International Journal of Business and Economics Research
www.drbgrpublications.in

Volume: 3; No: 3; September-2017. pp 347-362. ISSN: 2455-3921

Climate Change and Sustainable Development in Ethiopia

Dr.S.Sivakumar

Assistant Professor, School of Governance and Development Studies, Hawassa University, SNNPRS, Ethiopia

*Corresponding Author Email Id: ssiva123@gmail.com

Introduction

The international scenarios from scientists, academicians and global climate regimes on Environment and its relation to sustainable development have reached a consensus that the Earth's environment is changing due to human activities, and is undermining sustainable development. There is little doubt that the Earth's environment is changing on all scales from local (e.g. air, soil, and water pollution), to regional (e.g. acid deposition and land degradation) to global (e.g. climate change and loss of biodiversity).

These changes are to a large measure due to human activities, and undermine efforts to alleviate poverty and adversely affect water resources, human health, agriculture, forestry, fisheries, and ecosystems. Worse, future projected changes in the environment are likely to have even more severe consequences for sustainable development. World leaders at the 2012 United Nations Conference on Sustainable Development (Rio+20) reaffirmed their commitment to sustainable development which embraces economic progress, social development, and environmental protection for the benefit of all.

Climate change and development are intrinsically linked**.** Climate change poses a serious risk to lives and livelihoods, particularly for the world's poorest and most vulnerable populations. The impacts of climate change may reverse progress towards achieving the Millennium Development Goals now evolved in to sustainable development goals. In this sense climate change is both a development and an environmental challenge.

Climate policies can be more effective when consistently embedded within broader strategies designed to make national and regional development paths more sustainable. This occurs because the impact of climate variability and change, climate policy responses, and associated socio-economic development will affect the ability of countries to achieve sustainable development goals. Conversely, the pursuit of those goals will in turn affect the opportunities for, and success of, climate policies.

The Constitution of the Federal Democratic Republic of Ethiopia (1995) is the foundation of all policies and laws in the issue of environmental management and protection in Ethiopia. It has incorporated environmental rights as the fundamental privilege of all citizens. The right tosus tainable development is also recognized as the development trend which the country is supposed to follow. Agriculture is the source of livelihood to an overwhelming majority of the Ethiopian population (it employees more than 80% of the labor force) and is the basis of the national economy. A decrease in seasonal rainfall has devastating implications on agricultural production leading to food insecurity, malnutrition and famine.

The frequency and intensity of drought is likely to increase over the coming decades, which will present a serious threat to biodiversity, ecosystems, water, agricultural and human health. Impacts of increased climate variability and change include (1) increased food insecurity; (2) out breaks of diseases such as malaria, dengue fever and water borne diseases such as cholera and dysentery due to floods, and (3) respiratory diseases associated with droughts; (4) heavy rainfalls which tend to accelerate land degradation and damage to communication infrastructure.

Definitions and Concepts of Climate Change

There is a lack of preciseness in its definition. The term “climate change” is used by the media, funding agencies and in professional journals but without a clear and adequate definition as to what this term means. Here are a few definitions

1. Dictionary.com – climate change – a long-term change in the earth’s climate, especially a change due to an increase in the average atmospheric temperature: Melting glaciers imply that life in the Arctic is affected by climate change.

2. The EPA–Climate change is a problem that is affecting people and the environment.

Climate is usually defined as the "average weather" in a place. It includes patterns of temperature, precipitation (rain or snow), humidity, wind and seasons. Climate patterns play a fundamental role in shaping natural ecosystems, and the human economies and cultures that depend on them. But the climate we've come to expect is not what it used to be, because the past is no longer a reliable predictor of the future. Our climate is rapidly changing with disruptive impacts, and that change is progressing faster than any seen in the last 2,000 years.

Because so many systems are tied to climate, a change in climate can affect many related aspects of where and how people, plants and animals live, such as food production, availability and use of water, and health risks. Certain human activities have also been identified as significant causes of recent climate change, often referred to as global warming.

Global Warming Versus Climate Change

Global warming and climate change are often used as synonymous. But in strict usage they are different or simply mean different things to different people—and activate different sets of beliefs, feelings, and behaviors, as well as different degrees of urgency about the need to respond.

The term climate change appeared in the scientific literature before the term global warming, and has been used more frequently in peer-reviewed articles for more than forty years. For example, the closely-related term climatic change was first used in a seminal 1956 paper by Gilbert N. Plass, whereas the term global warming wasn't used until 1975 by author Wallace Broecker.

Global warming and climate change have different technical definitions, although they are often used interchangeably in popular media.

Global warming refers to the increase in the Earth's average surface temperature since the Industrial Revolution, primarily due to the emission of greenhouse gases from the burning of fossil fuels and land use change, whereas climate change refers to the long-term change of the Earth's

climate including changes in temperature, precipitation, and wind patterns over a period of several decades or longer.

Scientists have used both terms in the peer-reviewed literature for decades, but the scientific community generally prefers the term climate change, which refers to a wider range of phenomena than just the increase in global surface temperatures. The mass media, however, widely uses the terms interchangeably, with some sources stating that they do so explicitly.

From the above given definition Climate change in short it mean the long-term shift in weather patterns in a specific region or globally. Unlike global warming, which refers to just one aspect of climate change - a rise in the surface temperature of the earth's surface – climate change refers to changes in a regions overall weather patterns, including precipitation, temperatures, cloud cover, and so on.

Causes of Climate Change

The climate system includes a great deal of natural variability, and climate fluctuations have always been part of the Earth's 4.6 billion year history. However, over the past century changes in concentrations of greenhouse gases in the atmosphere are of an unprecedented rate and magnitude. Human population growth has led to increasing demands for energy and land resources. Through the burning of fossil fuels to produce energy for industrial use, transportation, and domestic power, and through land-use change for agriculture and forest products, humans have been altering the Earth's energy balance. Scientists believe that these changes may have already begun to alter the global climate

Models that account only for the effects of natural processes are not able to explain the warming observed over the past century. Models that also account for the greenhouse gases emitted by humans are able to explain this warming.

Earth's temperature depends on the balance between energy entering and leaving the planet's system. When incoming energy from the sun is absorbed by the Earth system, Earth warms. When the sun's energy is reflected back into space, Earth avoids warming. When absorbed energy is released

back into space, Earth cools. Many factors, both natural and human, can cause changes in Earth's energy balance, including: Variations in the sun's energy reaching Earth Changes in the reflectivity of Earth's atmosphere and surface Changes in the greenhouse effect, which affects the amount of heat retained by Earth's atmosphere

Recent climate changes, however, cannot be explained by natural causes alone. Research indicates that natural causes do not explain most observed warming, especially warming since the mid-20th century. Rather, it is extremely likely that human activities have been the dominant cause of that warming.

Many scientific researches shows that the increase in greenhouse gas (GHG) concentrations in the atmosphere over the last 2,000 years. Since 1750 are due to human activities in the industrial era. Because of this change on the mode of production human activities have contributed substantially to climate change by adding CO2 and other heat-trapping gases to the atmosphere. These greenhouse gas emissions have increased the greenhouse effect and caused Earth's surface temperature to rise. The primary human activity affecting the amount and rate of climate change is greenhouse gas emissions from the burning of fossil fuels.

Issues Insufficiently Addressed In The Epe

Nowadays, environmental pollution issue is becoming hot agenda throughout the world. Soil pollution, sound pollution, indoor pollution and water pollution are serious problems which didn‟t get sufficient attention equivalent to the problems.The Environmental Policy of Ethiopia considers air, water and soil pollution from industries and hazardous substances perspective. Pollution from agricultural activity such as the use of chemical fertilizers, pesticides and herbicides in agriculture are not well treated in specific manner.

A key component of environmental management is how policies, once adopted, are carried out the concept that "policies gain force through implementation" applies directly to environmental policy

As it has been argued by Serpil Savci, (2012), the nutrients contained in fertilizers will not only promote the growth of crops but also of wild plants, weeds as well as algal and aquatic plants in

rivers, lakes and the sea.As it has been cited by Forum for Environment (2011) and stated by Birgitta and Lindvall (1995), the major sources contributing to noise pollution globally are road and air transport; construction equipments and manufacturing processes. Religious institutions are also emerging as one of the sources of excessive noise. A study by Singh and Davar (2004) has, for example, shown that one of the main sources of environmental noise in Delhi, India is the use of loudspeakers in social and religious ceremonies.

` As realities in Ethiopia indicate, indoor air pollution especially in rural areas is serious environmental problem in the country, but the issue is not well addressed in the policy document. Damage usually results from nitrogen and phosphorus in excess. In recent years, fertilizer consumption increased exponentially throughout the world, causes serious environmental problems. Fertilization may affect the accumulation of heavy metals in soil and plant system. Plants absorb the fertilizers through the soil; they can enter the food chain. Thus, fertilization leads to water, soil and air pollution. Environmental noise is emerging as one of the major problems in the cities of developing countries including Ethiopia. In Ethiopia, noise Pollution is governed under the Environmental Pollution Control Proclamation 300/2002 and other laws) But it is not clearly defined in EPE.

Furthermore, when filled with rainwater, plastic bags become breeding grounds for mosquitoes, which cause malaria. In addition, plastics take many years (20-1000) to degrade and hence pose a disposal challenge. Heavy use of most nitrogen and some other fertilizers can lead to soil acidification and brings change in biological and physical soil properties.

Increased concentration of heavy metals can have adverse effect on soil life. Therefore, the EPE needs to indicate the discriminate use of inorganic fertilizer. When we deal about environment, soil pollution should be one of the focus areas. Soil pollution is caused by the presence of man-made chemicals or other alteration in the natural soil environment. This type of contamination typically arises from the rupture of underground storage links, application of pesticides, and percolation of contaminated surface water to subsurface strata, oil and fuel dumping, leaching of wastes from landfills or direct discharge of industrial wastes to the soil.

The most common chemicals involved are petroleum hydrocarbons, solvents, pesticides, lead and other heavy metals. The environmental policy of Ethiopia focuses more on soil degradation than soil pollution which is becoming serious problem of the environment.

Plastic waste is a major environmental and public health problem, particularly in the urban areas. Plastic shopping or carrier bags are one of the main sources of plastic wastes. Plastic bag wastes contribute to blockage of drains and gutters, are a threat to aquatic life when they find their way to water bodies, and can cause livestock deaths when the livestock consume them.

The general levels of nutrients in excess of those normally present in natural ecosystems will result in considerable disturbance to plant and animal communities, and these may be undesirable from the viewpoint of conservation, aesthetics, or recreation.

To sum up, EPE is believed to be well designed, comprehensive and addresses major environmental concerns regardless of minor issues to be considered in the future. It addresses implementation principles, evaluation and policy review and explicitly recognizes participatory management. What is critical to EPE is its implementation. As one can observe on the ground, there are high implementation gaps.

These gaps might be related to the capacity (lack of professionals, facilities, and finance) of respective institutions at each level, especially from region to woreda.

The main greenhouse gases

The most important GHGs directly emitted by humans include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and several others. Water vapor, Tropospheric ozone (O3), Chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6), together called F-gases, are often used in coolants, foaming agents, fire extinguishers, solvents, pesticides, and aerosol propellants. Unlike water vapor and ozone, these F-gases have a long atmospheric lifetime, and some of these emissions will affect the climate for many decades or centuries.

Other Climate Forcers

Particles and aerosols in the atmosphere can also affect climate. Consequently, the causes of climate change can be grouped into two categories. These are natural and manmade causes; The primary cause of climate change is the burning of fossil fuels, such as oil and coal, which emits greenhouse gases into the atmosphere—primarily carbon dioxide. Other human activities, such as agriculture and deforestation, land-use change also contribute to the proliferation of greenhouse gases that cause climate change.

Ethiopia's Contribution to Climate Change

The GHG emissions per capita in 1994 totaled to 900 kg CO2 equivalent per capita and year. Compared to other countries, Ethiopia's emissions are very low (e.g. the U.S. emissions amount to 23.7 tones CO2 equivalent per capita and year in 1994). Sector wise, Ethiopia's GHG emissions are dominated by agriculture, which contributes 80% of the total GHG emissions. This reflects the fact that livestock farming goes together with high methane emissions. The dominant position of livestock farming in Ethiopia's economy also influences the relative contribution of GHG to the total emissions. These are dominated by methane emissions, which account for 80% of the warming potential.

In addition to agriculture, the energy sector (heating, cooking, and transport) contributes to the total GHG emissions with 15%. 95% of the energy consumption is satisfied by biomass sources (mainly wood); petroleum and electricity are of minor importance. Ethiopia's GHG emissions are closely linked to basic needs of the population: Food production (through livestock farming) and heating. Therefore, the future GHG emissions will likely increase with the projected increase in population.

Effects of Climate Change

Evidently, climate change is an added stress to already threatened habitats, ecosystems species and agricultural production in both developed and developing countries but the problem is sever in

Africa. Since, agricultural production relies mainly on rainfall for irrigation and will be severely compromised in many countries, particularly for subsistence farmers in sub-Saharan Africa.

Ethiopia is not the exception. Like the rest of the developing countries, it has been affected and is vulnerable to climate change. Yes, the frequent drought, the heat wave and rain pattern changes of the country are good examples. Adaptation to climate change in developing countries is vital and needs to be given urgent priority.

The rise in global temperature is of great concern for all of us in the planet for it will - and has already started - putting the required aspects of human race at great risk. It is also obvious that increasing temperatures - as well as extreme weather events - have a very negative effect on production.

Impacts of Climate Change in Ethiopia

Climate change is already causing loss of life, damaging property and affecting livelihoods in many parts of the world, and it is expected to continue to do so in the future. Climate change will affect all nations, but the impact will be higher on low-income countries, such as Ethiopia, which have limited capacity to cope with the effects of a changing climate. The impacts of climate change in Ethiopia can be looked from different angles; on human health, the environment, agriculture, water supply, sanitation and socio-economic activities.

Climate change impacts on human health

The health impacts of climate change can be direct or indirect. The *direct* health impacts occur when climate changes in the temperature, precipitation and weather extremes affect our health and survival directly. For example, very hot weather can cause heat-related illness such as heat exhaustion and heat stroke; and floods can cause injury and drowning. These direct effects are predicted to increase as the rate of climate change increases in the future.

The *indirect* health impacts of climate change are health problems caused by changes in natural and social systems as a result of shifts in the climate, which in turn have adverse effects on

human health. Changes to social and ecological systems can allow disease to spread more easily, or cause disease to emerge in areas where previously it was unknown or only present at low levels

Climate change is expected to increase the frequency of waterborne and food-borne infectious diseases in countries like Ethiopia because of the inadequate supply of safe drinking water, low sanitation coverage and poor hygiene practices.

Climate change impacts on the environment

Climate change has several impacts on the environment in addition to the disruption to water resources. Increased heavy rainfall as a result of climate change can cause soil erosion, crop damage and water logging, which makes the land difficult or impossible to cultivate for agriculture. It is estimated that Ethiopia loses more than 1.5 billion tons of fertile soil each year through heavy rain and flooding; this lost soil could have increased the country's crop production by an estimated 1.5 million tons. Soil erosion aggravates the problem of food security in the country.

Climate change is also expected to affect biodiversity significantly, because it will change the environment and climatic conditions where plants and animals live. In Ethiopia, the unique environments that support our already endangered species are becoming less hospitable because climate change is causing longer dry periods and shrinking the available water resources.

Climate change effects on agriculture, livestock and the Ethiopian economy

Climate change poses huge challenges to the global economy and to social development. Its impacts will disproportionately affect sub-Saharan African countries such as Ethiopia because their economies are highly dependent on climate-sensitive activities such as rain-fed agriculture. In Ethiopia, agriculture contributes about 47% of the country’s Gross Domestic Product (GDP) and more than 70 million people (85% of the Ethiopian population) depend on agriculture directly or indirectly for their livelihoods. Therefore, any effect on agriculture will significantly affect the Ethiopian economy.

The impacts of climate change on the environment could also reduce the national income from the export of agricultural products such as coffee, pulses and flowers. Of particular concern is the possible impact on Ethiopia's famous Arabica coffee, which is exported all over the world. Coffee plants are very sensitive to climate change and there are concerns that Arabica coffee production could become impossible in Ethiopia by the end of this century if the change continues at the current rate.

Ethiopia is home to Africa's largest livestock population, and is the world's tenth-largest producer of livestock and livestock products which make up about 10% of the country's foreign currency earnings. Frequent and extensive droughts in the country have a considerable effect on Ethiopia's livestock because decreased rainfall shrinks available water resources and reduces the productivity of grassland and rangeland.

In addition to affecting agriculture and livestock, floods can cause huge damage to property, livelihoods and infrastructure. This occurred in the 2006 floods in Dire Dawa city which was the worst flooding that costs thousands of peoples life, estimated tens millions ETB from property damage and it displaced large number of peoples.

Climate change impacts on water resources

Climate change leading to increased surface temperatures, melting of snow and glaciers, rise in sea level and an increase in extreme weather events such as droughts and floods, can significantly affect water resources. As global warming increases the evaporation of water into the atmosphere and changes the patterns of major air streams and ocean currents such as El Niño and La Niña. This in turn alters the distribution of precipitation, so some regions experience greater rainfall and flooding while others become more prone to droughts.

Climate change impacts on sanitation and hygiene

Flooding due to climate change is expected to affect sanitation because it damages drainage infrastructure and wastewater treatment facilities. During flooding, the flood water can burst sewer lines, where they exist, and overwhelm waste treatment plants. In other areas, pit latrines and septic

tanks are liable to overflow. Sanitation facilities in urban and slum areas are highly vulnerable to flooding because they are often poorly designed and constructed.

Drought and water shortages also have considerable impact on sanitation and hygiene. Nowadays, an increasing number of households in better-off urban areas use water-flush toilets, which require several litres of water to flush human excreta into a septic tank or sewer. It is important to notice, however, that other factors threaten the livelihoods of Ethiopian communities as well. For example resource degradation and the overexploitation of natural resources such as fire wood is one of the key issues in association with the environmental decline.

Legislative Measures

Incorporation of environmental rights under the Constitution, adoption of Environmental Policy and the Conservation Strategyof Ethiopia,ratification of multilateral environmental Conventions, establishment of the Environmental Protection Authority are some of the basic moves towards heading for environmental protection and sustainable development in Ethiopia.

The environmental crises, however, may continue despite the taking of all the above-mentioned measures. This is because all the said measures are of a framework nature and thus they cannot implement themselves. They need the formulation and implementation of laws, standards and guidelines.

Therefore, the third stage marks the formulation of environmental protection laws so as to the objectives fixed by the Constitution and the Environmental Policy as well as the Conservation Strategy of Ethiopia and the environmental Conventions to which Ethiopia is a party. In this regard the Council of Ministers has recently deliberated upon and adopted the following draft environmental laws submitted to it by the Environmental Protection Authority.

Proclamation on The Establishment of Environmental Protection Organs

The main aim of the draft law is to establish a system that fosters coordinated but differentiated

responsibilities among environmental protection agencies at federal and regional levels so as to foster sustainable use of environmental resources, thereby avoiding possible conflicts of interests and duplication of efforts.

Environmental Impact Assessment Proclamation

Environmental impact assessment is used to predict and manage the environmental effects that a proposed development activity might entail and thus helps to bring about intended development. Furthermore, assessment of possible impacts on the environment prior to the approval of a public instrument is recognized as providing an effective means of harmonizing and integrating environmental, economic, cultural and social considerations into a decision making process in a manner that promotes sustainable development.

To this end the draft law is prepared to facilitate the implementation of the environmental rights and objectives enshrined in the Constitution and the maximization of their socio-economic benefits by predicting and managing the environmental effects which a proposed development activity or public instruments might entail prior to their implementation.

Environmental Pollution Control Proclamation

The draft law recognizes the fact that some social and economic development endeavors may inflict environmental harm that could make the endeavors counter-productive. It also underlines the fact that the protection of the environment, in general and the safeguarding of human health and wellbeing, as well as the maintaining of the biota and the aesthetic value of nature, in particular, are the duty and responsibility of all. To this end the draft law aims to eliminate or, when not possible, to mitigate pollution as an undesirable consequence of social economic and poletical condition.

Solutions to Climate Change

There is no single solution to climate change, which is primarily a problem of too much heat-trapping carbon dioxide (CO2), methane and nitrous oxide in the atmosphere. The technologies and approaches outlined below are all needed to bring down the emissions of these gases by at least 80 percent by mid-century. Boosting energy efficiency, Greening transportation**(**switching to low-carbon fuels and promoting efficient mass transportation systems), Exploring nuclear, Revving up renewable(such as solar, wind, geothermal and bio energy), Phasing out fossil fuel electricity, Managing forests and agriculture(by reducing emissions from deforestation and forest degradation and by making our food production practices more sustainable), Developing and deploying new low-carbon and zero-carbon technologies(Current research on battery technology, new materials for solar cells, harnessing energy from novel sources like bacteria and algae, and other innovative areas) and Ensuring sustainable development.

Conclusion

Reconciling climate and sustainable development is a contemporary burning issue; that the world faces common challenges, the solutions must be shared. Since no country is immune from the complex challenges of climate change. There is need to have a new momentum that is crucial to reach an agreement which integrates sustainable development needs with climate change. With regard to these context climate changes in Ethiopia are a constraining factor for sustainable development and improvement of people's livelihoods. Continued climate change is expected to increase climate variability and the incidence of extreme weather events (e.g. droughts, floods) which will further degrade the country's ecosystems.

The main drivers behind Ethiopia's environmental degradation include the high population growth, high urbanization rates as well as a rapid economic growth that is largely driven by agricultural production, infrastructure expansion and increasing energy demand. Furthermore, institutions have insufficient capacity to prevent and manage the major environmental issues, and there are gaps between political environmental commitments and actual implementation to improve environmental outcomes.

Although capacity is still limited, the Ethiopian government has shown considerable political will regarding its environmental problems, by e.g. establishing environmental protection agencies at federal level and in all regional states, as well as formulating various environmental proclamations and ratifying important environmental conventions, and promoting environmental investments. Benefits of building resilience can be seen in Ethiopia's Productive Safety Nets Programme (PSNP).

Ethiopia's high ambitions and efforts to promote sustainable development are also manifested by the establishment of the national strategy Climate Resilient Green Economy (CRGE). However, Ethiopia faces many challenges in terms of lack of human and financial capacity, green technology know-how and proliferation. Environmental governance needs to be improved at all levels. Weak capacity in environmental management, and insufficient law enforcement and monitoring are key challenges that need to be addressed in order to meet SDG targets and move towards a greener economy.

References

EPA (2011).Ethiopia's Vision for a Climate Resilient Green Economy.The path Way to Sustainable Development, Addis Ababa, Ethiopia.

EPA (2012).National Report of Ethiopia, the United Nations Conference on Sustainable De velopment (Rio + 20). FDRE, Addis Ababa.

EPA, 2004. Environmental Impact Assessment Guideline On Pesticides.

EPA/UNEP (2008): Ethiopian Environment Outlook: Environment for Development. Ad dis Ababa,Ethiopia

FDRE.(1995, August 21st).The Constitution of Federal Democratic Republic of Ethiopia.

Forum for Environment (2010).Ethiopian Environment Review, Addis Ababa, Ethiopia.

Forum for Social Studies (2008).Digest of Ethiopia's National Policies, Strategies and Program s, Addis Ababa, Ethiopia.

Ajibade, L.T (2003) A Methodology for the Collection and Evaluation of Farmers' Indigenous

AkliluAmsalu (2006). Caring for the land: best practices in soil and water conservati Beressawatershed, Highlands of Ethiopia.Wageningen University and Research Center, the Neth erlands.Tropical.

AlemayehuHailemicaelMezgebe (2012): Indigenous talents of Konso people to cope up clim ate change susceptibility, Ethiopia

Belay, K., Beyene, F. & Manig, W. 2005. Coping with drought among pastoral and agropastoral communities in eastern Ethiopia. Journal of Rural Development.

CSA (Central Statistics Authority). 1997. The Federal Democratic Republic of Ethiopia Statistical abstract. Addis Ababa, Ethiopia.

Deressa, T. 2007. Measuring the economic impact of climate change on Ethiopian agriculture: Ricardian approach. World Bank Policy Res. Paper No. 4342. World Bank, Washington, DC.

FAO. (2009). 'Grasslands: enabling their potential to contribute to greenhouse gas mitigation.' Grasslands Carbon Working Group Report. (Accessed at <www.fao.org/agriculture/crops>)

GOE (Government of Ethiopia). 2009. Disaster Prevention and Preparedness Agency. Humanitarian Requirements-2009: Joint Government and Humanitarian Partners' Document. Addis Ababa, Ethiopia

IFAD. (2009). Livestock and Climate Change thematic Livestock paper (available at htt p: //www. ifad.org/lrkm/events/cops/papers/climate.pdf)

IPCC Fifth Assessment Report, 2013. Accessed October 2016.

http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf

www.epa.gov/climate

www.partnershipsresourcecentre.org