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Climate Change and Socio-Economic Disparities in the Anthropocene: An Analysis of the Impact on Fulani Women and Children in Guinea and the Potential for Sustainable Development Paradigms

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Abstract. This paper focuses on an intersectional analysis of climate change, induced by the Anthropocene epoch, and its ramifications on socio-economic disparities among Fulani women and children in Guinea. The Anthropocene epoch, marked by significant human-induced alterations to the Earth's geophysical systems, engenders not only severe climatic changes but also substantial socio-economic challenges. However, it simultaneously unveils opportunities for transformative action in developing nations such as Guinea. Drawing upon the theoretical framework of environmental economics, this paper delves into the exacerbation of socio-economic inequalities resulting from climate change phenomena linked to the Anthropocene epoch. With a concentrated focus on the uniquely vulnerable populations of Fulani women and children, this study elaborates on the intricate intersectionality of climate change impacts and socio-economic disparities. This paper further investigates alternative sustainable development paradigms. In the context of the Anthropocene epoch, traditional GDP-centric measures for economic growth require reevaluation. A more holistic Genuine Progress Indicator (GPI) is proposed, incorporating economic, social, and environmental dimensions. Sustainable frameworks, such as the Green GDP, have been emphasized, considering their ability to account for environmental sustainability. The principles of the Circular Economy (CE) and Eco-intensification, prioritizing sustainability and resource efficiency, align with ecological intensification strategies. Implementing CE and Eco-intensification strategies can introduce new employment avenues, potentially benefiting marginalized communities. By improving socio-economic conditions, particularly for marginalized women and children, there is a tangible opportunity to foster sustainable development, mitigate generational poverty, and enhance education and healthcare prospects for the upcoming generations.

Keywords: Anthropocene Epoch; Climate Change; Social-Economic Disparities; Fulani Women and Children; Green GDP; Circular Economy; Eco-Intensification.

1. Introduction

Exploring the intersected arena of economics and environmental science, a distinguished atmospheric chemist and Nobel Laureate, Paul Crutzen, coined the concept of the Anthropocene, a term to delineate a new geological epoch predominantly decided by human activities on the Earth's climate and natural systems (Steffen, W., Crutzen, P. J., & McNeill, J. R. 2007). According to Crutzen and other pioneering researchers like Will Steffen and John McNeill, the Anthropocene signifies the unchangeable impacts starting from the industrialization roughly in 1800. One of the most defining characteristics of the Anthropocene is the extensive application of fossil fuels, which led to an unprecedented spike in atmospheric carbon dioxide concentrations—from preindustrial levels of 270-275 parts per million (ppm) to 310ppm by 1950 and then continued to increase to 380ppm afterward (Steffen, W., Crutzen, P. J., & McNeill, J. R. 2007). Crutzen further proposes that before the advent of the Industrial Revolution, the Holocene, also called "The Age of Man," impacted the Earth's climate, natural systems, and biodiversity. The Holocene commenced 11,700 years ago after the last significant Glacial Period, representing an era of relatively stable climate conditions along with the rise of human civilization. The Holocene's climate stability, understandably, facilitated agriculture development, which, in turn, gave rise to urbanization with the sprout and spread of consistent science and technology breakthroughs.

Throughout the Anthropocene era, a socio-economic notion of "The Great Acceleration" has gained increasing scholarly discussions. The Great Acceleration period began around 1950, when human activities have not only exponentially risen but also began to push the Earth's ecosystem toward a precarious limit. For example, since 1950, atmospheric carbon dioxide levels have skyrocketed from 310 to 380 ppm, with roughly 50% of this increase occurring in the last 30 years alone, impacting way more than the past thousands of years. Based on their thorough research, Steffen and other researchers provided data evidently suggesting that in the post-1950 period, the Earth System witnessed dramatic changes extending beyond the natural variability displayed in the previous epoch, the Holocene. The dramatic and irreversible changes made after 1950 made scientists name the period post-1950 as "The Great Acceleration" (Steffen et al., 2015). Under the dominant human activities during the Great Acceleration period, the Earth's biological, physical, and chemical processes have significantly changed, causing extreme weather conditions, severe biodiversity loss, and ecosystem degradation.

The magnitude of human activities in the Great Acceleration period—notably rapid industrialization, spreading technological breakthroughs, and exponential population growth—emphasizes the urgency for informed, concerted actions to mitigate the cascading environmental and socio-economic challenges accordingly. This urgency is especially significant for less developed countries and regions like Guinea. Often, these places have fewer governmental resources to deal with the effects of environmental degradation during the Great Acceleration period. Therefore, these places suffer disproportionately from the consequences, like extreme weather conditions or natural resource depletion.

2. Anthropocene and Guinea's Socioeconomic Disparities Among Fulani's Women and Children

Guinea, situated on the western coast of Africa, is a nation endowed with abundant natural resources and the accompanying opportunities for agriculture and mining industries. According to the most updated data released by the World Bank in 2023, Guinea has a population of 13.53 million people in 2022. Guinea's diverse economy is characterized by a mixture of extractive industries, such as bauxite and gold mining, and a burgeoning agricultural sector featuring crops like rice, coffee, and peanuts. The nation's rich soil, favorable natural resources, and suitable climatic conditions offer vast agricultural and extractive opportunities. According to the World Bank report, agriculture is a strong economic engine for Guinea, generating 52% of the job opportunities and thereby providing income for 57% of the rural households (World Bank, 2023).

Despite Guinea's resource abundance, however, it is still wrestling with significant socio-economic challenges, such as unstable governance in a transition period, alarming youth unemployment, and gender inequality (World Bank, 2023). Furthermore, during the Anthropocene period, especially the post-1950 Great Acceleration epoch, human activities in mining and hydropower development caused stark biodiversity loss and environmental degradation, which, in turn, posed formidable challenges for the agricultural and mining industries' sustainable development. For example, the Global Forest Watch reports that between the last two decades, 2001 and 2022, Guinea experienced a significant decline in approximately 2 million hectares in tree cover, which equals a 24% loss compared to the levels in 2000, along with the emission of 870 million metric tons of carbon dioxide. The data indicates that Guinea's degradation and deforestation resulted in the release of excessive carbon dioxide into the atmosphere. These emissions exacerbate global warming, leading to extreme conditions such as massive forest fires and the extinction of many animals due to the loss of habitats.

The Fulani people, also known as Fulbe or Peul, are among the largest ethnic groups dispersed across West Africa. Therefore, the Fulani people play a significant role in Guinea's diverse ethnicity, history, culture, and governance. With roots tracing back to the arrival of Islamic heritage in the 11th century, Guinea has long been influenced by Islamic culture and governance. The Fulani Muslim has developed as a crucial ethnicity along with the power shifting from various empires to smaller

kingdoms in Guinea. As a dominant ethnic group, Fulani accounts for approximately 33.4% of the population as of 2018 (CIA World Factbook, 2022).

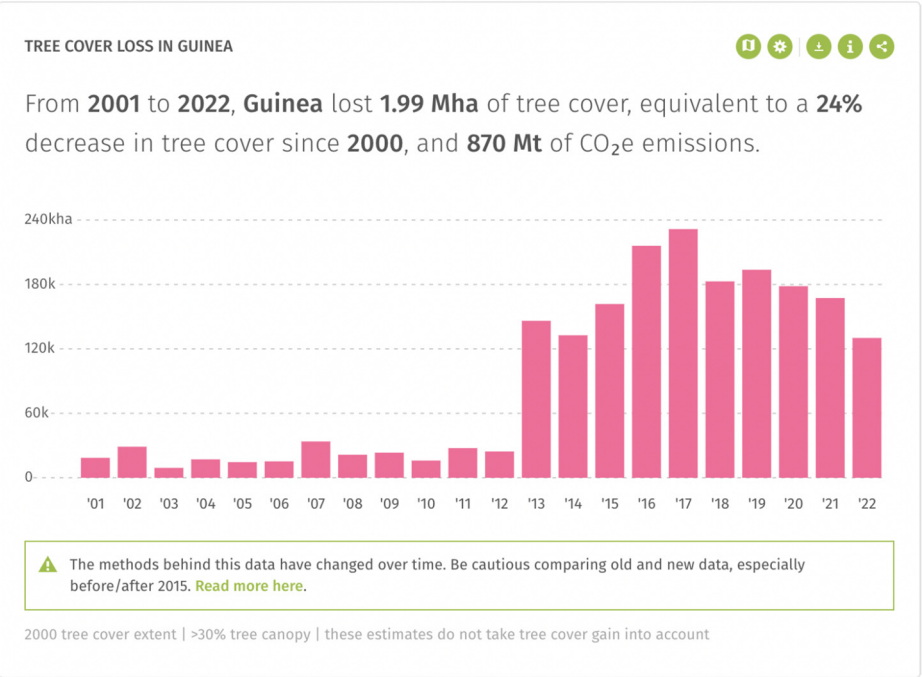

Fig 1. Data extricated from Global Forest Watch. (2020). Guinea Primary Forests. Retrieved from https://www.globalforestwatch.org/dashboards/country/GIN

As the Fulani people are predominantly pastoralists, their lifestyle is cattle herding and nomadic agriculture. Under such a lifestyle, climate change issues induced during the Great Acceleration period directly affect the socio-economic stability of the Fulani community. For example, prolonged droughts and erratic rainfall, can dramatically undermine agricultural productivity, leading to food insecurity. In their studies of rainfall variability and drought conditions in Africa, Ayanlade and other researchers found that based on the three-decade data from 1984 to 2014, a chief concern among the Fulani community is the sharp decline in the availability of grazing grass and water for their cattle due to severe drought. A decrease in rainfall, accompanied by increasing temperatures, contributes to this scarcity. In reaction to the severe drought, many Fulani farmers must migrate to greener zones constantly. According to the data, 68% of the Fulani farmers changed the planting date to the rainy seasons; 58% of them shrank production to cover crop loss, while 39% chose to plant drought-tolerant crops, and 48% insisted on adding irrigation (Ayanlade, A., Radeny, M., Morton, J. F., & Muchaba, T. (2018).

During the period of the Great Acceleration, the socio-economic disparities within the Fulani community, particularly among women and children, were intensified by the interplay of their traditional pastoralist lifestyles, Islamic culture, and established social hierarchies. Within the Fulani community, research by Castle (1995) on the Fulani community demonstrated that the nutritional status of children is closely linked to the hierarchal status of women within the household rather than the household's overall income. As such, children of mothers who are of lower status, such as junior daughters-in-law, are more likely to be malnourished even if they are part of high-income households (Castle 1995). Castle's research suggests that a woman's right to access and manage a household's wealth is a more decisive factor in her children's health and nutritional outcomes than the overall wealth of the household.

While the nutritional welfare of children often hinges upon the socio-economic stature of their mothers, a closer examination reveals the multifaceted nature of this interplay, especially in specific communities such as the Fulani. Regarding gender inequality, In Guinea, women and girls confront unique challenges that often place them at a disadvantage compared to their male counterparts across various dimensions of well-being. While investments in human endowments such as education and

health are essential, it is alarming that these investments are disproportionately lower for girls and women. Based on the World Bank study, *Unlocking Women's and Girl's Potential: The Status of Women and Girls Relative to Men and Boys in Guinea*, the differences in education among genders are notably acute. In 2018, only 22.0% of girls attended secondary school, a sharp contrast to the 32.2% of boys. Furthermore, the health of Guinean women is concerning, with maternal deaths constituting up to 28% of all female deaths. More disturbing is the data on younger women, where for ages 20-24 and 15-19, maternal deaths reach 35.3% and 41.0%, respectively. (World Bank, 2023).

These gender disparities in education and health have a domino effect on economic opportunities. Women are less likely to be part of the labor market than men, and those who do work are predominantly found in informal sectors, which offer low-quality jobs and reduced productivity. This leads to decreased lifetime incomes and an increased risk of poverty. For instance, 90% of women, compared to 86% of men, are underemployed, and 95% of women versus 83.3% of men are engaged in vulnerable jobs. This disparity is exacerbated by the fact that women, on average, spend 15.4 hours weekly on unpaid domestic work, triple the 5.2 hours men spend. The persistent gender disparities are a considerable impediment to Guinea's long-term progress (World Bank, 2023).

Within the Fulani community, the impacts of climate change are hitting women and children hardest. Fulani women are central to food production and family support. Yet, their roles are becoming even more challenging due to increasing environmental problems and unpredictable weather patterns linked to climate change. Their tasks, which rely on consistent environmental conditions, are now unpredictable. This threatens food security and impacts their status within the community. As for the children, the deteriorating environment is amplifying existing societal problems. As the climate crisis deepens poverty levels, it further widens the social inequality gap. As resources become scarce, families might choose between basic survival needs and services like education or healthcare for their children. This choice has long-term implications, potentially trapping the younger generation in a cycle of poverty and limiting opportunities. Climate change exacerbates challenges for the Fulani's most vulnerable members, highlighting an urgent need for effective solutions and support.

In the Anthropocene epoch, while challenges are evident, there are also opportunities to rethink socio-economic growth. Stiglitz and other environmental economists proposed a new economic measuring model, emphasizing the urgency of shifting from only tracking economic output to also measuring people's well-being (Stiglitz, Sen, Fitoussi, 2010). Using this idea, Guinea can leverage its natural resources and biodiversity to support sustainable development and better include communities like the Fulani. It's crucial to develop policies that ensure both economic growth and environmental protection to tackle the challenges of this epoch effectively.

3. An Integrated Environmental Economics Model for Guinea

The Anthropocene epoch highlights the paramount importance of a significant paradigm shift in evaluating economic growth. Traditionally, Gross Domestic Product (GDP) has been used as the primary metric to assess a nation's economic performance. However, this measure fails to account for the health of a nation's natural resources, the sustainability of its environmental practices, and the socio-economic equity among its populace. This oversight becomes glaringly apparent in the Anthropocene epoch, where human activities' environmental impacts have reached an unprecedented scale and pace (Costanza et al., 2014).

As Costanza et al. articulate, the Anthropocene epoch's unique challenges necessitate an approach that transcends the narrow focus on GDP. Costanza and other prominent researchers suggest that the national welfare assessment should not merely be based on the production of goods and services (as measured by GDP). Instead, it should also account for the state of the nation's natural resources, its commitment to environmental sustainability, and the fair distribution of wealth and opportunities among its citizens (Costanza et al., 2014). By incorporating these aspects, it is feasible to construct a more holistic, inclusive, and environmentally conscious model of economic growth. Such a model would not only gauge economic performance but would also reflect a nation's governance of its

natural resources, its efforts toward mitigating environmental degradation, and its success in narrowing socio-economic disparities. Therefore, in the era of the Anthropocene, the move beyond GDP-centric views is preferable and indispensable for ensuring sustainable development and social equity. Constanza and other researchers further propose adjusted economic measures for Guinea They divided three major adjustments for the Genuine Progress Indicator (GPI): Economic Adjustments—such as personal consumption expenditures and income distribution; Social Adjustments—such as value of housework and parenting, costs of underemployment, costs of lost leisure time; and Environmental Adjustments –such as costs of water pollution, costs of air pollution, loss of farmland (Costanza et al., 2014).

Recent studies advocate for the crucial role of social equity in driving genuine economic progress. Emphasizing equitable benefits distribution and safeguarding vulnerable demographics, particularly the Fulani women and children, from heightened environmental impacts is instrumental for achieving sustainable developmental goals. Current research suggests that adopting sustainable economic frameworks, such as green GDP metrics, circular economy principles, and sustainable agriculture methodologies, offers a promising pathway to address the prevailing socio-economic disparities of marginalized sections of the Fulani community. For example, Green GDP, an economic index that acknowledges environmental costs in evaluating economic growth, emerges as a potentially potent alternative (Guo et al., 2006). For a nation like Guinea, this signifies accounting for environmental degradation and biodiversity loss engendered by its extractive industries, such as mining and agriculture, within its economic engine. The dual advantage of these sustainable frameworks lies in their potential to promote resource sustainability while empowering underrepresented societal segments.

A viable strategy to alleviate the environmental burden of Guinea's extractive industries could be the adoption of Circular Economy principles. Circular Economy (CE) aims to maximize resource efficiency by promoting sustainable production and consumption habits. Ghisellini and other researchers conduct a study that reviews two decades of CE research, examining its beginnings, benefits, challenges, and global applications. Based on Ghisellini et al study, CE's concepts largely stem from ecological economics and industrial design. Adoption varies by region: China views CE as a national directive, while the European Union, Japan, and the USA apply it more as an environmental policy tool. The overarching goal of CE is economic growth that doesn't strain the environment (Ghisellini et al., 2016). Most global efforts have emphasized recycling over reusing. Specific sectors, like waste management in developed nations, have made notable advancements under CE. Under the Circular Economy paradigm, shifting focus to agriculture, investment in sustainable farming practices not only safeguards food security but also bolsters local economies and helps curb environmental degradation. Agroforestry, permaculture, and organic farming are some of the strategies that can rejuvenate degraded soils, bolster biodiversity, and sequester carbon, thus attenuating the impacts of climate change (Tittonell, 2014).

Beyond the Circular Economy paradigm, many scientists also advocate for ecological intensification as a crucial approach toward sustainable development. Pablo Tittonell investigated the differences and implications of “sustainable intensification” and “ecological intensification” in the realm of agriculture. Tittonell critically examines the definitions and discourses surrounding these concepts. He cites that “sustainable intensification,” as described by Pretty et al., revolves around augmenting outputs from a fixed land area, mitigating environmental adversities, and simultaneously enhancing environmental contributions. On the contrary, Doré et al.'s perspective on "ecological intensification" advocates for alternative production strategies (Tittonell, 2014).

There are inherent connections between the principles of ecological intensification, as described by Tittonell, and the fundamentals of a circular economy. For instance, both the circular economy paradigm and ecological intensification significantly emphasize optimizing resource use. While ecological intensification aims to harness natural ecosystem functionalities more intelligently, the circular economy is geared toward maintaining resources in use for an extended period, maximizing their value, and subsequently recovering and rejuvenating products and materials when they reach

the end of their usability. Furthermore, Tittonell's stress on curtailing negative environmental impacts resonates with the circular economy's goal of eliminating waste and pollution. In both approaches, waste is not merely viewed as an inevitable byproduct. Instead, it is a resource with potential for reuse, reduction, or recycling. Additionally, Tittonell's insights on augmenting contributions to natural capital and enhancing environmental services reflect the circular economy's ethos of renewing natural systems. Both frameworks emphasize the importance of restoring, regenerating, and revitalizing resources to ensure a sustainable future.

Furthermore, incorporating the circular economy paradigm into extractive industries can catalyze the creation of novel employment opportunities within waste management and recycling sectors. This approach not only offers solutions to environmental sustainability but also opens avenues for socio-economic advancement. Specifically, these emerging job prospects could be strategically made available to communities such as the Fulani, thus paving the way for socio-economic upliftment and fostering gender equality, as Ghisellini et al. (2016) noted. Such an initiative can particularly empower Fulani women by elevating their socio-economic status, which, in turn, renders a direct and substantial positive impact on the younger generations. When women assume the role of stable income providers, it facilitates significant investments in pivotal social sectors like education and healthcare. This economic empowerment and enhanced access to quality services can enrich the life prospects of Fulani children. Moreover, this approach is instrumental in diminishing generational cycles of poverty by providing children with better educational and health resources, thus equipping them with the tools to build a more secure and prosperous future. Women's enhanced socio-economic standing contributes to the community's overall well-being and stimulates a ripple effect, fostering holistic development and sustainability.

4. Conclusion

In the Anthropocene epoch, marked by significant human-driven environmental shifts, there's a pressing need to re-evaluate our established economic paradigms. These conventional models, focused on endless growth, need to be more suited to address the present complexities, especially for a nation like Guinea. Despite the challenges, this era offers Guinea a unique chance to reshape its economic landscape, interweaving environmental conservation with socio-economic progression.

This transformation demands a fresh approach: overhauling extractive sectors, endorsing eco-friendly agriculture, championing a circular economy, and emphasizing social fairness in economic dialogues. At the heart of this change should be the welfare of Fulani women and children. The climate crisis and socio-economic disparities make them particularly susceptible, necessitating inclusive, forward-thinking policies. We can bridge the gap they face by channeling resources into climate-resilient agriculture, education, and gender-sensitive services. Ensuring Fulani women are equipped with sustainable livelihood opportunities and giving children access to crucial services means they're not just bystanders but are pivotal in Guinea's evolution.

While shaping an eco-conscious and inclusive economic structure for Guinea is still in a blueprint, the rewards are profound: a healthier environment, balanced and just economic growth, and a society better prepared for the Anthropocene's intricacies. Essentially, the demands of the Anthropocene might propel Guinea toward a socio-economic revolution for its sustainable environmental, economic, and gender equity future.

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