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Agriculture, population dynamics and climate change: A role in contraception uptake

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ABSTRACT

The convergence of agriculture, population dynamics, and climate change significantly influences women's reproductive decision-making and the adoption of female contraception, especially in rural and developing areas. This narrative examines the impact of these interrelated factors on family planning decision-making and the availability of reproductive health care. The relationship between agricultural productivity and economic stability significantly influences family size preferences. When agricultural output is higher, there is generally a corresponding rise in contraceptive use because of enhanced financial security due to economic buoyancy. Population dynamics, such as rapid population expansion and urbanization, have a significant impact on reproductive behavior. The increased competition for resources and exposure to new social norms lead to a higher demand for smaller families and modern contraceptive technologies. Climate change, with its disruption of agricultural livelihoods and displacement of populations, introduces an additional level of intricacy, frequently impeding the availability of contraception and modifying reproductive decisions because of economic instability. The review places emphasis on the interconnectivity of agricultural progress, climatic adaptability, and reproductive healthcare to promote well-informed reproductive decisions and increase the adoption of contraception methods. Through systematic analysis of peer-reviewed literature and empirical data, we investigate how agricultural mechanization affects fertility preferences, how climate anxiety influences reproductive choices, and how population pressures interact with food security concerns. Our findings reveal that agricultural modernization generally correlates with decreased fertility rates and increased contraceptive use, while climate change impacts create complex pathways affecting reproductive access and decision-making.

The study demonstrates that integrated approaches considering agricultural, demographic, and environmental factors are essential for effective reproductive health policy development. This narrative offers useful information for policymakers and development practitioners who aim to enhance reproductive health outcomes amidst changing environmental and socio-economic obstacles.

1. Introduction

Agriculture is a diverse word used to denote the many ways in which crop plants and domestic animals sustain the global human population by providing food and other products [1]. Agriculture has been a cornerstone of human civilization, profoundly influencing the development and growth of societies [2]. As the primary means of producing food, it has played a critical role in shaping population dynamics, the patterns and processes involving the growth, distribution, and structure of human populations. The agricultural sector encompasses not only traditional farming practices but also modern biotechnology, sustainable farming methods, and precision agriculture technologies that collectively influence socioeconomic outcomes and demographic patterns. Understanding the interplay between agriculture, population dynamics, and climate change is essential for grasping how environmental and economic pressures shape reproductive behavior,

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particularly among women in vulnerable communities. These domains are not isolated; rather, they form a dynamic system where shifts in one area reverberate across the others. For instance, agricultural instability caused by climate variability can lead to food insecurity, migration, and changes in household structure — all of which influence reproductive choices and access to contraception.

In environmental science, population dynamics can be seen as the branch of ecology that examines the temporal and spatial fluctuations in population size and density for one or more species [3]. Population dynamics encompass the study of how populations change over time due to births, deaths, immigration, and emigration [4]. These dynamics are affected by several factors, including economic conditions, healthcare advancements, and technological innovations. Agriculture directly impacts these factors by determining food availability, which in turn affects health, mortality rates, and population growth and historically, regions with fertile land and advanced agricultural practices have supported denser populations and more complex societal structures [5]. Despite the growing body of research on each of these domains individually, there remains a notable gap in understanding how they intersect to influence reproductive decision-making. This study addresses that gap by examining how agricultural conditions and climate-induced displacement affect contraceptive uptake, especially in contexts where population pressures and gender norms complicate access and autonomy.

Regarding birth rates, the relationship between agriculture and population dynamics is multifaceted. On one hand, advancements in agricultural technology and productivity have facilitated population growth by ensuring a stable food supply [5]. This in turn has influenced reproductive choices, as access to sufficient resources can reduce the pressures on family size and childbearing practices. For example, in agrarian societies where labor is a crucial component of agricultural productivity, larger family sizes were historically favored to meet the labor demands [6] on the other hand, rapid growth in population poses challenges to sustainable agricultural practices. The pressure to produce enough food to meet the demands of a growing population can lead to overexploitation of land, degradation of natural resources, and diminished agricultural productivity over time [7]. This dynamic creates a feedback loop where the need for food security influences reproductive choices, and these choices, in turn, impact agricultural sustainability.

Ensuring food security has become a critical concern for countries at various stages of economic growth, and the agricultural sector plays a fundamental role in increasing food availability [5]. The rural urban drift of population especially in sub-Saharan Africa occurring as a result of climate change has been found to encourage an uptake especially in traditional contraceptive practice amongst women with the need to ensure the male partner is not necessarily aware of this choice [8]. The motivation for this study stems from the urgent need to contextualize reproductive health within broader environmental and socioeconomic frameworks. As global development agendas increasingly emphasize integrated approaches — such as those outlined in the Sustainable Development Goals (SDGs) — it becomes critical to explore how agriculture, climate resilience, and demographic shifts jointly shape women's reproductive agency. This is particularly relevant in regions like sub-Saharan Africa, where climate stress, rural-urban migration, and evolving agricultural practices converge to influence family planning behaviors in complex ways.

To provide clarity and structure, this paper organizes the discussion around three primary causal pathways that link agriculture, climate change, and population dynamics to reproductive health outcomes. First, agricultural conditions influence household income and economic stability, which in turn shape contraceptive access and use. Mechanization and productivity gains reduce reliance on child labor, shift fertility preferences, and increase disposable income that can be allocated toward healthcare and family planning. Second, climate change disrupts agricultural livelihoods, leading to food insecurity, economic stress, and altered fertility preferences. Climate-induced displacement and migration further strain health systems and reduce access to contraception, particularly in vulnerable regions. Third, climate change directly affects reproductive decision-making through displacement, health system breakdowns, and psychological distress. Extreme weather events damage infrastructure, disrupt supply chains for contraceptives, and create humanitarian crises that limit reproductive autonomy. Additionally, climate anxiety and concerns about environmental futures influence fertility intentions, particularly among younger and more environmentally conscious populations.

These pathways are not mutually exclusive but rather interact in complex ways. For instance, agricultural disruption caused by climate stress can lead to both economic hardship (affecting demand for contraception) and displacement (affecting supply and access). Similarly, mechanization may simultaneously increase household income and reduce the perceived need for large families. By distinguishing between supply-side constraints (availability of services) and demand-side factors (fertility preferences and decision-making capacity), this framework allows for a more integrated understanding of how macro-level environmental and demographic changes translate into individual-level reproductive behavior. The subsequent sections examine each pathway in detail, drawing on empirical evidence and theoretical insights to illustrate these dynamics.

While this paper draws attention to observed associations between agriculture, population dynamics, climate change, and reproductive decisions, it does not claim direct causality unless supported by empirical evidence. The analysis is primarily exploratory, aiming to highlight patterns and potential linkages that warrant further investigation. This paper explores the intricate relationships between agriculture, population dynamics, and climate change, with particular attention to their impact on women's reproductive decisions. It aims to shed light on the challenges arising from population growth and environmental sustainability, while identifying opportunities for policies and practices that address these issues effectively. The following section offers a detailed examination of the links between agriculture, population trends, and climate change, focusing on their effects on health, food security, and reproductive behaviours. Subsequent sections provide an in-depth analysis of specific aspects of these interactions.

2. Impact of agriculture, population dynamics and climate change on reproductive decisions

A variety of factors, including socioeconomic, cultural, and environmental influences, shape reproductive decisions. Among these, agriculture and population dynamics play a pivotal role. The development of agriculture brought about a significant shift in human reproductive patterns. The transition from nomadic hunter-gatherer societies to settled farming communities led to higher population densities and increased fertility rates [9]. The Neolithic demographic transition, which refers to the significant population growth and changes in human reproductive patterns that accompanied the shift from a nomadic hunter-gatherer lifestyle to settled agricultural societies during the Neolithic period was brought about by agriculture's greater food security, which in turn encouraged larger families and higher birth rates [10]. Archaeological data demonstrates an increase in population density and the spread of agrarian societies supports this change [9]. Agricultural practices still have an impact on reproductive decisions in modern settings, but they do so in more nuanced ways. Research has indicated that children are frequently viewed as valuable resources in agricultural communities, providing labor for agricultural tasks. Families looking to optimize their work force might observe an increase in fertility because of this financial incentive [11]. The relationship between high fertility rates in emerging nations and rural poverty and dependency on agriculture is examined by Lanjouw and Ravallion [12]. They contend that, despite the possibility of more poverty and scarce resources, the economic value of children in agricultural environments promotes bigger family sizes.

Reproductive decisions are also influenced by demographic shifts and rates of population growth. High rates of population increase can put a burden on resources in many emerging nations, which can alter reproductive patterns.

High fertility rates often persist in regions with rapid population growth due to prevailing cultural values and economic conditions. However, as countries undergo demographic transitions and urbanization, fertility rates typically decline, driven by increased access to education and employment opportunities, particularly for women [13].

Climate change significantly influences reproductive choices and socioeconomic outcomes. In high-latitude countries, which are typically wealthier, climate change may contribute to declining fertility rates and greater investment in education and skills. In contrast, low-latitude countries, which are often less prosperous and more vulnerable to climate impacts, may experience persistent higher fertility rates and limited opportunities for skill development due to economic and environmental challenges. Climate vulnerability in low-latitude regions often manifests through economic shocks such as crop failure, livestock loss, and reduced agricultural income, which can alter household labor dynamics and fertility preferences. For example, when agricultural productivity declines due to drought or flooding, families may either increase fertility to compensate for labor shortages or reduce fertility due to rising child-rearing costs and economic uncertainty [14]. Migration triggered by climate stress — particularly rural-to-urban drift — can also influence reproductive decisions, as displaced populations may face limited access to health services, including contraception, or adopt new reproductive norms shaped by urban environments [15]. Additionally, climate-related disruptions to healthcare infrastructure, such as damage to clinics or supply chain interruptions, can reduce access to family planning services, thereby affecting contraceptive uptake and fertility outcomes [15]. These pathways underscore the multifaceted ways in which climate change intersects with reproductive behavior, especially in regions where environmental stress compounds existing socioeconomic vulnerabilities [16] These contrasting trends could exacerbate existing income disparities between affluent high-latitude nations and less developed equatorial regions [17]. When examining variations in the impacts of climate change, there are minimal differences based on levels of development, independent of geographical location [18]. It has been documented that those pollutants and chemicals released into the environment because of industrial and agricultural operations have a significant long-term impact on the climate. Additionally, in the short term, these pollutants have harmful impacts on women's reproductive health. A study has found that these artificial chemicals, which have long-lasting effects, can disrupt the endocrine system in women, leading to negative impacts on their reproductive health [19].

Initially, alterations in economic limitations caused by climate change can result in changes in the need for household labor. It has been demonstrated that a typical reaction to decreasing agricultural production and other resource limitations linked to environmental change is an increase in household labor supply. In such circumstances, women may endeavor to enhance their fertility to the degree that children can be anticipated to contribute to household labor [20]. Alternatively, in different situations, fluctuations in labor demand can result in the redistribution of job responsibilities among family members. For example, *in situ*ations where drought or heat stress cause a decrease in agricultural production and revenue, women may choose to find jobs outside of farming [21]. If these changes result in increased workloads for women and/or their partners, research indicates that this will lead to a decrease in the desire to have children due to the rising costs associated with childbirth [22,23]. Several researchers have contended that the utilization of contemporary contraceptives, resulting in reduced fertility rates, is a crucial measure in the battle against climate change. This is because each additional individual born contributes to the release of greenhouse gases [24].

3. Agricultural modernization: The impact on reproductive choices/ contraception

This section examines the pathway fuelling the exploration of how agricultural modernization shapes economic conditions and reproductive choices. Reproductive decisions have also been affected by technological developments and agricultural modernization. Large families may no longer be economically necessary due to mechanization and increased agricultural production, since fewer workers are required to produce the same amount of agricultural goods [25]. The relationship between economic growth and agricultural modernization and lowering birth rates has been a mutual one. It has been contended that the economic case for big families declines with increased agricultural efficiency, leading to a shift in population toward smaller family sizes [26].

Farmers are progressively employing agricultural implements such as corn shellers, threshers, sprayers, chaff cutters and robotic harvesters. These agricultural implements eliminate the necessity for manual labor. Hence, it is reasonable to infer that the decrease in labor demand resulting from the adoption of mechanical equipment, such as tractors and farm implements, diminishes the importance of having children, consequently leading to a fall in the desire to have offspring. Based on the evidence of the impact of automated farm technology on replacing labor and considering the proven connection between the demand for farm labor and high fertility as proposed by the land-labor demand theory, it can be proposed that, the utilization of agricultural tools and equipment also diminishes the need for manual labor on farms by replacing human workforce, thereby leading to a decline in the number of births within farming household [27].

Prior research has indicated that affluence has a significant role in the use of contraceptive methods among women in developing nations. Specifically, women with higher socioeconomic status tend to have more access to and utilization of contraceptives. In wealthier nations, the adoption of mechanized farming often coincides with higher rates of contraceptive use; while this association is well-documented, it does not imply a direct causal relationship but rather reflects broader socioeconomic factors that influence both agricultural practices and reproductive behavior. Hence, we can infer that this behaviour may be due to a decrease in the economic expectations parents have for their children. This hypothesis is highly relevant to sub-Saharan Africa in terms of fertility control, as children are also considered a valuable labor force in a predominantly agricultural culture with limited mechanization in the agricultural sector. These results suggest that if households are economically empowered, parents will have lower economic expectations from their children [8].

Data from the Western Chitwan Valley - a rural and agricultural area in Nepal, suggest that until recently, the valley was mostly characterized by subsistence-based agriculture, with minimal utilization of contemporary farm technology. Furthermore, individuals were unable to regulate their fertility due to cultural factors and the restricted access to contemporary contraceptive techniques. Nevertheless, the valley has experienced significant shifts, leading to a notable shift from subsistence farming to a more commercially oriented agricultural system, involving mechanical technology. Moreover, these identical alterations also prompted a swift rise in the age at which individuals get married and the use of contraception, resulting in a subsequent decrease in the number of children born inside marriages. Consequently, these factors have had a significant impact on the quick transformation of the population's demographic patterns [27].

The mechanization of agriculture has a significant impact on contraceptive usage and intentions. Analysis suggests that for women who have already made the decision to cease having children, the additional motivation to utilize contraception resulting from increased commercialization of agriculture is unnecessary. Within the group of individuals who express a wish to have additional children or are uncertain about it, the process of commercializing agriculture seems to promote opposing behavior. The personal aspirations of these individuals clash with the

practicalities of the local economy in the village. The implementation of mechanization in agriculture is expected to decrease the need for child labor, thereby enhancing the probability that an individual employs contraception or anticipates its usage [28]. Agricultural transformation can result in increased access to contraception, particularly if it leads to higher earnings or improved availability of healthcare facilities. Additionally, the adoption of agricultural advances may also facilitate innovation in other areas. In a study that focused on analyzing the impact of agricultural technological advancements and the factors contributing to the drop-in fertility rates in South Asia, the initial beneficiaries of high-yielding variety (HYV) technology were typically individuals with higher socioeconomic status, but over time, even those who were economically disadvantaged were able to reap the benefits. Technological advancements have significantly increased investment in and the benefits of education. Consequently, education, particularly for women, is closely associated with a decline in fertility [29].

In developing countries like Nigeria, children are highly esteemed not only for their ability to showcase the masculinity of men, but also for their valuable contribution in communities heavily reliant on agriculture as their primary source of revenue. In addition, elderly parents and other extended family members rely on their children for financial support in their old age. Therefore, they are hesitant to impose restrictions on childbirth [30]. This single handedly will deter any novel contraceptive product from having adequate uptake amongst women. There is an associated increase in income for households who are involved in mechanized agriculture which improves access to health information and education. There is increased rural-urban migration and increased infrastructure based in communities who have improved agricultural practices. This leads to increased awareness of family planning and improved uptake of contraception. With the burden of women being reduced, there is a more likelihood of their engagement in other activities which in turn broadens their knowledge and gives exposure thereby influencing decision making with regards to their reproductive choices.

Building on this, it becomes evident that the economic shifts brought about by agricultural modernization do not just alter farming practices—they also quietly reshape how families think about fertility and access to reproductive health services. Agricultural modernization often leads to increased household income through enhanced productivity and market access. This rise in income can improve access to health services and education, both of which are critical determinants of contraceptive use. For example, higher earnings may enable families to afford transportation to clinics, purchase contraceptives, or access private healthcare providers [31]. Mechanization also reduces the economic reliance on child labor, shifting parental expectations and lowering the perceived need for larger families [32]. In communities where agricultural transformation is accompanied by infrastructure development — such as roads, mobile connectivity, and health outreach — women are more likely to receive reproductive health information and engage with family planning services [33]. These changes contribute to a broader shift in reproductive norms, where fertility decisions are increasingly shaped by economic opportunity, education, and autonomy rather than subsistence needs or intergenerational support.

4. Contraceptive option: The impact of climate change on reproductive access

Climate change can substantially affect health outcomes, particularly in disadvantaged populations with little ability and resilience to its effects. Women, particularly those constrained by gender inequities, frequently constitute one of the most impacted groups. During and after climate change related events, the sexual and reproductive health and rights of women are progressively worsened [34,35]. Access to reproductive rights services may already be limited due to constraints which could be economic, cultural, and social, preventing women from making decisions that concerns the autonomy of their bodies, and these access constraints increases during post climate disasters [36]. To understand how these constraints intensify during climate disasters, it is important to examine the specific mechanisms and real-world examples that illustrate the disruption of reproductive health access. Climate-related disasters such as floods, droughts, and cyclones often result in the destruction of health infrastructure, displacement of communities, and breakdowns in supply chains for essential medical supplies, including contraceptives. Fernandes et al. reported that, following Cyclone Idai in Mozambique in 2019, many health facilities were damaged or inaccessible, leading to a sharp decline in access to maternal and reproductive health services [37]. Similarly, in Pakistan, Wassem et al., reported that the 2022 floods displaced millions and disrupted routine health services, with women reporting limited access to contraception and antenatal care due to damaged roads and overwhelmed clinics [38]. In South Sudan, ongoing drought and conflict have compounded displacement, leaving women in refugee camps with minimal access to family planning services and no privacy to make autonomous reproductive decisions [39]. These examples demonstrate how climate-induced emergencies not only strain physical infrastructure but also exacerbate gendered vulnerabilities, particularly in regions where cultural norms already restrict women's mobility and decision-making. The compounded effect of environmental stress and social inequity severely limits reproductive autonomy and increases the risk of unintended pregnancies, maternal mortality, and psychological trauma. When faced with climate disruptions such as humanitarian emergency, it is important that reproductive choices are accessible to prevent unintended pregnancies while navigating the crisis. However, most people especially women that reside in climate impacted countries have had their access to contraception disrupted due to climate -related displacement [40]. Moreso, the limited access to the sexual and reproductive health and rights services increases women's risk of physical, mental, and psychological damage; it also impacts on their ability to build capacity and resilience to climate change [35].

Enhanced gender equality is closely tied to stronger resilience and adaptation to climate change. Achieving effective climate change resilience and adaptation requires a clear understanding of women's specific needs. This is because climate change poses significant risks to women's economic, social, and reproductive security. In contexts where women face restricted access and limited rights, climate-related disasters exacerbate the challenges to their sexual and reproductive autonomy. Despite being critical for successful climate change mitigation and adaptation, the reproductive rights of women are largely absent from both international and national climate frameworks. Furthermore, references to sexual and reproductive health and rights in the context of climate change are notably scarce in many international frameworks designed to establish standards for resilience and mitigation efforts. Consequently, Liberia in West Africa and Peru in South America are the only two countries that have included gender considerations in their national climate change policies. However, no other country has addressed or incorporated the right to access sexual and reproductive health services in the context of climate change within their intended Nationally Determined Contributions [35,41].

An increasingly recognized consequence of climate change is eco-anxiety, defined as mental distress or a persistent fear linked to worsening environmental conditions [42,43]. Eco-anxiety encompasses a range of emotions, including anger, fear, powerlessness, helplessness, and trauma following extreme climate events. It also includes climate grief, which refers to the distress caused by environmental degradation or change [42,44]. Adolescents and young adults are particularly vulnerable to eco-anxiety and climate-related distress, which can disrupt their daily lives. Women, people living in poverty, racialized groups, and marginalized communities are at greater risk of experiencing the effects of extreme climate events due to existing socioeconomic inequalities, which can exacerbate climate-related distress [45,46].

Even without experiencing eco-anxiety, many individuals have

environmental concerns that influence their sexual and reproductive lives. The intersection of climate-related events, eco-anxiety, and sexual and reproductive health is both socially and scientifically significant. Although media outlets occasionally highlight individual stories about rethinking hormonal contraceptive use or reproductive choices due to climate change concerns, scientific research on these issues remains limited [47]. It is paramount to explore how climate-related psychological distress—particularly eco-anxiety—can shape fertility intentions and contraceptive behavior in more concrete terms. Eco-anxiety, while often discussed in psychological terms, has emerging implications for reproductive decision-making. Individuals experiencing persistent fear or grief about environmental degradation may choose to delay or avoid childbearing due to concerns about future resource scarcity, climate instability, or the ethical implications of raising children in a deteriorating world [48]. In a recent study of young adults in the UK, nearly 40 % reported that climate concerns influenced their reproductive intentions, with some citing eco-anxiety as a reason for avoiding parenthood altogether [49]. This psychological response can also affect contraceptive behavior indirectly—those who feel overwhelmed or powerless may disengage from reproductive planning, while others may actively seek long-term contraceptive methods as a form of control in uncertain times. Among adolescents and marginalized groups, climate-related distress may compound existing barriers to reproductive autonomy, especially where mental health services and reproductive education are limited. These patterns suggest that eco-anxiety is not merely a background emotion but a factor that can shape reproductive choices in subtle but importantly significant ways.

5. Influence of climate concerns on waste generated as biproducts of contraceptives products

Climate-related concerns may influence the choice of individual, which may (in)directly influence their sexual health, including decisions about contraceptive use. While the preceding sections focus primarily on access barriers in resource-limited settings, this subsection addresses a different context: demand-side factors in higher-income populations where contraceptive access is generally available. Climate-related concerns may influence contraceptive choice among environmentally conscious individuals in developed countries, which may (in)directly influence their sexual health decisions. For example, latex condoms contribute to waste that most time end up in landfills or in waterways [50]. Similarly, hormonal contraceptives can lead to water contamination through synthetic oestrogens, although they are not the primary source of oestrogenic compounds in the environment [51]. These concerns including side effects of hormonal contraceptives on the overall health of individuals has led some people to choose nonhormonal behavioural methods, such as the calendar method, cervical mucus observation, luteinizing hormone (LH) levels, withdrawal etc. However, these nonhormonal methods carry a higher risk of unintended pregnancies, with typical-use failure rates ranging from 15 % (fertility awareness-based methods) to 20 % (withdrawal), as well as an increased risk of sexually transmitted infections [52].

Public health initiatives must actively disseminate evidence-based information to empower individuals to make informed contraceptive choices. Given the limited empirical data available, future research should focus on exploring whether climate-related concerns influence the selection of hormonal versus nonhormonal contraceptive methods. Such studies should include large-scale, representative population-based samples and in-depth qualitative interviews to understand these dynamics better. Furthermore, research should assess the extent to which individuals feel prepared and adequately educated to use nonhormonal or behavioral methods confidently and securely, without feelings of uncertainty or vulnerability [40].

6. Potential channels linking reproductive health and climate change impacts

Climate change has undoubtedly led to increased frequency, intensity and duration of extreme weather events. However, its impacts are not only environmental but also permeates into significant health risks including those associated with reproductive health. The mechanisms through which these can emerge could be related to biological, psychological and social. This section explores how these channels may drive the relationship between climate stressors and reproductive health decisions to aid our understanding of the dynamics.

We organize these channels into three distinct but related pathways. First, direct biological pathways involve physiological effects of climate stressors (heat, pollution, water quality) on fertility, pregnancy outcomes, and fetal development. Second, behavioral pathways emerge when individuals or couples adapt their reproductive plans in response to awareness of these biological risks—for instance, choosing to delay pregnancy during high-risk periods. Third, psychological pathways operate through climate anxiety and concerns about future environmental stability, which may influence childbearing intentions independently of immediate biological risks. These pathways are not mutually exclusive and may interact, but distinguishing them helps clarify the mechanisms at work.

Extreme weather events such as prolonged exposure to heat can cause dehydration which could disrupt the reproductive systems of some individuals leading to reduced fertility and adverse pregnancy outcomes. Such conditions can influence the decisions around family planning and contraceptive usage. A systematic review conducted by Chersich [53] found that high temperatures correlate with increased risks of preterm births and still births. This result was more pronounced in vulnerable sub-groups (especially those with lower economic status) and critical gestational periods. This evidence may influence family planning decisions, as individuals become aware of heat-related pregnancy risks and choose to use contraceptives to avoid conception during periods of extreme heat exposure. Other studies such as Basu et al. [54] have found similar results. These findings suggest a potential behavioral pathway: individuals or couples who are informed about heat-related pregnancy risks may delay conception through contraceptive use during periods of peak heat exposure, though empirical evidence of this behavioural response remains limited and warrants further investigation.

Further, climate change impacts exacerbate the exposure to toxins which could have adverse effects on reproductive health especially with regards to fertility and pregnancy related complications. Research has found that pollutants such as PM2.5 (particulate matter with a diameter of 2.5 μm or less, which can penetrate deep into the lungs and enter the bloodstream, to cause significant health risks) and endocrine-disrupting chemicals (mostly found in higher concentrations during wildfires and heatwaves) could affect fertility, sperm quality, and hormonal imbalances [55,56]. High concentrations of these chemicals due to climate change could lead to reproductive disorders and in some cases push some people in considering delayed pregnancies in a bid to avoid complications. It should be noted that the evidence linking pollution exposure to actual changes in contraceptive behavior or pregnancy timing remains sparse, and the mechanisms through which individuals would become aware of and respond to these risks require further empirical examination. Related to this is the dangers of unsafe drinking water during pregnancy due to climate-related events such as floods or droughts. There is evidence to suggest that unsafe drinking water is correlated with preterm birth and pregnancy induced hypertension. This can impact reproductive decisions [55].

Climate anxiety represents a distinct psychological pathway that operates independently of immediate biological risks. Unlike the behavioral adaptations described above (which respond to known pregnancy risks), climate anxiety involves broader concerns about bringing children into an uncertain environmental future. Some

individuals may consider the fears of an unstable environment and reconsider bearing children. Such psychological strain due to increased climate stressors can affect the use of contraception and decisions on reproduction. For instance, after analysing 13 studies across different countries, Dillarstone et al. [57] found that climate worries correlate with decisions to avoid or delay childbirth among parents.

7. Conclusion

Agriculture, population dynamics and climate have been observed to have a substantial impact on reproductive choices and the uptake of contraception. With the move from subsistence agriculture to mechanized farming practices and the ongoing wave of climate change leading to the greenhouse effect, there is a shift in demand as regards reproductive choices. It is imperative that policy makers and development practitioners create an enabling platform where these linked issues are addressed. This includes creating supportive conditions for informed reproductive choices and increasing the uptake of contraception via health promotion and education programs. These changes are crucial for the overarching development objectives of enhancing health, education, and economic stability in vulnerable regions. These will help to improve quality of life and living conditions by reducing the associated burdens.

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Chukwuma H. Ilomuanya: Writing – review & editing, Writing – original draft, Methodology, Investigation, Data curation, Conceptualization. **Peace-Ofonabasi O. Bassey:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Data curation. **Mutiat B. Ibrahim:** Writing – review & editing, Project administration, Methodology. **Kwadwo Danso-Mensah:** Writing – review & editing, Supervision, Project administration, Data curation. **Margaret O. Ilomuanya:** Writing – review & editing, Writing – original draft, Supervision, Resources, Methodology, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

[1] Harris D.R., Fuller D.Q., 2014. Agriculture: definition and overview. https://doi.org/10.1007/978-1-4419-0465-2_64.
[2] J.P. Guerra Ibarra, F.J. Cuevas de la Rosa, O. Arellano Arzola, Segmentation of leaves and fruits of tomato plants by color dominance, AgriEngineering 5 (4) (2023) 1846–1864, https://doi.org/10.3390/agriengineering5040113.
[3] S.A. Juliano, Population dynamics, J. Am. Mosq. Control Assoc. 23 (2 SUPPL) (2007) 265–275, https://doi.org/10.2987/8756-971x(2007)23[265:pd]2.0.co;2.
[4] N. Finney, L. Simpson, Population dynamics: the roles of natural change and migration in producing the ethnic mosaic, J. Ethn. Migr. Stud. 35 (9) (2009) 1479–1496, https://doi.org/10.1080/13691830903125935.
[5] K. Pawlak, M. Kołodziejczak, The role of agriculture in ensuring food security in developing countries: considerations in the context of the problem of sustainable food production, Sustainability. 12 (13) (2020) 5488, https://doi.org/10.3390/su12135488.
[6] K. Itao, K. Kaneko, Evolution of family systems and resultant socio-economic structures, Humanit. Soc. Sci. Commun. 8 (2021) 243, https://doi.org/10.1057/s41599-021-00919-2.
[7] H.C.J. Godfray, J.R. Beddington, I.R. Crute, L. Haddad, D. Lawrence, J.F. Muir, J. Pretty, S. Robinson, S.M. Thomas, C. Toulmin, Food Security: the challenge of feeding 9 billion people, Science, 327 (5967) (2010) 812–818, https://doi.org/10.1126/science.1185383.
[8] N. Mutombo, P. Bakibinga, The effect of joint contraceptive decisions on the use of injectables, long-acting and permanent methods (ILAPMs) among married female (15-49) contraceptive users in Zambia: a cross-sectional study, Reprod. Health 11 (1) (2014) 1–8, https://doi.org/10.1186/1742-4755-11-51.
[9] J.-P. Bocquet-Appel, The agricultural demographic transition during and after the agriculture inventions, Curr. Anthropol. 52 (S4) (2011) S497–S510, https://doi.org/10.1086/659243.
[10] T. Blagojević, M. Porčić, S. Stefanović, Addressing the intensity of changes in the prehistoric population dynamics: population growth rate estimations In the Central Balkans early neolithic, Radiocarbon. 66 (2) (2024) 280–294, https://doi.org/10.1017/RDC.2024.23.
[11] E. Mueller, The economic value of children in peasant agriculture. Population and Development, 2013, pp. 98–153.
[12] P. Lanjouw, M. Ravallion, Poverty and household size, Econ. J. 105 (433) (1995) 1415–1434, https://doi.org/10.2307/2235108.
[13] J. Bongaarts, Slow down population growth, Nature 530 (7591) (2016) 409–412, https://doi.org/10.1038/530409a.
[14] United Nations Population Fund (UNFPA), Climate Change and Sexual and Reproductive Health and Rights: A review of Evidence and Policy Implications, ANSER & UNFPA, 2025. https://eeca.unfpa.org/sites/default/files/pub-pdf/2025-05/2025-05_14_ANSER%20Climate%20change_V5.pdf.
[15] R. Sorcher, M.O. Arunda, A.I. Ajayi, J. Alger, M. Ali, et al., Key considerations for research into how climate change affects sexual and reproductive health and rights, Lancet Planet. Health 8 (6) (2024) e347–e348, https://doi.org/10.1016/S2542-5196(24)00093-7.
[16] Inovi Fertility, How Climate Change is Influencing Fertility Rates, August 14, Inovi Fertility, 2023, https://www.inovifertility.com/blog/how-climate-change-is-influencing-fertility-rates.
[17] A. Barreca, O. Deschenes, M. Guldi, Maybe next month? Temperature shocks and dynamic adjustments in birth rates, Demography 55 (4) (2018) 1269–1293, https://doi.org/10.1007/s13524-018-0690-7.
[18] G. Casey, S. Shayegh, J. Moreno-Cruz, M. Bunzl, O. Galor, K. Caldeira, The impact of climate change on fertility, Environ. Res. Lett. 14 (5) (2019), https://doi.org/10.1088/1748-9326/ab0843.
[19] M. Arulmohi, V. Vinayagamoorthy, D.A R, Physical violence against doctors: a content analysis from online Indian newspapers, Indian J. Commun. Med. 42 (1) (2017) 147–150, https://doi.org/10.4103/ijcm.IJCM.
[20] I. Sasson, A. Weinreb, Land cover change and fertility in West-Central Africa: rural livelihoods and the vicious circle model, Popul. Environ. 38 (4) (2017) 345–368, https://doi.org/10.1007/s11111-017-0279-x.
[21] M. Alston, J. Clarke, K. Whittenbury, Contemporary feminist analysis of Australian farm women in the context of climate changes, Soc. Sci. 7 (2) (2018) 16, https://doi.org/10.3390/socsci7020016.
[22] S. Eissler, B.C. Thiede, J. Strube, Climatic variability and changing reproductive goals in Sub-Saharan Africa, Glob. Environ. Change 57 (2019) 1–29, https://doi.org/10.1016/j.gloenvcha.2019.03.011.
[23] G. Van den Broeck, M. Maertens, Female employment reduces fertility in rural Senegal, PLoS. One 10 (3) (2015) e0122086, https://doi.org/10.1371/journal.pone.0122086.
[24] L. Senderowicz, T. Valley, Fertility has been framed: why Family planning is not a silver bullet for sustainable development. Studies in Comparative International Development (Issue 0123456789), Springer US, 2023, https://doi.org/10.1007/s12116-023-09410-2.
[25] K.O. Olatunji, O. Ogunkunle, O.A. Adisa, A. Taiwo, Effect of agricultural mechanization on production and farmers economy in Nigeria: a case study of Lagos State, Int. J. Eng. Res. Afr. 60 (2022) 211–231, https://doi.org/10.4028/p-414rk3.
[26] J. Cleland, C. Wilson, Demand theories of the fertility transition: an iconoclastic view, Popul. Stud. 41 (1) (1987) 5–30, https://doi.org/10.1080/0032472031000142516.
[27] A. Galmozzi, E. Dominguez, B.F. Cravatt, E. Saez, 基因的改变NIH Public access, Methods Enzymol. 538 (2) (2014) 151–169, https://doi.org/10.1111/ruso.12007.Rural.
[28] B. Entwisle, J.B. Casterline, H.A.A. Sayed, Villages as contexts for contraceptive behavior in rural Egypt, Am. Sociol. Rev. 54 (6) (1989) 1019–1034, https://doi.org/10.2307/2095721.
[29] Witcover, J., Economics, R., Vosti, S.A., .& Lipton, M. (2006). Agricultural change and population growth: district-level evidence from India.
[30] J.S. Seriki-Mosadolorun, N.O. Abiamuwe, A.A. Oluwadare, M.R. Asunmo, C. I. Ekuomaru, Family planning practices of young couples in badagry local government area of Lagos state, J. Home Econ. Res. 26 (1) (2019) 1–12.

[31] J. Cleland, S. Bernstein, A. Ezeh, A. Faundes, A. Glasier, J. Innis, Family planning: the unfinished agenda, Lancet 368 (9549) (2006) 1810–1827, https://doi.org/10.1016/S0140-6736(06)69480-4.
[32] A. de Janvry, E. Sadoulet, Agricultural growth and poverty reduction: additional evidence, World Bank. Res. Obs. 27 (1) (2010) 1–20, https://doi.org/10.1093/wbro/lkp015. Volume 25, Issue 1, https://documents1.worldbank.org/curated/en/649011468331246837/pdf/768000JRN0WBRO00Box374387B00PUBLIC0.pdf.
[33] J. Bongaarts, The causes of educational differences in fertility in sub-Saharan Africa, Vienna Yearb. Popul. Res. 8 (2010) 31–50, https://doi.org/10.1553/populationyearbook2010s31.
[34] N. Banwell, S. Rutherford, B. Mackey, R. Street, C. Chu, Commonalities between disaster and climate change risks for health: a theoretical framework, Int. J. Environ. Res. Public Health 15 (2018) 538, https://doi.org/10.3390/ijerph15030538.
[35] S. Husaini, S.E. Davies, Case report: another burden to bear: the impacts of climate change on access to sexual and reproductive health rights and services in Bangladesh, Front. Clim. 4 (June) (2022), https://doi.org/10.3389/fclim.2022.875515.
[36] Women Deliver, The Link Between Climate Change and Sexual and Reproductive Health and Rights, Women Deliver, 2020. Available online at: https://womendeliver.org/wp-content/uploads/2021/02/Climate-Change-Report.pdf.
[37] Q. Fernandes, O. Augusto, S. Chicumbe, et al., Maternal and child health care service disruptions and recovery in Mozambique after Cyclone Idai: an uncontrolled interrupted time series analysis, Glob. Health Sci. Pract. 10 (Suppl 1) (2022) e2100796, https://doi.org/10.9745/GHSP-D-21-00796.
[38] S. Waseem, S.H. Ahmed, K.A.H.M. Ahmed, T.G. Shaikh, I. Ullah, Reproductive health crisis amidst a natural disaster in Pakistan: a call to action, Women's Health 21 (2025), https://doi.org/10.1177/17455057251344725.
[39] United Nations Population Fund, Climate Change Vulnerability Assessment: Impact of Climate Change On Gender-based Violence, Sexual and Reproductive Health and Rights, and Gender Equality in South Sudan, United Nations Population Fund, Juba, 2024. https://esaro.unfpa.org/sites/default/files/pub-pdf/2025-08/UNFPA%20-%20Vulnerability%20Assessment%20Report%20%28High%20Quality%20Version%29.pdf.
[40] R. Catherine, Climate change and sexual and reproductive health: what implications for future research? Sex. Reprod. Health Matters. 31 (1) (2023) https://doi.org/10.1080/26410397.2023.2232196.
[41] K.R. Smith, A. Woodward, D. Campbell-Lendrum, D.D. Chadee, Y. Honda, Q. Liu, J. M. Olwoch, B. Revich, R. Sauerborn, U. Confalonieri, A. Haines, Z. Chafe, J. Rocklov, Human health: impacts, adaptation, and co-benefits. Climate Change 2014 impacts, Adapt. Vulnerability: A: Glob. Sect. Asp. (2015) 709–754, https://doi.org/10.1017/CBO9781107415379.016.
[42] S. Clayton, B.T Karazsia, Development and validation of a measure of climate change anxiety, J. Environ. Psychol. 69 (2020) 101434, https://doi.org/10.1016/j.jenvp.2020.101434.
[43] K. Usher, J. Durkin, N. Bhullar, Eco-anxiety: how thinking about climate change-related environmental decline is affecting our mental health, Int. J. Ment. Health Nurs. 28 (6) (2019) 1233–1234, https://doi.org/10.1111/inm.12673.
[44] P. Cianconi, S. Betrò, L. Janiri, The impact of climate change on mental health: a systematic descriptive review, Front. Psychol. 11 (74) (2020) 1–15, https://doi.org/10.3389/fpsyt.2020.00074.
[45] G. Gaard, Ecofeminism and climate change, Women's Stud. Int. Forum 49 (2015) 20–33, https://doi.org/10.1016/j.wsif.2015.02.004.
[46] A. Kaijser, A. Kronsell, Climate change through the lens of intersectionality, Env. Polit. 23 (3) (2014) 417–433, https://doi.org/10.1080/09644016.2013.835203.
[47] R. Santos, Worrying about the climate crisis is affecting people's relationships and sex lives. Vice, 2021. December 14.
[48] S. Clayton, C.M. Manning, M. Speiser, A.N. Hill, Mental Health and Our Changing Climate: Impacts, Inequities, Responses, American Psychological Association, and ecoAmerica, Washington, D.C., 2021. https://www.apa.org/news/press/releases/mental-health-climate-change.pdf.
[49] E. Marks, C. Hickman, P. Pihkala, Dataset for "Climate Anxiety in Children and Young People and Their Beliefs About Government Responses to Climate change: a Global Survey", University of Bath Research Data Archive, Bath, 2022 https://doi.org/10.15125/BATH-01124. Available from:.
[50] United Nations Population Fund, Safe disposal and management of unused, unwanted contraceptives. 2013.
[51] K. Moore, K.I. McGuire, R. Gordon, et al., Birth control hormones in water: separating myth from fact, Contraception 84 (2) (2011) 115–118, https://doi.org/10.1016/j.contraception.2011.04.014.
[52] L.E. Britton, A. Alspaugh, M.Z. Greene, et al., An evidencebased update on contraception: a detailed review of hormonal and nonhormonal methods, Am. J. Nurs. 120 (2) (2020) 22–33, https://doi.org/10.1097/01.NAJ.0000654304.29632.a7.
[53] M.F. Chersich, M.D. Pham, A. Areal, M.M. Haghighi, A. Manyuchi, C.P. Swift, B. Wernecke, M. Robinson, R. Hetem, M. Boeckmann, S. Hajat, Associations between high temperatures in pregnancy and risk of preterm birth, low birth weight, and stillbirths: systematic review and meta-analysis, BMJ 371 (2020) 1–13, https://doi.org/10.1136/bmj.m3811.
[54] R. Basu, V. Sarovar, B.J. Malig, Association between high ambient temperature and risk of stillbirth in California, Am. J. Epidemiol. 183 (10) (2016) 894–901, https://doi.org/10.1093/aje/kwv295.
[55] S. Meherali, S. Nisa, Y.A. Aynalem, M. Kennedy, B. Salami, S. Adjorlolo, P. Ali, K. L. Silva, L. Aziato, S. Richter, Z.S. Lassi, Impact of climate change on maternal health outcomes: an evidence gap map review, PLOS. Glob. Public Health 4 (8) (2024) e0003540, https://doi.org/10.1371/journal.pgph.0003540.
[56] N. Roos, S. Kovats, S. Hajat, V. Filippi, M. Chersich, S. Luchters, F. Scorgie, B. Nakstad, O. Stephansson, Maternal and newborn health risks of climate change: a call for awareness and global action, Acta Obstet. Gynecol. Scand. 100 (4) (2021) 566–570, https://doi.org/10.1111/aogs.14124.
[57] H. Dillarstone, A.M. McCright, Climate change and reproductive intentions in the United States: a mixed methods analysis, Popul. Environ. 42 (1) (2020) 1–27, https://doi.org/10.1007/s11111-020-00332-3.