CONTINGENCY PLAN FOR MANAGEMENT OF DESERT LOCUST IN KENYA

REPUBLIC OF KENYA

Ministry of Agriculture and Livestock Development
State Department for Agriculture

RESTORING LIVELIHOODS · SURVEILLANCE · CONTROL · EARLY WARNING

EMERGENCY LOCUST RESPONSE PROGRAM

THE WORLD BANK

CONTINGENCY PLAN FOR MANAGEMENT OF DESERT LOCUST IN KENYA IN OCTOBER 2024

Ministry of Agriculture and Livestock Development

DISCLAIMER

Contingency Plan for management of African armyworm in Kenya
The State Department for Agriculture under the Ministry of Agriculture and Livestock Development has developed this Contingency Plan to enhance Kenya's preparedness and reduce damage caused by the Desert Locust. This is expected to help the government achieve its agenda of increasing food and nutrition security through management of the Desert Locust invasion.

State Department for Agriculture
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FOREWORD

The Desert Locust, Schistocerca gregaria (Foskar) is a trans-boundary pest that belongs to a group of short horned grasshoppers' family Acrididae and naturally occurs in isolated form, scattered in low numbers in recession areas. In Africa, Middle East and Asia, the destructive effect on farmland and rangeland vegetation, impacts over 60 countries. It is a pest of economic importance due to its high reproductive potential, ability to aggregate, migrate, and its intensive feeding habit. This situation is compounded by its ability to change its breeding behavior and physiology depending on weather conditions. In addition, the breeding and migratory patterns can be escalated by effects of climate change which has adversely impacted the ecosystem and agricultural space globally. The frequency and strength of cyclones or strong winds can cause sudden unprecedented invasions which can strain the available resources and lead to re-allocation at expense of the targeted purpose and intentions. Desert Locust destruction on crops, pastures, and rangeland pose a global threat to food and nutrition security and livelihoods.

The 2019 - 2021 Desert Locust waves that hit countries in the Middle East and Horn of Africa, initially affected the northern part of Kenya and spread across 28 counties in three waves of varying magnitudes. Drawing from lessons learnt during the management of 2019-2021 upsurge, there is a need to enhance preparedness at national and regional levels. The State Department for Agriculture through Plant Protection and Food Safety Directorate (PP&FSD) together with other stakeholders has developed this contingency plan to strengthen coordination, improve resource mobilization and ensure effective communication systems. It also aims at enhancing the country's level of preparedness which will ensure rapid response to mitigate effects of Desert Locust invasion.

The plan is envisioned to help the government achieve its mandate of sustainable food systems and increase the country's resilience against effects of Desert Locust invasion. This will result to improved food and nutrition security, as anchored in Bottom-up Economic Transformation Agenda (BETA), the vision 2030, sustainable development goal number 2 (SDG 2); end hunger, achieve food security and improved nutrition and promote sustainable agriculture and Agenda 2063 goal 1; high standards of living, quality of life and wellbeing of citizens, and goal 3; ensure healthy and well-nourished citizen.

The State Department for Agriculture wishes to express sincere gratitude to every individual and institution that made the development of this contingency plan a success. The State Department also acknowledged the World Bank-through the Emergency Locust Response Program (ELRP), for financial support in developing this document.

Dr. Kipronoh Ronoh Paul, PhD
Principal Secretary
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PREFACE

Desert Locust, Schistocerca gregaria (Foskar) is a pest of great economic importance due to its intensive rapid multiplication capacity and high mobility. Change in environmental factors such as precipitation, temperatures, humidity and wind direction, creates an environment that is likely to cause future invasion that can escalate in magnitude and frequency of invasions. This situation is a threat to sustainable food systems and livelihood resilience hence compromising food and nutrition security.

Of the upsurges reported in the region since 1970, it is only swarms in the 2019-2021 upsurges that invaded Kenya. First swarms entered the country through Mandera and Wajir from Somalia in December 2019. Heavy rains that preceded the short rain season created an environment conducive for breeding. The upsurge caused destruction of vegetation in farmland, pastureland and protected areas, affecting livelihoods of many households in Samburu, Isiolo, Marsabit, Mandera, Kitui, Tharaka Nithi, Garissa, Laikipia, Wajir, Embu, Turkana, Baringo, Kajiado, Tana River, Lamu, Machakos, Elgeiyo Marakwet, Uasin Gishu, Kirinyaga, Meru, Nakuru, Murang'a, Nyeri, Trans Nzoia, Bungoma, Nyandarua, Bomet and Kericho Counties. The situation was contained by April 2021 through concerted efforts between the State Department for Agriculture together with regional and international partners.

Therefore, the lesson learnt was a reference point of developing this contingency plan that will structure the roadmap and framework to contain any future invasions. It highlights measures to be taken in risk preparedness, mapping of existing and required resources for rapid response and effective Desert Locust management. The plan aims at enhancing coordinated efforts between the collaborating partners of public, private, regional and international organizations for effective resource mobilization, efficient allocation and improved communication among various actors. The Plant Protection and Food Safety Directorate (PP&FSD) under the State Department of Agriculture, in collaboration with stakeholders, should periodically review and update the contingency plan to accommodate any emerging issues.

The implementation of this contingency plan will enable Plant Protection and Food Safety Directorate to achieve the 7 pillars as envisaged in migratory and Invasive Pests and Weed Management (M&IPWM) Strategy, and flagship 9 on sustainability and crisis management in Agricultural Sector Transformation and Growth Strategy (ASTGS).

Mr. Collin M. Marangu
Agriculture Secretary
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LIST OF ABBREVIATIONS AND ACRONYMS

AU	African Union
AU-IAPSC	Inter-African Phytosanitary Council of African Union
BETA	Bottom-up Economic Transformation Agenda
CABI	Centre for Agriculture and Biosciences International
CASSCOM	County Agricultural Sector Steering Committee
CBOs	Community Based Organizations
CDA	County Director of Agriculture
CDL	County Director of Livestock
CEC-M	County Executive Committee-Member
CIMMYT	International Maize and Wheat Improvement Centre
CO	Chief Officer
CoG	Council of Governors
CP	Contingency Plan
DL	Desert Locust
DLCO-EA	Desert Locust Control Organization for Eastern Africa
DLCU	Desert Locust Control Unit
DLIS	Desert Locust Information Service
DoD	Department of Defense
DOSHS	Directorate of Occupational Safety and Health Services
DREA	Department of Rural Economy and Agriculture
EAC	East African Community
EMPRES	Emergency Prevention System for Trans-boundary Animal and Plant Pests and Diseases
FAO	Food and Agricultural Organization
FBO	Faith Based Organizations
GIS	Geographic Information System
IAPSC	Inter-African Phytosanitary Council of African Union
ICIPE	International Centre of Insect Physiology and Ecology

ICPAC	IGAD Climate Prediction and Applications Centre
ICT	Information and Communication Technology
IDA	International Development Association
IGAD	Intergovernmental Authority on Development
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
JASCOM	Joint Agricultural Sector Consultation and Cooperation Mechanism
KALRO	Kenya Agricultural and Livestock Research Organization
KDF	Kenya Defense Forces
KEBS	Kenya Bureau of Standards
KEFRI	Kenya Forestry Research Institute
KEPHIS	Kenya Plant Health Inspectorate Service
KMD	Kenya Meteorological Department
KWS	Kenya Wildlife Service
M&E	Monitoring and Evaluation
M&P IWM	Migratory Pests and Invasive Weeds Management
MITT	Multi-Institutional Technical Teams
MoU	Memorandum of Understanding
NDVI	Normalized Difference Vegetation Index
NEMA	National Environment Management Authority
NGO	Non-Governmental Organization
NPPO	National Plant Protection Organizations
NRF	National Research Fund
NYS	National Youth Service
PCPB	Pest Control Products Board
PP&FSD	Plant Protection and Food Safety Directorate
PPE	Personal Protection Equipment
RCMRD	Regional Centre for Mapping of Resources for Development
REA	Commission of Rural Economy and Agriculture
REC	Regional Economic Communities

RPPO	Regional Plant Protection Organization
SCAO	Sub-county Agricultural Officer
SFE	Sub–Regional Office for Eastern Africa
SMAP	Soil Moisture Active Passive
SOPs	Standard Operating Procedures
SSPs	Spray Service Providers
TOR	Terms of Reference
ULV	Ultra-Low Volume
VMS	Vehicle Mounted Sprayers
WAO	Ward Agricultural Officer
WTO	World Trade Organizations

DEFINATION OF TERMS

Terms	Description
Pest	Any species, strain, or biotype of plant, animal or pathogenic agent injurious to plants or plant products and environment
Quarantine pest	A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled.
Occasional pest	Pest that infrequently occurs with no close association with a particular crop.
Persistent pests	Occurs on the crop throughout the year and is difficult to control.
Invasive pest	A species that does not occur naturally in a specific area and whose introduction does or is likely to cause economic (including agricultural) or environmental harm or harm to human health.
Invasion area	Are areas where DL migrates to and occurs as a result of outbreaks, upsurges and plagues.
Migratory pest	These are pests that move in search of food and suitable breeding places. They include locusts, armyworms, quelea bird among others. The pests usually concentrate as swarms (locusts), infestations (armyworms) or flocks (quelea birds)

Terms	Description
Solitary phase	Where locusts occur in low numbers and densities, behave as individuals.
Gregarious phase	Where desert locust form dense and highly mobile (marching) bands which behave as an entity
Notifiable pests	Pests that have the potential to cause the greatest damage to vegetation and should be reported immediately if they are spotted.
Recession	During recession periods, desert locusts are present at low densities and do not cause significant crop damage. Hopper bands or adult swarms are rare if not entirely absent.
Trans-boundary pests	Migratory pests that pose a significant threat to food security, trade, and livelihoods of people in the affected countries, and generate huge losses of crops and pastures.
Polyphenism	The occurrence of several phenotypes in a population, the differences between which are not the result of genetic differences
Outbreak	Outbreaks occur amid increases in locust numbers caused by concentration, multiplication, and gregarization over a period of several months. Outbreaks are generally localized or restricted to certain habitats, and the early stages of an outbreak are generally unobserved. However, when left unchecked, outbreaks can lead to the formation of bands and swarms.
Upsurge	Upsurges occur when an initially small population dramatically expands due to successful breeding over multiple generations. With each successive generation, the proportion of locusts in bands or swarms increases until few scattered individuals remain. Several simultaneous outbreaks followed by at least two generations of transient-to-gregarious breeding are likely to lead to an upsurge.
Plague	Plagues are periods of one or more years with heavy and widespread locust infestations. They occur amid favorable breeding conditions when control operations are unable to stop a series of outbreaks from developing into an unmanageable upsurge. The area in which plagues occur cover approximately 29 million km2, nearly twice the size of the recession area.
Recession area	Refers to the native Desert locust habit that occupies Sahel region in the Sahara Desert, Maghreb area in the north of Africa, Arabian Peninsula and Indo-Pakistani countries.

1.0 GENERAL INFORMATION ON DESERT LOCUST

1.1 Bio-Ecology of the Desert Locust

The Desert Locust, Schistocerca gregaria (Forskål), belongs to the category of locusts which exhibit a fascinating bio-ecology characterized by their ability to transition between solitary and gregarious phase. This phenomenon results in a set of behavioral and morphological transformation that is reversible and transmissible from one generation to another. In their solitary phase, these locusts are typically found in low-density populations, feeding on vegetation without forming large groups. However, under certain environmental conditions, such as increased rainfall and abundant food sources, they can undergo a transformation into their gregarious phase. In this phase, locusts swarm together in vast numbers, exhibiting synchronized behaviors that enhance their survival and reproductive success. There is also an intermediate phase called "Transiens". The transition from the solitary phase to the gregarious phase, called "gregarization", generally requires several successive generations under favorable ecological conditions. This shift not only influences their behavior and social dynamics but also has significant implications for agriculture and ecosystems, as swarming locusts can devastate crops and vegetation over large areas. Understanding this duality in their life cycle is crucial for managing locust populations and mitigating their impact on human activities. In its solitary phase, the Desert Locust is harmless and leads a discreet life in restricted geographical zones. These zones, called "recession areas", cover 16 million km2 spread over 30 countries and mainly concern the Saharan zone (Figure 1). Within this recession area there are several zones called "breeding areas" which if favorable ecological conditions persist, the Desert Locust changes from the solitary to the gregarious state. Outbreak is the first step in the transition from a situation of recession to a widespread Desert Locust invasion. The multitude of new outbreaks in the breeding areas gives rise to an upsurge. If this is not controlled, a widespread invasion can occur after successive generations.

During an upsurge, desert locusts invade approximately 10% of the world's population distributed across 60 countries in Africa, the Middle East and Southwest Asia (Figure 1). Desert Locust invasion has been reported to affect the grazing potential of nearly 685,000 pastoral and agro-pastoral households in the Horn of Africa.

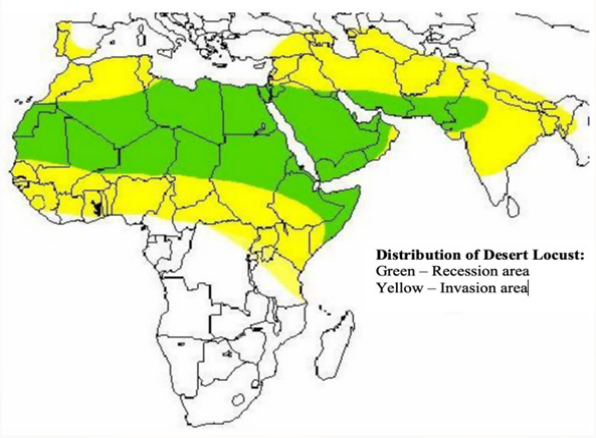


Figure 1: Map showing the Desert Locust Recession and Invasion Areas

1.2 Desert Locust Breeding Areas

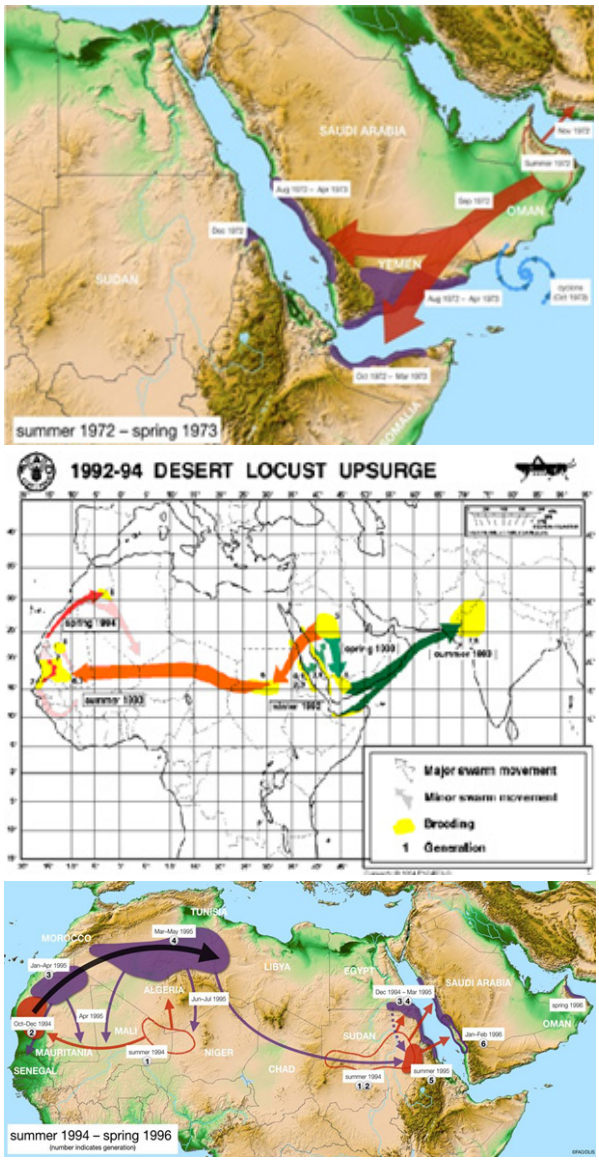
The Desert Locust is an organism which can only survive in an arid environment by moving between temporarily humid zones, which can be located several hundred or several thousand kilometers away (Table 1). In the different parts of the Desert Locust habitat area, favorable rains occur in different seasons, which explains the existence of seasonal breeding areas involving significant population movements.

Season (Months)	**Breeding areas**	**Movement from/to**
Summer Breeding (July-August)	Senegal & southern Mauritania, W. Africa, Chad, Sudan, Ethiopia, southern Arabia, Pakistan and India	o Sudan and north Ethiopia into Somalia and East Africa. o Sudan into Egypt, Middle East, and Southern Arabia. o Sudan into Chad, Niger, Mali into Tunisia a o Pakistan and India into Iran and eastern Arabia o west Africa into Niger and Chad and northwest Libya
Winter breeding (Feb-April)	East Africa, along the Red Sea coast and Gulf of Aden	o East Africa to Ethiopia and Somalia o Somalia into Ethiopia, Sudan, Yemen and southwest Arabia o Southwest Arabia to north Arabia, middle east, Iran and Pakistan o Southern Morocco into Algeria, Tunisia and Libya
Spring Breeding (March-May)	North Africa, Middle East, south Iran & Pakistan and East Africa.	o Middle East & N. Arabia into Egypt, Sudan, Chad, Niger and Mali o Middle East, Arabia and Iran eastwards into Pakistan and India o Central and southern Arabia into Somalia and Ethiopia o Northwest Africa through Mauritania and Senegal across the Sahara and Sahel countries to Chad and Sudan

Table 1: Desert Locust Breeding Areas

1.3 History of upsurges in the central region since 1970's

The region has witnessed more than five upsurges since 1970 (Figure 2) and this has shaped national and regional approaches to desert locust management. Some of the upsurges recorded in the Greater Horn of Africa include;



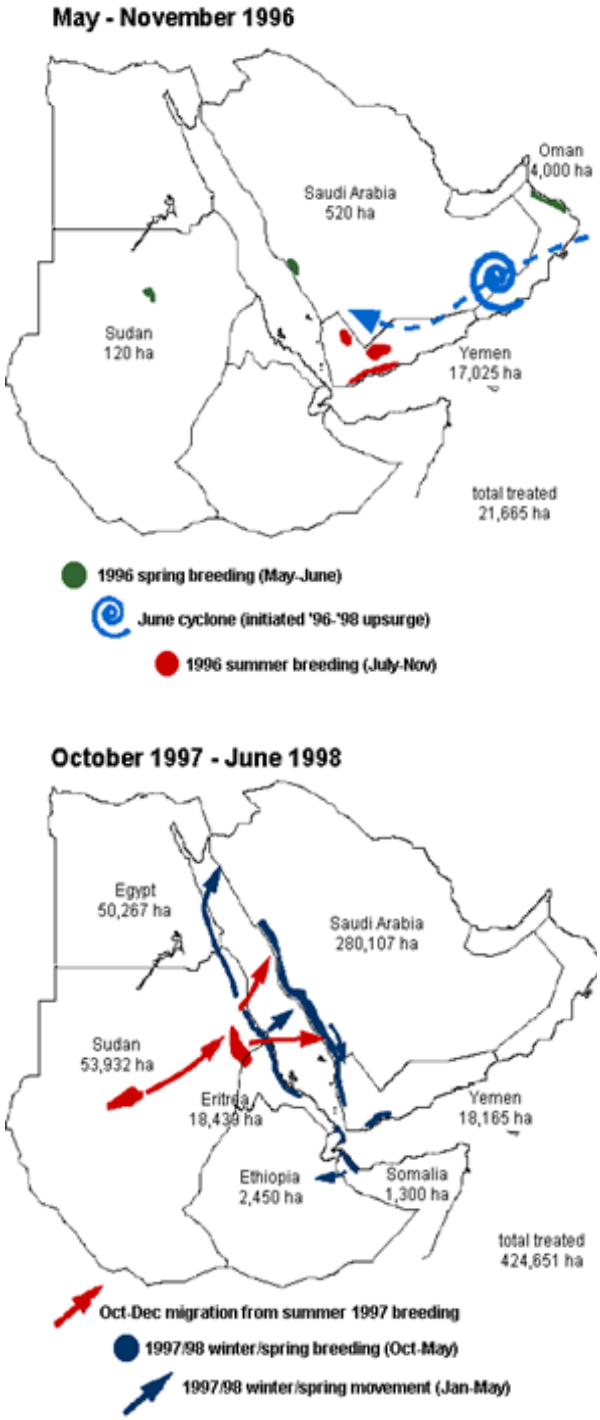


Figure 2: Desert Locust upsurges in the central region between 1972 and 1998

1972 – 1973: Breeding occurred during the summer of 1972 in northern Oman that produced swarms while limited breeding took place on the Red Sea coast of Saudi Arabia and southwest interior. The situation returned to normal as a result of ground

and aerial control operations combined with a lack of rainfall during the spring of 1973. 1992-1994: Desert Locust bred for several generations along the Red Sea coastal plains in the winter of 1992 and numbers built up. The resulting swarms moved to the Arabian interior and bred again during the spring of 1993. The swarms that moved to South-West Asia were controlled in the summer of 1993. 1994—1996: Summer-bred swarms formed in the interior of Sudan and moved to the Red Sea coast by the end of 1994 where breeding took place from Egypt to Eritrea until March 1995. Breeding commenced on the Red Sea coastal plains of Saudi Arabia in late November 1994. Control operations continued against hopper bands and swarms in all countries until April 1995. 1996-1998: A regional upsurge affected countries along the Red Sea as a result of a cyclone in June 1996 and heavy rains in November. Infestations were primarily concentrated in Saudi Arabia and to a lesser extent in Egypt, Eritrea, Ethiopia, northern Somalia, Sudan, and Yemen. 2019-2022: An outbreak developed in late 2018 on the Red Sea coast of Eritrea and Sudan and spread to the Arabian Peninsula. It was supplemented by cyclones and undetected breeding in the Empty Quarter, causing a further spread to spring breeding areas in the Central and Eastern regions, and summer breeding areas along the Indo-Pakistan border and in the Horn of Africa (Figure 3). Swarms emerging from the 2019-2021 Desert Locust upsurge affected many countries in the Greater Horn of Africa. While several warnings were issued by FAO and control actions launched in Egypt, Eritrea, India, the Islamic Republic of Iran, Oman, Pakistan, Saudi Arabia, Somalia, the Sudan and Yemen in 2019, the situation deteriorated rapidly in January 2020. The deterioration was attributed to weather conditions that were unusually conducive for breeding and spread.

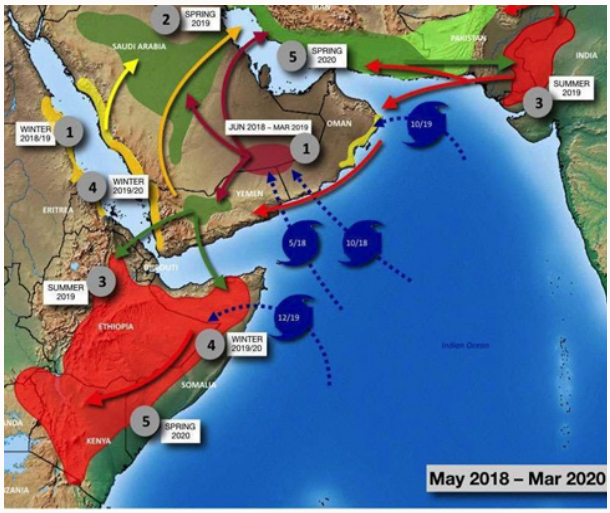


Figure 3: Movement of swarms during the 2019 – 2020 Desert Locust upsurge

1.4 Desert Locust Invasion and Economic Impacts in Kenya

Of the upsurges reported in the region since 1970, it is only swarms for the 2019-2021 upsurge that invaded Kenya. The swarms of the first wave entered the country through Mandera and Wajir from Somalia on 28th December 2019. Heavy rains that preceded the short rain season (October—December) created an environment conducive for locust breeding. By the end of February 2020, the swarms had invaded 20 Counties.

Over the next three months, locusts swarmed to North-Western Counties and by mid-May, cumulative crop and pasture losses were estimated at between 5-15% in Northern Kenya and 1-5% in South-Eastern Kenya. However, low levels of rainfall in May, in conjunction with continued ground and aerial pest control initiatives, led to decline in locust population with reduced average swarm sizes. The isolated swarms were restricted to the North-Western Counties of Turkana and Marsabit.

Continued low rainfall and the relative lack of greenery in North-Western Kenya resulted in a progressive decline in both swarm size and overall population from June to September, resulting in reduced levels of locust maturation, which placed much of the remaining locust population in recession. As of October 2020, several small (1–10 km2) swarms, slowly maturing at the border between the North-Western Counties of Baringo, Laikipia, and Samburu, were the only remaining gregarious locust populations in the country.

However, as a consequence of Cyclone Gati which made landfall in Somalia in November 2020, Desert Locust started to breed again in December. Numerous immature swarms started to form early in the month in Eastern Ethiopia and Central Somalia. In mid-December, swarms from Ethiopia crossed through Mandera and Marsabit, while swarms from Somalia crossed through Mandera, Wajir and to a small extent through Garissa. This invasion peaked in mid-January 2021 and spread across 22 counties. Sighting of swarms were made in Mandera, Wajir, Garissa, Tana River, Lamu, Kilifi, Taita Taveta, Kitui, Machakos, Kajiado, Embu, Meru, Tharaka Nithi, Laikipia, Nyandarua, Murang'a, Baringo, Elgeyo Marakwet, Isiolo, Samburu, Turkana and Marsabit Counties. Though many counties reported swarms, the list is dominated by counties in pastoral areas with significant effect being felt in Mandera, Wajir and Samburu. Other Counties that experienced crop losses include Laikipia, Embu, Meru, Machakos and Kitui. The second wave posed a higher risk to food security in arid and semi-arid areas where about 739,000 people were already facing high levels of acute food insecurity {(Integrated Food Security Phase Classification (IPC-phase 3 or above)}, including approximately 43,000 people in Emergency {(Integrated Food Security Phase Classification (IPC-phase 4).

Tremendous efforts were made by various survey and control teams to suppress the upsurge and mitigate its impact. The success of this effort is attributed to the timely and generous support from FAO's resource partners who facilitated implementation of various campaign components. Ultimately, the unprecedented locust threat was halted from spiraling into a plague during which a total 38,671 Ha was surveyed and 47,597 Ha treated in Kenya. In the region, the campaign averted crop losses estimated to be 4.6 million tons, saved 900 million liters of milk production, and secured food for 41.5 million people. The commercial value of the cereal and milk losses averted through the response is estimated at USD 1.77 billion.

1.5 Rationale for the Contingency Plan

The Desert Locust being a migratory notifiable pest, its management is the mandate of the PP&FSD in the State Department for Agriculture. Under favorable ecological conditions, the pest has high reproductive capacity, rapid development, high mobility, intensive feeding habits and ability to infest large areas causing significant losses to agricultural crops, pasture, forest trees and shrubs. Favorable ecological conditions can be caused by effects of climate change such as the cyclones witnessed in 2018 and 2019.

Drawing from the lessons learnt during the management of 2019-2021 upsurge, there is a need to enhance preparedness at national and regional levels. In this regard, PP&FSD through the Emergency Locust

Response Program (ELRP) has developed a contingency plan (CP) as part of the country's preparedness to ensure a rapid and effective response to Desert Locust invasion. This CP outlines the risks and risk assessment procedures, preparedness and rapid response activities to be undertaken during the DL invasion. The CP will help in achieving the vision 2030, the SDGs 2 by enhancing food and nutrition security and the Bottom-up Economic Transformation Agenda (BETA) of the Kenya government.

2.0 ORGANIZATIONAL AND LOGISTICAL ARRANGEMENTS

2.1 Mandate, functions and organizational structure of PP&FSD

2.1.1 Mandate

The mandate of the Plant Protection and Food Safety (PP&FSD) is to reduce Pre- and Post-harvest crop losses due to damage from migratory pests (Desert Locust, Quelea birds, and African armyworm), emerging trans-boundary pests, diseases, invasive weeds and mycotoxins.

2.1.2 Functions of PP&FSD

1. Undertake surveillance and monitoring of migratory pests and other trans-boundary pests in collaboration with other key agencies.
2. Undertake control operations for outbreaks and invasions of migratory pests and other trans-boundary pests in collaboration with County governments, relevant government agencies and development partners.
3. To build the capacity of county extension service providers and other stakeholders on migratory and trans-boundary pest's management in the country.
4. Provide centralized coordination and communication among government agencies, development partners and private sector on management of migratory and trans-boundary pests.
5. Provide ICT-based data, information and knowledge management service for migratory, trans-boundary and invasive pests and weeds including mycotoxins.
6. To formulate and review migratory and invasive trans-boundary pests' management policies and strategies.
7. To coordinate the development of Multi-Institutional Technical Team (MITT) project proposals and strategies on management of strategic and trans-boundary pests for resource mobilization.
8. To monitor and evaluate migratory and trans-boundary pest management in the country.

2.1.3 Current PP&FSD organization structure

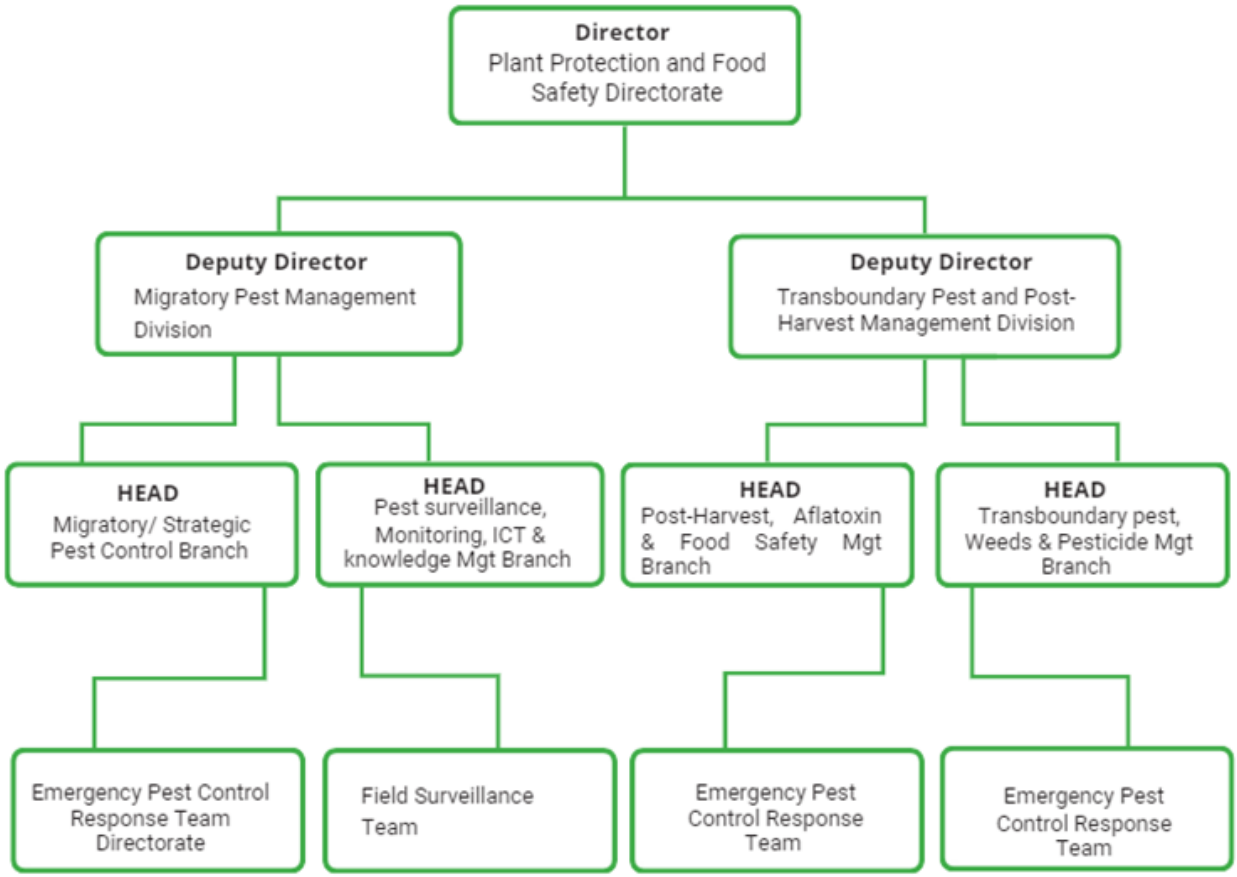


Figure 4: Current organizational structure of PP&FSD

2.2 Responsibilities and Functions of Partner Institutions

The PP&FSD is responsible for organizing and executing Desert Locust control operations when outbreaks occur. At the national level, the Directorate works in collaboration with relevant institutions and partners involved in the management operations. Table 1 presents a summary of some of the institutions involved and their functions.

2.3 National Multi-agency Collaboration

There exists at the national government a Multi-Institutional Technical Team (MITT), which assesses reported pest situations and guides the country in sustainable management of the trans-boundary pests. This technical team advises ministry policy makers on the various aspects of pest management including the appropriate approaches to be used, and pest threshold levels. The MITT has Director of PP&FSD as the chair with technical experts from MDAs.

On a need basis, other stakeholders are co-opted to bring the expertise required to address the immediate challenge. The MITT structure is anchored in the Migratory and Invasive Pests and Weeds Management (M&IPWM) strategy 2022- 2027 to guide the country in management of migratory pests. It also takes into consideration relevant policy statutes like the Food Security Policy 2011 and the National Phytosanitary Policy 2022. Counties have also been encouraged to institutionalize MITT structures at county level. They should take advantage of regional offices of regulatory bodies and research centres, universities and other key stakeholders to facilitate county interventions on migratory pests.

Table 2: List of partner institutions and their specific functions in relation to Desert locust

Partner Institution	Responsibilities
1. African Union Inter-African Phytosanitary Council (AU-IAPSC	· Coordinates and supports plant resource protection in AU Member States. · Enhances capacity building on phytosanitary measures. · Prevents the introduction and spread of exotic and invasive plant pests. · Increases market access.
2. World Bank	· Provides financial resources for locust crisis management. · Funded the Emergency Locust Response Program in Kenya (2019-2021). · Collaborates with DLCO-EA and IGAD for coordinated responses. · Supports training programs and improves early warning systems.
3. Food and Agriculture Organization of the United Nations (FAO)	· Provides early warnings and technical expertise. Operates the Desert Locust Information Service (DLIS) for monitoring and forecasting. · Offers technical assistance and training for national locust control programs. · Mobilizes international resources for control efforts.
4. IGAD Climate Prediction and Application Centre (ICPAC)	· Coordinates a regional platform on trans-boundary pests. · Offers technical support on climate-driven disasters.
5. Desert Locust Control Organization for Eastern Africa (DLCO-EA)	· Provides aircraft, crew, fuel, and scientists for locust management. · Provide guidance on management of desert locust · Capacity building on monitoring, early warning and preparedness and management of desert locust · Support technical materials development
6. Centre for Agriculture and Bioscience International (CABI)	· Provides information and scientific expertise for agricultural and environmental problems. · Works in crop health, value chains and trade, invasive species management, and more. · Integrates gender and climate change adaptation and mitigation. · Delivers digital development and science publishing.

Partner Institution	Responsibilities
7. Regional Centre for Mapping of Resources for Development (RCMRD)	· Provides geospatial tools and earth observation data. · Offers updated cropland masks and imagery. · Conducts capacity-building activities. · Supports surveillance, monitoring, and early warning systems for pest invasions. · Assists in natural resource monitoring and disaster management.
8. International Red Locust Control Organization for Southern Africa (IRLCO-SA)	· Coordinates national actions against Red Locusts. · Provides resources and services for migratory pest control. · Manages control of Red Locusts, Armyworms, Grain-eating birds, and Tsetse flies. · Undertakes effective control measures in member countries.
9. State Department for Agriculture	· Develop policy guidelines on management of migratory pests and weeds · Foster partnerships and resource mobilization · Capacity building
10. Kenya Plant Health Inspectorate Service (KEPHIS)	· Enforcement of phytosanitary standards for protection against introduction, spread and establishment of plant pests /disease · Inspection and certification of plant products to prevent entry of harmful organisms and food losses · Carry out national pest surveillance · Notification of trading partners on pest risks · Issue biological import permits for biological control organisms and monitor their establishments · Management of pests and diseases, creation of pest free areas to allow access of Kenya's produce to the market · Develop and update the database on migratory and invasive pests and weeds
11. Pest Control Products Board (PCPB)	· Enhance compliance of pest control products to set standards and facilitate trade. · Fast-track registration of new pest control products for migratory pests. · Support training of stakeholders · Post-registration review of pesticides
12. County governments	· Undertake pest surveillance, monitoring and reporting · Coordinate pest control and management activities · Capacity building for extension service providers and other stakeholders on pest management · Undertake resource mobilization for pest management · Awareness creation to the communities · Develop strategies in line with the national government structures
13. Farmers / farmer organizations/ producers	· Monitoring and reporting of pest incidences · Supporting control operations where applicable · Participating in training forums for awareness and capacity building · Providing feedback on effectiveness of control operations

Partner Institution	Responsibilities
14. FBO, NGO, CBO	· Offering extension services to farmers, agro-dealers and general public · Participate in community mobilization · Capacity building
15. Agrochemical Association of Kenya (AAK)	· Capacity building of agro-dealers, extension/spray service providers and farmers on pest control operations and responsible use of pesticides
16. Kenya Agricultural and Livestock Research Organisation (KALRO)	· Carry out research on aspects such as biology and management options for desert locust · Validate environmental friendly agricultural technologies for the management of the desert locust · Develop training materials and technology user guidelines for the desert locust management · Train extension service providers and lead farmers on desert locust management · Conduct efficacy trials on crop protection products for desert locust management
17. Tertiary learning institutions and Universities	· Develop training curriculum on management of migratory and invasive pests and weeds · Capacity building on desert locust · Conduct research · Support monitoring and evaluation
18. National Environment Management Authority (NEMA)	· Regulating, monitoring and assessing activities to ensure that the environment is not degraded · Enforcing environmental standards · Capacity building
19. Kenya Meteorological Department	· Providing forecasts to advice on appropriate timing for implementation of control measures. · Issuing guidance on extreme weather and anticipated impacts on the area in question. · Providing historical weather and climate data for research, control and policy. · Advising on climate change aspects that touch on desert locust.
20. National Youth Service (NYS)	· Support in desert locust ground surveillance and control activities
21. National Research Fund (NRF)	· Prioritize research on emerging pest issues · Provide research funds
22. Government Chemists Department (Public Health)	· Test substances and materials for chemical composition, compliance with legal specifications · Traceability studies

Partner Institution	Responsibilities
23. Directorate of Occupational Safety and Health Services (DOSHS)	· Enforce compliance of set standards · Identify and evaluate chemical factors in the work environment that may affect employed persons' health and safety
24. Kenya Wildlife Services (KWS)/Conservancy	· Surveillance and management of Desert locust · Capacity building · Logistics support · Data collection and information management system
25. Kenya Forest Services (KFS)	· Surveillance of desert locust · Logistics support
26. Kenya Defense Forces (KDF)	· Aerial and ground surveillance and control of desert locust Logistics support and security
27. Regional bodies e.g. East African Community (EAC), African Union (AU)	· Regional surveillance, monitoring and early warning of migratory pests · Resource mobilization and technical support of migratory pests · Provision of data, technological and technical support. · Support technical materials development

3.0 RISK ASSESSMENT

Risk is a measure of the likelihood or probability that damage or loss will occur to humans, livestock, crops, pastures, economy and the environment in the event of pest infestation. Risk assessment and management play a pivotal role in contingency planning. In Desert Locust management, risk assessment will aim to identify, analyze, and prioritize risks, enabling informed decision-making and effective allocation of resources. This section outlines a detailed framework encompassing risk assessment and management techniques to minimize desert locust related risks in Kenya. It covers risks associated with Desert Locust at global, regional and national levels.

3.1 Global Risks

Desert Locusts have been documented to have spread in over 60 countries globally, taking recession in arid and semi-arid deserts of Africa, East and Southwest Asia, covering about 30 countries receiving less than 200 mm of rainfall annually. The countries include Iran, Pakistan, Saudi Arabia, Yemen, Eritrea, Egypt, Sudan, Ethiopia, Kenya, Djibouti, Algeria, Burkina Faso, Chad, Libya, Mali, Mauritania, Tunisia, Senegal and Niger among others.

The global occurrence of Desert Locust is influenced by different factors including but not limited to weather patterns such as rainfall intensity, temperatures, cyclones, and seasons (spring, summer and winter) which determine vegetation conditions. Their spread is intermittent and not tied to particular timing. For effective management of Desert Locust, there is a need for continuously monitoring the climatic conditions in the recession regions. It is also important to note that Desert Locust has adapted to climate change, therefore forecasting can help in the prevention and management of possible invasion. Any Desert Locust swarms from the neighboring recession countries of Eritrea, Sudan and Ethiopia pose great risk to Kenya and should be closely monitored.

Globally, risk assessment is conducted based on the size of adult swarms and hopper bands. Swarms are categorized according to table 3, and since all categories pose real threats, they should be closely monitored.

Table 3: Categories of Desert Locust swarms and hopper bands

Swarm Category	Hopper Band Size	Swarm Size (km^2)
Very small	1 – 25 m^2	1km^2
Small	26 – 2,500 m^2	1 – 10 km^2
Medium	2,501 – 10 ha	11 – 100 km^2
Large	11 – 50 ha	101 – 500 km^2
Very large	50 + ha	500 + km^2

3.2 Regional Risks

The Desert Locust population build-up and favorable weather conditions in the Eastern cluster of Iran, Pakistan and the Arabian Peninsula poses a risk to both recession and invasion countries. The recession countries of importance to Kenya include Sudan, Ethiopia, Somalia, Eritrea and Djibouti. These countries neighbour Kenya, an invasive country thus necessitating close monitoring of locust behaviour given the unpredictable climate changes. Notably some recession countries in the East African region are politically unstable and might not effectively play their role in managing the Desert Locust outbreaks. Therefore, Kenya should remain on high alert in monitoring the build-up of the pest.

3.3 National Risks

The Desert Locust risks to Kenya accrue from the global and regional built up and subsequent invasion due to favorable conditions. Kenya, being part of the countries in the horn of Africa is always at risk whenever there is a buildup in any neighbouring recession country in the region. However, it is also important to be cognizant that the direction of wind influences movement of the Desert Locust. Therefore, Kenya in collaboration with global and regional bodies should continuously monitor the conditions that favor breeding and movement of Desert Locust.

3.4 Risk Analysis Framework

Risk analysis integrates the assessment, management and communication of risks posed by the pest being addressed. The risk analysis framework for Desert Locust invasions will entail the following:

3.4.1 Identifying Risks

When documenting the potential risks associated with Desert Locust invasions in Kenya, the following should be undertaken;

1. Identify specific regions or areas in Kenya that are susceptible and prone to Desert Locust invasions.
2. Document presence of the Desert Locust swarms and their categories.
3. Map the direction of winds and other suitable environmental conditions
4. Identify Desert Locust possible migratory patterns.

3.4.2 Assessing Probability of Desert Locust Occurrence

1. Evaluate the likelihood of Desert Locust invasions in the identified regions based on historical data, migratory patterns, proximity to recession and/or occurrence areas, wind patterns, forecasting based on the suitability of the variables, and prevailing environmental factors.
2. Assess the pro-activeness of countries in recession areas in management of Desert Locust outbreaks.
3. Assess the magnitude of the swarms and/or hopper bands.

3.4.3 Assessing Potential Impact of Desert Locust Invasion

1. Determine the potential impact of Desert Locust invasions on agriculture and wildlife related industries.
2. Estimate the potential economic losses.
3. Evaluate the impact on food security, community livelihoods, and overall ecosystem balance in the affected regions.
4. Determine the psycho-social impact of the Desert Locust invasion

3.4.4 Risk Prioritization

1. Prioritize the identified risks based on the probability and impact assessments, focusing on high-priority regions or areas where the risk of Desert Locust invasions is significant and where the potential impact might be severe.
2. Prioritize the size of the swarm categories in the affected regions
3. Categorize risks into immediate threats, potential risks and long-term concerns then make a decision.

3.4.5 Risk Assessment Reporting

The identified risks, their potential impact, and resources required to mitigate the potential impact of the Desert Locust invasion will be officially communicated to stakeholders. The report will cover a detailed risk assessment process, current Desert Locust mitigation plans, lessons learnt and recommendations.

3.4.6 Risk Assessment Register

Desert Locust management risk register/ risk log (Appendix 5) should capture and manage information related to the identified risks in case of Desert Locust invasion. It serves as a central repository for all relevant details about risks including their nature, potential impact, likelihood, and planned response strategies. This will be reviewed periodically to inform risk prioritization and resource allocation based on the potential crop and pasture damage, psycho-social, economic and environmental factors in risk areas.

Managing risks associated with Desert Locust infestations will involve a comprehensive risk management approach to minimize negative impacts on agriculture wildlife and forestry, humans, and maintain an ecological balance. As such, transparent, consistent and well-documented risk management procedures are essential. This will entail identifying potential hazards from Desert Locust invasion and its management using appropriate techniques, stakeholders and community engagement and in compliance with regulatory provisions.

4.0 RISK PREPAREDNESS ASSESSMENT

Risk preparedness in Desert Locust management involves measures and strategies to anticipate, prevent, mitigate and respond to potential risks and hazards to minimize the damage to crops, animals and ecosystems. To effectively prepare and manage Desert Locust invasion, the directorate will:

1. Develop an elaborate preparedness and an operational plan outlining the actions and strategies for management of Desert Locust invasions.
2. Establish a framework for stakeholder coordination and communication.
3. Undertake an audit of resource inventory to assess levels of preparedness for Desert Locust control operations
4. Inspect and maintain necessary equipment and facilities.
5. Procure materials and equipment for survey and control of Desert Locust.
6. Enhance capacity for the key stakeholders involved in Desert Locust management for early preparedness and rapid response to any invasion.

4.1 Preparedness Plan

Effective management of Desert Locust requires planning and preparedness to mitigate the potential impact of outbreaks on food security, livelihoods and environment. A comprehensive preparedness plan serves as a roadmap for coordinating efforts among various stakeholders, mobilizing resources, and implementing timely response measures to address Desert Locust threats. This section outlines the key components of a preparedness plan for Desert Locust management.

4.1.1 Desert Locust Information Management and Reporting

Information management and reporting systems include monitoring, mapping infestation areas, forecasting migratory patterns, and sharing timely updates with relevant stakeholders. A robust system will enable authorities and stakeholders to enhance their understanding of Desert Locust dynamics, facilitate early detection and response, and optimize resource allocation for control efforts. Additionally, accurate reporting mechanisms will strengthen collaboration and coordination, in Desert Locust management at local, national, and regional levels. The management will include:

1. Developing and/or utilizing standardized protocols for data collection, including methodologies, sampling techniques and data recording formats.
2. Implementing robust data management systems to collate, store, organize, analyze and share the collected information.
3. Analyzing data to identify patterns, trends and potential risks associated with desert locust populations.
4. Establishing reporting mechanisms to capture and communicate Desert Locust related information in a timely manner for decision-making and prompt response.
5. Establishing and/or utilizing platforms for information sharing, research findings, best practices & lessons learned, and feedback mechanisms.
6. Evaluating the effectiveness of information management and reporting systems.

4.1.2 Capacity Building

The PP&FSD in collaboration with the county governments, governmental agencies, development partners, research institutions, and regional & international organizations, will spearhead capacity building for extension officers and field scouts. This collaboration will ensure that staff stay updated on the latest technologies for Desert Locust forecasting, monitoring, surveillance and communication. Conduct sensitization for communities and their leaders by counties on Desert Locust management. Recognizing the dynamic nature of Desert Locust invasion, continuous training and capacity building of relevant stakeholders will be undertaken.
The training courses will be designed for various categories of personnel involved in Desert Locust management. Trainees will include field staff, researchers, community leaders, farmers, wildlife experts, data & information management officers, extension service providers, field scouts, spray service providers and administrative personnel among others.

Training courses will cover a range of topics to address the multi-dimensional nature of Desert Locust management. Specific topics will include:, Desert Locust biology, ecology and behavior., monitoring, surveillance and reporting, early detection and warning systems, control strategies, risk assessment and decision-making, ecological impacts and biodiversity conservation, community engagement and participatory approaches, communication and awareness, environmental health and safety, development of emergency response plan for Desert Locust, legal and regulatory aspects concerning Desert Locust management activities, occupational health, safe use and handling of pesticides, post-outbreak recovery and preparedness, spray equipment assemblage, calibration and servicing and data and information management.

4.1.3 Joint Preparedness Assessments and Deliberations

Effective and efficient management of Desert Locust will require a holistic approach where the national government, county government and key stakeholders are involved (Table 2). These coordinated efforts ensure systematic evaluation of readiness levels, identification of potential risks, and formulation of response strategies to mitigate the impact of locust outbreaks.

Key components of this approach include:
1. Data collection and analysis.
2. Risk assessment and scenario planning.
3. Resource mapping and allocation.
4. Development and reviewing of standard operating procedures (SOPs) and action plans.
5. Developing capacity-building programs.
6. Effective communication channels and protocols.
7. Continuous review and updating of the preparedness assessment tools.

4.1.4 Alerts and simulations

Alert systems and simulations play a crucial role in Desert Locust management by enhancing preparedness, testing response capabilities, and improving coordination among stakeholders. Annual simulations for trained scouts and control teams in Desert Locust prone counties will be essential for emergency preparedness. Mock drills to be organized before the impending locust invasion begins, to ensure the capability of all infrastructure required during Desert Locust control operations. These exercises will be combined with capacity-building activities to enhance the skills and readiness of stakeholders involved in locust management. Key considerations for these simulation activities will include objective setting, stakeholder participation, awareness creation, coordination and resource mobilization. Conducting an after-action review will provide insights to assess the level of preparedness and response capacity.

4.1.5 Preparedness in Insecure, Inaccessible and Ecologically Sensitive Areas

In Desert Locust management, insecure and inaccessible areas are characterized by limited or restricted access due to security concerns or physical barriers that pose significant challenges impeding timely detection and response to Desert Locust outbreaks. Such areas include conflict zones, remote and isolated areas, inter-border boundaries and rugged terrain.

Ecologically/Environmentally sensitive areas (ESA) are vulnerable to negative environmental impacts and need special protection. These areas have unique and fragile ecosystems, provide essential ecosystem services, denote cultural, historical and scientific heritage (habitat to rare or endangered species). Such protected areas include, indigenous territories, game parks/reserves, water bodies and human settlements.

Strategies for control in these areas should be tailored to a proactive monitoring and rapid response to safeguard the ecosystems.

1. The use of aerial surveillance and remote sensing technologies to monitor locust movements in these regions and establishment of mobile response units capable of quick deployment to affected areas.
2. Explore the use of artificial intelligence (AI) technologies to undertake surveillance and control operations.
3. Use of bio pesticides in areas where the synthetic pesticides are unsafe and monitor their effects on the ecosystem upon deployment.
4. Multi-agency collaboration mechanisms should be in place to ensure enhanced information flow between the County, National governments and the relevant stakeholders in Desert Locust management.
5. Collaboration, integrating indigenous knowledge and sensitization of local leadership on Desert Locust control operations.
6. Use of acoustic devices to disrupt locust swarms and deter them from settling in specific areas.
7. Undertake research and develop technologies known to disrupt locust mating and feeding behaviors.
8. Collaborate with neighboring countries for coordinated aerial spraying efforts to prevent Desert Locust migration across borders.

9. Evaluate the effectiveness of intervention measures through monitoring and assessment.
10. Adapt to corresponding locust dynamics, environmental conditions, and technological advancements.
11. Develop and/or utilize Information, Education and Communication (IEC) materials to raise awareness about locust threats, early warning systems and mitigation measures.

4.1.6 Inspection and Maintenance of Equipment and Facilities

Desert Locust management requires use of various equipment and facilities depending on whether the control operation is ground-based or aerial. Inspection and maintenance of these equipment and facilities play a vital role in ensuring smooth and efficient operation. Key considerations for inspection and maintenance include;

1. Regular inspections and maintenance of equipment and facilities to ensure serviceability.
2. Adherence to established safety protocols and guidelines.
3. Keeping records of inspections, maintenance and repairs.
4. Training and certification of staff responsible for equipment and facilities based on industry best practices.
5. Seeking technical assistance from the national and international experts when necessary.
6. Developing and updating emergency plans and protocols for addressing equipment failure.

Despite the infrequent Desert Locust invasion, maintaining a routine inspection and maintenance plan will ensure the reliability and longevity of equipment and facilities. By prioritizing regular inspections, scheduled maintenance and following protocols, Desert Locust management operations will be conducted effectively in order to minimize downtime and ensure the reliability and longevity of equipment and facilities.

4.1.7 Procurement

The procurement of materials, equipment, and hiring of aircraft are essential components of Desert Locust management. These resources will contribute to the effectiveness and efficiency of surveillance, monitoring, control and response efforts. The procurement process should be done in accordance with the prevailing government guidelines and procedures (Public Procurement and Asset Disposal Act, 2015). Procurement decisions will be based on risk assessment, inspection and maintenance reports, invasion thresholds (crisis level- at emergency response) and preparedness needs. If there is a need for international or regional support to procure any goods or services, the Ministry of Agriculture and Livestock Development (MoALD) will make a formal request. This structured approach ensures that all necessary resources are available and properly managed to combat Desert Locust invasions effectively.

4.1.8 Monitoring and Evaluation

Monitoring and Evaluation (M&E) within risk preparedness assessment involves systematic processes for tracking, assessing, and improving the effectiveness of risk management and preparedness measures. Such activities include;

1. Regularly collecting data on key indicators related to risk factors, vulnerabilities, and preparedness activities to improve the preparedness plan.
2. Tracking the progress of risk mitigation strategies and emergency response plans for enhanced mitigation measures.
3. Monitoring early warning systems and indicators of potential risks for effective and rapid response.
4. Assessing the availability and effectiveness of resources allocated for risk preparedness in order to determine the outcomes achieved.
5. Analyzing data and gathering feedback from stakeholders and development partners to inform future response.

Integrating M&E into risk preparedness assessment will allow PP&FSD to create evidence-based, adaptive strategies that continuously improve response to Desert Locust invasions. This iterative approach enhances resilience enabling organizations to better anticipate, prevent, and respond to potential threats and emergencies.

4.1.9 Preparation for Survey Processes

The survey operations should be conducted to combat the impending Desert Locust threat and invasion. The country will ensure that there is adequate capacity to sustainably survey the suspected areas. This will be achieved through availing skilled manpower, equipment and effective coordination mechanisms.

A logical approach is required to ensure that the Desert Locust monitoring systems in hot spot Counties are efficient in order to collect information immediately using minimum resources. Planning surveys should be conducted in accordance with the locust situation (trends, ecological conditions and population magnitude) in the recession areas, and the likelihood of a potential risk of the Desert Locust invasion.

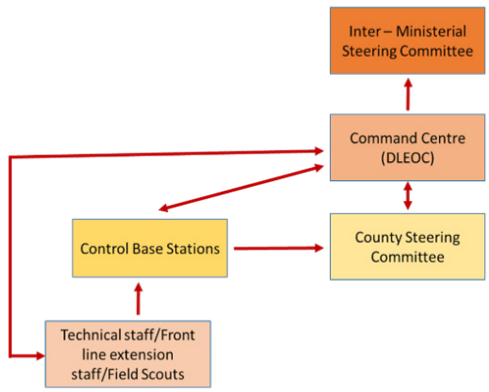
5.0 EMERGENCY RESPONSE FOR DESERT LOCUST

A DL emergency response plan contains actions to mitigate risks posed by the pest. The plan aims at preventing the outbreak and spread of Desert Locust imminent threats to livelihoods and strengthening the systems for preparedness. A Desert Locust Emergency Operation Coordination (DLEOC) office is required for effective response, efficient communication, and resource mobilization and allocation.

5.1 Desert Locust Emergency Response Coordination

In the event of a crisis, the DLEOC office shall be constituted to strengthen the coordination of response to the locust crisis (figure 5). The office can be constituted as a directive of the Cabinet Secretary Ministry of Agriculture and Livestock Development or the Principal Secretary State Department for Agriculture or the Director PP&FSD.

Figure 5: Desert Locust emergency response coordination chart



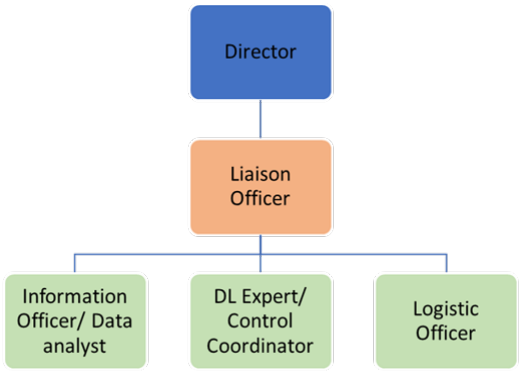
5.1.1 Desert Locust Emergency Operation Coordination Office (Command Centre)

The command centre will be based at Kilimo House and it will provide strategic leadership, coordination, regular briefing during crises and technical expertise to manage the outbreaks/invasions.
Above the command centre, there will be an inter-ministerial steering committee that oversees DL management operations. The command centre will work in collaboration with the County Steering Committees. In addition, the command centre will oversee the control bases and frontline extension officers or scouts in the affected counties.

5.1.1.1 Structure and Membership of the Command Centre

The command centre will be manned by the following officers; the Director, Liaison Officer, Information Officer/ Data Analyst, Desert Locust Expert/ Control Coordinator, and the Logistics Officer (Figure 6).
The command centre will be in charge of; strengthening early warning systems, activation of the contingency plan, coordinating capacity building initiatives, communications, risk assessment, control operations, resource mobilization and allocation, supervision of the control bases, and M&E.

Figure 6: Structure of the command Center



5.1.1.2 Responsibilities of the officers at the command Centre

1. **The Director**
   a. *Overall leadership and management of the command centre.*
   b. *Supervision of activities and personnel.*
   c. *Decision-making and strategic planning.*
   d. *Regular information briefs on the status of the Desert Locust invasion.*
   e. *Coordinating communication, collaboration with stakeholders and capacity building*
   f. *Liaising with relevant government agencies, departments, research institutions, and regional and international organizations.*
   g. *Promoting partnerships for research, funding, and resource mobilization.*
2. **Liaison Officer**
   a. *Facilitating communication and information sharing between the control operations teams and policy makers.*
   b. *Facilitating collaboration and information exchange among stakeholders.*
   c. *Organizing training, review of training materials and capacity-building initiatives.*
   d. *Overseeing operational logistics.*
   e. *Advising the Director on DL matters*
3. **Desert Locust Expert/ Control Coordinator**
   a. *Developing and reviewing information, education and communication materials.*
   b. *Coordinating awareness, training and Desert Locust management activities*
   c. *Drafting press and policy briefs on Desert Locust status.*
   d. *Liaising with Logistics Officer on services/equipment for procurement,*
   e. *Ensuring that equipment is well maintained, inspected and serviceable*
4. **Information Officer**
   a. *In-charge of all the relevant information relayed from the field*
   b. *Receiving, verifying and analyzing reports on Desert Locust*
   c. *Generating reports and maintaining a database for the command centre*
   d. *Preparing briefs, alerts and bulletins on DL*
5. **5. Logistics Officer:**
   a. *Managing all logistical needs for management of Desert Locusts.*
   b. *Coordinating procurement and distribution of equipment and supplies*
   c. *Procurement of services*
   d. *Deployment of personnel to affected areas.*
   e. *Documentation and keeping of records related to operations, finances and human resources.*
   f. *Providing administrative support to the Command Centre Director.*

5.2 Early warning and Forecasting

Desert Locust Information Service (DLIS) plays a crucial role in monitoring and forecasting movements of DL to help mitigate their impact in agriculture and ecosystem. DLIS collects data from various sources including satellite imagery, ground surveys, weather data, and reports from affected regions. This information should be analyzed to understand locust behavior including breeding patterns, swarm formation, and migration routes.

DLIS shall utilize predictive modeling techniques to forecast future locust movements based on factors such as weather patterns, vegetation dynamics, and historical data on locust behavior. It is from these predictions that early warning systems shall be enabled to alert communities and authorities in at-risk areas, and advise on preventive measures such as spraying activity.

The actual DL movements should be tracked with DLIS, which relies on real-time data from ground observations, aerial surveys, and satellite imagery. Once the information is available, authorities shall use it to pinpoint the current location of locust swarms and assess their threat level to nearby regions.

5.3 Detection

Effective Desert Locust management mainly starts with regular monitoring of their primary breeding areas (recession areas), changes in the weather and ecological conditions favoring their grangerization and migration. The detection of Desert Locusts relies on a combination of satellite imagery, ground surveys, and the use of specialized technology to monitor changes in vegetation and population density in breeding areas. If the early warning and forecasting system indicates an imminent DL invasion, the country should undertake survey to establish the presence/absence of DL in order to inform control operations.

5.3.1 Survey process

1. Identify survey team: The survey team consists of field scouts recruited by the county government and trained technical staff from PP&FSD.
2. Determine survey area location and timing: Surveys should be conducted in hotspot counties where Desert Locust invasions have previously been reported. The timing should consider the locust's life cycle and environmental conditions conducive to their presence.
3. Select type of survey: Depending on the situation, decide on the appropriate type of survey to conduct. This could include rapid assessment surveys or more detailed search surveys.
4. If there's uncertainty about locust presence, conduct a rapid assessment survey. This typically involves conducting foot and vehicle transects at survey stops and interviewing people along the route.

5. If significant locust populations are found during the rapid assessment survey, conduct a more detailed search survey to determine the swarm size and extent of infestations and , as well as to identify control requirements accurately.
6. Choose survey method (ground or air): Determine whether the survey should be conducted on the ground or by air (Aerial surveys) depending on population and accessibility.
7. Prepare vehicles and/or aircraft and associated equipment: Ensure that vehicles and/or aircraft are ready and equipped with necessary tools and materials for the survey, such as GPS devices, survey forms, and communication equipment.
8. Collect and record information: Gather the required information during the survey and record it on designated survey forms. This information may include locust population, density, vegetation status, and weather environmental conditions, among others.
9. Transmit Survey Results: Promptly transmit the survey results to the Locust Command Centre promptly for analysis and decision-making.
10. Plan next survey: Based on the survey results, plan the timing and location of the next survey to monitor locust activity and assess the effectiveness of control measures.

5.4 Activation Arrangements

Timely and accurate information are critical in desert locust early warning and prevention. In the event of an imminent threat to the invasion country, control strategies should shift from reactive and curative to proactive and preventive. By timely activating the DL management campaign (Resource mobilization, surveillance and control teams, and impact assessment protocols), the country will effectively respond to the threat.

5.4.1 Trigger and Mobilization Mechanisms

After getting confirmatory reports of an imminent threat of an outbreak, the Director, PP&FSD will convene a crisis meeting to establish trigger mechanisms and resource mobilization processes to ensure a coordinated response to the invasion.
The main elements of a trigger and mobilization mechanism includes:-

i. Early Warning System: The command centre will establish an early warning system to detect the presence and movement of Desert Locusts. This will involve surveillance techniques such as remote sensing, satellite imagery, ground observations and reports from local authorities and/or farmers.

ii. Decision-Making Process: This involves the assessment of the severity of the Desert Locust infestation, determining appropriate response strategies and allocating necessary resources once the presence of Desert Locust is confirmed.

iii. Triggers for Response: Based on predetermined thresholds or triggers, the Director will decide when to activate the response mechanisms based on information generated at the command centre. Triggers include extent of the infestation, the rate of spread, extent of damage to crops, pastures, rangelands, forests, and the potential economic impact.

5.5 Declaration of an Emergency Situation

The declaration of an emergency occurs when the resources available are inadequate to manage the prevailing Desert Locust invasion in the country. It is a structured process that follows specific guidelines. The threshold of emergency declaration is indicated as follows;

1. The presence of at least 2 large-sized swarms (>500 km2) in at least 5 front-line counties (Garissa, Isiolo, Mandera, Marsabit and Wajir) and weather conditions favouring locust breeding shall be the threshold that demonstrate the need to declare an emergency and /or.
2. The presence of hopper bands (11 - 50 ha) and larger adult swarms (>500 km2) in at least 24 of the counties, and favourable weather conditions for breeding of locusts shall be the threshold indicating the need for the declaration of an emergency

The process of declaring an emergency is as follows;

1. The Principal Secretary, State Department for Agriculture shall convene the National Plant Health Emergency Response Unit (NPHERU), public/ private agencies and development partners to discuss the Desert Locust invasion status that warrants declaration of an emergency in the country.
2. The Principal Secretary, State Department for Agriculture shall advise the Cabinet Secretary, MoALD to officially declare an emergency both verbally and in writing.
3. The Cabinet Secretary shall convene the Inter-ministerial steering committee, private agencies and development partners to discuss the status of the desert locust invasion that warrant declaration of an emergency in the country.
4. The Cabinet Secretary, MoALD shall advise the President to declare an emergency.
5. The President shall make verbal and written public pronouncement of a state of emergency.
6. The declaration of an emergency shall trigger the activation of contingency plans.

5.6 Resource Mobilization for Emergency Response

The Principal Secretary (PS), State Department for Agriculture shall lead the Inter- Ministerial Steering Committee to mobilize resources during Desert Locust emergency. A rapid assessment shall be done in order to establish the resource requirements, availability, identify the gaps and suggest how the deficit shall be addressed. A resource assessment report shall be prepared to outline the estimates of the control operations and a projection based on how long the invasion is estimated to last. The PS shall be responsible for additional resources mobilization at the National level from other Government agencies, National Treasury, regional and international partners and from any other relevant stakeholders.

The allocation and deployment of the resources to various base stations and Counties shall be the responsibilities of Director PP&FSD based on the information at the command centre. Considerations for allocation of resources for DL management will be based on the description in Table 4 below

Table 4: Key Considerations for resource mobilization

Resource	How to mobilize the resources
Human resource	· Assess the existing workforce to identify competencies and gaps · Recommend the hiring and training of new personnel or reallocate existing staff from relevant government departments or agencies · Collaborate with relevant stakeholders to leverage their expertise, resources, and networks
Equipment, tools and Materials	· Evaluate the available equipment, tools and materials required for Desert Locust management · Mobilize the required additional equipment, tools and materials by coordinating relevant stakeholders
Funds	· Conduct a comprehensive assessment of the financial resources needed for Desert Locust management activities · Engage with the government agencies, national treasury and other relevant stakeholders to secure additional funding · Develop concepts on the importance of Desert Locust management in safeguarding agriculture, livelihoods, and the economy · Explore potential funding sources, such as budget reallocations, emergency funds, grants, or partnerships with private sector entities and regional/international partners · Engage with policymakers, government officials, and opinion leaders through targeted advocacy campaigns, public meetings, and media platforms to garner support and commitment for resource mobilization
Control Materials - Pesticides	· Assess the availability of registered pesticides by PCPB for use in Desert Locust Management · Fastrack registration of new pesticides for DL control · Assess the ease of triangulation of pesticides available within the region
Monitoring and Reporting	· Regularly assess the progress, effectiveness, efficiency and impact of resource deployment · Transparency and accountability: Provide and share reports on resource utilization to/with relevant stakeholders

5.7 Mobilization of Survey and Control Teams, Equipment and Facilities

Survey teams consisting of trained personnel shall conduct comprehensive surveys to assess the distribution and abundance of DL in affected areas. In the case where the number of trained personnel is inadequate, capacity building shall be undertaken. The aircraft used during control are provided by the DLCO-EA or other stakeholders, with a trained pilot who will undertake the task in case of aerial spraying. The airstrips for aerial operations and reconnaissance during locust emergencies will be identified.
Training on the use of necessary equipment such as vehicle mounted sprayers, drones and mobile applications (elocust3g and elocust3m), will be done. Control teams shall be responsible for implementing appropriate measures to minimize the DL invasion. These control teams will work in collaboration with county government and relevant authorities to ensure effective and safe implementation. All field officers involved in locust control will be provided with internet facilities and computer peripherals for e-communication. The survey and control teams will be coordinated by the command centre.

5.8 Prepositioning and Movement of Teams and Equipment

In response to DL invasion, strategic positioning of teams and equipment is essential based on DL distribution and movement. This should enable targeted interventions during the invasion. Prepositioning should rely on current invasion status, past data, ecological models, and/or early warnings to allocate resources for rapid response in high-risk areas. Monitoring the DL dynamics, migration, and vegetation vulnerabilities shall guide the deployment of teams and equipment.

Regional partners like DLCO-EA monitor the breeding of DL in recession areas. Sharing the information from the DLIS will enable prediction of the intensity of any subsequent invasion, which will guide in repositioning of control teams and equipment.

5.9 Establishment of Control operations evaluation and environmental assessment team

A team of experts from diverse fields shall be formed to assess Desert locust management operations. To effectively manage DL outbreak, this interdisciplinary team shall analyze the outcomes of control measures, assess the efficiency of control operation and monitor environmental implications in accordance with established guidelines. The evaluation team will advise on the way forward.

5.9.1 Key considerations for establishing an efficient interdisciplinary team:

1. Control operation evaluation: Develop an evaluation criteria and methodologies to assess the outcomes and impact of desert locust control operations
2. Environmental health and safety assessments (EHS): Conduct environmental assessment to evaluate the impact of DL management activities on the surrounding ecosystem.
3. Data collection and analysis: Develop protocols for data collection and analysis to ensure relevant information is systematically collected, analyzed and reported.
4. Collaboration and Communication: Foster collaboration among team members to ensure regular communication and knowledge sharing that will inform decision-making

5.10 Procurement

The procurement of materials, equipment, hiring of aircraft and other related aspects are essential components of Desert Locust management. Depending on the magnitude of invasion, rapid stocktaking report shall be used to determine what and how much is to be procured. Government guidelines on procurement procedures during emergencies should be followed. Protocols on how to receive and deploy the resources received from regional and development partners should be developed and reviewed.

6.0 COMMUNICATION AND PUBLIC RELATIONS

Communication and public relations in Desert Locust management plays a crucial role in raising awareness, coordinating efforts, and providing accurate information. Since Desert Locusts are migratory pests, they have potential of spreading over long distances in swarms whose infestations can result in heavy economic losses within the crops, livestock and wildlife sub-sectors among others if not controlled in a timely manner. Therefore, effective and timely communication in DL management will increase levels of preparedness for rapid response and action to reduce spread and negative impact on food security and community livelihoods. These then requires a multi-dimensional approach starting from surveillance, monitoring, early warning, control and impact assessment.

6.1 What to communicate

Communication information is varied and comprises of the following among others:

a. Alerts on imminent invasions
b. Presence of pest (Developmental Stage)
c. GPS Location of infested areas
d. Nature of terrain
e. Area-Hectare under threat
f. Types of crops /pasture under threat
g. Approximate amount and types of pest control products required
h. Type of equipment needed for control operations
i. Logistical and financial requirement

j. Approximate time-frame for executing the control operations.
k. Approximate number of control teams required.
l. Awareness creation sessions to affected communities.
m. Ecological sensitive areas within infested areas.
n. Post-spray assessment on effectiveness of control operations.
o. Gender-Based Violence (GBV) instances.
p. Estimated economic losses due to the infestation among others.

6.2 Communication Process

At the National government, in the State Department for Agriculture, there is an established Locust Control Unit (LCU) domiciled at PP&FSD. The LCU is charged with the responsibilities of receiving, analyzing and disseminating relevant information on DL status.
The LCU officers brief the National Locust Control Coordinator (NLCC) who is also the Director – PP&FSD. This kick starts a top-down communication and coordination process in case of an emergency response. Establishing a Call Centre at National Level, facilitates rapid communication between key stakeholders.

6.3 Communication at the National Level

Communication from the National Government originates from the Principal Secretary (PS), State Department for Agriculture. The PS provides directives and strategic guidance to the Director PP&FSD, who is the National Locust Control Coordinator (NLCC) and the chairperson of the Multi-Institution Technical Team (MITT) for the National Steering Committee, which provides policy oversight for desert locust management. The Director then facilitates communication with the County Executive Committee Members (CEC-M) for Agriculture of the various counties. This ensures that county-level authorities are well-informed about desert locust management efforts and can coordinate response activities effectively within their respective areas.

Upon receiving information on impending threat, the NLCC immediately convenes a MITT consultative meeting with experts on DL control drawn from national and regional bodies like DLCO-EA, FAO, PP&FSD, PCPB, KWS, KALRO, NEMA, University, among others. The team reviews outbreak reports and adopts the country's contingency plan on DL control.

The NLCC with representation from MITT, briefs the PS on the impending threat or outbreak and proposed control plan for further guidance.

After receiving the brief, the PS convenes a National Steering Committee meeting and inform them on the impending threat or outbreak with the proposed control plan for their input or concurrence.

The PS sends a communication alert to the CEC-M Counties which are at high risk and activates the strategic bases and the control units ready for control operation. If the situation is in the alarm phase, the PS advises the Cabinet Secretary to declare DL outbreak a national disaster

6.4 Communication at the County Level

Upon receiving the alert communication, the CEC-M convenes and briefs the County Steering Committee on the impending threat of desert locust in their respective counties for decision making. This may include; initiating action plans, monitoring and preparedness for desert locust management operations. The County Directors of Agriculture and Livestock mobilizes Sub-Counties, ward teams and field scouts to assess the desert locust situation and report back. The CDA establishes a County Locust Coordination Centre (CLCC) to facilitate internal and external communication.

The county technical team sensitizes the community members to ensure the information is communicated following the right channel. This allows Ward Agriculture Officers (WAOs) and field scouts to confirm or verify the presence of desert locust reported by the community members. The CDA/CDL compiles a county desert locust status report which is used to brief the CEC-M giving the status of desert locust, developmental stage, locality, magnitude of infestation, and nature of terrain. The CEC-M seeks support from the PS while taking any possible measures within the county.

The PS mobilizes financial, technical and material support for managing reported outbreaks and actions of the NLCC to execute the control operations.

The National Control team moves into action in collaboration with the county technical team to execute control operations for observed DL swarms and hopper bands and report accordingly. The Director PP&FSD constantly briefs PS and National steering committee on progress made in controlling reported DL outbreaks until all swarms have been put under control. The CDA/CDL constantly briefs CEC-M and the County Steering committee on progress made in controlling the outbreak.

6.5 Means of Communication

In DL management, various means of communication should be employed to effectively disseminate information and engage stakeholders. This includes, designated channels such as phone hotlines, emails, web-based reporting system, letters, telephone calls, mobile phone Apps (SMS or WhatsApp message), social media such as Facebook, X and Instagram, physical and virtual meetings, reports and bulletins, electronic media -Radio and TV, print Media, local dailies, technical information materials, press releases and coverage, E-newsletter, videos and documentaries. The communication channels will ensure regular updates, collaboration, and coordination amongst the members.

7.0 BUDGET FOR DL MANAGEMENT

The estimated budget for the implementation of this CP during a one (1) year period is KES 865,200,000. This will include the cost of establishing and implementing early warning systems, procurement of agricultural materials and equipment, surveillance, control operations, establishing DL management office, safe disposal of empty pesticide containers, capacity building, development and printing of technical materials, publicity and public awareness campaigns and M&E.

Table 5: Budget

Thematic Area	Activity	Description	Cost (KES)
Risk Assessment	Early warning and forecasting	Data collection (in ten hotspot counties), analysis and modeling	30,000,000
	Monitoring and surveillance	Surveillance activities (Field activities)	15,000,000
	Mapping of ecologically sensitive areas	Earth observation and Field activities	10,000,000
	Review and update of the risk register	3 Workshops held	4,500,000
Preparedness	Training of trainers and scouts on surveillance, environmental monitoring, management and safe use of pesticides)	4 Workshops held to train 120 personnel in 12 counties (20 / county)	30,000,000
	Development/updating of technical materials (brochures, leaflets, manuals, Guidelines and SOPs) on DL management	3 Workshop held	6,000,000
	Procurement of agricultural supplies and small equipment	Assorted quantities of (PPEs, Sprayers, first Aid Kits)	42,000,000
	Alerts and simulation	Field activities and workshops	6,000,000
	Establishment of the DL emergency response office	Furniture, computer & accessories	5,000,000
	Stakeholders engagements	6 workshops	14,400,000
	Maintenance of stores and equipment	-	3,000,000
Emergency Response	Pre and post-control assessments	3 pre and 3 post control assessment (Field activities) collection & analysis of soil, water and vegetation samples	12,000,000
	Control Operation (ground)	Control operations in 22 counties	40,000,000
	Surveillance (ground)	Surveillance in 22 counties	35,000,000
	Monitoring and evaluation	Carry out 6 monitoring evaluation visits	7,200,000

Thematic Area	Activity	Description	Cost (KES)
	Stakeholder workshops	Hold 6 stakeholder workshops	14,400,000
	Resource mobilization	Hold 3 resource workshops with potential partners	7,200,000
	Disposal of empty containers	Collection, washing, crushing and incineration of containers	5,000,000
	Procurement of Assorted Pesticides	Procure 30,000 lts of ULV pesticide	420,000,000
	Hire of Aircraft (aerial survey and control)	Hire 4 aircrafts	150,000,000
Communication	Public awareness/ sensitization campaigns and sensitization of local communities measures	Print and electronic media, Carry out Community meetings	5,000,000
	Airtime	For coordination	500,000
	Media publicity	Hire	3,000,000
	Hotline and bulk SMS services	-	1,000,000
	Media briefing	-	3,000,000
	Website hosting and maintenance	-	1,000,000
TOTAL			**865,200,000**

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APPENDICES

Appendix 1: Lists of trained Plant Protection and Food Safety Directorate (PP&FSD) staff

The list of staff trained can be accessed at the PP&FSD database through the following link https://plantprotection.kilimo.go.ke/downloads/.

Appendix 2: List of Registered Pesticides for Locust Control

The list of pesticides registered in Kenya for control of the Desert locust is included in the Pest Control Products Board website and can be accessed through the following link: https://www.pcpb.go.ke/on-crops/.

Appendix 3: Desert Locust Standard Operating Procedures (SOPs)

The Ministry thorough PP&FSD has developed Standard Operating Procedures for Desert locust on the areas of coordination and communication, ground surveillance, ground control and environmental safety. These SOPs can be accessed on the PP&FSD website via the following link; https://plantprotection.kilimo.go.ke/downloads/.

Appendix 4: A Resource Assessment Template for DL risk management

S/No.	Item Description	Condition	Quantities Available	Quantities required (Deficit)
1.	Knapsack Sprayers			
2.	Mist blowers			
3.	Vehicle mounted sprayers (VMS)			
4.	Handheld ULVs			
5.	Motorized sprayers			
6.	Assorted pesticides			
7.	Survey team (scouts)			
8.	Control team			
10.	Personal protective equipment (PPEs)			
11.	First aid kits			
12.	Assorted technical information materials			
13.	Blood test kits			
14.	Spray – aircrafts			
15.	Control aircrafts			

Appendix 5: Risk Assessment and Management Matrix for Desert Locust Objective

Objective	Risk ID	Risk description		Risk Assessment				Treatment	Assessment	Responsibility
		Trigger	Impact	L	C	L x C	Level of concern			
Monitoring Life Cycle of DL	Period of egg laying	Weather conditions (rainfall, temperature, wind direction and suitable variables)	Vegetation				Low			FAO, DLCO-EA, PP&FSD
Monitoring DL population build up	DL patterns in the recession areas	Weather conditions (rainfall, temperature, wind direction and suitable variables	Transformation from solitary to gregarious				Medium			FAO, DLCO-EA, PP&FSD
Swarms	Swarm category (small, medium, large, very large	weather conditions (rainfall, temperature, wind direction and suitable variables)	Feeding on green vegetation, causing crop loss, pastures, and environmental hazards				High			FAO, DLCO-EA, PP&FSD
Migration of the swarms	Roosting, egg laying and breeding	Increased population of DL	Damaging of vegetation, economic losses, psychosocial issues associated with the swarms				High			FAO, DLCO-EA, PP&FSD
Management practices	Pesticides	Spraying	Environmental contamination, possible exposure to control teams, non-target organisms etc.				Medium			FAO, DLCO-EA, PP&FSD

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