Report of Monitoring and Assessment of Desert Locust in Africa and Asia

Mid April 2020

Desert Locust monitoring and loss assessment in Yemen and Ethiopia

Overview

Integrated with multi-source Earth Observation data, e.g. meteorological data, field data, and remote sensing data (such as GF series in China, MODIS and Landsat series in US, Sentinel series in EU), and self-developed models and algorithms for Desert Locust monitoring and forecasting, the research team constructed the 'Vegetation pests and diseases monitoring and forecasting system', which could regularly release thematical maps and reports on Desert Locust.

This report focuses on the locust plagues in Yemen and Ethiopia. The results showed that, as of mid-April 2020, 20 provinces in Yemen had been harmed since Desert Locust invaded northeastern Yemen in January 2019. The vegetation damaged area is 1535.9 thousand hectares, including 437.3 thousand hectares of cropland, 264.5 thousand hectares of grassland and 834.1 thousand hectares of shrub, accounting for 34.4%, 46.0% and 14.8% of the total cropland, grassland, and shrub in Yemen, respectively. In March to early-mid April 2020, Desert Locust in Ethiopia harmed

Content

about 1750.4 thousand hectares of vegetation area (including 393.0 thousand hectares of cropland, 404.7 thousand hectares of grassland, and 952.7 thousand hectares of shrub), mainly distributed in southern SNNPR, northern and central Somalia, and northern and southern Oromiya.

At present, locust spring breeding is underway in Yemen and Ethiopia. April-June is an important planting and growing season for crops in Yemen, and is also an important harvesting season for crops in Ethiopia. If not controlled properly, locusts will bring a major threat to agricultural and pasture production and the national economy and the people's livelihood. It is necessary to carry out the monitoring and early warning of the

intercontinental Desert Locust plague continuously and dynamically, and organize joint prevention and control in multiple countries, to ensure the safety of agricultural and pasture production and regional stability. The specific research results are as follows:

Monitoring and assessment of Desert Locust in Yemen

In May 2018, the tropical cyclone Sagar formed in the Gulf of Aden and the tropical cyclone Mekunu formed in the southern Arabian Peninsula brought lots of rainfall to southern Yemen. In October 2018, the tropical cyclone Luban formed over the Arabian Sea and moved towards the Arabian Peninsula, brought lots of rainfall to eastern Yemen, southern Oman, and southern Saudi Arabia. The two precipitations increased green vegetation in southwestern, southern and eastern Yemen, and the border areas with Oman and Saudi Arabia, providing suitable conditions for Desert Locust reproduction.

In January 2019, Desert Locust appeared in the Rub' Al Khali Desert (Empty Quarter), at the border of southeastern Yemen, Oman, and Saudi Arabia. The second-generation reproduction was completed at the end of the month. Part of the locusts invaded northern Saudi Arabia, western Rub' Al Khali Desert, United Arab Emirates (UAE) and southern Iran. From February to March 2019, the Desert Locust in northeastern Yemen continued to multiply and spread to the planting area of Wadi Hadramawt. From April to May 2019, the Desert Locust moved westward to Marib and Al Jawf, and continued westward to the northern highlands of Dhamer and Sana'a. Mature locust swarms appeared in Ataq and Shabwah

in the south, some locusts began to lay eggs. By the end of May 2019, 9 provinces in eastern and mid-western Yemen had been invaded by Desert Locust. The vegetation damaged area is 131.6 thousand hectares, including 22.4 thousand hectares of cropland, 16.4 thousand hectares of grassland and 92.8 thousand hectares of shrub. From June to July 2019, Desert Locust started summer breeding, Desert Locust in southern Marib continued to lay eggs and hatch. Mature locust swarms appeared in the Suq Abs area in the north of the Red Sea coast, and the Gulf of Aden in the south continued to lay eggs and hatch. The precipitation in July caused Yemen's locusts to multiply for many generations and gradually spread to the southwest of Saudi Arabia along the Red Sea. At the same time, some locust swarms crossed the Gulf of Aden invaded northern Somalia, southern Eritrea, and eastern Ethiopia. From August to September 2019, locust swarms reached the coast of the Red Sea and the Gulf of Aden. Unusually heavy rainfall gave birth to a large number of locust swarms in Yemen, especially in the southern and eastern Marib. From October to December 2019, locusts in the breeding area of the coastal plain of the Red Sea in northern Yemen and the neighboring areas of Saudi Arabia continued to lay eggs, hatch, and start winter breeding. Besides, locusts in the southern coastal were also breeding and gradually clustered. By the end of December 2019, the newly added vegetation damaged area was 499.4 thousand hectares, including 155.0 thousand hectares of cropland, 136.6 thousand hectares of grassland and 207.8 thousand hectares of shrub.

In January 2020, Desert Locust in the coastal plains of the Red Sea continued to multiply, new locust swarms continued to form and lay eggs, some locust swarms moved to the eastern highlands, some crossed the Red Sea to Eritrea. At the same time, some locust swarms along the border between India and Pakistan, and south of Oman moved south along the coast, to the southern coast of Yemen. In February 2020, the locust swarms of the coastal plain started the next generation reproduction. Some locust swarms moved northward to Saudi Arabia, and some locust swarms moved to the eastern highlands and inside Yemen. On the 29th, mature locust swarms appeared in Sana'a, and newly reproduced locusts appeared in Aden on the southern coast. In March 2020, the locusts in the Aden area of the southern coast continued to multiply, mature, and form swarms. A large amount of precipitation occurred in central Wadi Hadramawt, continuously forming new locust swarms in the inland and coastal areas at the border between Yemen and Oman. In early April 2020, mature locust swarms appeared along the border with Oman, and in northern Aden. Desert Locust in the eastern plateau were laying eggs. By the end of early-mid April 2020, the newly added vegetation damaged area was 904.9 thousand hectares, including 259.9 thousand hectares of cropland, 111.5 thousand hectares of grassland and 533.5 thousand hectares of shrub (Fig 1 and 2).

Research results showed that from January 2019 to early-mid April 2020, Desert locusts invaded 20 provinces in Yemen except Suqutra. Desert Locust has caused the damage of 1535.9 thousand hectares in Yemen with 437.3 thousand hectares of cropland, 264.5 thousand hectares of grassland, and 834.1 thousand hectares of shrub, account ting for 34.4%, 46% and 14.8% of the total cropland, grassland, and shrub in Yemen. Most of the vegetation in Yemen is distributed in the western region, so the vegetation damage area in western Yemen is larger. Among them, Al-Hudaydah province on the west coast of the Red Sea has the largest damage area of 341.1 thousand hectares. The second is in the southwestern province of Ta'izz with an area of 293.5 thousand hectares. Next, in the provinces of San'a and Ibb adjacent to the east, the affected areas were 138.9 thousand hectares and 134.4 thousand hectares. The affected area of Ad-Dāli Province is 112.7 thousand hectares; the affected areas of Lahij Province in the southwest and Dhamar in the Midwest are 96.3 and 92.4 thousand hectares, respectively. The affected areas of Hajjah and Amrān in the northwest are 62.7 thousand hectares and 59.2 thousand hectares, respectively. The affected areas of Al-Mahwīt, Sa'dah, and Al-Baydā are 46.2 thousand hectares, 45.8 thousand hectares, and 38.8 thousand hectares, respectively. Although the locusts appeared earlier and had higher density in the central and eastern provinces, the vegetation coverage in these areas was low and the affected area was relatively smaller. The affected areas of Abyān, Hadramawt, Raimah, Al-Mahrah, Shabwah, Ma'rib, and Al-Jawf Province are 17.8 thousand hectares, 14.6 thousand hectares, 13.3 thousand hectares, 10.6 thousand hectares, 7.7 thousand hectares, 5.6 thousand hectares, and 4.3 thousand hectares, respectively. In addition, although there are locusts invaded in Aden, the affected

area is slightly smaller, totaling 48.44 hectares. Yemen is a typical agro-pastoral country with an agricultural population of 75%. The locust plague severely damaged Yemen's pastures and farmland, reduced crop production, and caused huge losses to local agricultural and animal husbandry production.

The comprehensive analysis showed that, from April to June 2020, the Desert Locust along the Red Sea coast, the southwestern coast, and the junction with Oman in the east of Yemen will continue spring breeding and gradually spread inland. It is expected that the swarms will move to central Saudi Arabia from April to May. As the locusts in the Arabian Peninsula breed in spring, it is expected that the swarms will migrate to central Yemen in June for summer breeding. At present, a large number of locusts in Yemen have laid eggs on the ground and kept hatching. A new round of spring breeding has begun. April-June is an important planting and growing season for crops in Yemen. If the locusts couldn't be controlled effectively, the plague will continue, which may hit Yemen's agriculture and livestock production hard.
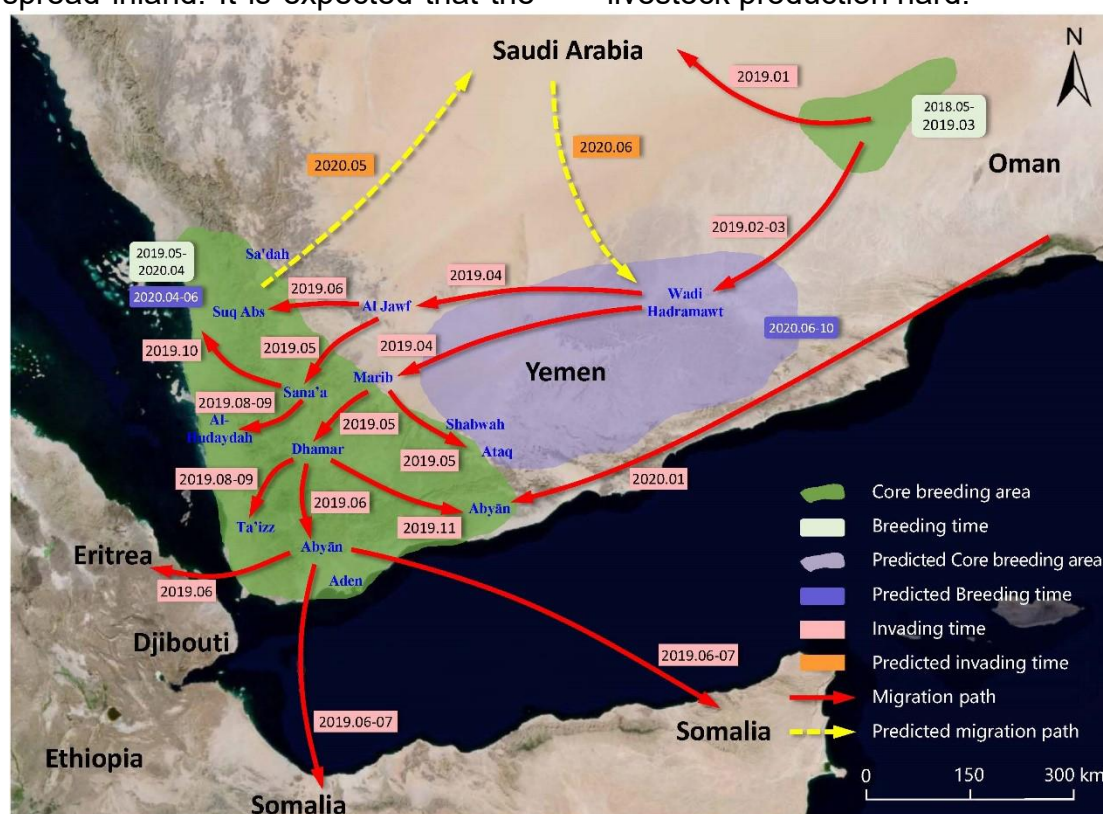
Figure 1 *Migration path of Desert Locust in Yemen (2019-2020)*
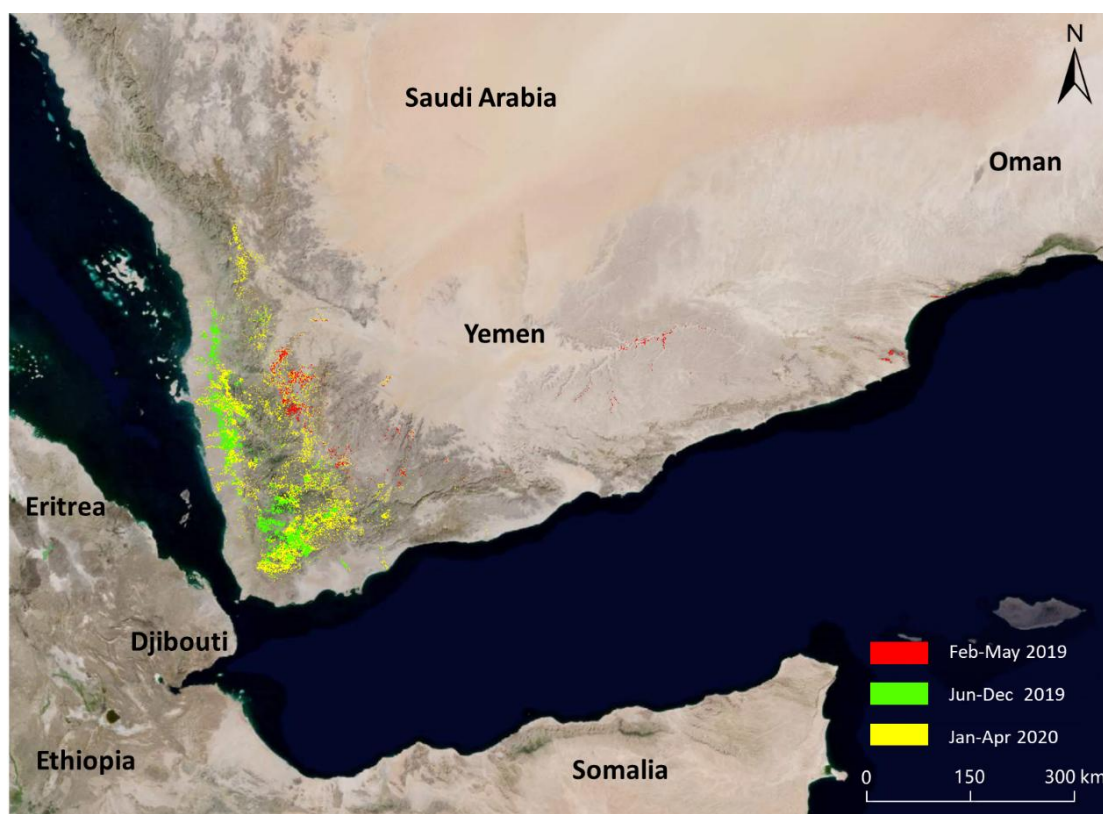
Figure 2 *Monitoring of Desert Locust damage in Yemen (February 2019 to Early-mid April 2020)*

Monitoring and assessment of Desert Locust in Ethiopia

In March 2020, locusts in southern Amhara and Afar, and rift valleys of northern Oromiya and SNNPR, continued to reproduce in spring. Locusts were maturing and swarming, air and ground control operations were continuing. In late March, Ethiopia experienced extensive precipitation, which promoted the reproduction of locusts. At the end of the month, new locust swarms appeared in Dire Dawa and Jijjiga in western Somali, and locusts continued to mature and lay eggs. By the end of March 2020, the newly added vegetation damaged area in Ethiopia was 1016.3 thousand hectares, including 300.9 thousand hectares of cropland, 271.4 thousand hectares of grassland and 444.0 thousand hectares of shrub. In the early-mid April, the locusts in northern Kenya spread northward, the number of locusts in the SNNPR, and Yabello and Negele regions in southern Oromia increased. In mid-April, locust swarms were reported to appear in the Gode region of southern Somalia, and the locust swarms in the north also continued to multiply and expand, causing further damage to the area. The newly added vegetation damaged area is 734.1 thousand hectares (including 92.1 thousand hectares of cropland, 133.3 thousand hectares of grassland and 508.7 thousand hectares of shrub) (Fig 3).

The result shows that from March to mid-April 2020, the newly added vegetation damaged area in Ethiopia is 1750.4 thousand hectares, including 393.0 thousand hectares of cropland, 404.7 thousand hectares of grassland and 952.7 thousand hectares of shrub, accounted for 1.6%, 2.3%, and 1.3% of Ethiopia's crop land, grassland, and shrub, respectively. The affected areas are mainly

located in central and southern Ethiopia. Among them, Oromiya has the largest area of damage, with a total of 1151.1 thousand hectares. The Somali is the second most affected, with a total of 289.7 thousand hectares. The SNNPR ranks third, with a total of 267.9 thousand hectares. The newly affected areas in Afar and Amhara in the northwest are 38.4 thousand hectares and 3.3 thousand hectares, respectively. 80% of the population in Ethiopia is the agricultural and pastoral population. The locust plague has caused a huge impact on the local agricultural and pastoral production, which seriously threatened the local agricultural and pastoral safety and national livelihood. The domestic disaster situation is severe.

This study used Planet images with a spatial resolution of 3 m to monitor the Desert Locusts damage in severely affected areas in the Rift Valley of eastern Ethiopian (Fig.4). Research data is Planet data for February 2019 and February 2020. The study area is located at the junction of Oromiya and Afar, about 24 km southwest to Awash, and about 22 km northeast to Mieso. The vegetation types include grassland, shrub and cropland, with a total area of 37.3 thousand hectares, of which grassland is 6.5 thousand hectares, shrub is 28.6 thousand hectares, and cropland is 2.2 thousand hectares. The monitoring results showed that, the vegetation affected by Desert Locust was 4.5 thousand hectares, accounting for 12.1% of the total area of the study area. Among them, shrub has the largest area of damage, with a total of 3.6 thousand hectares. Grassland is 0.7 thousand hectares. Cropland is 0.2 thousand hectares, accounting for 12.6%, 10.8%, and 9.1% of the total area of shrub, grassland and cropland in the study area, respectively. The results prove that, Desert locusts can cause large losses to vegetation, and its outbreaks will seriously affect Ethiopia's agricultural production and food security (Fig.4).

The comprehensive analysis showed that, from April to May 2020, Desert locust in central Ethiopia will continue spring breeding. At the same time, locust swarms in northern Somalia are also at risk of crossing the border to eastern Somalia. The locust swarm is expected to move to summer breeding areas in northern Amhara, Afar, and Djibouti from April to June. The locust swarm in Somalia is expected to move towards the Indo-Pakistan border with the southwest monsoon of the Indian Ocean. At present, the spring breeding is underway in Ethiopia. With the continuous hatching of locust eggs in May, it is expected that new locust swarms will form from late June to July. April-June is an important harvesting season for crops in Ethiopia. The situation of desert locust control is still severe. Continuous monitoring and multi-country joint prevention and control are needed to ensure local agricultural and animal husbandry production and food security.
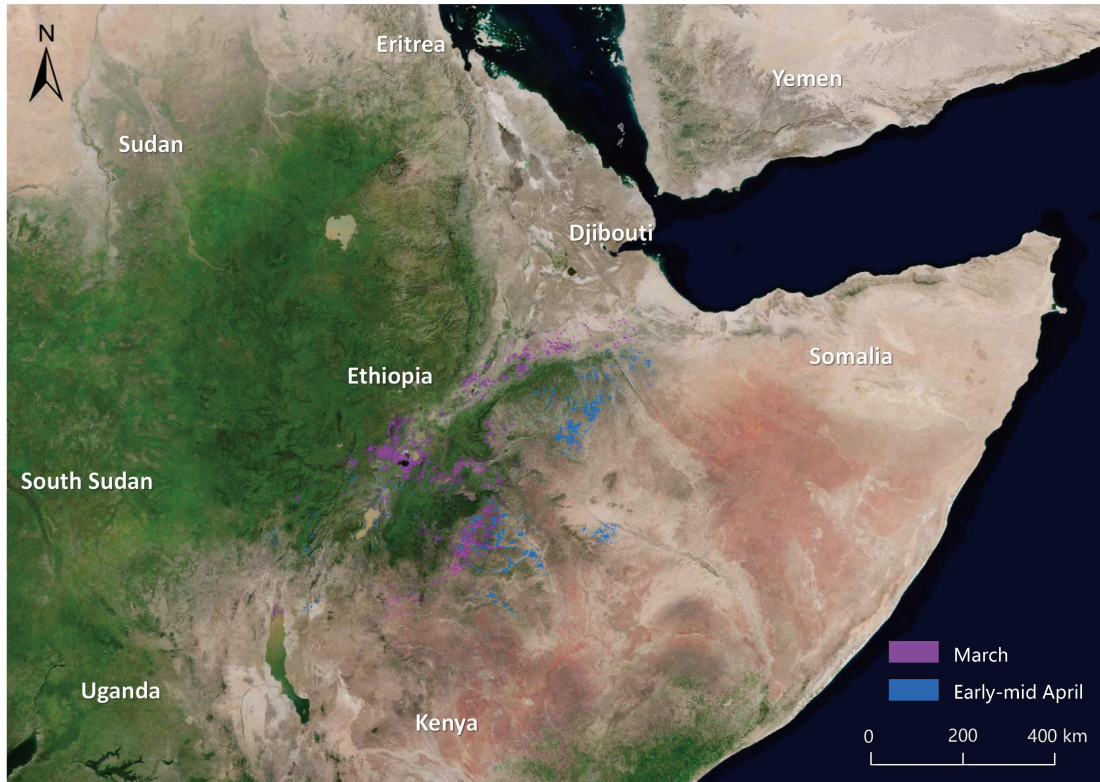
Figure 3 *Monitoring of Desert Locust damage in Ethiopia (March to Early-mid April 2020)*
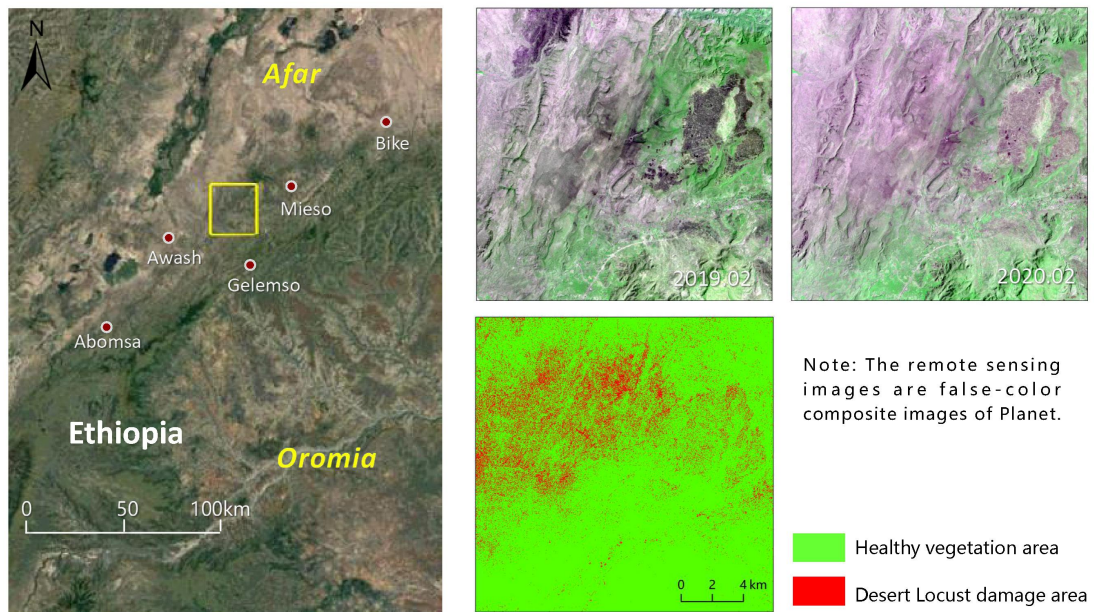
Figure 4 *Monitoring of Desert Locust damage in the key damage area of Ethiopia based on Planet images*

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