

Climate Change and Public Health Challenges in the Horn of Africa: The Need for Sustainable Leadership and Institutions

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Abstract Accumulated indigenous knowledge and scientific data prove that climate change is real. In the Horn of Africa, climate change is unmistakably visible. Instead of rain coming seasonally, it comes more sporadically. Frequently, the region experiences either severe flooding or drought. Lakes, rivers, and ponds are drying out, and forest fires are becoming more prevalent and intense. The highland regions of the Horn of Africa are fast losing their biodiversity. Climate change is aggravating food insecurity, water scarcity, and increasing the rate of water-food-borne diseases. It causes anthropogenic and zoonosis disease transmission to be more prevalent and aggravates heat-related disorders, such as respiratory and seasonal allergies. These conditions are fostering competition for resources and leading to conflicts. Climate change is becoming a major public health challenge of the century. Objectives: This paper's primary objective is raising awareness of the risks that climate change poses and advancing the need to develop sustainable leadership and institutions. The secondary aim is exploring the role of sustainable leadership and institutions in transforming society, mitigating and adapting to climate change and managing emerging public health problems. Methods: Using the "upstream" public health metaphor, I explore the relationships between climate change and public health problems and provide theoretical reasoning for developing sustainable leadership and institutions. Findings: For the Horn of Africa, climate change is the major public health challenge of the century. Climate change affects health in three major pathways: a) changing the severity or frequency of health problems; b) creating unprecedented or unanticipated health problems; c) multiplying health threats in places where they have not been known. Conclusions: Preventing those complex public health problems requires the development of sustainable leadership and institutions. Effective ways of adapting and mitigating climate change are fostering sustainable development and sustainable culture. The pursuits of public health goals are supported and supplemented by institutional and leadership development. Hence, public health needs to advance the development of sustainable leadership and institutions.

Keywords: *sustainable leadership, sustainable institute, culture of sustainability, sustainable culture, climate change, public health, Horn of Africa*

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1. Introduction

Climate change has resulted from several century-old accumulated damages to our natural world. Although the problem is ongoing, we have only recently understood and connected the situation with human activities. The public health problems that climate change causes are manifold and complex. The solution to those problems should be multilayer, well thought out, and evidence-based. Understanding and addressing those enormous challenges go beyond the capacity of individuals and a single country. Those unprecedented challenges necessitate developing competent leadership and institutions prepared to foster systemic thinking,

leading society in mitigating and adapting to climate change, and navigating paths to sustainable culture and a culture of sustainability. Those leading challenges necessitate constructing cross-cutting knowledge and systemic thinking leadership and institutions.

In their daily prayers, Oromo elders say, "give us peace (nagaa), preclude us from bloody and destructive wars (waraana), extreme poverty (deega), famine (beela), and epidemic diseases (dhukkuba)". These words show that they acknowledge that those issues are longstanding public health problems, express their wishes and hopes, and inform the younger generation that they need to find solutions. For the Oromo people, personal health and peace are intertwined with peace, health in the family, community, the natural world, and harmony with divine power. For them, peace is not the absence of war, and it is

about social and environmental justice [1]. The pursuit of better public health conditions is a longstanding goal, and achieving it requires protracted efforts. In the time of climate change, institutional building and competent leadership are the keys.

Our natural world has equilibrium. If the state of chemical/physical/biological balances is changed, multiple pathogenic conditions occur. When we say climate, we are referring to weather in a particular place over a long period. However, weather routinely changes within a day (night/day) and months of the year. The composition of the earth's atmosphere consists of nitrogen (78%), oxygen (21%) and greenhouse gases (GHGs) 3%. The GHGs include carbon dioxide (CO₂), methane (CH₄), nitrogen oxide (N₂O), halocarbons, ozone (O₃), and water vapor (H₂O). Over the last five decades, studies show that atmospheric CO₂ is mostly emitted by human actions, and methane is mostly emitted naturally. The GHGs are accumulating in the upper atmosphere. The GHGs absorb infrared radiation and increase the earth's surface and alter the climate [2].

The emissions of the GHGs lead to increases in their concentrations in the atmosphere. In 2017, the proportion of GHGs was estimated to be carbon dioxide 82%, methane 10%, and nitrous oxide 6%, and fluoridated gases 3% [2]. The impacts of those gases on climate change are dependent on their concentration, how long they stay, and how strongly they impact. Some of these gases remain in the atmosphere for a few years, and others stay for a century. For example, methane is short-lived- about 12 years- whereas carbon dioxide stays 20 to 200 years. Methane absorbs heat 25 times more than carbon dioxide. All durations of GHGs are long enough to have a significant impact. These accumulated GHGs in the atmosphere increase UV radiation and heat on the earth and those changes have short and long-term implications. Climate change causes an increase in temperature, flooding, and wind speeds. From 1880 to the present, the global average temperature has climbed by more than 1 degree Celsius [3]. Climate change is more severe in tropical regions. Temperature increases in Africa are projected to be higher than the global mean temperature. African regions within 15 degrees of the equator are projected to experience an increase in hot nights and have longer and more frequent heatwaves.

Our health is dependent on the air we breathe, the foods we eat, the water we drink, and the places we work, live, and play; hence, safeguarding the environment is one of the duties of public health. Resulting from climate change, increases in temperature, flooding, and wind speed have already caused unprecedented ecological and social disruptions. Climate change limits soil productivity and aggravates food insecurity. Hence, it limits people's choices in life and affects the social determinants of health. The direct impact of climate change on health includes extreme weather events (e.g., heatwaves and floods). The indirect effects of socially mediated risks include displacement, conflict, and damages to infrastructure. The ecologically mediated risks include drought, water-food borne diseases, and diseases transmitted by the vector [4]. For those reasons, climate change is seen as the major public health challenges of the century [5,34].

The Horn of Africa is overwhelmed by a range of intransigent chronic public health problems. In this region, temperatures have notably increased in the last century. Droughts are becoming more frequent and severe. New species of grasses and vegetables are appearing, and some species of plants and animals indigenous to the area are disappearing. Rain is becoming more erratic, both during the rainy season and dry seasons [6]. Lakes, rivers, and ponds are either drying or overflowing. Malaria-free zones are becoming malaria-prone zones. Scarcities of water and food insecurity are increasing. The shortage of water, soil erosion resulted from floods, food insecurity, and diseases create conditions for people to compete for resources. Competition is leading to conflict and displacement of people. For example, on July 1, 2019, the Ethiopian Prime Minister's report to the parliament made known that there were over 2.3 million internally displaced people. Among them, the displacement of over 400 thousand people has been caused by climate change[7].

Climate change is a multiplier of poverty and aggravates the gaps between the poor and the rich. As such, climate change is creating multi-layers of public health problems. Collecting data, analyzing, understanding these complex interactions, developing nibbling policies in mitigating, and adapting to them requires system thinking leadership and institutions. Competent leadership and institutions are needed to foster adaptive and mitigating episteme, i.e., sciences and arts.

We can measure success by the distances one has moved - rather than looking at where the person has finally ended up. As we work to be "environmentally sustainable," develop socially and environmentally just policies, and foster the culture of sustainability and sustainable culture, experts in public health need to provide theoretical and practical reasons for it. Experts in public health need to articulate the need for evidence-based and nibbling policies, substantiate the benefits of sustainability, and the need to develop sustainable leadership and institutions. Also, they need to provide evidence that social and environmental justice are intertwined, and one cannot be achieved without the other. Furthermore, they need to foster envisioning a sustainable development and framing it in the planetary health agenda.

Climate change poses unprecedented public health challenges. In multiple pathways, climate change affects public health. What makes the problem complicated is many of the causal processes are unknown, and there are many uncertainties. The time has come to change the ways we have been thinking and doing about our natural world. It is time to adopt systemic thinking and an "upstream" intervention approach to understand the problem, frame policy directions, and work collaboratively and responsibly. Public health professionals and policymakers need to discuss, construct knowledge, and frame evidence-based sustainable policy directions. The time has come to change the way we have been thinking and doing in our social and natural world.

This paper has five major parts. The first section gives an introduction to climate change and public health. The second part covers the objectives of the research, research questions, and the methodology used. The third part covers public health impacts of climate change and the

need to develop sustainable leadership and institutions. In the last part, I provide discussions and conclusions.

1.1. Objectives

A healthy and sustainable society does not suddenly appear from nowhere. It results from creative vision, strategic thinking, and thoughtful implementation. It happens by design, through meticulous and continuous efforts. As stated above, when the Oromo elders say give us peace, preclude us from unnecessary war, poverty, famine, and epidemic diseases, on the one hand, they are stating their wishes and hopes. On the other, they infer that progress in public health goes hand-in-hand with peace, social justice, and planetary health. In the Horn of Africa, climate change is posing many public health challenges. The prayer necessitates the development of creative and visionary leadership and institutions that think strategically, the development of evidence-based policies and the management and mitigation of climate change. Understanding the challenges that climate change poses, this paper's primary objective is to promote the need to develop sustainable leadership and institutions and foster the transformation of society and manage emerging public health problems. This paper aims at constructing cross-cutting age knowledge and systemic thinking leadership and institutions, i.e., or sustainable leadership and institutions. It requires developing leadership and institutions that foster energy- sufficient, innovative solutions, diversifying the economy, advancing the culture of sustainability. This paper reviews and weaves together literature on sustainable leadership, institutions, and public health and promotes evidence-based policymaking.

1.2. Research Questions

When Albert Einstein said, “we cannot solve our problems with the same thinking we used when we created them,” [8] he offered us valuable advice. We see the world through our mind's eyes, and unless we change the lenses through which we see the world, we will continue seeing them the same way and doing the same things we have been doing all along. Human activities have caused climate change; if we continue to think in old ways, we will continue polluting the environment and further aggravating climate change. What is the best way to respond to this significant public health problem? If we take the advice of Albert Einstein, we should start to ask ourselves and others, how do we need to think to mitigate and adapt to climate change? The simple answers could be living sustainably and having a sustainable lifestyle. The question that would follow is, what does it mean to live sustainably and to have a sustainable lifestyle? To foster societal sustainability, one needs to develop a sustainable episteme. Developing mitigating and adaptive capacities to climate change requires acquiring appropriate social, economic, political, cultural, and environmental capital. For example, to get everyone to live sustainably, leaders need to develop reasons that are palatable to society. They need to build the political capacity required to lead the community sustainably. They also need to develop cultural capabilities such as the culture of sustainability in sciences and arts necessary to mitigate and adapt;

guarantee leadership and institution for sustainability rooted in the idea of planetary health¹ paradigm.

1.3. Framework Thinking

The word “theory” comes from the Greek word “theoria,” which means seeing or envisioning. Theories are principles set to organize knowledge [9]. Hence, to theorize is to use our mind's eye and systematically articulate guiding principles and inform our understanding and practices [10]. In public health, a framework of thinking guides empirical work and enhances our understanding of health determinants. It helps to critically see and trace the pathways in which risks and protective factors are built and guides policymakers to reflect before they plan interventions and evaluations. This paper uses the upstream-downstream public health metaphor as a theoretical framework to advance sustainable leadership and institutions that foster planetary health. Hence, before I embark on answering those questions and discussing the type of leadership and institutions needed, I will give the classic public health story and then pivot to show why sustainable leadership and institutions are required.

Imagine a river is flowing from a highland region of the country to the lowland region over a high waterfall. Imagine that the people in the lowland area noticed children drowning by the shore of a swiftly flowing river. At one point, they hear the cry of drowning children. Men and women jumped into the dirty water. They swam against the strong current and reached the struggling children. They were able to hold the hands of some of the struggling children, pull them out to the shore and revive them. For some of those children, it was too late. Soon after that, they heard the older men and older women's cries for help. They jump into the river, swim against the strong current, and get to the older men and older women. They grab their hands and carefully pulled them out of the river, and revived some of them. They succeeded in saving some older men and older women but not others.

Before these rescue groups have any break, they hear another cry for help. This time, it is the sound of drowning women. The rescuers jumped into the river fighting against the strong current and reached the women and, as quickly as possible, pulled them out and revived them. Just as some of the women started to breathe independently, they heard another cry for help. At this point, the rescuers were exhausted; their duty became just jumping and rescuing. They started to ask themselves what is going on upstream, and the rescuers decided to find out who or what is there upstream that pushes people into the river.

When the rescuers were thoroughly exhausted, a few wise men and women decided to go upstream and determine what causes these people to end up in the river. They want to address this problem at its source. In the Horn of Africa, chronic malnutrition, war, displacement and climate change are like the swiftly flowing river, and they are eroding the poorly developed public health system. Climate change is limiting people's choices and multiplying risks. Population health is dependent on the

¹ Planetary health is understood as safeguarding current and future generations' health and well-being through good stewardship of earth's natural ecosystem and rethinking the way we eat, travel, shelter, power, and care for people (WHO, 2019).

natural and built environments; thus, promoting sustainability is one of the public health agendas [11]. The contemporary public health leadership is not prepared to act at the upstream level and mitigate and adapt to climate change. This must change through discussions on sustainable leadership and institutions.

2. Methodology

In public health practices, applying upstream and mid-stream interventions is more economically feasible and socio-culturally acceptable than just downstream interventions. Knowledge synthesis is central in advancing research and practices for upstream intervention. In this paper, as I review the literature on environmental sustainability and public health, I synthesize knowledge in the area. Then, I weave the data generated to explore the types of leadership and institutions needed to mitigate and adapt to climate change and minimize risk factors and enhance protective conditions.

Science is accumulated knowledge; a literature review is an essential tool in knowledge construction and synthesis. Indeed, growing interest in knowledge syntheses makes a literature review an indispensable public health tool. Literature reviews are essential to (a) identify what is known about the topic; (b) determine if the research findings reveal trends or patterns; (c) aggregate empirical findings that support evidence-based practices; (d) generate new frameworks of thinking and theories; (e) identify topics of further inquiry. Informed by the public health upstream-downstream metaphor in this paper, as I reviewed literature in sustainable leadership and institutions, I looked for those that fostered desirable characteristics.

3. Definitions

To avoid ambiguity and give the context in which this research paper is framed, I define significant terms. Consistent with the United Nations Framework Convention [12], in this paper, climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and natural climate variability, as observed over comparable periods [12].

Public health is the science and art of promoting health, preventing disease, and prolonging life through society's organized efforts [13]. Public health leadership is defined as "the ability of individuals to influence, motivate, and enable others to contribute toward the effectiveness and success of their community and/or their organization. It involves inspiring people to craft and achieve desirable public health vision and goals. Leaders provide mentoring, coaching, encouraging, empowering, and allowing other leaders to emerge" [14].

Indeed, the etymological root for the English word leader and leadership is *laedan*, which means path or road [15]. In the Russian language, leadership is *руководство* (*rukovodstva*), and it is derived from two words *ruka* =hand and *vodit* = guide; literally, it means holding hands and guiding. In the Oromo language, *Hogaanaa*, and

Somali Hogaaminta- the terms are derived from the term rope used by a lead person to guide a group of camels. In Amharic, it is *ጠጠጠጠ* (*Amerari*) from which the term *meri*, the steering wheel, is also derived. In all those languages, it is about showing the paths and giving directions. What types of leadership and institutions are needed to tackle climate change and prevent emerging public health problems in the Horn of Africa are the core questions of this work. Sustainability is defined as "meeting the needs of the present without compromising the ability of future generations to meet theirs." In this paper, sustainable public health leaderships and institutions are "the ability of individuals and institutions to influence, motivate, and enable others to contribute toward the effectiveness and success of their community and/or the organization in which they work, inspire people to develop sustainable theory/practice and culture and achieve planetary and public health goals [16].

Institutions can be social, political, economic, and cultural ideas and principles. They guide societies in research, policymaking, and implementation. Sociologists describe institutions as something that provides theoretical reasons for individuals, helps them in their everyday decision-making, offers orientation and interpreting actions, and defines their role in society [17]. Institutions shape cultural values and determine how and what the cultural group should develop. Institutions give the framework of thinking for actions, integrate and lead the social and political community [18]. Hence, institutions are permanent and internalized patterns of behavior and orientations that implicitly assume a regulatory function. In this paper, a sustainable institution is social, political, economic, and cultural ideas and principles set to guide research agendas, policy directions in implementing sustainable planetary and public health goals.

Institutions are permanent social structures that give formal and informal rules, coordinate, influence people's behavior, and inform the ways of life [19,30]. They provide directions on social interactions, expectations, and thought. There are five major shared institutions. The first such institution is the family. Family procreates biologically and culturally and maintains the identity of the group. It nurtures and teaches values to the younger generation. It is instrumental in maintaining unity and harmony among the members. The second institution is religion. Religious teaching offers answers about the mystery of life and death and establishes morality and ethics. It plays a critical role in guiding members during heartbreaking situations. The third type of institution is the economy. The economy is the production, consumption, and distribution of goods and services. The fourth institution is the government. The government gives political orders and directions through policymaking. It maintains peace and stability, and coordinates the human and natural resources of the society. The fifth institution is education. Education shapes society and prepares the young mind to inherit the culture and continue articulating societal needs and aspirations [19].

Mitigation of climate change is the intervention measure taken to reduce or prevent the emission of GHGs and the speed of climate change by enhancing the sink of GHGs. It is intended to reduce the emissions of

heat-trapping gases or remove carbon dioxide from the atmosphere. Mitigation is upstream public health intervention, and it includes controlling the sources of emission by modifying natural resource use. It is part of health promotion and the primary disease prevention strategy. Social policies aimed at promoting sustainable development are part of this strategy. Adaptation is policies and measures that are midstream interventions and driven to adjust to natural systems to a new or changing environment and exploit beneficial opportunities or moderates' negative consequences [20]. Adaptation to climate change is the secondary prevention measures aimed at easing climate change impacts [4].

4. Why Sustainable Leadership and Institutions, Why Now?

First, the history of public health is full of individuals and institutions that transformed our understanding of the biological, chemical, and social conditions, changed our thinking and lifestyle and improved our life expectancy. A few influential public health figures are John Snow, Rudolph Virchow, and Louis Pasteur [21]. In both the past and present, public health is one of the pillars of social justice and peace; advancing public health is an essential part of realizing peace and security. For the Oromo people, personal and community health are intertwined with environmental health. In the Horn of Africa, climate change is aggravating public health problems. The Horn of Africa countries needs leadership and institutions that function, that consider social and environmental justice, change systems' food production, storage, housing infrastructure, and energy supply models, and make them sustainable. . It is time to foster sustainable leadership and institutions.

Second, in my observations and research findings, the policies of the Horn of Africa countries are inequitable and unsustainable. For example, in Oromia, the Ethiopian discriminatory language policy [22], denial of the development of Oromo leadership and institutions [23,24,25], and denial of free media [26] multiplied risk factors inimical to the population's health. Unless equitable and sustainable epistemes are developed or revitalized [27], they cannot build mitigating and adapting social, economic, political, and cultural capital.

Third, in my observation, the Oromo people have a sustainable culture and a culture of sustainability. In the Oromo culture, it is taboo to cut growing plants and kill growing animals. The Waqefaanna religious leaders will not kill and eat the meat of young female goats, lambs, cows, and others [1]. They justify that view by saying that the mother creator needs them for procreation. Eating them is seen as working against the plan of divine power. The Ethiopian Orthodox Churches and mosques have condemned the Waqefaanna view about the natural world. The Ethiopian government and religious institutions attack the Oromo sustainable worldviews.

Fourth, the policies of successive Ethiopian regimes have not been environmentally friendly. The Haile Selassie regime's policies are consistent with those of the Orthodox Church. The Haile Selassie government saw the Oromo people's worldview of the natural world as

backwardness. Mengistu Haile Mariam's policy was derived from the communist idea, and his approach was conquering nature. Conquering nature means unsustainable development, such as dismantling natural forests. To subsidize unnecessary war and feed half a million troops, the Mengistu regime dismantled thousands of hectares of forests and expanded state and collective farms.

When I was a teenager, my first job was uprooting trees. It was a project sponsored by the Ethiopian government to clear the forest for farming. One of the free labor services that I gave was planting trees. Many people were forced to plant trees, and in resistance to the order, I observed people deliberately planting trees upside down. This shows that social and environmental justice are intertwined.

The late Prime Minister Meles Zenawi's environmental policy was worse than the previous regimes. On the one hand, to enrich himself and his community, he allowed corporations to pollute the environment. On the other, to deny hiding places to the Oromo Liberation Army (OLA), he ordered the deliberate burning down of the natural forests [29] and the poisoning of ponds and water wells.

In July/August 2010, I visited Oromia and noticed people were forced to plant trees. I learned that planting trees has continued for the last twenty-five years. In my observation, the area was more deforested than the time I knew. I asked people, "If they have been planting trees for many years, where have those trees gone?" The answer is most of those trees did not survive. In a few cases, the Ethiopian government officials sold them to corporations. Human rights violations and corruption are part of the problem. If most of the planted trees are not surviving, why did they not develop a better plan in the last three decades?

The current Ethiopian Prime Minister, Abiy Ahmed, presents himself as more environmentally friendly than his predecessors. However, he is not much different from his predecessors. Like his predecessors, he deliberately burns natural forests to deny the OLA shelter and food. Instead of seriously negotiating and peacefully settling political differences with opposition groups having in mind social and environmental justice, he preferred war. On the other, exploiting the culture of sustainability, he mandated planting trees. Yet, although we hear from the media about the number of trees planted, no record shows how many hectares of land have been reforested.

Fifth, in my observations, the Ethiopian government's tree planting project was not strategically planned or well-thought-out. Those regimes do not generate new knowledge and translate it into policies or allow experts to synthesize and transfer knowledge. Consistent with McCann's view [16], I see leadership and institutions in the natural world metaphor- they are continuously changing and adapting. Unless the Horn of African countries make their leadership and institutions that resemble the natural world that continually evolves and adapts over time, they cannot achieve sustainability.

Sixth, the Horn African countries are behind in many public health indicators [31]. Climate change is multiplying public health problems and further threatening to slash modest progress. Hence, public health leadership

and institutions have never been as critically needed as now-, in the era of climate change.

Seventh, climate change is unprecedented, and contemporary theory and practices aren't useful. I am not alone in asking about the type of leadership needed to manage climate change. A decade ago, Meijerink and Stiller [32] asked what kinds of leadership are required for climate adaptation and offered a few vital points. They identified the essential leadership qualities needed for climate adaptation. Those identified qualities are:

1. Influences the policymaking process necessary for adaptation and implementation.
2. Enhance collaboration across different policy-makers, sectors, and actors.
3. Foster building adaptive capacity (adaptability) of governance networks concerned with climate adaptation.
4. Enhance the capacity of society to learn in response to feedback from the natural system in particular.

The leadership quality they proposed is appropriate for a midstream intervention.

Climate change makes public health problems complex and unpredictable. Those realities necessitate that Horn of Africa countries develop sustainable and equitable policy directions and strive to ensure their population's highest attainable health standards. The skills needed for leadership and institutions during the era of climate change should go hand in hand with the challenges. Upstream and systemic thinker, visionary, and sustainable culture are the desired leadership qualities.

Eight, Ethiopia and other Horn of African countries are rapidly urbanizing. In this region, massive industrialization and intensive farming is going on. This is happening without proper safe farming practices, environmental regulations, social programs for the poor and marginalized, and adequate labor laws. When those unhealthy social conditions are combined with climate change, it creates unprecedented public health challenges. Poor sanitation in cities and towns, unhealthy workplaces, unregulated farming practices, compounded with climate change, create favorable conditions for known and unknown biological and chemical contaminants. The COVID-19 pandemic taught us that in the global world, infections that start in any corner of the world can rapidly spread across the globe more quickly than ever before [28]. Hence, the efforts we make to advance sustainable leadership and institutions and ideas we generate in this area are the effects we make to promote health, locally and globally.

Ninth, for over a century, the Ethiopian government banned the Oromo indigenous institutions such as Gada, Siiqee, and Waqeffanna. These institutions are democratic, equitable, and sustainable. For example, the Matcha and Tulema Self-help and the Oromo Relief Associations were banned until recently. Oromo people are denied political representation. Banning Oromo indigenous institutions and stopping others from being developed have contributed to environmental degradation and hindered the enhancement of public health conditions [23,30]. Developing sustainable leadership and institution can revitalize the indigenous institutions and speed up the regaining of lost opportunities.

5. What Can be Done?

As I mentioned earlier, leadership and institutions are needed to address people's social problems, and thinking at the "upstream" level. If we carefully look at what caused deforestation in Oromia, we can see five primary reasons. The first reason is food insecurity. People dismantle forests to expand their farmlands and guarantee themselves food security. This suggests that just planting trees is not good enough. We need to plant trees that can also give food. Planting trees should contribute to guarantee food security. For that reason, the Ethiopian government needs to advance agroforestry. Many edible perennial plants can easily and quickly adapt to the Horn of Africa.

The second important reason for deforestation is the search for firewood needed to cook, warm, and light their homes. In parallel to planting trees, we need to develop efficient energy usage and using renewable energy. Tree planting should go hand in hand with securing the energy needed for cooking, lighting, and warming of homes.

The third reason is people use wood to build their houses. Unless the government invests in developing building materials that can partly replace wood, they will continue cutting trees. This necessitates investing in producing sustainable building materials. There are more reasons why the Horn of Africa governments need to take housing more seriously. In this region, most of the houses are built from wood, grass, and soil. Due to climate change, as temperatures rise and humidity increases, those houses become places where pathogenic microorganisms increase. Warmer weather increases the risk of fire damage to homes. Climate change also causes an increase in the speed of the wind, tropical typhoons, and lightning. The houses built from grass, wood, and soil cannot stand high-speed winds and flooding.

Let me give concrete evidence and substantiate why sustainable leadership and institutions are needed. For the 2019 OSA conference, I connected Oromo engineers in Oromia with those in the diaspora to organize a panel and discuss Oromia's housing problem and envision sustainable solutions. Some of those engineers hesitated to collaborate out of fear of the Ethiopian government. If there is sustainable leadership and institutions, they would have freely exchanged ideas and constructed knowledge necessary to address housing problems. The exchanges would have enhanced our understanding and helped us to mitigate and adapt to climate change.

Fourth, people cut trees to produce charcoal and generate income. In a society where the unemployment rate is high and basic needs are not guaranteed, people are conditioned to live unsustainably. Leadership and institutions that support social programs for the poor and marginalized, and adequate labor laws are needed.

Fifth, the Oromo people and the southern Ethiopian people have a sustainable culture and culture of sustainability. They have developed an episteme of planetary health. As the colonial culture and episteme was imposed upon them, they were conditioned to abandon the sustainable culture. Revitalization of the sustainable culture should go hand in hand with planting trees.

Let me give a concrete example. In 2016, informally, experts in different fields analyzed climate change impacts on food security and public health in the Oromia region. In our discussions, we started to ask what we could do to mitigate and adapt to climate change. At one point, we began to meet formally. We decided to review the literature and examine whether we can introduce perennial plants such as oil-producing olive trees, oil-producing palm trees, breadfruit trees, and quinoa grains.

The first question we wanted to answer from the literature review was whether or not the oil-producing olive tree (Eejersaa -in Oromo) can grow and produce in Oromia. The hypothesis comes from our observation that olive trees grow in the wild in a wide area of Oromia. However, in Oromia, olive trees do not produce oil. Researchers reviewed the soil chemistry, humidity, temperature, and sunlight needed to grow the oil-producing olive tree. Olive trees grow in the Middle East, Southern Europe, Asia, Latin America, and the USA. Based on the literature review, in Oromia's highland regions, olive trees are most likely to grow and produce an adequate amount of oil. Once planted, olive trees can continue to produce seeds rich in healthy oil for over five hundred years.

The second question was whether or not we can introduce breadfruit to Oromia. Breadfruit is indigenous to Hawaii, and it produces starchy fruits. Once it starts to produce fruit, it can give starchy fruit for over two hundred years. The leaves and stem of the tree are edible for domestic animals. The wood can be used to make furniture. Based on the literature review, breadfruit can be productive in a wide range of Oromia regions.

The third perennial edible plant we reviewed was the palm tree. Based on the literature review, we were convinced that it could grow in some regions.

Fourth, we reviewed if quinoa grain gives good harvests in poor soil and has a short vegetation period. This grain is rich in protein, iron, and fiber and is considered a healthy food. Indeed, the origin of quinoa and corn are the same. Corn and quinoa grow in the same climate and soil conditions. There are many varieties of quinoa, and it can grow in most of Oromia.

Fifth, as we brainstormed and discussed further, we also learned that we could grow fig fruits in Oromia's highland areas. In Oromia, there are wild fig trees. They produce an adequate amount of fruit. Until now, no one has tried farming figs. The local fig tree is vast, and it takes many years before it starts to give fruit. The domesticated fig tree can grow and give fruit reasonably quickly. As I discuss a project we started and the challenges we faced, I want to take you to this paper's core idea- sustainable leadership and institutions. We researched on our own time. Our objective is to address the needs of the Oromo people partly. Initially, the experts in the diaspora are those who started the discussion. Later on, they invited Oromo scholars from Oromia. After we conducted the literature review and developed a proposal for the project, experts from Oromia worried about their safety and told us to hold off on the project. We discontinued the project because the Ethiopian government's dominant objectives are to control the citizens' activity. We could not find favorable conditions to work with individuals and institutions that would work with us. If the Ethiopian

government was democratic, and sustainable leadership and institutions were in place, we would have tested the project. Indeed, the idea of sustainable leadership and institutions emerged in my mind when I realized that Ethiopian government policies were hindering us from finding sustainable solutions.

6. What are the Public Health Challenges of Climate Change?

We now better understand the relationships between social and the natural world. Through our progress in sciences and technology, progressively we improved our understanding. Our natural environment is not a limitless resource where we can freely exploit and discharge our wastes. Our natural world is set in balance, and it works as an equilibrium. If the state of physical balance is tilted, it brings multiple changes. As we pollute the environment, the balance of equilibrium is tilting and causing climate change. From the air we breathe, the water we drink, the foods we eat, and the houses we live in, we are directly dependent on the natural world. The natural world also influences biological agents that can, directly and indirectly, impact our social world. Climate change is characterized by extreme weather, i.e., weather temperature increases [34], flooding, high-speed winds, tropical cyclones, and lightning [35]. The impacts of those extreme weather patterns are enormous. Those impacts could be direct or indirect through paths or multiple paths. The effects could be global or limited to a specific place.

In general, high temperature, humidity and increased lightning add to the risks of severe forest fires and threaten biodiversity. Higher temperatures reduce moisture in the soil and increase water scarcity. Moisture in the soil is essential for the growth and development of plants and microorganisms, and increases in the temperature alter the flora of forests and microbiology of the soil. As a result, microorganisms involved in absorbing nitrogen from the air and enriching the soil are significantly affected. The limited growth of farmer-friendly microorganisms affects the fertility and productivity of the soil.

Besides, the increased heat multiplies the risk of drought, its frequency, and longevity. Drought means malnutrition, scarcity of water, increased vulnerability of infections, competition for natural resources, human displacements, and breakdown of public health infrastructure [33].

Increased temperatures and moisture create a competitive advantage for Mesophilic microorganisms². Mesophilic microbes are known to be pathogenic, and they reduce food shelf life, increase nutrient losses, and increase food and water-borne diseases. This will further aggravate the existing food insecurity and increase the cases of food and water-borne diseases. The Horn of Africa is one of the regions with a high prevalence of infections [36]. Until recently, fungi infections were not

² Based on the bases of preferred ranges of temperature, microorganisms are classified into four primary groups: Psychrophilic (cold-loving 0-20°C), Mesophilic (moderate temperature loving 15-45°C), Thermophiles (heat-loving 38-80°C), and Hyper-thermophilic high heat temperature-loving 65-105°C, microbes.

common pathogens to humans. However, cases of toxic fungal infections, such as mycotoxins, are increasing [37]. In the Horn of Africa, mycotoxins are becoming one of several newly emerging public health problems. This is being widely observed in Kenya and Ethiopia.

Prof. Asfaw Beyene, a thermodynamicist from San Diego State University in California, gave a keynote speech at the 34th Oromo Studies Association (OSA) annual conference on comparative analysis of available data on climate change, specific to the Horn of Africa. In his speech, he presented his assessment from data generated with various computer models.

He reiterated findings that one area of low consistency among climate simulation models relates to predictions of the spatial distribution of mean precipitation changes, particularly at a regional scale. In contrast, one common area of agreement of climate model studies seems to relate to precipitation, that it will exhibit increased intensity and decreased frequency to accompany climate change. Notably, this is expected in the highlands of the Horn. In a simplified context, the "wet-gets-wetter" mechanism predicts that rainfall should increase in regions that already have much rain, leaving a tendency for dry areas to get dryer.

The increased intensity of the 2020 rainy season in the highland regions of the Horn of Africa, one of the most intense rainfall seasons in history, seems to have validated what was discussed by Prof. Beyene. Floods destroyed houses, erosion washed out farmlands, and displaced millions of people. This also resulted in the refilling of some of the lakes that had been dried out for years. An increase in rainfall means higher atmospheric humidity. An increase in moisture in hot tropical weather means increased risks of thunderstorms, higher wind speeds, and favorable conditions for some microorganisms. Those significant changes will have considerable public health impacts. Prof. Beyene's lecture suggested that policy directions intended to manage and mitigate climate change need to be customized for low and highland regions of the Horn of Africa.

Climate change increases vector-borne diseases. It improves their reproduction and survival, increases the vector's biting rate and the pathogen's incubation rate. Malaria is one of the significant public health concerns resulting from climate change. Malaria-free zones of the Horn of Africa are fast becoming malaria-prone zones [38].

Heatwaves are one of the emerging public health problems. Recently several heatwave cases have been recorded in Europe, North America, and Asia. As a result, hundreds of people have died from heatstroke and simple dehydration. There are cases when schools and workplaces have had to send their people home. In the major cities of the world, having cooling centres has become a new norm. Clearly, in the Horn of Africa, the temperature is increasing, and extreme heatwaves are emerging problems.

Flooding is one of the significant challenges of climate change. Flooding washes away fertile soil and affects its

productivity. As the erosion washes off the topsoil, it reaches the minerals deposited beneath. This might alter the soil's PH level and even lead to chemical toxicity. Flooding spreads biological and chemical pollutants from place to place, further increases clean water scarcity, and moves pathogenic agents from place to place. Flooding contributes to sea-level rise. The sea-level rise takes away the land where people live, farm, and hunt and causes displacement. It also increases the salinity of coastal soil. In the Horn of Africa, sea-level rises have been recorded in Kenyan and Somalian coastal regions.

Climate change is considerably impacting food security and safety. Flooding compounded with higher temperatures increases humidity in the air and further creates a competitive advantage for certain microorganisms such as bacteria, viruses, parasites, harmful algae, fungi, and other vectors. Specifically, mycotoxins produced by fungi are becoming a significant public health concern [39,40]. Those microorganisms limit the shelf life of foods. In the Horn of Africa, food poisoning is a growing problem.

In the Horn of Africa, public health conditions are not well developed. In multiple ways, climate change is further eroding the little signs of progress achieved. Our health is entirely dependent on our natural world- if we do not learn to care about planetary health, we cannot achieve the desired public health goals [40]. Ecological sustainability is part and parcel of planetary health. Consistent with the public health metaphor mentioned above, promoting sustainability and planetary health are the upstream actions. Promoting sustainability maintains and improves the complex systems that support health and life and enhances people's choices.

7. The Implications of Increased Wind Speeds

Climate change is a threat multiplier [41]. Increased wind speed is one of the known effects of climate change. High wind speed means damages to private and public properties such as houses, schools, institutions, manufacturing and business centres, telephone cables, electric lines, bridges, and highways. Those infrastructures are critical to public health. On the one hand, those damages limit access to essential services and hinder people's choices in life. On the other hand, they cause an increased scarcity of liveable housing and schooling [41] and other infrastructures. Wind can carry chemical, physical, biological contaminants and allergies and create further health burdens.

Lightning results from the amount of water or precipitation in the atmosphere, and hot weather and atmospheric instability create situations that allow airspeed to rise rapidly. In 2014, a case study estimated that, for every average global increase of one degree Celsius, there would be a 12% increase in lightning. If global temperatures increase by three degrees Celsius, the number of lightning strikes will increase by 50%. Half of the U.S.A's wildfires are caused by lightning, which could significantly impact the number of wildfires, especially in remote areas [41]. In the highland regions of the Horn of Africa, lightning is a significant problem. It is worrisome that climate change further aggravates lightning.

From 1900 to 2020, in the Western world, life expectancy has increased from 50 to over 80 years. Among them the 25 years of improvement has come about through public health intervention and 5 years from medical care. Those public health interventions include safe and healthy foods, control of infections, healthy environments, vaccinations, regulation of tobacco use, motor vehicle safety, the decline in coronary heart disease, healthier mothers and babies, addressing the social determinants of health, universal policies that reduce health disparities, safe, and family planning [14]. Climate change risks undermining those public health gains of the century. In the Horn of Africa, an increase in life expectancy occurred during the same time. In this region, from 1900 to 2020, life expectancy has improved from 40 to 60 years [49]. However, climate change is threatening to slow or reduce the improvements they have achieved.

8. The Significance of Sustainable Public Health Leadership and Institutions

Climate change is creating complex public health problems. We cannot effectively tackle these unprecedented problems without fully understanding the social conditions that cause or can potentially mitigate and improve health conditions. As I have cited above, when Albert Einstein said, “we cannot solve our problems with the same thinking we used when we created them,” he is suggesting that the tools needed to fix the wrongs of the past cannot be found in the thinking of the past but rather of the present and future. Climate change is the manifestation of wrong assumptions, and the framework of thinking needed to understand and solve those problems can only be found in an episteme of the future. Human activities cause climate change; if we remain thinking and acting in the old way, we will continue polluting the environment and further aggravating the problem. To develop the new tools needed for sustainability, we need to shift our paradigm of thinking.

Without continued data collection, interpretation, and evaluation, policymakers cannot come up with evidence-based policy directions. Without those essential tools, individuals and communities could not strive to live sustainably. Without a comprehensive assessment of policies and procedures, we cannot measure the outcomes. Those crucial works should not be left just for the few. It necessitates building knowledge constructing and synthesizing institutions. Institutions are needed to closely monitor weather patterns, give early warnings, enhance renewable energy sources and sustainable food systems. In the Horn of Africa, the relationships between conflict and climate change are paradoxical. Climate change can cause conflicts, and in turn, conflicts contribute to climate change³. This

³ As I write the final draft of this paper, the Ethiopian government is engaged in war in the North in Tigray and South and West in the Oromia regions. It is bombing, displacing, burning houses, killing citizens, disconnecting telephone and internet services, and claiming victory. Although the African Union, United Nations, European Parliament, and the US government asked the Ethiopian government to settle political differences through peaceful means, the Ethiopian Prime Minister refused to negotiate. The Ethiopian Prime Minister justified sovereignty in refusing to resolve the political differences by peaceful means. The

necessitates developing sustainable institutions that are systemic thinkers, planetary health promoters, equity enablers, and democratic society builders.

9. Sustainable Leadership and Institutions

The need for transformative leadership and institutions is not a new idea [43,44]. For centuries public health has been engaged in investigating how the natural and built environment and the social conditions in which people live and work are implicated in public health problems. In many cases, social movements were forced by authoritarian/racist governments to change their paradigm of thinking and pushed them to make appropriate reforms. For example, in the USA, the civil rights movement changed the ways black people were treated and made their social issues political agendas - therefore, publicly discussed and researched [47]. Credit goes to Civil Rights Movement leaders such as Martin Luther King, who framed transformative plans and mobilized people to the cause. Research in sustainable leadership and institution is an integral part of our planetary and public health.

Indeed, since 1976, the Ottawa Charter of health promotion has advanced, creating a supportive environment for health [44]. Inequitable social relationships and degraded environments limit people's choices in life. To enable people and widen their choices, public health needs to promote sustainable development and sustainable leadership and institutions.

Leaders are those who strive to make significant differences in the lives of those whom they represent. They are actively involved in influencing changes and bringing social transformations. Public health leadership and institutions should function with population health i.e. public good in mind - and advance inclusive policy. Public health leadership strives to enhance the quality of life for the whole population. The literature on leadership suggests six characteristics that contribute to effective public health leadership. Those characteristics include visionary, knowledgeable, adaptive, team-player, enabler, and systemic thinker. The characteristics of sustainable public health leadership encompass that and more. Hargreaves and Fink [45] offered us seven principles of sustainable leadership. Those identified qualities are: a) Preserve and sustain learning; b) Secure success over time; c) Sustain leadership development of others; d) be open to the issue of social and environmental justice; e) Sustain the development of human and material resources; f) Sustain environmental biodiversity and capacity; g) Sustaining undertaking in environmental activism. The work of Hargreaves and Fink [45] aimed at educational leadership, and it captured what is right in the field. From the public health perspective, those qualities should be broader and include: h) sustain holistic/systemic thinking; i) sustain the morality of caring for planetary health; j)

successive Ethiopian regimes' political culture represents the real character of unsustainable leadership.

maintain the knowledge and skill of thought in the “upstream” public health metaphor.

Let me elaborate more on the significance of sustained learning and sustained leadership, as well as sustained social and environmental justice. Learning, knowledge construction, and problem-solving skills are developed more intensively in a group setting. As peers brainstorm, communicate openly, think deeply about the project and conduct simple and complex research, they construct cross-cutting age knowledge [47]. To sustain learning about climate change and develop mitigating and adapting strategies, institutions need to foster multiple leaders who can compete and collaborate. Suppressing the development of multiple leaders hinders sustained learning. Besides, being open to social and environmental justice makes them develop a sustained morality towards planetary health and makes them lifetime learners. The pathways in which climate change has implications for public health are complex, and the solutions should be multilayered. Some of those paths are not clearly known. Systemic thinking promotes approaching the problem and solutions holistically. Equipping leaders and institutions with systemic thinking make creating a sustainable society possible.

As I have elaborated above, the five major intertwined institutions [19] can play critical roles in sustainability. For example, a family can teach children a sustainable lifestyle and values. It can nurture and teach children to mitigate and adapt to climate change. Religion promotes morality and ethics. It can frame the ethics of caring for the natural world. The economy is about the production, consumption, and distribution of goods and services. Accordingly, economic institutions can shape society and set sustainable agendas. The fourth type of institution is the government. In the contemporary world, it is the most influential institution. Governments can provide a framework of thinking, political orders, and policy directions; they are more equipped to foster sustainability. Education shapes society and prepares the mind to manage the future world. It can prepare the community to live sustainably and mitigate and adapt to climate change.

10. Ushering in Sustainable Public Health Institutions

As I have noted above in this paper, an institution is social, economic, political, and cultural ideas set to guide the members' perspectives and inform policy directions. Public health institutions collect data and construct and synthesize knowledge. The primary duties of public health institutions include: a) early identifying problems and framing solutions; b) timely identifying social opportunities and preparing societies to acquire them; c) establishing a normative foundation in the community, i.e., the culture, spirituality, norms, and values that generally play as protective factors flourish; d) governing the interactions [46]. This includes identifying socio-cultural values that increase the risks and tackling them and developing enabling ideas and values.

Leadership is art and science. Institutions guide the types of leadership society develops; on the other hand, leadership shapes institutions. In the past, leadership and

institutions were about control, competition, uniformity, self-centeredness, and conquering. Such leadership is undemocratic and unsustainable. Sustainable leadership and institutions foster, manage, empower, collaborate, diversify actions, and promote high ethical purposes. Leaders actively involve and influence social transformation and achieve desired population health goals. Leaders foster bonding ideas, interests, and people. They shape values, vision, and inspire people to work collectively and construct knowledge. Bringing positive change and fostering social transformation requires a paradigm shift. A paradigm shift informs policy makers to refine policy direction, legislation, and accountability. A paradigm shift can put an end to the system that is responsible for climate change and enhance social and environmental justice. In public health, leadership is about an individual's ability to influence, motivate, and enable others to contribute to their community's effectiveness and success and enhance population health. It involves inspiring people to craft and achieve visions and goals. Leaders provide mentoring, coaching, and recognition. They foster empowerment, allow other leaders to emerge [42,43].

11. Fostering Sustainable Culture

Climate change is the accumulated effect of longtime mismanagement in our natural world. The industrialized world has contributed to climate change much more than the rest of the world. Euro-centric ideas promote structuralism, domination, and hierarchy. They promote a division between humans and the natural environment. Such an episteme does not promote harmony between the social and natural world- it has allowed the exploitation of the social and natural world. Sustainability requires knowledge, skills, attitudes, and values, i.e., a morality of caring for social and the natural world. It requires setting protracted plans, procedures, and a continuously evolving “imaginary world” [46]. Mobilizing the mass to sustainability, i.e., an imaginary world, on the one hand, requires fostering a sustainable culture. On the other, it needs a revitalizing sustainable episteme and new worldviews.

Because sustainability is an integrated policy framed holistically or systemic thinking that approaches centering on planetary health (Social and Environmental dimensions), we need to foster a sustainable culture and even spirituality. The term culture can be interpreted differently. In this paper, I refer to culture as the norm and values that promote sustainability or hinders it. Culture is a process of intellectual, spiritual, or aesthetic development that influences all aspects of life, such as understanding the social impacts of climate change and incubating the solutions. Understanding the effects of climate change and addressing them is possible if we advance a paradigm shift in the societal episteme, fostering cross-cutting knowledge, and system thinking.

Next, I look at the Oromo indigenous religion as one example of sustainable culture or even spirituality and a paradigm of thinking necessary for sustainability. I bring Waqeffanna into the discussion to show where we need to turn to foster a shift in the paradigm of thinking.

12. Waqeffanna -As One of the Tools

Developing a sustainable culture and culture of sustainability is one of the 21st-century projects. Growing a new culture can be seen as exploring new realities. The challenge with the idea of change in the culture is that the opportunities it brings are not fully known. People fear the unknown and this slows the desired changes. However, the revitalization of a sustainable culture brings the long-standing and the living culture to the present reality. This makes revitalizing sustainable institutions and cultures not only desirable and exciting but essential. The Waqeffanna teaches ideas that foster sustainable living, cohesiveness with the social and natural world [1]. It provides a unique moral compass that helps us see our social and natural world through a different lens. It can be one of the worldviews that we need to revitalize.

Education is not just about learning facts and remembering them. It is about training the mind to think, organizing information, and constructing and synthesizing knowledge. We collect and organize our thoughts based on prior experiences. We do what we already have in our minds; policymakers set policy directions based on how they view the community they live in and stakeholders. When individuals feel a sense of belonging and are connected to nature, and they see their ecological connection is part of their spirituality [48], they live more sustainably. For those who are trained or culturally prepared to control the natural world, the leadership skills needed for sustainability requires them to shift their worldviews. Such leaders need to change their thinking and understanding of the natural world from objects they need to control to a beautiful system they need to live with in harmony. Focusing on systemic thinking and interconnecting the social and natural world at multiple layers is critical to sustainable leadership.

Colonizers wanted to control how the colonized people think. They did that because whoever owns the minds of others owns the future. As the means of controlling the colonized people, the colonizers made a continuous effort to change the episteme of the colonized. Colonizers and the colonized competed on the epistemological foundation of the society [47]. In the Oromo case, before colonization, they had developed a sustainable environmental episteme. Under colonial rule, such an episteme was outlawed, shamed, and criminalized.

Abrahamic religious discourses teach that human beings have absolute authority over the natural world. From the perspective of planetary health, this provided theoretical reasons for exploiting the natural world and extensively polluting the environment. On the contrary, in the Oromo worldview, personal health, community health, and peace are intertwined with environmental health. From the Oromo perspective, not seeing the natural world as an integral part of the social world provides theoretical reasons to pollute the environment, create poor health conditions and be ultimately unsustainable [1].

Until recently, religion and sustainability have been overlooked in public health research and policy-making. However, as we have seen, threats to sustainability present unprecedented risks to public and global health, so we started to think at a systemic level. This necessitates making sustainability part of formal and informal education.

Such teaching makes us focus on developing knowledge and behavior to sustain ecology. Integrating ecology and public health requires fostering the thinking and teaching that makes the human world part of the natural world.

Epistemological loss creates a dysfunctional society. Socially and biologically, healing restores the lost functions, and revitalization is a necessary step in fostering healing locally, regionally, and globally [1]. Compelling evidence shows that religious doctrines influence our assumptions and direct our actions. This necessitates the revitalization of spiritual teachings *that promote sustainability*.

Climate change is the manifestation of long-term complex human interactions between us and nature. In Abrahamic religious teachings, life on earth is less important than life after death. Life on earth is a preparation for eternal life, spent together with divine power in heaven or hell. Those teachings do not encourage members to pay enough attention to their social and natural world on earth or making the utmost efforts to guarantee environmental sustainability.

In Waqeffanna, life after death is in the natural world where he/she has lived. In the Waqeffanna, preparing for life after death includes caring for the natural world. The Oromo worldview promotes living in paradise, where everyone needs to be at peace with him/herself, family, community, and the natural world. They believe the dead person's spirits expect their loved ones to maintain stability and peace in the family, community, and the natural world. From such deeply settled moral reasoning, when a loved one dies, family members' and friends plant trees. This gave the Oromo people theoretical reasons to develop policies and practices to live harmoniously with the natural environment [1].

The little attention that Abrahamic religious teachings give to life on earth made the newly converted people not make continuous efforts to live sustainably. Not only that, the teachings focused on life after death in faraway places, "heaven or hell." From the Oromo point of view, these teachings do not prepare people to be mindful and care about their natural environment. Instead, the members are indirectly encouraged not to give enough attention to their natural habitat and indirectly provided theoretical reasons to pollute the natural environment [1].

13. Results

Climate change is the result of complex system interactions between the human and natural world. For the Horn of Africa, it is a major public health challenge of the century. The challenges that climate change brings are complex and multilayered. For those reasons, many of the impacts of climate change are unknown. Finding workable solutions to the problems require first profoundly understanding them. Not fully knowing those complex problems make the challenge enormous. Those challenges necessitate developing leadership and institutions equipped to think and act at a systemic level.

The known primary pathways in which climate change affects public health problems in the Horn of Africa are: a) Changing the severity and/or frequency of public health problems; b) Creating unprecedented conditions and unanticipated problems; c) Multiplying health threats in

the places where they are not known or aggravating existing problems. Preventing those public health problems requires the development of sustainable leadership and institutions.

In the Horn of Africa, cultural institutions and leaderships are more sustainable than imported-contemporary leaderships and institutions. The present leadership and institutions adopted Euro-American perspectives and function, believing that they entitled them to exploit human and natural resources. Hence, they are not prepared to manage and adapt to climate change. Therefore, provoking discussion and providing theoretical reasons for sustainable leadership and institutions are necessary.

14. Conclusions and Recommendations

Based on the above analyses, I make the following conclusions. First, climate change manifests as increased temperatures, flooding, higher wind speeds, and more lightning. Those extreme weather events act individually and collectively and limit people's choices in life and multiply public health problems. In the Horn of Africa, climate change is noticeable- lakes, ponds, and rivers are drying up. A scarcity of clean water, food insecurity, and dreadful competition for resources is becoming the new norm. Water-food borne diseases are becoming significant public health challenges. Those microorganisms that are responsible for water-food-borne diseases affect the shelf life of foods, and further increase food insecurity.

Second, climate change causes sea levels to rise and threaten to take over grazing and farmlands and displace people. Displacements resulting from sea rise, water scarcity, and food insecurity conditioned people to break moral ethics and find the means of survival by all means possible. Inevitably this leads to competition for resources and then conflict and instability in the region.

Third, mitigating and adapting to climate change requires leadership and institutions uniquely prepared to minimize the damage and foster a sustainable culture and culture of sustainability. Leadership and institutions are needed to produce systemic thinkers, keen on social and environmental justice who have developed a sustained morality to planetary health.

Fourth, the culture of sustainability and sustainable culture is something everyone can learn. Learning sustainable culture requires a paradigm shift of thinking. The transformation includes moving away from thinking about the natural environment as objects we need to control and exploit; we need to think of it rather as a living beauty that we need to live in harmony with. The principle of sustainable culture and culture of sustainability needs to be taught in formal and informal schooling.

Fifth, the Oromo indigenous worldview, Waqeffanna, promotes social and environmental justice, which are quintessential to the development of sustainable culture. Revitalizing such values and teaching can be one of the tools necessary to mitigate and adapt to climate change.

Sixth, in understanding that our health is directly dependent on the natural and built environments, the theoretical underpinning of the ecological model of public

health needs to be that of thinking and acting at an "upstream" level and protecting our natural world in multiple ways. For these reasons, public health professions need to emphasize that achieving health goes hand in hand with sustainable development. Promoting environmental sustainability should be one of the dominant agendas of contemporary public health leadership. The success of the future public health leaders and institutions in the Horn of Africa will be judged by their ability to provide sustainable culture and sustainable policy directions.

Seventh, the challenges that climate change poses are complex and multilayered. Understanding those threats and managing those complex challenges requires developing systemic thinking leadership and institutions.

Eighth, climate change is exerting enormous challenges, and those challenges are beyond the capacity of a few leaders and institutions. The idea of sustainable leadership and intuition includes fostering leadership and institutional developments rather than suppressing them. Encouraging leadership and institutions to develop in a financially feasible manner can help identify others' deficiencies and make timely evidence-based policy decisions possible.

Statement of Competing Interests

This paper emerged from the presentation I made at the 33rd Oromo Studies Association (OSA) Annual conference in Finfinne/Addis Ababa, Ethiopia, on July 26-28, 2019, at Rift Valley University.

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