Policing Pests on Plants: Securitisation of Desert Locust Management to Protect Human Security

Gachie Eliud Baraka [1], **Ann Merecia Sirera** [1], **George Otieno Ong'amo** [2]

[1] *Kenyatta University*
P. O. Box 43844-00100, Nairobi, Kenya

[2] *University of Nairobi*
P. O. Box 30197-00100, Nairobi, Kenya

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Corresponding Author:
Gachie Eliud Baraka
barakagachie@gmail.com

Abstract. The gregarious desert locust is one of the most dangerous pests that require urgent and extreme interventions. The study, therefore, sought to analyse desert locust management practices that were securitised to protect human security in Kenya. The study employed a mixed methods approach using ex-post facto evaluation and cross-sectional survey designs. The target population included desert locust-affected persons. A multi-stage sampling approach using stratified and purposive sampling techniques was used to target a sample size of 900 respondents drawn from 30 counties affected by desert locusts. Structured questionnaires and focus group discussions (FGD) were used to collect quantitative and qualitative data. Quantitative data was analysed through descriptive and inferential statistics using frequencies, percentages and ordinal logistic regression. Qualitative data was analysed using thematic analysis and incorporated in the discussion. The results showed the securitisation of chemical control, recovery programs, physical control, surveillance and indigenous technical knowledge and skills (ITKS), contributing 43%, 16%, 16%, 15% and 10% in safeguarding human security against desert locust risks. From the findings, the study concludes that all the phases of managing desert locusts were securitised to protect human security. Since the securitisation of chemical control had the highest contribution in protecting human security against desert locust risks, the study recommends research on applying biological pesticides rather than synthetic insecticides.

Keywords: Desert locust; Human security; Risk; Securitisation; Threat.

INTRODUCTION

Desert locust invasion creates fear and exacerbates human wants through hunger or famine after the massive destruction of vegetative plant biomass [5]. Destruction of vegetative plant biomass, which serves as human food, livestock and wildlife feed, and habitat for many organisms, interferes with human security by threatening people and the environment. In India, it was published that there was economic insecurity due to reduced yields and unplanned expenses of managing desert locusts [2]. Food and Agriculture Organisation (FAO) and World Food Program (WFP) found an increase in the proportion of households using emergency food sources from 22% to 49% between 2019 and 2020 in Amhara, Somalia, Oromia and Afar regions of Ethiopia [20].

Emana has published that two-thirds of Sudan's farmers considered the insect the most dangerous crop pest that causes a 20-30% reduction in potential yield during upsurges [6]. United States Agency for International Development (USAID) reported that 3.6 million acres in Ethiopia, Somalia, Kenya and Uganda were affected by desert locusts during the last upsurge, risking the livelihoods of 3.3 million farmers [19]. As such, desert locust risks have far-reaching effects on human security. This study has operationalised human security to involve food, economic, health, environmental, personal, and political dimensions. However, the studies above focused on food and

economic security, neglecting other human security dimensions.

Desert locusts pose a transnational existential threat to lives and livelihoods. As such, many countries, especially those in invasion regions such as Kenya, often securitise subsequent management practices. Securitisation herein refers to the political process of publicising an issue as an existential human security threat that is so dangerous and alarming that it requires urgent countermeasures [7]. Accordingly, the issue at hand is articulated as a severe problem (securitised) by those with social and institutional power. In this study, securitisation of desert locust management involved framing the pest as a natural disaster by international, regional and local organisations such as FAO, Desert Locust Control Organisation for Eastern Africa (DLCO-EA) and the government at national and county levels. The pest was, therefore, considered a national security issue that required activation of crisis management through emergency response. However, there was limited documentation of how interventions against desert locusts were securitised and their contribution to protecting human security.

METHODOLOGY

The study employed a mixed methods approach using ex-post facto evaluation and cross-sectional survey designs. The study site was Kenya, one of the countries that experienced the 2019-2022 desert locust upsurge in the east and horn of Africa region. Kenya was specifically unique because it was an invasion country. The target population included people who were affected and/or participated in desert locust management.

The sample's population included general public/community members and employees of the national government, county governments and international /non-governmental organisations (I/NGOs). A multi-stage approach using purposive and stratified sampling techniques was used to target a sample size of 900 respondents from 30 counties. The respondents were invited to remotely complete a digitised online questionnaire using a web-based Kobocollect form. Some 96 questionnaires were excluded from the analysis for lacking more than 75% of responses, while 28 were excluded as duplicates from respondents who had made more than one submission. After cleaning the data, 779 questionnaires were considered for analysis, representing an 86.6% response rate.

Mixed methods concurrent research design was used in data collection where structured questionnaires and focus group discussions (FGD) were used to collect quantitative and qualitative data. Quantitative data was analysed through descriptive and inferential statistics using frequencies, percentages and ordinal logistic regression. Qualitative data was analysed using thematic analysis. Both quantitative and qualitative datasets were triangulated to provide a corroborative discussion of the findings.

RESULTS AND DISCUSSION

To assist the analysis, securitised desert locust management practices were contextualised regarding surveillance and traditional control using indigenous skills, physical power, chemical control, and recovery programs. The constructs of analysing securitisation of desert locust surveillance were ground monitoring and reporting by national government officers, county government employees, and community scouts, as well as aerial observation, tracing, and tracking using aircraft or drones. The constructs of analysing securitisation of desert locust control included spraying the insects with pesticides, scaring them with noise, digging trenches to trap hoppers, praying for divine intervention, spraying with homemade substances, mechanically killing the insects, harvesting the pest for food and feed, burning them with fire, and using supernatural powers, especially witchcraft. The constructs of analysing securitisation of desert locust recovery measures included the supply of crop input packets, reforestation, relief food supply, reseeding, money-for-work programs, restocking, livestock input packets and cash transfers. Each of the constructs was assessed by respondents on a 5-point Likert scale, and the results are displayed in Figure 1.

Out of the 779 participants who successfully responded to the study, 672 (86.3%) felt that surveillance by county government employees, 657 (84.3%) agreed that surveillance by national government officers, and 651 (83.6%) reaffirmed that surveillance by community scouts, protected human security against desert locust risks. In addition, 643 (82.5%) of respondents agreed that surveillance using aircraft, and 496 (63.7%) approved that drone surveillance helped protect human security against desert locust risks.

From a sample of 779 participants, 622 (79.9%) respondents had the opinion that spraying desert locusts with pesticides, 429 (55.1%) agreed that scaring the pest with noise, and 374 (48.0%) supported digging of trenches to trap hoppers as control strategies that protected human security against desert locust risks. In addition, 367 (47.1%) of respondents agreed to pray for God's intervention, 359 (46.1%) felt that spraying desert locusts with homemade substances, and 356 (45.7%) supported the mechanical killing of desert locusts was a control measure that protected human security. There were 341 (43.8%), 227 (29.1%), and 77 (9.9%) respondents who supported harvesting desert locusts for food and feed, burning the pest with fire and using witchcraft, respectively, as measures of protecting human security against desert locust risks.

Figure 1 – Percentage response to constructs of analysing securitised Desert locust management practices

A total of 674 (86.5%) respondents agreed that the supply of crop input packets, 674 (86.5%) agreed that reforestation and 673 (86.4%) supported the supply of relief food as recovery programs that protected the human security against desert locust risks. In addition, 614

(78.8%) of respondents agreed that reseeding programs, 593 (76.1%) had the opinion that money-for-work programs and 577 (74.1%) supported restocking programs as recovery activities that contributed to protect human security against Desert locust risks. Moreover, 566 (72.7%) and 514 (66.0%) of respondents agreed that supplying livestock input packets and cash transfers contributed to protecting human security against desert locust risks.

Results for the securitised desert locust management practices that protected human security were summarised as the percentage contribution from surveillance, physical control, chemical control, traditional methods and recovery programs (Figure 2).

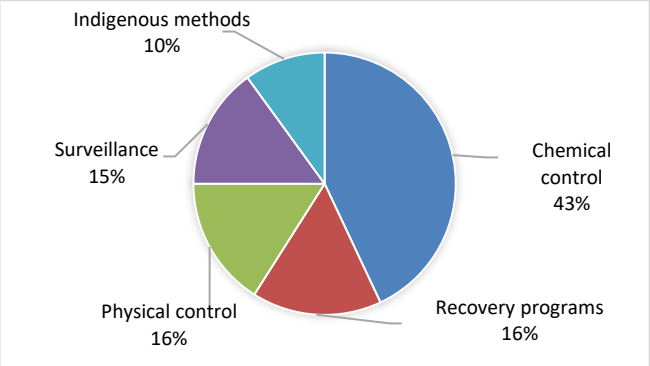

Figure 2 – Percentage contribution of securitised desert locust management practices in protecting human security

Among the securitised desert locust management practices, chemical control contributed 43% to protecting human security. The high contribution of chemical control was due to the use of pesticides as the first line of defence against desert locusts, especially in invasion countries where preventive strategies may be impractical. Physical control contributed 16% in protecting human security against devastation by desert locusts. This could be linked to the desperate control measures by community members to try and reduce desert locusts through any means available to them.

Recovery programs contributed 16% to protecting human security. This could be attributed to emergency response to protect lives and livelihoods. Surveillance contributed 15% to the overall desert locust risk reduction. Surveillance is the most critical phase of preventive and responsive desert locust management. Indigenous technical knowledge and skills in managing desert locusts contributed 10% to risk reduction.

Based on the results, there was evidence that securitised desert locust management practices protected human security against the risks from pests. However, descriptive statistics were inconclusive because frequencies and percentages neither revealed differentiated contributions from each securitised desert locust management practice. In addition, qualitative data from FGD sessions could not entirely be used to validate the findings as opinions could have been biased. Regression analysis was done to understand the causative effect of various securitised desert locust management practices (Table 1).

Table 1 – Model fitting and goodness of fit information for securitised Desert locust management practices

Model Fitting Information					Goodness-of-Fit			
Model	-2 Log Likelihood	Chi^2	df	Sig.		Chi^2	df	Sig.
Intercept only	2819.807				Pearson	4363.003	4059	1.000
Final	1648.548	1171.260	5	<0.001	Deviance	1648.548	4059	1.000

The model fitting information showed statistical significance (χ^2 (5) =1171.26, p<0.001), indicating that there was a significant improvement in fit as compared to the null model. The model exhibited an excellent fit for the research data. The goodness of fit information showed statistical insignificance (χ^2 (4059) =4363.00, p>1.000); thus, the model fitted the research data because there were no significant differences in the observed data and fitted/assumed model. The results of regression analysis are shown in Table 2.

Based on the ordinal logistic regression test, all the odds for the securitised desert locust management practices to protect human security showed statistically significant contributions as follows (Table 2): Wald χ^2 (1) = 389.447, p<0.001 for chemical control, Wald χ^2 (1) = 280.748, p<0.001 for physical control and Wald χ^2 (1) = 152.948, p<0.001 for recovery programs. Wald χ^2 (1) = 128.054, p<0.001 for surveillance and Wald χ^2 (1) = 68.325, p<0.001 for indigenous methods.

Table 2 – Contribution of securitised desert locust management practices in protecting human security

Desert locust management practices	Wald	df	Sig.	95% Confidence Interval		
				Exp_B	Lower	Upper
Chemical control	389.447	1	<0.001	7.885	6.424	9.679
Physical control	280.748	1	<0.001	2.939	2.591	3.333
Recovery programs	152.948	1	<0.001	2.878	2.396	3.456
Surveillance	128.054	1	<0.001	2.680	2.293	3.136
Indigenous methods	68.325	1	<0.001	1.865	1.608	2.162

The results revealed that securitisation of chemical control contributed the most to protecting human security from desert locust risks, while indigenous methods had the most minor contribution. As such, an extra effort to securitise either surveillance, control or recovery interventions by increasing response speed or by enhancing the limit of action led to a corresponding reduction in desert locust risk to human security.

Securitisation of Desert locust surveillance to protect human security

Securitisation of desert locust surveillance was analysed using ground monitoring and reporting by national government officers, county government employees, and community scouts, as well as aerial observation and tracing and tracking using aircraft and drones. Out of the 779 participants who successfully responded to the study, 672 (86.3%) respondents felt that county government employees' surveillance helped protect human security against desert locust risks. The fact that agriculture is a devolved function led to the active participation of county employees and community scouts in desert locust surveillance activities. One of the county agricultural officers said:

"Everyone was running after locusts from one village to another and sending location coordinates to control teams to help kill the pest".

This statement shows extreme practices that would not be sanctioned for everyday pest management. The statement shows evidence of police-like patrol to trace and track desert locusts.

One of the agricultural extension officers' responsibilities is managing plant pests and diseases. However, community involvement in supporting agricultural extension officers during surveillance of desert locusts and the need to report the pest fast indicates the extreme and urgent nature of interventions. The mention of control teams also suggested the interventions were multifaced. Such a layered organisational approach in pest management is also extreme and points to the securitisation of desert locust management. County agricultural officers played a critical role during desert locust surveillance by verifying crowdsourced reports and guiding control teams during spray operations. They also sensitised the public and created awareness of the need to report desert locusts. Such levels of community mobilisation exhibit an escalation of desert locusts beyond standard pest management practices, where only the concerned parties are informed on a need basis.

Gregarious desert locusts fly during the day and roost on plants in the evening and at night when they continue to feed on plants [20]. From the quote, it was clear that the migratory and destructive nature of desert locusts could have triggered the securitisation of surveillance by demanding monitoring by everyone, precise reporting of their roosting locations and fast response by control teams. This is because there is limited time for desert locust control, either in the evening or early morning. These are opportune moments to control desert locusts, as spraying a flying swarm during the day is difficult. Perhaps this explains why surveillance of desert locusts was securitised with extreme and highly organised practices to ensure every available opportunity to reduce their population was utilised. The findings of the study corroborate a report by Tabar *et al.* that discovered that the global strategy for desert locust management is supported by ground surveillance [18].

There were 651 (83.6%) respondents who alluded that surveillance by community scouts contributed to protecting human security against desert locust risks. Training of community scouts by the government, development partners, and NGOs on reporting using GPS-enabled mobile applications created a burden of responsibility for communities to report desert locusts. Community scouts were crucial in reporting desert locust presence in their localities. One youth from a

remote village passionately expressed himself, saying:

"We acted like spies. We spoke to random people on our way to ask where locusts were seen. We then carefully took pictures of the locusts and sent them to authorities using our phones as if we were reporting thieves".

As denoted by the quote, desert locust surveillance was organised like an anti-crime intelligence collection operation. When dealing with a standard plant pest management procedure, one would not expect such a high community mobilisation and organisation level.

Desert locust management success depends on successful surveillance, especially the ability to trace and track migrating swarms from one location to the next until spraying is done [16]. Community scouts, therefore, played a critical role in ground monitoring and reporting precise coordinates for precision pest spraying. From the literature, foot transects by trained professionals are often used during surveys to estimate the total infested area [4]. However, given the diverse risks from desert locusts, the process was scaled up to include the general public for continuous real-time reporting and prompt response. As such, making desert locusts a political issue allowed resources for the training and facilitation of scouts with special equipment, such as GPS-enabled mobile applications.

The increasing number of swarms invading Kenya and the fear of associated human security risks made national and county governments collaborate with local, regional and international institutions to manage the pest. This resonates with the publication by USAID that emphasised the need to scale up desert locust control operations in, among other regions, central and northern Kenya, where locusts were continuing to mature, breed and form additional progenies that threatened different aspects of human security [19]. This globally recognised planning of desert locust surveillance confirmed the securitised nature of monitoring and reporting pests during upsurges and plagues.

Of the successful respondents, 657 (84.3%) agreed that national government officers' surveillance helped manage desert locust risks. Although agriculture is a devolved function, the national government still coordinates the management of migratory pests through the responsible ministry. However, the decision by both levels of government to suspend the separation of roles and work interdependently shows how crises can leverage the securitisation process. One plant protection expert noted:

"Migratory pest invasions are a national security threat. Desert locust as a transboundary disaster should even be considered an international security issue that requires high-level collaboration by different countries just like terrorism".

The statement indicates the critical political position that migratory pests such as desert locusts take in national security matters. For example, the desert locust invasion coincided with the COVID-19 pandemic. However, desert locust management was treated as an essential service that required waiver from some COVID-19 containment measures, such as restricted movement. One officer explained this situation by narrating:

"Despite the Covid-19 lockdown, we crisscrossed the country chasing locusts from one county to another. We had special passes that we would show the police at checkpoints, and they would allow us through".

The quote demonstrates the securitisation of desert locust management. For example, everyone who played a critical role during desert locust management was given authority to move beyond lockdown boundaries, like security personnel and medical practitioners. Plant protection officers were accorded movement privileges by framing desert locusts as an existential threat that required urgent attention. This allowed them to trace and track desert locusts everywhere, including remote, protected and insecure areas.

Other than plant protection officers, the counties' national government administrative officers (NGAOs) played an essential role in information collection and dissemination. The NGAOs include members of the administrative arm of government, such as chiefs, assistants, deputies and county commissioners. The participation of NGAOs, who form part of security committees at national and sub-national levels of governance, points to the securitisation of desert locust management. Under normal circumstances, these officers focus on crime and intelligence collection. However, the elevation of desert locusts to national security concerns created a burden of responsibility for NGAOs. They were required to report on the progress of desert locust management in their areas of responsibility. The NGAOs assisted with public sensitisation and awareness

creation among community members to reduce misinformation during desert locust surveillance. They promoted reporting by citizens as a personal security responsibility. The results of this study align with desert locust survey and control standard operating procedures (SOPs) that recognise security agents as an essential source of information during surveillance [8].

Out of the 779 participants who successfully responded to the study, 643 (82.5%) and 496 (63.7%) respondents agreed that surveillance using aircraft and drones contributed to protecting human security against desert locust risks. Authors [18] acknowledge that the global strategy for desert locust management is supported by ground surveillance. However, using aircraft and drones goes beyond the norm to show the heightened need for speed, precision and safety in reporting desert locust positions for rapid control. The results support a report by Alemu and Neigh that recognised the critical role of aerial surveillance and remote sensing using UAVs [1]. Aircraft and drones have been employed to access rugged terrains in Ethiopia during desert locust management operations [1]. One participant complained:

"There were low-flying aircraft every morning and evening. We thought they were chasing bandits only to learn they were looking for locusts".

It has been reported that roosting swarms and large hopper bands are visible by looking down at an angle from a low-flying aircraft [4]. Accordingly, navigating a helicopter as low as possible and not higher than 5 metres above the ground can disturb any locusts that may be present, making them fly up from about midpoint under the helicopter [4]. To this end, surveillance aircraft had to fly low on suspected roosting sites to identify desert locusts for precision targeting with pesticides. Therefore, the securitisation of desert locusts by elevating their human security risk to an existential level allowed the use of aircraft in surveillance. This brought a relative advantage over foot transects as aerial surveys are more accurate for fast and practical pesticide application. As such, fixed-wing spotters and rotary-wing helicopters were used during search surveys to trace and track desert locusts in Kenya. Rotary-wing aircraft were also used to restrict spray zones for precision spraying. Delimitation of spray zones also protected non-target areas from pesticide contamination.

Based on the biology and behaviour of desert locusts, the pest roosts on plants in the evening after flying during the day [20]. They remain on plants, eating throughout the night, and get down to the ground in the morning after sunrise to bask for energy that supports their flight. Tracing desert locust roosting sites in the evening and tracking their locations in the morning reduces the requisite time for the control. This was critical for successful desert locust operations because losing their migratory route would mean transferring their risk to other counties, countries or regions. Recognising this danger of risk transfer, the securitisation of desert locust surveillance using low-flying aircraft could have been done to avoid irresponsible omissions that would expose more people to devastating threats from the pest.

496 (63.7%) respondents alluded that drone surveillance protects human security against desert locust risks. Although UAVs were not extensively used for desert locust surveillance in Kenya, drones were used to survey remote and hilly areas. One farmer commented:

"We thought it was a bird. We wondered which bird continuously whistled and why other birds followed it without attacking it. We later learned that they are called drones".

The extreme efforts by authorities to seek alternative means of assessing the desert locust's presence in hard-to-access areas point to securitisation. Drones were a safer surveillance option in hilly places with low-altitude manoeuvrability by fixed-wing aircraft [4]. In addition, drones were more practical than aircraft in insecure areas where helicopter attacks by bandits, with projectile ammunitions, could occur. The results resonate with a study by Matthews that found that drones can complement manual surveillance in harsh geographical terrains [14]. Other than assessing surveillance options to protect human security against desert locust risks, the study also assessed control methods.

Securitisation of desert locust control to protect human security

The securitisation of desert locust control was analysed regarding chemical control, physical control, traditional/indigenous methods, and recovery measures. Securitisation of chemical control was assessed concerning spraying desert locusts with synthetic or biological pesticides. Securitisation of physical control was evaluated in terms of mechanical killing of desert locusts, digging trenches to trap hoppers, harvesting locusts for human food and animal feed, scaring the insects

with noise, and burning the pest with fire. Securitisation of traditional control was assessed using prayers to God and the use of other supernatural powers such as witchcraft. Adaptive and resilience programs were used to evaluate the securitisation of recovery measures.

Securitisation of chemical control of desert locusts

Securitisation of chemical control was assessed regarding spraying desert locusts with synthetic or biological pesticides. 622 (79.9%) respondents agreed that spraying desert locusts with chemical pesticides protected human security. Under good agricultural practices (GAP), especially integrated pest management (IPM), using chemicals to control pests is done judiciously and as an option of last resort [12]. During the national FGD, one participant asserted:

"Desert locusts were damaging everything on their way like terrorists. The pest required a silver bullet to eradicate it. Pesticides provided that lethal option. There was integrated spraying of desert locusts through ground and aerial options using EC and ULV pesticides, especially Fenitrothion and Deltamethrin. Deltamethrin was preferred in Kenya as a safer option among synthetic pesticides as it contains pyrethroids which are not detrimental to humans and wildlife".

Equating desert locusts with terrorism shows the level of destructiveness and fear the pest caused in Kenya. The mention of the need for the silver bullet connotes the desire for a magical solution to a complex problem. Indeed, the invasion of desert locusts was a complicated problem for the Kenyans. In one of the FGD sessions, one participant said:

"None of us seated in this room had ever witnessed this phenomenon. This kind of thing, we are told, happened about seventy years ago".

The quote suggests that the desert locust menace was an unfamiliar pest problem to many Kenyans. The implication was that the issue, although global and rampant in most breeding areas, had been forgotten and perhaps unforeseeable in Kenya.

The rapidly evolving threat of desert locusts to human security created fear that awakened the desire to use a securitised, doing-everything-possible approach. The concurrent spraying using ground and aerial platforms demonstrated extraordinary measures that were employed. The use of multiple strategies demonstrated the urgency required to reduce the pest population and minimise its impact on human security. In addition, the use of synthetic pesticides despite the adverse effects on the environment and population shows the need for an immediate and assured response to desert locust infestations.

Using uncommon pesticide formulations such as Ultra-low volume (ULV) also indicated extreme considerations in decision-making during desert locust management. For example, in arid and semi-arid lands (ASALs) where access to water is limited, ULV is preferred [13]. The ULVs are oil-based and ready to use; thus, mixing them with water is unnecessary. In addition, small quantities of 0.5-1.0 litres can control up to 1 hectare of desert locust-infested area [13]. This reduces operational costs in controlling desert locusts.

The benefits of using ULV notwithstanding, its use in desert locust control requires specialised skills. For example, expertise in calibration of spray equipment, handling, and consideration of prevailing weather is essential for its effectiveness and efficiency. The use of ULV, therefore, demonstrated some special operations and supported the idea of treating desert locust invasion like terrorism, which requires special skills to counter. However, the pesticides used could have had direct negative ecological implications and may have posed health risks [13]. Therefore, chemical control of desert locusts could have negatively impacted non-targeted organisms, humans, and the environment. The mention of Deltamethrin in the quote as a safer pesticide shows recognition of the need to protect human security amidst the need for urgent and extreme interventions.

One of the county government officials asked:

"Why couldn't the national government give us the money to spray locusts instead of running all over the country like we didn't exist? The national government made it look like a security operation".

These sentiments are valid based on the fact that agricultural functions are devolved to counties. However, desert locusts, a transboundary migratory pest with the potential to move up to 200 kilometres daily, could not be contained within county administrative boundaries [17]. In addition, the long-distance mobility of the pest meant there was limited time to build the capacity of all 47 counties for uniform and coordinated operations. Therefore, it called for the national government to coordinate desert locust management activities in all the affected locations across the

country. Recognition of desert locust management as resembling security operations suggests that control activities went outside the norm.

Limited financial, technical, and human resource capacity required a high-level decision support mechanism to coordinate and mobilise requisite equipment and skilled workforce. These unique needs could have been the basis of securitising desert locust control operations to use readily available government resources that would not be accessible for pest management under normal circumstances. A national FGD participant reported:

"Military aircraft and vehicles mounted with sprayers did aerial and ground control of desert locusts. Trained NYS members also did ground spraying".

This quote portrays an extreme approach to desert locust management. Using national security critical personnel and equipment in desert locust control operations was to ease the mobilisation of resources, increase the work rate and ensure the effectiveness and efficiency of operations in protecting human security. For instance, other than hiring private aircraft, taking advantage of military aircraft that would have been idle during peacetime addressed the challenges of limited resources. In addition, it was easy to access many youths during their national youth service (NYS) community service stage, train them and quickly deploy them as part of corporate social responsibility (CSR). Initiating and following through the lengthy government recruitment processes, which can take months, meant that desert locusts could have had more time to cause destruction to plants and exacerbate the risk to human security. Besides the effectiveness and efficiency of using available government resources, the military and NYS teams were equipped with unique self-defence, survival and endurance skills. They could access geographically remote, rough-terrains and insecure areas.

To reaffirm the securitisation of desert locust control, one participant commented:

"They were spraying locusts with machine guns".

Although this statement sounds ignorant from a subject matter perspective, it supports securitising desert locust control. Typical pest infestations would be managed using handheld or backpack knapsacks and motorised sprayers. However, a 1 square kilometre swarm of desert locusts can have up to 40 million insects with the potential to eat 80 metric tonnes of green vegetation [20]. As such, a pest with such a high destructive capability could not have been controlled using standard sprayers. Securitisation of control operations allowed the importation of vehicle-mounted sprayers (VMS), which could have looked like machine guns, to a layperson. A VMS is an improved spray equipment mounted on motor vehicles to enhance the work rate. Another participant enthusiastically expounded:

"I thought Jeshi are only concerned with terrorists, only to find them flying aeroplanes and driving land rovers with sprayers instead of machine guns".

"Jeshi" is a Swahili word for Soldiers. The mention of soldiers in a plant protection conversation shows the securitisation of desert locust management. Acknowledgement that military vehicles should be mounted with machine guns, not sprayers, reinforces the securitisation discourse. Due to the securitisation of desert locust management, the military assumed their secondary mandate of supporting civilian activities during disasters. Desert locust invasion was framed as a natural disaster that posed an existential threat to humanity. Soldiers were, therefore, performing one of their rightful peacetime humanitarian duties. The resilience and discipline of military personnel also allowed for their rapid mobilisation and deployment to remote and geographically challenging areas. The findings concur with documented evidence that the British Army participated in anti-locust operations in the Arabian Peninsula between 1942 and 1945 during World War II [9].

Reflecting on the regional nature of desert locust upsurges, another FGD participant reminded others:

"This is an imported problem, and Kenya should not behave like it can deal with it alone. Had our neighbours done their bit, we would not be where we are today".

This statement reiterated that the securitisation of desert locusts was not a perception but an inevitable reality. The participant felt there was a need for a regional approach to desert locust management. The pest's long-distance migratory attribute poses transnational threats to regions and sometimes continents [9]. Therefore, individual countries cannot manage the pest alone [9].

As highlighted earlier, one respondent equated desert locusts to terrorism. Securitisation of desert locust management required escalation of the issue to geopolitical status. This enabled collaborations among regional and international organisations during desert locust management. There

were multilateral collaborative efforts through DLCO-EA, the Inter-Governmental Authority on Development (IGAD) and the FAO Central Region Commission for Controlling the Desert Locust (CRC). Kenya is a frontline invasion country where preventive management of desert locusts is unfeasible because the pest invades in gregarious swarms. Pesticides may have been the only effective first line of defence against the destructiveness of the pest. The findings concur with a publication that the overarching strategy for desert locust outbreak control involves spraying the pest with pesticides [18].

There were 359 (46.1%) respondents who felt that spraying desert locusts with homemade substances protected human security by reducing damage to crops, pasture and vegetation. A participant explained this further, saying:

"We mixed pili pili with wood ash in water and sprayed desert locust".

"Pilipili" is a Swahili word for Hot pepper. This mixture is part of the community-based indigenous technical knowledge and skills (ITKS). The mixture may not have passed prerequisite efficacy tests, but its use justified the risk of losing crops to desert locusts. Moharana *et al.* discovered that farmers in India used biological concoctions, especially garlic spray, to repel desert locusts [15]. The urgency of the local community to act fast despite their limited experience and knowledge in managing desert locusts suggested that individuals as a unit of analysis can securitise threats.

Securitisation of physical control of desert locusts

Securitisation of physical control was assessed in terms of mechanical killing of desert locusts, digging trenches to trap hoppers, harvesting insects for human food and animal feed, scaring the pests with noise, and burning them with fire. Among the 779 participants who successfully responded to the study, 429 (55.1%) agreed that scaring the desert locusts with noise protected human security by reducing potential damage to crops, pasture and vegetation. The results are in tandem with the findings of a study by Yuga and Wani, who found that affected communities in Sudan used noise-making as a management strategy against desert locusts [21]. During county FGD, a participant reported:

"When we arrived to initiate desert locust control operations, everyone in the village shouted as if they were chasing a thief. Even police reservists were shooting bullets in the air to try and scare away locusts".

The fact that people were making loud noise "…*as if they were chasing a thief…"* points to securitisation at the community level unit of analysis. Standard pests would not require such an abnormal response. In addition, the act of police reservists shooting bullets in the air confirmed the securitisation of desert locust management. Using bullets in whichever form is considered lethal force, which would not be needed when dealing with pests. However, the human security risks from desert locusts called for urgent and extreme interventions. This could have warranted the use of gunshots to scare away the swarms and thus stop them from destroying crops and pasture. The findings conform to a publication by Chitre, who documented the use of police sirens to scare away desert locusts in India [3]. However, from a logical point of view, making noise only disturbs desert locusts and may cause short-distance movement. As such, noise-making only reduces the level of damage in one location but transfers the risk to other places.

More significantly, the locals' actions demonstrated a shared understanding of what will be collectively responded to as a threat. Framing desert locusts as a threat to people's lives and livelihoods thus allowed for collective action by community members. Although actions by community members could have contributed little to managing the pest, their cry for help could have contributed to the securitisation process. Actions by community members could have made elites, politicians, and government officials securitise desert locust management. Speech-acts through distress calls by people in affected areas could have helped shape the securitisation discourse. It should be noted that citizens elect politicians and expect them to remain sensitive to community needs. As such, the securitisation of desert locusts by the general public could have forced politicians to act on the people's behalf as their government representatives. In line with this view, a high-ranking agriculture officer stated:

"I could receive calls from politicians in affected constituencies questioning why we had not been in their areas to spray desert locusts. Top county leaders were even calling top national government officers. We received phone calls from top ministry leadership questioning why dealing with the locusts

in some areas took a long time, demanding immediate action. It was disturbing and overwhelming".

As quoted, the desperation by communities in desert locust-affected areas through what may be seen as bizarre actions might have created space for securitised operations. Therefore, although phone calls come to the lower ladder of desert locust management, they could have contributed to the securitisation process. Communications among securitising actors such as politicians helped to enhance human security by allowing immediate action using all available means.

There were 374 (48.0%), 356 (45.7%) and 227 (29.1%) respondents who supported digging of trenches to trap hoppers, mechanical killing of Desert locusts and burning the pest with fire, respectively, as control measures that contributed to protecting of human security against the risks from desert locusts. A respondent explained the use of physical control, saying:

"We would step on them, beat them with sticks and burn them early in the morning before they wake up and start flying".

The mention of people beating and burning desert locusts indicates desperation. However, the timing of these desperate actions indicates some urgency in dealing with the pest.

Physical efforts of managing desert locusts may seem labour-intensive and time-consuming. However, they can help to manage desert locusts during low-scale infestation and in sensitive locations where aerial spraying is hazardous. For example, Moharana *et al.* assessed the status of desert locust control strategies and found that farmers in India were beating the insects and using fire to burn them [15]. While physical control of desert locusts may help preventive control during outbreaks, it may be ineffective in invasion areas such as Kenya, where gregarious swarms arrive in large numbers. These desperate actions were, however, helpful in calling for immediate action needed to protect human security from desert locust risks. Consideration of desert locusts as a security threat at household and community levels showed the dire need for external support from the government.

There were 341 (43.8%) respondents who thought harvesting desert locusts for food and feed contributed to protecting human security against desert locust risks. A respondent recalled:

"We would wait until late at night, go to where locusts were sleeping, shake the trees for them to fall, then collect and put them in sacks. We were paid Kes. 50 per kilogram".

Another respondent during the national FGD session explained:

"A village harvested 1 tonne of desert locust, and we paid a whopping Kes. 50,000. We couldn't believe it!"

Harvesting desert locusts at night sounds and feels out of the norm as an extreme way of managing pests. The tactical move of villagers to wait until late at night to catch the locusts also seemed deliberate and well executed. This kind of manoeuvres would not be necessary in routine pest management practices. Such actions reveal recognition by the people of the existential risk from the pest that required extraordinary response. The mention of 1 tonne of desert locusts having been harvested in 1 night also served as evidence of the magnitude of the risk.

Harvesting and processing desert locusts may not be sustainable in invasion countries due to a few upsurges spread far apart. However, this could have been a complementary method of managing the pest to safeguard human security. Harvesting and converting desert locusts into food, feed, and fertiliser is evidence of extraordinary measures that could have emerged from the need to control the pest in any manner necessary. The findings are corroborated by a publication that reported that locusts could produce human food and livestock feed [10]. Indeed, harvesting of desert locusts could form part of the integrated recovery program, where communities are paid to collect desert locusts. The collected desert locusts could then be processed and returned to the communities for free as bio-fertiliser or livestock feed.

Securitisation of traditional methods of controlling desert locusts

Traditional control was assessed using prayers to God and the use of other supernatural powers such as witchcraft. There were 367 (47.1%) and 77 (9.9%) respondents who thought praying for divine intervention and using witchcraft contributed to protecting human security against desert locust risks. During county FGD, a participant recalled:

"I prayed, sometimes fasting, hoping God would not punish us for long".

Another old participant reported:

"During the last invasion before Kenya got independence, there used to be an old man who could blow ash with his mouth, and the locust would follow the direction of the ash without settling in our area".

Usually, only security threats beyond people's control are considered for supernatural interventions. The belief that prayers and witchcraft could have resolved the desert locust problem indicates that individuals securitised the pest. This quote suggests that modern societies still believe in ITKs. Some community members were traditionally given special powers to cast spells on anything that could affect people negatively. However, there is little empirical evidence that prayers or other supernatural powers could have helped to manage desert locusts.

Securitisation of desert locust recovery measures to protect human security

Desert locust recovery programs were categorised into adaptive and resilience recovery programs. Adaptive recovery programs were meant to help communities with short-term endurance from immediate shocks of lost livelihoods. This included provision of relief food, cash transfers and money-for-work programs. Out of the 779 participants who responded to the study successfully, 673 (86.4%) supported relief food supply as recovery programs that acted as a safety net against food insecurity that desert locusts caused. To describe the dire situation that people found themselves in, one participant commented:

"Locusts made us start living like refugees. We received food from the government and well-wishers. Without them, we would all be dead by now".

The respondents acknowledge that they assumed the status of people who needed humanitarian support. Most humanitarian situations attract securitised interventions due to the responsibility to protect people. This demonstrates how framing desert locust invasion as a natural calamity that needed emergency response helped securitisation. Standard security threats do not typically require humanitarian interventions such as distributing relief food. The quote reveals that the government distributed relief food during the desert locust emergency. The findings align with those of Lassa, who reported that following the invasion of desert locusts in 2016-2017, the government distributed rice to people in East Sumba, Indonesia [11]. However, most humanitarian organisations are changing their implementation strategy from relief food supply to cash benefits to provide more robust support to affected households. Nevertheless, giving people foodstuffs was helpful in remote areas where market access is difficult. Cash transfers in remote villages could have caused beneficiaries an additional burden of travelling long distances to purchase food.

There were 593 (76.1%) and 514 (66.0%) respondents who felt that money-for-work programs and cash transfers contributed to protecting people from the economic security risks that desert locusts had caused. A respondent narrated:

"I received Kes. 4000 for three months from an NGO. The money was insufficient, but it helped me to feed my family for some days".

This statement, coupled with an earlier mention of desert locusts turning people to begging, confirms the extent to which human security was affected by the pest. In addition, cash transfers are associated with humanitarian aid during crises.

The fact that the desert locust invasion in Kenya coincided with the COVID-19 pandemic meant that restricted movement to contain the disease also barred people from going far to seek help. This confinement could have easily turned the situation into a crisis, bearing in mind that most people had lost their livelihood from livestock and crop production, as discussed earlier. Direct intervention through cash transfers is not sustainable in the long term. However, cash transfers were functional social safety nets to sustain households' purchasing power after losing livelihoods due to the destruction of crops and pasture desert locusts.

Other than adaptive recovery programs being done alongside desert locust control operations, there were also resilience recovery programs during the post-invasion period. Resilience recovery programs were meant to help the communities revive their affected agricultural enterprises. These included reseeding, restocking and reforestation. There were 614 (78.8%) and 577 (74.1%) respondents who agreed that reseeding and restocking programs assisted households in recovering from the human security risks that desert locusts had occasioned. Respondents described this saying:

"I received maise, green gram and bean seeds from an NGO. Government officials also gave me one goat that gave me some milk. The goat has also given me

two twin kids. Now, I have five goats. I don't know where I would be without this help".

This quote emphasises the critical role of resilient buildings in absorbing the economic shocks of natural disasters. However, resilient recovery programs are not routine practices during plant pest management. Such recovery interventions would be associated with disasters such as floods and drought.

With lost livelihoods after the massive and indiscriminate destruction of crops and pasture by desert locusts, most communities were left vulnerable. Therefore, there was a need to initiate income-generating activities to help the communities earn sustainable livelihoods. Securitisation gave desert locusts the status of a natural disaster and justified impetus for extreme recovery interventions such as reseeding and restocking. While reseeding and restocking programs may not have adequately compensated the farmers for the losses associated with desert locusts, they cushioned households against the shocks of having to start all over from nothing. This also eliminated dependence on unsustainable relief food and cash transfers. Long-term resilience-building empowered affected people to be self-sustaining through food production and income generation from surplus produce.

There were 674 (86.5%) and 566 (72.7%) respondents who alluded that the supply of crop and livestock input packets helped protect human security. One respondent recalled:

"I received fertiliser, pesticides and poultry feed. Without food for the chicken they gave me. I could have eaten them rather than watching them die of hunger".

As described in the quote, such recovery interventions would be associated with natural calamities such as extended drought. The quote also points to integrating protective and empowerment recovery measures. Governments and NGOs, therefore, supplied input packets to sustain the revival of agricultural enterprises in the desert locust-affected areas. Providing seeds and livestock without accompanying farm inputs would have been a zero-sum intervention.

674 (86.5%) respondents felt that reforestation helped protect environmental security against desert locusts. A respondent explained this by reporting:

"We received fruit tree seedlings, especially avocados, from the government and NGOs. They promised we would get additional seedlings from every successful transplant".

This statement confirms that institutions involved in the post-desert locust invasion recovery were aware of the environmental security risk that the pest could have caused through the indiscriminate destruction of vegetation. However, reforestation would not be a regular activity due to pest infestation; thus, this reinforces the securitisation of desert locust management. Reforestation would be occasioned by disaster situations such as wildfires. However, it is worth noting that while environmental security could have been the most affected by desert locusts, most recovery programs focused on livelihood restoration. There is, therefore, a need to intentionally plan for ecological rehabilitation in the desert locust-affected areas after upsurges and plagues. In addition, despite emotional stress having been identified during the assessment of desert locust risks to people, there was limited documented evidence of efforts that were geared towards psychosocial rehabilitation.

CONCLUSIONS

The study concludes that despite the securitisation of chemical control having independently contributed the most in protecting human security against desert locust risks, alternative control measures had a higher combined contribution. Every effort towards the management of desert locusts was therefore necessary. The findings also conclude that although politicians and capital owners are the main drivers of securitisation, human collectives such as community members can trigger the process when faced with a common threat, such as desert locust, by initiating speech acts through a united distress call for help. Since securitisation of chemical control had the highest contribution in protecting human security against desert locust risks, research on and application of biological pesticides rather than synthetic insecticides should be prioritised.

Authors' Contribution

GEB did the research work, including collecting data and drafting the article for his PhD program. AMS and GOO supervised the research study and reviewed and edited the article.

REFERENCES

1. Alemu, W. G., & Neigh, C. S. R. (2022). Desert Locust Cropland Damage Differentiated from Drought, with Multi-Source Remote Sensing in Ethiopia. *Remote Sensing, 14*(7), 1723. doi: 10.3390/rs14071723

2. Chatterjee, S. (2020). How Hard Did That Sting? Estimating the Economic Costs of Locust Attacks on Agricultural Production†. *Applied Economic Perspectives and Policy, 44*(1), 434–459. doi: 10.1002/aepp.13127

3. Chitre, M. (2020). *Locust Swarm Encroaches MP's Panna Tiger Reserve; Officials Deploy Sirens and Other Measures*. Retrieved from https://www.republicworld.com/india-news/general-news/madhya-pradesh-officials-use-police-sirens-to-scare-away-locust-swarm.html

4. Cressman, K. (2008). The Use of New Technologies in Desert Locust Early Warning. *Outlooks on Pest Management, 19*(2), 55–59. doi: 10.1564/19apr03

5. Cressman, K. (2016). Desert Locust. *Biological and Environmental Hazards, Risks, and Disasters*, 87–105. doi: 10.1016/b978-0-12-394847-2.00006-1

6. Emana, B. (2002). *Socio-Economics of Desert Locust Control in Sudan: A Micro-Level Case Study*. Retrieved from https://www.unisdr.org/files/3717_Document2005925151457EcomomStudySudanCaseBezabih2002.pdf

7. Eroukhmanoff, C. (2018). 'It's not a Muslim ban!' Indirect speech acts and the securitisation of Islam in the United States post-9/11. *Global Discourse, 8*(1), 5–25. doi: 10.1080/23269995.2018.1439873

8. FAO. (2021, October 11-14). *Evaluation of Field Trials Data on the Efficacy and Selectivity of Insecticides on Locusts and Grasshoppers*. Retrieved from https://www.fao.org/ag/locusts/common/ecg/800_en_PRG08e.pdf

9. Government of India. (2019, June). *Contingency Plan for Gregarious desert locust Invasions, Outbreaks and Upsurges*. Retrieved from https://ppqs.gov.in/sites/default/files/contingency_plan_0.pdf

10. Kietzka, G. J., Lecoq, M., & Samways, M. J. (2021). Ecological and Human Diet Value of Locusts in a Changing World. *Agronomy, 11*(9), 1856. doi: 10.3390/agronomy11091856

11. Lassa, J. A. (2017). *The Return of Locust Outbreak in Sumba, Indonesia: A Rapid Situational Analysis*. Retrieved from https://www.researchgate.net/publication/317645910_The_Return_of_Locust_Outbreak_in_Sumba_Indonesia_A_Rapid_Situational_Analysis?channel=doi&linkId=594663e7aca2722db4a5f137&showFulltext=true

12. Lecoq, M. (2010). Integrated Pest Management for Locusts and Grasshoppers: Are Alternatives to Chemical Pesticides Credible? *Journal of Orthoptera Research, 19*(1), 131–132. doi: 10.1665/034.019.0107

13. Mamo, D. K., & Bedane, D. S. (2021). Modelling the effect of desert locust infestation on crop production with intervention measures. *Heliyon, 7*(7), e07685. doi: 10.1016/j.heliyon.2021.e07685

14. Matthews, G. A. (2021). New Technology for Desert Locust Control. *Agronomy, 11*(6), 1052. doi: 10.3390/agronomy11061052

15. Moharana, S., Khuntia, P., Das, S. S., Das, R., & Panigrahi, S. (2020). A Systematic Review of Behavioural Aspects & Management Techniques to Control Locusts. *IJSART, 6*(7), 361–369.

16. Showler, A. T., Shah, S., Sulaiman, Khan, S., Ullah, S., & Degola, F. (2022). Desert Locust Episode in Pakistan, 2018–2021, and the Current Status of Integrated Desert Locust Management. *Journal of Integrated Pest Management, 13*(1). doi: 10.1093/jipm/pmab036

17. Symmons, P. M., & Cressman, K. (2001). *Desert locust Guidelines: Biology and behaviour*. Retrieved from https://reliefweb.int/attachments/e2acf58b-1485-39da-b860-a202fcae2d7e/4ACFA4327267DBE4C1256FA3005953D8-LocustGuidelines_FAO_Jan_2001.pdf

18. Tabar, M., Gluck, J., Goyal, A., Jiang, F., Morr, D., Kehs, A., Lee, D., Hughes, D. P., & Yadav, A. (2021). A PLAN for Tackling the Locust Crisis in East Africa. *Proceedings of the 27th ACM SIGKDD Conference on Knowledge Discovery & Data Mining*. doi: 10.1145/3447548.3467184

19. USAID. (2020, October). Desert Locust Surveillance and Control: Programmatic Environmental Assessment. Retrieved from https://2017-2020.usaid.gov/sites/default/files/documents/USAID_EAFR_Locust_PEA_FAO_11-10-20_508_Compliant.pdf

20. WMO, & FAO. (2016). *Weather and Desert Locusts*. Retrieved from https://library.wmo.int/records/item/55360-weather-and-desert-locusts

21. Yuga, M., & Wani, P. (2022). Assessing the Impact of Desert Locust Infestation on Crops, Pasture and Livestock Health in Eastern Equatoria State, South Sudan. *European Journal of Applied Sciences*, *10*(3), 332–341. doi: 10.14738/aivp.103.11936