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### **Kenya: Combating the Growing Locust Swarms**

Sabina lives in rural Kenya with her husband and three children. She starts her mornings at sunrise to begin her search for water and firewood. Sabina spends much of her day on a hunt for water. Twice a day, she makes a four-mile round trip to get the thirteen gallons of water her family uses in a single day. Her days also consist of cultivating fruit trees and growing maize while also staying busy raising dairy cows and many chickens. Sabina started farming when her husband began a job in town to make money to send back to his family. Her children walk two miles every day just to get to school, and many times her daughter will have to stay home to help Sabina do chores. Although Sabina's story is fictional, this is not uncommon in rural Kenya as now more than 76% of women work in agriculture (UNCTAD).

While agriculture employs about 75% of the country's working force ("Kenya Jobs"), only about 20% of the land is suitable for cultivation ("Kenya – Agriculture"). Growing main staple crops such as maize and wheat is common, as about 8.3 million people in rural Kenya farm for the sole purpose of feeding their families (Mausch Kai, and David Harris). About 72% of farmers farm with an average of six acres (Jayne, T.S, et al.). They rely on rain for their crops to grow, but with inconsistent weather patterns, this leaves their crops extremely vulnerable. Since many farmers don't have a steady income, they lack many comforts that others take for granted. Only 39% of families have electricity in their homes ("The World Factbook"). Affordable healthcare isn't satisfactory, and proper healthcare isn't affordable.

According to Kenya's 2019 Census Report, the country is home to 47.6 million people ("2019 Kenya Population"). Kenya is located in eastern Africa sharing a coastline with the Indian Ocean. Much of the country is a plateau of highland areas bisected by the Great Rift Valley (Moen). From November to May Kenya experiences a wet season when most of the rain takes place, and from June to October Kenya experiences a dry season where droughts can occur (Ham). In the past two years, weather conditions in eastern Africa have provided the perfect environment for locusts to breed freely.

After dry spells, rain returns and large swarms form and shift into what is known as the gregarious phase of their life ("Locusts"). During this time locusts undergo great physiological and behavioral changes including changes in body shape, color, fertility and survival ("About Locusts"). In 2018, two cyclones heavily hit the Arabian Desert in western Asia creating lakes in the desert where an estimated three generations of locusts were bred (Stone). The locusts continued to spread in 2019, crossing the Red Sea to enter eastern Africa (Stone). Severe autumn rains and another rare storm allowed them to carry on breeding, exponentially growing the locust population (Stone). Efforts were made to combat the locusts using pesticides, but insufficient funds ultimately led to failure (Stone). By February of 2020, the locust swarms infested five countries in the region including African countries: Somalia, Kenya, and Ethiopia (Stone), creating the worst outbreak Kenya had experienced in seventy years (Levine). As of May, 23 countries have been greatly affected by swarms, making the situation into what is known as a plague ("World Bank Announces").

A locust can eat its bodyweight in a day, and a swarm with a mile-wide diameter can consume enough food to feed 35,000 people ("Massive Locust Swarms") and travel up to 80 miles in a day ("Locusts"). A single locust can lay about thirty eggs at a time (Department). One can only imagine how quickly the

swarms can exponentially increase in size. The life cycle of a single locust can only last up to about five months (“Locusts”), but this also allows for more frequent breeding, which is how swarms can thrive for so long.

Locusts prefer plants when they are in the green growing phase and by the time they arrived in Kenya, most of the crops had already matured (Collins). Therefore, the locusts didn’t impose a significant amount of damage to Kenyan crops when they first arrived but became a high threat when attempts to eradicate the early swarms were unsuccessful (Stone). When the planting season came around in April, the swarms were flourishing with a second wave about to hatch (Baker). Many farmers had no choice but to plant their fields knowing that the locusts could potentially destroy the crops as they began to germinate. Currently, the second generation of spring breeding declined in Kenya in mid-July, but a second generation of summer breeding will begin shortly in September (General Situation). As of August 2020, the FAO estimates that 20.2 million people are facing severe acute food insecurity due to the plague in the most affected countries in Eastern Africa and the Middle East (Locust Hub).

The locusts are not only affecting the crops, but the mental health and daily lives of families. The village of Mathyakani is home to about 10,000 people and covers about 19 square miles and has suffered an estimated \$1.4 million worth of damage (Njagi). Esther Ndavu has a four-acre farm in the village and for over a week her children stayed home from school to help battle swarms with their parents (Njagi). Her children would wake up screaming in the night because they dreamt another swarm had attacked their home. Many women in the village are also suffering from throat problems from the strain of yelling to scare off the locusts (Njagi). The locusts are also attacking the grassy pastures that animals graze in. Editor-in-chief Halima Kahiya, who works at a radio station in Wajir, Kenya commented, “The locusts seem to destroy more grazing land than crops. They eat the grass and leaves that our goats, sheep, cows, and camels usually feed on,” (Mas). Consequently, it is critically important to viciously attack these swarms before they leave millions of people and animals without food and farmers without a source of income from their crops.

The Food and Agriculture Organization (FAO) of the UN continues to request more money for their rapid response plan. What started as the original request of \$76 million has now increased to \$312 million in July 2020 (“Desert Locust Crisis. Desert”). So far, the FAO has been funded nearly \$200 million (“Desert Locust Crisis.” Desert) to: curb the spread through close observation, safeguard livelihoods by giving recovery and farming packages, and coordinate preparedness for rapid support between affected areas (“Desert Locust Crisis. FAO”). The organization has a response plan intact that has included spraying 834,000 liters of pesticide and 12,700 kg of bio-pesticide along with 25 aircrafts spread throughout all the affected areas for spraying (“Desert Locust Crisis.” FAO). Bio-pesticides are nature-based and provide a less harmful way to combat the locusts, as they can be designed towards killing specific types of insects (“Biopesticides”). They are more beneficial for preventing spread rather than curing because they take longer to work than traditional pesticides (“Biopesticides”). The World Bank announced in May, a \$500 million program to support countries in Africa and the Middle East (“World Bank Announces”). Kenya was included with three other countries in receiving a total financing package of \$116 million (“World Bank Announces”). This program was to support physical assets and human capital, but also provided farmers with seed packages to make up for some of the lost crops (“World Bank Announces”). The Kenyan government also is making attempts to avoid a full-blown crisis. They sent seven helicopters to the hatching sites and current swarms to spray them with pesticides and employed two helicopters for surveillance (Musalia). Soldiers have also been trained to spray in areas where the swarms are too thick

for the aircraft to get through, and many farmers bang pots to create noise in the hope of scaring the locusts away (Baker).

The FAO and Kenyan government have made impactful contributions, but there are more efforts to be made. The reduced spreading and breeding are the two main concerns currently as the situation continues to impose a very high risk for furthering the country's food insecurity. Once the swarms hatch and grow their wings after about 20 days (Department), they become impossible to control, so it is vital to destroy the eggs or nymphs before they form full-flight locusts. The eggs are laid in the soil and leave a drill hole in the ground (Department). In 2000, China used a poultry army of more than 700,000 chickens and ducks to combat and devour locusts in Xinjiang ("Asia-Pacific"). The army would be released into grasslands and then at the blow of a whistle they were trained to eat the locusts ("Asia-Pacific"). Officials estimated the birds to have devoured more than 100 million insects ("Asia-Pacific").

Chickens can eat about 70 locusts a day while ducks can consume about 200 (Redigolo). Kenya has an estimated 23 million chickens in the country (Zootechnica). Although ducks can eat three times more locusts in a day than chickens, Kenya should utilize the chickens they have to feed on the locusts. Using the chickens the country already has will save money and effort compared to shipping in ducks from another country. Ducks also depend on water more than chickens which can be sparse in many areas of Kenya. Using the domestic chickens also is more advantageous in that the country doesn't have to deal with containing and caring for hundreds of thousands of foreign animals that could cause an imbalance in Kenya's ecosystem. Insects are also a part of chickens' diet ("Entomology Today"), so farmers would not have to worry about additionally feeding their chickens while they are out enjoying the locusts. The army used in Xinjiang had trained their birds to be able to respond to a whistle. This allowed officials to have more control over where the ducks would travel but was not essential to the operation. Most farmers can self-implement the plan of distributing chickens among their crops and other farms in their villages. Larger farms with thousands of chickens could be encouraged to sell their chickens to smaller farms or the government to contribute to the effort. Chickens could also be sold to the government to be put in areas that are not owned or inhabited by farmers. The government could set up a special organization or committee that would keep in close contact with the response teams who are surveilling the country by helicopter. This way the organization would have an idea of where these chickens would be most needed. Although chicken consumption of insects will not completely eradicate the issue, it would reduce the use of spraying pesticides and accompanying expenses.

An obvious solution is to increase the amount of pesticides that are being produced and applied. The FAO and Kenyan government have the most control over aerial spraying of pesticides because it is such a large-scale operation, and the FAO has funds dedicated specifically to pesticides and bio-pesticides. Since the planes can only be in so many places at once, farmers may need some relief that they can provide themselves. Kenya is a top producer of Pyrethrum flowers (Orminde), which contain pyrethrin, a product used in pesticides. Pyrethrin is very effective as it invades the nervous system of all flying and crawling insects, but it is also one of the safest chemicals to use on food products as it is used in organic farming ("Pyrethrum Farming"). Since it is a plant the country already produces, it would provide a great opportunity for farmers to utilize their own resources to spray their own land. The FAO or World Bank could allocate some funds to provide spraying tanks and other supplies needed to farming communities. This would include spraying nozzles and protective gear. The pesticides are quite easy to create, as all that is needed is the Pyrethrum flowers and water. FAO or World Bank officials and volunteers could spend time showing Kenyans how to mix the pesticides, or even provide instructions when they drop off supplies needed for the operation. This seems like an idea the World Bank would have interest in as the organization wants to help individual farmers recover from the damage. In areas of the country where the plant is plentiful, citizens could be paid by the government to concoct pesticides for affected areas that

may be lacking Pyrethrum flowers. This would not provide a permanent fix but gives farmers a way to defend their own crops when they have no other options, and includes a low cost compared to traditional pesticides.

Applying pesticides and using chickens to combat the locusts are short-term responses to exterminate the locusts but preventing this catastrophe from happening again and in other parts of the world is equally important. Like stated earlier, the cause of the excessive locust breeding was warmer and wetter conditions than the area usually experiences. This included multiple cyclones and storms that produced heavy rains. The root of this problem can be identified as climate change. Climate change is natural as the earth has always experienced periods of ice ages and droughts, but many scientists believe humans could be further contributing to the cause. The largest impact humans have on the environment is an increase in greenhouse emissions and aerosols (“How Do Human”). This is a result of burning fossil fuels that add carbon dioxide gases to the atmosphere (“How Do Human”). Greenhouse gases allow radiation from the sun to enter, but don’t allow infrared radiation to exit earth’s atmosphere (“U.S. Energy”). When the greenhouse effect traps this infrared radiation in the atmosphere, the earth warms (“U.S. Energy”). Agriculture and industrial sources are thought to be some of the largest contributors to greenhouse emissions globally. In 2019, university researchers announced that in the next five years, they predict that agriculture in the U.S. will reduce its greenhouse emissions by 50% (Bader). Farmers have already made many efforts towards this goal. They have been planting cover crops in between cash crops to lessen the gas emissions. These cover crops increase soil carbon storage which can then be utilized by the cash crops in the next season and could potentially lower soil carbon emissions by 70% (Bryant). Also, despite much controversy, dairy farms only account for 0.36% of methane gas emissions in the United States (Bader). Alternatives to industrial energy created through the combustion of fossil fuels are renewable sources such as wind and solar power which create no gasses. More than 100 cities globally, are powered by at least 70% renewable energy (Nunez), but many cities still have a long way to go. Many people and places are more hesitant to invest in solar or wind power because the initial price is more expensive than burning fossil fuels. On average it takes about eight years for the installation of solar power to pay off for a single household, but after that families can save an average \$2,500 a year on power (Marsh). The cost of solar and wind power is also continuing to decrease, making it even more affordable and appealing to the average American (Scott). Humans do impact climate change, and although changes and improvements have been made, the world needs to continue to innovate the way it uses resources because it will take a global effort to produce a significant impact.

Ultimately, the locust swarm situation presents a very high risk in Kenya but has the potential to be reduced if efforts are made quickly. Families like Sabina’s fictional story from earlier, are now struggling even more with daily life as a result of the havoc locusts have wrought on the land. Pesticides are the best solution, but not always possible as they require a lot of resources and money. If everyone in Kenya does their part to attack the swarms by either allowing their chickens to roam freely to feed on young locusts, or by helping local farmers and communities by making homemade sprays with the help of the FAO, the country can dramatically decrease the future impact the new generation of locusts could have on their food security. If globally, people and businesses can find ways to reduce their greenhouse emissions such as through the use of renewable resources, it could contribute to the decrease of human impact on climate change, and help reduce the risk of more locust swarms developing in the future worldwide.

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