MITIGATING THE RISK OF CLIMATE CHANGE IN HERBS USED IN TRADITIONAL AFRICAN MEDICINE: CHALLENGES AND STRATEGIES

Benedict Micheal S. PhD
Department of Philosophy,
Benue State University, Makurdi.
Email: benmike3@gmail.com, mshamijah@bsum.edu.ng
Phone: +2348115561542

Amodu Salisu Ameh
Department of Philosophy,
Kogi State University, Anyigba, Kogi State, Nigeria
Email: sampsonzeed@gmail.com; amodu.a.a@ksu.edu.ng
Phone: +2348100262890; +2348127962025
ORCID iD: https://orcid.org/0000-0002-9897-8247

Abstract

Traditional African medicine relies heavily on the use of medicinal herbs, which play a vital role in the healthcare systems of many African communities. However, climate change poses a significant threat to the sustainability and availability of these medicinal plants, thereby jeopardizing the health and well-being of local populations. Adopting an analytic method, this article explores the challenges and strategies associated with mitigating climate change risk on herbs used in traditional African medicine. In doing that, thispaper investigates the potential impacts of climate change on the distribution and abundance of medicinal herbs. In doing that, it highlights how rising temperatures, changing precipitation patterns, and habitat loss through deforestation, urbanization, and industrialization can directly affect these plants' growth, development, and survival. The article also discusses how altered climatic conditions may impact medicinal herbs' chemical composition and therapeutic properties, potentially compromising their efficacy and safety. In conclusion, this paper emphasizes the socio-economic implications of climate change on traditional African medicine. Byshedding light on the vulnerability of local communities, particularly those reliant on medicinal herbs for healthcare, disruptions in the availability and quality of these resources can lead to increased health risks, reduced cultural practices, and loss of traditional knowledge.

Keywords: African medicine, precipitation patterns, deforestation, urbanization, industrialization,vulnerability.

Introduction

Climate change is a pressing university and global concern with far-reaching consequences for various sectors of the world, including traditional African medicine. The traditional African medical system has been an integral part of African culture for centuries, relying heavily on the use of medicinal herbs to treat various ailments and diseases. However, the impact of climate change on those herb plantations hasposed significant challenges to the sustainability and availability of these herbs, threatening the efficacy of traditional African medicine and the well-being of communities reliant on these remedies. This introduction will provide an overview of the challenges posed by climate change to herbs used in traditional African medicine and discuss strategies that can be employed to mitigate these risks. By understanding the potential impacts of climate change on the traditional world medicinal herbs and implementing proactive measures, we can ensure the preservation of traditional healing practices and promote the sustainable management of medicinal plant resources. Overall, this work highlights the urgent need to address the risks of climate change on herbs used in traditional African medicine. By understanding the challenges faced and implementing appropriate strategies, it is possible to ensure these medicinal plants' continued availability, sustainability, and cultural significance, ultimately safeguarding the health and well-being of African communities.

Conceptualizing Climate Change

The term climate refers to prevailing outdoor environmental conditions including temperature, humidity, wind, precipitation, sea level, and other phenomena. Climate change refers to modifications in those outdoor conditions that occur over an extended period of time. The Intergovernmental Panel on Climate Change (IPCC) defined "climate change as any change in climate over a time period that alters the composition of the global atmosphere and this change might be due to natural climate variability or a result of human activity" (IPCC, 2007). According to the United Nations Framework Convention on Climate Change (UNFCC) climate change refers to "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and is in addition to natural climate variability observed over comparable time periods" (cf. USGCRP, 2009). Human activities, most importantly the burning of fossil fuels, natural causes, industrialization, and changes in land use are modifying the concentrations of atmospheric constituents or properties of the surface that absorb or scatter radiant energy. Observations of key climatic variables provide a rich historical record of how the climate has changed in the past and serve as a basis for assessing potential future change.

However, measurements of global mean temperature indicate that the first decade of the 21st century was 0.8°C (1.4°F) warmer than the first decade of the 20th century. Associated with that temperature rise have been observations that heat waves have become longer and more extreme and that cold spells have become shorter and milder. For example, the Western Europe heat wave of 2003 was responsible for upwards of 70,000 deaths and was the warmest summer there in over 600 years (Robine et al., 2008). No single event like that can be reliably attributed to climate change, but it is consistent with expectations for the future. Within the United States, hot days, hot nights, and heat waves have become more frequent in recent decades and were the leading cause of weather-related morbidity and mortality during 1970–2004 (USGCRP, 2009).

On an urban scale, the heat-island effect contributes to local temperature increase. For example, the urban heat island around Phoenix, Arizona, raises minimum nighttime temperatures by as much as 12.6°F (7°C) (Brazel et al., 2000). When increased ozone events occur simultaneously with heat waves, mortality can rise by 175% (Filleul, 2006). As extremely hot days tend to be associated with high pressure and stagnant air-circulation patterns, ground-level ozone, PM2.5, particulate sulfate, and organic carbon have been found to correlate strongly in summer months (NRC, 2008). The changes in climate, particularly increases in temperature have already affected a wide range of physical and biological systems in many aquatic, terrestrial and marine environments in various parts of the world. The climate change will increase the risks of extinction of more vulnerable species and loss of biodiversity.

The overall conclusion of the National Academies Report Advancing the Science of Climate Change was that climate change "poses significant risks for and in many cases is already affecting a broad range of human and natural systems" (NRC, 2010). The US Global Change Research Program, which coordinates and integrates federal climate change research, found that;

> Climate-related changes have already been observed globally and in the United States. These include increases in air and water temperatures, reduced frost days, increased frequency and intensity of heavy downpours, a rise in sea level, and reduced snow cover, glaciers, permafrost, and sea ice. A longer ice-free period on lakes and rivers, lengthening of the growing season, and increased water vapor in the atmosphere have also been observed. Over the past 30 years, temperatures have risen faster in winter than in any other season, with average winter temperatures in the Midwest and northern Great Plains increasing more than 7ºF. Some of the changes have been faster than previous assessments had suggested (USGCRP, 2009).

These climate-related changes are expected to continue while new ones develop. Likely future changes for the United States and surrounding coastal waters include more intense hurricanes with related increases in wind, rain, and storm surges (but not necessarily an increase in the number of these storms that make landfall), as well as drier conditions in the Southwest and Caribbean. These changes will affect human health, water supply, agriculture, coastal areas, and many other aspects of society and the natural environment.

Causes of Climate Change

Several studies have been carried out on the causes of climate change, although not exhaustive. In this section of the paper we shall look at a few of them. Some of these factors are;

Mining and Manufacturing Activities

Mining is the act of extracting raw materials from the soil. Most of the materials extracted are Oil, Gold, Coal, Tin, Granite, lime stone, etc. the process by which this is been extracted pose so much to the lives of living things in the society. Billions of tons of CO2 are released into the atmosphere every year as a result of coal, oil, and gas production. Human activity is producing greenhouse gas emissions at a record high, with no signs of slowing down. In order to maintain GDP at 8% per annum, China will have to generate more than 9200 TWh in 2030 and the current trends indicate that it has no other options but to burn coal to supply 70% of its energy needs. If the trends continue, China will continue to lead the world as the largest emitter of CO_2 and other global warming gases. In Port Harcourt of Nigeria some years ago, there was a record of black spot in the nose of the residence of that area and the rain of black particles. These are as a result of carbon emission through oil extraction.

Bush Burning

Bush burning as it is being studied not only poses health hazard to man alone but also affects the environment in general via the emission of the various pollutants. It is glaring that particulates, carbon monoxide, hydrocarbons, oxides of nitrogen and negligible percentage of oxides of sulphur are the major pollutants of bush burning and they all have various effects on man and his environment, like reduction of visibility by particulate matters, especially during periods of air stagnation and causing some respiratory diseases. Oxides of sulphur and nitrogen are also hazardous as they cause respiratory disorders and irritants respectively.

Apart from the soil destruction and desert encroachment caused by bush burning, it has also a marked increase in global warming due to the emission of NO_2, SO_2, SO_3, NO, CO and CO_2 gases which have tremendous effect on the ozone layer and also formation of acid rain which deteriorate plant life, damage calcium containing soils and also increase the acidity of surrounding lakes and river.

Deforestation

Deforestation results from the removal of trees without sufficient replacement, which leads to reduction in habitat, biodiversity as well as wood and quality of life. The use of the term "Deforestation" at times is associated with distortion of forestry issues. It is used to denote activities that use the forest, for instance, felling of wood for fuel, commercial logging and activities associated with temporary removal of forest cover such as slash and burn technique, which is a major component of shifting cultivation agricultural systems or clear cutting. It is equally used to describe clearing of forest for grazing or ranching. Deforestation has tremendously threatened depleted or endangered biodiversity of the forest ecosystem.

Deforestation is one of the major causes of enhanced green house effect. Trees and other plants remove carbon in form of carbon dioxide from the atmosphere during the process of photosynthesis. Carbon dioxide is injurious to animals including man and as deforestation takes place, the few trees left cannot make use of the carbon dioxide, therefore, the excess carbon dioxide gets into the atmosphere causing global warming. Deforestation is estimated to contribute up to one third of all carbon dioxide. The water cycle is equally affected by deforestation as trees extract groundwater through their roots and release it into the atmosphere. When deforestation takes place, the region may not hold as much water which can lead to a much drier climate.

Over Population

Population growth plays a key role in environmental sustainability. The increase in the number of persons within a geographical area has a lot negative impacts. This ranges from deforestation, water pollution and air pollution. Associated with overpopulation in a way is war, while it could be said to have positive impart in terms of population control the devastating effect.

War

War is one of the major causes of climate change and environmental problems in the society. The world war 1, world war 11, the Vietnam war, the Rwandan war, the Kosovo war, the Gulf war and the attempted world war 111 (between USA and Iran) have left a negative imprint and major consequences in the lives of man and environment. During the war, a lot of chemicals are being used either to protect the environment and resources or for the destruction of enemies. During World War 1, about 125,000 tons of chemical agents were employed and 96,000 tons during the Vietnam conflict. Nerve gas also called organophosphorous anticholinesterases was used at lethal level against human being and destroyed a high number of nonhuman vertebrate and invertebrate populations.

The invention of mass destruction ushered in World War 2 which has created significant environmental destruction leading to climatic change. On top of loss in human lives, natural resources are usually the first to suffer, forest and wild animals are wiped out. During the Vietnam war, orange agent was one of the herbicides and defoliants used by the U.S military. An estimated 21,136,000 gal of Agent Orange were sprayed across South Vietnam exposing 4.8 million vietnamese people to agent orange and resulting in instant deaths and disabilities of 400,000 people and 500,000 born with birth defects.

Climate Change in Africa

Climate change poses significant challenges to African herbaceous plants, impacting their growth, distribution, and overall ecological balance. Thus, taking into account the effects of changing rainfall patterns in Africa today, it can be recorded that climate change alters rainfall patterns, leading to increased variability and changes in precipitation levels. African herbs, many of which are adapted to specific moisture conditions, are affected by these changes. Extended drought periods can result in water stress and reduced herb growth. Conversely, excessive rainfall can lead to waterlogging and increased disease incidence.

In other words, temperature extremes become one of the major factors faced by climate change in Africa. Rising temperatures associated with climate change have adverse effects on African herbs. Higher temperatures can accelerate evaporation and soil moisture depletion, impacting the availability of water for herbaceous plants. Heat stress can also reduce photosynthetic efficiency, hinder nutrient uptake, and increase vulnerability to pests and diseases. Shifts in Growing Seasons: Climate change influences the timing and duration of growing seasons in Africa. Changes in rainfall patterns and temperature regimes can disrupt the traditional growth cycles of herbs, affecting their flowering, seed production, and regeneration. As a result, some herbs may struggle to adapt to altered phenomenological patterns, leading to reduced fitness and potential population decline. Habitat Loss and Fragmentation: Climate change exacerbates habitat loss and fragmentation in Africa. As temperatures rise and precipitation patterns shift, certain herbaceous plant communities may no longer find suitable habitats within their historical ranges. This can lead to range contractions, loss of biodiversity, and increased competition for limited resources among herbaceous species.

The Nature ofMitigation on Climate Change

It is of great concern to note that, the global world today is urgently seeking ways to mitigate the scale and impact of climate change that has been on its horizon most especially the African continent and her environment. It is a great responsibility shifted on the shoulders of our world leaders to be locked in deliberations as they attempt to discover permanent solutions that will save the universe, humanity, and the planet Earth forever. A series of debates about the reduction of greenhouse gas emissions, a just transition to a net-zero global economy, and who should pay for thisisongoing in Europe and other prominent continents today to reduce man-made activities that affect the ozone layers. These discussions are critical and yet the issue of climate change which is being overlooked and which should underscore all attempts to fix our warming Earth is what we are doing to address the loss of nature.Thus, currently, only 40 percent of the African population has access to early warning systems to protect them against extreme weather and climate change impacts. Africa is therefore a top priority in the campaign against climate change.Thus, Nature is the planet's in-built mechanism for regulating climate and mitigating the impact of extreme climatic events. But for nature to be properly effective, biodiversity which consists of all species interacting with each other and their environment must be intact and fully functional.

Problems Faced by Mitigating Climate Change

Mitigating the risk of climate change in herbs used in traditional African medicine poses several challenges and requires the implementation of various strategies. trying to address the problem of mitigating the risk of climate change in Africa will require a holistic approach that includes improving financial resources, enhancing technology transfer, strengthening institutions, raising awareness, fostering international cooperation, and integrating climate change considerations into broader development strategies. It is essential to recognize the unique challenges faced by African countries and provide them with the necessary support to mitigate the risks of climate change effectively. Here are some key points to consider as the challenges faced by mitigating the risk of climate change:

Institutional and Governance Challenges:

Effective climate change mitigation requires strong institutions and governance structures. However, Africa faces various institutional challenges, including corruption, lack of coordination between different government agencies, and inadequate policy frameworks. These factors impede the development and implementation of robust mitigation strategies.

Vulnerability to Climate Impacts in Africa:
Following the natural position of the world map, one will understand that the continent of Africa is highly vulnerable to the impacts of climate change, including droughts, floods, heat waves, desert encroachment, and desertification. These climate-related hazards exacerbate existing socio-economic challenges, such as food insecurity, poverty, and inadequate infrastructure. Addressing mitigation in such a vulnerable context becomes more challenging due to the need for simultaneous adaptation measures.

Population Growth and Urbanization:
Africa's rapidly growing population and urbanization pose additional challenges for climate change mitigation. Increased energy demand, expanding urban areas, and changing consumption patterns put additional pressure on natural resources and increase greenhouse gas emissions. Managing these demographic trends while pursuing sustainable development becomes crucial for successful mitigation.

The Problem of Mitigation of the Risk of Climate Change on the African Trado Medicine
Climate change can lead to the loss of plant species and habitats, which poses a significant challenge to the availability and sustainability of herbs used in traditional African medicine. As the climate shifts, some herbs may struggle to survive in their natural environments. Thus, Loss of biodiversity and climate change are interconnected global challenges that pose significant risks to the planet and its inhabitants that lead to biodiversity. In the word of Kaziranga and Udry, Biodiversity refers to the variety of life on Earth, including ecosystems, species, and genetic diversity. In connection to this, climate change, on the other hand, refers to long-term shifts in weather patterns and average temperatures caused primarily by human activities, such as the burning of fossil fuels and deforestation (Kazianga and Udry 121). While climate change and loss of biodiversity are distinct issues, they are closely linked in several ways as listed below:

Altered plant growth and medicinal properties:
Climate change can affect the growth patterns, phenology, and chemical composition of medicinal herbs. Rising temperatures, changes in rainfall patterns, and increased frequency of extreme weather events can alter the plant's growth cycles and chemical constituents, potentially affecting their therapeutic efficacy.

Disruption of traditional knowledge systems:
Climate change can lead to the displacement of local communities and disrupt traditional

knowledge systems related to herbal medicine. This can result in the loss of indigenous knowledge and practices associated with the cultivation, harvesting, and preparation of medicinal herbs.

Strategies for Climate Change in Africa

The Overall Objective of the Africa Climate Change Strategy is the achievement of the agenda vision in Africa by building the resilience of the African continent to the negative impacts of climate change. The detaileddetached is the attainment take urgent action to combat climate change and its impacts.

African on the Environmental Friendliness

There are numerous African initiatives and practices aimed at promoting environmental friendliness and sustainability across the continent, in line with the paradigm shift in energy consumption, abundant provinces all across the globe are beginning to more penetratingly explore the options of disinfectant energy replacements.

Thus, it can be argued from the point of renewable energy, on can stress that many African countries are investing in renewable energy sources such as solar, wind, and hydropower to reduce their reliance on fossil fuels. For instance, Morocco has developed one of the world's largest concentrated solar power plants, and Kenya is known for its geothermal energy production. This shift has also extended its tentacle to wildlife conservation. This is because African countries are home to diverse and unique wildlife, and numerous conservation efforts are in place to protect endangered species and their habitats. Parks and reserves, such as Kruger National Park in South Africa or Serengeti National Park in Tanzania, serve as important conservation areas.

And again, one can still argue from the position of sustainable agriculture, because African farmers are adopting sustainable agricultural practices to reduce soil degradation, water pollution, and deforestation. Techniques like agroforestry, conservation farming, and organic farming are gaining popularity to promote biodiversity and protect ecosystems. Which is also applicable to waste management in Africa today, as argued byGabbatiss:

African countries are implementing waste management strategies to reduce pollution and promote recycling. For example, Rwanda has implemented a nationwide ban on plastic bags, and South Africa has established recycling initiatives to manage electronic waste (Gabbatiss 321). From the foregone Blaikiefurther stress from community-based conservation, where he argues that "Many African communities are involved in community-based conservation projects where local people actively participate in managing natural resources and benefit from sustainable ecotourism activities" (Blaikie 111). This approach helps preserve biodiversity while supporting local livelihoods. Climate Change Adaptation: African nations are working on climate change adaptation strategies to address the impacts of global warming. This includes implementing measures to mitigate desertification, promote climate-smart agriculture, and develop resilient infrastructure.

Effects of Climate Change on the African Person

Climate change has a wide range of effects on human beings, both direct and indirect, which can impact various aspects of their lives. Thus, the catastrophic consequences of climate change on the African person in connection to his environment threaten the availability of our food and other natural resources which are environmentally dependent for survival. At the same time, food production itself is a major cause of the crisis. Here are some key ways in which climate change affects the individual African person:

Mental Health and Well-being

The impacts of climate change, such as experiencing natural disasters, loss of homes, and forced migration, can have profound psychological effects on individuals. Climate-related stress, anxiety, depression, and post-traumatic stress disorder (PTSD) are becoming more prevalent, especially among those directly affected by climate-related events.

Economic Impacts: Climate change has significant economic consequences. Extreme weather events can damage infrastructure, homes, and businesses, leading to costly repairs and economic losses. Industries dependent on natural resources, such as agriculture, fisheries, and tourism, may suffer due to changes in climate patterns, impacting livelihoods and economic stability.

Health Impacts: Climate change contributes to an increase in extreme weather events such as heatwaves, hurricanes, and floods, which can directly harm human health. Heatwaves can lead to heat exhaustion, heatstroke, and even death, particularly affecting vulnerable populations like the elderly and those with pre-existing health conditions. Additionally, changing climate patterns can affect the distribution of diseases like malaria, dengue fever, and Lyme disease, exposing more people to these illnesses.

Food and Water Security: Changes in rainfall patterns and rising temperatures can disrupt agricultural systems and reduce crop yields. This can lead to food scarcity, malnutrition, and increased food prices, impacting vulnerable communities that rely heavily on subsistence farming. Climate change also affects water availability, leading to water scarcity and conflicts over water resources.

Displacement and Migration: Rising sea levels, coastal erosion, and extreme weather events force people to leave their homes and migrate. Climate-induced displacement can lead to increased competition for resources, overcrowding in cities, and the loss of cultural identity and community ties. It can also lead to conflicts and humanitarian crises, exacerbating social and political tensions.

Social Inequality: Climate change exacerbates existing social and economic inequalities.

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Vulnerable populations, including the poor, marginalized communities, and indigenous peoples, often bear the brunt of climate impacts due to limited resources, inadequate infrastructure, and limited access to healthcare and social support systems.

It's important to note that the effects of climate change are not uniform and can vary across regions. Additionally, efforts to mitigate climate change and adapt to its impacts can help reduce the severity of these effects on individuals and communities. On the whole mitigating the risk of climate change in herbs used in traditional African medicine poses significant challenges, but there are strategies that can be employed to address this issue. Climate change is already affecting the availability, quality, and potency of medicinal herbs in Africa, thereby impacting traditional African medicine practices and the communities that rely on them. One of the key challenges is the vulnerability of medicinal herb species to climate change. Many herbs are sensitive to shifts in temperature, rainfall patterns, and extreme weather events, which can alter their growth, reproduction, and chemical composition. This poses a threat to the sustainability and efficacy of traditional medicine practices. To mitigate these risks, several strategies can be implemented.

There is a need for comprehensive research and monitoring to understand the specific impacts of climate change on medicinal herb species. This includes studying their distribution, population dynamics, and medicinal properties in the context of changing climatic conditions. Another crucial strategy is the conservation and sustainable management of medicinal herb resources. This involves promoting the cultivation and propagation of important medicinal plants in controlled environments, such as botanical gardens or community-managed nurseries. Additionally, efforts should be made to protect natural habitats and biodiversity hotspots where these herbs are found, ensuring their long-term survival.

Furthermore, it is essential to enhance the resilience of traditional medicine systems and the communities that rely on them. This can be achieved through knowledge-sharing and capacity-building initiatives, empowering local communities to adapt their practices to changing environmental conditions. Integrating traditional knowledge with scientific research can lead to the development of climate-smart practices and the identification of alternative medicinal plants that may thrive under new climate scenarios. Collaboration and partnership among various stakeholders are critical in implementing these strategies. Governments, research institutions, traditional healers, local communities, and international organizations should work together to develop policies, guidelines, and educational programs that promote the conservation, sustainable use, and resilience of medicinal herbs in the face of climate change.

Conclusion

In conclusion, mitigating the risk of climate change in herbs used in traditional African medicine requires a multi-faceted approach that combines scientific research, conservation efforts, community engagement, and policy support. By implementing these strategies, Africans can strive to protect the rich medicinal heritage of their continent, ensure the availability of effective traditional remedies, and safeguard the well-being of communities that depend on these herbs for their healthcare needs.

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