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Chapter

Nexus Between Savannah Woodland Degradation and Climate Change in Northern Ghana

Raymond Aabeyir, Kenneth Peprah and Gervase Kuuwaabong

Abstract

The Savannah woodland and forest ecosystems are considered as fragile ecosystems in Ghana. They are located in pro-poor areas of the country. They serve as livelihood support systems for the poor in those areas. In the midst of climate change, the same woods are expected to provide mitigation support against climate change. These woodland and forest ecosystems are in a state of dilemma: providing adaptation support to humans and at the same time providing mitigation support against climate change in the midst of climatic and seasonal challenges: low rainfall, excessive heat, harmattan and annual bushfires. The sustainability of these ecosystems depends on the net effect resulting from the pressures of adaptation, efforts of mitigation, resilience of the ecosystems and other natural support systems. This chapter explores the relationship among woodland, adaptation and mitigation activities. In this relationship, the human face has played a central role, thus influencing the direction of the net effects of the pressures on woodland ecosystems. Adaptation is over-emphasised, misunderstood and decoupled from mitigation resulting in maladaptation. This has contributed to the worsening impacts of climate change. Climate change adaptation needs to be re-emphasised to ensure mitigation is considered in every adaptation measure.

Keywords: adaptation, Giddens Paradox, mitigation, maladaptation

1. Introduction

The meaning people ascribe to climate change in terms of their understanding of the phenomenon, perception of the risks involved, value judgments, and emotional reactions, is closely related to how they adapt to and mitigate the impacts of climate change [1]. For instance, climate change is influenced by many factors, and it also influences many aspects of life and nature, which make it a complex issue to understand and deal with. Global climate change and its impacts are major environmental issues the world is currently battling with [2]. It is considered the most serious global environmental issue of today and the most difficult issue to manage by both scientists and policymakers [2, 3]. It affects every aspect of human society and worst of all, human well-being. It requires both individual and global efforts towards a sustainable solution (idem). The arguments and counter arguments about its existence, causes, and impacts are converging and there is a high level of global consensus about its

existence, impacts, and the need to address it [4]. It is agreed that the solution lies in the ability to keep global temperature rise within a 2°C limit although there are disagreements on the strategies to reduce global temperature rise to below 2°C. This requires strong and sustained reductions in emissions of carbon dioxide (CO₂) and other greenhouse gases that would limit climate change [5].

The global community is relying so much on the mitigating capacity of woodland and forest ecosystems through the sequestration of atmospheric CO₂, and reduction in emissions from anthropogenic activities while encouraging the rural communities to adopt other ways of livelihoods. Current adaptation strategies are resulting in negative feedback on climate change and the woodland and forest ecosystems are under pressure to support alternative livelihoods. This suggests that the relationship between climate change, woodland/forest ecosystems, and adaptation is still not clearly understood. It is therefore important to understand climate change from a system perspective of how it influences woodland/forest ecosystems and anthropogenic activities and how they interact to influence climate change.

Though climate change is not new in human history, the current changes in the global climate change have serious implications for human life, other living organisms, and ecosystems in general. Scientific observations and model simulations have indicated that the climate of the Earth is now changing at unprecedented rates which are attributed to human activities such as burning fossil fuels clearing woodlands/forests for farmlands and cities, and grazing activities [5]. These activities release a huge amount of greenhouse gases (GHGs) (e.g. carbon dioxide, methane, halo-carbons, and nitrous oxide) into the atmosphere with dire consequences for the climate system of the Earth. Lots of efforts in various forms have been expended with the aim of reducing GHGs and improving the climate system of the Earth thereby making the Earth a conducive place for humans. These efforts are mainly in four areas:

- a. The Science of climate change which is geared towards understanding climate and its associated changes. This has been debated over the past three decades and an acceptable consensus has been reached.
- b. The Impact of climate change which is aimed at understanding the current and future effects of climate change on man and the environment.
- c. Adaptation to climate change, which is aimed at understanding the coping strategies of man to lessen the effects of climate change on man, his livelihoods, and the environment.
- d. Mitigation of climate change geared towards understanding the efforts of a man towards slowing down climate change and its negative effects on man and his environment.

In all these efforts, it is how humans adapt and mitigate the current impacts of climate change that will inform the intensity and extent of future climate change.

Although the scientific effort has yielded a number of good results in terms of scientific and political agreement on the reality of anthropogenic climate change and the need to tackle it, the adaptation and mitigation efforts are not yielding the needed results. One reason could be the inadequate understanding of the relationship between the forces of anthropogenic climate change, woodland/forest ecosystems,

and adaptation strategies in rural areas. Also, there is no consensus among the rural, national and global communities on the mitigation strategies for tackling climate change. The global and national communities placed Reducing Emission from Deforestation and forest Degradation (REDD) and later Reducing Emission from Deforestation and forest Degradation coupled with forest conservation, sustainable forest management and enhancement of forest carbon stock (REDD+) top on the mitigation agenda and imposed that on the rural communities, which they see as a threat to their means of adaptation to same climate change. These strategies are currently resisted at the local levels due to the economic issues relating to adaptation. The caveat to overcome the challenges encountered from the implementation of REDD and REDD+ such as Payments for Ecosystem Services (PES) where beneficiaries or users of an ecosystem services make payments to the providers of those services [6], carbon markets cannot still overcome the strong land tenure and adaptation barriers mounted by the rural communities. The effects of resistance against these interventions are contributing significantly to the negative feedback effects of climate change adaptation on climate change and its impacts across the world.

In Ghana, the relationship between adaptation, woodland and forest ecosystems, and mitigation at the rural community level is still not clearly understood. This is leading to maladaptation due to over-dependence on woodland and forest ecosystems for adaptation, with very little effort in woodland and forest-based mitigation activities.

This chapter throws more light on the relationship between adaptation, woodland and forest ecosystems, and mitigation, with a focus on charcoal production and logging in the Savannah areas of Ghana. These adaptation and mitigation activities have a direct influence on the state of the woodland and forest ecosystems in the area.

2. Climate change and human ineptitude in the rural communities of Ghana

Scientists have explained that the impacts of climate change will continue to be devastating for both natural and human systems. In northern Ghana, the evidence of climate change is clear. The trend of minimum and maximum monthly temperatures of some parts of Northern Ghana (Wa, Navrongo, and Tamale) for a 45-year period (1961–2005) revealed increasing trends of minimum and maximum temperature values. The trend is of concern because current minimum temperature values are approaching past maximum temperature values. The trend lines for the monthly minimum and maximum for the period all indicate positive gradients, signifying a general increase in the average temperature values for three locations (**Figures 1 and 2**). In the case of the Tamale station, there is a dip in the trend line suggesting that there was a slide reduction in the minimum temperatures within the period and it then started increasing gradually again (**Figure 1**).

However, the trend of the annual rainfall amounts for the 45 years showed dwindling annual rainfall amounts (**Figure 3**). The trend lines for the three locations showed negative gradients, suggesting a continuous reduction in the average annual rainfall amounts for the 45 years.

These trends in the minimum, maximum, and annual rainfall amounts point to the fact that the efforts of natural systems alone would not be able to reverse the trends but there is the need for concerted human effort to complement the effort of the natural systems. Human intervention must emphasise the change in consumption

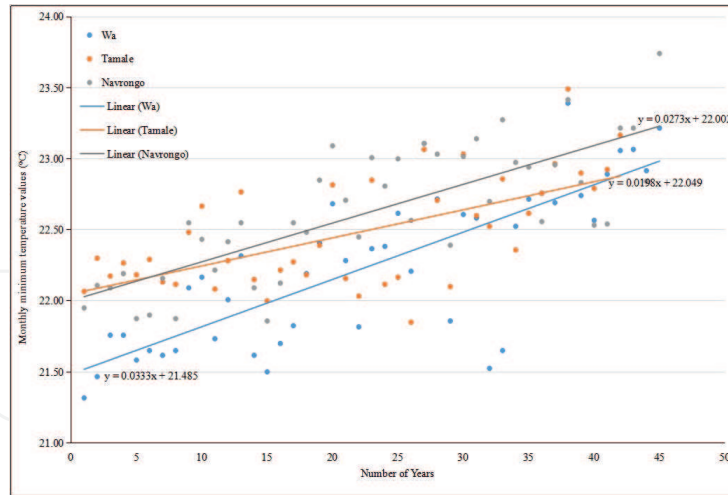


Figure 1. Trend of minimum monthly temperature values from 1961 to 2005 of selected weather stations in Northern Ghana. (Data source: Ghana Meteorological Agency).

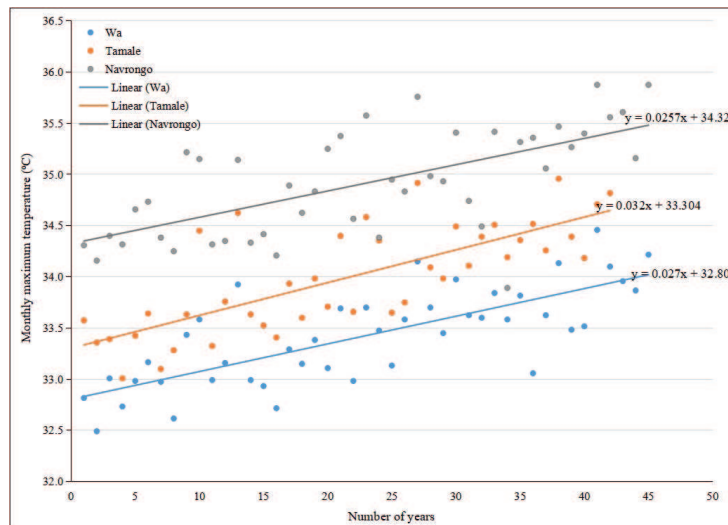


Figure 2. Trend of maximum monthly temperature values from 1961 to 2005 of selected weather stations in Northern Ghana. (Data source: Ghana Meteorological Agency).

and sustainability attitudes towards natural resources, namely forest resources, and oil and gas products that influence the climate system.

The advocacy for change to mitigate the current and future impacts of climate change is well advertised through REDD, REDD+, AFLU (Agriculture, Forestry, Land Use), etc. The expectation is that there should have been a visible decline in the impacts of climate change, with increasing mitigation activities at the local community level but that is not the case. This leaves many people in the Giddens Paradox, wondering why a threat of such magnitude is ignored by some sections of society. Giddens [7] explained that if there is a lack of tangible and immediate dangers from a threatening phenomenon such as climate change, most people will do nothing to respond immediately. Consequently, by the time the dangers of the phenomenon become visible and dangerous to everyone, it would be too late to act. This suggests that if this is the current perception about climate change in the rural Ghanaian communities, then the worst of the impacts of climate change is yet to happen in the country because some people are yet to experience the tangible and immediate dangers of

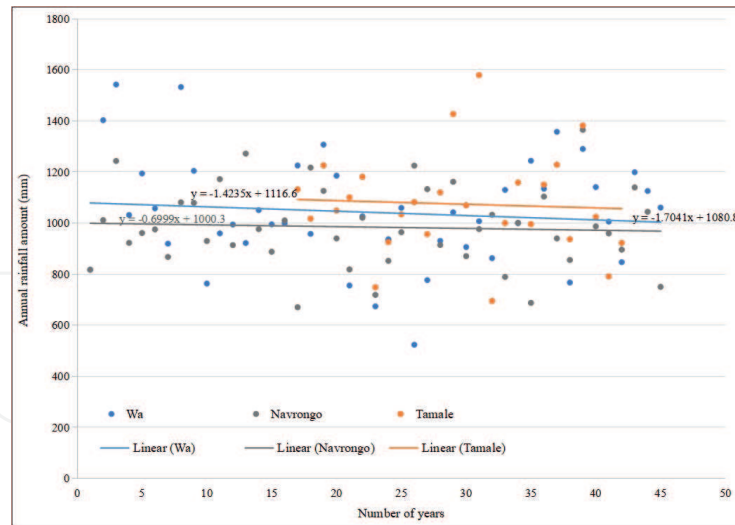


Figure 3. Trend of annual rainfall amounts (mm) from 1961 to 2005 for Wa, Navrongo, and Tamale weather stations. (Data source: Ghana Meteorological Agency).

it and until then life is still business as usual [4]. However, the Giddens Paradox does not sufficiently explain the ineptness of some people towards climate change although they experience the impacts of climate change and acknowledge that it is real, and everyone is at risk (**Figure 4**). Some people feel that the risk of poverty today is more detrimental to their survival than the risk of climate change today and tomorrow; no matter what or who is the cause of the change. In the case of the rural poor, if the rains fail and government policies do not support them, their mode of adaptation can be the cause of climate change, but they will continue to ensure their daily survival rather than climate change mitigation. For instance, in the case of charcoal production and timber logging, the rural poor will not allow the last tree to sequester CO₂ while they suffer in poverty on daily basis (**Figure 4**). They prefer to fight poverty through charcoal production and sale, and unsustainable logging of timber at the expense of climate change mitigation strategies such as REDD+, sustainable harvesting of wood, and protection of the woodland ecosystems. Such people feel that the effects of poverty are experienced now while the effects of climate change mitigation are in anticipation and for them, the choice between mitigation and adaptation is obvious [8–10]. Charcoal production has become a major climate change adaptation strategy for many people in the charcoal production value chain. This is because it generates quick income for those involved with low startup capital requirements for the producers, many of whom rely on natural woodland for the raw materials for the production of charcoal. The production of charcoal in Ghana is on the rise.

3. Climate change adaptation in the rural areas

Adaptation is a necessity in climate change but how do those who lack or have insufficient capacity to adapt, do so sustainably? Without the appropriate capacity to adapt, the intended adaptation would be maladaptation i.e. more negative feedback effects on the climate system than the benefits to cope with the impacts of climate change. For the poorest of the poor, adaptation is meaningless without the capacity to adapt. When there is no capacity support from state institutions, non-governmental

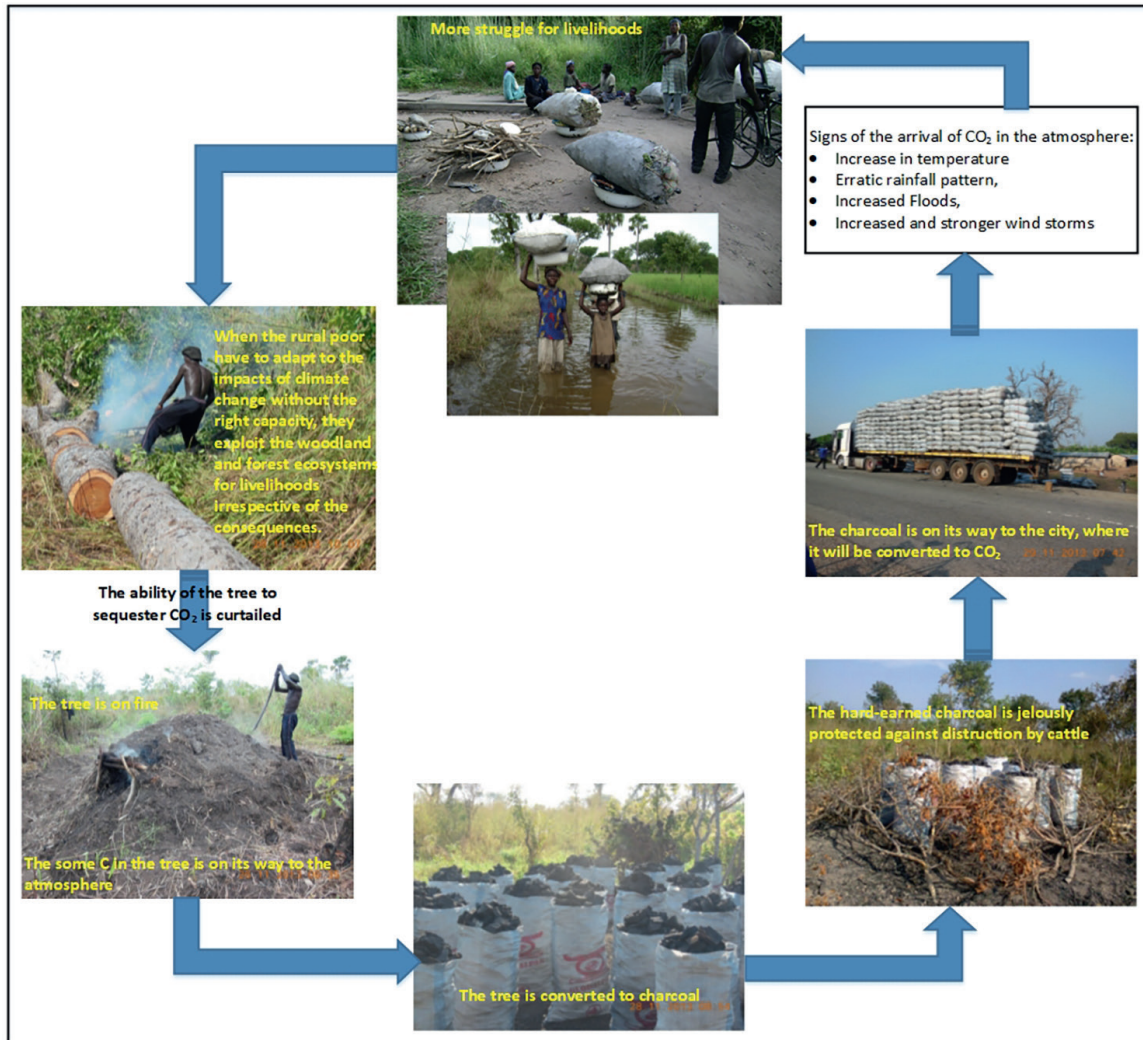


Figure 4. The struggle against rural poverty at the expense of climate change mitigation. (Source of pictures: field data, 2014).

organisations (NGOs), and philanthropists, the capacity of the poor to adapt to climate change impacts would largely be dependent on woodland and forest ecosystems (**Figures 4** and **5**). However, over-emphasis on these systems would place undue stress on the capacity of these ecosystems.

The issue with the initial climate change discourse is that the need for the rural poor to adapt was over-trumpeted without providing such people the capacity to adapt sustainably. Thus, everything about climate change to the rural poor is an adaptation, adaptation, and adaptation. Adaptation is then misunderstood and decoupled from mitigation activities resulting in the worsening climate change impacts. The past misconception of adaptation by the rural poor later conflicted with the view of scientists about climate change as illustrated in **Figure 5**. The crust of the conflict is when it was realised that they (the scientists) and the rural poor are competing for the same woodland and forest ecosystems in addressing both adaptation and mitigation issues. The rural poor in Ghana, through no fault of theirs, have opened Pandora's box on the woodland and forest ecosystems for various adaptation activities thereby loosening existing access arrangements for these ecosystems (see [11]).

The woodland ecosystems require human support to either maintain or enhance their capacity to support the woodland-based adaptation activities of humans.

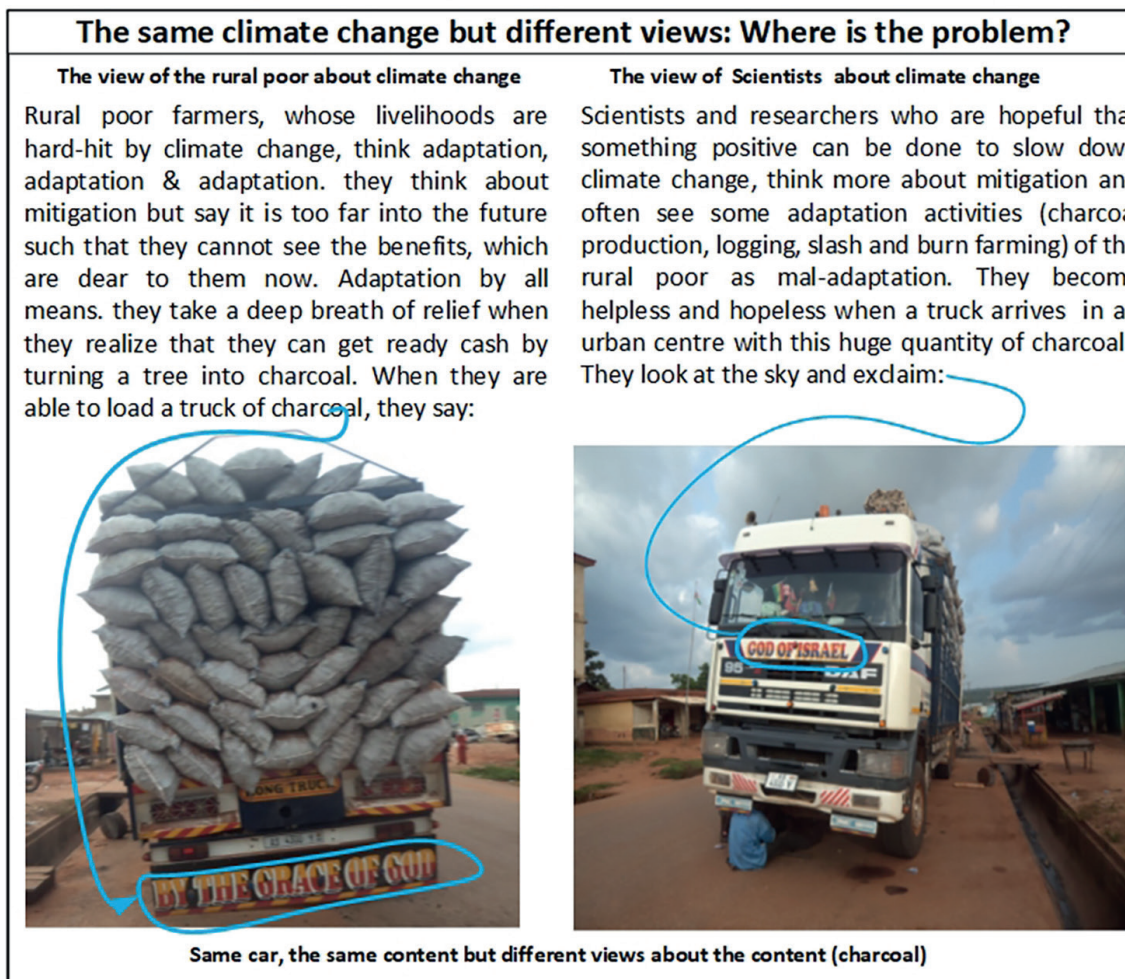


Figure 5. Conflicting views of climate change about adaptation and mitigation. (Source of pictures: Field data, 2014).

Unfortunately, they are not receiving the needed support, they are rather exploited because of their fundamental role in rural livelihoods in the country [12]. In principle, it is clear that scientists are losing hope in the woodland and forest ecosystems mitigation strategies as a panacea to the increasing impacts of climate change because the dependence on the woodland and forest ecosystems' livelihoods is overwhelming.

4. Woodlands and forest ecosystems, adaptation and mitigation

Forest is an ecosystem that is dominated by trees (perennial woody plants) that are taller than 5 m at maturity and occupy a land area larger than 0.5 ha, with a tree crown cover of more than 10% [13, 14]. The forest ecosystem as defined could be used for production, protection, conservation, or multiple uses. Woodland is an ecosystem with a tree crown cover of 5–10% of trees able to reach a height of 5 m at maturity, a crown cover of more than 10% of trees not able to reach a height of 5 m at maturity, or shrub and bush cover of more than 10% [15]. These ecosystems in Ghana dominate the northern part of the country and have played important ecological and socio-economic roles in the development of the country. They have served as a buffer zone for both livelihood adaptation and mitigation activities (See **Figure 6**) [12].

The part of the country often described as Northern Ghana lies between latitudes 8°0'N and 11°5'N and longitudes 3°0'W and 0°32'E (**Figure 6**). It covers about 41%

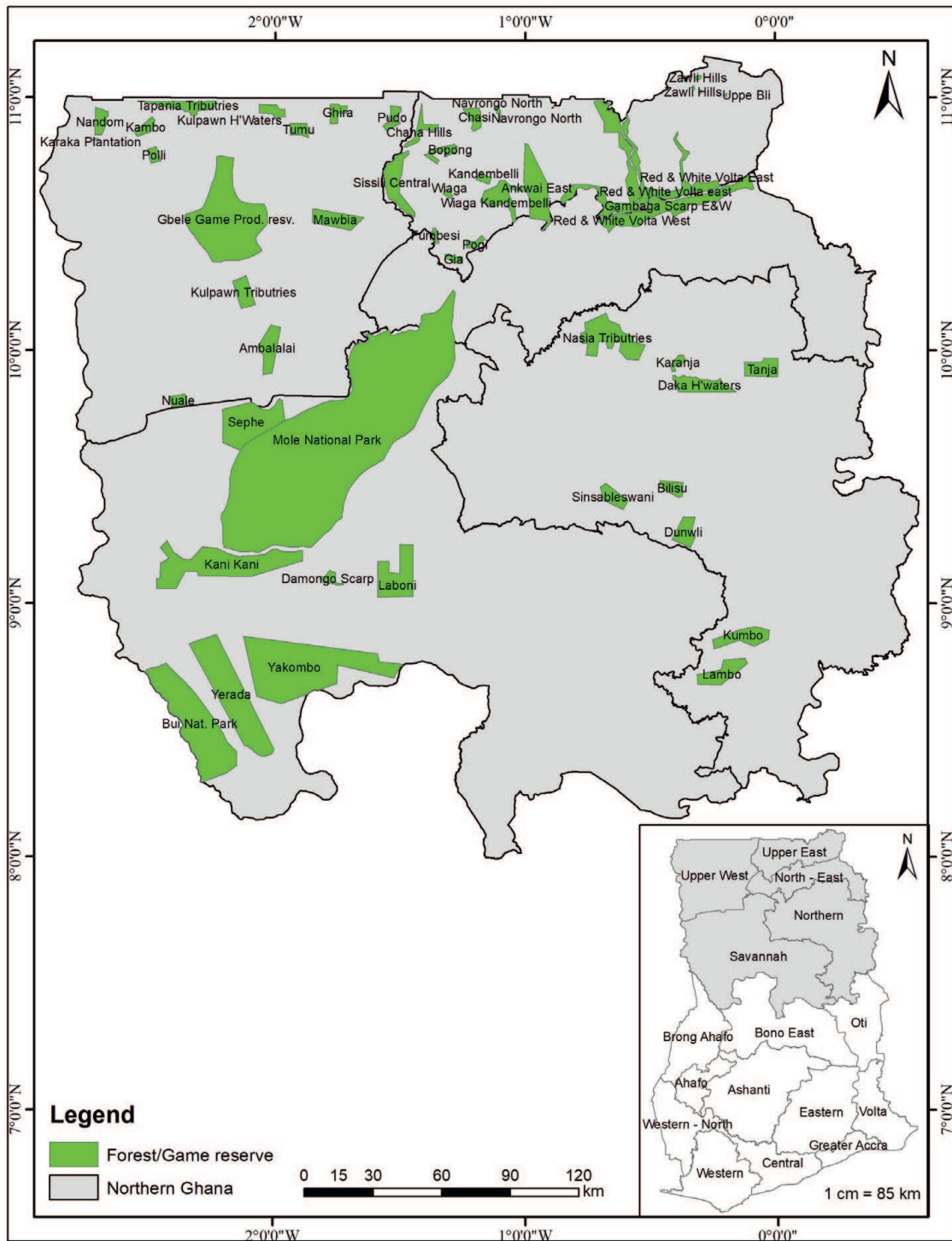


Figure 6. Northern Ghana in the national context (source: authors' construct, 2022).

of the total area of Ghana with 52 patches of forests/game reserves. Poverty is high in rural areas with high dependence on woodland and forest ecosystems. While these ecosystems, through natural regeneration and human effort, mitigate the effects of climate change; humans through the same ecosystems adapt to climate change by deriving alternative livelihoods such as charcoal production, firewood harvesting, timber logging, and mineral exploitation [12, 16].

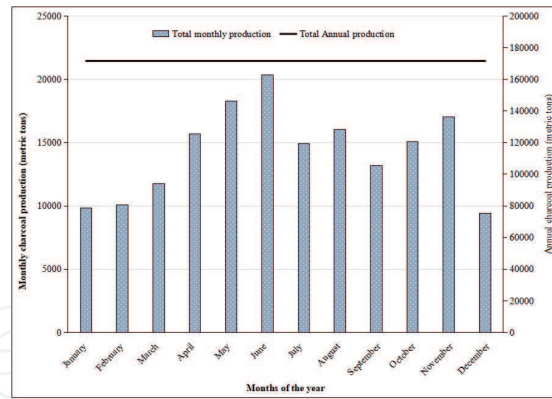


Figure 7. Monthly trend of charcoal production compared to the annual production in Northern Ghana for 2016 (Source of data: [21]).

Woodland and forest ecosystems in the Savannah areas are fundamental to the livelihoods of those who reside in rural woodland areas in Ghana [12]. Woodlands provide economic, social, cultural, and spiritual services, which are critical in the era of increasing climate change impacts [17]. For instance, charcoal production and logging of trees for timber and firewood in the country have become major climate change adaptation strategies in the rural areas rather than conventional livelihood activities. Most charcoal producers in the 1970s and 1980s were perceived as the Sissala people [18, 19] but today, many other tribes are engaged in charcoal production as a supplement to the failing mainstream food crop farming (see [19, 20]). Charcoal production has been on the increase in northern Ghana, question the woodland and forest-based climate change mitigation strategies and efforts because the rate at which the trees are harvested for charcoal production is certainly greater than the rate of regeneration of shrubs. For instance, the trend of the monthly charcoal production in Northern Ghana for 2016 is presented in **Figure 7**, with an annual production of 171,624 metric tons. Other woodland related activities namely logging of rosewood for timber became lamplight livelihood activity in the early 2000s and escalated around 2017.

Adaptation and mitigation activities largely target the woodland and the forest ecosystems (**Figure 8**). Unfortunately, the intensity, extent, and rate of adaptation are

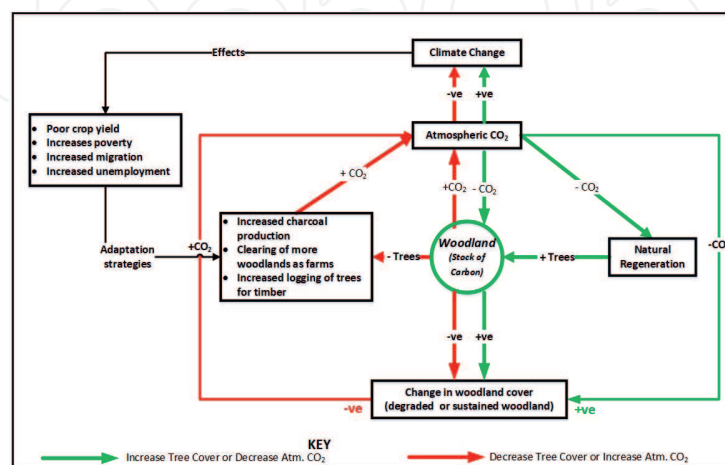


Figure 8. Relationship between climate change and woodland-based adaptation strategies in Ghana. Source: Adapted from [22].

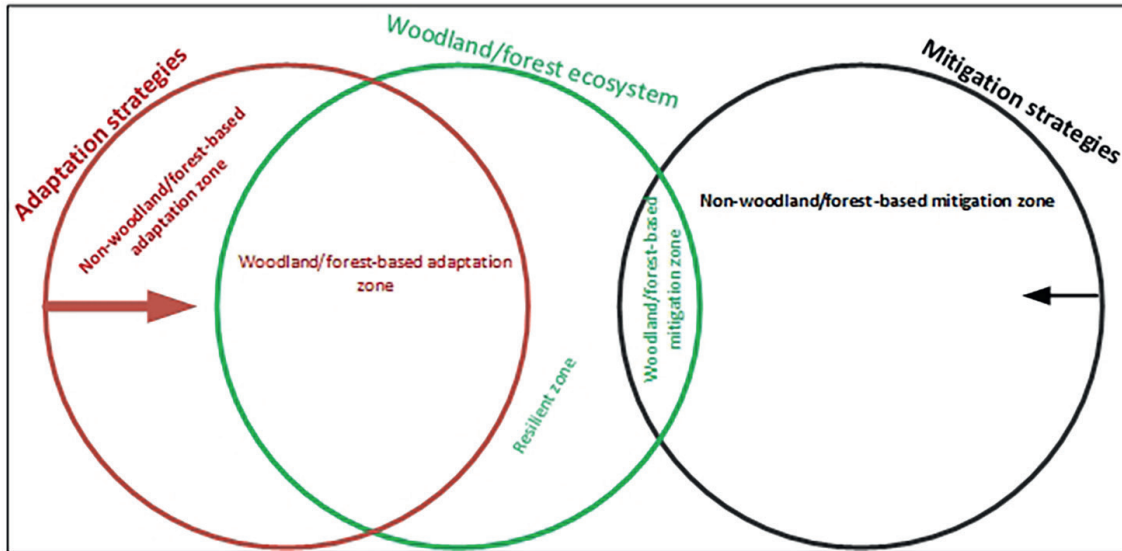


Figure 9. Relationship among climate change adaptation strategies, mitigation strategies, and woodland and forest ecosystems at the rural Ghanaian community level.

not same as that of mitigation, thus creating a net imbalance between the effects of adaptation and mitigation activities.

Ideally, a net effect in mitigation is desirable in the relationship between adaptation, mitigation strategies, and woodland and forest ecosystems taking into account the strengths, weaknesses, opportunities and threats of the adaptation and mitigation activities (Table 1). Many poor people are seeking woodland and forest-based adaptation strategies with high intensity compared to those working to improve in the capacity of the woodland and forest ecosystems at the community level (see Figure 9). This indicates that many more portions of the woodland and forest ecosystems in the Savannah areas are exploited for adaptation strategies than those being developed for mitigation strategies.

Thus, these ecosystems are under-stressed to support adaptation strategies namely charcoal production, logging rosewood, hunting for wildlife, and recently minerals exploitation [16]. For instance, it is indicated that a lot of the charcoal produced in the country comes from woodland areas of the country. Also, the rosewood that is exported to other countries is harvested in the same woodland and forest ecosystems.

The effects of climate change have been overwhelming and the element of the human face has greatly influenced adaptation and mitigation activities disproportionately resulting in maladaptation.

The need to adapt to climate change impacts was given media and policy hype which created anxiety among the vulnerable and affected population. In the climate change-adaptation and mitigation nexus, adaptation is heightened to the detriment of mitigation (Table 1). The negative impacts on livelihoods were blown out of proportion creating fear and anxiety in people, especially the poor and the vulnerable. It is difficult to have effective adaptation to anxiety because people under duress in emergencies can make dangerous, unsafe choices, which may have tragic or fatal consequences [23]. The current climate change impacts are partly fatal consequences of the maladaptation decisions that were taken in anxiety in the past. Adaptation without mitigation is adaptation without resilience and sustainability. Maladaptation is therefore the bane of mitigation and further over-emphasis on adaptation without mitigation is a fight in support of worsening impacts of climate change. A win-win situation

Climate Change Response	Strengths	Weaknesses	Opportunities	Threats
Adaptation	<ul style="list-style-type: none"> • Ability to diversify sources of livelihood. • Availability of policies to construct dams and dugouts for irrigation and rearing. • Vast grassland and water bodies for the rearing of animals. • Provision of climate insensitive jobs in urban areas. • Presence of tourist attractions. 	<ul style="list-style-type: none"> • Inability to be cautious of the feedback effects on climate change. • Inability to maintain existing irrigation schemes • High cost of irrigation inputs. • High population growth rate in an urban area. • Inadequate capacity to adapt to available alternative livelihoods • Lack of awareness of carbon trade 	<ul style="list-style-type: none"> • Government policies provide opportunities for diversification of livelihoods, e.g. planting and rearing for food and jobs • Increase donor support for capacity enhancement on adaptation strategies • Development of adaptive crop varieties • Funding support for research in capacity development 	<ul style="list-style-type: none"> • Endemic poverty in rural areas • Dwindling rainfall amounts • Increasing temperatures, increasing population, • Increased frequency of pests and diseases
Mitigation	<ul style="list-style-type: none"> • Establishment of agroforestry systems in Northern Ghana. • Ability of degraded woodlands to regenerate naturally. • Formulation of policies to protect forest reserves e.g. greening Ghana policy. • Availability of land to expand existing forest reserves and establish new ones • Availability of reserves across Northern Ghana. 	<ul style="list-style-type: none"> • Over-exploitation of woodland for charcoal, timber, and firewood • Over-reliance on charcoal for domestic and informal-sector food and local beverage enterprises • Inability to prevent bush fires reduce the natural regeneration efforts of trees. • Inability to enforce national forest policies. 	<ul style="list-style-type: none"> • Availability of funding opportunities under REDD+ • Payment for ecosystem services • Availability of carbon markets. • Availability of alternative energy sources, solar, liquefied petroleum gas, electricity • Financial support from global partnerships and collaborations • Reduction in global temperatures and extreme climate events. 	<ul style="list-style-type: none"> • Annual bushfires • Excessive logging and charcoal production • Over-reliance on natural woodland for charcoal • Land tenure issues • High cost of petroleum products

Table 1. Strength, weaknesses, opportunities and threats (SWOT) analysis of climate change adaptation and mitigation in Northern Ghana.

in the adaptation-mitigation nexus is to first consider mitigation in every adaptation measure. Effective adaptation must have a carefully thought-out mitigation measure but most of the adaptation measures are taken in anxiety missing out the consideration of the mitigation element. Adaptation and mitigation should not be decoupled in the fight against climate change and its impacts.

5. Conclusions

This chapter discussed the relationship between woodland and forest ecosystems, climate change adaptation, and mitigation in northern Ghana. The Savannah woodland and forest ecosystems have the *potential* to support adaptation activities and serve climate change mitigation needs. However, the need to adapt was over-emphasised, yet the capacity to adapt and mitigate climate change was downplayed. There is the need to understand that for every adaptation activity, there must be a corresponding mitigation strategy if the gap between adaptation and mitigation effects on the Savannah woodland and forest ecosystems in the rural areas of the country.

Author details


Raymond Aabeyir^{1*}, Kenneth Peprah² and Gervase Kuuwaabong¹

1 Department of Geography, SD Dombo, University of Business and Integrated Development Studies, Wa, Ghana

2 Department of Environment and Resource Studies, SD Dombo University of Business and Integrated Development Studies, Wa, Ghana

*Address all correspondence to: raabeyir@ubids.edu.gh

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