



CLIMATE SMART AGRICULTURE STRATEGIES FOR ZAMBIA - ANALYSIS OF POLICIES AND PROGRAMMES

PREPARED BY:

RESEARCH:

Albert Kasoma (Senior Researcher) with the support of **Bernadette Deka Zulu** (Executive Director)

TECHNICAL REVIEW:

Salim Kaunda (Head of Research and Analysis)

EDITORIAL TEAM:

Brian Sambo Mwila (Communication Specialist) **Layout and Design**
Melody Simukali (Head of Communication and Grants) **Editorial**

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ABBREVIATIONS AND ACRONYMS

AR4	Fourth Assessment Report of IPCC
CA	Conservation Agriculture
CO ₂	Carbon dioxide
CO ₂ eq	CO ₂ equivalent (using the GWP-100 metric of AR4)
CSA	Climate Smart Agriculture
EDGAR	Emissions Database for Global Atmospheric Research
GDP	Gross Domestic Product
GHG	Green House Gas
GWO-100	Global Warming Potential over a 100 years period
JRC	Joint Research Centre of the European Commission
Mt	Megatonnes (10 ⁶ tonnes or 1 tera gramme) mass of a given (greenhouse gas) substance
n/a	Not Available
NPCC	National Policy on Climate Change
T	Tonne (1 t or 1 mega gramme) mass of a given (greenhouse gas) substance



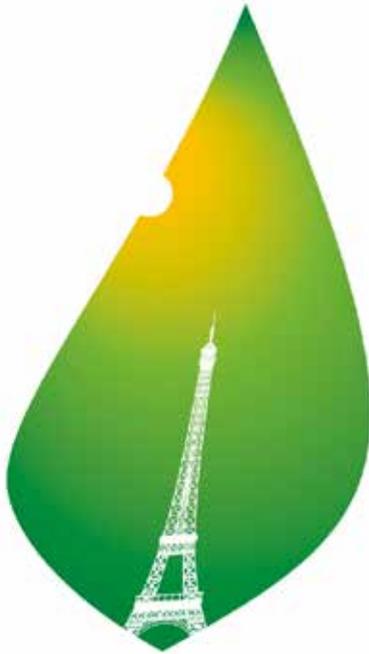
Source image: <https://www.openzambia.com/lifestyle/2019/2/4/drought-hit-southern-province-receives-relief-food>

EXECUTIVE SUMMARY

Statistics from the Living Conditions Monitoring Survey of 2015 show that over 50% of the population live below the poverty line. This vulnerable population does not have sufficient capacity to cope with, or adapt to the impacts of extreme weather events. One of major contributors to extreme weather patterns has been deforestation. The country's forest cover has been lost due to **massive deforestations with losses in excess of 79,000 hectares of forest cover per annum** (Integrated Land Use Assessment Report, 2016).

To effectively cope with climate change, there is need to develop adaptation and mitigative measures to address climate change. At the national level, Government has developed national strategies and attempted to domesticate some international interventions. Key among the several noticeable strategies include the following; **Climate Change Policy (2016); The Zambia's National Climate Change Response Strategy (2010); National Policy on Environment (2009), National Strategy for Reducing Emissions from Deforestation and Forest Degradation (REDD+) 2015 among others.**

At a global level Zambia is a signatory to the **Paris Climate Change Agreement** through the United Nations Framework Convention on Climate Change (UNFCCC) where countries have committed themselves to implement ambitious efforts to combat climate change and adapt to its effects while promoting sustainable development.



COP21 • CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

This paper relied on desk review and key informant interviews to look at how the country has attempted to mainstream promotion of sustainable agriculture and climate smart agriculture in various policy documents.

Source logo: <https://www.un.org/sustainabledevelopment/climate-action/>

Recommendations

In order to encourage adoption of Climate Smart Agriculture (CSA), due consideration needs to be given to the following recommendations;

- The Ministry of Agriculture (MOA) and other stakeholders need to upscale field schools among small scale farmers to effectively promote the adoption of climate of CSAs.
- MOA needs to adequately package Zambia Metrological Department (ZMD) information and distribute to those farmers that would be the most affected by crop failure and there is need to narrow the communication gap between the ZMD and District authorities at different levels.
- Government through the Ministry of Finance (MOF) and MOA needs to provide tax incentives on all farming inputs that enhance CSA approaches such as subsidized organic fertilizers, zero tax rates on selected farm equipment and inclusion of starter packs for agroforestry. Both the Fertilizer Input Support Programme (FISP) and Agroforestry should have in-built incentive measures that award adopters.
- MOA needs to employ more extension staff to meet the recommended ratio of 400:1 farmer to one extension officer. Extension officers play a key role in training farmers on CSA practices and in building resilience against climate change effects.
- Successful adoption of CSAs such as Conservation Agriculture (CA) having been linked to land rights. In this vein the Government is urged to address the issue of land rights by improving the land titling procedure and waiting time.
- In all sustainable land approaches in the Agriculture sector, Government is urged to use the landscape approach that takes into account the multiple functions of land and other ecosystems. The approach ensures that the best possible balance is achieved among a range of different development objectives, including **climate change mitigation** and **adaptation, environmental and biodiversity conservation, enhanced economic productivity, and improved livelihoods**.
- We urge Government to extend carbon tax to all other sectors that use fossil fuels as opposed to motor vehicle carbon tax only. Carbon tax can serve both purposes of mitigation and adaptation. The resources realized from the tax can be utilized to promote Climate Smart Agriculture (CSA) practices and provision of relief food to families worst hit by the impacts of climate change. Carbon tax is a Pigovian tax since it returns the cost of global warming to their producers and can consequently reduce carbon emissions as a mitigative measure. Zambia can learn from South Africa who in May 2019 enacted a long-delayed carbon tax into law as one of the continent's worst polluters.

INTRODUCTION

Climate change refers to a large-scale, long-term shift in the planet's weather patterns and average temperatures. **Since the mid-1800s, humans have contributed to the release of carbon dioxide and other greenhouse gases into the air.** This causes global temperatures to rise, resulting in long-term changes to the climate.

Climatic hazards caused by climate change and extreme weather events are a threat to economic growth and development in the world and Zambia in particular. **Droughts and floods have, adversely impacted on food security, water, health, energy and the sustainable livelihoods of rural communities.**

Source: <https://sadcnnews.org/2019/12/25/drought-left-zambia-and-zimbabwe-in-the-darkness/>

For the population living below the poverty line, they do not have sufficient capacity to cope with, or adapt to, the impacts of extreme weather events. Therefore, there is need to develop adaptation and mitigative measures to address climate change.

The global community and the Zambian Government in particular, has developed strategies and policies that present the bare minimum number of activities that must be implemented with urgency in order to enable vulnerable communities cope with the adverse effects of climate change. The implementation of these activities has to some extent significantly reduced the negative impacts of climatic hazards on vulnerable communities and areas, and assured sustainable livelihood for these communities. These strategies range from Paris Climate Change Agreement and the United Nations Framework Convention on Climate Change (UNFCCC) at a global level, to other policies and strategies such as the National Policy on Climate Change, National Strategy for Reducing Emissions and Seventh National Development Plan (7NDP) at the national level among others.

With such strategies and policies in place, there is need to further investigate and determine the extent to which these strategies and policies have been implemented and the extent to which vulnerable communities have developed resilience to climate change. Research is crucial in order to synthesize climate change knowledge, impacts, and trends across Zambia and sectors to inform decision making and resilience-building activities across the country.

BACKGROUND

Zambia's population has been on the rise from **8 million in 1994 to 15.5 million in 2015 and projections point to 22 million by 2030**. The majority of this population is rural based with 58.2 % residing in the rural area¹.



Poverty levels are high and account for 54.4 % of Zambia's population; The rural poverty is even worse at 76.6 % compared to 23.4 % in urban areas². The majority of the population depend on agriculture for their livelihoods. Agricultural activity is the main economic activity engaged in by 58.5 % of households which can further be broken down as 89.4 % of households in rural areas and 17.9 % in urban areas³.

It must be noted, however, that Zambia's climate has been highly variable over the last few decades characterized by a series of climatic extremes, e.g. droughts, seasonal floods and flash floods, extreme temperatures and dry spells, many of these with increased frequency, intensity and magnitude⁴.

Temperatures have been on the rise while precipitation (rainfall) has dropped. Mean annual temperature has increased by 1.3°C since 1960, at an average rate of 0.29°C per decade. Daily temperature observations show significantly increasing trends in the frequency of hot days and nights in all seasons. Average annual rainfall over Zambia has decreased by an average rate of 1.9mm per month per decade since 1960 primarily due to rainfall decreases from December to February⁵.

Evidence indicates that Zambia has contributed to climate change by her engagement in massive deforestation. Forests are important in absorbing carbon dioxide, which is a product of fossil fuel combustion and has been responsible for

1. Zambia Statistics Agency, 2015 Living Conditions Monitoring Survey (LCMS) (Lusaka,Zambia, 2015).
2. Zambia Statistics Agency.
3. Zambia Statistics Agency.
4. Suman Jain, An Empirical Economic Assessment of Impacts of Climate Change on Agriculture in Zambia, The World Bank ,Development Research Group WPS4291, 2007.
5. Irish Aid-Resilience and Economic Inclusion Team, Zambia Climate Action Report for 2016, 2017.

global climate change. The country's forest cover is estimated at 45.9 million hectares or approximately about 60 % of the total landmass of Zambia. However, currently the country loses about 79,000 to 150,000 hectares of forests per year ⁶.

In order to mitigate⁷ and adapt⁸ to effects of climate change, global and country level policy instruments have been developed to coordinate interventions. Several of such policies in Zambia have focused on the promotion of climate smart agricultural practices (CSAs). While Zambia has been considered a leader in promoting Conservation Agriculture (CA) in Sub-Saharan Africa, adoption of the practice by smallholders has been generally low and characterized by partial adoption; as well as high dis-adoption rates of up to 95% of farmers in some locations⁹. The Seventh National Development Plan (7NDP) acknowledges that the limited knowledge and capacity of farmers to maintain the practices after initial support, are some of the drivers of low adoption and high dis-adoption rates¹⁰. **Additionally, farmers usually have to wait for multiple seasons to reap the benefits of the practice, and in some land holdings, crop residues are valued more for animal feed rather than for soil cover, making the investment less attractive to smallholders.**

IMPACT OF CLIMATE CHANGE ON GROSS DOMESTIC PRODUCT (GDP)

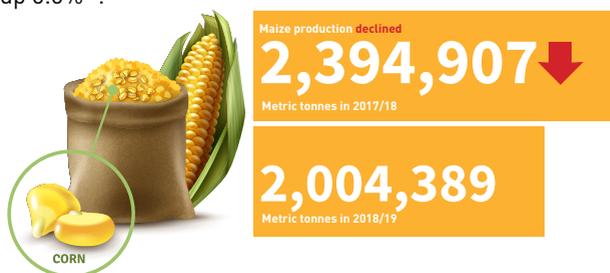
Climate change variation has led to reduced power generation due to changes in the hydrological cycle of most hydro power generation plants in Zambia which accounts for 82% of total installed generation capacity in Zambia¹¹. The reduced power generation has had some adverse effects on the economy. For instance, the country was forced to import power especially between 2014 to 2016. By November 2019, ZESCO had increased the extent of load shedding to fifteen (15) hours a day for the majority of its household, commercial and industrial consumers¹². **The economic impact has been severe, with key economic sectors such as mining, manufacturing and agricultural sectors scaling down production and employment, as the intensity of the blackouts increased and imported energy became expensive.** During periods of prolonged load shedding even small enterprises resort to reducing their work outputs resulting in reduced turnover whilst incurring additional costs such as idle labour and overtime. Some enterprises suffer losses due to equipment damage and high replacement costs¹³. One estimate of the **economy-wide effects indicate that economic losses were equivalent to around 18.8% of annual GDP of which 1.6 % was loss to the Agricultural GDP**¹⁴.

6. Forestry Department- Ministry of Lands and Natural Resources, Integrated Land Use Assessment Phase II, 2017.
7. Mitigation refers to efforts that seek to prevent or slow down the increase of atmospheric Green House Gases (GHG) concentrations by limiting current and future emissions and enhancing potential sinks for greenhouse gases
8. Adaptation refers to actions aimed at managing the known and unknown impacts of climate. This can be achieved by mainstreaming climate change adaptation at all levels to enhance the resilience of rural communities and ecosystems against climate shocks.
9. Ministry of National Development Planning-Zambia, Seventh National Development Plan -2017-2021.
10. Ministry of National Development Planning-Zambia.
11. Energy Regulation Board (ERB), Energy Sector Report for 2018.
12. Lusaka Times-Online Publication, 'Current Load Shedding of 15 Hours to Remain - ZESCO', Lusaka Times-Online Publication, 30 October 2019 <<https://www.lusakatimes.com/2019/10/30/current-load-shedding-of-15-hours-to-remain-zesco/>>.
13. Alfred Mwila and others, Impact of Load Shedding on Small Scale Enterprises, Energy Regulation Board (ERB), Working Paper (Lusaka, 2017).
14. Paul Samboko and others, The Impact of Power Rationing on Zambia's Agricultural Sector, IAPRI Working Paper (Lusaka, 2016).

IMPACT OF CLIMATE CHANGE ON AGRICULTURE

Climate Change in Zambia has also negatively impacted the Zambian agricultural sector vis-à-vis an **increase in the incidence of hunger due to destruction of crops, reduction in cultivatable land and increased soil erosion**. On an economic outlook, the production of staple crops which include maize, millet, sorghum and rice has been dropping steadily in recent years.

According to the Crop Forecast for the 2018/19 Agriculture Season, **Maize production declined from 2,394,907 metric tonnes in 2017/18 farming season to 2,004,389 metric tonnes in 2018/19 accounting for 16% decline in production due to climate change** effects that led to prolonged dry spells¹⁵. Out of the total production of maize small and medium scale farmers contributed 94.5% while large scale farmers took up 5.5%¹⁶.



Electricity is key to improving agriculture production, food security and boosting agribusinesses. Agriculture uses electricity to operate machinery and equipment, to heat or cool buildings, for lighting on the farm, for irrigation and indirectly in the production of fertilizers and other chemicals produced off the farm. The Seventh National Development Plan (7NDP) indicates that most rural parts of Zambia have low access to electricity and have poor road networks to attract investment and contribute effectively to diversification and job creation, especially in the agriculture sector¹⁷. The increased extent of load shedding to fifteen 15 hours a day is only worsening the state of vulnerability of rural farmers.

Farming has been highlighted as a significant contributor to climate change, but it has also been affected by negative effects such as the two main greenhouse gasses, methane and nitrous oxide, which are released in high amounts during crop and animal production. In aiming to reduce these greenhouse gasses, farmers need to adopt farming practices that will not harm nature or negatively affect the climate. These farming practices include Climate Smart Agriculture techniques such as Conservation Agriculture (CA). CA is an approach which includes a set of practices which conserve the soil, water, soil moisture, enhance fertilizer and seed use and in turn saves money and time.

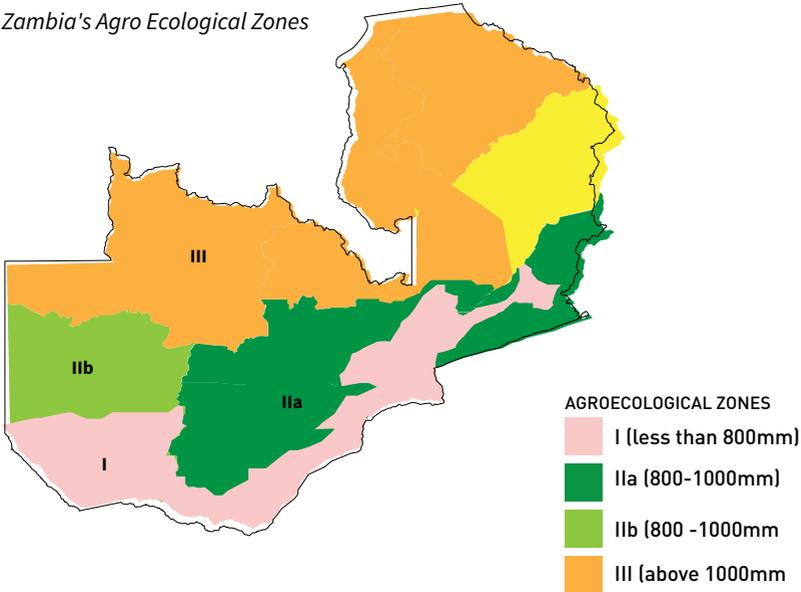
15. Ministry of Agriculture, Ministerial Statement by Minister of Agriculture, Honourable Michael Katambo on Crop Forecasting Survey & Food Security Status for the 2019/2020 Agriculture and Marketing Season., 2019.

16. Ministry of Agriculture, Ministerial Statement by Minister of Agriculture, Honourable Michael Katambo on Crop Forecasting Survey & Food Security Status for the 2019/2020 Agriculture and Marketing Season.

17. Ministry of National Development planning-Zambia.

When it comes to adaptation measures in the agricultural sector, since Climate Change is already running its course, the Zambian Government is urged to encourage more farmers to find means of improving sustainable agricultural practices. Data from the 2015 national representative Rural Household Survey, conducted by IAPRI found that only 8.8% of smallholder households adopted Conservation Agriculture (CA) as a climate smart agriculture technique in the 2013/'14 farming season¹⁸. **The rates were however, slightly higher in areas that were affected by climate change effects such as the Agro-Ecological Zone I and II, in the southern parts of the country**, where 11.7% of farmers adopted Conservation Agriculture as a climate smart technique ¹⁹.

Zambia's Agro Ecological Zones



Average Annual Temperatures

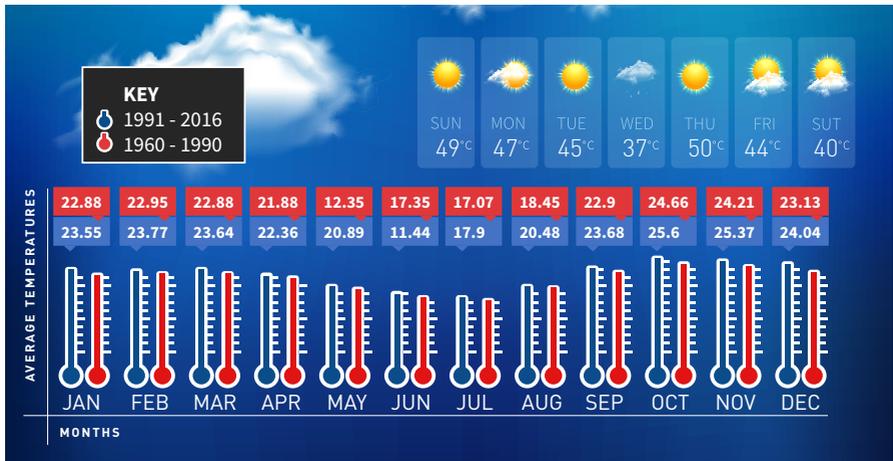
The average number of 'hot' days per year in Zambia has increased by 43 (an additional 11.8% of days) between 1960 and 2003. The frequency of cold days and nights has decreased since 1960 in all seasons and the average number of 'cold' days per year has decreased by 22 (6% of days) between 1960 and 2003²⁰. Figure 1 shows that the average temperature for each month in a calendar year has increased when comparing periods 1960-1990 and 1991-2016.

18. Olipa Zulu-Mbata, Antony Chapoto, and Munguzwe Hichaambwa, What Drives Conservation Agriculture Adoption among Smallholder Farmers What Drives Conservation Agriculture Adoption among Smallholder Farmers in Zambia?, Indaba Agriculture Research Institute (IAPRI) Working Paper [Lusaka, 2018].

19. Zulu-Mbata, Chapoto, and Hichaambwa.

20. World Bank Group, 'Climate Knowledge Portal.', World Bank Group Web Page, 2019 <<https://climateknowledgeportal.worldbank.org/country/Zambia/climate-data-historical>> [accessed 11 November 2019].

Figure 1: Average monthly temperature



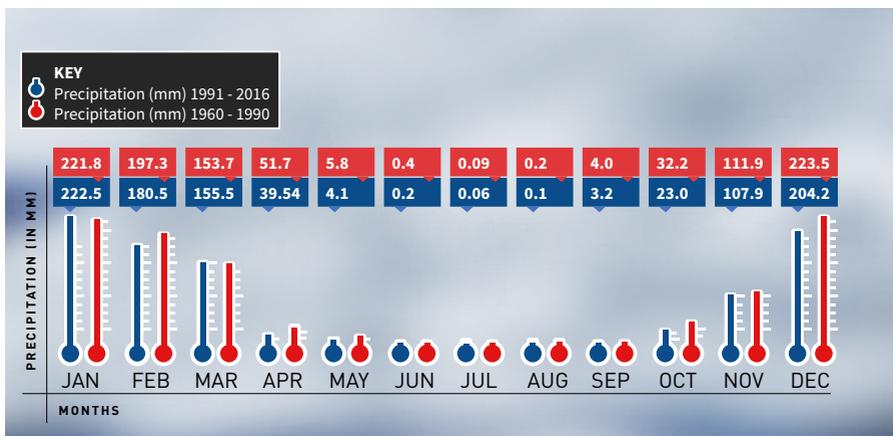
Source: generated using World Bank Group data, Climate Knowledge Portal. Available at <<https://climateknowledgeportal.worldbank.org/country/zambia/climate-data-historical>>

Average Annual Precipitation

Mean annual rainfall over Zambia has decreased by an average rate of 1.9 mm per month (2.3%) per decade since 1960. This is largely due to decreases in December-February rainfall (or part of the wet season), which has decreased by 7.1 mm per month (3.5%) per decade²¹.

Figure 2 indicates that the average monthly precipitation for the months of September, October, November, December and February have reduced when comparing periods 1960-1990 and 1991-2016.

Figure 2: Average Annual Precipitation



Source: generated using World Bank Group data, Climate Knowledge Portal. Available at <<https://climateknowledgeportal.worldbank.org/country/zambia/climate-data-historical>>

21. World Bank Group.

POLICY DOCUMENTS ON CLIMATE CHANGE

To lessen the impact of climate change on agricultural livelihoods, the Government of the Republic of Zambia has put in measures as spelt out in several policy documents with the aim of streamlining and promoting sustainable agriculture including Climate Smart Agriculture (CSA) to guarantee livelihoods. Several interventions have been spelt out in various policy documents, among others the following:

The Paris Climate Change Agreement



The Paris Agreement is the world's first truly global plan to address climate change. The UN climate agreement was adopted at COP21 in 2015, demonstrating the world's collective willingness to take urgent action towards climate change. **The unprecedented pact urges nations to pursue every effort to limit global temperature increase to well below 2°C – and aiming for 1.5°C – to stave off some of the worst impacts of climate change on people's livelihood including reduced agricultural output²². The overwhelming evidence is that global warming is mostly man-made – it is largely due to burning fossil fuels and large-scale deforestation – it is not a natural process.**



President Edgar Chagwa Lungu signed the Paris Agreement on Climate Change during the UN Treaty Signing Event at the United Nations General Assembly in New York USA on Tuesday 20 September 2016²³. However, much more needs to be done, to domesticate many more provisions of the Paris Climate Change agreement to effectively contribute to the reduction of greenhouse gas emissions and limit the global temperature increase to below 2 degrees Celsius.

22. United Nations (UN), 'Goals of the 2030 Agenda for Sustainable Development.', United Nations Web Page, 2016 <<https://www.un.org/sustainabledevelopment/climate-action/>> [accessed 12 November 2019].

23. National Assembly of Zambia, Speech for the Official Opening of the Fourth Session of the Twelfth National Assembly by President Edgar Lungu, 2019.

Seventh National Development Plan (2017-2021)

Zambia has taken several steps to integrate issues of climate change and agriculture into national development planning by ensuring that sustainable agricultural practices such as Climate Smart Agriculture (CSA) practices form part of the country's national adaptation goals and commitments.



In an effort to adapt and mitigate the effects of climate change on the agriculture sector, the Government through the Seventh National Development Plan (7NDP) intends to promote the adoption of agricultural environment-friendly practices (**climate smart and organic techniques**) such as conservation farming, crop rotation, less use of chemical fertilizer and creating public awareness on the adverse effects of climate change²⁴. In the 2020 budget presentation, the Government intends to zero rate VAT on the importation of equipment to be used in the manufacturing of organic fertilizers²⁵. Use of organic fertilizer is climate smart and helps to eliminate soil and water contamination from artificial fertilizers.

In addition, the 7NDP recognizes that “organic crops advantages” including the currently low use of chemical fertilizer will allow Zambia to leapfrog to high productive organic fertilizer use and techniques, which receive a premium price on the world market. This will create local value addition in organic fertilizer production, increase organic crop export revenues and reduce the import bill from chemical fertilizers.

24. Ministry of National Development Planning-Zambia.

25. National Assembly of Zambia, 2020 Budget Address by Honourable Dr.Ng'andu, Minister of Finance, Delivered to the National Assembly on Friday 27th September, 2019, 2019.

National Agriculture Policy 2016

One of the objectives of the Second National Agricultural policy²⁶ of Zambia is to mainstream all issues of the environment and climate change into the agriculture sector. Some of the measures put in place to achieve this include;

1. Promoting and strengthening agricultural production methods that are resilient to climate change.
2. Promoting awareness on Climate Change adaptation.
3. Integrate Climate Change adoption measures in plans and programmes.
4. Promote environmentally friendly and climate-smart farming systems.
5. Promote weather-based insurance schemes especially among small holder farmers.

To promote adoption of Climate Smart Agriculture (CSA), farmers accessing the Government supported Farmer Input Support Program (FISP) are required to practice conservation farming as a prerequisite for access to inputs. **However, it has been noted that the enforcement of such provisions has been weak, as the prominent requirement for one to access FISP is the aspect of being vulnerable but viable as ascertained by the Agricultural Camp Committees.** FISP administration has evolved over time with the introduction at a large scale of the Electronic FISP²⁷ in the 2017/2018 farming season. The implementation of electronic FISP has at least given farmers a broad choice of inputs to choose from including climate smart agricultural inputs such as early maturing seeds.

The policy recognizes and promotes the need for CSA practices for livestock mainly focusing on manure, pasture, grazing and forage management; livestock integration into cropping systems; integration of agroforestry into crop-livestock production systems; and improved housing and feeding practices²⁸.

26. Ministry of Agriculture and Ministry of Fisheries and Livestock, Second National Agricultural Policy (Lusaka,Zambia: Ministry of Agriculture and Ministry of Fisheries and Livestock, 2016).

27. Electronic FISP relies on the use of electronic card/vouchers by the by farmers to access farm inputs such as seed and fertilizer from agro-dealers.

28. Ministry of Agriculture and Ministry of Fisheries and Livestock.

National Energy Policy 2008

The National Energy Policy seeks to promote the cross sectoral linkages between the energy sector and other **key social and economic sectors such as agriculture, trade industry, transport, information and communications technology, health and education among other sectors.**

To promote sustainable agriculture, the policy focuses on the development of biomass energy technologies, and providing agriculture support to farmers wishing to grow energy crops such as jatropha, sugarcane and sweet sorghum²⁹.

The policy further advocates for the establishment of a coordinating mechanism between institutions responsible for energy, agriculture and forestry; to agree on land expansion for agriculture.

To ensure better management of woodlands and forests as sustainable sources of wood fuel, the policy advocates for supply of modern energy sources to small rural farmers and thereby increase the productivity of existing crop-land and reducing the need to engage in slash and burn agriculture, one of the sources of deforestation³⁰.

National Agricultural Advisory and Extension Strategy (NAAES),2016

The National Agricultural Advisory and Extension Strategy (NAAES) for 2016-2020 commits to support of smallholder farmers' adaptation to climate change through irrigation, diversification, and agrometeorological information, but also specifically mentions the need to promote climate change mitigation practices such as agroforestry, manure management and bioenergy³¹.

The strategy also looks at plans to strengthen agricultural extension service delivery by advocating for improvement of the efficiency and effectiveness of the existing extension staff, and promoting private extension service provision to supplement public extension system. Given that the agriculture sector has wide variation in extension approaches and service delivery, especially with the coming on-board of **private extension services, it is prudent to strengthen communication, coordination and collaboration among extension service providers.**

The strategy indicates that agricultural extension and advisory services shall focus on three specific adaptation measures³² in addressing the effects of climate change as follows:

Three specific adaptation measures on next page



29. Ministry of Energy and Water Development - Zambia, National Energy Policy.

30. Ministry of Energy and Water Development - Zambia.

31. Jain.

32. Ministry of Agriculture, National Agricultural Extension and Advisory Services Strategy (NAESS), 2016.



- 1. Short-term solutions for adapting crops, fish and livestock production** include dissemination of messages that promote improved water irrigation systems, more efficient water use, soil management, soil protection, pest management, fertilization and shade management. Other Solutions include promotion of supplementary feeding of fish and livestock, improved pasture management and provision of veterinary services closer to the farming families.



- 2. Measures to reduce greenhouse gases** would be encouraged through promotion of forestation/reforestation, mulching techniques, organic production and utilization of waste materials/ bio-energy.



- 3. Long-term strategies** will include dissemination of extension messages for diversification of incomes, use of new and improved production techniques, use of improved varieties and species and preservation of genetic diversity³³. This shall be concurrent with deliberate efforts to improve access to climate data, linking of small-scale farmers to carbon markets as well as linkage of organizations with external financing.

33. Ministry of Agriculture, National Agricultural Extension and Advisory Services Strategy (NAESS).

National Climate Change Response Strategy, 2010

Zambia's National Climate Change Response Strategy (2010) **takes a sectoral approach to addressing climate change adaptation and mitigation, focusing on investments in sustainable land use (agriculture and forestry sectors), early warning, and agro-climatic information**³⁴.

The strategy was pivotal in advocating for the development of an appropriate climate change governance (policy, legal and institutional) framework including main-streaming climate change in all the key sectors of the economy.

The United Nations Framework Convention on Climate Change (UNFCCC) is the overarching international agreement instituted to address anthropogenic (man-made) climate change. The main objective of the UNFCCC is outlined in its Article 2, which is to stabilize Green House Gases (GHG) concentrations in the atmosphere to a level that would prevent dangerous anthropogenic interference with the climate system.

The National Climate Change Response Strategy³⁵ looked at the need to develop sustainable land use systems to enhance agricultural production and ensure food security under the changing climate through:

1. **Adaptation and Disaster Risk Reduction**

The aim is to ensure that the most climate-sensitive sectors are protected from the impacts of climate change by putting in place climate-resilient adaptation actions and ensuring that Disaster Risk Reduction (DRR) is mainstreamed in all sectors of the economy.

2. **Mitigation and Low Carbon Development**

The aim is to ensure that mitigation actions are implemented in the most GHG-intensive sectors of **land-use (agriculture and forestry), energy, transport and mining, and development** proceeds using low carbon pathways.

34. Ministry of Tourism Environment and Natural Resources-Zambia, National Climate Change Response Strategy (NCCRS) [Lusaka, 2010].

35. Ministry of Tourism Environment and Natural Resources-Zambia, National Climate Change Response Strategy (NCCRS).

National Climate Change Policy, 2016

The overall objective of the National Climate Change policy is to provide a framework for coordinating climate change programmes in order to ensure climate resilient and low carbon development pathways for sustainable development towards the attainment of Zambia's Vision 2030³⁶.

This policy outlines the **measures that will be implemented in order to achieve the objectives of ensuring that country adapts and mitigates against the effects of climate change. Among other measures targeting the agriculture sector, is the emphasis on the promotion and adoption of appropriate Climate Smart Agricultural (CSA) technologies for different agro-ecological zones as well as the promotion of landscape-based livelihood diversification.**

National Policy on Environment, 2009

The policy serves to enhance efforts by Government institutions to protect, safeguard the natural resources and environment and ultimately improve public health in the country.

As a linkage to the agriculture sector, the policy promotes environmentally sound agricultural development by promoting sustainable crop and livestock production through ecologically appropriate production, management techniques and appropriate legal and institutional framework for sustainable environmental management³⁷. Furthermore, the policy recognizes that **conservation of biodiversity both within and outside protected areas are critical to environmental sustainability together with other policies such as the Land Use Policy and Sustainable Agriculture policies.**

The policy also advocates for strengthening of the Ministry of Agriculture, Ministry of Lands Natural Resources and the office of the Commissioner of Lands in order to **cater for improved land use and compliance of the lease covenants relating to good land husbandry practices and land tenure issues**³⁸.

36. Ministry of National Development Planning & Ministry of Lands Natural Resources and Environmental Protection - Government of Republic of Zambia, National Policy on Climate Change (Lusaka, Zambia, 2016).

37. Ministry of National Development Planning & Ministry of Lands Natural Resources and Environmental Protection - Government of Republic of Zambia.

38. Ministry of National Development Planning & Ministry of Lands Natural Resources and Environmental Protection - Government of Republic of Zambia.

National Strategy for Reducing Emissions from Deforestation and Forest Degradation (REDD+), 2015

Climate change exacerbated by increased emissions is known and already manifested as a development challenge in Zambia, affecting the productivity of key economic sectors of the Zambian economy such as agriculture. **The REDD+ Strategy³⁹ advocates for interventions that addresses the need for agricultural intensification leading to reduced frequency of clearance of forests for increased agricultural productivity through:**

- The collaboration and coordination between the Forestry Department and the Department of Agriculture leading to staff being trained in farming systems diagnosis for selecting areas for specific agricultural intensification practices.
- The Forestry Department playing a critical role in the establishment of community nurseries and conducting extension services for appropriate on-farm agroforestry tree species and technologies for agricultural intensification; and
- Implementing appropriate Climate Smart Agriculture(CSA) demonstrations to improve adoption in the target areas.

The REDD+ Strategy also acknowledges that the proximate drivers of deforestation and forest degradation in Zambia are specific to its forestry, agriculture, energy, mining, and land use (infrastructure development) sectors. For the agriculture sector, the drivers have been categorized as follows;

- Extensive and unsustainable crop production practices
- Poor livestock management practices
- Agro-processing reliance on wood fuel
- Lack of incentives for agricultural intensification
- Use of fire for land preparation

The REDD+ strategy therefore promotes key elements of **CSA approaches such as zero-or minimum-tillage (reduced emissions from soil), spot planting and other techniques that aim at improving soil fertility, water use efficiency and efficient cycling of organic matter from crop residues into the soil; effectively reducing deforestation.**

The strategy also advocates for landscape approaches at watershed level and through policy reforms at national level. Landscape approaches take into account all land uses in a holistic way (including water and wildlife) and works to lessen the competition for natural resources among different sectors. The approach ensures that the best possible balance is achieved among a range of different development objectives, including climate change mitigation and adaptation, environmental and biodiversity conservation, enhanced economic productivity, and improved livelihoods.

39. Ministry of Lands Natural Resources and Environmental Protection & Forestry Department, Zambia National Strategy to Reduce Emissions from Deforestation and Forest Degradation., 2015.

National Adaptation Programme of Action (NAPA) on Climate Change, 2007

National Adaptation Programme of Action (NAPA) on Climate Change recognizes that Region I of the Zambian agro-ecological zones is extremely vulnerable to climate change, followed by Region II in terms of arable cropping⁴⁰. Hence planning for climate change in these two regions is definitely a necessity. NAPA indicate that results from crop production, suggested that key varieties, particularly maize, would not mature due to shortening of the growing season in agro-ecological Regions I and II, respectively, undermining food security in the two regions. NAPA further acknowledges that the southern part of Zambia is drought-prone.

NAPA proposes the following adaptation measures in the agriculture sector.

- Production of cereals, legumes, root and tuber crops, and horticultural crops including promotion of early maturing/drought resistance crops;
- Promotion of irrigation and efficient use of water resources;
- Water harvesting; and
- Use of technologies for fertility improvement and moisture storage (including soil conservation measures).

National Agriculture Investment Plan (NAIP), 2014-2018

The National Agriculture Investment Plan promotes sustainable use of natural resources through the Sustainable Utilization of Natural Resources Programme. The key objective of the programme was to create and enhance the sustainable use and maintenance of the existing agricultural resource base to efficiently support vibrant and resilient agricultural production systems. **These include land-use planning, improving land use planning, and reducing land degradation in priority catchments. Forestry Management was to target reduction in deforestation due to shifting cultivation and agriculture extensification⁴¹.**

NAIP further advocated for the promotion of Good Agricultural Practices (GAP) which addresses a number of challenges, including: low levels of improved input adoption; poor response to fertilizer use due to high soil acidity, and; low adoption rates of Conservation Agriculture (CA) as these are all embedded in Good Agricultural Practices.

NAIP also recognized limited availability of extension services to farmers. At the time of developing the NAIP, Principle Methodology Extension Officers estimates indicated that the extension officer to farmer ratio in Zambia was only 1:900. This far exceeded the recommended level of 1:400. Moreover, a World Bank Report of 2010 estimated

40. Ministry of Tourism Environment and Natural Resources-Zambia, National Adaptation Programme, 2007.

41. Ministry of Agriculture, Zambia National Agriculture Investment Plan (NAIP) 2014-2018, 2014.

that Agricultural Officers spend 75 to 80% of their time dealing with FISP logistics between August and January. This leaves very little time for them to dedicate to their core work of providing extension advice to farmers especially advice on the need to adopt CSA practices aimed at building resilience against climate change.

NAIP advocated for the development and piloting use of renewable (bio-energy) options for smallholders such as mini biogas plants using manure.

NAIP BUDGET TABLE ON
NEXT PAGE

Table 1: NAIP Budget (US \$Million) by Programme, year and Financier 2014 - 2018

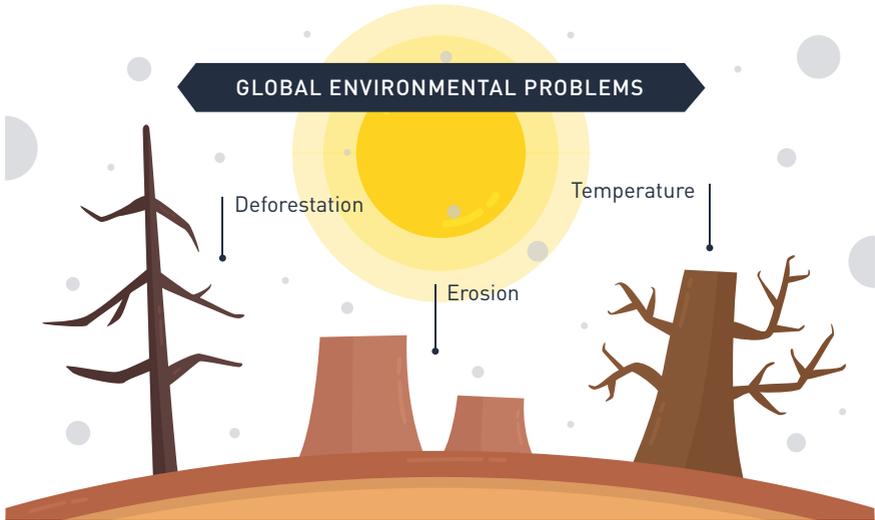
Programme	Implementation Period (years)					Total	Source of Funding		
	2014	2015	2016	2017	2018		GRZ/CP	Farmers	Private Sector
Crops Production and Productivity	180.30	180.39	180.54	155.44	156.01	852.68	379.12	319.25	154.30
Livestock production and productivity	68.51	75.17	81.45	69.96	59.16	354.25	331.6	20.19	2.00
Aquaculture Production and Production	12.89	11.57	10.79	10.21	6.09	51.57	45.58	1.93	4.06
Market Access and Services Development	19.62	55.82	99.70	23.23	58.80	257.21	209.73	11.48	35.99
Food and Nutrition Security and Disaster Management	110.13	137.27	137.80	137.49	137.17	659.86	640.71	19.15	0.00
Sustainable Support Resources Management	39.15	62.43	66.77	62.24	50.22	280.80	259.79	19.66	1.35
Knowledge Support System	49.91	69.00	50.38	41.79	43.39	254.48	254.48	0.00	0.00
Institutional Strengthening	7.86	5.09	2.60	2.032.28	19.86	19.86	19.86	0.00	0.00
Total	488.37	596.02	630.02	503.02	513.13	2730.69	2141.33	391.67	197.70

Source: NAIP, 2016

The figures above shows the NAIP budget for the years 2014-2018. A considerably high amount of US \$280million was budgeted for the Sustainable Natural Resources Management Programme which included components that covered promotion of CSA approaches. Since NAIP came to an end in 2018, there is need to review the performance NAIP before developing the successor programme which is long overdue.

National Forestry Policy, 2009

Zambia's abundant forest resources are threatened due to unsustainable harvesting practices and competition for forest land for agriculture, settlements, mining, and other land uses. Estimates by Integrated Land Use Assessment (ILUA) have shown that the deforestation rate is between 75,000 to 150,000 hectares per annum which is attributable primarily to agriculture expansion into the forested land.



Permanent land use changes, driven by low crop productivity in crop lands under subsistence agriculture, and a combination of factors have therefore been the major cause of deforestation. The National Forestry Policy⁴² advocates for the following strategies to promote sustainable agricultural practices;

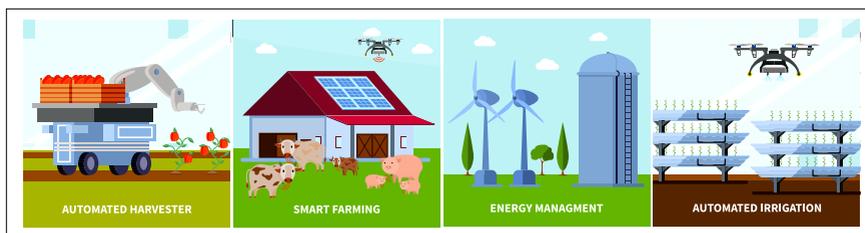
1. Promotion of a land-use system that ensures the protection of headwaters, river basins and terrestrial resources
2. Facilitating sufficient and sustainable allocation of land between major competing uses and sectors such as agriculture, energy and mining
3. Developing a management system that promotes the functional role of forestry in maintaining ecological and climatic functions.

42. Ministry of Tourism Environment and Natural Resources-Zambia, National Forestry Policy (Lusaka, 2009).

Presidential/ Ministerial Pronouncements

During the official opening of the Fourth Session of the Twelfth National Assembly in 2019, President Lungu advocated for the promotion of climate smart agricultural practices which are poised at improving agricultural production and productivity. The President indicated that Government was promoting climate resilient food crops such as sorghum, millet, cassava and yams – these crops are not only resilient to adverse weather conditions, but are also nutritious. The President encouraged every Zambian to engage in some form of agriculture because of its key role in guaranteeing national food security. In an effort to reduce dependency on rain-fed agriculture, the President also indicated that Government working with Cooperating Partners had up-scaled irrigation development projects; with dams being constructed across the country with a total capacity of eight million cubic meters⁴³.

Minister of Finance, Bwalya Ng'andu in his 2020 Budget Address⁴⁴ to Parliament indicated that climate change related challenges required the adoption of climate **smart agricultural technologies and practices**. The Minister also indicated that Government was going to build capacity of the Zambia Meteorological Department (ZMD) to improve early warning systems.



Literature indicates that information on climate patterns is processed at the ZMD that could contribute to adaptation, especially in the agricultural sector. However, this information is not adequately packaged and distributed to those farmers that would be the most affected by crop failure. It has been noted that such information stays at higher levels and does not reach grass root where it is really needed. There is a communication gap between the Zambia Meteorological Department and District authorities at different levels

43. National Assembly of Zambia, Speech for the Official Opening of the Fourth Session of the Twelfth National Assembly by President Edgar Lungu.

44. National Assembly of Zambia, 2020 Budget Address by Honourable Dr. Ng'andu, Minister of Finance, Delivered to the National Assembly on Friday 27th September, 2019.

Why carbon tax should be rationalized across all sectors

Figure 3 on the next page⁴⁵ shows that Green House Gas (GHG) emissions in Zambia have increased by **124 % from 14.463 Megatons of carbon dioxide (CO₂) equivalent in 1990 to 32.392 Megatons of CO₂ equivalent in 2015**⁴⁶.

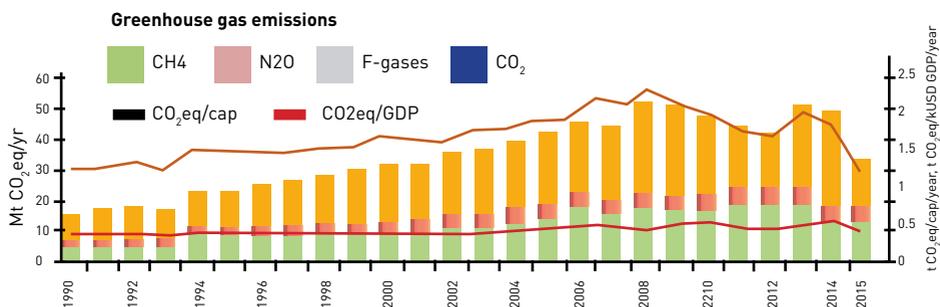


United States of America International Development (USAID)⁴⁷ analysis indicates that the **largest contribution** to GHG emissions in Zambia came from **land use change** and **forestry**, which accounted for 73.7% followed by **agriculture** at 18.9%. **Energy** contributed 4.8% followed by industrial processes and waste at 1.8% and 0.8%, respectively.

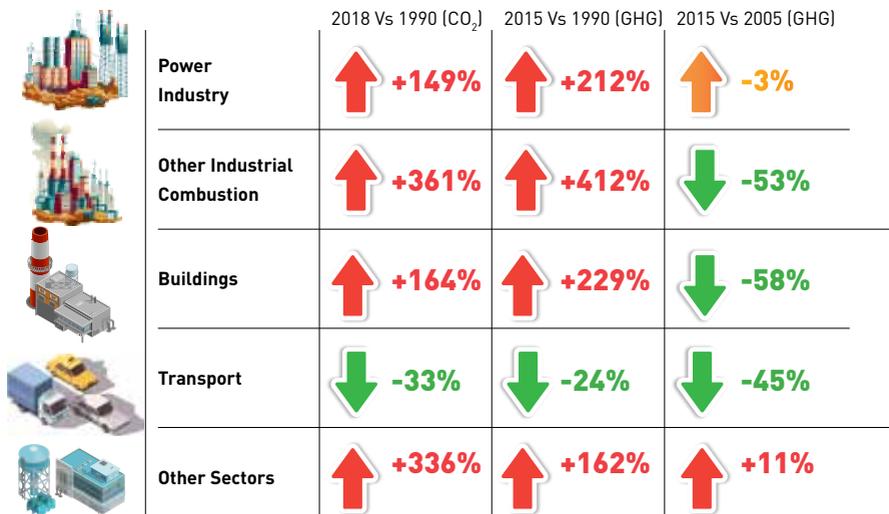


45. The estimates are based on Fourth Assessment Report (AR4) of Inter-Governmental Panel on Climate Change (IPCC) adopted by annual Conference of Parties (COP 2014) since year 2015
46. M. Crippa and others, Fossil Carbon Dioxide (CO₂) and Green House Gas (GHG) Emissions of All World Countries Contact Information [European Commission, Joint Research Centre, 2019] <<https://doi.org/10.2760/687800>>.
47. United States of America International Development (USAID), 'Greenhouse Gas Emissions in Zambia', 2015 <www.climate-links.org/resources/greenhouse-gas-emissions-factsheet-zambia> [accessed 11 November 2019].

Figure 3: Estimates of GHG for Zambia ,1990-2015



Year	Mt CO ₂ /yr	GHG: Mt CO ₂ eq/yr	t CO ₂ /cap/yr	GHG: t CO ₂ eq/cap/yr	t CO ₂ /kUSD/yr
2018	11.768	N/A	0.407	N/A	0.181
2015	14.287	32.392	0.531	1.203	0.173
2005	21.777	38.367	1.058	1.864	0.255
1990	6.887	12.463	0.571	1.200	0.172



Source: M. Crippa and others, 2019
 Source on icons: <https://www.freepik.com>

Zambia should consider the imposition of a carbon tax across all sector as opposed to the motor vehicle carbon tax only. Carbon tax can serve both purposes of mitigation and adaptation. Carbon tax is a Pigovian tax since it returns the cost of global warming to their producers and can consequently reduce carbon emissions as a mitigative measure. Resources realized from the carbon taxes can be channelled to **adaptive measures such as investments into climate smart agriculture practices and distribution of relief foods to areas affected by climate change**. Zambia can learn from South Africa who in May 2019 enacted a long-delayed carbon tax into law as one of the continent's worst polluters.

LESSONS FROM OTHER COUNTRIES

Tanzania

For successful implementation of Conservation Smart Agriculture (CSA) practices to occur, Tanzania used a participatory dissemination method involving farmers in problem analysis, setting extension priorities, planning and obtaining feedback from them. The community involvement in planning through demonstration plots and field schools provided a platform for farmers' participation and feedback⁴⁸. The Himo Environmental Management (HEM) project successfully used community participation integrated in the village local Government through formation of village committees to sensitize, raise awareness, convincing farmers, train, plan, and implement Conservation Agriculture (CA) and erosion control⁴⁹. The village committee members that include village leaders and Government extension staff, and the strength of leadership were considered key in success of HEM project in Tanzania.

Kagera River Basic (Burundi, Rwanda, Uganda and Tanzania)

Another success story in the implementation of substantiable agriculture is the Transboundary Agro-ecosystem Management Project for the Kagera River Basin. The goal of the project which was administered by Food and Agriculture Organization (FAO), was to adopt an integrated ecosystem approach for the management of land resources in the Kagera River Basin⁵⁰. The Basin is shared by Burundi, Rwanda, Uganda and the United Republic of Tanzania. Through a landscape approach the project helped restore degraded lands, adapt to climate change and promoted agricultural biodiversity in a sustainable way while improving agricultural production, rural livelihoods and food security. One of the farmers living in Kiruhura District in Uganda was inspired to take on the new way of herd management to improve his income after being introduced to better farming methods that enabled him to keep a small, high productivity herd while combining this activity with agricultural cultivations. **He sold 150 heads of cattle to keep only 10 and managed to increase his income from milk** while planting about 10,000 trees, one acre of fruit trees, pastures and leguminous fodders whose seeds he supplied to other farmers⁵¹. In addition, his farming benefits from gardens of maize, cauliflower, carrots in addition to 20 bee hives increased. He attributed the quick adoption of the new land management way

48. Lengale Consulting Company Limited, Documentation of the Lessons and the Best Practices For Climate Smart Small-Scale Agriculture, 2013.

49. Lengale Consulting Company Limited.

50. Lengale Consulting Company Limited.

51. Lengale Consulting Company Limited.

to Farmer Field School activities that promote farmer-to farmer learning.

RECOMMENDATIONS

In order to encourage adoption of Climate Smart Agriculture (CSA), due consideration need to be given to the following recommendations;

- The Ministry of Agriculture (MOA) and other stakeholders need to upscale field visits among small scale farmers to effectively promote the adoption of Climate Smart Agriculture (CSA) practices.
- MOA needs to adequately package Zambia Metrological Department (ZMD) information and distribute to those farmers that would be the most affected by crop failure and there is need to narrow the communication gap between the ZMD and District authorities at different levels.
- Government through the Ministry of Finance (MOF) and MOA need to further provide tax incentives on all farming inputs that enhance CSA approaches such as subsidized organic fertilizers, zero tax rates on selected farm equipment and inclusion of starter packs for agroforestry. Both the Fertilizer Input Support Programme (FISP) and agroforestry should have in-built incentive measures that award adopters.
- MOA needs to employ more extension staff to meet the recommended ratio of 400:1 (four hundred farmers to one extension officer). Extension officers play a key role in training farmers on CSA practices.
- Successful adoption of CSA practices such as Conservation Farming (CA) having been linked to land rights. In this vein the Government is urged to address the issue of land rights by improving the land titling procedure and waiting time.
- In all sustainable land approaches in the Agriculture sector, Government is urged to use the landscape approach that takes into account the multiple functions of land and other ecosystems. The approach ensures that the best possible balance is achieved among a range of different development objectives, including climate change mitigation and adaptation, environmental and biodiversity conservation, enhanced economic productivity, and improved livelihoods.
- We urge Government to extend carbon tax to all other sectors that use fossil fuels as opposed to motor vehicle only. Carbon tax can serve both purposes of mitigation and adaptation. The resources realized from the tax can be utilized to promote Climate Smart Agriculture (CSA) practices and provision of relief food to families worst hit by the impacts of climate change. Carbon tax is a Pigovian tax since it returns the cost of global warming to their producers and can consequently reduce carbon emissions as a mitigative measure. Zambia can

learn from South Africa who in May 2019 enacted a long- delayed carbon tax into law as one of the continent's worst polluters.

CONCLUSION

This paper reviewed Zambia's efforts in streamlining Climate Smart Agriculture (CSA) by pulling together existing information (from documents and stakeholder interviews). It describes the current evidence, and has identified some of the gaps pertaining to climate change. It also gave an overview of national vulnerability to climate change especially in the agricultural sector, the policy framework to address climate change, and some actions/strategies taken to mitigate and adapt to climate change in the sector.

To be effective, CSA adaptation interventions need to be main-streamed across multiple sectors and greater policy coherence is essential. To effectively mainstream climate change adaptation, Government is urged to actively embrace longer-term cross-sectoral planning through cross-ministerial structures, such as those initiated through Zambia's Climate Change Departments under the Ministry of Lands and Natural Resources and Ministry of National Development Planning. This may foster greater policy coherence and integrated adaptation planning. The department however, needs to conduct regular monitoring and periodic evaluation of various Climate Change interventions outputs, outcomes and impacts. To enhance main-streaming of CSA across sectors, future policy documents need to explicitly incorporate Climate Smart Agricultural policies as opposed to using broad and general terms such as good agriculture practice or sustainable agriculture.

References

- Crippa, M., G. Oreggioni, D. Guizzardi, M. Muntean, E. Schaaf, E. Lo Vullo, and others, Fossil Carbon Dioxide (CO₂) and Green House Gas (GHG) Emissions of All World Countries Contact Information (European Commission, Joint Research Centre, 2019) <<https://doi.org/10.2760/687800>>
- Forestry Department- Ministry of Lands and Natural Resources, Integrated Land Use Assessment Phase II, 2017
- Irish Aid-Resilience and Economic Inclusion Team, Zambia Climate Action Report for 2016, 2017
- Jain, Suman, An Empirical Economic Assessment of Impacts of Climate Change on Agriculture in Zambia, The World Bank ,Development Research Group WPS4291, 2007
- Lengale Consulting Company Limited, Documentation of the Lessons and the Best Practices For Climate Smart Small-Scale Agriculture, 2013
- Lusaka Times-Online Publication, 'Current Load Shedding of 15 Hours to Remain - ZESCO', Lusaka Times-Online Publication, 30 October 2019 <<https://www.lusakatimes.com/2019/10/30/current-load-shedding-of-15-hours-to-remain-zesco/>>
- Ministry of Agriculture, Ministerial Statement by Minister of Agriculture, Honourable Michael Katambo on Crop Forecasting Survey & Food Security Status for the 2019/2020 Agriculture and Marketing Season., 2019
- , National Agricultural Extension and Advisory Services Strategy (NAESS), 2016
- , Zambia National Agriculture Investment Plan (NAIP) 2014-2018, 2014
- Ministry of Agriculture and Ministry of Fisheries and Livestock, Second National Agricultural Policy (Lusaka,Zambia: Ministry of Agriculture and Ministry of Fisheries and Livestock, 2016)
- Ministry of Energy and Water Development - Zambia, National Energy Policy
- Ministry of Lands Natural Resources and Environmental Protection & Forestry Department, Zambia National Strategy to Reduce Emmissions from Deforestation and Forest Degradation., 2015
- Ministry of National Development Planning & Ministry of lands Natural Resources and Environmental Protection - Government of Republic of Zambia, National Policy on Climate Change (Lusaka,Zambia, 2016)
- Ministry of National Development planning-Zambia, Seventh National Development Plan -2017-2021
- Ministry of Tourism Environment and Natural Resources-Zambia, National Adaptation Programme, 2007
- , National Climate Change Response Strategy (NCCRS) (Lusaka, 2010)
- , National Forestry Policy (Lusaka, 2009)
- Mwila, Alfred, Besa Chimbaka, Gerson Banda, and Chenela Nkowani, Impact of Load Shedding on Small Scale Enterprises, Energy Regulation Board (ERB), Working Paper (Lusaka, 2017)
- National Assembly of Zambia, 2020 Budget Address by Honourable Dr.Ng'andu, Minister of Finance, Delivered to the National Assembly on Friday 27th September, 2019, 2019
- , Speech for the Official Opening of the Fourth Session of the Twelfth National Assembly by President Edgar Lungu, 2019
- Samboko, Paul, Antony Chapoto, Auckland Kuteya, Stephen Kabwe, Rhoda Mofya-mukuka, Bruno Mweemba, and others, The Impact of Power Rationing on Zambia ' s Agricultural Sector, IAPRI Working Paper (Lusaka, 2016)
- United Nations (UN), 'Goals of the 2030 Agenda for Sustainable Development', United Nations Web Page, 2016 <<https://www.un.org/sustainabledevelopment/climate-action/>> [accessed 12 November 2019]
- United States of America International Development (USAID), 'Greenhouse Gas Emissions in Zambia', 2015 <www.climatelinks.org/resources/greenhouse-gas-emissions-factsheet-zambia> [accessed 11 November 2019]
- World Bank Group, 'Climate Knowledge Portal.', World Bank Group Web Page, 2019 <<https://climateknowledgeportal.worldbank.org/country/zambia/climate-data-historical>> [accessed 11 November 2019]
- Zambia Statistics Agency, 2015 Living Conditions Monitoring Survey (LCMS) (Lusaka,Zambia, 2015)
- Zulu-mbata, Olipa, Antony Chapoto, and Munguzwe Hichaambwa, What Drives Conservation Agriculture Adoption among Smallholder Farmers What Drives Conservation Agriculture Adoption among Smallholder Farmers in Zambia ?, Indaba Agriculture Research Institute (IAPRI) Working Paper (Lusaka, 2018)

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Correspondence on this Analysis can be sent to:
info@pmrczambia.net

Policy Monitoring and Research Centre (PMRC)
Ministry of National Development Complex, Corner of John Mbita and Nationalist Roads, Ridgeway,
Private Bag KL 10
Tel: +260 211 269 717 | +260 979 015 660

www.pmrczambia.com

