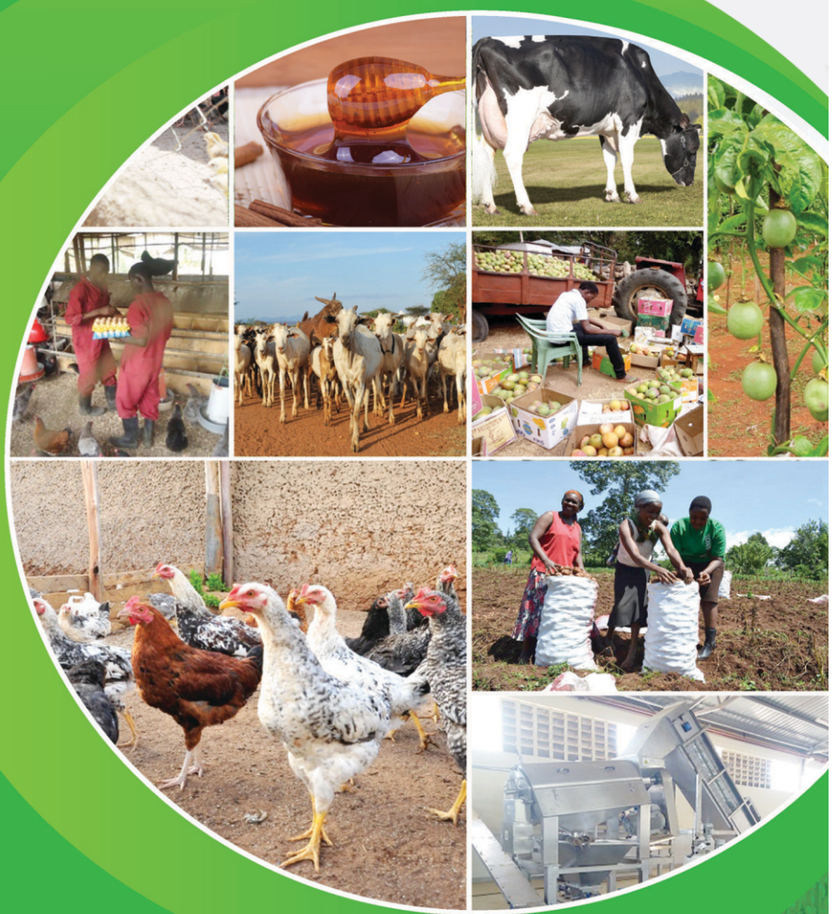
REPUBLIC OF KENYA

MINISTRY OF AGRICULTURE, LIVESTOCK, FISHERIES AND COOPERATIVES AND COUNTY GOVERNMENTS

ASDSP
AGRICULTURAL SECTOR DEVELOPMENT SUPPORT PROGRAMME

AGRICULTURAL SECTOR DEVELOPMENT SUPPORT PROGRAMME II (ASDSP II)

KERICHO COUNTY PRIORITY VALUE CHAIN SUITABILITY ATLAS



"Transforming Kenya Agriculture Sector"

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March 2020

"Transforming Kenya Agriculture Sector"

Agricultural Sector Development Support Programme II (ASDSP II)

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ABBREVIATIONS

AHP	Analytical Hierarchical Process
AI	Artificial insemination
ASDS	Agricultural Sector Development Strategy
AP	Agricultural Policy
APA	Apollo Pan Africa
ASALS	Arid and semi- Arid Lands
ASDSP II	Agriculture Sector Development Support Programme II
ASTER	Advanced Space-borne Thermal Emission and Reflection Radiometer
ASTGS	Agriculture Sector Transformation and Growth Strategy
BDO	Business Development Officer
CA	Conservation Agriculture
CECM	County Executive Committee Member
CI	Consistency Index
CIC	Corporate Insurance Company
CIDP	County Integrated Development Plan
CO	Chief Officer
CPS	County Programme Secretariat
CR	Consistency Index
DEM	Digital Elevation Model
ESP	Economic Stimulus Program
FAO	Food and Agricultural Organization
GDEM	Global Digital Elevation Model
GDP	Gross Domestic Product
GIS	Geographical Information System
IWD	Inverse Distance Weighted interpolation
ILWIS	Integrated Land and Water Information System
ILRI	International Livestock Research Institute
KALRO	Kenya Agricultural and Livestock Research Organization
KEMFRI	Kenya Marine and Fisheries Research Institute
KCC	Kenya Cooperative Creameries
KCEP-CRAL	Kenya Cereal Enhancement Programme-Climate Resilience and Agricultural Livelihood
KDB	Kenya Dairy Board
KEPHIS	Kenya Plant Health Inspection Services
KFA	Kenya Farmers Association

KFS	Kenya Forest Services
KNBS	Kenya National Bureau of Statistics
KES	Kenya Shilling
MCE	Multi Criteria Evaluation
NARIGP	National Agriculture & Rural Inclusive Growth Project
NDMA	National Drought Management Authority
NEMA	National Environment Management Authority
NRM	Natural Resource Management
NPS	National Programme Secretariat
PWCM	Pairwise comparison matrix
PVC	Prioritized Value Chain
QGIS	Quantum Geographic Information System
RCI	Random Consistency Index
RCMRD	Regional Centre of Mapping of Resources for Development
SID	Society for International Development
Soil OC	Soil Organic Carbon
Soil CEC	Soil Cation Exchange Capacity
Soil AWC	Soil Available Water Content
Soil pH	Soil potential for hydrogen
THI	Temperature humidity index
USD	US Dollars
VC	Value Chain
VCA	Value Chain Actors
VCO	Value Chain Organization
VRL	Veterinary Research Laboratories
WB	World Bank
WETF	Women Enterprise Trust Fund
WGS	World Geodetic System

FOREWORD

Agricultural sector growth and development is crucial to Kenya's overall economic and social development. Agriculture significantly contributes to the county economy; ensures the county is food secure; generates incomes and provides employment both directly and indirectly for the population. Sustained agricultural growth is therefore critical to uplifting the standards of living of our people. The county however faces several challenges which need to be overcome for this growth to occur. These challenges include high levels of poverty, food insecurity and the negative effects of climate change.

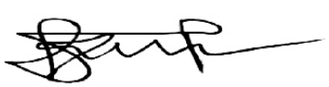
Kenya's development blueprint, Vision 2030 recognizes the agricultural sector as one of the vehicles that will aid the achievements of the targets. The sector's Agricultural Sector Transformation and Growth Strategy (2019-2029) focuses on increasing the income of 3.3 million small scale households; significantly improving sector contribution to the national GDP through enhancement of land productivity and agro-processing to improve agricultural outputs and value addition and boosting household food resilience against environmental and fiscal shocks through cost reduction of nutritious foods and well-targeted support in terms of subsidies and social protection. The county government of Kericho in collaboration with other development partners and specifically with initial support from the government of Sweden has brought the realization of this goal a step closer through the Agricultural Sector Development Support Programme (ASDSP II) that is being implemented at both the national and county governments' level.

In order to make informed decision on priority value chains (dairy cow milk, indigenous chicken and tomato) for the county, it was necessary to establish the scientific generated resource and suitability maps. It is my strong believe that value chain actors and stakeholders will use this information in addressing the challenges that the sector faces in food security, productivity and natural resource management. The development of these maps was therefore timely and critical for this county as the basis for planning and setting priorities of adaptation intervention in the sector.

The exercise integrated biophysical (climatic and soil factors), economic (population, road network and market outlets), social (agrarian characteristics) and political (framework conditions) parameters to classy the county into regions that are highly and moderately suitable.

The moderately suitable areas require attention by both levels of governments and stakeholders in order to address constraints that affect productivity of the priority value chains. The adaptations, innovations and technologies proposed to improve value chain performance, require resources that require multi sectoral and multi-disciplinary approach to address.

I wish to encourage all stakeholders to not only study the reports but also utilize the data and information for evaluating their activities and improving their implementation profiles to achieve realistic goals. As a department, we are committed to use the findings to inform the process of county domestication of policies and guide current and future programs actions that will lead to realization of food and nutrition security and wealthy households.



Eng. Philip Mason,
County Executive Committee Member (CECM),
Department of Agriculture, Livestock and Cooperatives- Kericho County

ACKNOWLEDGMENT

The ASDSP II is implemented at national and county level in the 47 counties through the National Programme Secretariat (NPS) and the County Program Secretariat (CPS). The purpose of the nationwide resource mapping was to provide information to be used in making key decisions in intervening to improve value chain productivity as guided by the suitability maps. The intensive and highly technical resource map development exercise at the county was undertaken from June 2019 by the technical multi-disciplinary teams who concluded the exercise in January 2020 across the 47 counties in the country. The specific objectives of the surveys were to identify the suitability levels of the ASDSP II value chains and develop adaptation methods ,innovations and technologies which best fit a particular value chain. The joint exercise between the County, NPS and the service provider was to enable the counties to own the suitability maps, understand the base maps and be able to interpret the parameters used so as to define innovations and technologies for use in the value chain moving towards commercialization.

Further, the value chain resource maps are intended to avail data to be shared with other stakeholders to guide them in planning and making key decisions. The survey considered the three priority value chains being implemented by the programme. The exercise involved value chain actors and organizations.

We acknowledge the Government of Sweden, Government of Kenya and County Government of Kericho for the support in providing the requisite resources for ASDSP II. I acknowledge the CEC agriculture, the CO and the entire CPS Kericho county for providing the support to the programme at the county level. We are grateful to the National Programme Secretariat for the support during the exercise. We also take this opportunity to return our gratitude to the management of AL&F department and the entire staff establishment of Kericho County.

Mr. Jeremiah Rotich
Kericho County Programme Co-ordinator
Kericho County

EXECUTIVE SUMMARY

The agriculture sector development support programme phase II (ASDSP II) is anchored to the success of ASDSP I which ended in 2016. ASDSP II overall goal is to transform crops, livestock and fisheries into commercially oriented enterprises that promote food and nutrition security to the people of Kenya. The programme covers the 47 counties of Kenya and is funded by the Government of Sweden, the national Government of Kenya and the counties.

The four outcome areas identified at the end of ASDSP phase I include, improved productivity, development of entrepreneurial skills of priority value chain actors, access to market information and development of structures for coordination, consultation and cooperation in the agriculture sector. The sustainability maps were developed to achieve the four mentioned outcomes.

Kericho County prioritized three value chains i.e. cow milk, tomato and indigenous chicken. The biophysical (temperature, rainfall, slope and soil), market, agrarian and political parameters were used to determine the suitability of the PVCs. The suitability categories included highly, moderately and conditionally/marginally suitable.

In reference to the aforementioned parameters the cow milk was highly suitable except some few areas bordering the Mau forest and Londiani forest respectively. The community is known for the famous "***Mursik***" Fermented milk as their main identity which is in line with dairy farming. These areas with moderate suitability could be modified through adaptation measures. Tomato value chain is moderately suitable in Kericho County with. Highly suitable areas being characterized by low rainfall, high temperatures and good soils. The biophysical, market, social and political parameters are highly suitable for indigenous chicken value chain across Kericho County.

The county government has made endeavors to improve the county agricultural competitiveness in order to make Kericho an investment destination of choice through reviewing of policies and legislations as well as strengthening institutions to promote service delivery and ease of doing business.

1. INTRODUCTION

1.1 National Agricultural development landscape

Agricultural development in Kenya was founded on large-scale production as advanced by white colonial settlers in the early 1900s. The development concentrated in the central and rift valley highlands which were found to be ***most suitable*** for the production of wheat, coffee, tea and dairy. During this period, structures were put in place by the colonial government and the settler farmers to support commercial production and marketing of agricultural commodities. These structures included input services and output market organizations such as the Veterinary Research Laboratories in 1910, the Kenya Farmers Association (KFA) in 1923 and the Kenya Co-operative Creameries (KCC) in 1925.

Between 1900 and 1950, the colonial administration established various Ordinances aimed at controlling ***land use*** in the country. The ordinances restricted Africans to ***rural areas*** and also from occupying land that belonged to ***other tribes***. The dual restrictive policy was marked by alienation and overcrowding of Africans in villages leading to agitation and struggle for better living conditions. In the late 1940s, due to escalation of the land use crisis and dwindling economic returns from native agricultural practices, a restructuring of African agriculture by the colonial government was made. This was aimed to support existing colonial production of food and raw materials for exports.

The most radical and comprehensive intervention during this period was the £5 million twenty year Swynnerton agricultural development plan that commenced in April 1954. The main thrust of this plan was to increase household incomes through radical changes in land tenure system mainly in central Kenya. Small parcels of land were consolidated into at least 10 acre units per family. These units were registered and developed to improve productivity and household earnings from agriculture that averaged £10 to £100 in cash sales per year. This action resulted in a dramatic rise in the value of recorded output from the small-holdings from £5.2 million in 1955 to £14 million in 1964 with coffee accounting for 55 percent of the increase. The impact of this policy action resulted in significant decrease in the proportion of small holders living below poverty from over 60% in 1953 to less than 18% in 1974 in Central Kenya. This reduction was significant when compared to near zero poverty reduction levels witnessed in other parts of the country that were not covered by the plan. The major failure of the Plan was the neglect and marginalization of other areas of the country which led to imbalances in development between different regions.

After Kenya attained her independence, the agricultural industry concentrated support on smallholder farming with the goal of attaining food self-sufficiency and rural development. The policy actions at this time saw the former large-scale farms in the highlands subdivided and sold to smallholder farmers. Subdivision of large scale farms into small scale systems compromised the commercial viability of most agricultural enterprises in the productive areas of Rift Valley and Central Kenya. Small scale agricultural production reduced productivity fourfold.

Another policy shift that had far reaching implications to agricultural development was the Sessional paper No. 10 of 1965 on African socialism and its application to planning in Kenya. This policy ensured that the country's wealth would remain in the productive areas, which included the former white highlands and those covered by early registration under the Swynnerton Plan. It stressed that to make the economy grow as fast as possible, development funds would be invested where it would yield the largest increase in net output. This approach clearly favoured the development of areas endowed with natural resources, good land and rainfall, transport and power facilities while areas without such facilities were neglected (Kenya, 1965).

The Sessional paper No. 1 of 1986 on Economic Management for Renewed Growth re-emphasized the place of agriculture as the leading sector in stimulating growth and job creation in the country. This sessional paper prompted the profound structural adjustment process ever initiated by the Kenya government. A key element of this policy development was the liberalization of the production and marketing of important agricultural commodities like maize.

Other efforts geared at improving agricultural production by national government aligned to land use planning before the advent of devolution included provision of targeted extension services including the Training and Visits Extension Program, The Catchment Approach to Soil Conservation and the focal area approach of the National Agriculture and Livestock Extension Program (2000). The Economic Stimulus Program (ESP) of 2009/2010 was another national government initiative that committed financial support aimed at jumpstarting the Kenyan economy towards long term growth and development. Priority areas in agriculture were skewed towards construction of horticultural markets and promotion of small holder inland aquaculture. Government interventions and programs in agricultural sector during the intervening period between 1963 to 2013 were not informed by any spatial plans that linked the resource base to agricultural development.

Following the promulgation of Kenya Constitution 2010, the country transited into a devolved government system in 2013 with agriculture becoming a devolved county function. The Kenya 2010 Constitution ushered a new planning system with the national and county governments tasked to develop national and county specific spatial maps to support zoning and designation of areas for production of scheduled agricultural commodities. The Kenya National Spatial Plan 2015- 2045: An integrated Spatial Plan for Balanced and Sustainable National Development, was developed within this constitutional framework and has laid the foundation on which Article 66, on the regulation of land uses, Article 68, on maximum and minimum land holding sizes and Article 69 on environment management will be achieved. The Kenya Crops ACT 2013 designates the Cabinet Secretary in charge of Agriculture with the advice of the Agricultural and Food Authority with the responsibility of developing rules for identifying and zoning agricultural land suitable for the production of the scheduled crops. The Crops ACT 2013 however allows individual land owners to have a final say on the actual land use practice to implement.

The development of suitability maps to inform competitive land use practices aligned to promotion of priority value chains in the 47 counties of Kenya therefore builds on the demands for spatial planning and regulation of land uses by examining the suitability of the Kenyan land resource in supporting some 29 priority value chains (PVC). The maps offer an interim evaluation and demonstrate to some extent the underlying reasons behind the decline in agricultural productivity based on the potentialities that exist to support commercialization of some 29 priority value chains. The value chain suitability maps provided here are aligned to each of the 29 value chain commodities promoted under the Agriculture Sector Development Support Program (ASDSPII), a five year program (2018-2022) of the Ministry of Agriculture, Livestock, Fisheries and Cooperatives with funding support from the national and county governments, The Swedish government and the European Union. For Kericho County, these priority value chains are cow milk, tomato and indigenous chicken.

1.2 Agricultural resources

The Kenyan agricultural development is mainly land and climate depended. The constitution of Kenya 2010 under Article 260 defines land broadly to mean the surface of the earth and the subsurface rock; any body of water on or under the surface; marine waters in the territorial sea and exclusive economic zone; natural resources completely contained on or under the surface; and the air space above the surface. The constitution under Article 60 calls for efficient, productive and sustainable use of land. Kenya is a diverse country with rainfall and temperature endowments that support a wide scope of crop, livestock and aquaculture systems. The country receives between 250mm to over 2000 mm of rainfall (**Error! Reference source not found.**) with temperature ranges as low as 4.6° C and highs of over 34° C (**Error! Reference source not found.**).

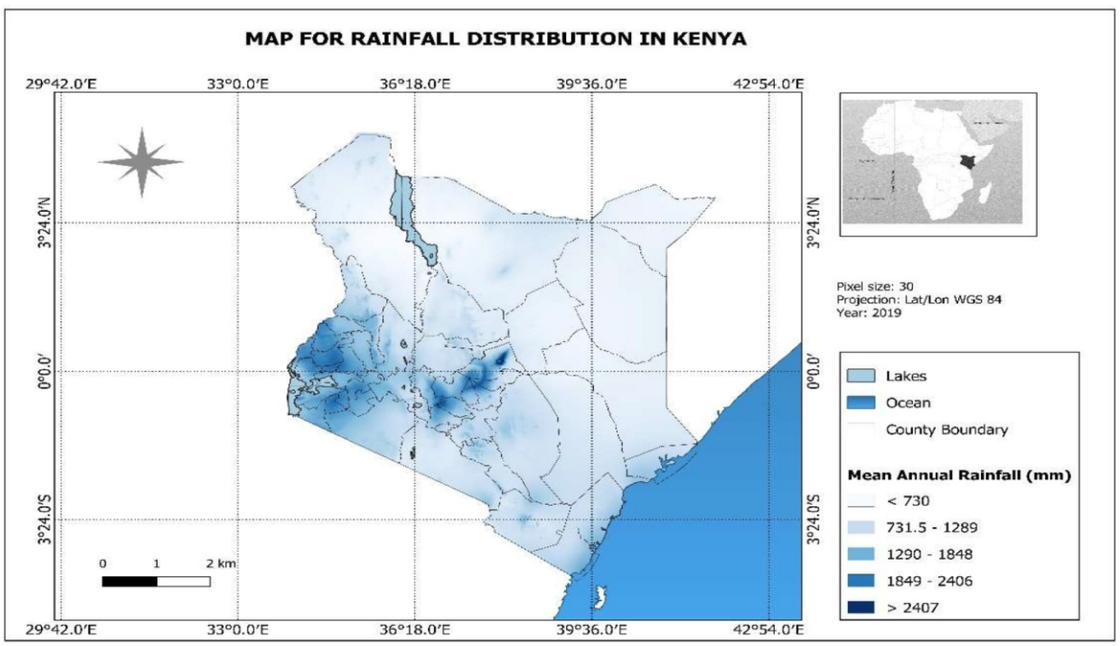


Figure 1: *Kenya Rainfall distribution*

The demand and distribution of agricultural produce within the country is affected by population density (**Error! Reference source not found.**) and infrastructure development (**Error! Reference source not found.**) since these attributes are key proxies to determining internal market access and size. The Kenyan population is not uniformly distributed while over the years the government has invested in the development and expansion of the road and railway networks actions that have contributed to improving market access for both the inputs and agricultural commodities.

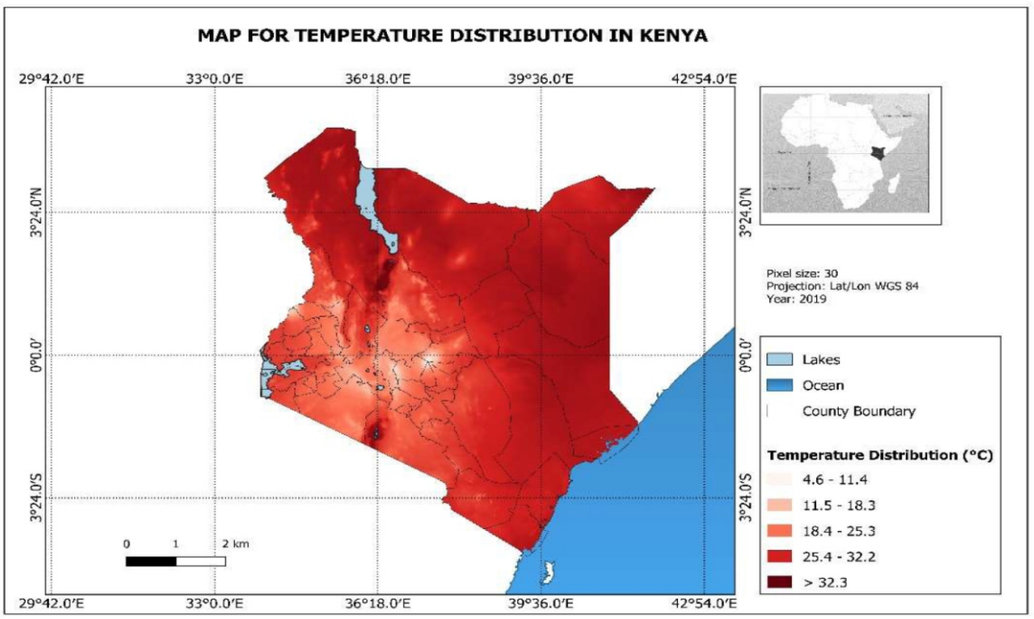


Figure 2: *Kenya Temperature*

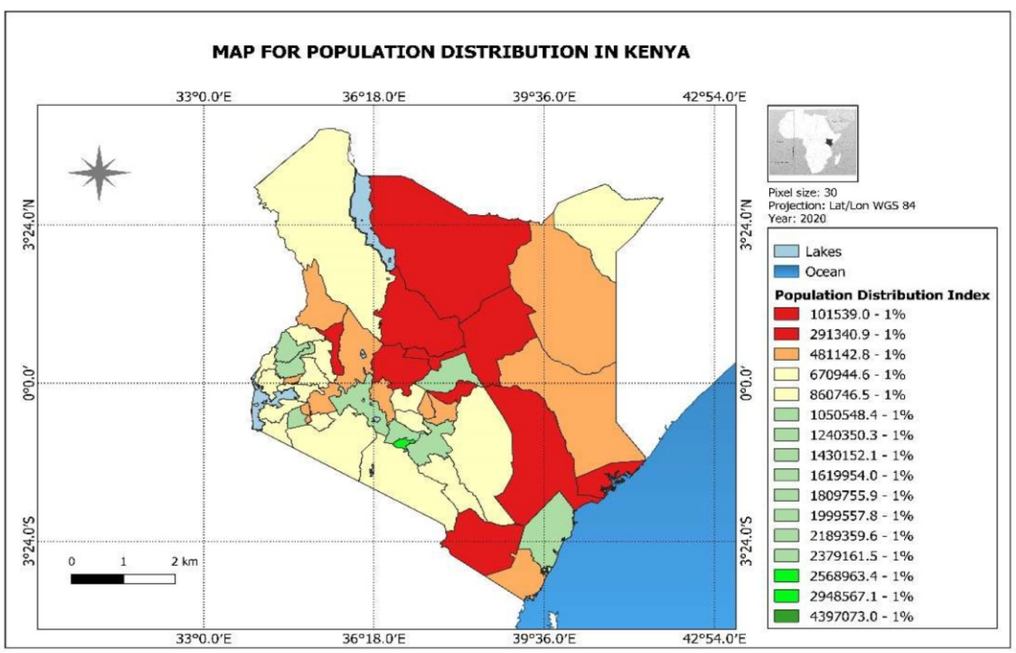


Figure 3: *Kenya Population Density*

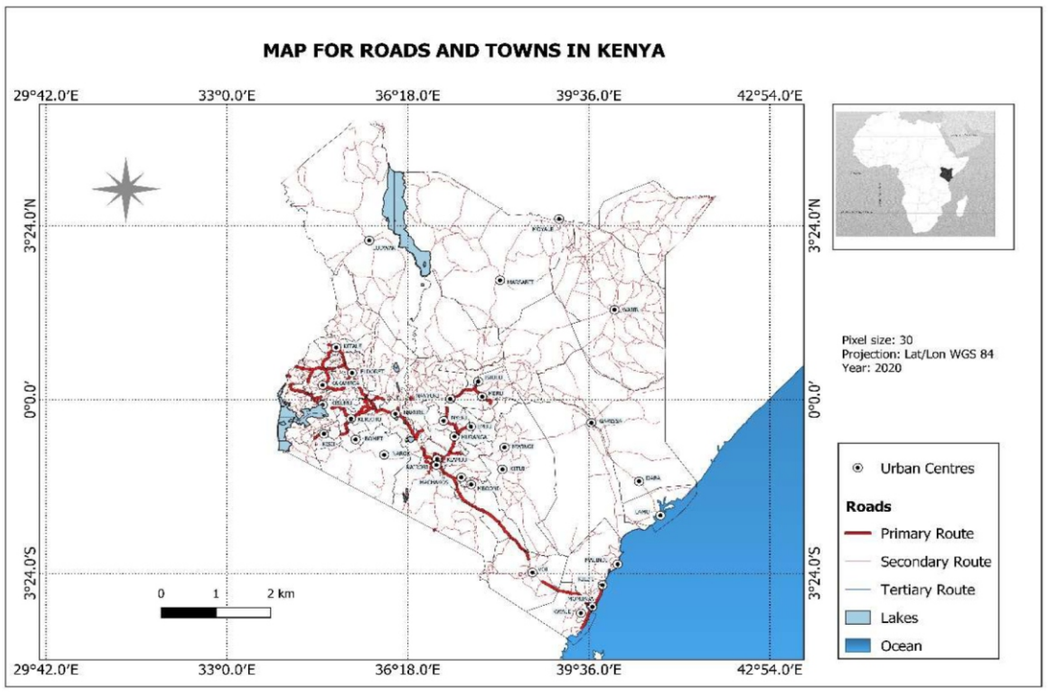


Figure 4: *Kenya Roads and Major Towns*

1.3 The Agricultural Sector Development Support Programme

1.3.1 ASDSP I

Agriculture Sector Development Support Programme (ASDSP I) was a national formulated and implemented programme financed by Government of Kenya and the Government of Sweden. The first phase was implemented during a period of five years (2012-2017). The developmental objective (purpose) of ASDSP I was *"increased and equitable incomes, employment and improved food security of the target groups as a result of improved production and productivity in the rural smallholder farm and off-farm sector".* It was one of the major programmes implementing the sector strategy, Agriculture Sector Development Strategy (ASDS: 2010-2020) whose goal was to commercialize agriculture. During this programme phase, each county prioritized three agricultural value chains for promotion.

The priority value chains were identified through a scooping and consultative study forums facilitated by a team of experts in each of the seven regions of the country (the then Provinces except Nairobi, which was paired with Central). The 10 point criteria developed to guide the stakeholders in identifying and prioritizing the value chains examined among others; potential to increase in productivity; potential for private sector participation and crowding in; potential for contribution to sustainable land and natural resource management (NRM); competitiveness of the sector; unmet market demand; market size and growth prospects; profitability of enterprise; potential to contribute towards food security; potential to generate employment; potential for value addition; potential for women and youth involvement; potential for participation of vulnerable groups (i.e. low investments/quick returns enterprises) and Cultural Acceptability. Application of these criteria led to the selection of 29 priority value chains (PVCs) three in each of the 47 counties with the most preferred value chains being dairy, indigenous chicken, maize and fish (**Error! Reference source not found.**).

1.3.2 ASDSP II purpose

The overall goal of ASDSP II is aligned to the Agricultural Policy and is to contribute to "Transformation of crops, livestock and fisheries production into commercially oriented enterprises that ensures sustainable food and nutrition security". ASDSP II purpose is to commercialize priority VCs with expectations of increasing incomes among the VCAs and assure attainment of food and nutrition security to the VCAs households. The programme is devolved to all the 47 Counties. The identified outcome areas of the programme are; *increasing productivity of priority value chains, enhancing entrepreneurship of priority Value Chain Actors, improving access to market by VCAs* and support to strengthen structures and capacities for consultation, cooperation and coordination (3Cs) in the sector.

During the roll out of ASDSP II, a simpler and easy 5 point criteria (*Income, Food security, Employment creation, Environmental Sustainability and Opportunity to promote social inclusion*) was applied to validate the existing PVCs (**Error! Reference source not found.**) and in almost all the counties, the same PVCs promoted under ASDSP I were retained. Some counties however added an extra PVC and went ahead to invest additional resources on the programme.

Table 1: *Priority value chains*

	County	**Prioritized Value Chain**			**County**	**Prioritized Value Chain**
1	Baringo	Meat Goat		25	Marsabit	Meat Goat
		Honey				Camel Milk
		Cow Milk				Sukuma Wiki
2	Bomet	Cow Milk				Indigenous Chicken
		Maize		26	Meru	Maize
		Indigenous Chicken				Cow Milk
		Irish Potato				Indigenous Chicken
3	Buugoma	Cow Milk		27	Migori	Cow Milk
		Indigenous Chicken				Sweet Potato
		Tomatoes				Indigenous Chicken
4	Busia	Indigenous Chicken		28	Mombasa	Fish
		Fish				Local Vegetables
		Ground Nut				Cow Milk
5	Elgeyo Marakwet	Cow Milk		29	Muranga	Banana
		Irish Potato				French Beans and Snow Peas
		Maize				Cow Milk
6	Embu	Cow Milk		30	Nairobi	Broilers
		Banana				Sukuma Wiki
		Indigenous Chicken				Cow Milk
7	Garissa	Tomatoes		31	Nakuru	Pyrethrum
		Camel Milk				Fish
		Beef				Cow Milk
8	Homa Bay	Indigenous Chicken		32	Nandi	Maize
		Fish				Indigenous Chicken
		Sorghum				Fish
9	Isiolo	Beef				Maize
		Camel Milk		33	Narok	Beef

Table 1: *County Priority Value Chains cont'd.....*

	County	Prioritized Value Chain			County	Prioritized Value Chain
		Tomatoes			Cow Milk	
10	Kajiado	Cow Milk				Maize
		Tomatoes		34	Nyabururu	Irish Potato
		Beef				Fish
11	Kakamega	Cow Milk				Cow Milk
		Maize		37	Nyamira	Banana
		Indigenous Chicken				Local Yege tables
12	Kericho	Cow Milk				Cow Milk
		Tomatoes		36		Irish Potato
		Indigenous Chicken				Indigenous Chicken
13	Kiambu	Cow Milk				Beef
		Indigenous Chicken		37	Samburu	Maize
		Ban				Honey
14	Kilifi	Cassava				Indigenous Chicken
		African Eye Bird Chilli		38	Siaya	Mango
		Indigenous Chicken				Fish
15	Kirinyaga	Cow Milk				Cow Milk
		Banana		39	Taita Taveta	Banana
		Rice				Indigenous Chicken
16	Kisii	Cow Milk				Mango
		Banana		40	Tana River	Beef
		Indigenous Chicken				Fish
r	Kisumu	Indigenous Chicken				Banana
		Fish		41	Tharaka Nithi	Cow Milk
		Cotton				Indigenous Chicken
is	Kitui	Indigenous Chicken				Banana
		Gadam Sorghum		42	Tran-Nzoia	Maize
		Green Gram				Indigenous Chicken
19	Kwale	Indigenous Chicken				Fish
		African Eye Bird Chilli		43	Turkana	Sorghum
		Passion Fruit				Meat Goat
:o	Laikipia	Maize				Fish
		Cow Milk		44	Uasin Gishu	Passion Fruit
		Sheep and Goats				Indigenous Chicken
21	Lamu	Indigenous Chicken				Cow Milk
		Fish		4?	Vihiga	Indigenous Chicken
		Cashew Nut				Cow Milk
	Machakos	Cow Milk				Banana
		Indigenous Chicken		46	Wajir	Watermelon
		Mango				Indigenous Chicken
23	Makueni	Indigenous Chicken				Camel Milk
		Mango		47	West Pokot	Honey

Table 1: *County Priority Value Chains cont'd.....*

	County	Prioritized Value Chain			County	Prioritized Value Chain
		Green Gram				Indigenous Chicken
24	Mandera	Tomatoes				Meat Goat
		Camel Milk				
		Meat Goat				

1.4 Rationale

The Kenya Vision 2030 aims at developing "an innovative, commercially-oriented and modern Agriculture". This Vision is embedded in the Agricultural Policy (2016) and in Agriculture Sector Transformation and Growth Strategy (ASTGS: 2019-2029). Two flagship areas of the ASTGS of relevance are those that aim at strengthening and launching priority digital and data use cases to drive decision making and performance management of the sector and establishment of systems for active monitoring of sustainable and climate-smart natural resource management of water basins, soil quality and land use. The preparation of priority value chain suitability maps was made in response to these policy directives. The maps will inform development actions of priority value chains in each leading to agricultural transformation and growth.

The ASDSPII outcome area one seeks to increase productivity of the priority value chains through enhanced application of climate smart agricultural interventions, practices and technologies. Suitability maps are important decision tools that shall be applied to demonstrate the feasible baseline productivity of geographical regions (county, ward, country etc.) and guide in generating adaptive actions to counter the excesses of climate change and unsuitable conditions. Identification and application of climate smart technologies to meet the production needs of value chain systems will facilitate commercialization.

Transformation and growth of the agricultural sector will only be achieved when the problems and challenges of rapid and unregulated urbanization is addressed. Unplanned urbanization leads to conversion of rich agricultural land to urban use; environmental degradation, unbalanced development of high potential areas at the expense of other areas, poor economic performance of agriculture and sub-optimal use of land and the rich natural resource endowment. The priority value chains suitability maps provide a framework for addressing challenges by providing strategies to address the challenges based on land capability classes.

The priority value chains suitability maps considered biophysical, economic, social and political attributes as they affect productivity and commercialisation of the value chains. This is a departure from the conventional agro ecological zoning procedures (**Error! Reference source not found.**) and the soil suitability mapping (Figure 6) processes.

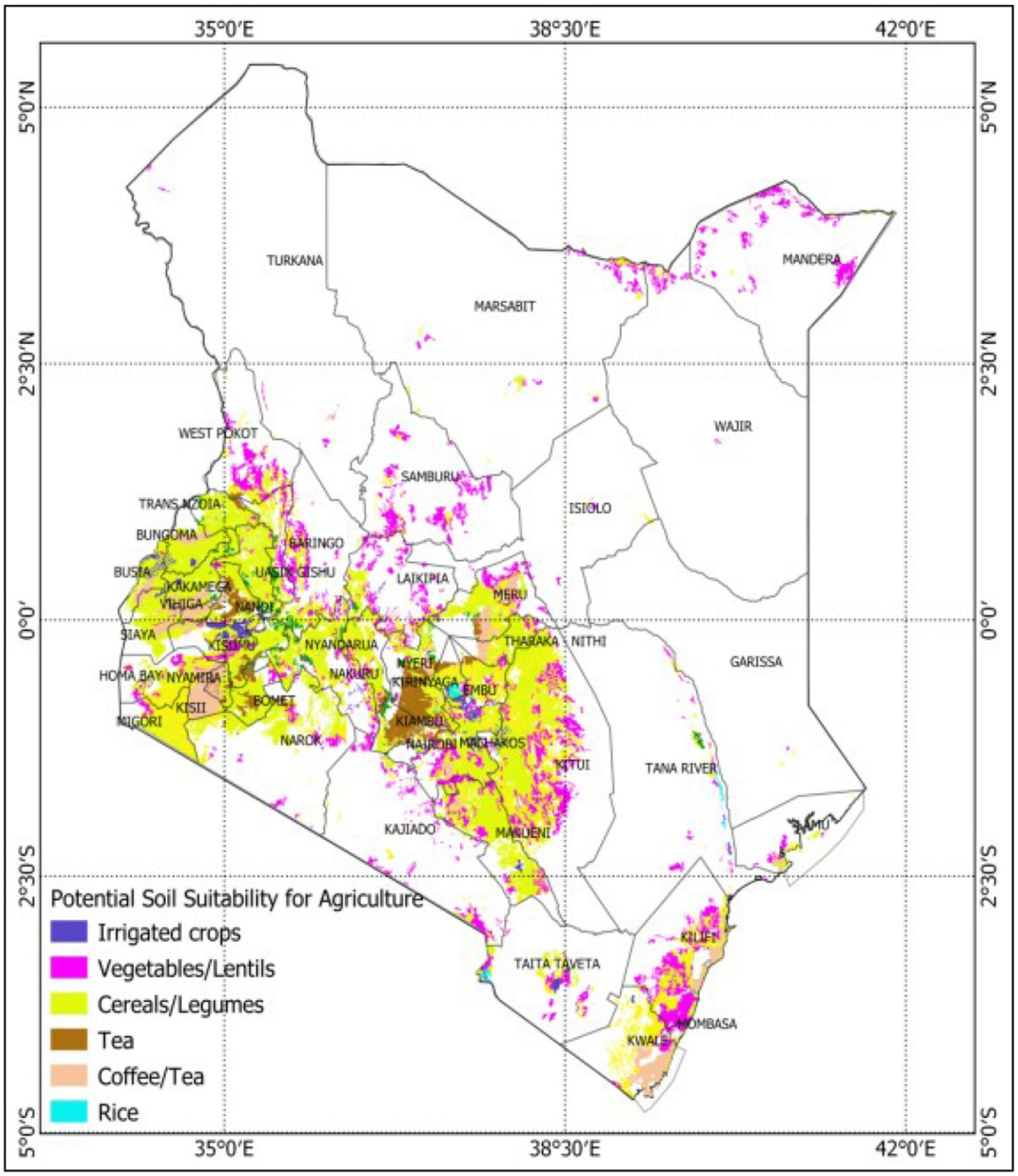


Figure 5: *Soil suitability classification*

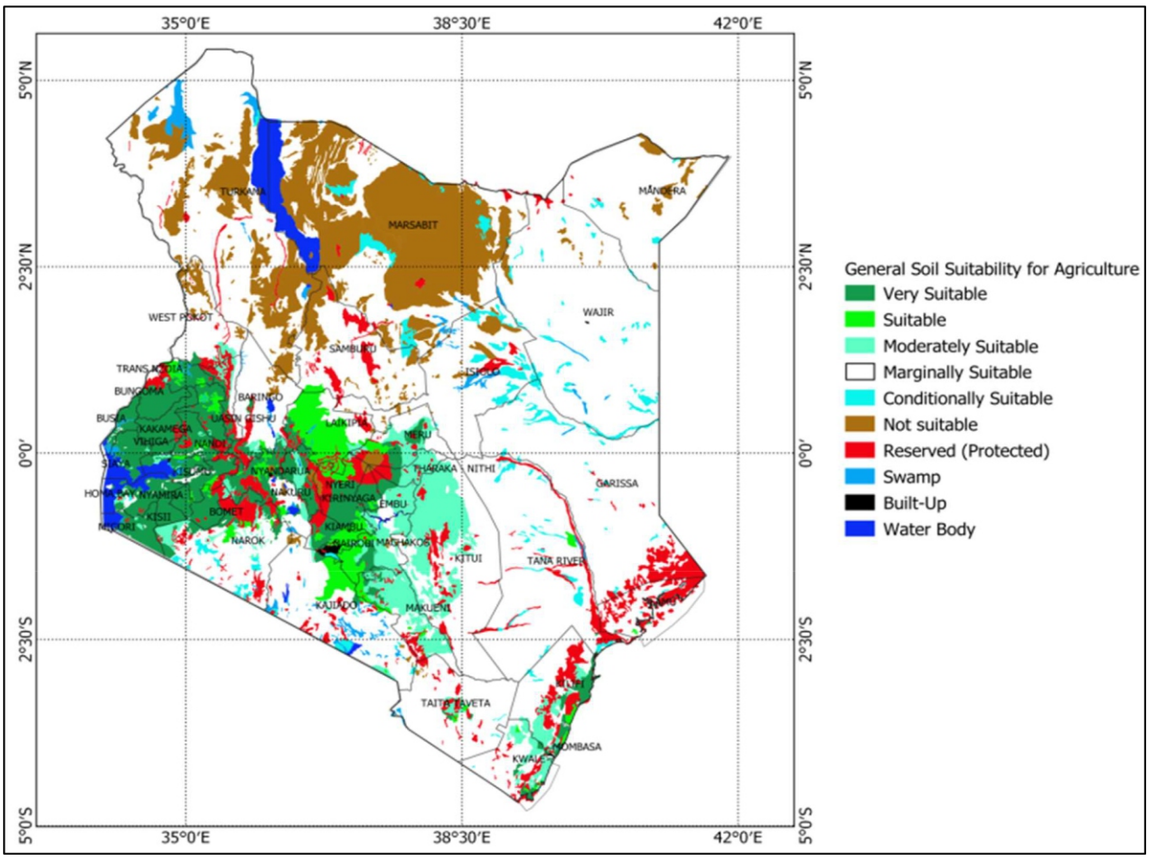


Figure 6: *Soil suitability classification*

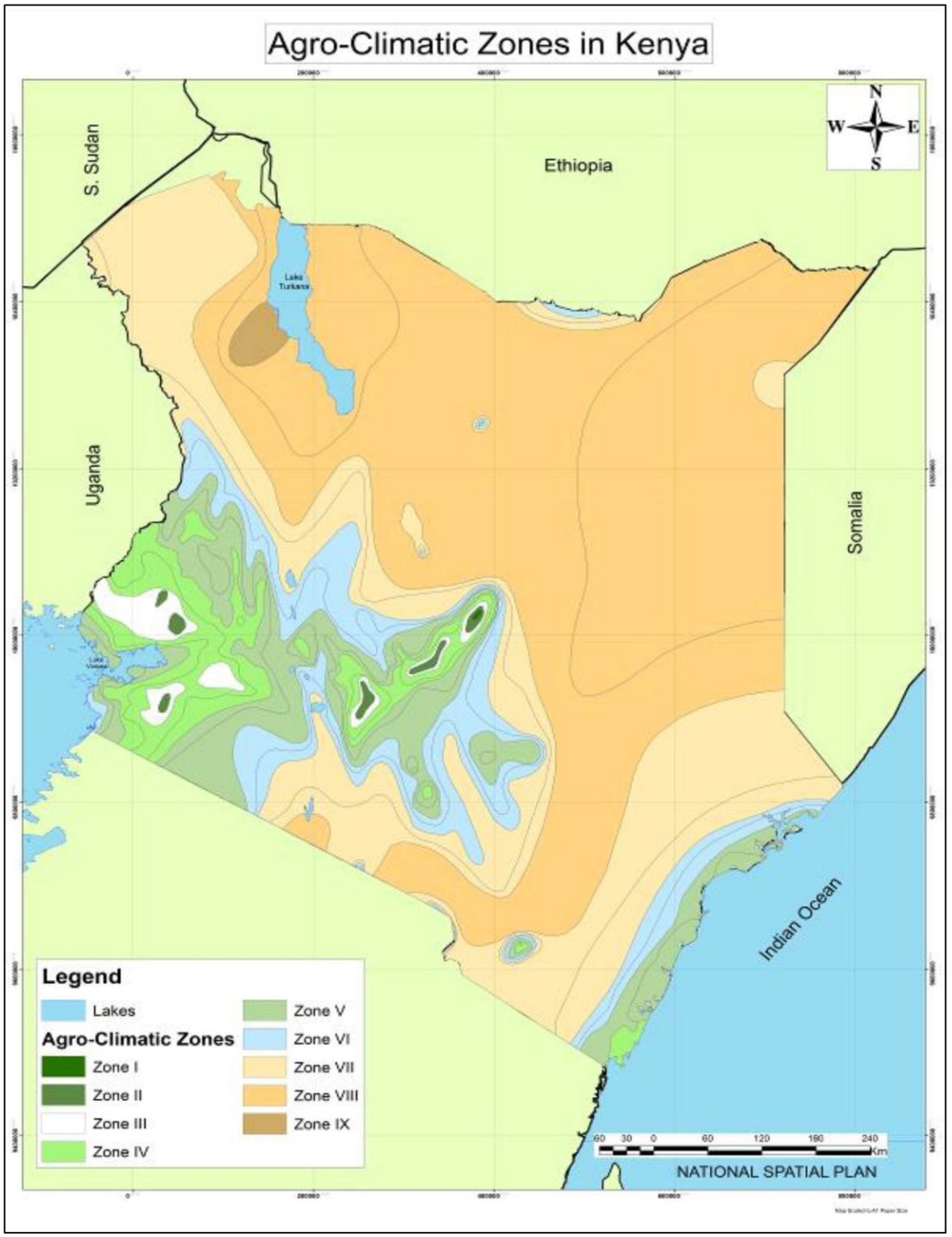


Figure 7: *Agro ecological zones*

1.5 Objectives

The objectives of the priority value chain suitability atlas are:

i. To create a spatial planning context to strengthen priority value chain competitiveness;

ii. To optimize allocation and utilization of land, natural human and capital resources to increase value chain productivity;

iii. To secure the natural environment for high quality of life;

Principles

The principles that guided the preparation of priority value chains suitability maps are;

i. Transformation and commercialization of agricultural value chains. That the value chain development must be anchored on scales that are commercially viable and technically feasible with direct benefits accruing to VCAs in incomes and food security terms. The maps were prepared to address the needs to plan resource allocation to drive commercialization and transformation of agriculture

ii. Consultation and effective public and cross sectoral participation and engagement: All the maps were prepared in a participatory and consultative manner with relevant stakeholders and sectoral actors. The process involved experts from Survey of Kenya, county physical planners, Kenya Agricultural Research Organization, Kenya Marine and Fisheries Research Institute, State and County agricultural personnel, value chain actors, universities and the private sector.

iii. Value chain approach to agricultural and rural development. Development of the maps considered factors that affect production, trade and marketing to derive parameters that most represent the ease of commercializing a value chain represented as suitability classes.

iv. Knowledge driven and evidence based planning and development. The process was driven by application of scientifically proven processes and tools to capture, query, analyze data, synthesize information for presentation and use by stakeholders.

v. Climate smart agriculture and green growth: The maps present measures that promote sustainable use of natural resources, increase resilience to climate change effects with low carbon footprints.

2. METHODOLOGY

The suitability maps were generated through integration of a set of parameters that were derived through expert opinion and literature review. The criteria considered were grouped into four main categories namely; biophysical (land, water, climate), economic (population density, proximity to roads and markets and poverty index), social (agrarian orientation) and political (policies and supportive framework conditions). The parameters were processed as thematic maps and consolidated by overlaying to produce suitability classes of land use practices on a GIS environment using QGIS, ILWIS, SAGA and R Studio. This approach was a progression from the traditional land suitability and land evaluation mapping process.

2.1 Selection of evaluation criteria

The biophysical parameters were assessed on the basis of climatic (rainfall, temperature, humidity and temperature humidity index) and soil (soil pH, soil CEC, soil organic carbon, soil texture, soil drainage, soil depth, available soil water and soil fertility, topography, length of growing period, stoniness and proximity to water resources) criteria. The economic criteria were based on total population, population density, proximity to roads/rail, and proximity to marketing points. The proxy indices were applied as representations for establishing market demand and access. The agrarian culture of the people was a proxy for examining the potential growth and adoption of a value chain. These parameters were used to determine suitable areas for promoting any crop, livestock or fish value chain through a methodological process illustrated below.

An Analytical Hierarchical Process (AHP) as a Multi Criteria Evaluation was used to determine relative importance of each criterion and the resulting weights were used to construct the attribute maps/layers on the GIS platform. It was preferred because of its capacity to integrate a large quantity of the heterogeneous data. A further processing of the attribute maps was done overlaying them to generate suitability composite maps. The composite maps were then subjected to a validation process from where the explanatory notes were made and incorporated in this atlas

2.1.1 Data gathering and preparation

Soil data was obtained from Kenya Soil Survey (KSS) Land Information Cradle (online) and also from the ILRI GIS (online). Climate data was obtained from Kenya Meteorological Services (KMS – online services). The socio-economic data was obtained from Kenya National Bureau of Statistics (KNBS). The huge climate data from the KMS were interpolated to get the climate information of all the 47 Counties. Satellite image and Digital Elevation Model (DEM) were obtained from Regional Centre for Mapping of Resources for Development (RCMRD) at 30-meter spatial resolution and re-projected to WGS84 coordinate system. The slope information was obtained from Advanced Space-borne Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model Version 2 (GDEM V2) and processed on ILWIS and SAGA to analyze the terrain.

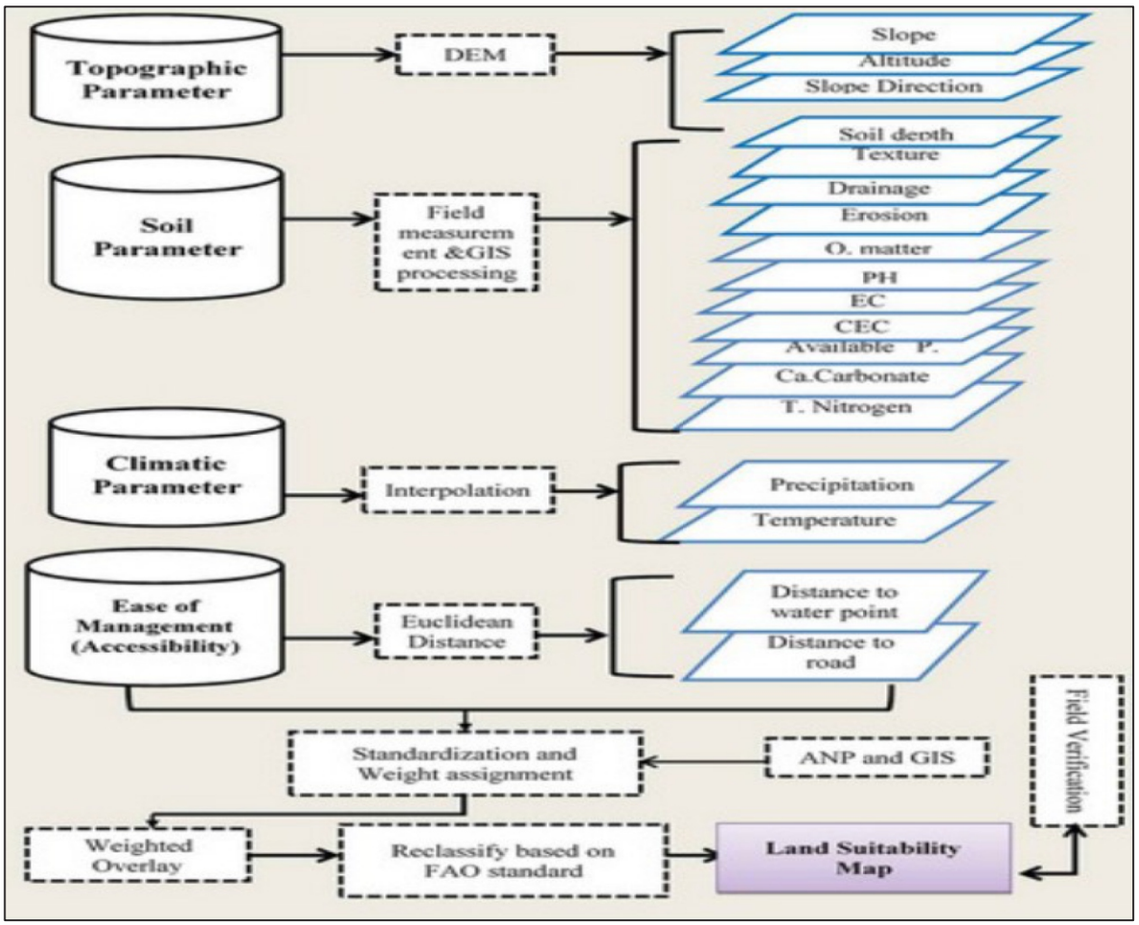


Figure 8: *Suitability mapping process*

Thematic maps for the slope and the soil parameters were developed using QGIS 3.4.2 software. Annual rainfall and mean annual temperature thematic maps were generated using Inverse Distance Weighted (IDW) interpolation. IDW interpolation determines cell values using a linearly weighted combination of a set of sample points. All the maps were geo-referenced to WGS84 coordinate system. Suitability levels Highly Suitable S1, Moderately Suitable S2, Marginally Suitable S3and Not Suitable N were assigned score 1, 2, 3, and 4 respectively. Pairwise ranking and weighting was done to the sub-criteria and classes with higher scores subjected to suitability evaluation. The thematic maps were resampled and reclassified before being run on the SAGA and ILWIS for the final output.

2.1.2 Applying MCE and Assigning weight of factors

To determine relative importance/weight of criteria and sub criteria, AHP method of MCE was used. In order to compute the weights for the four (4) criteria (biological, physical, social and economic aspects) and the sub-criteria (Soil pH, Soil Texture, Soil Depth, Soil Drainage, Soil Fertility, Soil OC, Soil CEC, Stoniness, Soil AWC, Slope, Rainfall, Temperature, Relative Humidity, Length of Growing Period, Market Proximity, Road Proximity, Temperature- Humidity Index, and Agrarian Culture), a pairwise comparison matrix (PWCM) was constructed

using information obtained from Agricultural Sector Development Support Programme (ASDSP) experts gathered at the Morendat Training Centre, Naivasha in June/July 2019 during an ASDSP sponsored validation workshop. During this exercise, each factor was compared with the other factors, relative to its importance, on a scale from 1/9 to 9 according to Saaty rating scale (**Error! Reference source not found.**). During the pairwise ranking, inconsistencies were checked by ensuring that the corresponding consistency ratio (CR) was less than 10% according to Triantaphyllou et al, 1995. The CR was obtained by working with the Consistency Index (CI) and the Random Consistency Index (RCI).

Table 2: *Saaty Rating Scale*

Intensity if importance	Definition	Explanation
1	Equal importance	Two factors contribute equally to the objective.
3	Somewhat more important	Experience and judgement slightly favour one over the other.
5	Much more important	Experience and judgement strongly favour one over the other.
7	Very much more important	Experience and judgement very strongly favour one over the other. Its importance is demonstrated in practice.
9	Absolutely more important	The evidence favouring one over the other is of the highest possible validity.
2,4,6,8	Intermediate values	When compromise is needed

Table 3: *Sample of Pair wise comparison matrix for the soil sub-criteria (Biological Aspects)*

	PH	Texture	Depth	Drainage	Fertility	OC	CEC	Stoniness
pH	1	1/3	1/3	1/3	5	7	1/4	3
Texture	3	1	3	3	1/7	1/3	1/3	3
Depth	3	1 3	1	1/2	3	5	6	1/3
Drainage	3	1 /3	2	1	5	9	7	5
Fertility	1/5	7	1/3	1/5	1	1/3	1/3	5
OC	1/7	3	1/5	1/9	3	1	4	5
CEC	4	3	1/6	1/7	3	1/4	1	6
Stoniness	1/3	1/3	3	1/5	1/5	1/5	1/6	1

Table 4: *Sample of Pair wise comparison matrix of Physical Aspects sub-criteria with respect to climate*

	Temperature	Rainfall
Temperature	1	1/3
Rainfall	3	1

Table 5: *Sample Pair wise comparison matrix of soil, climate and topography criteria*

Parameters	Soil	Climate	Topography (slope)
Soil (Biological)	1	3	7
Climate (Physical)	1/3	1	5
Topography (slope)	1/7	1/5	1

Table 6: *Sample Pair wise comparison between the economic aspects*

Parameter	Road proximity	Market proximity	Total population
Road proximity	1	4	5
Market proximity	1/4	1	6
Total population	1/5	1/6	1

Table 7: *Pair wise comparison between the social aspects*

	Population density	Agrarian culture
Population density	1	3
Agrarian culture	1/3	1

Table 8: *Pair wise comparison between the soil, climate, topography and socio-economic aspects*

	Soil	Climate	Topography	Socioeconomics
Soil	1	5	3	9
Climate	1/5	1	7	5
Topography	1/3	1/7	1	3
Socioeconomics	1/9	1/5	1/3	1

2.1.3 Overlaying map layers

The reclassified thematic maps/layers of each variable were weighted using the weights derived from the AHP process and the Boolean algebraic logic. The weighted maps/layers were combined by performing the weighted overlay using SAGA, Raster calculator and ILWIS to produce the final suitability map.

3 MAPPING COUNTY RESOURCES

3.1 County background

Kericho County is one of the 47 counties in the Republic of Kenya. It's located in the South Rift of the Great Rift Valley, about 256kms from Nairobi, the capital city of Kenya. The County lies between longitude 35º 02'and 35º 40'East and between the equator and latitude 0 23'South with an altitude of about 2002m above the sea level. The county is bordered by the Uasin Gishu County to the North West, Baringo County to the North, Nandi County to the North-West, Nakuru County to the East and Bomet County to the South. It is bordered to the South West by Nyamira and Homa Bay Counties and to the West by Kisumu County. The county occupies a total area of 2,479 sq. Km and is divided into 6 sub counties, 30 wards, 85 locations and 209 sub locations. The county is well positioned to benefit from various markets provided by the neighboring counties as it has robust national and county roads connecting to the rest of the counties.

The county is characterized by undulating topography. The overall slope of the land is towards the West, consequently drainage is in that direction. The county forms a hilly shelf between the Mau Escarpment and the lowlands of Kisumu County. To the North West are the hilly areas of Kipkelion rolling towards Koru. The Kericho plateau forms the central part of the county sloping gently from 2,500m to about 1,800m above the sea level. The county is surrounded by Tinderet Hills to the North and to the North-East is the Mau Escarpment and between them is the gently rolling land which forms Londiani hills (Tuluap-sigis). The central part of the county rises eastward towards 3,000m above sea level. The county is well drained with a good number of rivers that include Chemosit, Kiptaret, Kipsonoi, Timbilil, Maramara, Itare, Nyando, Kipchorian and Malaget. Some of these rivers are characterized by rapids and falls which could be harnessed for hydro-electric power generation. Some of the rivers with the waterfalls include Maramara, Itare and Kiptaret.

The county has seven gazetted forests comprising the South Western Mau Forest Reserve that occupies a total area of 32,700 ha, Makutano Forest covering 5,474ha, Tendeno Forest (724ha), Kuresoi Forest (7,367ha), Londiani Forest (9,016ha), Malagat Forest Station (3,138ha) and Sorget Forest Station (6,857ha). Private forests within the county are mainly owned by James Finlay Tea and Unilever Tea. The forests are situated in Londiani and within the tea estates.

3.2 County Resources

3.2.1 Biophysical Parameters

Mean annual temperature

Mean temperature condition for Kericho county ranges from as low as 14^{0}C and as high as 20^{0}C with some areas having extremes. In reference to resource map for temperature, the areas with relatively high temperatures of above 20 ^{0}c are Soin/Sigowet and some parts of Kipkelion west which majorly borders Kisumu in the lower pats of Kericho county. Areas of temperature range of 18-20 ^{0}c covers Bureti, Belgut and cuts through lower parts of Ainamoi to some parts of Kipkelion west which is regarded as a transitional zone between Highland and lowland areas, and areas with temperature range of 15-18 covers major parts of Ainamoi and Kipkelion East. It's also noted that there are some few areas with temperature range of less than 15 ^{0}c in the periphery of Kipkelion East which boarders the Mau and Londiani forest. Figure 9 below shows the mean annual temperature for Kericho county.

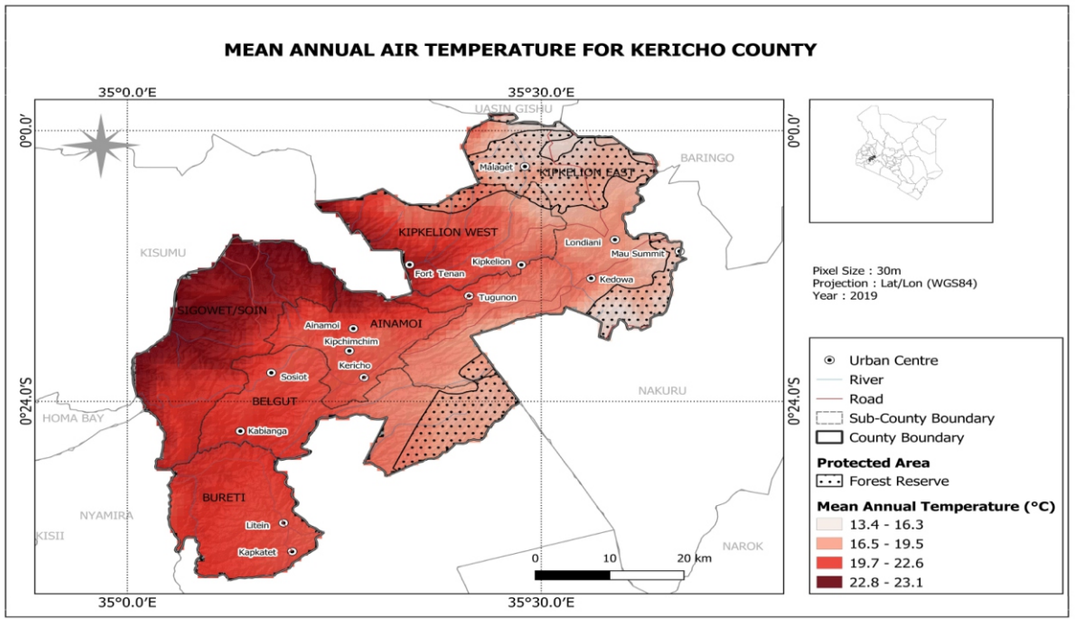


Figure 9: *Mean Annual Temperature for Kericho county*

Rainfall availability Kericho County

Rainfall distribution in Kericho ranges from 1290-1800 mm per annum. The long rainy season occurs between April and June whereas the short rainy season occurs between October and December every year. The driest season is mostly from January to February. In reference to the rainfall availability resource map for Kericho, the areas depicted to have relatively low rainfall range of 1290- 1500 mm per annum is Soin/ Sigowet, Lower Ainamoi, Kipkelion west and east. The areas with relatively high rainfall include Bureti, Belgut, Ainamoi with some parts of Kipkelion east i.e. Malaget, Londiani, Barsiele and Chepsir receiving less than 1290mm of rainfall per annum. Figure 10 below shows the rainfall availability in Kericho County.

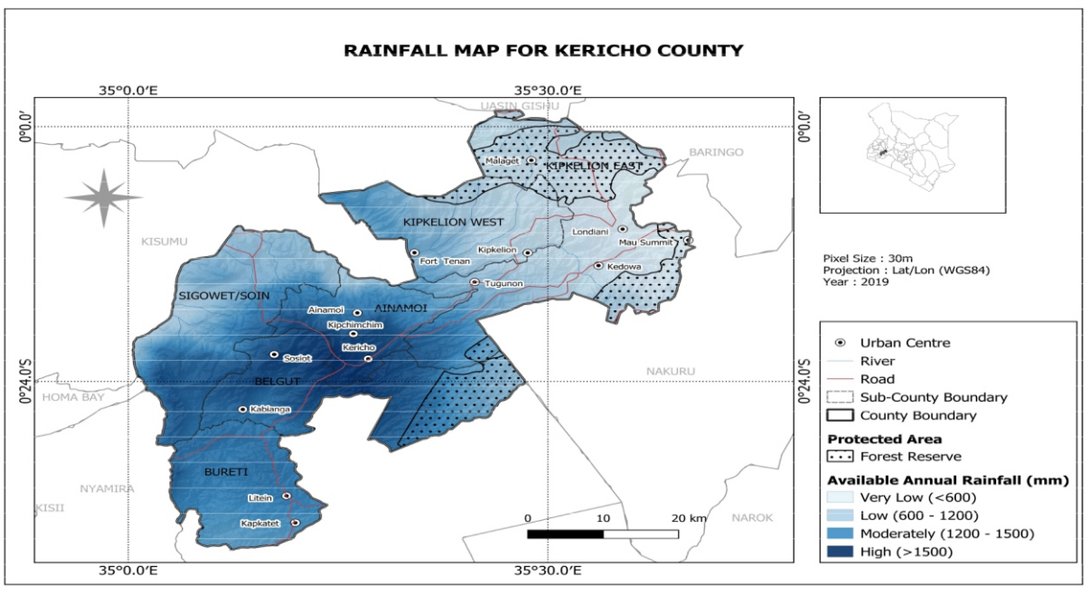


Figure 10: *Rainfall availability Kericho County*

Kericho County soils

Kericho County soils are majorly loamy with parts of Ainamoi, Bureti and Belgut having red volcanic soils which is suitable for production of tea and are highly regarded as acidic in nature.

Figure 11 below presents the soil map for Kericho County.

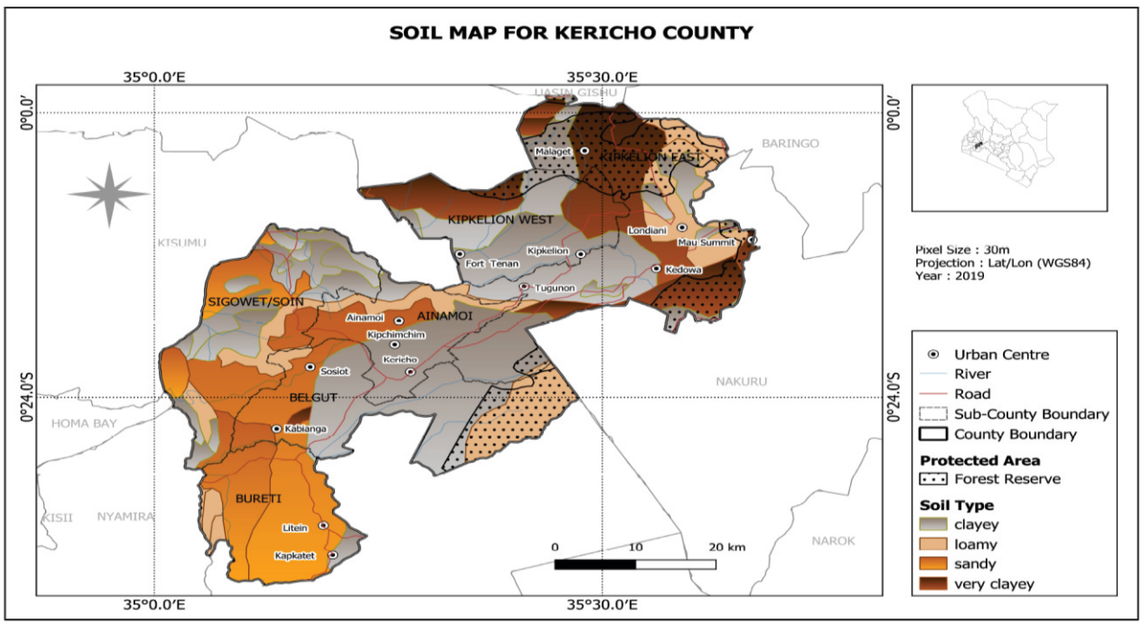


Figure 11: *Soil map for Kericho County*

Slope resources for Kericho County

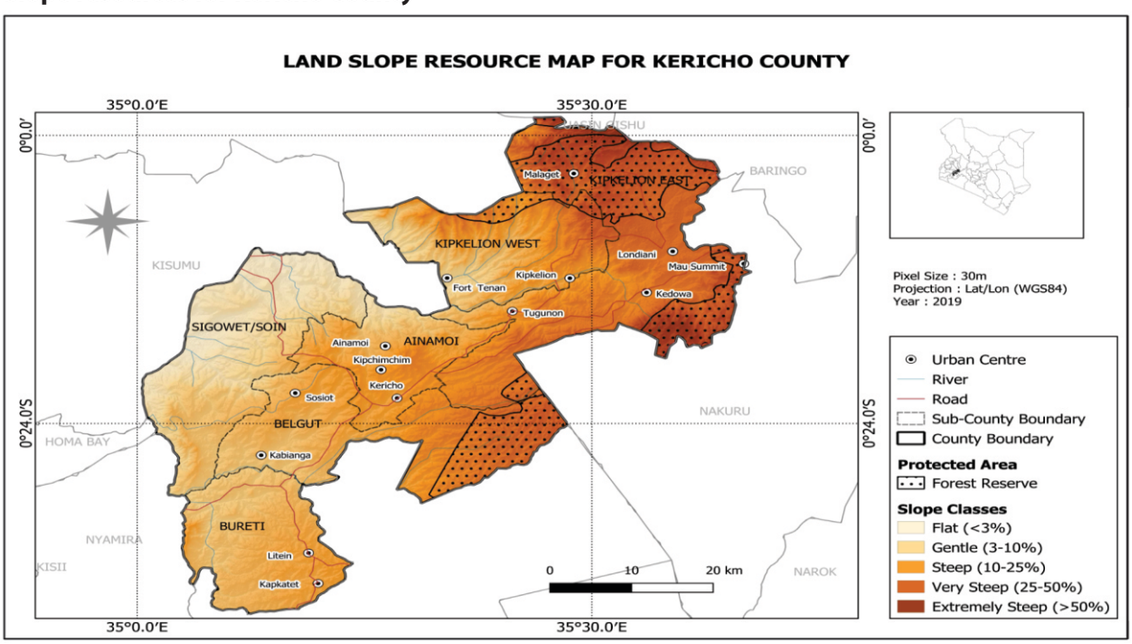


Figure 12: *Land slope resource map for Kericho County*

Heat stress levels in Kericho County

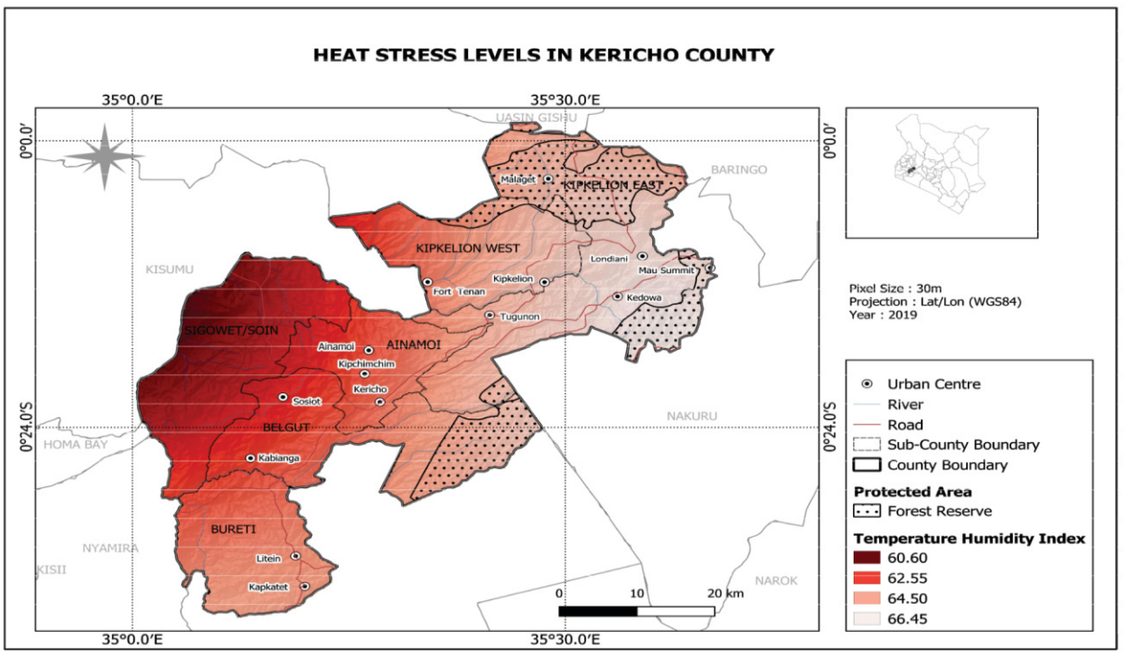


Figure 13: *Heat stress levels in Kericho County*

3.2.2 Agrarian Parameters for Kericho County

Kericho county is a cosmopolitan county with larger residence being the Kipsigis people a sub tribe of Kalenjin. The community is known for the famous "*Mursik*" Fermented milk as their main identity which is in line with dairy farming. This group of people have from ancient times been pastoralist until when the white settlers came to start farming in the area. Tea is currently the major agriculture activity being carried out by the Kipsigis people living in high potential areas of Bureti, Belgut, Ainamoi while others are maize and sugarcane farmers in the lowers side of Sigowet/Soin and Kipkelion East/west respectively. Other small farming activities are carried across the county which include dairy farming and poultry farming among others. The Kipsigis people are calm and very intelligent people who are known to be the best singers among the Kalenjin subtribes. They are characterized by slow in adopting to new technologies and venturing into new things until they are certain that this works for them, this is to say that they are not risk takers.

The average farm size for small scale farmers was 0.9 ha while for large scale farmers it was 14 hectares (ha). The large-scale farms are dwindling due to land fragmentation. Land resources in most parts of the county were utilized for farming, which comprised both food and cash crop farming and livestock rearing. The main crops grown include tea, coffee, sugarcane, potato, maize, beans, pineapples, horticulture (tomato, vegetables, among others). About 80 percent of the county is arable while the remaining 20 percent is non-arable.

3.2.3 Economics Parameters

The market parameters included roads, population and markets. The market accessibility map for Kericho represents the distribution of markets for agriculture produce which is highly characterized by the population. In general, the map shows that almost 90% of Kericho county farmers have access to the market for their

produce with major town centers being highly accessible. Figure 14 below shows the market access for Kericho county.

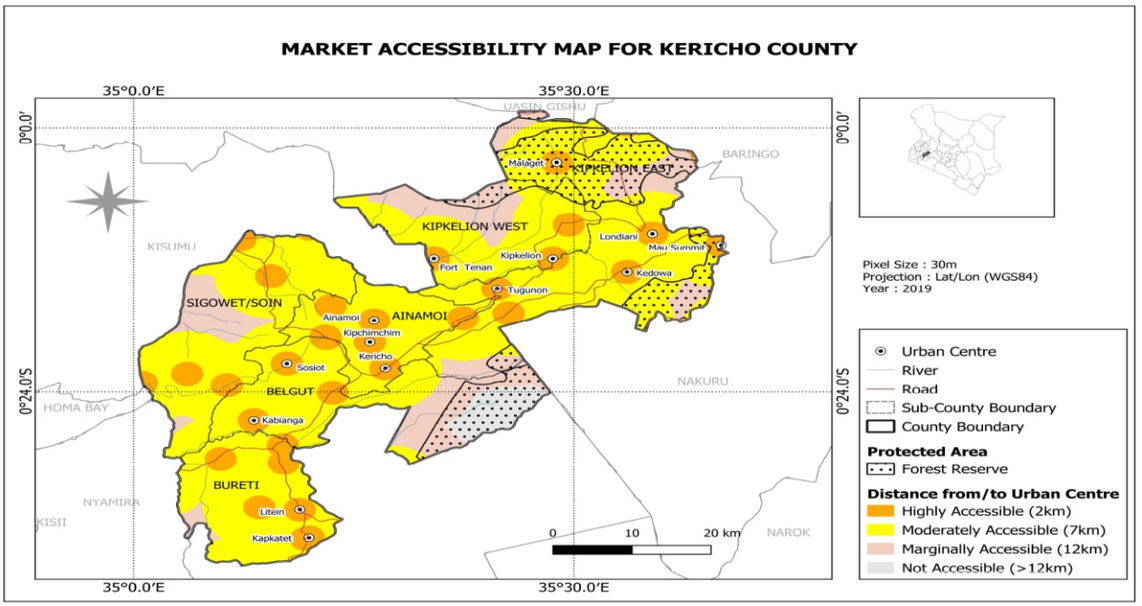


Figure 14: *Market access for Kericho County*

Road accessibility in Kericho County

Most of the roads are highly accessible in Kericho County. Figure 15 below shows the road accessibility in Kericho County.

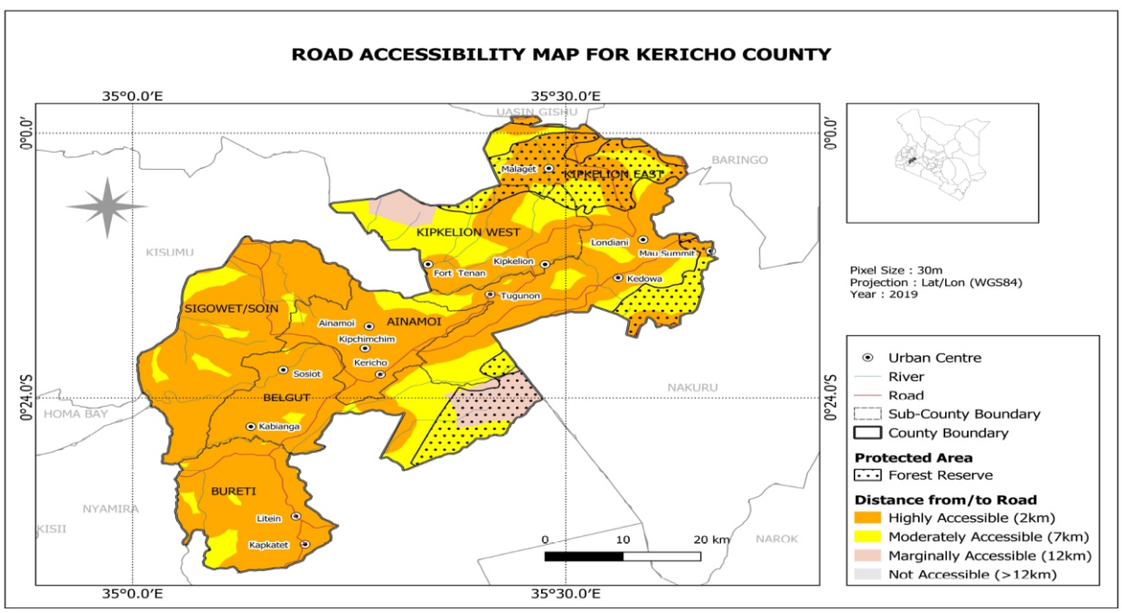


Figure 15: *Road accessibility in Kericho County*

County population density

Kericho county population is 901,777 according to 2019 national population census with, males being 419,898 and 481,879 are females. The high population is a catch market for agricultural produce.

County poverty distribution

The county has an absolute poverty rate of 41.3% while 38.7% of the population lives below the food poverty line.

3.2.4 Political Parameters

The county government of Kericho prioritized on the key sectors including value addition of agricultural products, scaling up health services, education, training, and conservation of the environment and proper utilization of natural resources (CIDP 2018-2022). The other strategic interventions prioritized by the county government is job creation for the youth, women and persons with disabilities.

In order to provide foundation for transformation in all sectors county-wide, the county government of Kericho proposed to prioritize on the infrastructure, promoting efficient service delivery and collaborate with other counties to build synergy in driving development agendas. In addition, application of Information Communication and Technology in service delivery, adoption of modern technology and deepening research and development.

The county also endeavors to improve its competitiveness in order to make Kericho an investment destination of choice through reviewing of policies and legislations as well as strengthening institutions to promote service delivery and ease of doing business.

4. PRIORITIZED VALUE CHAIN SUITABILITY MAPS

4.1 Background

The analysis of biophysical, economic and social characteristics of Kericho show that the county is a highly suitable place for the commercialization of the three prioritised value chains i.e cow milk, indigenous chicken and tomato.

4.2 Cow Milk Value Chain

4.2.1 Parameter analysis for dairy cow milk

Mean temperature condition for Kericho county ranges from as low as 14^{O}C and as high as 20^{O}C with some areas having extremes. The cow milk specific value chain temperature requirements are between 15-20^{O}C in which most parts of the county are represented in the map and thus regarded as highly suitable while for areas with relatively high temperatures (above 20^{O} C) such as Soin/Sigowet and some parts of Kipkelion west was marked as moderately suitable. Areas of low temperatures range of 15-18 which covers major parts of Bureti, Belgut, Ainamoi and Kipkelion East are highly suitable while some areas of both Kipkelion East & West and parts of Soin areas is marked as marginally suitable.

Rainfall distribution in Kericho ranges from 1290-1800 mm per annum. In reference to the suitability map for cow milk VC, the areas depicted to have relatively low rainfall of range 1290- 1500 mm per annum is marked as moderately suitable, for this case Soin/ Sigowet, Lower Ainamoi, Kipkelion west and some parts of Kipkelion east. The areas with relatively high rainfall include Bureti, Belgut, Ainamoi which is depicted to be Highly suitable. Major parts of Kipkelion east and significant parts of Soin/sigowet is found to be marginally suitable. This area is noted to receive less rainfall of less than 1290mm p.a.

Table 9. *Summary table for Cow Milk VC Suitability map*

Parameters for Cow milk	Para meters for Cow milk	Suitability	VC requirements	ADAPTATION	Innovation	Technology
Fertility	1.4	HS	Hs >1			
		MS	Ms 0.8-1	Use of manures	Well decomposed manure to be used in fodder establishment.	
		MGS	Mgs 0.5-0.8			
		NS	Ns <0.5			
Slope	3-50	Hs	Hs <8			
		Ms	Ms 8-10	Reduce the cow's movement	Adopt intensive and semi intensive management	Zero grazing
		Mgs	Mgs 10-20			
Land		Ms				
Temp	15-20	Hs	Hs 15-20	Increase tree cover in the area	Trees along the farm boundaries	Agroforestry,
		Ms	Ms 20-30			

Table 9. *Summary table for Cow Milk VC Suitability map cont'd.....*

Parameters for Cow milk	Para meters for Cow milk	Suitability	VC requirements	ADAPTATION	Innovation	Technology
		Mgs	Mgs 30-40	Improved varieties	Use of certified seeds and drought resistant varieties	
		Ns	Ns >40			
Rainfall	1100 - 2000	Hs	Hs >1100			
		Ms	Ms 1000-1100			
		Mgs	Mgs 800-1000	Rainwater harvesting	Dams construction, water reservoirs, insitu water pans	
		Ns	Ns <800			
THI	65-72	Hs	<68			
		Ms	68-72			
		Mgs	72-75			
		Ns	>75			
Tsetse fly	<1	Hs	Hs <1			
		Ms	Ms 1-1.2	Livestock breeds Genetic potential improvement	Breeding for tsetse tolerant cows	Artificial Insemination
		Mgs	Mgs 1.2-1.5			
		Ns	Ns >1.5			
Market	<3	Ha	Hs <3			
	3	Ma	Ms 3-4.5	Organizing farmers into marketing groups	Federation of VCOs	Cooperative society
		Mga	Mgs 4.5-7			
		Na	Ns >7			
Roads	Ha	Ha		Maintain the feeder roads and upgrade more roads	Murramming and grading	Grading
	Ma	Ma				
		Mgs				
		Na				
Population		Hs				
		Ms		Increase access to target market	establish milk coolers and market outlets in the densely populated areas	Milk shops, Milk ATMsand coolers
		Mgs				

Table 9. *Summary table for Cow Milk VC Suitability map cont'd.....*

Parameters for Cow milk	Para meters for Cow milk	Suitability	VC requirements	ADAPTATION	Innovation	Technology
		Mgs				
		Ns				
Agrarian	>4	Hs	Hs >4			
		Ms	Ms 3-4	Changefrom traditional ways of farming to modern farming	Improved breeds, Adopt intensive and semi intensive management	AI, Zero grazing
		Ms	Mgs 2-3			
		Ns	Ns <2			
Politics	Hs	Hs	Hs	Maintain the political good will in promoting dairy farming through funding	Increase funding to agriculture, livestock and fisheries sector	Budget approvals
		Ms				
		Mgs				
		Ns				

Soil drainage in Kericho is well drained and is highly suitable for fodder and pasture establishment. The soil fertility for the county is 1.4 while the requirement for pasture and fodder establishment is more than 1, which shows that the area is highly suitable for pasture production. Soil organic compounds for the county is 3.4-40 while the required for tomato growing is 2 and thus its rated as highly suitable, for production of tomatoes.

Dairy farming requires a slope of between <3 to 8 while the County slope range is between 3- 50%. The slope therefore is rated as highly suitable, moderately suitable and marginally suitable for some areas. The slopes in the county is moderately suitable for cow milk value chain.

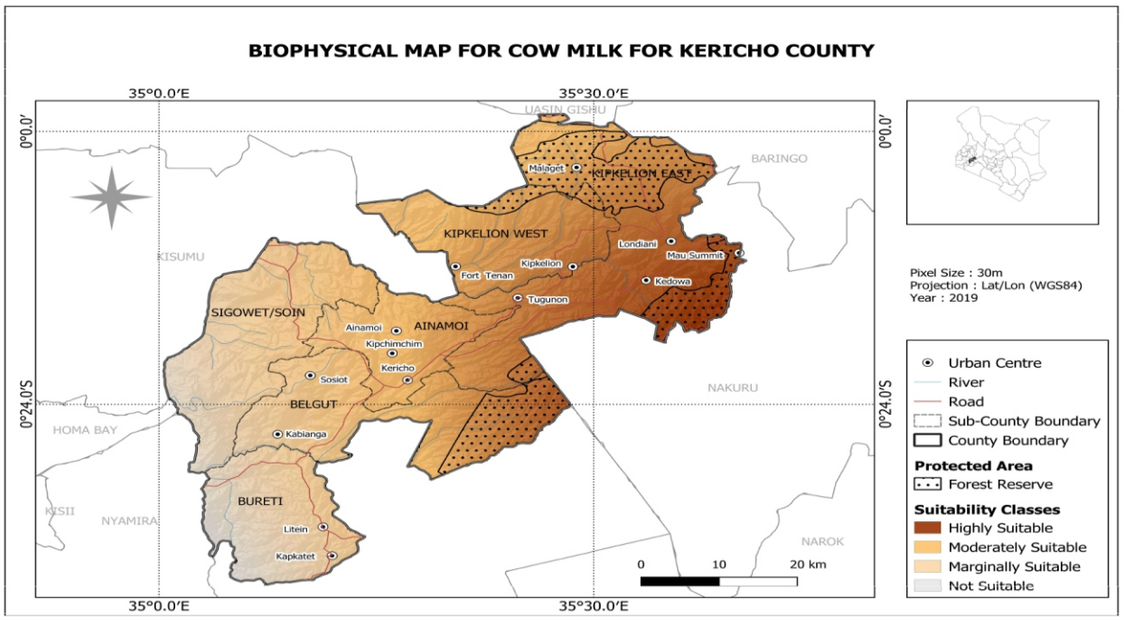
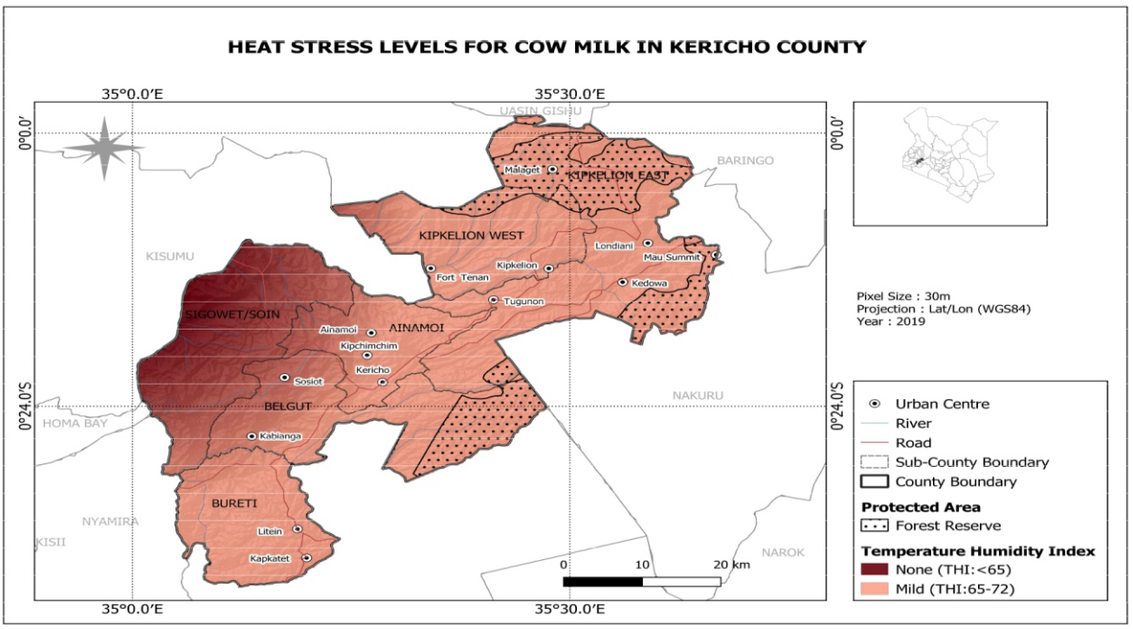


Figure 16: *Biophysical map for cow milk in Kericho County*

Heat stress levels in Kericho County



4.2.2 Population

The population for Kericho is concentrated to urban areas as compared to rural areas and thus the market for milk is relatively high in urban areas than in rural areas. There is need for sustainable strategies to commercialize the cow milk value chain to meet the increasing demand in the county.

4.2.3 Political parameters

Milk production has been given much attention in the county since its one of the most important value chains that has been practiced since ancient times and more so it's an enterprise that is of economic importance to the county. Cow milk VC is regarded as highly suitable for as political good will is concern. The county government of Kericho has among others promoted the dairy sector through subsidized AI services, purchase of coolers and improve on veterinary services.

4.2.4 Suitability classification for cow milk value chain promotion

Cow milk suitability map for Kericho shows that nearly all parts of the county is highly suitable except some few areas bordering the Mau forest and Londiani forest respectively. In regard to rainfall distribution resource map for Kericho the areas marked as highly suitable are characterized by low temperatures and high rainfall. The figure below shows the dairy cow milk suitability map.

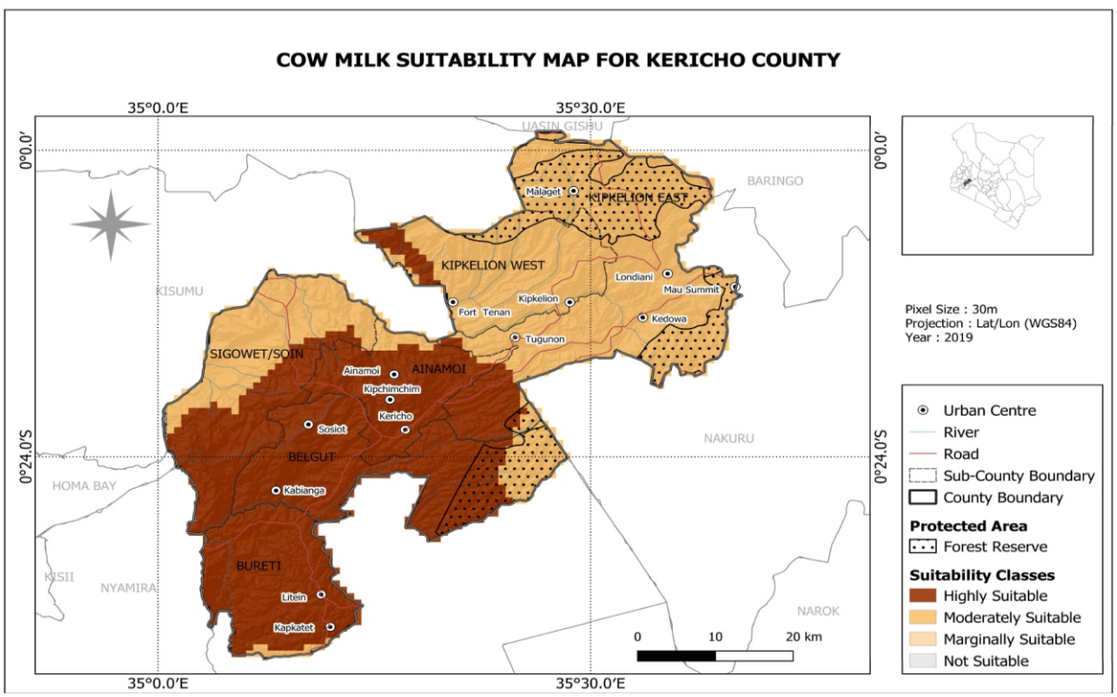


Figure 17: *Cow milk suitability map in Kericho County*

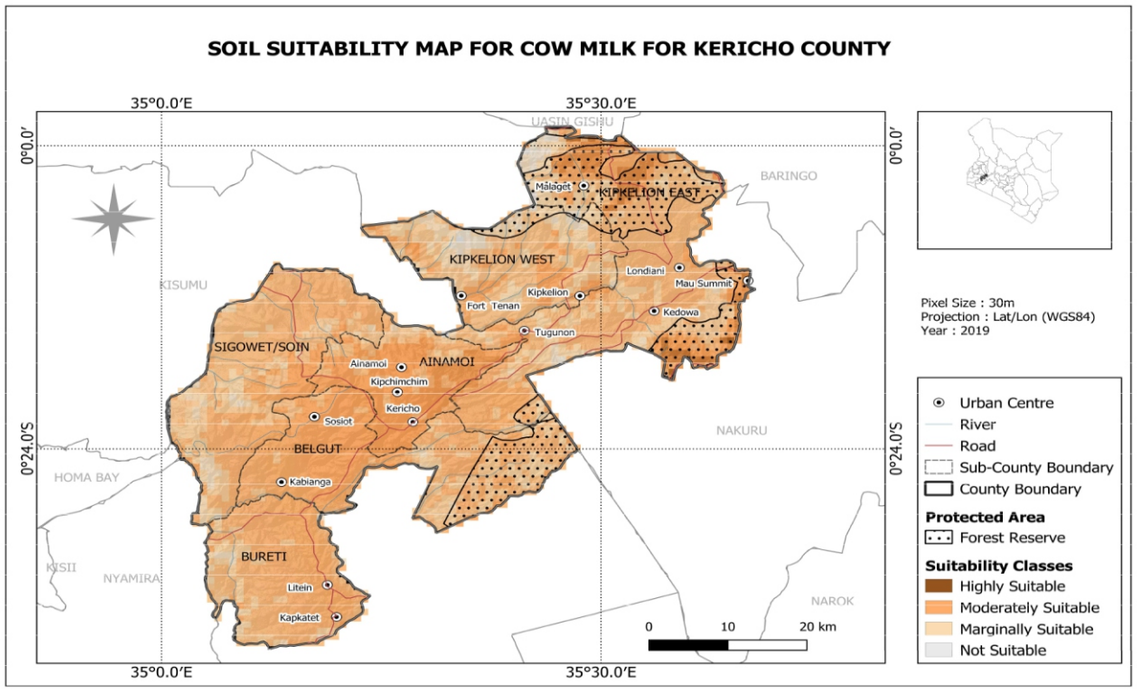


Figure 18: *Soil suitability map for cow milk in Kericho County*

Generally, cow milk is highly suitable for Kericho county. The adaptation measures to employ in commercialization of the value chain is presented in table 9 above.

4.2.5 Adaptation technologies and innovations

Overall, Kericho County is classified as highly suitable for the production of cow milk with some patches of moderately and marginally suitable regions. The areas with moderate suitability could be modified through adaptation measures elaborated in Table 9. Some important modifications include milk cooling during transportation and at trading sites, milk processing to increase value and shelf life and rainwater and soil management for improved pasture and fodderproduction.

Heat stress management for improved cow milk productivity in Kericho County

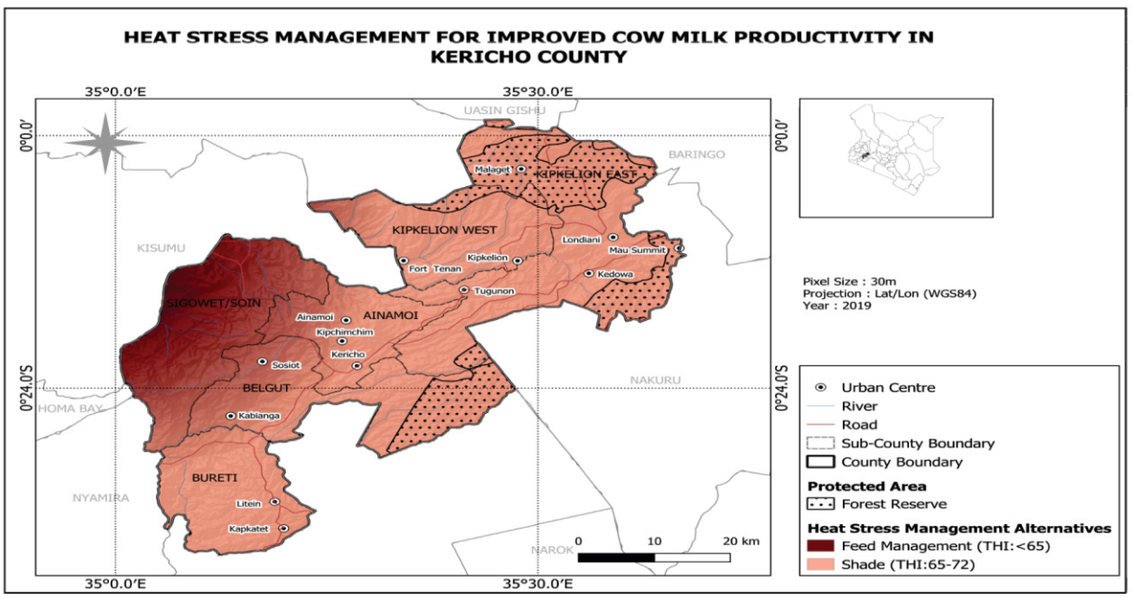


Figure 19: *Heat stress management for improved cow milk productivity in Kericho County*

Rainwater management for improved cow milk productivity in Kericho County

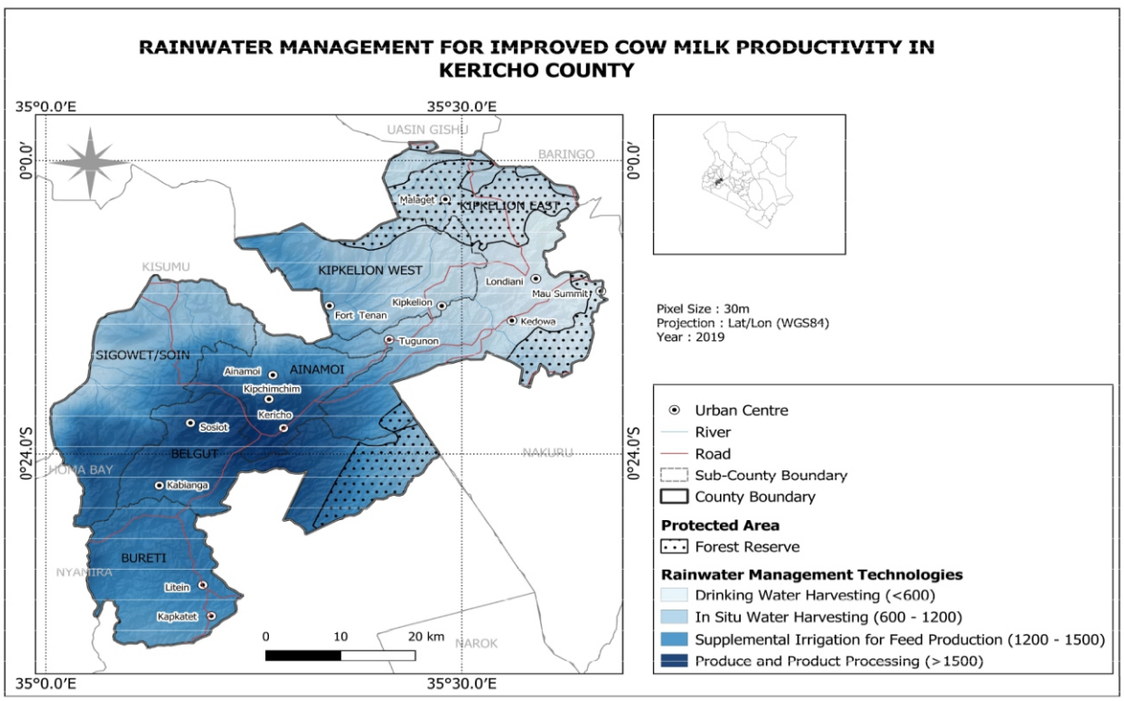


Figure 20: *Rainwater management for improved cow milk productivity in Kericho County*

Rainwater management for improved fodder productivity in Kericho County

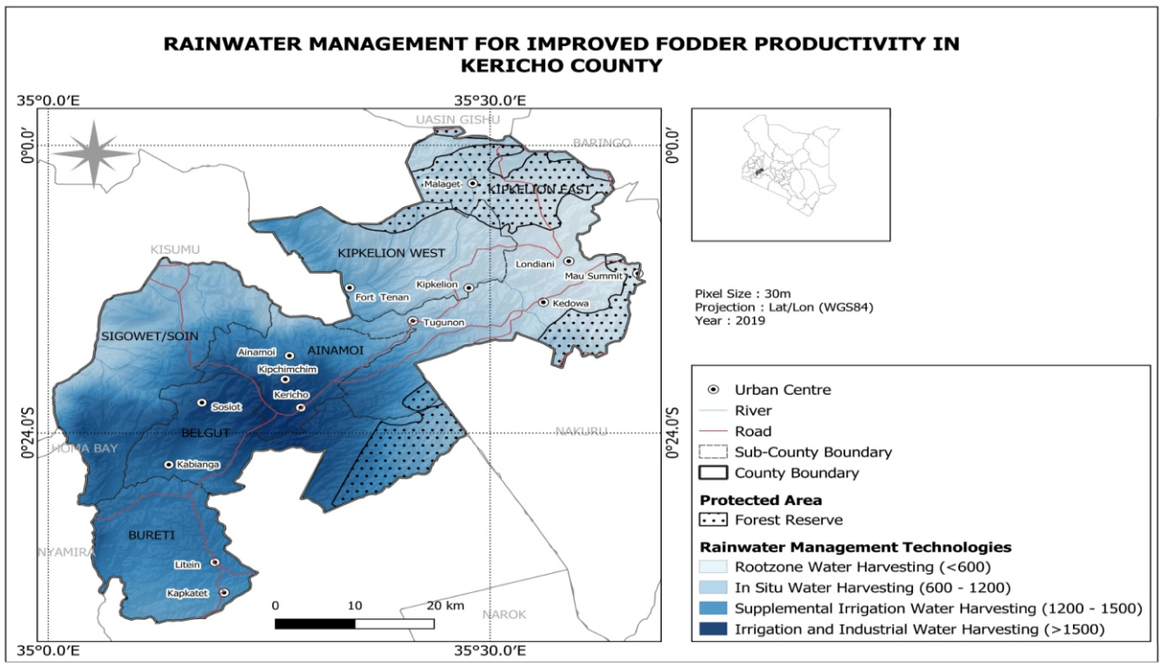


Figure 21: *Rainwater management for improved fodder productivity in Kericho County*

4.3 Tomato Value Chain

4.3.1 Biophysical Parameter analysis

Mean temperature condition for Kericho county ranges from as low as 14^{0}C and as high as 20^{0}C with some areas having extremes. In reference to suitability map for tomato, the areas with relatively high temperatures (above 20^0 C) such as Soin/Sigowet and some parts of Kipkelion west was marked as highly suitable and majorly moderately suitable in areas of low temperatures range of 15-18 which covers major parts of Bureti, Belgut, Ainamoi and Kipkelion East. Some areas of both Kipkelion East & West and parts of Soin areas is marked as marginally suitable.

Rainfall distribution in Kericho ranges from 1290-1800 mm per annum. In reference to the suitability map for Tomato, the areas depicted to have relatively low rainfall of range 1290- 1500 mm per annum to be highly suitable, for this case Soin/ Sigowet, Lower Ainamoi, Kipkelion west and east. The areas with relatively high rainfall include Bureti, Belgut, Ainamoi which is depicted to be moderately suitable. Major parts of Kipkelion west through Ainamoi to some parts of Soin/sigowet is found to be marginally suitable.

Soil drainage in Kericho is well drained and is highly suitable for tomato production. The soil PH is between 4.5-7.5 which has extremes. The recommended PH range for tomato is 5.5-6.15. Also, the average county average soil dept is 50-100 with >100 being the requirement for tomato growing. Soil organic compounds for the county is 3.4-40 while the required for tomato growing is 2 and thus its rated as highly suitable. The parameter for tomato value chain are analyzed in table 10 below.

Table 10: Tomato VC parameters analysis

Parameters for Tomatoes	County Parameters	VC requirements	Adaptation	Innovations	Technology
Drainage	Well drained	Hs-Welldrained	Increase organic matterin the soil	Use of manure	compositing, mulching, plant residue retention.
		Ms-moderately Drained	Prevent soil erosion	construction of terraces	Contour farming, bench terraces
		Mgs-Imperfectly Drained			
		Ns- Poorly drained			
PH	4.5-7.5	Hs 5.5-6.15			
		Ms 6.15- 6.8			
		Mgs 6.8- 7.5			
		Ns <5.3 or >7.5	lower soil acidity	apply lime to the farm	Disking and plowing
soil Dept	50-100	Hs>100			
		Ms 50-100	Increase soil depth	Breaking up hardpans	Soil ripping
		Mgs 25- 50		planting cover crops or use of dry materials to cover the soil	Mulching, lawning
		Ns <25			
		Ms 1-2			
		Mgs 0.5-1			
		Ns <0.5			
Soils	3.3	Ms			
Slope	3-50	Hs <3			
		Ms 3-5	prevent soil erosion	Ploughing across the slope, terracing	Bench terrace, contour farming
		Mgs 5-8	Use of hand tools to plough		
		Ns 8			
Soils		Mgs			
Temp	15-20	Hs-20-25			
		Ms 25-30	Modification of temperature conditions to between 21-27 degrees	Provide shading	Greenhouse, shade nets

Table 10: Tomato VC parameters analysis cont'd...

Parameters for Tomatoes	County Parameters	VC requirements	Adaptation	Innovations	Technology
		Mgs 30-35			
		Ns >35			
Rainfall (mm)	1400-2000	Hs 600-950			
		Ms 950-1300 Or 400-600			
		Mgs 1300 -1800			
		Ns >1800 or <400			
Political	MS	HS	Enhance political will	Enhance VCOs and federate to have bargaining power	Cooperative formation
Agrarian	MS	Hs >			
		Ms >	Change of attitude and stop over-dependent on rainfed agriculture	Embrace new ways of farming using harvested water and conditioning of climatic parameters	Irrigation, greenhouse
		Mgs >			
		Ns >			
Market Access/availability	MGA		Get an alternative market	Support market linkages to highvalue markets	Supermarkets, export market
Parameters for Tomatoes	**County Parameters**	**VC requirements**	**Adaptation**	**Innovations**	**Technology**
			Promoting contract Farming between producers and traders	Use of contract farming inmarketing	Contractual agreements
Roads	MA		Lobbying for prioritization of development	rehabilitation of feeder's roads intomato cluster zones	Murraming and grading
Population (target marke)	MGA				

Tomato production requires a slope of between <3 to 8 while the County slope range is between 3-50%. The slope therefore is rated as highly suitable, moderately suitable and marginally suitable for some areas. The biophysical map is presented in figure below.

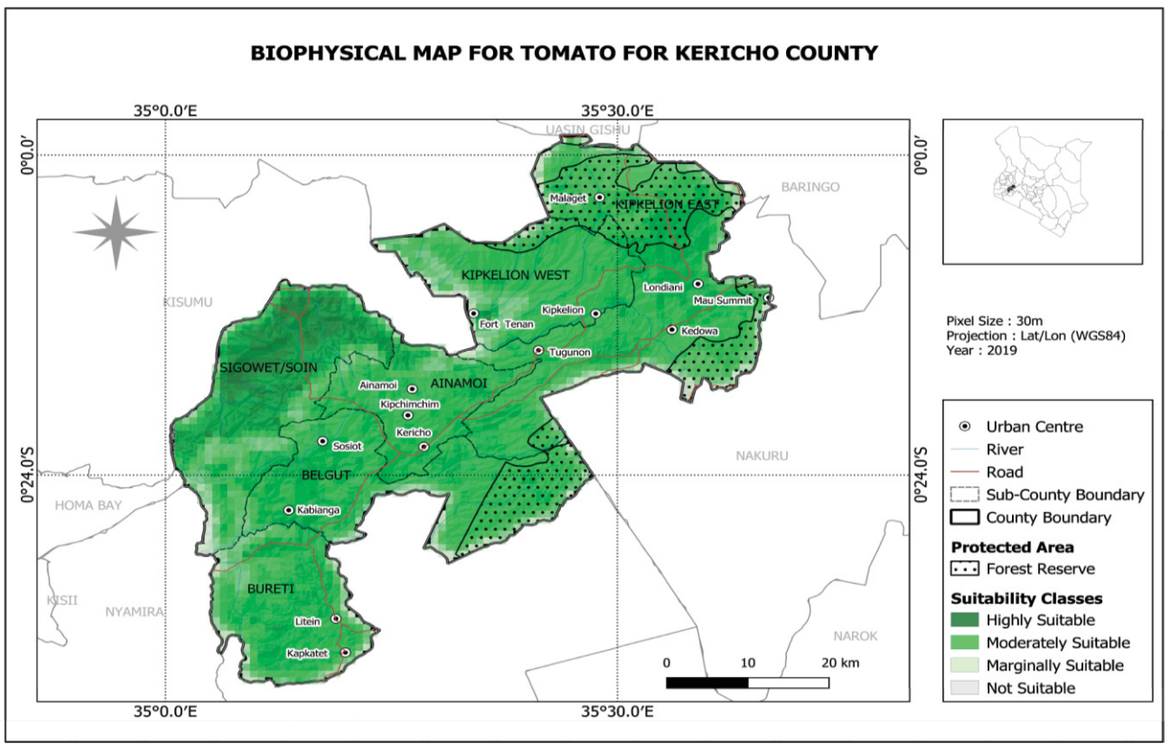


Figure 22: *Biophysical map for tomato value chain in Kericho County*

4.3.2 Population Parameters

The population for Kericho is concentrated to urban areas as compared to rural areas and thus the market for tomato is relatively high in urban areas than in rural areas.

4.3.3 Political Parameters

Tomato production has not been given much attention since its only concentrated in a small area and thus rated as moderately suitable in regard to political will/support.

4.3.4 Suitability classification for tomato value chain

Tomato value chain is moderately suitable in Kericho County. The highly suitable areas are characterized with by low rainfall, high temperatures and good soils. The map below shows the tomato value chain suitability in Kericho County.

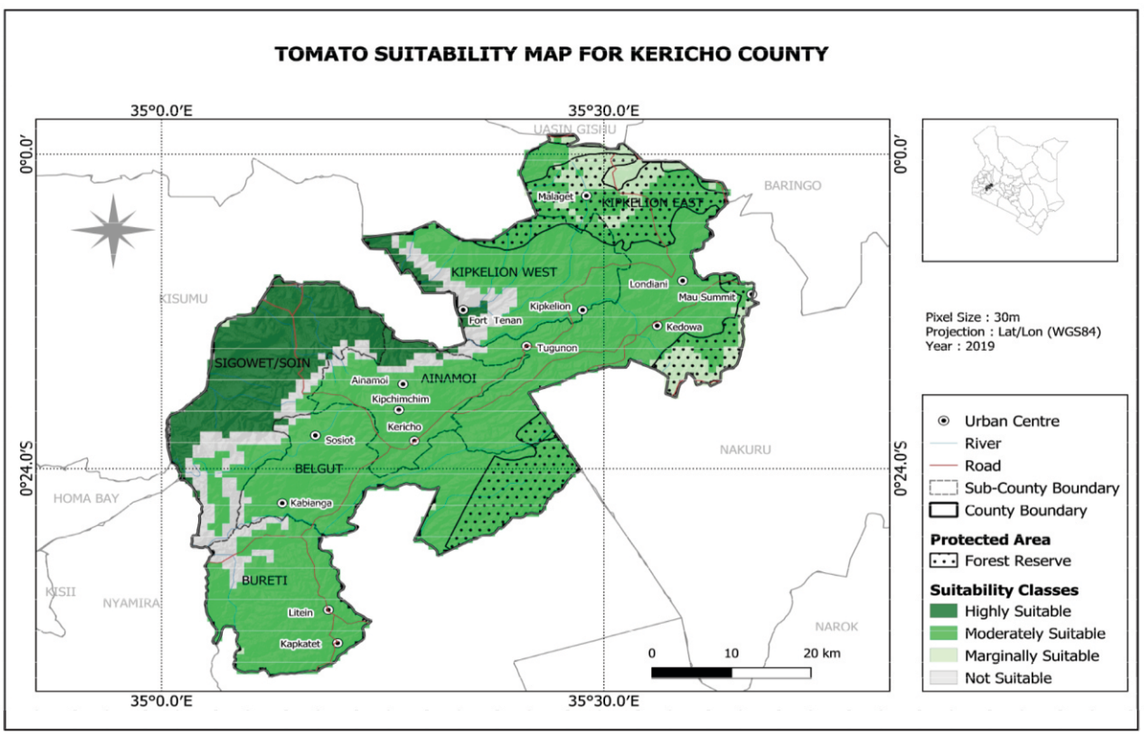


Figure 23: *Plate 7: Tomato suitability map for Kericho County*

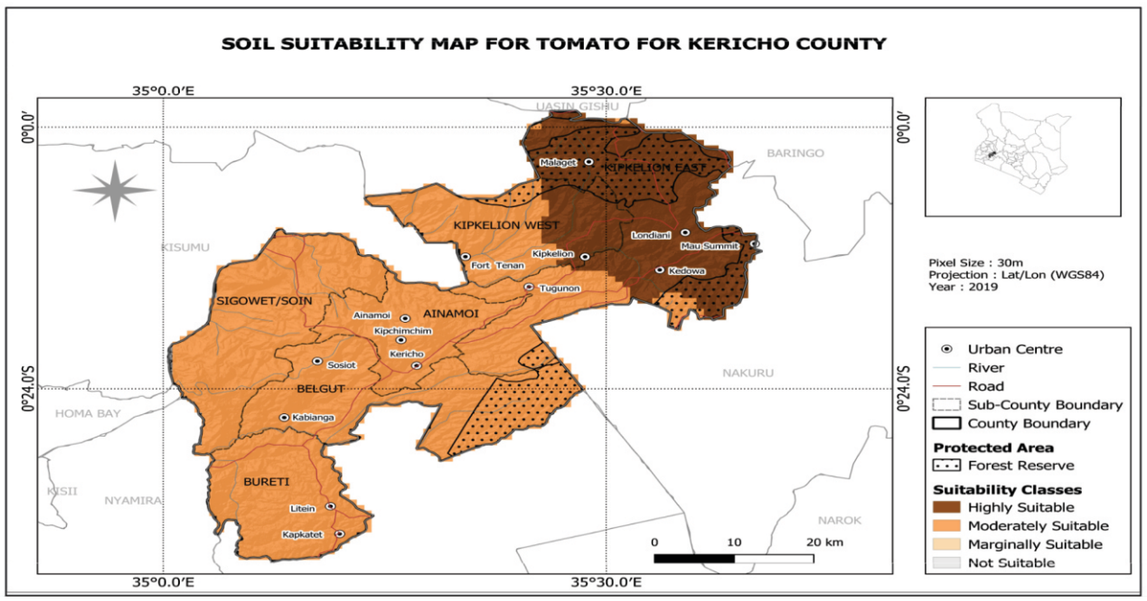


Figure 24: *Soil suitability map for Kericho County*

4.3.5 Adaptation Technologies and innovations

Overall, Kericho County is classifying as highly to moderately suitable with some areas not suitable for tomato value chain. The areas with moderate suitability could be modified through adaptation measures elaborated in Table 2. Some important modifications include agroforestry use of green houses and nets, rainwater and soil management, e-marketing and value addition on tomatoes. Also federation of value chain organizations and refurbishment of feeder roads would enhance commercialization of the tomato value chain.

Land mechanization potential for improved tomato productivity in Kericho County

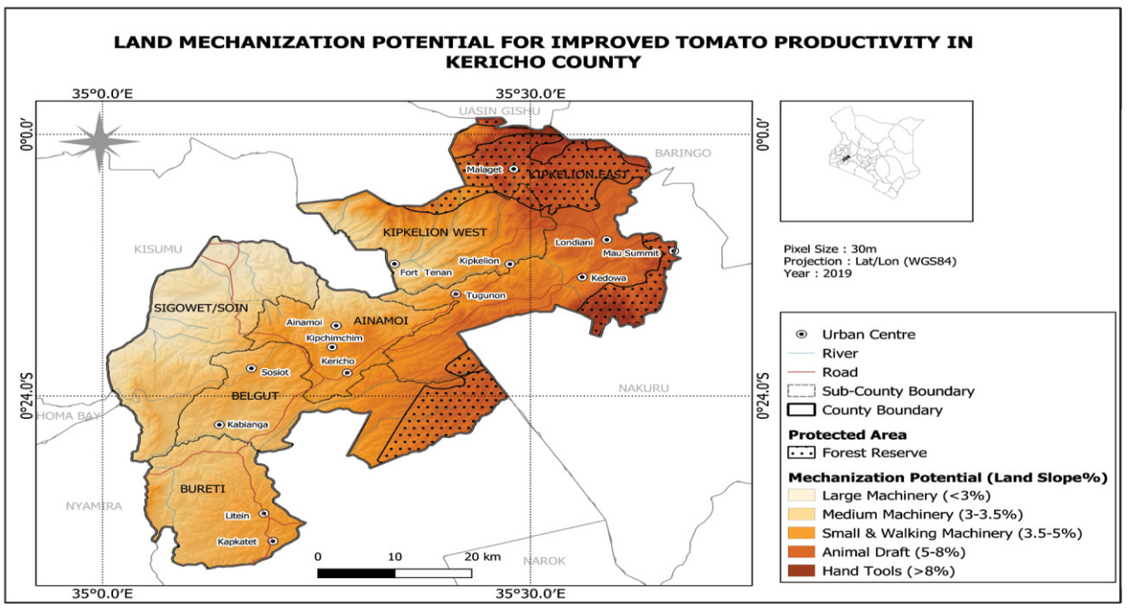


Figure 25: *Land mechanization potential for improved tomato productivity in Kericho County*

Rainwater management for improved tomato productivity in Kericho County

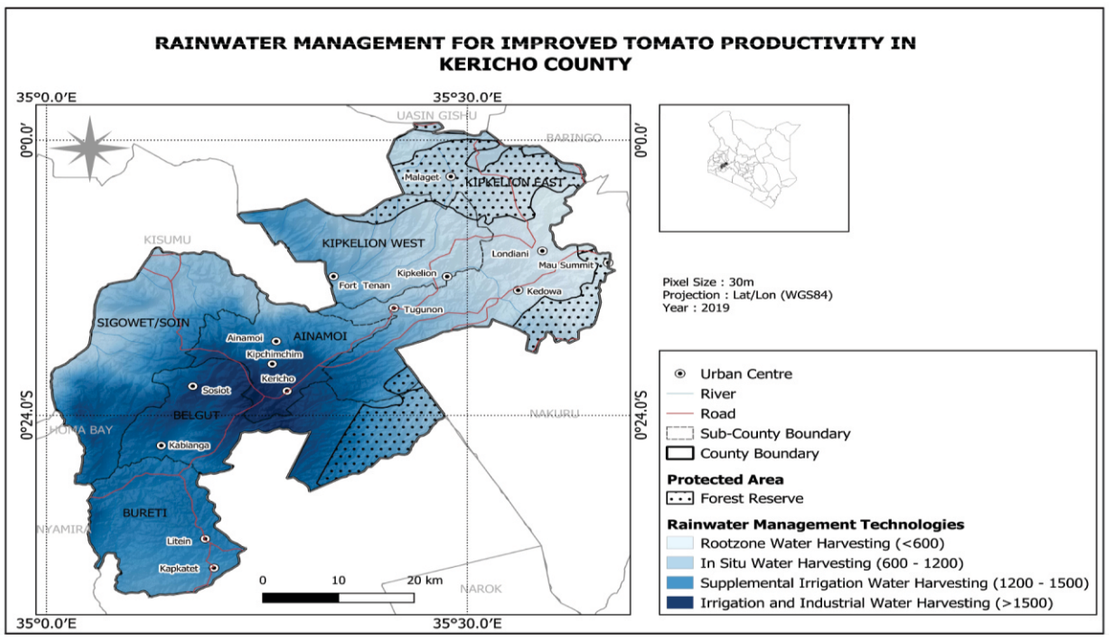


Figure 26: *Rainwater management for improved tomato productivity in Kericho County*

Land modification for improved tomato productivity in Kericho County

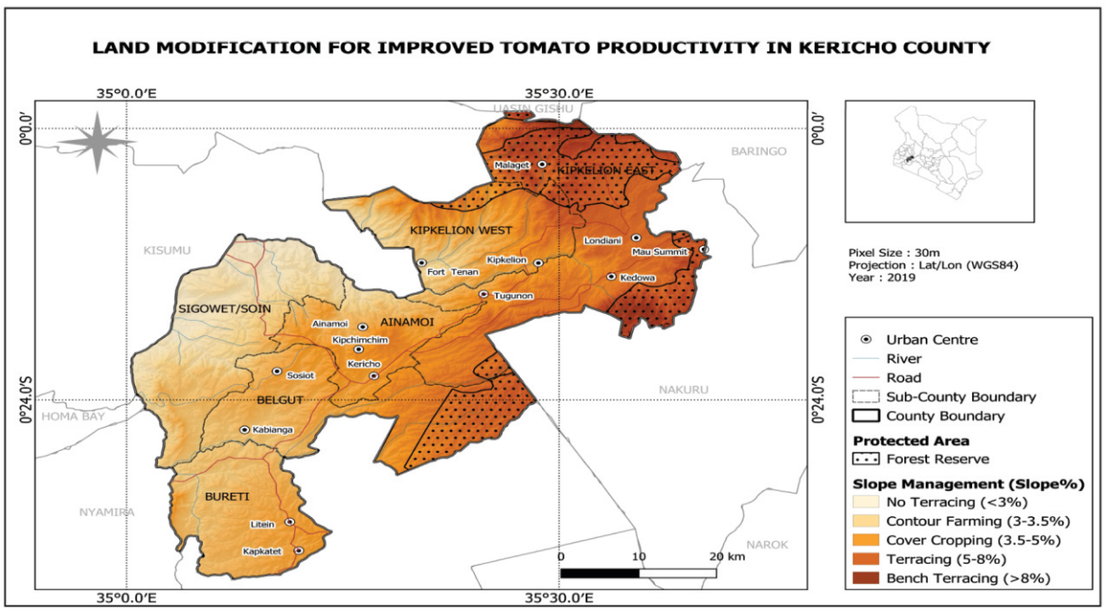


Figure 27: *Land modification for improved tomato productivity in Kericho County*

4. INDIGENOUS CHICKEN VALUE CHAIN

4.4.1 Background

Indigenous chicken VC is a value chain that the residents of Kericho has embraced since the entry of ASDSP I. The biophysical, market, social and political parameters are, highly suitable for indigenous chicken value chain in Kericho County. The commercialization of the value chain is depended on adaptation technologies and innovations including good political goodwill.

4.4.2 Parameter analysis for indigenous chicken value chain

The Temperature humidity index of the county is less than 65 whereas the requirement for IC VC is less than 65. This implies that the IC VC is highly suitable for Kericho County. The humidity range is between 43- 83 whereas the required range is less than 70 thus highly suitable for Kericho County. The parameter is presented in table below.

Table 11 *Parameters analysis for indigenous chicken value chain suitability map*

PARAMETERS FOR IC	COUNT Y PARAM ETERS	SUITABI LITY	VC SPECIFIC	ADAPTATION		TECHNOLO GY
TEMP Range	15-20	Highly Suitable	Hs <25	Temperature moderation	Trees planting	Agro forestry
		Moderately suitable	Ms 25-27			
		Marginally Suitable	Mgs 27-30			
		Not Suitable	Ns >30			
Humidity	43-83	Highly Suitable	Hs<70			
		Moderately suitable	Ms 70-75			
		Marginally Suitable	Mgs 75-80			
		Not Suitable	Ns >80	Proper housing management	Use of modern housing for poultry	Battery system deep litter system
THI	<65	Highly Suitable	<65	Use of solar or wind energy to condition the poultry units		
		Moderately suitable	65-68	Heat stress management	Feeding birds with chilled water	
		Marginally Suitable	68-72	Reduce heat stress	Installation of mist blowers	
		Not Suitable	>72		Air conditioning	Fechno cooling
						Fans
Political	MS		Ms	construction of slaughterhouses, cooling system and market outlets	Value Addition	Slaughterin g, freezing and packaging
				Create awareness of enacted on transportation, slaughter and disposal of chicken and chicken products	information dissemination to poultry forums and value chain actors	E-technologies, media, civic education

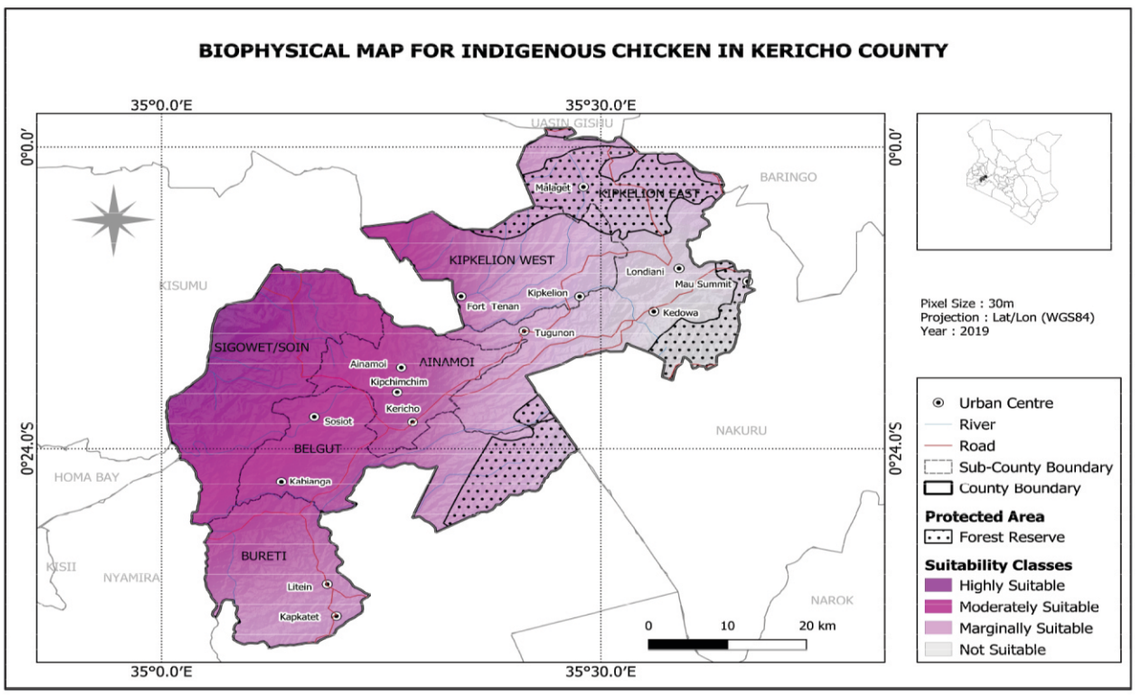
Table 11: *Parameters analysis for indigenous chicken value chain suitability map cont'd....*

PARAMETERS FOR IC	COUNT Y PARAM ETERS	SUITABI LITY	VC SPECIFIC	ADAPTATION		TECHNOLO GY
Agrarian	3-4	Highly Suitable	Hs >4.2			
		Moderately suitable	Ms 3.5-4.2	Entrepreneurial skills and attitude change should be promoted to attract all genders and age to invest in the VC		
		Marginally Suitable	Mgs 1.5-3.5			
		Not Suitable	Ns<1.5			
Market	2-3	Highly Suitable	Hs >8	Federation of VCOs to have an organized market system	Formation of cooperatives and strong organizations	One stop shop
		Moderatel	Ms3-7.5	Strengthening of	Processing and	Value
		y suitable		marketing associations, promotion of value addition, strengthening of market linkages	packaging	addition
		Marginally Suitable	Mgs 1.5-3			
		Not Suitable	Ns<1.5			
		Not Suitable	<50-100			
Distance from river (m)	>200	Highly Suitable	>150	Maintain the distance from the rivers for poultry units	Designation and planting of trees in riparian land	Afforestation
		Moderately suitable	125-150			
		Marginally Suitable	100-125			
		Not Suitable	<100			
Distance from road (m)	<100	Highly Suitable	<75	Improveme nt of road network	use of graders and murraming	Grading
		Moderately suitable	75-125			
		Marginally Suitable	125-250			

Table 11: Parameters analysis for indigenous chicken value chain suitability map cont'd....

PARAMETERS FOR IC	COUNTY PARAM ETERS	SUITABI LITY	VC SPECIFIC	ADAPTATION		TECHNOLO GY
		Not Suitable	>250			
Distance from electricity (m)	50-100	Highly Suitable	<50	Reduce market loses due to spoilage	Introduce the use of Solar system to generate electricity	Solar energy
		Moderately suitable	50-100			
		Marginally Suitable	100-200			
		Not Suitable	>200			

The biophysical map for indigenous chicken value chain map in Kericho County is shown below.



4.4.3 Economic Parameters

Roads in Kericho are highly accessible and population is concentrated in the urban centres where the market for chicken and eggs is highly suitable. The markets access is highly suitable for the IC VC.

4.4.4 Political and agrarian parameters

The political will for Indigenous chicken VC in Kericho is highly suitable since all the political leaders and the county government have given the support to this VC. Traditionally (Agrarian) poultry was categorized as women and children activity by Men in Kericho county, but things changed over time which has made the VC attractive while attracting low investment in equal measure.

4.4.5 Suitability classification for indigenous chicken value chain, Kericho County

The Indigenous chicken VC suitability map mostly moderately to highly suitable for Kericho County as shown in figure 28 below.

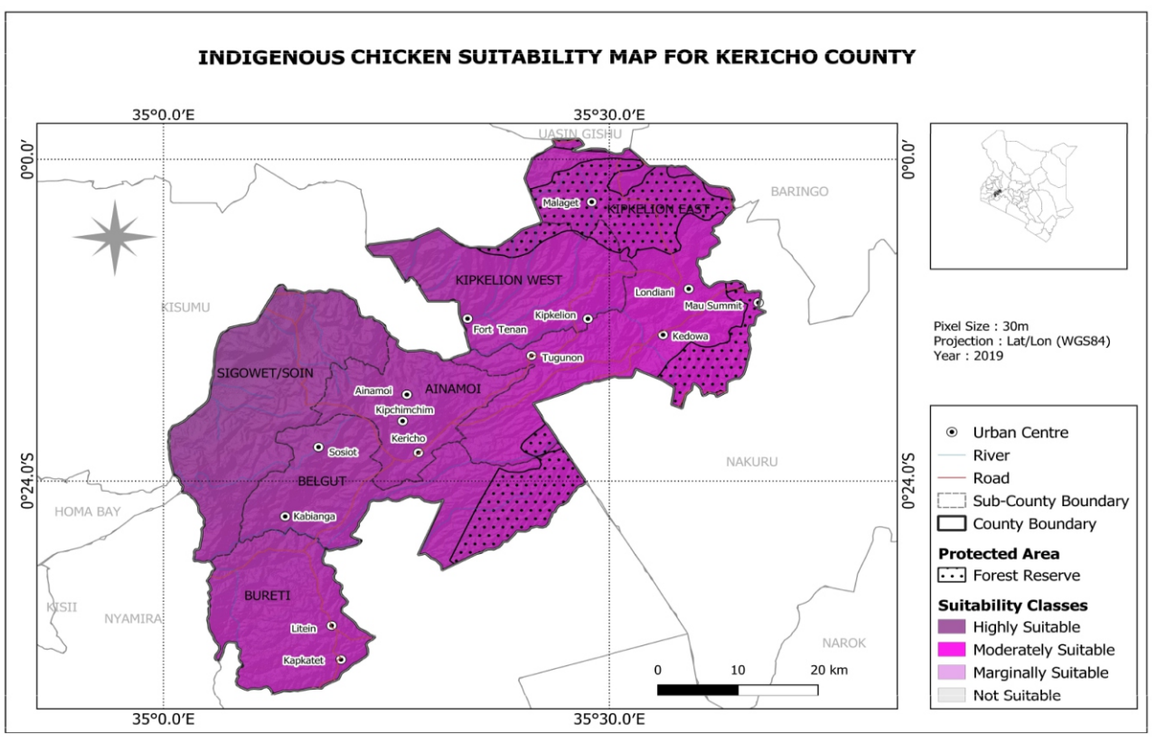


Figure 28: *Indigenous chicken suitability map for Kericho County*

4.4.6 Adaptation Measures

Climate moderation through proper housing management, use of solar or wind energy to condition the poultry units, heat stress management, reduce heat stress, construction of slaughter houses, cooling system and market outlets. Also create awareness of enacted laws on transportation, slaughter and disposal of chicken and chicken products. Inculcate entrepreneurial skills and attitude change should be promoted to attract all genders and age to invest in the VC. Federation of VCOs to have an organized market system. Strengthening of marketing associations, promotion of value addition, strengthening of market linkages will enhance growth in the VC.

4.4.7 Adaption technologies and innovations

Innovation	Technology
Trees planting	Agroforestry
Use of modern housing for poultry	Battery system deep litter system
Feeding birds with chilled water	Techno cooling
Installation of mist blowers	
Air conditioning	Fans
Value Addition	Slaughtering, freezing and packaging
Information dissemination to poultry forums and value chain actors	E-technologies, media, civic education
Plant trees in all riparian areas along the rivers	Strip planting
use of graders and murramming	Grading
Introduce the use of Solar system to generate electricity	Solar energy, wind power

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

The suitability analysis reveals that the priority food value chains of cow milk, tomato and indigenous chicken range from marginal to highly suitable for Kericho County. The maps and the statistical analysis of ranking and weighting provided factual understanding for decision making. This model is very important in physical planning, especially when preparing spatial development plans, zoning of production areas and integrating agriculture in the urban areas to improve economic competitiveness, food security and sustainable development.

5.2 Recommendations

- Integrated and multi sector approach is required to improve on the cow milk, tomato and indigenous chicken suitability
- Unsuitable biophysical factors can be managed to improve micro climatic conditions
- Use of adaptation methods, innovations and technologies is highly recommended
- Agriculture related Policies, plans strategies and regulations are required to attract investment in the sector
- There is need to partner with other programs and projects implementing similar value chains for synergy.

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COUNTY GOVERNMENTS