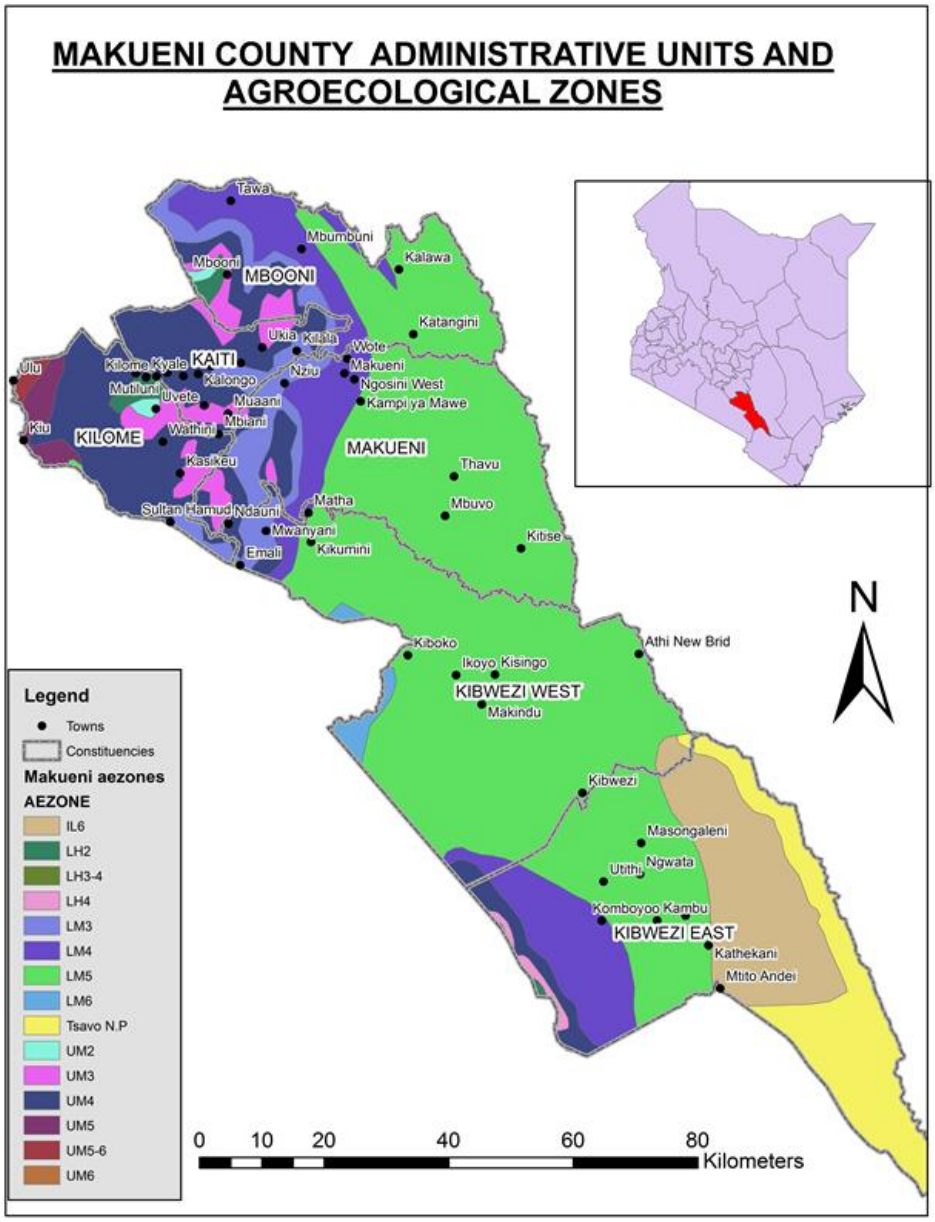
Kenya County Climate Risk Profile Annex: Makueni County

Annex 1

Land division and value chain commodity details

Makueni County is divided into six sub-counties and approximately 15 AEZs. The figure below outlines the administrative and agro-ecological divisions of the county in detail.



For the development of this County Climate Risk Profile, four major value chain commodities (VCCs) were selected for in-depth analysis, based on their contribution to food security, productivity characteristics and importance to the economy. These VCCs, validated by local stakeholders, have been selected from a list compiled from the above-mentioned documents, using the following prioritization indicators: harvested area (hectares), production (90 kg bags), variation in production (in the past five years), value of production (US$/bag), dietary energy consumption (Kcal/ capita/ day), protein content (g of protein/ 100 g of product), iron content (mg of iron / 100 g of product), zinc content (mg of zinc / 100 g of product), and Vitamin A content (IU Vitamin A / 100 g of product). The VCCs selected are: mango, green gram, local poultry and dairy cattle.

Table 1 : Value Chain selection indicators

Indicator (units)	**Value Chain Commodity**			
	Mango	**Green gram**	**Local Poultry**	**Cattle** (Dairy)
Harvested Area (Ha)	10,736.5	89,444	N/A	N/A
Production (90 Kg bags)**	1,626,944	400431	47,246	26089070
Variation in production	N/A	N/A	N/A	N/A
Value of production (US$) *	1,817,438,326	480,800,000	2126100000	1174008168
Dietary energy consumption (Kcal/ capita/ day)	60	347	143	62
Protein content (gr of protein/100 gr)	0.82	23.86	12.56	3.21
Vitamin A content (IU Vitamin A/100 gr)	1082	144	540	165

*USD$ 1 was equivalent to KSh 90

** Poultry meat was converted to 90 Kg units, whereas milk is indicated in liters.

Note: The value for local poultry did not include the value of eggs due to data limitation. The value for meat are; Kcal/capita/day: 258, Gr of protein/100gr: 17.55 and IU Vitamin A/100 gr: 178

Sources: County Livestock Department (2015), Economic Review of Agriculture (2015) and USDA

Annex 2

Crop and livestock productivity in Makueni County

Differences can be observed between the productivity of the prioritized value chains based upon both the gender and age of the head of the household, as well as the growing season in consideration. These differences are captured in the table below.

Table 2: Seasonal crop and livestock productivity by head of household

Crop or animal (unit)	**Head of Household**							
	Total		**Male**		**Female**		**Youth**	
Season	S1	S2	S1	S2	S1	S2	S1	S2
Green grams (kg/acre)	182.6	98.3	155.8	93.1	91	168	408.8	65.3
Mangoes (kg/acre)	1950		2129		1486		100	
Local cattle (litres)	5.8	7.3	5.6	6.9	6.4	8.6	6.3	8.3
Cross breed (litres)	7.4	9.4	8	10	4.5	6.5	7.3	9.3
Exotic cattle (litres)	9	11.8	9.3	12.3	7.4	9.1	8.7	11.7

Note: Season 1 is 2012-2013; Season 2 is 2013. Mango is single season.
Source: ASDSP (2014)

Annex 3

Climate Analysis

For the current study, past trends and future projections of precipitation- and temperature-related hazards, such as flooding events (including flash floods) and drought during the growing season were analyzed. The growing season was defined as follows: the first season (Season 1) is the 100-day wettest period during the months of January to June, while the second season (Season 2) is the 100-day wettest period during the months of July-December. In the case of floods, the focus was on heavy precipitation events during the first and second season, defined as the 95th percentile of daily precipitation. For each pixel, the 95th percentile of daily precipitation distribution conformed of 100 wettest days per season per year was calculated. Then we identified the 95 extreme percentile, value which was plotted in time series[1]. Fluctuations in heavy precipitation events can have important consequences on water availability for agriculture, by impacting drought and flood events.

To assess the degree of adequacy of rainfall and soil moisture to meet the potential water requirements for agriculture, the focus was on drought stress, represented by the maximum number of consecutive days in each season where the ratio of actual to potential evapotranspiration (ETa/ETp) is below 0.5. This was calculated for each pixel per season per year[2] by evaluating soil's water capacity and evapotranspiration in order to define the number of days that could undergo a level of stress.

Two Representative Concentration Pathways (RCPs) were used, also known as the four greenhouse gas concentration (not emissions) trajectories adopted by the IPCC for its fifth Assessment Report (AR5) in 2014. The two RCPs, RCP2.6 and RCP8.5, are named after a possible range of radiative forcing values in the year 2100 relative to pre-industrial values (+2.6 and +8.5 W/m2, respectively). The pathways are used for climate modelling and research. They describe two possible climate futures, considered possible depending on how much greenhouse gases are emitted in the years to come. RCP 2.6 assumes that global annual GHG emissions (measured in CO2-equivalents) peak between 2010 and 2020, with emissions declining substantially thereafter. In RCP 8.5, emissions continue to rise throughout the 21st century.

[1] In this case, we only used precipitation as input file.
[2] In this case, as input files we used maximum temperature, minimum temperature, precipitation, solar radiation, and water capacity of soil.

Annex 5

Adaptation options in Makueni County, as identified in the ASDSP

Various adaptation strategies were identified by stakeholders and residents of Makueni County in the Government of Kenya's "Agricultural Sector Development Support Programme (ASDSP)" of 2014. The table below compiles these results and disaggregates them by percentage of the population using each practice, as well as percentage based on the gender and age of the head of the household.

Table 3: Adaptation strategies

Adaptation strategy	% Adoption, by Head of Household				Value Chain	Value Chain Activity	Inputs	Results	Challenges
	M	F	Y	All					
Tree planting (Agroforestry; Urban area greening; Forest rehabilitation)	59	54	56	58	All	Production	-Drought tolerant seedling -Water -Land	-Soil and water conservation -improving the tree cover -improving soil microbial activity	-Scarcity of water -marginalization of women due to land tenure issues -deforestation due to high wood-fuel utilization
Soil-water conservation (cover crops; intercropping; conservation agriculture)	50	56	71	53	All	Production	-Seeds -Water (sand dams, Zai pits, Farm Ponds, shed nets) -Herbicides	-Good water holding capacity - change in crop mixes -increased yields -reduced water and wind erosion -reduced distance to water sources Increasing organic matter	-high poverty levels -low farmer adoption -expensive equipment -water scarcity -poor land demarcation
Change crop type (early maturing or drought tolerant varieties; crops with pre-existing market)	54	65	65	57	Green grams Citrus Pigeon peas	Production	-Hybrid /certified seeds -pesticides -fertilisers	-Increased yields -minimal crop failures -high farm incomes -reduced food insecurity	-low technology adoption (detrimental cultural practices) -expensive and unavailable inputs -water scarcity
Feed conservation	20	17	24	20	Live-stock	Production	-Bailers -pastures	-Reduced animal movements -high production	-expensive inputs -lack of storage
Change livestock type	14	13	12	13	Dairy cow Local	Production	-Hybrids vaccination -artificial	-Good animal quality -high production	-expensive inputs -harsh climate

(improved breeds)					poultry		inseminatio n (AI)	-low feed requirement -reduced disease incidences	
Irrigation	11	10	12	11	Live-stock Crops	Production	-Water -water pumps	-Reduced crop/pasture failure -good quality animal -increased production	-water scarcity -high poverty
On-farm diversificatio n	8	15	9	9	Livesto ck Crops	Production Marketing	-Seeds -fertiliser -capital -entrepren-eurship	-Increased income -better livelihoods -food security -reduced production and marketing risks	-lack of inputs -lack of capital -low entrepreneurial capacity -water scarcity
Value addition (processing; cooling; grading; boiling; de-feathering)	24	21	35	25	Live-stock Crops	Marketing	-Processors -transporter -packaging material	-High prices -increased shelf-life	-low capacity -poor infrastructure -expensive equipment -low knowhow
Food storage facilities	22	8	21	20	Maize Green grams	Post-harvest handling	-Pesticides -storage facilities	-Food availability -post-harvest losses	-low food production -post harvest loss
Seek employment (abandoning agriculture)	24	23	18	23	Live-stock Crop	-	-Skills -education	-Stable incomes -urban migrations -high unemployment	-congestion in urban areas -lack of appropriate education and skills

Note: M, F and Y stands for Male- , female- and youth- headed households.
Source: ASDSP (2014) and author's compilation.