



The United Republic of Tanzania
Agricultural Sector Lead Ministries

Climate Change Adaptation and Mitigation Policies in the Crops, Livestock, and Fisheries Sector

A Concept Note for the 8th Annual Agricultural Policy Conference

Dodoma, June 6th – 8th, 2022



Organized by the Policy Analysis Group (PAG) in collaboration with ASLMs.

The Context: 8th AAPC Theme and Sub-themes

There is compelling evidence that Tanzania is already experiencing the negative impacts of climate change. Changes in precipitation patterns, rising temperatures, and extreme weather events pose an increasing threat to the country's economy. Among other sector economies, the agricultural sector is at the forefront of experiencing climate change's brutal impact. The sector's heavy reliance on rainfall and natural resources intensifies its vulnerability and further complicates the country's efforts to improve sector productivity. Agriculture remains a key driver of rural development employing 61 percent of the population while contributing 29 percent and 24 percent to the country's GDP and export earnings respectively (URT 2021a, URT 2021b). The Agricultural sector's economic contribution warrants immediate action towards climate change adaptation and mitigation.

Climate change has been among the top global agendas in 2021, highlighted by the successful conclusion of the United Nations Climate Change Conference COP26 in Glasgow, Scotland, and the United Nations (UN) Food Systems Summit at the UN General Assembly in New York. Tanzania has been at the forefront in supporting the climate agenda, as evident in a speech by Her Excellency Samia Suluhu Hassan, the President of the United Republic of Tanzania, at the United Nations General Assembly (UNGA). The President emphasized how climate change affects food security, livelihoods, and income across the globe, especially in developing countries. She pointed out the economic burden developing countries like Tanzania have to shoulder as a result of the effects of climate change, stating, "Tanzania's government spends 2 to 3 percent of GDP to mitigate and build the resilience of communities, and this is a lot in a country that is still fighting against poverty".

In line with the Global and National Agenda on Climate Change, the theme of the **8th AAPC** intends to further emphasize the importance of this agenda to the Tanzanian economy.

Agriculture's vulnerability to climate change is further exacerbated by its heavy dependency on natural resources such as water and energy resources. Sustainable utilization of these resources is vital for the growth and sustainability of the sector and the economy in general. The sector is the largest user of freshwater, utilizing 70 percent of total global withdrawal, while more than one-fourth of energy used worldwide is an input for food production, distribution, and consumption (FAO 2014). In addition, food production and supply chain simultaneously utilize approximately 30 percent of the total energy used globally (FAO 2019). This emphasizes the importance of the water-food-energy nexus to sustainable development as the demand for all three increases. The expected increase in agricultural production will bear heavily on Greenhouse Gas emissions and climate change.

Tanzania has one of the most extensive forest covers in Eastern and Southern Africa. The country has 35.3 million hectares of forests, out of which 16 million hectares comprise of reserve forests, 2 million hectares are forests in national parks, and the remaining 17.3 million hectares (49% of all forestlands) are unprotected forests on public land (URT 2012). Despite a relatively high amount of forest stands, all are under significant threat of deforestation.

The country has an annual deforestation rate of about one percent, around 400,000 hectares, twice the world rate of 0.5 percent per year. Between 1990 and 2010, Tanzania has lost 19.4% of its forested land, equivalent to about 8 million hectares. There is very little remaining primary forest in the country, and the high deforestation rate is likely to lead to increased clearings (Project Gaia 2015). The main reasons for deforestation include clearing for agriculture and settlement, energy needs, and over-exploitation of wood resources for commercial purposes. These activities contribute a significant share to the increase of CO₂ in the atmosphere at a time when carbon sink is progressively reducing. Consequently, temperatures are projected to rise by 1.40C – 3.60C by 2080 throughout the country. Precipitation trends will remain uncertain, and annual precipitation is expected to decrease by up to 42 mm by 2080 (GIZ 2021).

Climate change and climate variability create a ripple effect as temperatures rise due to reduced forest cover. Water resources in the country are also becoming more vulnerable. In the form of lakes, the country's freshwater reserves store approximately 29,425 km³ of all the world's freshwater resources. This is about 25% of the world's fresh surface water. The reserve also includes water dams with a capacity of over 1,000,000 m³, six of these dams are currently used for hydroelectric power generation. The country also has a significant annual average renewable water resource of 126,262 mcm¹ per year, amounting to about 2,300 m³ per capita, above the globally agreed Falkenmark Water Stress Indicator of 1700 m³/cap/yr (URT 2019a).

Despite the abundant water resources, the increasing water demand in the key economic sectors such as agriculture, energy, and manufacturing, alongside rising population growth requirements, show the country is moving toward a water deficit status. Tanzania's economy is already suffering directly from a lack of water. A study estimated that overall GDP growth in 2011 was reduced from 7 percent to 6.4 percent due to drought affecting water and hydropower. A 0.6 percent reduction in GDP corresponds to a \$142 million in 2011 prices. Based on average GDP per capita figures, this is equivalent to the contribution to GDP of over a quarter of a million people (2030WRG 2014). The future projection for the per capita average renewable water resources is expected to decline to below 1,700 m³ per person by 2035 (URT 2019a). An increase in surface water availability, particularly in the dry season, could be achieved by capturing water in storage reservoirs in the rainy seasons and promoting efficient water use technologies for the agricultural sector like micro-irrigation schemes.

Tanzania's energy sources include hydropower, natural gas, coal, biomass, solar, wind, geothermal, biomass, and tidal waves. Of all these, the biomass energy resource, which comprises fuelwood and charcoal, accounts for 85 percent of total energy consumption, of which 75 percent is consumed in rural areas, heavily contributing to deforestation (URT 2020). Natural gas and hydropower are significant sources of commercial energy in the country, comprising 94 percent of the total grid installed capacity in the country. It is reported that Tanzania has

¹ Million cubic meters

an estimated 7491 MW potential for hydropower capacity (URT 2020); however, only a tiny percentage has been tapped. Climate change has been one of the major constraints to achieving this potential, as drought conditions have led to a significant decline in water levels in most hydropower stations. In a recent statement issued by Tanzania Electric Supply Company Limited (TANESCO) at the end of 2021, a drop in power generation is attributed to the declining water levels in hydropower rivers and dams. Daily power generation has dropped by 345 MW, equivalent to a 21 percent drop in daily power production (Mwananchi 2021). Blackouts and power rationing due to low water levels in the hydropower dams have forced TANESCO to rely on gas-powered generators. Power rationing for domestic and industrial use makes Tanzania's economy more vulnerable to climate change-related disasters.

Climate change also jeopardizes food security and nutrition. Every 1°C temperature increase is associated with a 1.64% global increase in the probability of severe food insecurity, which in turn drives up malnutrition (Romanello, 2021). The relationship between climate and the agriculture sector (crops, livestock, and fisheries) puts the food system and environment at risk as crop yield, crop nutrients, crop composition, crop quality, and density are all affected. This negative relationship leads to the availability, accessibility, and affordability of nutritious food being further impaired. Additionally, climate change affects the availability of safe and clean water, which is critical in reducing water-borne related diseases and improving water, sanitation, and hygiene practices (WASH) for improved nutrition. Less clean and safe water leaves communities with limited food and consumable water choices, thus increasing various forms of malnutrition such as Dietary Related Non-Communicable Diseases.

There is urgency in understanding the connections between agriculture (growing enough food) and its primary resources. Balancing rising energy needs and providing enough water for all sectors and domestic use remains central to climate change response and sustainable economic development.

Responses to climate change include adaptation, mainly to reduce the vulnerability of people and ecosystems to climatic changes, and mitigation, to reduce the magnitude of climate change impact in the long term. However, neither adaptation nor mitigation alone can offset all effects of climate change. It is necessary to focus on mitigation by reducing the emission level of gases contributing to global warming and adaptation by supporting local communities in dealing with the impact. To this effect, there is a need for adequate information to guide effective decision-making and policy interventions that can harmonize the use of critical resources within the agricultural production. The 8th AAPC will serve as a timely initiative to stimulate discussions on climate actions within the agricultural sector.

The 8th AAPC looks into climate change and the Agricultural sector within five themes. The themes are:

- Climate Change and Food Security
- Adaptation and Building Resilience
- Livestock Systems and Climate Change
- Innovations Toward Climate Change Mitigation
- Cross-cutting Issues

Regional and Global Experience: Policies for Climate Change Adaptation and Mitigation

At a global level, the threat of climate change is being addressed by the United Nations Framework Convention on Climate Change (UNFCCC) and its treaties. UNFCCC's long-term objective is to combat "dangerous human interference with the climate system," in part by stabilizing Greenhouse Gas (GHG) concentrations in the atmosphere (UNFCCC 1992). To ensure its objective's attainment and further strengthen the Convention, UNFCCC adopted the Kyoto Protocol in the early 1990s. The treaty put in place legally binding emission reduction requirements for industrialized countries. The Kyoto Protocol was superseded by the Paris Agreement, which entered into force in 2016, aiming to increase governments' ability to adapt to climate change effects and mobilize sufficient finance.

Since the establishment of UNFCCC, most industrialized nations and developing countries have implemented climate change-related policies. Global policy recommendations on reducing GHG have focused mainly on using economically efficient market-based policy instruments, such as carbon taxes, fuel excise taxes, and emissions trading systems (OECD 2021). Other market-oriented policy instruments that countries have used include taxes on carbon or energy, the removal of environmentally harmful subsidies, tradable permit schemes, and the Kyoto Protocol flexibility mechanisms. Experience has shown governments often face significant opposition from affected industries when implementing policy instruments that affect company revenues and incomes. Best practices that countries have used to address competitiveness have often included recycling tax revenues back to the affected sectors while having in place policy incentives to minimize GHG emissions.

African countries contribute marginally to the changing climate, with just two to three percent of global emissions. However, it stands out disproportionately as the most vulnerable region in the world. This makes adaptation to climate change a primary concern for African countries, as reflected in the predominance of adaptation measures in their Nationally Determined Contributions (NDCs) (WMA 2021). Priorities identified in the NDCs of African countries reflect the heavy dependency of Agriculture in African economies. Most countries' national climate change responses indicate a need for policy instruments that ensure early warning systems to help them to respond to weather, water, and climate-related hazards.

Nonetheless, successful adaptation and mitigation measures for major sectors like the Agricultural sector also require greater policy attention to accelerate the uptake of existing green technologies and practices. This is evident in Ethiopia, where farmers have adopted a range of green technology and its practices, including altering crop varieties, adopting soil and water conservation, and changing planting and harvesting periods.

A survey of 48 crops grown in the Nile River basin of Ethiopia showed that farmers who took up adaptation methods produced between 93kg-300kg per hectare, more than those who did not alter their farming techniques, reflecting a 10-29% difference in output (Joto-Africa 2009). Factors that increased farmers' capacity to adapt included:

- Access to early warning systems and information on food prices and weather (even with simple text or voice messages to inform farmers on when to plant, irrigate or fertilize. That is, enabling climate-smart agriculture)
- Access to a well-informed extension service
- Access to climate-smart technologies, including sustainable agro-mechanization technologies, improved inputs, seeds, fertilizer

Under the Africa Adaptation Program (AAP), initiatives at the regional level have led to 16 countries incorporating climate change considerations into government investment plans. Kenya, for example, adopted the Threshold 21 (T21) model, which was integrated into the Ministry of State for Planning, National Development, and Vision 2030 in the Macro-Planning Directorate. The model is uniquely customized for the long-term integrated development planning and scenario analyses of climate adaptation options under uncertainties. The model also allows the cost of adaptation to be quantified, which is a pre-requirement for attracting financing for adaptation. In Niger, climate change resilience has been integrated through its Economic and Social Investment Plan. While the Government of Nigeria has integrated climate change into national macroeconomic policies (UNDP 2018).

KEY POLICY QUESTIONS FOR DISCUSSION

Based on the theme and sub-theme for the 8th AAPC, the following are some of the critical questions that will be addressed during presentations and discussions:

- 1) How has Tanzania positioned itself to tackle climate change?
- 2) Is the Agricultural sector adapting to climate change?
- 3) How can stakeholders sustainably finance the cost of climate change?
- 4) What lessons could Tanzania draw from other countries on climate change adaptation and mitigation for the Agricultural sector?
- 5) How effective are existing policies on climate change mitigation?
- 6) Are there legal, regulatory, and institutional frameworks in place to implement climate change adaptation policies?

- 7) Do significant sector policies adequately integrate climate change adaptation and mitigation strategies?
- 8) Is cross-sectoral planning on climate change mitigation evident?
- 9) What is the institutional capacity and knowledge at the national and local level addressing climate change?
- 10) Is there enough research and data to inform the development of adaptive strategies within the Agricultural sector?
- 11) How is the Nutrition sector prepared to deal with climate change?
- 12) Are there any climate change adaptation policies to curb malnutrition?

ABOUT PAG AND AAPC

The Annual Agricultural Policy Conference (AAPC) is organized by the Policy Analysis Group (PAG) in collaboration with the Ministry of Agriculture. The PAG is an informal (community of practice) and a voluntary group that consists of members working on Agricultural policy projects/initiatives, academia, and local and international policy think tanks. Established in 2013, the group has about 20 members and provides a platform for sharing information on policy research findings to enhance coordination, collaboration, and synergy. The PAG also aims at ensuring consistency in policy messaging.

The AAPC brings together over 150 participants from academia, research institutions, policymakers, advocacy groups, and development practitioners from Tanzania in the region and beyond. The Conference provides an opportunity to assess progress in implementing policy reforms under the Comprehensive Africa Agriculture Development Programme (CAADP) framework of the New Alliance on Food Security and Nutrition. In addition, the Conference discusses successes, lessons learned, identified remaining gaps, how to increase competitiveness within the alliances, and emerging issues that require attention.



PAG members are deliberating at a PAG retreat on the 21st of January 2022. ASPIRES Tanzania hosted the event in Dar-es-Salaam

The Policy Analysis Group (PAG) include the following:

- Aga Khan Foundation (AKDN)
- Agricultural Markets and Development Trust (AMDT)
- Agricultural Non-State Actors Forum (ANSAF)
- Agricultural Sector Lead Ministries (ASLMs)
- Agricultural Sector Policy and Institutional Reforms Strengthening (ASPIRES)
- Alliance for a Green Revolution in Africa (AGRA)
- Dalberg
- Eastern Africa Grain Council (EAGC)
- Economic and Social Research Foundation (ESRF)
- Feed the Future Tanzania
- Financial Sector Deepening Trust (FSDT)
- International Fund for Agricultural Development (IFAD)
- International Food Policy Research Institute (IFPRI)
- International Livestock Research Institute (ILRI)
- One Acre Fund (OAF)
- Policy Link
- Research on Poverty Alleviation (REPOA)
- Sokoine University of Agriculture (SUA)
- Southern Agricultural Growth Corridor of Tanzania (SAGCOT)
- Tanzania Horticultural Association (TAHA)
- TAHA Fresh
- Tanzania Private Sector Foundation (TPSF)
- Trademark East Africa

Development Organizations who have been close partners to the PAG and financial contributors to AAPC through the years include:

- Food and Agriculture Organization of the United Nations (FAO)
- Japan International Cooperation Agency (JICA)
- The World Bank
- UN Women
- USAID

PAG also recognizes the close collaboration of corporate organizations who have supported and financially sponsored AAPC through the years:

- CRDB
- National Microfinance Bank (NMB)
- PASS TRUST
- Tanzania Agricultural Development Bank (TADB)

PREAMBLE FOR VALUE CHAIN SESSIONS

Climate Change and Food Security

Climate change is one of the most pressing issues affecting agriculture and food security in developed and developing nations. It is a serious and growing threat to resource-poor farmers' food and nutrition security worldwide. As defined by the Food and Agriculture Organization of the United Nations, food security exists when all people have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life. However, climate change harms food security elements such as food availability, food access, food utilization, and stability. (El Bilali, *et al.* 2020; Schmidhuber *et al.* 2007).

Climate change impacts food systems in various ways, ranging from crop production to supply flows and food price spikes. Climate change affects the crop subsector and the fisheries subsector due to the gradual increase in sea and inland water surface temperature. Evidence suggests that climate change reduces crop, livestock, and forestry productivity (Gitz *et al.* 2016).

Climate change adaptation of seed systems has also been a major issue. Similarly, climate change threatens to exacerbate soil erosion and degrade soil quality. The question is, what can be done in addition to genetic makeup, nutrition, and management to mitigate and build resilience to climate change. Crop adaptation to climate change necessitates the introduction of crop varieties and recommendations to assist farmers in matching the best variety to their field. All of this necessitates proper soil health knowledge for climate change management and mitigation, robust extension services, and a skilled labor force for sustainable cropping systems, soil, and water quality.

Due to the threat posed by climate change, East African countries such as Tanzania, Kenya, and Uganda are expected to experience a 22% decline in agricultural production rates by 2050, further deepening poverty and malnutrition among vulnerable farmers. Furthermore, it is estimated that as a result of climate change, approximately 38 million people in Sub-Saharan Africa (SSA) will be at risk of hunger in 2050 (IFRPI, 2018).

As a result, climate change increases developing countries' reliance on imports of food products. The impact is likely to be significant, particularly for net food-importing countries, as food exports may be reduced or banned in the event of extreme weather events (El Bilali *et al.* 2020).



Critical challenges for climate change and food security include:

- Inadequate funding for crop/seed breeding and research
- Integration of knowledge on sustainable and climate-friendly farming practices to the existing extension services curriculum

The following key policy issues dominate the discussion concerning climate change and food security:

- How can Agriculture sector policies integrate climate change adaptation measures for extension services?
- What policy measures could transform the existing seed system to be more efficient and adaptable to climate change?
- What policy measures could be taken to avoid competition across the sector for critical resources like water and energy?
- How can tree crops such as cashew nut and fruit trees such as avocado help mitigate climate change?
- How can the agriculture and nutrition sector ensure that nutritious foods are accessible and affordable to those in need?

Adaptation and Building Resilience

Preparedness and Early Warning Systems: Weather Forecast, Market Intelligence, Managing Public and Private Stocks

Ensuring food security and good nutrition in a changing climate requires effective adaptation and building resilience at all levels, from policies to better technologies to address the changing agricultural landscape. Climate change preparedness has become a widely accepted tool for governments to reduce the risks to future events. Essential components in preparedness and early warning systems include weather forecast, risk assessment, market intelligence, and public and private stocks management. Providing timely and reliable weather information that aids decision-makers and farmers in making critical management and production decisions is an essential component of climate change planning. If used correctly, this information can help mitigate the effects of drought and other extreme weather events (Wilhite 2000).

Tanzania has experienced a variety of rainfall patterns over time, reflecting complex patterns of seasonality and inter-annual variability. Crop adaptation measures at the production level include changes in crop management,

particularly planting dates, and the use of adapted seed varieties or breeds with varying environmental tolerances. Similarly, various adaptation options for livestock production are available at multiple scales, including breeding livestock and cultivated forages and crop residues.

Climate change also creates difficulties in the marketing of agricultural products. It impacts agriculture, resulting in changes in production patterns and prices that affect both producers and consumers, and changes the profitability of agricultural produce. Market intelligence is critical in responding to a climate shock because it provides market information and connects producers to domestic and regional markets. Therefore, policies and regulations that promote market functionality, timely and accurate market information, transparency, low transaction costs, and incentives for long-term investments are critical (Gitz et al. 2016).

Furthermore, climate change contributes to post-harvest losses and, as a result, food insecurity. While post-harvest losses in Tanzania are estimated to be 40%, it is critical to improving farmers' technical knowledge of adapting farming systems to climate variability. Additionally, post-harvest management training can reduce food losses and improve household food security (Abass et al. 2014). Management of public and private food stocks is critical to ensuring the country's food security stability. One strategy for managing food stocks is for the government to increase the capacity of the National Food Reserve Agency (NFRA) to procure, reserve, and release food stocks in response to a climate shock in the country.

Private Sector and Agribusiness Response to Climate Change

The adverse impact of climate change is a threat to individuals, communities, and the private sector. The latter is a key contributor to employment (75% of the Tanzania workforce), economic growth, and poverty reduction (URT 2021b). Direct climate-related risks to the private sector affect core business operations. Extreme weather events are increasingly becoming a business risk that can cause business interruption and damage infrastructure and physical assets. Unfavorable temperatures can impact staff health and crop and livestock productivity. Water scarcity will pose challenges for river transport, industrial cooling, and hydroelectricity. Sectors that will be particularly affected include agriculture, infrastructure operators, and tourism, most of which are private sector driven (DECD 2016). This makes the private sector a critical player in the climate action space.

The private sector is increasingly becoming aware of climate change and has started making efforts towards climate adaptation and mitigation measures. However, more efforts are needed for the private sector to become more fully engaged and effective in responding to climate change (Biagini 2013). Such efforts include:

- Increasing awareness about the significance of climate change
- Inclusion of the private sector in national and international adaptation efforts
- Engaging private sector innovation in developing products and services that can reduce the costs and impacts of climate change
- Ensuring the existence of an appropriate policy framework and an enabling environment that fosters sustainable investments and growth of the private sector

Building Nutritional Resilience to Climate Change

Climate change increases the overall risk of hunger and undernutrition, affecting food and nutrition security. It also has a bearing on environmental health issues such as sanitation, water availability, access, and quality, and

the transmission of water-borne, food-borne, vector-borne, and other diseases, which further exacerbate undernutrition (Tirado et al. 2013).

Agriculture remains central to reducing global hunger and is integral in improving nutrition outcomes. Climate change presents an urgency to finance more sustainable, resilient, and efficient ways of producing, distributing, and consuming agricultural food products. This, combined with the conventional nutrition intervention programs for women, children, and youth, can reduce food and nutrition security threats.



A woman sets up a solar-powered irrigation system in her village

Policy issues pertaining to adaptation and building resilience revolve around the following areas:

- Unreliable investments in infrastructure for water storage
- Inadequate infrastructure for water management
- Nutrition integration in climate change initiatives
- Efficient management (including accurate tracking of stock movements and balances) of public and private food stocks in Tanzania

Key policy questions for the discussion include the following:

- What policy measures can ensure sustainable financing of climate change adaptation and mitigation measures?
- What policy reforms are necessary to incentivize private sector investments in climate change adaptation initiatives?

- How best can the government integrate policies and institutional frameworks that recognize and timely address the climate-related early warnings?
- How can agricultural market information systems be integrated into the sector's policies to strengthen the response to climate change?
- What policy reforms can ensure efficient public and private food stock (real-time tracking of stock movements and balances)?
- What policies are needed to stimulate smallholder farmers' adaptation and mitigation to climate change?

Livestock, Fisheries Systems, and Climate Change

Impact, Adaptation, and Mitigation: Need for Improvement of Pastureland and Water Management

The possible effects of climate change on food production are not limited to crops. Climate change will have far-reaching consequences for dairy, meat, and egg production. Higher temperatures and changing rainfall patterns affect livestock production (through competition for natural resources such as water), quantity and quality of feeds and forage, heat stress, increased spread of livestock diseases and pests, and biodiversity loss. This is at a time when demand for livestock products is expected to increase by 100 percent by the mid-21st century (Garnett 2009).

Tanzania has the second largest livestock population in Africa after Ethiopia; the country has approximately 30.5 million cattle, 18.8 million goats, and 5.3 million sheep. Other livestock kept in the country includes 38.2 million local breed chicken, 36.6 million exotic breed chicken, and 1.9 million pigs (URT 2017a). The country is endowed with 60 million hectares of rangeland suitable for livestock grazing (URT 2007). Climate change is expected to shrink further the rangelands, essential for livestock-keeping communities in Tanzania. This shrinkage will be further aggravated because 60% of the total rangeland is infested by tsetse fly making it unsuitable for livestock pastures and human settlements (URT 2007). Similarly, studies show that the existing number of cattle in Tanzania has already surpassed the average carrying capacity in most areas, creating more pressure on the available resource. This, coupled with increasing concern on the impact of livestock systems as one of the main contributors to global Greenhouse emissions, warrants measures to combat the effect of climate change on the sector.

Through a range of management options combined with climate change adaptation strategies, livestock systems can be friendly to the environment. Initiatives like securing water access for livestock (especially during dry and drought conditions), water harvesting (in the form of dams), improving water infrastructure efficiency, decreasing stocking rates, targeted breeding, and reintroducing native species and silvopastoralism could all be beneficial to the environment.



Cows grazing in a stable

Fisheries and Climate Change

Tanzania is well endowed with natural resources in terms of fisheries. The country has several lakes, dams, rivers, wetlands, and marine waters. The country has a total water coverage of 346,337 km², equivalent to 36.7% of 945,000 km² of the total land area. The fisheries potential from all water bodies is estimated at 750,000 metric tons, whereby 100,000 metric tons is from marine waters, and 650,000 metric tons is from inland waters (URT 2019b). Climate change represents a threat to the sustainability of captured fisheries and aquaculture development.

The consequences of global warming and the associated physical changes will become increasingly evident, along with the impact of more frequent extreme weather events. The effects of increased pressure on fisheries (environmental pollution, environmental degradation resulting from unsustainable aquaculture practices, intensive exploitation of marine resources), together with future climate change, will have a bearing on fisheries in different socio-economic and geographical contexts. There is a dire need to understand the direction and consequences of the changing climate on fisheries resources to guide adaptation and mitigation strategies of affected populations.

Some of the challenges facing livestock and fisheries systems:

- Competition for land among crops, livestock, and wildlife
- Inadequate water resources due to land degradation and climate change
- Overstocking of livestock

Key policy issues for discussion:

- How are sector policies incorporating issues of climate change?
- Are there policy strategies to transform the livestock sector to be more environmentally friendly?
- Is pastureland management achievable?



Freshly caught fish

Innovations Towards Climate Change Mitigation

1. Green Growth Financing

Increased threats posed by climate change have placed Green Growth and the transition towards a green economy among the world's top agendas. To achieve this transition towards a green economy requires enormous financial investment by both public and private investors, with the latter playing an increasingly important role. Access to finance for smallholders and large-scale producers is critical in increasing the country's agricultural productivity sustainably. The emerging move towards sustainable financing by local banks with support from international organizations and NGOs is key in boosting and extending Tanzania's climate-smart agriculture (CSA) financing. Considering that most farmers in Tanzania are smallholders, developing mechanisms for green growth financing is inevitable. The following approaches can be considered:

- Financial institutions developing and deploying customized financial products that will enable farmers, especially smallholders, to access loans for green energy technologies
- Developing tool kits that will aid financial institutions in evaluating potential loan repayment risks, e.g., Inclusive Green Growth (IGG) tools developed by SUSTAIN-Africa
- Financing initiatives such as micro-irrigation schemes that use green energy while conserving natural resources such as water (pivot/drip irrigation)

2. Mechanization

Agriculture mechanization in Tanzania is still low, with only 7 percent of farmers using improved technologies (URT 2017b). Evidence of agricultural sector transformation suggests an increase in agricultural mechanization soon. It is essential to guide the uptake of agricultural mechanization towards sustainable investment. The kind of mechanization that adopts conservation agriculture practices and enables agriculture to be productive and profitable for farmers while preserving and enhancing the resource base and the environment. It protects the soil, conserves water, uses less energy, improves input-use efficiency, and reduces post-harvest losses.

3. Adoption of Renewable Energy in Agriculture

The demand for conventional energy in the Agricultural sector is still relatively low due to the low level of technology employed by most Tanzanian farmers and producers. Nevertheless, as the Agricultural sector is transforming with evidence of increased medium-size farmers and an expanding agro-industry subsector, the energy demand is expected to grow significantly. Presently, the most common energy sources for agricultural activities in Tanzania include electricity from hydroelectric power, and petrol and diesel for agricultural machinery. In the past years, drought has caused the drying up of major hydropower dams affecting electricity production, while diesel and petrol are significant contributors to Greenhouse emissions. Tanzania's Agricultural sector dependence on climate-sensitive energy sources makes the sector vulnerable, posing a threat to agricultural production and productivity.

Tanzania has abundant potential for renewable energy, including more than 670 MW of solar energy, over 1,000 MW of wind energy, and 5,000 MW of geothermal resources, which can be harnessed for power production (URT 2020). Yet none of these renewable energies contribute electricity to the national grid, and little attempt is being made to utilize these energy sources off-grid.

The existing renewable technologies can supply enough energy to the agri-food value chains. Opportunities range from solar/wind water pumping for irrigation and livestock, solar/geothermal food drying machinery, solar/wind/hydro milling agro-industries, and solar-powered refrigeration trucks for transport of agro-produce. Additionally, since most of these energies are locally concentrated, farmers could potentially sell the surplus energy they produce (e.g., electricity generated from wind turbines, biofuels, and products from biomass). This will potentially reduce the carbon footprint, lower the cost of energy as input, and reduce the production costs of low-carbon agricultural products. Harnessing these resources will significantly enhance energy resilience.

Issues of concern on innovations towards climate change mitigation include the following:

- Access to sustainable agricultural technologies in adapting to climate change.
- Investment in alternative clean energy sources
- Inadequate financing climate change initiatives
- Participation of local financial institutions in green financing

Key policy issues concerning innovation towards climate change mitigation:

- Is there a policy and regulatory framework to promote public-private investment in green finance?
- What policy reforms can incentivize private sector investment in green finance?
- Does the existing policy framework enable access to energy-efficient technologies and innovations?
- Do Tanzania's financial sector policies incorporate green financing?



A solar-powered irrigation system

Cross-cutting Issues

Vulnerability and Resilience: Women Youth and Other Vulnerable Groups

Impacts of climate change affect women, youth, and vulnerable groups in different ways due to their different roles in society. Integrating a gender perspective in climate change adaptation is critical, and empowering women has positive outcomes in their capacity to adapt to climate change. Considering the inequitable impacts of climate change, interventions and implementation of adaptation and mitigation strategies to climate change need to account for gender and marginalized groups. Without this specific focus, there is a risk that adaptation can

perpetuate and enhance existing inequalities. To narrow the gender gap and promote inclusivity, the following interventions need to be considered:

- Integrating gender and vulnerable groups by relating issues into climate change initiatives
- Ensuring that climate change research generate gender-disaggregated data on impacts and response
- Enhancing equitable representation of women, youth, and vulnerable groups at all levels in planning, decision making, and implementation of adaptation and mitigation initiatives
- Promoting safeguards that will ensure women, youth, and vulnerable groups equity in sharing climate change initiatives

Key challenges and policy issues

- What policy measures could be taken to improve and incentivize women, youth, and vulnerable groups to participate in climate change initiatives?

PARTICIPANTS

The three-day conference will bring together more than 200 stakeholders from the agricultural and nutrition-sensitive sectors. These include representatives from the following entities:

- Agricultural Sector Lead Ministries
- Nutrition specific and nutrition-sensitive sectors/ organizations
- Regulatory authorities in agriculture
- Members of the Parliamentary Committee on Agriculture Livestock and Water
- Farmers and agribusiness associations
- Development partners
- NGOs engaged in agricultural development
- Research and training institutions
- Private sector

THE APPROACH

AAPC continues to intensify its regional and international character. This conference is the second AAPC that has engaged its participants both on the ground and virtually. The hybrid conference allows over 100 participants to take part in the proceedings in-person and more than twice this number to participate virtually. The conference will take a partial "Davos" style, in which thematic papers are presented, followed by a panel discussion before opening the session to the floor for questions and answers. All meetings at the conference will take place in facilities that can support virtual meetings. The technology used provides the output in high-resolution format, and the AAPC task force works with virtual communication professionals with experience in managing virtual meetings.

The blended format also motivates buy-in from the donor community. Best practices from the AGRA's African Green Revolution Forum (AGRF) and tools from the AGRF will be adapted to ensure a successful 8th AAPC.

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