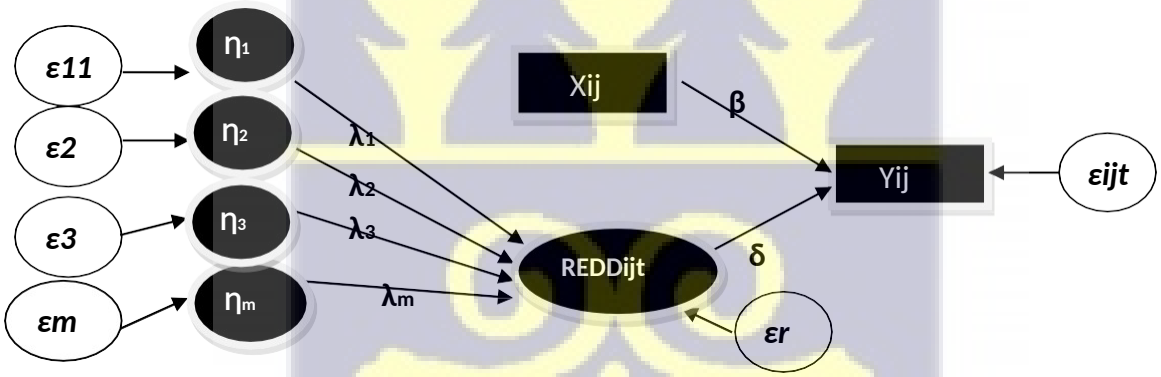
(Source: Author, 2021)

3.3. METHODS OF DATA ANALYSIS

3.3.1. Model Specification for estimating the linkages between the REDD+ Political Economy and agrarian Land Access of farmers in the Study Area.

Since REDD+ Political Economy is a multidimensional latent construct (pregnant with several observed variables) that cannot be directly observed (or measured on the field), more than one technique is needed for studying this phenomenon. Thus, a Factor Analysis (FA) and Multiple Linear Regression Analysis is most appropriate for addressing this complex issue: The Structural Path Diagram for both direct and indirect predictor variables on agrarian Land Access response variable excluding all extraneous confounding factors, is represented as follows:

Figure 3.2: Structural Path diagram of theory



Source: Author, 2021

Table 3.1: Major and Minor constructs (Factors) with their manifest variables for FA

MAJOR CONSTRUCT	FACTORS	OBSERVED VARIABLES
REDDijt	Carbonized Exclusion, η_1 (Tobias & Richmond, 2014; Asiyanbi et al., 2016)	Y_1--Loss of usufruct rights due to Carbon Forestry Y_2--Difficulty in accessing farmlands within community forest Y_3--Confiscation of crop farm(s) by forest patrol team of the GFC Y_4--- level of investment in agriculture
REDDijt	Hierarchical Corruption, η_2 (Kasanga et al, 2018) Goldstein and Udry (2008)	Y_5--Proliferation of illegal forestland brokers Y_6--Payment of monetary inducement to illegal brokers to gain land access Y_7--Exorbitant land lease arrangements Y_8--Fraudulent acquisition of reclaimed (reforested) forest lands for agrarian activities Y_9—Use of Powerful position in local sociopolitical hierarchy for land access
REDDijt	Green Grabbing, η_3 (Osborne, 2011)	Y_{10}--Employment of displaced farmer as tree planter and/or caretaker on private forest timber plantations. Y_{11}--Loss of farmland in the last 10years Y_{12}--Conversion of farmlands into timber plantations Y_{13}-- Disincentive of tree tenure
REDDijt	Exclusion from Procedural Rights, η_4 (Hall et al., 2011)	Y_{14}--Community level participation in decision making in forest governance Y_{15}--Access to information regarding activities of the REDD+ Program within the community Y_{16}--Access to justice to seek redress for their reservations on forest management decisions that affect their livelihoods. Y_{17}--Farmer's level of access to certification to partake in timber plantation business within the community Y_{18}-- Disincentive of benefit rights

(Source: Author, 2021)

3.3.1.1. Factor Analysis (FA)

It is a data reduction and summarization technique that reduces a large number of variables on a questionnaire, based on underlying similarities and inter-correlations, and represents them in different components (Valunaite Oleskeviciene & Sliogeriene, 2020; Li et al., 2011). It assesses whether or not a number of variables of interest are linearly related to a smaller number of unobserved factors so that the information contained in a large data set of interdependent variables is summarized into relatively smaller number of variables called **factors** (or constructs)

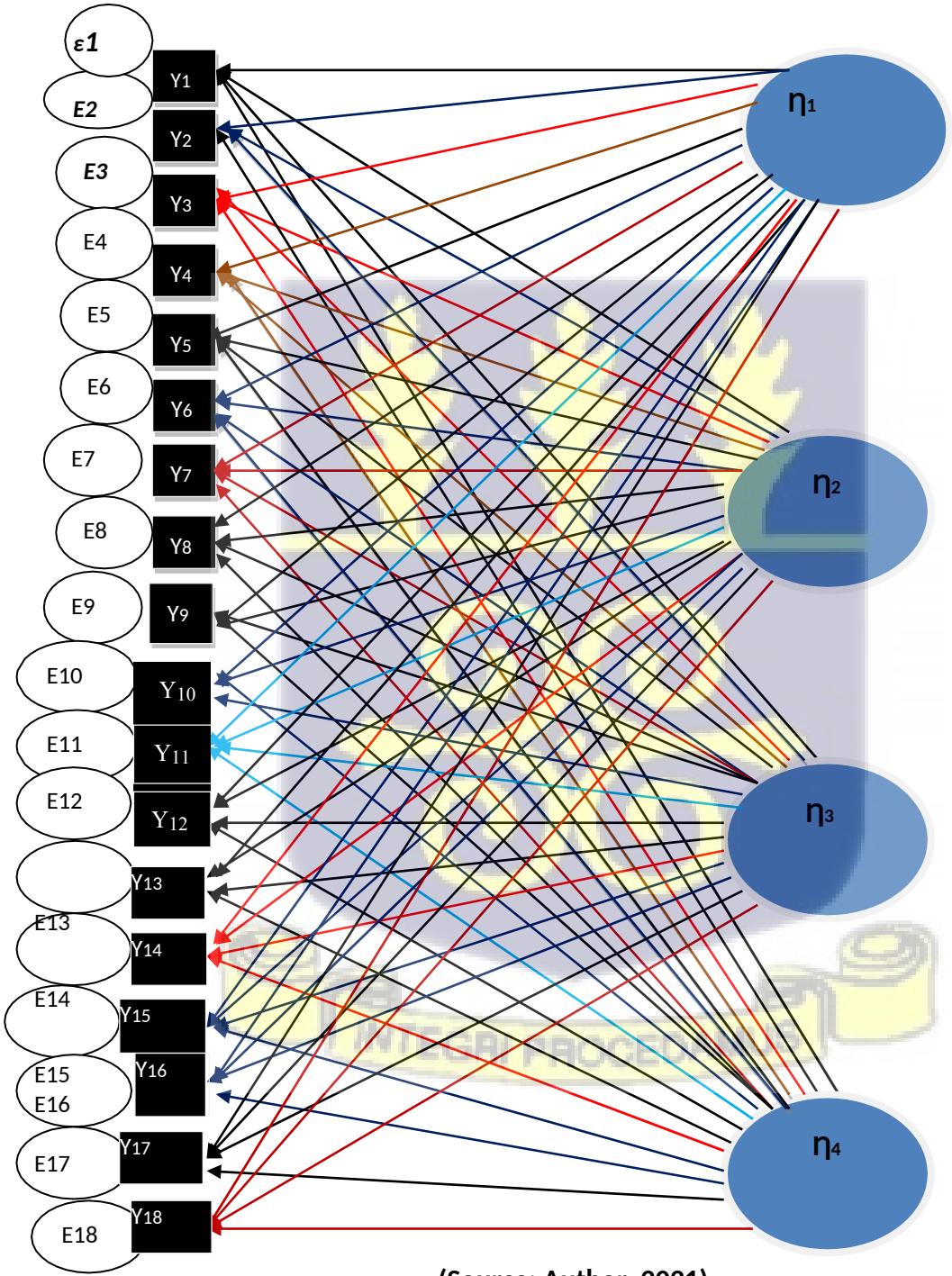
for parsimonious analysis. Thus, through Factor Analysis, latent variables (Constructs) which cannot be observed directly on the field (or real life) are measured through a set of objective instruments. *Exploratory Factor Analysis* (EFA) was employed in this study for a more rigorous analysis of the factorability or otherwise of the correlation matrix obtained, and for determining whether or not the questionnaire items under each proposed latent construct (factor) are internally consistent to load well unto our REDD+ political economy factors of interest or not.

Although the principal underlying factors expected to drive the covariation of the observable variables ($Y_{i=1,2,3\ldots m}$) have been identified from literature to be *Carbonized Exclusion, Hierarchical Corruption, Green Grabbing* and *Exclusion from Procedural Rights,* which is a necessary condition for Confirmatory Factor Analysis (CFA), the presence of a high degree of cross-loadings of the variables onto the factors (based on theory), violates the sufficient condition for a full scale CFA to be carried out. This is because full scale CFA is done after purposively assigning the variables (based on theory) to their respective underlying factors with minimum cross-loadings. But CFA restricts the factor model by assigning zero (0) factor loadings for cross-loading variables. One expects high degree of cross loadings, one cannot escape factor rotation, hence cannot perform CFA. Howbeit, in place of the CFA, the *Monte Carlo PCA for parallel Analysis* is combined with other reliability checks to ensure that the factors extracted deserve to be in the final analysis.

From the ongoing, an Exploratory Factor Analysis (EFA) which allows for analysis of all associations between our factors of interest and permits factor rotation to cater for cross-loadings was used for this study. Also, apart from literature, questionnaire was modified during field visit to cater for more items solicited from key foresters during field survey. The Likert scale **(1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree 5=Strongly agree**) was the scale of measurement used in answering all 38 questionnaire items for the Factor Analysis. Figure 3.3.

gives a diagrammatic representation of the operationalized path diagram for Exploratory Factor Analysis (EFA) and Scale for the minor Constructs.

Figure 3.3: Operationalized Path Diagram for Exploratory Factor Analysis (EFA) and Scale for Constructs.



(Source: Author, 2021)

3.4.1.1.1: Measurement Model Specification for EFA

Vector of equations for *p* observations in population, we have

$$Y_{p\times 1}=¿\begin{pmatrix}Y_1\\Y_2\\\vdots\\Y_p\end{pmatrix}\qquad \mu_{p\times 1}=¿\begin{pmatrix}\mu_1\\\mu_2\\\vdots\\\mu_p\end{pmatrix}\qquad \text{Cov(Y)} = \mathbf{\Sigma}\ ¿\begin{pmatrix}\varepsilon_{11} & \varepsilon_{12}\cdots\cdots & \varepsilon_{1p}\\\varepsilon_{12} & \varepsilon_{22}\cdots\cdots & \varepsilon_{2p}\\\vdots & \vdots & \vdots\\\varepsilon_{1p} & \varepsilon 1_{2p} & \varepsilon_{pp}\end{pmatrix}$$

Considering **m** factors and **p** manifest variables for this study, we have

Vector of factors, $\eta_{m\times 1}=¿\begin{pmatrix}\eta_1\\\eta_2\\\vdots\\\eta_m\end{pmatrix}$ which is due to the causal effect of $Y_{p\times 1}$

From **figure 3.4.2** above, we can write the following simultaneous regression equations:

$$Y_1 = \mu 1 + \lambda_{11}\eta_1 + \lambda_{12}\eta_2 + \lambda_{13}\eta_3 + \ldots + \lambda_{14}\eta_m + \varepsilon_1 \quad (1)$$
$$Y_2 = \mu 2 + \lambda_{21}\eta_1 + \lambda_{22}\eta_2 + \lambda_{23}\eta_3 + \ldots + \lambda_{24}\eta_m + \varepsilon_2 \quad (2)$$
$$\vdots$$
$$Y_p = \mu_p + \lambda_{p1}\eta_1 + \lambda_{p2}\eta_2 + \lambda_{p3}\eta_3 + \ldots + \lambda_{p4}\eta_m + \varepsilon_p \quad (p)$$

Matrix formation for **p** manifest variables and **m** principal components becomes:

$$\begin{pmatrix}Y_1\\Y_2\\\vdots\\Y_p\end{pmatrix}¿\begin{pmatrix}\mu_1\\\mu_2\\\vdots\\\mu_p\end{pmatrix}+\begin{pmatrix}\lambda_{11} & \lambda_{12} & \lambda_{13} & \lambda_{1m}\\\lambda_{12} & \lambda_{22} & \lambda_{23} & \lambda_{2m}\\\vdots & \vdots & \vdots & \vdots\\\lambda_{p1} & \lambda_{p2} & \lambda_{p3} & \lambda_{pm}\end{pmatrix}\begin{pmatrix}\eta_1\\\eta_2\\\vdots\\\eta_m\end{pmatrix}+\begin{pmatrix}\varepsilon_1\\\varepsilon_2\\\vdots\\\varepsilon_p\end{pmatrix}$$
$$(p\times 1¿\quad (p\times 1¿\quad (p\times m¿\quad (m\times 1¿\quad (p\times 1¿$$

In matrix notation, the above correlation matrix equation can be simply written as:

$Y = \mu + \hat{}\eta + \varepsilon$ ——————— (19)

Equation (**19**) means that each variable $Y_{i=1,2,3\ldots p}$ is dependent on each of the predetermined latent factors (η_1, η_2 $\eta_{3\ldots.}$ η_m) in our data, a necessary and sufficient condition for Exploratory Factor Analysis. This yield: $Y - \mu = \hat{}\eta + \varepsilon$ (20)

Equation 20 is known as the **factor model.**

Where:

$\mathbf{Y_{i=1,2,3\ldots p}}$ *(p×1 matrix)* = Manifest variables obtained from the population, backed by theory

$\mu i = 1,2,3\ldots p$ *(p×1)* = Mean vector of manifest variables, $\mathbf{Y_i}$

$\eta j = 1,2,3\ldots m$ *(m ×1)* = Vector of Principal Components (Factors) causing $\mathbf{Y_i}$

λ_{ij} *(p×m)* = Matrix of Factor Loadings (correlation coefficients) measuring principal factors' influence on manifest variables.

y_{ij} $(p \times 1)$ = Vector of Residual terms of manifest variables

$\hat{}$ *(p×m)* = correlation coefficient matrix of factor model

p = number of manifest variables

m= number of factors

For factor model to pass for Exploratory Factor Analysis (EFA), the following assumptions must hold:

1. The expected value of the manifest variables, **E (Y) = μ**
2. The covariance of the manifest variables, **Cov(Y) = Σ**
3. Expected value of factors, **E(η) =0**
4. Expected value of the error term, **E(y) = 0**
5. Covariance of factors, Cov (**η**) = E(**η η**^{T}) = I (Identity matrix)
6. **Cov** (δ ¿ $= \psi = \begin{pmatrix} \psi_{11} & 0 & \ldots & 0 \\ 0 & \psi_{22} & \ldots & 0 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & & \psi_{pp} \end{pmatrix}$ = **Diagonal matrix** for p variables
7. **Cv** ($\eta\varepsilon$ ¿ $= 0$

Adequacy Test for EFA

Before we perform a Factor Analysis on a correlation matrix, there is the need to check if a Factor Analysis is necessary in the first place. Tabachnick & Fidell (2013) propose that merely examining the correlation matrix of the manifest variables gives an indication as to whether a Factor Analysis is needed or not: As a rule of thumb, they postulate that if majority of the correlation values are ≥0.3, then we can proceed to perform a Factor Analysis, otherwise Factor Analysis is pointless.

Dziuban & Shirkey, (1974) also propose a much more robust determination on the matter by recommending that either of two tests, namely, *Bartlett's Test of sphericity* and *Kaiser Meyer-Olkin Measure of Sampling Adequacy (KMO MSA)* be carried out to ascertain the plausibility of carrying out an FA.

This study employs the *Bartlett's test of Sphericity* and *Kaiser Meyer-Olkin Measure of Sampling Adequacy (KMO MSA),* together with Tabachnick & Fidell's large presence of ≥0.3 correlation coefficients of matrix rule.

3.4.1.1.3: Bartlett's Test of Sphericity

The Bartlett's test of Sphericity formula is specified as:

$$\chi^2 \; \mathbf{p(p-1)/2} = -\left[(n-1) - \frac{(2p+5)}{6}\right] \ln|\mathbf{R}|$$

Where:
p = Number of manifest variables
N = number of observations
$\ln|\mathbf{R}|$ = Log of the Determinant of the correlation matrix
χ^2 = Chi square

Hypothesis testing:

H_0: Factor Analysis is not possible.

H_a: Factor Analysis is possible.

Decision Rule: Accept H_0 if the value of $\{-\left[(n-1)-\frac{(2p+5)}{6}\right]\ln|R|\}$ is lower than tabulated value (i.e. $\mathbf{T_{calc} < T_{crit}}$).

Do not accept H_0 if $-\left[(n-1)-\frac{(2p+5)}{6}\right]\ln|\mathbf{R}|$ is greater than tabulated value.

The null hypothesis of Bartlett's test statistic implies that the manifest variables in the population correlation matrix is an identity matrix; meaning it correlates only with itself (r=1) but does not correlate with the other variables (r=0). If it does not correlate with any other variable in the data set, then the variables cannot be grouped under any of the unobserved constructs (factors). Simply put, for factorization to be possible, we expect high degree of correlation (≥0.3) among most of the items.

3.4.1.1.2. Kaiser Meyer-Olkin Measure of Sampling Adequacy (KMO MSA)

The Kaiser-Meyer-Olkin (Kaiser & Rice, 1974) value is calculated using the formula:

$$KMO = \frac{\Sigma\Sigma_{j\neq k} r_{jk}^2}{\Sigma\Sigma_{j\neq k} r_{jk}^2 + \Sigma\Sigma_{j\neq k} q_{jk}^2}$$

Where,

$\mathbf{r_{jk}}$ = original off-diagonal correlations
$\mathbf{q_{jk}}$ = off-diagonal elements of the partial correlations

Hypothesis

H_0: Factor Analysis is not possible.

H_a: Factor Analysis is possible.

Decision Rule:

Reject H_0 if KMO value falls below 0.5. Otherwise do not reject H_0.

A **0.5** KMO value is the smallest value considered acceptable; (Kaiser & Rice 1974) proposition of [**0.5**s = miserable; **0.6s** = mediocre; **0.7s** = middling; **0.8s** = meritorious and **0.9s** = marvelous] will guide our factorability examination decision in this work. KMO value closer to 1 (with $\Sigma\Sigma_{j\neq k}q_{jk}^2 \rightarrow 0$) is desirable.

3.4.1.1.3. Dealing with Multicollinearity

An examination of the determinant of the correlation matrix (produced by the SPSS algorithm) would be done to ascertain the presence of multicollinearity (Tabachnick & Fidell, 2013).

Determinant values very close to zero (0) signals multicollinearity. Field (2018) also says determinant values of ≤ 0.00001 is a sign of multicollinearity.

Multicollinearity can also be checked by regressing each of the manifest variables onto the rest of the manifest variables and the *Variance Inflation factor* (VIF) computed: The formula for the Variance inflation Factor is specified as:

$$\mathbf{VIF_i} = \frac{1}{1-R_i^2} = \frac{1}{Tolerance}$$

Where:

$\mathbf{R_{i=1,2,3....p}^2}$ = unadjusted coefficient of determination for regressing the ith manifest variable on rest of manifest variables.

Hypothesis Testing:

H_0: Multicollinearity is present

H_a: Multicollinearity is absent

Decision Rule: Reject H_0 if VIF =1, Do not reject H_0 if VIF >1

According to Tabachnick & Fidell (2013), the estimated R^2 value of the i^{th} manifest variable on the rest of the regressor variables is actually the main determinant of multicollinearity in the VIF

formula above: If $R^2 = 0$, then VIF = $\frac{1}{1-0} = \frac{1}{1} = 1$

Thus, an $R^2 \rightarrow 0$ is desirable. A high R^2 value on the other hand means that the manifest variables are correlated with the other manifest variables. If such a problem exists in our data set, it means some of our manifest variables are redundant, and that our model is over-fitted. When that happens, the algorithm (SPSS) is unable to capture the correlation coefficients of the redundant variables, leading to spurious regression.

3.4.1.1.3.1. Correction of Multicollinearity

The Orthogonal varimax factor rotation of Principal Component Analysis is employed in this study to minimize the coefficients that correlate very high within the correlation matrix. As a rule of thumb, based on the optimal sample size of 194 used for this study, only manifest variables with minimal cross factor loadings greater that 0.30 were admitted as relevant for a particular factor (Hair et al., (2009). A particular manifest variable that cross loads significantly (⚽0.3) onto more than one factor after several iterations was deleted as recommended by Hair et al., (2009); Le, T.C., & Cheong, F. (2010).

3.4.1.1.4. Principal Component Analysis

One of the major limitations of least square estimation in multiple regression analysis is the problem of multicollinearity in which there is a near-constant linear function between two or more predictor variables. The problem may not necessarily be indicated by large correlations between sub-set of variables, this can lead to high variances of some of the estimated coefficients and eventually lead to spurious regression (Blinkin, 1998).

To overcome such a problem, several techniques have been proposed: One possibility is using a portion of the predictor variable sub-set, and ensuring that the chosen items are not multicollinear (Draper & Smith, 1998).

Principal Component Analysis (PCA) is a second-best approach to dealing with the problem of multicollinearity, and it falls within the purview of Biased Regression Estimators (Blinkin, 1998). Apart from PCA, *ridge regression, shrinkage estimators, partial least squares* and *LASSO* all fall within the class of biased regression estimators. The best of them all is the Principal Component (PC) regression, which replaces IVs with their underlying PCs. PCA is that stage of PC regression where some of the PCs are deleted based on some rules of thumb; and only variables known extracted after passing all PCA tests make it into the final regression analysis (Blinkin, 1998).

Simply put, there are several methods for factor extraction under Factor Analysis: *Common Factor Analysis, Unweighted least squares, Generalized Least Squares, Maximum Likelihood, Principal axis factoring, Alpha factoring, Image factoring and Principal Component Analysis* (PCA). The PCA multivariate technique is the method employed in this study. PCA is not only the commonest procedure widely used in literature; it is also the default method in SPSS, hence our choice to use it for the study. The purpose of Principal Component Analysis is to reduce the **p** manifest variables into each of ≤**m** PCs.

3.4.1.1.4.1: Factor Extraction Method

In order to decide the number of components to retain in the final PC analysis, the following procedures are used in this study:

1. Eigen values >1 rule
2. Scree Plot rule

3.4.1.1.4.2: Eigen values

Let Y be our sample correlation $p \times p$ matrix for an ith observation, then Q_i (representing λ_{ji}) is called **Eigen value** of Y, if and only if, there is a nonzero vector, v, such that $\mathbf{Yv} = \mathbf{Qv}$.

Where v = associated Eigen vector of λ. Rewriting, we have $\boldsymbol{Yv} - \boldsymbol{Qv} = \mathbf{0}$

Since a vector cannot be subtracted from a matrix, we introduce an identity matrix, I, so that

$\boldsymbol{Yv} - \boldsymbol{Qv} = \boldsymbol{Yv} - \boldsymbol{QI} = (\boldsymbol{Y} - \boldsymbol{QI})\boldsymbol{v} = \boldsymbol{o}$

For a nonzero solution, $(Y - QI)$ must be singular [meaning, its determinant must be equal to zero, ($i.\ e.$ $\mathbf{det}\ ((\boldsymbol{Y} - \boldsymbol{QI}) = \mathbf{0}$]. Det $((Y - QI) = 0\ is\ called\ the\ \boldsymbol{characteristic\ equation.}$ A characteristic equation yields a quadratic function of Y, which is then solved for Eigen Values.

Alternatively, Eigen value of a correlation matrix is the sum of the communalities [which are the squares of all the Pearson correlation coefficients indicating the amount of variation in the manifest variables accounted for by the principal component(s)]. For p manifest variables with corresponding Eigen vectors, the Eigen Value can be calculated with the formula:

$$\boldsymbol{Q}_i = \sum_{\mathbf{p}} \lambda_{\mathbf{i}}^{\mathbf{j}\,\mathbf{2}}.$$

As a rule of thumb, only Principal components with Eigen values greater than 1 (Q>1) and/or corresponding Cumulative % variance = $\frac{eigen\ value\ of\ i\ th\ variable}{total\ number\ of\ variables} \times 100\,\% \geq$ 50%, will be retained (extracted) as principal components (factors) for naming and further analysis.

3.4.1.1.4.3: Extraction Estimates

To extract **m** principal components (factors) for **p** manifest variables at m>p,

We decompose the Population variance matrix, **Σ** into Eigen value and Eigen vector pairs:

Let $\mathbf{Q_j}$ = Eigen value and $\mathbf{e_j}$= Eigen vector.

Then our spectral decomposition of population variance matrix, $\mathbf{\Sigma} = \sum_{j=1}^{p} Q_j e_j^T$

Where $\mathbf{Q_j}$ ¿ $\begin{pmatrix} \lambda_{11} & \lambda_{12} & \lambda_{13} & \lambda_{14} \\ \lambda_{12} & \lambda_{22} & \lambda_{23} & \lambda_{24} \\ \vdots & \vdots & \vdots & \vdots \\ \lambda_{181} & \lambda_{182} & \lambda_{183} & \lambda_{184} \end{pmatrix}$ (p×m matrix)

Therefore, $\mathbf{\Sigma = \Sigma\ Q_j e^T_j = Q_1 e^T_1 + ¿\ Q_2 e^T_2 + ¿\ Q_3 e^T_3 + \ldots\ Q_{18} e^T_{18}}$

But the variance structure is such that, $\mathbf{\Sigma} = \wedge\wedge^T + ¿\ \psi$

And so if $\wedge\wedge^T = [\sqrt{\mathbf{Q_1 e_1}} + ¿\ \sqrt{\mathbf{Q_2 e_2}} + ¿\ \sqrt{\mathbf{Q_3 e_3}} + \ldots\ \sqrt{\mathbf{Q_{18} e_{18}}}] \begin{bmatrix} \sqrt{Q_1 e_1^T} \\ \sqrt{Q_2 e_2^T} \\ \sqrt{Q_3 e_3^T} \\ \vdots \\ \sqrt{Q_{18} e_{18}^T} \end{bmatrix}$

Then for **m=4** factors, $\wedge\wedge^T = [\sqrt{\mathbf{Q_1 e_1}} + ¿\ \sqrt{\mathbf{Q_2 e_2}} + ¿\ \sqrt{\mathbf{Q_3 e_3}} + \ldots\ \sqrt{\mathbf{Q_4 e_4}}] \begin{bmatrix} \sqrt{Q_1 e_1^T} \\ \sqrt{Q_2 e_2^T} \\ \sqrt{Q_3 e_3^T} \\ \sqrt{Q_4 e_4^T} \end{bmatrix}$

Thus, deleted components become our error term, ψ (since $\Sigma = \wedge\wedge^T + ¿\ \psi$)

That is, $\psi = ¿[\sqrt{\mathbf{Q_5 e_5}} + ¿\ \sqrt{\mathbf{Q_6 e_6}} + ¿\ \sqrt{\mathbf{Q_7 e_7}} + \ldots\ \sqrt{\mathbf{Q_{m+14} e_{m+14}}}] \begin{bmatrix} \sqrt{Q_5 e_5^T} \\ \sqrt{Q_6 e_6^T} \\ \sqrt{Q_7 e_7^T} \\ \vdots \\ \sqrt{Q_{m+14} e_{m+14}^T} \end{bmatrix}$

Where,

$\sqrt{\mathbf{Q_p e_p}}$ = Factor loadings for the *pth* manifest variable

$\mathbf{e_p}$ = Eigen vector for the *pth* manifest variable

A spectral decomposition of the sample covariance matrix, **S** will yield the estimated Factor loadings of interest for the 4 (or less) extracted factors: Thus, $S=\hat{\lambda}\hat{\lambda}^T + \hat{\psi}$
Where,
$\hat{\lambda}\hat{\lambda}^T + \hat{\psi}$ = estimated communality + specific variance.

3.4.1.1.4.4. Scree Plot

A scree plot is a downward sloping line graph of Eigen values (y-axis) against number of factors (x-axis) which indicates the number of factors to be retained (extracted), and those that are to be excluded. It was introduced in the year 1966 by Raymond B. Cattell to helps us visualize the magnitude of the variance associated with each of the components in a principal component analysis.

Just like the Eigen value rule, there is no statistical test for determining the number of factors to retain in a correlation matrix without losing vital information; such decisions are based on "rules of thumb": The **Kaiser criterion (Rule)** of retaining only factors with Eigen values greater than 1 is employed to decide the cut-off point of our scree plot. Variables with Eigen values less than 1 explain less of the variation hence fall short of the Kaiser criterion.

3.4.1.1.4.5. Factor Rotation

If two or more factors are retained based on the Eigen value, scree plot and Kaiser Rules after carrying out our EFA, an **orthogonal factor rotation** will be performed to block any possible correlations among the extracted factors. That way, the extracted factors pass the OLS assumption of "no multicollinearity", to enable them be used as independent substitutes for the **REDD$_{ijt}$** variable in the OLS regression model specified in **equation A** above. Meanwhile, the CFA performed after the EFA will also maximize the correlation coefficients of the components of each factor; thereby minimizing the correlations among the error terms of the manifest variables (autocorrelation).

That is, assuming there is **m>1** number of uncorrelated factors extracted from our PCA, then

$\mathbf{REDD_{ijt}} = \eta_{(i=1)jt} + \eta_{(i=2)jt} \ldots + \eta_{(i=m)jt}$

Where,

$\eta_{(i=1)jt}$ = Factor 1
$\eta_{(i=1)jt}$ = Factor 2
$\eta_{(i=1)jt}$ = Factor m

3.4.1.2. Multiple Linear Regression

All along, our primary objective (in Factor Analysis) has been to measure the degree or strength of linear variations and covariance among the latent constructs and their corresponding manifest variables using correlation coefficients.

In Regression analysis, we are interested in measuring the main objective of this study; namely, establish causation and estimate the mean (or expected) value of Land Access, given some fixed values of several predictor variables [which now include as a prerequisite, the factor(s) extracted from the *Principal Component Analysis* (PCA) procedure performed above].

The simple linear regression model for the main objective is expressed as:

$$Yijt = \alpha + \beta Xijt + \delta REDDijt + \varepsilon ijt \text{ ----------Eqn A}$$

From the Factor Analysis above, $REDDijt = \eta_1 + \eta_2 + \ldots + \eta_m$

Substituting into **eqn A**, we have:

$$Y_{ijt} = \alpha + \Sigma B_{1t} X_{1t} + \Sigma \beta_{2t} X_{2t} + \ldots\ldots - ¿\, \Sigma \beta_{12t} X_{12t} + \ldots - ¿ \Sigma \beta_{15t} X_{15t} \ldots + \Sigma \beta_{26t} X_{26t} - ¿\, \Sigma \delta_{1t} \eta_{1t} - ¿\, \Sigma \delta_{2t} \eta_{2t} \ldots\ldots - ¿\, \Sigma \delta_{1t} \eta_{mt} + \varepsilon_{ijt.}$$

Where,

$\mathbf{Y}_{it}$ = Land Access (Hectares) by the *ith* farmer within base year (t =2011).
α = intercept.
t = Base year (Since 2011).
$\boldsymbol{\beta_1,\ldots\beta_{26}}$ = Marginal effects of the explanatory variables influencing the smallholder farmer's access to agricultural land.
$\mathbf{X_1, \ldots, X_{26}}$ = The Regressor individual/household characteristics and socioeconomic variables.
$\boldsymbol{\delta_1 \ldots\ \delta_{1m}}$ = Marginal effects of the REDD+ endogenous constructs of interest.
$\boldsymbol{\eta_1 \ldots\ldots \eta_m}$ = Latent endogenous constructs of the REDD+ Political Economy extracted from PCA.

The definitions of the independent variables (X_1 *to* X_{25} and η_1 *to* η_m) are listed in Table 3.2. Variable(s) found to be collinear were excluded from the model.

Table 3.2: Explanatory variables of Land Access within the last 10years

SYMBOL	VARIABLE	EXPECTED OUTCOME	MEASUREMENT SCALE
	Individual/Household Characteristics		
X1	Age	+	Continuous (interval): in Years
X2	Gender	+/-	Dummy: 1=Male 0=Female
X3	Farm Experience	+	Continuous: Years of farming
X4	Landholding size	+	Continuous: Hectares
X5	Education	+	Ordinal: 5= tertiary 4= SHS/Level 3= JHS/O level 2=Primary 1= No education
X6	Household Size	+	Continuous (interval): Number of heads
X7	Household Annual Income	+	Continuous (interval): in Ghana Cedis
	Socioeconomic characteristics		
X8	Total Farm size (both Off Reserve and On Reserve)	+	Dummy: 1 = Yes 0 =No
X9	Cost of Off-reserve land	-	Continuous: GHS
X10	Annual Farm Income	+	Continuous: GHS
X11	Annual Total HH Income	+	Continuous: GHS
X12	Source of household Income	+	Ordinal
X13	Member of FBO	+	Dummy: 1 = Yes 0 =No
X14	Teak Plantation ownership	+	Dummy: 1 = Yes 0 =No
X15	Current MTS Participant	+	Dummy: 1 = Yes 0 =No
X16	Type of Farming activity	+	Ordinal:
X17	Usufruct rights to farm in On Reserve	+	Dummy: 1 = Yes 0 =No
X18	Mode of acquisition of landholding in Off Reserve	+	Ordinal:
X19	Possession of Informal Land titling	+	Dummy: 1 = Yes 0 =No
X20	Documents of Off Reserve Land	+	Dummy: 1 = Yes 0 =No
X21	Right to sell Off Reserve Land	+	Dummy: 1 = Yes 0 =No
X22	Right to bequeath Off –Reserve land to children or next of kin	+	Dummy: 1 = Yes 0 =No
X23	Do you hold any leadership position within the community?	+	Dummy: 1 = Yes 0 =No
X24	Do you operate land as a free land	-	Dummy: 1 = Yes 0 =No
X25	holder?	+/-	Dummy: 1 = Yes 0 =No
X26	Do you operate a share crop plot?	+	Dummy: 1 = Yes 0 =No
X27	Do you operate a rented plot?	+	Dummy: 1 = Yes 0 =No
X28	Do you have right to sell or lease your landholdings with or without anyone's approval? Do you have right to bequeath	+	Dummy: 1 = Yes 0 =No

X29	landholdings to your children or next of kin?	-	Dummy: 1 = Yes 0 = No
X30	Have you ever been involved in any land dispute in the past? Are you currently involved in a land dispute over your landholdings with any person/group/institution?	-	Dummy: 1 – Yes 0 = No
	REDD+ Political Economy variables		
η_1	Carbonized Exclusion		Ordinal: (5-Point Likert Scale)
η_2	Hierarchical Corruption	−¿	Ordinal: (5-Point Likert Scale)
η_3	Green Grabbing	−¿	Ordinal: (5-Point Likert Scale)
η_4	Exclusion from Procedural rights	−¿	Ordinal: (5-Point Likert Scale)

Source: (Author, 2021)

Predictor variables of interest: *Carbonized exclusion, Green Grabbing, Hierarchical Corruption* and *Exclusion from Procedural rights*.

Hypothesis Testing for Carbonized exclusion

A priori expectation: If a farmer is displaced as a result of a private timber company taking over his/her farmland, it will be difficult for him/her to regain that landholding. Hence, carbonized exclusion will have a negative effect on land access.

Null Hypothesis (H_o): The null hypothesis is that *Carbonized exclusion* due to the REDD+ Program limits smallholder farmers' access to forest land for farming activities within the study area *ceteris paribus*.

Alternative Hypothesis (H_A): That Carbonized exclusion due to the REDD+ Program does not impede smallholder farmers' access to forest land for farming activities within the study area, *ceteris paribus*.

Hypothesis Testing for Green Grabbing

A priori expectation: An over-reliance on carbon forestry as the sole REDD+ strategy, without regard to agriculture will vitiate forest laws in favor of timber plantation developers, and

this will increase their access to land within the off reserve, thereby decreasing farmers' access.

Null Hypothesis (H_o): The null hypothesis is that *Green Grabbing* due to the REDD+ Program limits smallholder farmers' access to forest land for farming activities within the study area *ceteris paribus*.

Alternative Hypothesis (H_A): That Green Grabbing due to the REDD+ Program does not impede smallholder farmers' access to forest land for farming activities within the study area, *ceteris paribus*.

Hypothesis Testing for Hierarchical Corruption

A priori expectation: Proliferation of timber plantation activities within the off-reserve increase the demand for land within the reserve, ceteris paribus, a farmer cannot compete with a medium

to large scale timber plantation developer for land. This will lead the farmer to engage in all manner of deals both legal and illegal, including the payment of bribes to power brokers just to get access to a farm plot. And as long as bribes ought to be paid to gain access to land, many vulnerable farmers would be blocked from accessing land.

Null Hypothesis (H_o): The null hypothesis is that *hierarchical corruption* due to the REDD+ Program limits smallholder farmers' access to forest land for farming activities within the study area *ceteris paribus*.

Alternative Hypothesis (H_A): That hierarchical corruption due to the REDD+ Program does not impede smallholder farmers' access to forest land for farming activities within the study area, *ceteris paribus*.

Hypothesis Testing for Exclusion from procedural rights

A priori expectation: Lack of information regarding the REDD+, the exclusion of farmers from forest management decisions and denial of justice disempowers farmers from engaging in

the right kind of negotiation with key stakeholders in addressing their reservations. Hence, such a situation always put the non-farm users of the off-reserve one step ahead of the farmers in everything including matters of land access.

Null Hypothesis (H_o): The null hypothesis is that *Exclusion from Procedural rights* due to the REDD+ Program limits smallholder farmers' access to forest land for farming activities within the study area *ceteris paribus*.

Alternative Hypothesis (H_A): That *Exclusion from Procedural rights* due to the REDD+ Program does not impede smallholder farmers' access to forest land for farming activities within the study area, *ceteris paribus*.

Land access is one with a long contract period for atleast one production cycle, clearly defined boundaries, and legally guaranteed user rights. The underlying logic is that the respondents' access to land for farming in the forest is seized by socio-economic factors and Institutional factors (instigated by the REDD+ Program). We define small holder farmers as farmers having usufruct rights to farm in the off-reserve forest whether he plants or takes care of naturally growing trees or not.

3.4.2: Model Specification for ranking of major constraints facing farmers within the area

This objective was achieved by exploring literature to identify the major constraints affecting smallholder farmers in forest fringe communities. The farmers were then made to itemize community-specific farming constraints they face individually. Constraints from literature were reconciled with those itemized by the farmers and giving to farmers to rank in descending order of magnitude.

The Weighted Average (Mean Rank) was employed for the ranking: The Kendall's Coefficient of Concordance was then used to test the degree of agreement among the rankers.

According to (Legendre, 2005), apart from Kendall's ranking technique, Friedman test, Kruskal-Wallis test, Spearman's rank of correlation coefficient, Wilcoxon rank sum test amongst others can also be used for ranking of objects in statistical analysis. But unlike the Friedman's and Garett's ranking tests for instance, which places emphasis on the items being ranked and the ordinal mean scores of the rankers respectively, the Kendall's coefficient of concordance focuses on the rankers. Thus, the Kendall's technique is most appropriate for this study.

3.4.2.1. Kendall's Coefficient of Concordance

Before the farmers are made to itemize and rank the major challenges limiting their farming activities in the study area, the weighted average approach is employed to compute the mean rank values for each of the constraints.

The weighted average formula is given by: $W = \frac{\Sigma Ti}{\Sigma m}$

Where,

$T_{i=1,2,3,\ldots n}$ = summation of rankings for the ith constraint m = total number of rankers (farmers)

Decision rule: Least weighted average constraint is taken as the most pressing constraint.

Thus, the mean rank scores for each of the constraints will be calculated; and the constraint with the least weighted average is ranked the most pressing, and vice versa. The Kendall's coefficient of concordance (W) is then employed to measure the degree of agreement among the rankings done by the farmers. W ranges between 0 and 1 ($0 \leq W \leq 1$):

0 = maximum disagreement among the farmers 1 = ranks assigned by farmer *i* is same as those assigned by the other farmers.

The coefficient of agreement formula is given as, $W = \frac{12[\Sigma T^2 - (\Sigma T)^2/n]/n}{nm^2 (n^2 - 1)}$

Where,

T = sum of ranks for each constraint
m = number of farmers
n= number of constraints being ranked

Hypothesis testing:

H_0: There is no concordance among the rankings done by the farmers

H_A: There is agreement among the rankings

Decision rule: If chi-square calculated is greater than chi-square critical value from Fisher's chi-square statistics distribution, reject null hypothesis; otherwise do not reject null hypothesis.

NB: Chi-Square calculated is determined using the formula, $\chi^2 = \lambda(n^2-1)/(k+1)$.

Where,

n-1 = degrees of freedom
k= number of constraints
λ=number of times a comparison occurs

3.4.3. Model Specification for Objective 3

Assess farmers' perspective about the nature and scope of Corporate Social Responsibility (CSR) programs that private forest companies operating within the study area have undertaken in the past 5years or more. A qualitative organizational analysis of the nature and scope of CSR that the private timber companies operating within the host forested community have been undertaking in the last five (5) years was performed using data from key informant interviewees after soliciting for the views of the respondents on the matter.

3.5: DATA COLLECTION

This section deals with the source and types of data to be used in the analysis. The optimal sample size, sampling technique, survey instrument and the statistical software packages used for

the study are also captured in this section.

3.5.1. Data Source and Type

Primary data was obtained from a field survey in the study area was used for this study. The primary data encompasses a total of ninety-eight (98) questionnaire items: Twenty-six (26) individual and socioeconomic characteristics questionnaire questions, thirty (30) five-point Likert scale questions based on 18 variables (for Factor Analysis) on each of the four dimensions of REDD+ Political Economy, one (1) question on the second objective of ranking of eight (8) major constraints, and twenty-three (25) questions on Corporate Social Responsibility. This is augmented by secondary data from literature, annual reviews and reports, and from key informant interviews of stakeholders such as District managers of the Forestry Commission in the study area, Forest range supervisors and Agricultural Extension Agents whose works fall within the purview of forest Governance and agriculture.

3.5.2. Optimal Sample size and sampling procedure

3.5.2.1. Optimal Sample size

The study area has a farming population of 65,306. The formula for calculating the optimal sample size for this study is based on work done by Yamane (1973) in (Size, n.d.). This formula is widely used for its simplicity, and given as follows: For the purpose of this social science study, the generic 10% (0.1) margin of error in Yamane's formula is reduced to 7.5% (0.075):

$$n = N/(1 + N(e)2)$$

Where,

n = desired sample size,

N = total population at the time of the survey and

e = margin of error (0.075).

The optimal sample size (n) is therefore calculated from the equation as follows: n = N/(1+N (e)^2) n = (65,306)/(1+(65,306)*(0.075)^2

n = 177.30 = 177 respondents

Thus, for a farming population of 65,306, a sample size of 177 is ideal. This figure falls above the rule of thumb of 100 optimal sample size for studies involving Exploratory Factor Analysis recommended by Gorsuch, (1990) and Ferguson & Cox, (1993) regardless of the number of items. And applying the rule of thumb of a minimum of 5 respondent per item proposed by Bryman & Cramer (1997) yields an optimal sample size of 90. But this study expects a KMO value of not less than 0.5 and a Bartlett's test value significant at 0.01 in order to avoid the problem of splintered/rogue factors and misclassification of manifest variables (items).

And since some people may refuse to participate in the survey, or be absent during the entire three- week duration of the interview, a 13% oversampling was done to cater for this shortfall, thereby, bringing the sample size to 200 which is at par with Guilford (1954) sampling adequacy recommendation. Meanwhile, six (6) respondents either declined to partake or did not complete the interview. Hence, 194 data points were obtained for the analysis.

3.5.2.2. Sampling Procedure

The Offinso Forest district of the Ashanti Region was purposively selected for the study due mainly to the following reasons:

Firstly, The Offinso Forest district area was earmarked as Plantation zone under the *National Forest Plantation Development Programme* (NFPDP) by the Ghana Forestry Commission, due to high incidence of bush fires in all its nine (9) forest reserves. As a result, all the five (5) Private commercial forest Plantation companies, namely, *Mere Plantations Ltd, FORM Ghana,*

MIRO Forestry Ghana, African Plantations for Sustainable Development (APSD) and *Ayum/Greenfields,* responsible for 46% of Ghana's total area planted under the country's forest plantation development program in 2014, have established plantations within the Offinso Forest Reserve; thereby, making the area suitable for any investigation involving the activities of timber plantation developers.

Based on proportionate distribution of sample size, respondents were randomly selected from each of the FFCs within the Mankrang Forest Reserve. Five (5) respondents were assigned to each community based on the proportion of farmers in overall community population. A group ranging between 25 and 40 crop farmers were randomly invited by the forest range supervisors with assistance from the agricultural extension agents for each community. A random probability sampling through balloting was used to select the specific number of respondents assigned to each community. Selected farmers were later visited at their homes or farms.

Additionally, one (1) assistant district manager, four (4) range supervisors, one (1) cartographer and were interviewed individually to authenticate the internal consistencies of the responses provided by the 194 farmers. Table 3.3 gives a breakdown of forest fringe communities and the formula used for the distribution of respondents:

Secondly, the scope of this study is restricted solely to activities of these timber plantation developers (beneficiaries of REDD+ funds and architecture) within the off-reserve; and with the 2010-2012 Expanded Plantation Program (EPP) extending the activities of timber plantation developers into the country's off-reserve forests, with a high possibility of flagging farmlands as deforested lands and displacing farmers in the process, the Offinso forest district, which had its share of these off-reserve private plantation development activities, is best suited for assessing the impact of the activities of these forest developers on land accessibility by the fringe

community farmers within the off-reserve. There are **nine (9)** permanent forest estates within the forest district; they include: *Opro, Mankrang, Asufu East, Gianima, Afram West, Afram East, Kwamisa, Afrensu Brohuma* and *Asubima* forest reserves respectively. Each forest estate has several communities on its fringes.

The study uses a multistage probability sampling technique to select **194** farmers and **4** range supervisors from **twenty-two (22)** communities on the fringes of **four (4)** out of the **nine (9)** permanent forest estates (reserves) through face-face interviews using semi-structured questionnaires. The Mankrang reserve was purposively included for having 56% of the overall forest district's population. The rest were randomly selected based on geography-North, South, East and West) to compartmentalize the forest fringed communities (FFCs) within the study area into five clusters: **Mankrang cluster** in the north made up of 12 FFCs (*Tawiakrom, Meredane, Nfante, Mpapaamu, Ankonum, Kutrie, Subriso 1 & 2, Mankranho, Bafokrom, Apaaso* and *Tanokrom*), **Asufu shelterbelt (East)** in the south made up of a total of 6 FFCs (*New Berekum, Koforidua, Abokyire, Kyekyewere, Nyameadom* and *Asoredanho*), **Afram East** made up of 2 FFCs (*Bogyase* and *Anyinaso*) and **Afram West** made up of 2 FFCs (*Asempaneye* and *Adankwanta*).

Table 3.3. Distribution of FFCs and Respondents within Study Area.

FOREST RESERVE	FOREST FRINGE COMMUNITIES (FFCs)	PERCENT OF CORRESPONDING FFCS IN SAMPLE SIZE
Asufu Shelterbelt $\delta = \frac{Asufu\ Popln}{Offinso\ Overall\ Popln} 100$	New Berekum	X_1
	Koforidua	X_2
	Abrokyire	X_3
	Kyekyewere	X_4
	Nyameadom	X_5
	Asoredanhu	X_6
Mankrang $\gamma = \frac{Mankrang\ Popln}{Offinso\ Overall\ Popln} 100$	Tawiakrom	M_1
	Meredane	M_2
	Nfante	M_3
	Mpapaamu	M_4
	Ankonum	M_5
	Kutrie	M_6
	Subriso 1	M_7
	Subriso 2	M_8
	Mankranho	M_9
	Bafokrom	M_{10}
	Apaaso	M_{11}
	Tanokwaem	M_{12}
Afram Headwaters $Z = \frac{Afram\ East\ Popln}{Offinso\ Overall\ Popln} 100$	Bogyase	A_1
	Anyinaso	A_2
	Asempaneye	W_1
	Adankwanta	W_2
TOTAL	**22**	**100**

(**Source:** Author, 2021)
Where,
δ = percentage of Asufu in Offinso forest district population.
ɣ = percentage of Mankrang population in Offinso forest district population.
Z= percentage of Afram East & West population in Offinso forest district population.
$X_{I=1,2,3...6}$ = Percentage of corresponding Asufu FFCs in sample size of 194.

$M_{i=1,2,3...12}$ = Percentage of corresponding Mankrang FFCs in sample size of 194.
$A_{i=1,2}$ & $W_{i=1,2}$ = Percentage of Afram East and West FFCs in sample of 194.

3.5.3. Survey Instrument

A well-structured questionnaire with both closed and open–ended questions is employed in this case study. The questionnaire captures demographics and socioeconomic features of the respondents; as well as solicit the views of respondents on some questions relevant to the entire study. Secondary data was also obtained from various sources such as Forestry Commission Annual Reviews and Project Reports, and from literature for the study.

3.5.4. Statistical Software Packages

The statistical software used for data management and variable transformation, and for running Exploratory Factor Analysis (EFA), Descriptive analysis are Excel and Statistical package for the social sciences (SPSS), STATA was used for the OLS MLR analysis.

3.5.5. Study Area

The Offinso Forest district covers two of the 43 administrative districts of the Ashanti Region of Ghana, namely, *Offinso North District* and the *Offinso Municipality*. Both districts were created in 1988 as one administrative assembly called Offinso District, until President John Agyekum Kuffour split it into the Offinso North district (in the north) and the Offinso Municipal (in the south) in 2008. The nine (9) forest reserves stretch from north to south of the two administrative districts: The *Gianima, Asufu shelterbelt* (East & West) and the *Kwamisa* forest reserves lie within the Offinso Municipality, whereas *Mankrang* and *Afrensu-Bohuma* lie within the Offinso North District. The remaining three reserves *Afram headwaters* (East & West) and

Opro reserves overlap between the two districts (GSS, 2010). The study was conducted in five (5) out of nine (9) permanent forest estates in the Offinso forest District: They include the 20,114ha Afram headwaters East and West, Mankrang (9,249ha) and the 1,831ha Asufu shelterbelt East and West forest estates (GSS, Census, 2010). There is a total of 266 forest reserves in Ghana (GFC, 2019).

The Offinso North district has a farming population of 30,000, and 7,000 farm holders with landholdings ranging from below 1hectare to 30hectares. Whereas, the Offinso Municipality has a farming population of 35,306. This gives a total population of 65,306 farmers operating within the Offinso forest district. The Offinso Forest district is one of the 46 forest districts in Ghana. Table 3.4 gives a pictorial representation of the five forest reserves selected for the study: A breakdown of the number of forest fringe communities, size of forest reserve, geographical coordinates, percentage in overall country forest area and respective overall population of FFCs fringing each reserve.

Table 3.4: Forest Reserve size, geographic location and FFCs

Forest Reserve	Geographical Coordinates	No. of FFC	Size of forest reserve/ha	%national forest area	Population of FFCs	FFCs as a % of FFC population (19,100)
Asufu Shelterbelt (East & West)	Latitude: 7^0 7^1 59.99” Longitude: -$1^0$37^{1}59.99” Elevation: 357m above sea level		1,831	0.07	5,500+	28.80
Afram Headwaters (East & West)	Latitude: 1^0 32^{1}W - $1^0$48W’ Longitude: $6^0$45^{1}N -7^0 25’N	4	20,114	0.80	2,600+	13.61
Mankrang	Latitude: 7^0 22’33.31” Longitude: -$2^0$5’6” Elevation: 280m above sea level: 305m above	12	18,547	0.7	11,000+	57.59

	sea level			4		
National Total Reserve	Latitude: 7.9465^0 N Longitude: 1.0232^{0}W Elevation: 61m	**NA**	**2, 505,717**	**10 00**	**30,000,000+**	**100**

(Source; Field Data, 2021)

The 39.2km Techiman Kumasi highway passes through the forest district. The District falls within the semi-equatorial climatic zone with a double maxima rainfall pattern which falls between April and June (major season) and September to October as minor season. The vegetation is semi-deciduous, with traces of thick vegetative cover and some stretch of guinea savanna. It is also drained by 4 rivers, namely *Offin, Anyinasu, Ode* and *Pro rivers.* The district is also home to many tourist attraction sites, namely, the virgin forest of Abofour, the Asuboi waterfalls, Kentaa (Onyina Siboso, the Tutuase Shrine and the Twumase natural caves and the Papasisi natural caves (located at the highest point of the district).

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1. INTRODUCTION

This chapter discusses the results obtained from the various analyses undertaken to achieve each of the three objectives of the study. It starts with a mapping of the forest fringe communities dotted across five (5) of the nine (9) permanent forest estates where the study was carried out; followed closely a non-parametric description of the individual household information, socio-demographic characteristics and economic activities of the respondents in the study area. A descriptive analysis of the perception of the respondents on some key variables of interest also made it into this section. The next section presents the results for the *Principal Component Analysis* carried out to reduce 30 five-point-Likert-scale items into four (4) principal factors with the help of SPSS. This is followed by a multiple linear regression analysis of the main objective.

Also, the results for the farmers' ranking of constraints is discussed, followed by a comprehensive statistical analysis of the nature and scope of corporate social responsibility undertaken by timber plantations within the case forest district. Then finally, the perception of farmers about their awareness of the presence of REDD+ Carbon payment scheme within the study area is discussed.

4.2. SUMMARY OF STATISTICS

4.2.1. Distribution of Respondents in Study Area

A total of **194** farmers were sampled from twenty-two (**22**) forest fringe communities (FFCs) in four (**4**) out of nine (**9**) permanent forest estates within the Offinso Forest District of the Ashanti Region of Ghana. The distribution of the farmers within the various FFCs is based

on the data from the 2010 national housing and population census appendices on the population distribution of the 20 largest communities within Offinso North district and Offinso Municipal: The rule of thumb is that, since the census reported on only the top 20 most populous communities and is silent on smaller communities within the two districts, with the minimum populations for Offinso North being 690 (*Mpaapaemu*), and that of Offinso Municipal being 975 (*Fawoman*), any FFC that does not make it into the top 20 communities in either Offinso North district or Offinso Municipal, is assumed to have a population below 690 and 975 respectively. These figures were assumed to be the maximum threshold for these smaller communities, and the sample selection was proportionally distributed among them to obtain parity in number of respondents from smaller communities.

A Community like *Koforidua* (with population of 1,947) which is among the top 20 communities listed by for instance had the lion's share of respondents (of 16) within the Asufu forest area. 1,947 is twice the number of the 947-minimum threshold for that district, hence the designation of 16 as number of respondents to be selected for interview in the community *(Offinso Municipality, n.d.);* (*Offinso North District*, n.d.). The table 4.1 gives a summary of the distribution of respondents in the study area.

Table 4.1: Distribution of FFCs and respondents within Study Area

FOREST RESERVE	FOREST-FRINGE COMMUNITIES	FREQUENCY	PERCENT
Asufu Shelterbelt [↱= 28.8%] 56 farmers	New Berekum	8	4.1
	Koforidua	16	8.2
	Abrokyire	8	4.1
	Kyekyewere	8	4.1
	Nyameadom	8	4.1
	Asoredanhu	8	4.1
Mankrang [✚ = 57.59%] 112 farmers	Tawiakrom	11	5.7
	Meredane	9	4.6
	Nfante	9	4.6
	Mpapaamu	9	4.6
	Ankonum	9	4.6
	Kutrie	9	4.6
	Subriso 1	8	4.1
	Subriso 2	9	4.6
	Mankranho	10	5.2
	Bafokrom	9	4.6
	Apaaso	10	5.2
	Tanokwaem	10	5.2
Afram Headwaters East & West [ℹ= 13.6%] 26 Farmers	Bogyase	6	3.1
	Anyinaso	6	3.1
	Asempaneye	7	3.6
	Adankwanta	7	3.6
TOTAL	**22**	**194**	**100**

(Source: Survey data, 2021)

4.2.2. Socio-Demographic Characteristics

Socio-demographic characteristics include gender, age, marital status, ethnicity, religion, household size, level of education, years of farming experience and residence status. The results from the analysis are shown in table 4.2 as follows:

Age

The minimum age of the respondents is 27years, maximum is 72years. The mode and median age are 42years and 42years, revealing a very youthful farming population within the study area.

Gender

Of the 194 respondents, 105 (representing 54.1%) are male and 89 (representing 45.9%) are female. Thus, there are more male farmers than female farmers in the study area. But the disparity in gender is not a par with the census data for 2010 in which the females form the majority in the Offinso North and Offinso Municipality with a representation of 50.2% and 51.8% respectively. This is expected, as the women migrate outside the rural communities to the urban areas such Kumasi to sell farm produce and engage in other business ventures to support their families back home.

Ethnicity

About 42% of the farmers are non-Akans, whereas 58% are Akans. The figure for Non-Akans is very much close to the average of 45% Non-Akans living in rural areas figure obtained during the 2010 Census.

Education

About 55.5% of the respondents have obtained basic education from primary up to Senior High School, with 5.7% making it to the tertiary level. This implies that majority of the rural population can read and write. This is consistent with the findings of GSS in 2010 in which 58.2% and 67% of the Offinso North district and Offinso Municipal populations are literates with a minimum of a senior high school certification respectively.

Marital Status

About 36.7% of the 194 respondents are married. 42.8% are unmarried. 5% and 3.2% of them are widowed and divorced respectively. These figures entirely overlap with the 37% married, 43% unmarried, 5% widowed and 3% divorced figures recorded during the 2010 national housing and population census.

Residence Status

Regarding residence status, 54% of the farmers are migrants mainly from the five (5) northern regions. 46% are native farmers. This data is consistent with the 2010 census data in which at Offinso north (37.8% migrant) and Offinso Municipal (27.6% migrant), both have a chunk of their migrants (bout 59%) living in rural communities as farmers.

Household size

The forest district population of 19,100+ has 3,821 households; representing 20% of the population. The average household size is 6.72 persons per household. Minimum household size is 3, maximum is 15. Children constitute the largest majority (representing 42.3%). 9% of the

household members are spouses, whereas nuclear households (head, spouse(s) and children) constitute 21% of the household size in the study area.

Years of farming experience

The maximum number of years of farming experience is 51years. Minimum is 14months and average for entire sample population is 13years.

Table 4.2: Results Summary (Socio-demographic characteristics)

Characteristics	Category	Frequency	Percent
Gender	Male	105	54.1
	Female	89	45.9
Marital Status	Married	171	88.1
	Widowed	16	08.2
	Unmarried	7	03.6
Ethnicity	Akan	113	58.3
	Non-Akan	81	41.7
Religion	Christian	115	59.0
	Moslem	58	30.0
	Traditionalist	5	02.7
	No Religion	16	08.3
	Others	0	00.0
Level of Education	Primary	44	22.7
	JHS/JSS	59	30.4
	SHS/SSS	24	12.4
	Tertiary	11	05.7
	None	56	28.9
Residence Status	Native Non-native	89 105	45.9 54.1
Household size	Minimum	3	**
	Maximum	15	**
	Average	6.72	**
Years of Farming Experience	Minimum	1.2	**
	Maximum	51	**
	Average	13	**

Source: Field Survey, 2021

4.2.3. Economic Characteristics of Respondents

Table 4.3 outlines the economic characteristics of the respondents:

Total Farm size (both Off Reserve and On Reserve)

The minimum farmland holding size (including farm plots and fallow farmlands) in the area stands at 0.41ha. The largest farmland holding is 50hectares. These lands are used for the cultivation of cocoa, plantain, cassava, teak and other food crops. The average farmland size of 2.962ha shows that the farmers are predominantly smallholder. About 72% of these farmlands lie within the off-reserve. The remaining 28% are farm plots within the on-reserve that were either gazetted as "admitted farms" by the Forestry Commission or leased out to farmers under the Modified Taungya Scheme (MTS).

Annual Farm Income

The dominant cash crop grown in the area is cocoa. The average annual Income from the average farm investment in the area is GHS27,600.35. This income is raised from farming in two seasons (major season --September to January and minor season --June to August) after selling their produce to itinerant traders, who in turn sell to other buyers within the value chain. The maximum annual farm income is GHS277,280, with a minimum of GHS1,790. Due to the *abunu* (50:50) and *abusa* (40:30:30) lease arrangement regime prevalent in the area, majority of the farmers (mostly migrant farmers), earn between GHS1,790 and GHS5,330 annually. Majority of the high-income earners are either landowners who operate their own farms or are farmers who practice good agricultural practices. A minority group of the farmers also rear livestocks and grow oil palm, citrus, avocado pear, and food crops such as cocoyam, cassava, maize and vegetables on a small scale to augment their incomes.

Annual Total HH Income

Apart from farming, the respondents and/or members of their households engaging in other non-farm activities as alternative sources of household income. Some of these ventures include public sector jobs, artisanship, petty trade, sand winning, dressmaking, hairdressing, taxi, *Aboboya* and *Pragia* driving, tree planting, logging, auto fitting, oil palm processing, carpentry, pito brewing, akpeteshi distilling, amongst others. Remittances from family members in greener pastures outside the forest district was a significant contributor of annual household income in the area.

The maximum total household income from both on-farm and off-farm activities within the area is GHS308,540. The minimum is GHS2,570, with an average of GHS105,600.54. This implies that the major source of annual household income (between farming job and other forms of occupation) in the area is farming, representing 72% of average total annual household income.

Source of Income

Three main sources of income were identified in the study area: On-farm income source, Off-farm Job and Remittances. Remittances constitute 8.8% of annual household income; farm income represents 72% of total household income, and Off-farm jobs contribute to 19.2% of annual household income.

Membership of Famer Based Organization (FBO)

FBOs provide training and technical assistance to farmers to grow their crops sustainably and responsibly, to increase their yield per hectare and improve their socioeconomic livelihoods. About 102 of the respondents (representing 52.6%) belong to one cocoa cooperative or the other. A good number of the farmers (about 47.2%) were once members who have stopped being members or do not subscribe to joining any cooperative with the dominant reason that they are not serving their interests as is expected. Instead, they rely on the Agricultural Extension Agents, Crop Health Extension Agents of COCOBOD and other NGOs for technical assistance.

Teak Plantation Ownership

Apart from private timber developers such as FORM Ghana, Mere Plantations Ltd, Evans Timbers and sawmills operating with the forest reserve, individual households including community leaders and chiefs engage in teak plantation within the area's off-reserve. Many of these farmers opted for teak plantation based on recommendation from forest range supervisors. According to the range supervisors, the said farmlands owned by community members within the off-reserve are waterlog (wetlands) and unsuitable for crop farming. About 9 respondents in all (representing 4.6% of sample) own teak plantations ranging between 15acres and 50acres in the off-reserve.

Current Participation in Modified Taungya Scheme (MTS)

At the time of this survey, majority of the farmers in various compartments under the Modified Taungya Scheme (MTS) had completed the scheme, with many receiving full share of their tree benefits for tending to trees of the Ghana Forestry Commission within compartments on the on-reserve to full canopy, while growing their crops. Some areas no longer practice the scheme due to its failure to achieve the intended objective of reforestation there.

In all, 45 farmers (representing 23.2%) claim to have benefitted recently from the MTS tree benefit sharing scheme. 7.5% of respondents under a separate compartment were yet to receive their share of the tree benefit, since the compartment is yet to be harvested by a logger.

Usufruct rights to farm in On-Reserve

Despite the on-reserve being a protected area, 34 respondents (representing 17.5%) attest to having access to farm on admitted farms within the on-reserve, either under a lease arrangement or through ownership. There are also complains from the Assistant district Manager of some of these cocoa farm landholders illegally expanding their farm plots within the on-reserve. Some of these farmers have been arraigned before the district court.

Mode of acquisition of landholding in Off Reserve

All lands within the study area are stool lands belonging to the Asantehene, with the paramountcy, divisional and sub-chiefs, clan heads and family heads as caretakers, in the trust of the State. About 94 of the respondents (representing 48.5%) obtained their lands through family inheritance. 20 farmers (10.3%) say they rented their farm lands under various payment arrangements. Also, 39.2% of the farmers obtained their usufruct rights through sharecropping (abunu/abusa). While 4 farmers (representing 2.1%) admit to farming on portions of the off-reserve as squatters. Two (2) of the respondents obtained land as gifts. Off reserve farmlands for food crop production are relatively cheaper as compared to lands with old cocoa farms.

Possession of Informal Land Titling Documents of Off Reserve Land

About 62.9% of the respondents do not have any formal or informal land titling document covering their lands within the off-reserve, even though they claim to be in full control of their lands without fear of encroachment. None of these lands were in dispute at the time of this survey. This lack of legal documentation usually leads to minor disputes between sharecroppers and land owners. But such disputes are rear; and there is always an appropriate means for resolving such issues when they arise.

There is also the problem of high cost of land rent associated with well documented farmlands. Those who do not have land documents know their farm sizes and boundaries. And they blame their inability to acquire land documents for their landholdings on the tedious nature of the processes and procedures involved in registering customary land.

Table 4.3: Economic Characteristics of Respondents

Characteristics	Category	Quantity	Percent
Total Farm size (both Off Reserve and On Reserve)	Minimum Maximum Average	1acre = 0.41ha 123.5acres =50ha 7.32acres= 2.962ha	
Annual Farm Income	Minimum Maximum Average	GHS1,790 GHS277,280 GHS21,774.35	
Annual Total HH Income	Minimum Maximum Average	GHS2,570 GHS308,540 GHS25,600.54	
Cost of Off-Reserve land/Ha/Yr	Minimum Maximum Average	GHS2,000 GHS132,000 GHS 19,570	
Source of Income	On farm job Off-farm job Remittances		72.0 19.2 8.8
Member of FBO	Member Non-member	102 92	52.6 47.4
Teak Plantation Ownership	Owner Not an owner	9 185	04.6 95.4
Current Participant of MTS	Participant Non-participant	45 149	23.2 76.8
Type of Farming Activity	Cash crop only Both cash crop and Food Crop Cash crop/Food crop/Livestock Livestock only	62 97 32 2	32 50 16.5 1.5
Usufruct rights to farm in On Reserve	Yes No	44 150	22.7 77.3
Mode of acquisition of landholding in Off	Stool land in Family	94	48.5

Reserve	custody Rented Sharecropping (Abunu/Abusa) Squatting	 20 76 4	 10.3 39.2 2.1
Possession of Informal Land titling Documents of Off Reserve Land	Yes No	72 109	37.1 62.9

Source: Field Data, 2021

4.3. RESULTS OF FACTOR ANALYSIS

From the Pattern matrix for the rotated factor loadings with Kaiser value criteria of >1 and factor loadings ⊛ 0.3 rules of thumb, four components had 14 items loading

From table 4.4, four factors loaded above 0.3 on factor 1, and three items loaded above 3.0 on factors 2, 3 and 4. The even distribution of the factor loading unto each of the four factors (with eigen value greater than 1) proves the number of factors extracted in the scree plot.

Table 4.4: Pattern Matrix.
Extraction Method: *PCA*.
Rotation Method: *Orthogonal Varimax with Kaiser Normalization* Converged after 13 *iterations*

Items	1	2	3	4
E8	0.575			
G1	0.675			
G2	0.743			
G4	0.571			
D1		0.870		
D2		0.836		
D4		0.636		
E1			0.564	
E2			0.789	
E3			0.791	
G7				-0.597
F4				0.541
F6				0.717

Source: SPSS Algorithm of Survey Data, 2021

Table 4.5 gives the items that loaded well unto the factors:

Table 4.5: Definition of most efficient Items

Item	Questionnaire Question
G1	Farmer partake directly in forest governance decisions within the community.
G2	Farmer is consulted by the forestry Commission before forest resource decisions are taken
G4	Famer is aware of the carbon trade benefits paid to farmers by the REDD+ secretariat
E8	Tree benefit sharing regime for non-crop trees harvested on farm is very satisfactory
D1	Farmer has lost portion(s) of landholdings in off-reserve to timber plantation developers
D2	It is easy accessing farm plot within off reserve for farming activities
D4	Farmer is willing to invest long term in crop production on landholding within off reserve
E1	Farmer acquired farm plot through a community forest broker
E2	Forest broker business is booming in the community
E3	Farmer has ever paid money (bribe) to a forest broker to help you get access to a farmland within off reserve
G7	There are justice avenues for seeking redress on forest governance decisions that deny farmer access to a farmland within production forest.
F4	Farmer has ever lost your landholding or a portion of it to the forestry commission or to a private timber company
F6	Farmer willingly gave out landholding to a timber developer in exchange for monetary benefit

Source: Author, 2021.

4.3.1. Strength of Factor Analysis

Dziuban & Shirkey (1974) proposed that either of two tests, namely, Bartlett's Test of sphericity and Kaiser Meyer-Olkin Measure of Sampling Adequacy (KMO MSA) be carried out to ascertain the plausibility of carrying out an FA. According to Kaiser & Rice (1974), 0.5 KMO value is the smallest value considered acceptable.

Thus, from Table 4.6, a KMO value of 0.671, coupled with a Bartlett's Test p-value of 0.000 (< 0.01) shows that there is a significant correlation between the variables used in the factor analysis, and that Factor Analysis was necessary for this study.

Table 4.6: KMO and Bartlett's Test

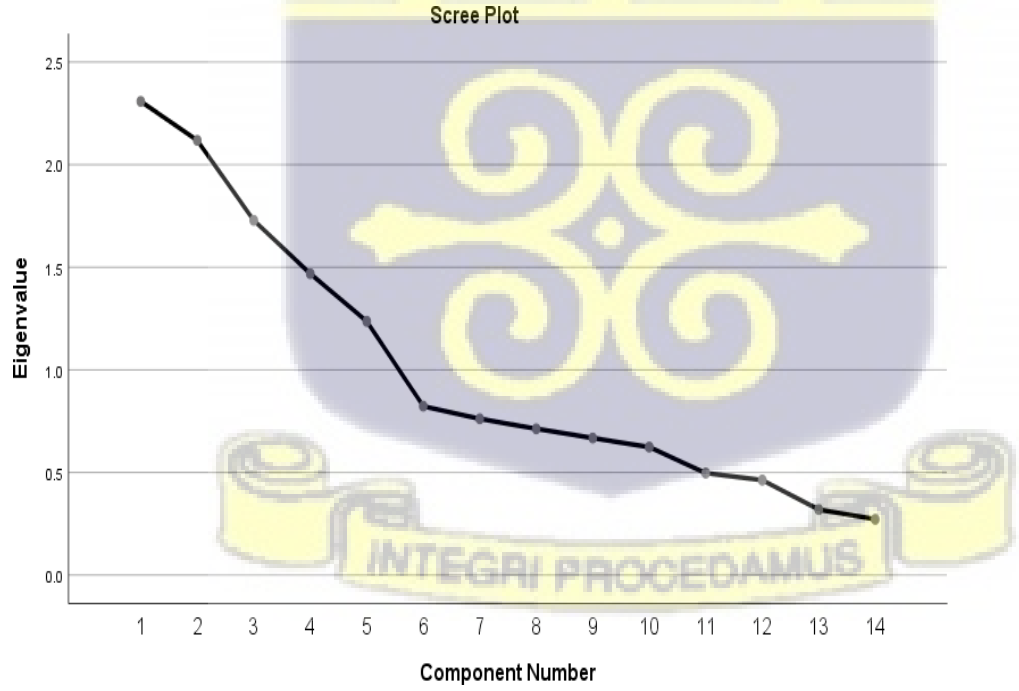
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.671
Bartlett's Test of Sphericity	Approx. Chi-Square.	537.262
	df	91
	Sig.	0.000

Source: Field Survey, 2021

4.3.2. Factor Extraction and Rotation

The scree plot output in figure 4.1 shows the relationship between the Eigen Values and number of components, and gives us an indication that five (5) factors ought to be retained based on the Kaiser Criterion of Eigen Value >1. Nonetheless four factors were retained based on ≥0.3 cross loadings rule of thumb.

Figure 4.1: Scree Plot



Source: Field data, 2021

Table 4.7 gives a summary of the four factors that do the best job of explaining the relationship among all the 14 of the 30 most efficient questionnaire items. Cumulatively, each factor explains the total variance in the matrix by 55%, 67%, 42% and 75%.

Table 4.7: Summary of factors rotated based on Eigen value >1 rule

Component	Eigen Values	Cumulative%
1	2.071	54.792
2	1.969	68.858
3	1.837	41.981
4	1.747	74.460

Source: Field Data, 2021

4.3.3. Monte Carlo PCA for Parallel Analysis

Generating 100 different random parallel eigen values for 194 subjects at 70 replications for the remaining 14 items, and comparing with calculated eigen values from PCA above, we have:

Monte Carlo Hypothesis Testing

H_0: The first four factors extracted by PCA are not the best option of factors to be extracted.

H_A: The four extracted factors are our best options to be extracted for further analysis.

Decision rule: Reject null hypothesis if the eigen value calculated are greater than the randomly generated eigen values, otherwise do not reject H_0.

From **table 4.8**, the first four factors have their eigen values greater than their corresponding randomly generated eigen values, but all the subsequent factors, 5 and 6 and so on, have their eigen values being less than the randomly generated parallel eigen values; so we reject the null hypothesis (H_a) and conclude that the four components extracted from the scree plot are our best option of factors.

Table 4.8: Monte Carlo PCA Parallel Analysis Results for top six items.

Factor	Eigen Value Calculated	Random Eigen Value	Standard Dev.
1	**2.071**	**1.341**	**0.202**
2	**1.969**	**1.362**	**0.173**
3	**1.837**	**1.433**	**0.191**
4	**1.747**	**1.627**	**0.154**
5	1.432	1.651	0.137
6	1.097	2.304	0.109

(Source; Field data, 2021)

4.3.4. Naming of extracted factors

Based on the nature of the extracted questionnaire items, the following names were allotted each factor:

Table 4.9: Naming of extracted Factors

FACTOR	NAME
1	Exclusion from procedural rights
2	Carbonized Exclusion
3	Green Grabbing
4	Hierarchical corruption

Although, the analysis in itself does not overlap with any previous study on the subject matter, three of the extracted factors, namely "Exclusion from Local Participation in Forest management decisions", "Over-reliance of State on Carbon forestry" and "Farmer's willingness to vacate land for timber producers in exchange for compensation" are consistent with the vernacularization by Asiyanbi et al., (2016), Tobias & Richmond (2014), Kasanga et al., (2018) and Hall et al., (2011) respectively on the dimensions of the REDD+ Political Economy in Sub-Saharan Africa, namely, *'Carbonized Exclusion', 'Green Grabbing'* and *"Exclusion from Procedural Rights*.

Hall et al., (2011) defines Procedural rights as encompassing 'Denial of access to forest governance Information', 'Exclusion from forest management decisions', and 'Denial of

Justice'. But the factor rotation separates items explaining "*Exclusion from Justice"* from those that explain '*Procedural rights'*.

4.4. RESULTS OF MULTIVARIATE LINEAR REGRESSION ANALYSIS

After performing a parametric (normality) test in SPSS on all dependent and independent variables, some variables were found to be significantly skewed (negatively or positively). Hence, in order to fit our data to meet the normality assumption, those variables were log transformed to forestall any violation of the OLS linearity assumption. A Shapiro-Wilk's test ($p>0.05$) (Shapiro & Wilk, 1965; Razali & Wah, 2011) and a visual inspection of the histograms, normal Q-Q plots and box plots of these predictor and Response variables show that they were approximately normally distributed, with a skewness and Kurtosis whose Z values were between 1.96 and -1.96 (Cramer, 1998; Cramer & Howitt, 2004; Doane & Seward, 2011). The results in Table 4.10 are estimates from normalized data sets containing both level and log transformed variables that were regressed with agrarian land access as response variable:

Table 4.10: Regression Results

Variable	Unstandardized Coefficients	Std. Error	Sig	t	Collinearity (VIF)
Constant	0.952	.574	0.042	1.659	1.142
Mean (Factor 1)	-0.551	0.213	0.821	2.587	1.531
Mean (Factor 2)	-0.543	0.135	0.635	4.022	1.204
Mean (Factor 4)	-0.223	0.146	0.412	1.527	1.361
LogAnnual_HH_Income	0.813E-5***	0.405E-5	0.000	2.007	1.659
Log(Operating_as_Squatter)	-0.02***	0.006	0.025	3.333	2.340
Log(Cost_of_Land)	-0.004***	0.002	0.005	2.000	4.112

Source: Field Survey, 2021

$R^2 = 0.776$ R^2 Adjusted = 0.603

F-Statistics = 9.971***. Std. Error of Estimates = 2.04504

*= significant at 10%, ** = significant at 5% and *** significant at 1%

Hypothesis Testing and Model Fitness

The Analysis of Variance (ANOVA) F-stats which measures the joint significance of all the variables as a group, is significant at 0.000, and so we reject the null hypothesis that the model with intercept only (without the independent variables) fits the data as well as the model, and do not reject the alternative hypothesis that the specified model fits the data well (the predictor variables are not all equal to zero) (Archdeacon, 1994, p.168).

Also, the R-Square Adjusted value of 0.535 means that the predictors jointly explain the variation in the response variable by 53.5%. Since all the REDD+ Political economy factors are not statistically significant, the null hypothesis (H_0) that REDD+ Political economy has a linkage with agrarian land access within the off-reserve forest is rejected. Thus, we do not reject the alternative hypothesis (H_a) that there is no linkage between the variable of interest and the agrarian land access response variable.

Regression Equation

Land Access = 0.952 + 0.000008LogAnnual_HH_Income – 0.002LogOperating_as_squatter – 0.004LogCost_of_Land + 0.00001Education + 0.006FBO_Member + 0.005LogTimber_Plantat – 0.007Residence Status.

Interpretation

Ceteris paribus, a 1% increase in annual household income will increase a farmer's access to agro-forestland by 0.00008hectares. A 1% increase in the number of farmers operating on a forestland as a squatter without approval from the forestry commission or permission from land owners reduces overall access to land by 0.002ha. All things being equal, a 1% increase in the cost of land leads to a decreased access to land by 0.004ha. A 1 unit increase in the number of years of education increases a farmer's access to forestland by 0.00001ha, ceteris paribus.

Dealing with Multicollinearity

The ideal VIF value of 10 recommended by Hair et al, (1995) was employed in this study, leading to a deletion of over 7 highly correlated variables to avoid the problem of multicollinearity**.** The final predictor variables included in the model all have VIF less than 5, and passes the maximum VIF threshold of 5 proposed by Ringle et al., (2015).

Once the joint predictive power of our variables is established, we analyze the individual significance of the various predictor variables in the final MLR model.

Results of Hypothesis Testing

Carbonized Exclusion

The Null hypothesis (H_0) that the carbonized exclusion variable explains the variation in the response variable is rejected. Thus, we do not reject the Alternative hypothesis (H_A) that the said independent variable (IV) explains the variation in the dependent variable (DV).

Hierarchical Corruption

The Null hypothesis (H_0) that the hierarchical corruption variable explains the variation in the response variable is rejected. Thus, we do not reject the Alternative hypothesis (H_A) that the said independent variable (IV) explains the variation in the dependent variable (DV).

Green Grabbing

The Null hypothesis (H_0) that the Green Grabbing predictor variable has a linkage with the response variable is rejected. Thus, we do not reject the Alternative hypothesis (H_A) that the said independent variable (IV) has a zero coefficient.

Exclusion from Procedural Rights

The Null hypothesis (H_0) that exclusion from procedural rights causes a variation in the responses variable is rejected. Thus, we do not reject the Alternative hypothesis (H_A) that the said independent variable (IV) explains the variation in the dependent variable (DV).

Conclusion

Hence, we conclude that the REDD+ Political Economy constructs (i.e. *Carbonized exclusion, Hierarchical corruption, exclusion from justice and exclusion from procedural rights* do not determine land access in the Offinso Forest District. The sociodemographic characteristics such as willingness and ability of a farmer to pay for the cost of agrarian land determines his access. Thus, cost and scarcity of farmland within the off-reserve due to increase in demand for land are the main factors determining land access in the area. The result reveals that Ghana is fully committed to the REDD+ safeguards, and that farmers' lack of access to forestlands in the study area is not due to REDD+ political economy, but principally due to rising cost and scarcity of land, ceteris paribus, which is consistent with the theory of Scarcity. Also, the positive causal relationship between land access and Annual Household Income implies Income Elasticity of demand: When a farmer's income falls, his effective demand for an additional plot of land decreases and vice versa.

Also, the inverse relationship between annual cost of land and land access is consistent with the economic theory of demand: Ceteris paribus, the higher the price of land, the lower the quantity demanded (access), and vice versa.

Finally, the land tenure insecurity regime of a squatter who farms on a land that does not belong to him is higher. Such a farmer wants to benefit from the resource commons at little or no cost.

Such a phenomenon falls within the purview of Consumer behavior's *Willingness to Pay (WTP)* theory: Willingness to pay is the willingness of a consumer to pay for the benefit derived from a resource or product. A squatter on a community land, just like any rational consumer is not willing to pay higher prices for something he believes does not belong to a single individual. He prefers more to less. A person's level of income amongst other factors is a major determining factor of his willingness to pay (WTP): Therefore, with a low total household income level, a farmer may resort to squatting, which eventually leads to displacement or eviction from the land, hence the inverse relationship between squatting and land access.

4.5. RESULTS FOR THE IDENTIFICATION AND RANKING THE MAJOR CONSTRAINTS FACING SMALLHOLDER FARMERS WITHIN THE OFFINSO FOREST DISTRICT.

From table 4.11, the Least Weighted Average which indicates the most pressing of the eight (8) constraints is Access to Credit. This is followed by Cost of farm inputs, and then Access to farm land as the third most pressing constraint. The most pressing constraint lends credence to the issue of increased Household Income enhancing farmer's access to land in the study area: If a farmer gets access to credit, (s)he will increase their farm investments to take advantage of economies of scale, thereby increasing his/her farm and household incomes concurrently. An increase in household income means (s)he can acquire more secured lands to diversify or increase her productivity.

A weighted average of 7.09 for Access to Government Services shows that the farmers seems satisfied with the work of Agricultural Extension Agents of MOFA, Cocoa Health Extension Division Agents of COCOBOD and range supervisors of the Forestry Commission operating within the forest district. This is testament to the work done by the Forestry Commission to ensure that the commission's forest governance activities do not become

deleterious to agrarian livelihoods within the community, hence, the finding that REDD+ hegemony does not block land access in the district.

A mean rank of 4.56 for Climate Change related issues is indicative of the prevalence of bushfires in the area. According the Assistant District Manager, the forest district was earmarked for a national plantation development because of the prevalence of bushfires and draught which affected cocoa farms fringing the permanent forest estates.

Table 4.11: Mean rank (Weighted Average)

CONSTRAINTS	MEAN RANK	RANKING
Access to credit	1.56	1
Cost of Inputs	2.78	2
Access to Land for farming	2.96	3
Profit from farming	4.23	4
Climate change related issues (Draught & Bush fires)	4.56	5
Competing with non-farmland users such as timber plantation developers, illegal miners, charcoal producers and illegal loggers.	6.39	6
Non-suitability of land within off reserve for farming	6.42	7
Access to Government services	7.09	8

Source: Field Data, 2021

4.5.1. Kendall's W test results

The coefficient of agreement among the 194 farmers, W = 0.667. This implies a 67% rate of agreement among the rankers.

Meanwhile, the Null hypothesis that there is no agreement among the farmers is rejected due to the p-value of 0.000 at 99.999% confidence interval. Hence, we conclude that there is a 67% degree of agreement among the farmers regarding their rankings.

Table 4.12: Results for Kendall's W

N	194
Kendall's	0.667
Chi – Square	905.612
df	7
Asymp. Sig	0.000

Source: Field Data, 2021.

4.6. EVALUATING FARMERS' LEVEL OF UNDERSTANDING AND APPRECIATION OF FOREST CONSERVATION AND SUSTAINABLE AGRICULTURE

From table 4.13, all 194 farmers (representing 100%) have a strong understanding and appreciation of forest conservation and sustainable agriculture. About 98% of farmers practice climate smart agriculture; and about 100% of them strongly agree that the forest and trees are important for sustaining their livelihoods and wellbeing; while at the same time serve as the first line of defense against climate change.

Table 4.13. Frequency table for Five-Point Likert Scale weighted mean

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Forests and trees are important for my livelihood and socioeconomic wellbeing	194	0	0	0	0
Forests serve as first line of defense against heat, drought, floods and disturbed seasons.	194	0	0	0	0
Protecting the environment contributes to a healthy environmental change	190	4	0	0	0
Climate variability affects my farming activities when I cut down trees	191	3	0	0	0
I practice Climate smart agriculture	190	3	1	0	0

Source: Field data, STATA, 2021.

4.7. RESULTS OF FARMERS' PERSPECTIVE ABOUT THE NATURE AND SCOPE OF CORPORATE SOCIAL RESPONSIBILITY (CSR) PROGRAMS.

Table 4.14 gives a summary of the CSR results: About 90.75% of the respondents are aware of the activities of Plantation developers within the community forest reserves. Some of these private timber companies operating within the forest reserves in the area are listed in Appendix B: About 58 farmers (representing 81.4%) admit that these timber plantation companies provide employment opportunities for the FFC labor force. About 36.65% of them say that atleast one member of their household has been employed by a timber plantation developer and other actors within the timber industry. Of the 71 farmers whose household member work for a timber company, 61 of them are satisfied with the remuneration at the timber plantation job. 36 are dissatisfied with their timber plantation job, and hope for an increase in remuneration. Also, 61 out of the 71 say their household members work on part basis with timber companies. About 10 of them admit working full time. About 14 of the respondents whose household members work with a timber company, work as caretakers, 29 of the respondents' household member(s) work as tree planters, 21 respondents' household member(s) work as both tree planters and caretakers, and 7 farmers kinsmen undertake other responsibilities other than tree planting and caretaking.

When it comes to the provision of social amenities, portable drinking water, sanitation projects, educational projects, healthcare, road infrastructure and water projects, the respondents unanimously agree that no such projects have been undertaken by any timber plantation company within the district. But atleast 3.6% of the respondents admit to receiving some form of support in terms of farm inputs and training programs from some timber plantation developers and their partners.

However, 98.45% and 80.93% concord that the activities of timber plantation companies have led to a restoration of biodiversity and reclaim of deforested lands respectively within the community forest landscape. Nonetheless, Information gathered from the Assistant District Manager at the Offinso Forestry Commission and four Range supervisors indicate that the scope of Social Responsibility Agreement that the timber companies and communities go into, apart from providing employment opportunities for the inhabitants include:

1. Code of Conduct.
2. Compensation for Opportunity cost of land use
3. Corporate Responsibility benefit payment
4. Restoration of forest cover and biodiversity

Code of conduct

Code of conduct refers to a set of rules outlining the norms, rules and responsibilities or proper practices of the timber plantation companies. As part of their Professional behavior, it has become company policy among timber plantation development companies to observe all taboos, holidays of obligation, amongst other norms and values that the communities live by. This he says form part of the industry's Social Responsibility (SR).

Compensation for Opportunity cost of land use

Apart from paying timber rights fees (off-reserve companies are exempted from paying), Contract area rents and stumpage fees, 33% of timber proceeds is paid as royalties for the use of stool lands for plantation development by the Timber plantation developers. This compensation fee (or royalties) paid to the chiefs is compensation for the economic benefits that an alternative

use of the stool land could have brought to the community. This is paid to the Office of the Administrator of Stool Lands (OASL) through the District Forestry Commission.

Corporate Responsibility benefit payment

About 5% of the value of each tree within a 5km radius being harvested is paid to the host community as Social responsibility.

Restoration of forest cover and biodiversity

The activities of timber plantation developers have silvicultural benefits: Some of these benefits include enhanced biodiversity (with the return of bush rodents for bush meat) and forest canopy cover which provides shades for cocoa trees, provides clean air, and enhances the soil fertility level for crop farming activities, production of wood, firewood and charcoal, recreational and other countless environmental services to the host communities.

Table 4:14: Corporate Social Responsibility Results

VARIABLES	INTER	FREQ	%
Awareness of Timber Plantation Activities within community Off Reserve	Yes No	176 18	90.7 9.3
Provision of employment opportunities by Timber Companies	Yes No N/A	158 5 31	81.4 2.6 16
Household member employed by timber plantation	Yes No N/A	71 87 36	36.6 44.8 18.6
Nature of job of household member	Part Time Full Time	61 10	31.4 5.2
Household member's position in timber company	Caretaker Tree planter Both care/Planter Others	14 29 21 7	7.2 14.95 10.82 3.61
Level of satisfaction of household member with timber plantation job	Satisfied Dissatisfied	35 36	18.04 18.55
Sanitation projects undertaken by atleast one Timber	Agree	0	0

company	Disagree	194	100
Water projects undertaken by atleast one Timber company	Agree Disagree	0 194	0 100
Education projects undertaken by atleast one Timber company	Agree Disagree	0 194	0 100
Health projects undertaken by atleast one Timber company	Agree Disagree	0 194	0 100
Assisting farmers with farm inputs/training by atleast one Timber company	Agree Disagree	7 187	3.61 96.39
Road projects undertaken by atleast one company	Agree Disagree	0 194	0 100
Activities of Timber plantation companies led to restoration of biodiversity in forest reserve	Agree Disagree	191 3	98.45 1.5
Activities of timber plantation developers has reclaimed deforested lands within community forest landscape	Agree Disagree	157 37	80.93 19.07
Activities of timber plantation developers interfere with farming activities within Off reserve	Yes No	116 78	59.79 40.21

(Source: Field Survey, 2021)

Conclusion

Regarding the nature and scope of Social Responsibility undertaken by Timber Plantation developers within the study area, the study makes the following findings:

1. Timber plantation companies operate in an ethical and sustainable way and deals mainly with environmental impact (positive externalities) of their activities (restoring biodiversity and providing sustainable environmental services) on host communities.
2. The Plantation developers pay attention to the human resource development, community development and welfare of forest fringe community members by prioritizing their alternative livelihood sources as tree planters, caretakers, and the payment of royalties which, when put to good use by the community leaders will inure to the benefit of the entire community.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. SUMMARY

This study underscores the causal relationship between the REDD+ Political economy and agrarian land access of forest fringe community dwellers who depend on the forest for their livelihoods. The study was conducted in the Offinso forest district of the Ashanti Region of Ghana. The views of 194 farmers were randomly solicited using well-structured questionnaires. To achieve the main objective, three (3) specific objects analyzed: Identifying and ranking of major constraints facing farmers in the forest district and their level of understanding and appreciation of forest conservation and sustainable agriculture were analyzed. The nature of Corporate Social Responsibilities of Timber Plantation developers was also evaluated. Four (4) main dimensions of REDD+ Political economy (namely, *Carbonized Exclusion, Hierarchical Corruption, Green Grabbing* and *Exclusion from Procedural rights*) were identified from literature as predictor variables in a final MLR analysis after an exploratory factor analysis was performed on the variables for having a minimum of five (5) underlying measured variable items each. The Exploratory Factor Analysis (EFA) was performed using *Principal Component Analysis* (default algorithm in SPSS) to reduce 30 5-point Likert scale questionnaire items to 14 manifest variables (after removing all items with loadings below 0.3 and cross-loadings). The KMO value of 77% and Bartlett's test results significant at 0.01 vindicated our decision to perform Factor Analysis on the manifest variables, rather than including all of them (possible cause of multicollinearity and over-specification bias) directly into the multivariate linear regression model.

Orthogonal rotation was done after factor extraction to ensure that the four (4) REDD+ Political economy variables were uncorrelated with each other. Land access was measured as amount of land in hectares that a farmer has usufruct rights to within the off-reserve forest. Farmers who operate only in the on-reserve forest were excluded from the study.

The results of the regression reveal that none of the four (4) minor constructs of REDD+ Political economy was statistically significant. Other demographic characteristics were significant at 0.05. Access to credit ranked the most pressing constraint ahead of agrarian land access which ranked third, thereby lending credence to the regression results that access to land is not the most pressing constraint within the production forest in the study area. Also, the ranking of bushfires and draught as 5th most pressing constraint implies that portions of the forest have been lost to climate change induced factors; and this vindicates the GFC's decision to earmark the district for the forest carbon development of the REDD+ and forest plantation programs respectively.

5.1.1. Conclusions

The findings on the linkage between REDD+ Political Economy and agrarian land access, presupposes that Ghana is committed to the REDD+ safeguards of protecting the livelihoods of forest dependent people which is a necessary UNFCCC requirement for accessing the second funding window of the REDD+. On the contrary, access to land within the district is linked to socio-economic and extraneous confounding factors which have been influencing farmers' access to agro-forestlands before Ghana signed up for the REDD+ action in 2010. Thus, it can be concluded from the study that contrary to the findings by (Asiyanbi et al., 2016; Hall et al., 2011; Osborne, 2011; Kasanga et al., 2018; Goldstein & Udry 2008) that the REDD+ program is engendering "environmental dispossession" and "carbonized exclusion" by

denying rural households' access to the forest resource, the activities of the timber plantation companies operating within the Offinso Forest District in the Ashanti region of Ghana do not cause such problems for the local people. The major finding of this study is in synch with the findings of Cobera et al., (2017) and Harvey et al., (2010). This implies that restricting the survey exclusively to the off-reserve forest, significantly changes the narrative by critics of the REDD+ within the study area.

Secondly, "access to credit" ranking as most pressing constraint facing the farmers in the study area confirms the finding of Bugri (2006) who upon examining the constraints to agricultural productivity within the Bongo and Bolgatanga semi-arid areas of Ghana found access to finance as most pressing constraint. The ranking implies that farmers in the forest district can be able to access land if they are willing and able to pay for land at any prevailing rate. The results of the ranking also suggest that REDD+ political economy is not responsible for denying forest fringe community farmers access to agrarian land in the off-reserve forest, access to credit is.

Also, 100% of farmers having a very good understanding and appreciation of forest conservation and sustainable agriculture implies that although this study has not demonstrated that farmers are being excluded from forest governance in the forest district, if farmers are included in forest governance, the REDD+ action will achieve more efficient outcomes through their participation and collaboration. After all, they are the ones trading-off the forest to expand their farm sizes, they should equally play an active part in the solution.

Finally, the findings on Corporate Social Responsibility (CSR) implies that the priority of Timber plantation companies is the multiplier effect that their job creation in the timber value chain, and sustainable environmental services due to reclaimed forests and restored biodiversity

have on the socio-economic livelihoods of FFCs within the district, in accordance with the safeguards of the REDD+ Program goal.

5.2. POLICY RECOMMENDATIONS

This study recommends a number of policies based on the conclusions from the findings, to improve the evolving REDD+ Implementation program in Ghana especially as far as the livelihoods of forest fringed communities are concerned: The study identifies "access to credit" to be at heart of access to agro-forest lands:

The study identifies "access to credit" to be at the heart of access to agro-forest lands. This study therefore recommends that the World Bank, International Labor Organization (ILO), Ghana's Rural and Community Banks (RCBs), Association of Rural Banks (ARBs), International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA) hasten to meet the financial needs of low-income rural dwellers, especially women, by mobilizing and transferring good financial capital for the purpose of investment in the areas of climate smart agriculture and non-farm enterprises to stimulate rural economic growth in developing economies such as Ghana.

The Government of Ghana must also through the following means endeavor to treat the transformation of rural financial sector of the Ghanaian economy with some form of urgency, as the sector has the best chance of accelerating economic development:

- The key outcome of COP26 climate summit in Glasgow, UK in 2021 to honor the 2009 pledge to invest US$100billion in Climate Change mitigation in less wealthy nations such must be effectuated to help secure agricultural livelihoods and possible carbon financial benefits to smallholder farmers in FFCs in Ghana.
- Government should incentivize Rural and Micro Finance Institutions (RMFIs) to patronize

rural financing especially in cocoa growing landscapes. Credit institutions must give assistance to farmers in the form of physical inputs and other services in order to eliminate the problem of credit diversion by the farmers.

- Investment (increase Budgetary allocation) must be made by Government, with technical and financial support from NGOs, parastatal institutions, the Bretton Wood Institutions and other development partners in research in the areas of capacity building of MRFIs, performance-based grants for internal controls, Management Information Systems (MIS), Technical Analysis (TA), savings mobilization, link to commercial funds and product development, etc., in order to scale-up outreach and self-sustainable performance to respond appropriately to the demands of rural folks.
- Ensure efficiency of rural financial service delivery and markets through the establishment of favorable government fiscal policies to make rural sector investment attractive to investors; macroeconomic stability, removal of urban-biased policies and constraints on agricultural production and marketing, eliminate subsidized credit schemes and set up a robust regulatory and legal framework to manage risks, address market failures and support rural development.
- Commercial Banks and Financial Institutions must be aided by Government to engage in complementary rural investments in social and economic infrastructure to improve the general well-being, reduce vulnerability, raise skills, assets and debt capacity of target farmer groups, and provide business development services, start-up subsidies for rural savings and credit associations and marching grant for productive assets.

Also, based on the findings on the level of understanding and appreciation of forest conservation and climate smart and sustainable agriculture that forest dependent people have, the State through the Ministry of Lands and Natural Resources and the Forestry Commission must put in place measures to remove the major constraints that block the active participation of forest

dependent people in forest governance and livelihood activities, to enable them augment the efforts of governments and the UNFCCC with indigenous solutions to deforestation and forest degradation.

A research desk for the dissemination of information about the REDD+ Program and other forest related interventions must be set up at various GFC offices to provide information to rural stakeholders. This will help farmers appreciate firsthand, the important environmental and economic benefits of the various green economy interventions such as the REDD+ and carbon forestry development being implemented in their area, and live and work in harmony with them. There is also a need for DAs to have intervention or help desks for addressing alternative livelihoods concerns that farmers within the area face. The status quo in which Livelihood empowerment programs are nine-day wonders within these communities does not auger well for the vulnerable poor. Part of REDD+ funds must be set aside as a special purpose vehicle for farmers to access soft loans and grants for farm investment.

The REDD+ Program even though comes with laid down criteria for implementation has opportunity for beneficiary countries to ask for support for addressing country-specific targets, the Forestry Commission must use that window to access the needed funds for embarking on REDD+ Awareness campaigns through radio, television, print media, durbars, Cooperatives, Churches, Mosques, Information service departments, etc. to bring all chiefs, land owners and farmers up to date on the nature, scope and benefits of the REDD+, with their respective roles clearly defined to them. They should be aware for instance, of the carbon payment scheme that pays cash to farmers and land owners who are able to keep trees on their farms for a considerable period of time.

Meanwhile, the Forestry plantation development program must intensify their supply of tree seedlings to farmers to begin taking advantage of the carbon financial opportunities that the

United Nations Convention on Climate Change are willing to make available to foresters for the conservation of the old growth forests and reclamation of deforested lands.

Last but not least, multinational timber plantation developers should be mandated by law to include educational scholarships for brilliant but needy students living in forest fringe communities as part of their strategic corporate social responsibilities to help in churning out quality and high-level manpower needed to champion the course of rural development of the communities within forest districts in the country in the foreseeable future.

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APPENDICES

APPENDIX A

QUESTIONNAIRE UNIVERSITY OF GHANA
DEPARTMENT OF AGRICULTURAL ECONOMICS AND AGRIBUSINESS

Effects of REDD+ Political Economy on Agrarian Land Access of Smallholder Farmers in the *Land Use, Land-Use Change and Forestry* (LULUCF) Of The Asunafo North District Of Ghana.

Introduction to contact

Good morning /afternoon/evening. My name is Godfred Atanga. I'm a final year MPhil Student from the Department of Agricultural Economics and Agribusiness of the University of Ghana, Legon, Accra. I am conducting a survey research on farmer's perception of the effects of institutional property rights of the REDD+ Program of the Ghana Forestry Commission on farmers' access to agricultural lands he Offinso Forest District in partial fulfillment for an award of a Master's Degree in Agricultural Economics.

We have contacted you because you are either a farmer/Community Leader/staff of the forestry Commission within the study area and have a perspective on the issue under consideration. The interview will take about 40minutes of your time. There will be no right or wrong answers. You can choose not to participate in the survey. If you participate, you can stop at any time without problems. The information you provide is strictly confidential and will not be divulged to a third party. Your name will be kept separate from the information you provide.

Please let me know if you have any questions before we proceed. We will begin the survey after I have answered all the questions you might have.

Q1. Are you willing to partake in this interview?

1. Yes
2. No <<<<<<<Thank respondent and terminate interview

Thanks for your willingness to participate in this interview. I am going to start by asking you some general information questions, if you don't

OBJECTIVE I: FACTORS AFFECTING LAND ACCESS (Multiple Linear Regression Model)

SECTION A: INDIVIDUAL/HOUSEHOLD INFORMATION

Ques. No	Question	Responses	Instructions
A1.	**How old are you?**	……yrs	
A2.	**Gender**	1. Female 2. Male	
A3	**Years of Farming experience**	…… ……yrs	
A4	**What is your level of education?**	1. Primary 2. JHS/JSS 3. SHS/SSS 4. Tertiary 5. None 6. Other (specify)	
A5.	**What is your marital status?**	1. Single 2. Married 3. Divorced 4. Widowed	
A6	**What is your ethnicity?**	1. Akan 2. Non-Akan	
A7.	**Are you a native or a settler?**	1. Native 2. Settler	
A7	**What is your household size?**	……	

SECTION B: SOCIO-ECONOMIC INFORMATION

Ques. No	Question	Response	Instruction
B1.	**Total Farm size (both Off Reserve and On Reserve)**	…….Ha	
B2.	**Annual Farm Income**	…….GHS	
B2.	**Annual Total HH Income**	……..GHS	
B3.	**Source of household Income**	1. On farm job 2. Off-farm job 3. Remittances	
B4.	**Member of FBO**	1. Yes 2. No	
B5.	**Teak Plantation ownership**	1. Yes 2. No	
B6.	**Current MTS Participant**	1. Yes 2. No	
B7.	**Type of Farming activity**	1. Cash crop only 2. Both cash crop and Food Crop 3. Cashcrop/Food crop/Livestock	
B8.	**Usufruct rights to farm in On Reserve**	1. Yes 2. No	
B9.	**Mode of acquisition of landholding in Off Reserve**	1. Stool land in Family custody 2. Rented 3. Sharecropping (Abunu/Abusa) 4. Squatting	

B10.	**Possession of Informal Land titling Documents of Off Reserve Land**	1. Yes 2. No	
B11.	**Right to sell Off Reserve Land**	1. Yes 2. No	
B12.	**Right to bequeath Off –Reserve land to children or next of kin**	1. Yes 2. No	
B13.	**Do you hold any leadership position within the community?**	1. Yes 2. No	
B14.	**Do you operate land as a free land holder?**	1. Yes 2. No	
B15.	**Do you operate a share crop plot?**	1. Yes 2. No	
B16.	**Do you operate a rented plot?**	1. Yes 2. No	
B17.	**Do you have right to sell or lease your landholdings with or without anyone's approval?**	1. Yes 2. No	
B18.	**Do you have right to bequeath landholdings to your children or next of kin**	1. Yes 2. No	
B19.	**Have you ever been involved in any land dispute in the past?**	1. Yes 2. No	
B20.	**Are you currently involved in a land dispute over your landholdings with any person/group/institution?**	1. Yes 2. No	
		1. Yes	

B21.	**Knowledge of REDD+**	2. No	
B22	**Willingness to keep trees to benefit from REDD+ Carbon Payment Scheme**	1. Yes 2. No	

SECTION C: AGRARIAN LAND ACCESS RESPONSE VARIABLE

Ques. No	Question	Response	Instruction
C1.	**What was your agricultural land holding size 10years ago?**	……..Acres	
C2.	**How did you acquire those lands?**	1. Family inheritance 2. Rented 3. Lease 4. Govt MTS project 5. Purchase 6. Squatting without permission from owner 7. Other (specify)	
C3.	**Do you still hold usufruct rights to farmlands given to you by the forestry commission of Ghana under the MTS?**	1. Yes 2. No	
C4.	**What is your current total landholding size?**	……..Acres	
C5.	**What accounts for the shortfall in your landholding size?**	…….	
C6.	**What amount of your landholding is currently in use as farm plots (INCLUDING THOSE IN LEASE TO OTHER FARMERS, IF ANY)?**	……..Acres	
C7.	**What amount of your land holding has been lost to the**	……Acres	

	Forestry Commission due to Aforestation program?		
C8.	**Have you ever been displaced from a previous farmland within the forest?**	1. Yes 2. No	
C8.	**How long have you been farming on your farm plot(s)?**	…….Yrs	
C9.	**Do you feel that your farmland is secure enough for long term agricultural investment?**	1. Feel Very Secure 2. Feel fairly 3. secure 4. Does not feel secure	
C10.	**Why are you not feeling confident about your land tenure security?**	……..	
C11.	**Who is/are your main competitors for land?**	1. Forest Plantation developers 2. Large scale cash crop farmers 3. Other (specify)	
C12.	**How affordable is land for agricultural purposes in the area?**	1. Very affordable 2. Affordable 3. Expensive 4. Very expensive	
C13	**How fertile or usable is the land within the area for agrarian activity?**	1. Very fertile 2. Fertile 3. Unsuitable	

POLITICAL ECONOMY MAJOR LATENT CONSTRUCT (**Factor Analysis**: *Principal Component Analysis*)

SECTION D: **Carbonized Exclusion** Minor Construct

(Five-point Likert scale where 5 = strongly agree effect, 4= agree effect, 3 = neutral, 2 = moderate effect, 1 = do not agree effect. Thus, all the variables are put on equal rating in order to comply with the requirements of factor analysis)

4Quest No.	Question	Response	Instruction
D1.	**You have lost portions of your farmland(s) to timber plantation developers**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
D2.	**It is easy getting access to a plot of land within the forest for farming**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
D3.	**You have accessed land from a reclaimed forest land for your farming activities in the past**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
D4.	**The forest patrol team has ever confiscated or destroyed your cropland before**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	If 1>>>>>>>>>D5
D5.	**Your farm plot got destroyed or confiscated by the forestry commission patrol because you acquired the land illegally**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
D6.	**You are willing to invest**	1. Strongly agree	

	long term in farming on landholdings that lie within the forest?	2. Agree 3. Neutral 4. Moderate 5. Do not agree	
D7.	**You are able to access land within the production forest for your farming activities**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	

SECTION E: **Hierarchical Corruption** Minor Construct (Five-point Likert scale)

Ques. No.	Question	Response	Instruction
E1	**You acquired farmland through a forest broker or (middleman)?**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
E2	**The forest broker business is booming in your area**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
E3	**You have ever paid moneys to a middle man and/or forest broker to help you get access to a plot of farmland**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
E4.	**The land lease arrangement in my area is very favorable to the vulnerable group and migrant farmers**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
E5.	**You hold a powerful position within the community**	1. Strongly agree 2. Agree 3. Neutral	If 1,2,3>>>>>>>>>>>>E6

		4. Moderate 5. Do not agree	
E6.	**Have you have ever used you position to lobby for access to a farm plot within the forest for farming purposes?**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
E7.	**You have paid bribe to a forestry commission worker to enable you reclaim a land from a timber company**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	

SECTION F: **Green Grabbing** Minor Construct (Five-point Likert Scale)

Ques No.	Question	Response	Instruction
F1	**You have ever been employed as a tree planter by a timber plantation company**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	If 1,2,3>>>>>>>F3
F2.	**You have ever been employed as a caretaker of a timber plantation within the community**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	If 1,2,3>>>>>>>F3
F3.	**You were employed in F1 and/or F2 above after being displaced from your farmlands**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
F4.	**You have lost a landholding (or farm plot) in the last 10years to a private timber plantation developer operating within the community**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
F5.	**Your landholding or part of your**	1. Strongly agree	

	farm plot has been converted into a timber plantation in the last 10years	2. Agree 3. Neutral 4. Moderate 5. Do not agree	
F6.	**You gave out your farmland to a timber plantation company or the forestry commission within the last 10years to be used for an afforestation program**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
F7	**You were compensated for giving out your farmland to timber plantation company or forestry commission**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	If 1,2,3>>>>>>>F8
F8	**The compensation was a onetime monetary payment**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	If 4 or 5,>>>>>F9
F9.	**You were not compensated by the timber plantation company or forestry commission for losing your land because you are a squatter**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	

SECTION G: **Exclusion from Procedural Rights** Minor construct (5-point Likert scale)

Ques. No.	Question	Response	Instruction
Q1.	**You partake directly in forest governance decisions within the community**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
Q2.	**You are consulted on forest resource related issues by the decision makers**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
Q3.	**You are very much involved in forest governance decisions within the community?**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
Q4.	**You have heard about the presence of the REDD+ Program of the forestry Commission in your community**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
Q5.	**You have heard that the REDD+ of the forestry commission is responsible for reclaiming deforested lands through a carbon forestry development initiative**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
Q6.	**You have access to information regarding the activities of the REDD+ Program implementers within your area**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
Q7.	**There are justice avenues for seeking redress on forest management decisions**	1. Strongly agree	

	that affect your livelihood	2. Agree 3. Neutral 4. Moderate 5. Do not agree	
Q8.	**Exclusion from procedural rights prevent you from getting access to justice to seek redress on forest management decisions that affect your livelihood**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
Q10.	**You are satisfied with benefit regime from naturally occurring trees that grow on your farm within the forest**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	
Q11.	**You are satisfied with the benefit regime from trees that you plant and take care of on your farm within the forest**	1. Strongly agree 2. Agree 3. Neutral 4. Moderate 5. Do not agree	

OBJECTIVE II: RANKING OF CONSTRAINTS LIMITING THE FARMERS' ACCESS TO FARMLAND IN THE STUDY AREA

Q2. Rank the 'n' number of underlisted constraints in the space provided from the most pressing constraint to the least, using numbers 1,2,3,4 and so on (where 1=most pressing; n= least pressing)

CONSTRAINTS	RANKING
Access to land for farming	
Cost of inputs	
Access to Credit	
Access to Government services	
Profit from farming	
Non-suitability of land for farming	
Climate Change Related issues	
Competing with non-farm land users	

OBJECTIVE III: ASSESSING FARMERS' PERSPECTIVE ABOUT THE NATURE AND SCOPE OF CORPORATE SOCIAL RESPONSIBILITY (CSR) PROGRAMS THAT PRIVATE FOREST COMPANIES OPERATING WITHIN THE STUDY AREA HAVE UNDERTAKEN IN THE PAST 5YEARS.

Ques. No.	QUESTION	RESPONSE	INSTRUCTION
Q1.	**Are you aware of the presence and activities of any timber plantation company within your community?**	1. Yes 2. No	If 1, >>>>>>>>>>Q2
Q2.	**Name any timber plantation company/ies present within the community that you know**	……	Open ended
Q3.	**Have these companies generally embarked on any CSR Project within the community in the last 5yrs?**	1. Yes 2. No	If 1, >>>>>>>Q4
	COMPANY-SPECIFIC CSR PROJECTS		
Q4.	HUMAN RESOURCE	1. Yes 2. No	If 1, >>>>>>>>>Q5
Q5.	**Have these companies generally provided jobs for the local people in the last 5years?**	1. Yes 2. No	If 1, >>>>>>>Q6
Q6.	**Have you or any member of your household been employed by any of these companies in the last 5years?**	1. Full time 2. Part-time	If 1, >>>>>>>Q7
Q7	**Have you (or your household member) worked full time or part time with the timber company in the last 5years?**	……	
Q8.	**Why did you (or your household member) choose to work full time with the timber plantation company?**	1. Care taker 2. Tree Planter 3. Both caretaker & tree planter 4. Other (specify)	Open ended

Q9.	**What is/was your (or your household member's) position in the company?**	1. Yes 2. No	
Q10.		GHS……	
Q11.	**Are/were you (or your household member) satisfied with your position at the timber plantation company?**	GHS……..	
Q12.	**What is/was your (or your household member's) annual total earnings from working with the timber plantation firm?**	**1.** Yes **2.** No	
Q13.	**What is/was your annual total earnings from farming activities before joining the timber the timber company as staff?**	1. Strongly agree 2. Slightly agree 3. Agree 4. Disagree 5. Strongly disagree	
Q14.	**The company permits/ed you (or your household member) to undertake farming activities on parts of the company land(s) at an affordable lease rate.**	1. Strongly agree 2. Slightly agree 3. Agree 4. Disagree 5. Strongly disagree	
	COMMUNITY DEVELOPMENT		
Q15.	**The Timber Plantation companies operating within the community forest reserves invest/ed in** sanitation projects **in the community in the last 5years**	1. Strongly agree 2. Slightly agree 3. Agree 4. Disagree 5. Strongly disagree	
Q16.	**The timber plantation companies have provided** portable drinking water **for the host community in the last 5years**	1. Strongly agree 2. Slightly agree 3. Agree 4. Disagree 5. Strongly disagree	

Q17.	**The timber plantation companies have** built fully furnished classroom blocks **for the host community in the last 5years**	1. Strongly agree 2. Slightly agree 3. Agree 4. Disagree 5. Strongly disagree	
Q18.	**The timber plantation companies have helped in the provision of** quality healthcare services **for members of the host community in the last 5yrs.**	1. Strongly agree 2. Slightly agree 3. Agree 4. Disagree 5. Strongly disagree	
Q19.	**The timber companies provide** educational scholarships for tertiary students **within the host communities in the last 5years.**	1. Strongly agree 2. Slightly agree 3. Agree 4. Disagree 5. Strongly disagree	
Q20.	**The timber companies have assisted farmers with the provision of** farm inputs and training programs to boost their agrarian livelihoods **in the last 5yrs**.	1. Strongly agree 2. Slightly agree 3. Agree 4. Disagree 5. Strongly disagree	
Q21.	**Timber companies have constructed** roads and/or bridges **within the forest fringe community in the last 5yrs.**	1. Strongly agree 2. Slightly agree 3. Agree 4. Disagree 5. Strongly disagree	
Q22.	ENVIRONMENT **The activities of these timber plantation developers have led to a restoration of biodiversity within the community forest reserve in the last 5years.**	1. Strongly agree 2. Slightly agree 3. Agree 4. Disagree 5. Strongly disagree	

Q23.	**The activities of the timber plantation developers have led to a reclaiming of deforested lands within the community in the last 5years**	1. Strongly agree 2. Slightly agree 3. Agree 4. Disagree 5. Strongly disagree	
	FAIR BUSINESS PRACTICES		
24.	**The activities of the timber plantation developers do not in any way interfere with activities of forest fringe community dwellers in the last 5years.**	1. Strongly agree 2. Slightly agree 3. Agree 4. Disagree 5. Strongly disagree	
25	**Timber plantation companies have been displacing farmers from their farms within the production forest and affecting their livelihoods in the last 5years.**	1. Strongly agree 2. Slightly agree 3. Agree 4. Disagree 5. Strongly disagree	

End of Interview.

Thanks for your Participation!

APPENDIX B

RESULTS FROM PRINCIPAL COMPONENT ANALYSIS (PCA)

Table 1: Total Variance Explained Table

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% Variance	Cumulative %	Total	% Variance	Cumulative %	Total
1	2.071	33.249	33.249	2.071	33.249	33.249	2.004
2	1.969	28.979	48.223	1.969	28.979	48.223	1.719
3	1.837	17.755	50.431	1.837	17.755	50.431	1.311
4	1.747	12.082	65.321	1.747	12.082	65.321	1.047
5	1.536	6.113	78.432				
6	.967	5.788	81.533				
7	.882	4.576	84.456				
8	.769	3.465	86.275				
9	.832	3.316	88.222				
10	.747	2.659	93.005				
11	.644	2.134	95.313				
12	.603	1.652	97.821				
13	.527	1.414	99.111				
14	.555	.875	100.000				

Extraction Method: Principal Component Analysis

a.When components are correlated, sums of squared loadings cannot be added to obtain a total variance

Table 2: Component Correlation Matrix Table

Component Correlation Matrix

Component	1	2	3	4
1	1.000	.809	.532	-.279
2	.809	1.000	.467	.562
3	.532	.467	1.000	-.212
4	-.279	.562	-.212	1.000

Extraction Method: Principal Component Analysis

Rotation Method: Varimax Rotation with Kaiser Normalization.

Table 3: Communality Table after removal of several items with loadings below 0.3 and high cross-loadings

Communalities

	Initial	Extraction
E8	1.000	.621
G1	1.000	.653
G2	1.000	.696
G4	1.000	.597

Extraction Method: Principal Component Analysis