

Kenya County Climate Risk Profile Annex: Embu County

Annex 1

The table below provides more detailed information regarding the various irrigation schemes in operation or planned in Embu County.

Table 1: Irrigation Schemes in Embu County

Sub-County	Scheme Name	No. farmers	Area (Ha)	Irrigation Method	Water Source	Financier	Remarks/ Status
Embu East	Ena co-op	278	120	Sprinkler	Ena stream	KFW funded	Horticultural crops grown include french beans, cabbage, tomato, cucurbits and bananas
	Kanthitu	40	16	Sprinkler	Ena stream	Sourcing for funds	Operational, requires rehabilitation.
	Kamiugu	60	30	Sprinkler	Kamiugu stream	Sourcing for funds	Operational, requires rehabilitation.
	Mwamum/mwaugu	80	40	Sprinkler	Mwaugu stream	Sourcing for funds	Operational, requires rehabilitation.
Mbeere North	Nthawa Irrigation Scheme	250	100	Sprinkler	R. Ena	MKEPP-GOK/IFAD	Crops grown include french beans, banana, water melons, tomato, kales and paw paws
Manyatta	Njukiri/Nthambo	324	120	Sprinkler	River. Kapingazi	Plan International	Operational
	Kamiu/Kavanga	220	55	Sprinkler	River Kapingazi	IFAD/ GOK (MKEPP)	Operational
	Nthamari/Gachichori	120	25	Sprinkler	River Kirurumwe	IFAD/ GOK (MKEPP)	Operational
	Kiruki Kiende	250	60	Sprinkler	River Kirurumwe	KFW, Smallholder irrigation program Mt.Kenya Region	Operational
	Kiaga	378	150	Sprinkler	Rupingazi	GOK/SIPMK/ CDF	Operational
	Mwiria	30	13.9	Sprinkler	Nyanjaara	IFAD	Completed and Operational
	Kamavindi/Gatunduri	22	7.9	Sprinkler	Kii	IFAD	Completed and Operational
	Kibutu/Ng uviu	100	45	Sprinkler	Kapingazi	CDF	Phase one is operational
	Kii-Kithiria	15	5	Sprinkler	Kii	CDF	Completed and Operational
	Kianduku	21	10	Sprinkler	Kii	Community	Requiers rehabilitation
Kavaria /	20	10	Sprinkler	Thambana	Community	Requiers rehabilitation	

	kamavingi						
	Runga	180	78	Sprinkler	Nyanjara	CDF	Complete and operational
	Gichangai	38	15	Furrow	Gichangai	CDF	Complete and operational
	Ngerwe	22	10	Sprinkler	Rupingazi	RDF	Operational and requires rehabilitation
	Karangi	20	10	Sprinkler	Karangi	Community	Operational and requires rehabilitation
	Itabua/ Muthatari	500	200	Sprinkler	R. Kapingazi	community	Proposed New intake River Rupingazi Current intake kapingazi river
Mbeere North	Kiambindu	120	160	Sprinkler	R. Thuci	GOK / IFAD Local Initiative Fund, ALRMPII, JICA	120 farmers connected; area under irrigation 48 Ha. Further funding needed for completion. Main crops are pawpaw, kales, tomato and onion.
	Kathiga Gaceru	161	80	Sprinkler	R. Ena	SHDP- GOK/ADB	120 farmers connected; area under irrigation 63 ha. Main crops include kales, pawpaw, banana and tomato.
	Kathigi Ishiera	100	80	Fallow	R. Thuci	GOK/IFAD	20% under horticulture, 80% under food crops. Horticultural crops include kales, onions and tomato. Requires farmers remobilization and possibly canal lining to avert the challenge of seepage
	Murachaki	430	160	Sprinkler	R. Thuci	Sideman-sal/ County Government initiative	Intake constructed, 13 /13 km mainline excavated. Construction works being undertaken by the County Government in phases.
Embu East	Runyenjes township	1000	350	Sprinkler	Thuci	Sourcing for funds	Designs ready
	Itimbogo	64	25	Sprinkler	Itimbogo	GoK Funded	Implementation on-going, intake and mainline complete.
	Iriari	200	132	Sprinkler	Kithuci	GoK/LATF	Implementation ongoing, intake and design complete. Mainline 0.5km installed.
	Kariru	500	200	Sprinkler	Thuci	Sourcing for funds	Designs need revision
	Kigumo	400	90	Sprinkler	Thuci	Sourcing for funds	Designs ready
	Mukambi	129	N/A	Sprinkler	Thuci		Requires feasibility studies.
	Ngimari	30	N/A	Sprinkler	Ngirimari		Requires feasibility studies.

Source: County Director Agriculture

Annex 2

Productivity Indicators for prioritized crops

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 in Embu include maize, beans, and banana, and some of their indicators are detailed below.

Table 2: Productivity and value indicators for crops in Embu County

Crop	Indicator	Year							
		2008	2009	2010	2011	2012	2013	2014	2015
Maize	Area (Ha)	52,980	52,209	61,678	44,756	45,215	41,786	40,630	44,121
	Production (90 kg bags)	162,259	641,984	424,714	375,533	574,925	304,621	308,630	839,672
	Value (million KSh)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bean	Area (Ha)	30,882	32,296	30,213	22,587	23,758	23,948	23,275	27,696
	Production (90 kg bags)	87,992	233,455	168,028	137,028	207,170	128,596	153,357	327,800
	Value (million KSh)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Banana	Area (Ha)	1,499	1,587	1,589	4,425	4,484	4,379	4,396	4,508
	Production (90 kg bags)	29,980	31,710	31,750	66,375	68,809	71,294	80,820	85,427
	Value (million KSh)	449.7	475.7	476.3	995.6	1,032.1	1,083.3	1,782.3	1,828

Source: GoK, 2016

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 analysed. 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 series¹. 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 (ET_a/ET_p) is below 0.5. This was calculated for each pixel per season per year² 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 Embu County, as identified in the ASDSP

Various adaptation strategies were identified by stakeholders and residents of Embu 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 in Embu County

Adaptation Strategy	Adoption Rate by Head of Household (%)				Description of the Intervention				
	M	F	Y	All	Value Chain Link	Technical inputs	Inputs	Results Sought	Challenges
Value addition	18	15	10	16	Post-harvest	Training	Processors, transporters, packaging material	Product diversification (e.g. banana crisps, wine, yoghurt. income generation)	Exploitation by middlemen
Staggered cropping	27	26	10	25	Production	Training	Farm inputs (seeds, fertilizers, labour, land, etc.)	Improved yield	Prohibitive input prices
Food storage facilities	9	6	5	8	Post-harvest	Training	Storage pesticides, traditional on farm granaries, NCPB, hermetic bags	Food security	Inadequate food storage facilities; Weak and inadequate farmers cooperatives; Exploitation by middlemen; Aflatoxin
Water harvesting	34	41	20	34	Production	Expertise in water harvesting techniques	Water tanks, water pans, shallow wells, sub surface dams, dams	Improved, consistent yield	High price of water tanks; Installation of dam is expensive
Change crop type	40	26	20	36	Production	Advisories and sensitization	Early maturing and drought resistant varieties (pigeon peas, green grams, millet, sorghum)	Income generation, stability	Early maturing varieties can be expensive
Soil and water conservation	47	50	30	46	Production	Training: minimum tillage, mulching, cover crops, crop rotation.	Farm inputs (seeds, fertilizers, water pans, etc.)	Improved yield; conservation; reduced soil erosion and runoffs to the rivers	Increased labour required in the sustainable land management practices, (e.g. planting the Napier grass)
Enterprise Diversification	18	6	10	15	Marketing	Training, knowledge	Capital, labour	Income generation through dairy goat, meat goat, poultry keeping, beekeeping, aquaculture	Start-up capital

Off-farm employment	12	3	10	11	Marketing	Skills and expertise in non-agricultural sectors; training	Experience in other sectors (mining, sand harvesting, taxi, hospitality, industry, public sector)	Income generation	High illiteracy levels
Tree planting	54	62	40	54	Production	Sensitisation, from KFS, NEMA, Caritas, Embu Kenya Red Cross, Tea co.s	Nurseries for local and indigenous trees; water	Sustainable natural resource management	Climate hazards; lack of community participation and involvement
Change livestock type/ breed	15	15	5	14	Production	Veterinary and AI services	Husbandry materials: improved local breeds; artificial insemination; vaccination	Income generation	Improved local breeds and AI are expensive and may not cope well or may replace the original species
Feed conservation, diversification	13	15	0	12	Production	Training for making silage	Feed bales in case of drought; Drought tolerant Calliandra	Less of household income used on external inputs; Improved yield; Increased income	Bales costs are prohibitive to some farmers
Irrigation activities	5	6	10	6	Production	Licensing, Irrigation schemes	Irrigation infrastructure; water	Improved vegetable production; nutrition; increase fodder supply	Bureaucracy and protocols in licensing
Land leasing	1	0	5	1	Production	Where one has more than on parcel of land.	Leaser, lessee	Increased household income	Low adoption rates (less than 2%)
Insurance	1	0	5	1	Marketing	Approval by the insurance companies such as UAP, Jubilee	Premiums payment	Assurance in the agricultural production	Lack of cultural understanding, support

Source: Compiles by author using ASDSP (2014)

Annex 5

Agricultural and climate-related programs directed by Catholic Caritas

The faith-based organization, Catholic Caritas, and their partners are highly active in Embu County and have provided a number of programs and projects aimed at improving social, agricultural, and livelihood resilience in Embu County: the table below details these programs.

Table 4: Caritas Programs in Embu County

PROGRAM/ PROJECT	GOAL	PARTNER	DURATION
Integrated Rural Development Programme	To achieve sustainable and holistic improvements for the rural-urban population	Misereor Secretariat – Germany	1988 - present
Micro-Finance	Improvement living standards through the provision of affordable financial services	CARITAS AUSTRALIA,	2002 - present
Post-harvest handling project	To promote effective grain storage so as to improve food security using metal silos	CRS, CYMMT & KARI	2009 - present
Kenya Livelihoods Support Project (KLSP)	Improve drought resilience in Mbeere North and Mbeere South	Caritas Korea through Caritas Kenya	2013 - present
Community Based Livestock Services	Support of local livestock industry	Self-Sustaining	1995 - present
Emergency Appeal	To respond in a humane and timely manner to drought and other disasters	Caritas Kenya	09/2011 - 05/2013
Rural Water Programme	Alleviate poverty by promoting more effective use of natural resources and integrated watershed management	Misereor Secretariat – Germany	1999 - 2010
Emergency Operation (EMOP/ PRRO)	Emergency operation on relief food	World Food Programme	2000 - 2005
Seed Relief	Increase access to food for the most vulnerable farming populations by increasing self-resilience with the use of high quality farm inputs.	CARITAS AUSTRALIA	2009 - 2010
Integrated Health and Agriculture Programme	To increase food security in marginalized communities in Mbeere	Catholic Relief Services - Kenya	2001 - 2006
Lucrative Grain Legumes	To raise farmers' incomes through use of profitable grain legumes technologies and improve linkages to markets	Catholic Relief Services – Kenya	2005 - 2008
Quality Protein Maize	Contributing in improving household food security	Catholic Relief Services –Kenya, ASRECA and KARI	2005 – 2008, 2010 - present
Drought Recovery Project	To increase the capacity of the community to prevent and mitigate effects of drought	Food and Agriculture Organisation (FAO)	08/2011 – 01/2012

Source: Caritas Catholic