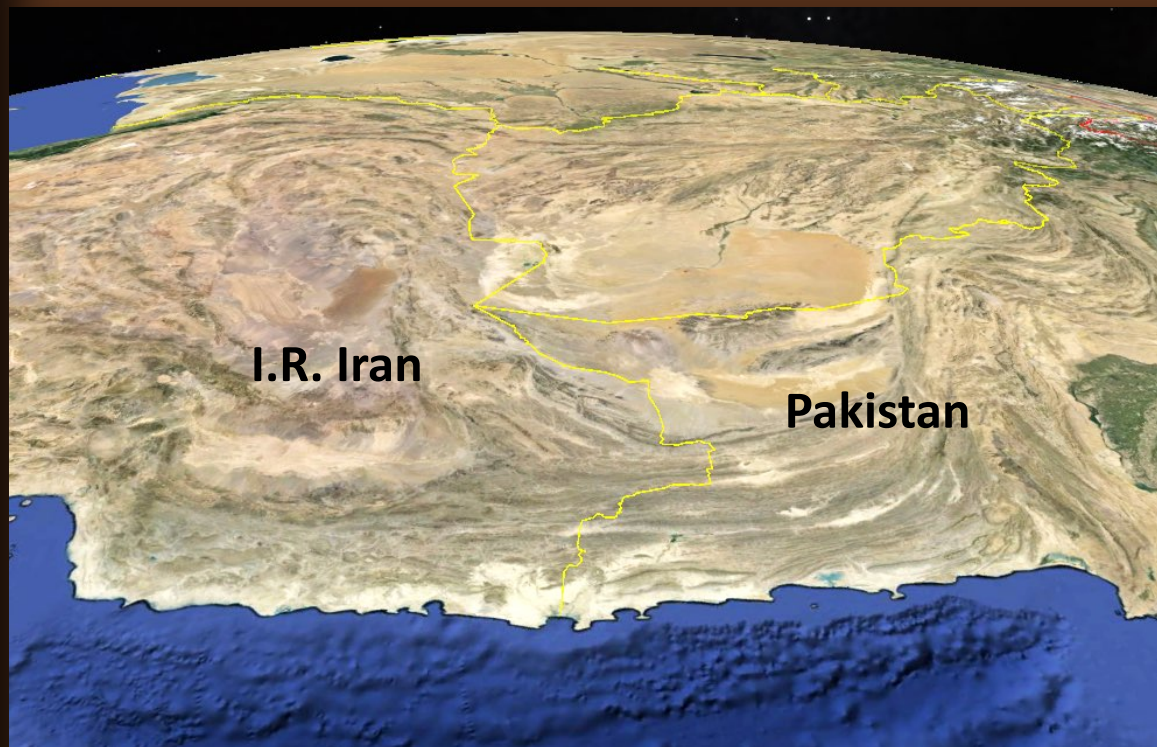




Desert Locust Joint Survey in the Spring Breeding Areas of the I.R. Iran and Pakistan

April 2022



Food and Agriculture Organization
of the United Nations

Desert Locust Joint Survey
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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2022

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Special thanks and acknowledgments are recorded here for the aforesaid organizations and their representatives for every kind of support.

Executive Summary

The idea of a joint survey in the spring breeding areas of the Desert Locust in I.R. Iran and Pakistan had been perceived from the reality that both countries possess a significant area within their political boundaries that is prone to invasion and breeding by Desert Locust during the spring season (February/March to May/June). Since 1995, both countries have been conducting joint surveys under the auspices of the FAO Commission for Controlling the Desert Locust in South-West Asia (SWAC). The 31st Session of SWAC, held virtually on 12–14 December 2020, reaffirmed the requirement for this year's survey to be conducted jointly by locust experts of I.R. Iran and Pakistan (Option A) or as separate surveys in the respective territories of each country by their own team members if the security situation in Baluchistan, Pakistan is not good (Option B). Unfortunately, COVID19 restrictions disrupted the joint survey for the past two years and it could not be undertaken in 2020 and 2021.

Option B was opted for the 2022 joint survey, which was carried out simultaneously in both countries from 5 to 25 April 2022 in I.R. Iran and from 2 to 24 April 2022 in Pakistan on both sides of the common border as per the approved itinerary. At the end of survey, the National Locust Heads, Survey Team Leaders and Locust Information Officers of both the countries met at the Department of Plant Protection (DPP) in Karachi on 28–29 April 2022 with the FAO Senior Locust Forecasting Officer to finalize the draft of the joint survey report.

The I.R. Iran team surveyed a total of 192 stops along a route of 9 328 km and checked an estimated area of 10 320 ha. The Pakistan team surveyed a total of 291 stops along 7 665 km in Baluchistan and checked an estimated area of 59 880 ha. Thus, a total of 483 stops were surveyed on the ground along 16 993 km, checking an estimated total area of 70 200 ha on both sides of the border. Ecological conditions were not found to be suitable for locust activity in either country. Only low numbers of solitarious adults and a few solitarious hoppers were observed in five places along the coast in southeast I.R. Iran and four places in southwest Pakistan. As the conditions were dry, a greater distance and higher number of stops could be achieved during this year's survey compared to previous joint surveys.

The locust infestation rate was extremely low in this year's joint survey – an average of 1.9% (2.6% in I.R. Iran, 1.4% in Pakistan) – compared to 60% (76% in I.R. Iran, 34% in Pakistan) for the last joint survey in 2019.

The results of the joint survey indicate that this year's spring breeding was exceedingly limited due to unusually poor rainfall and unfavourable ecological conditions. Consequently, there is absolutely no threat to the summer breeding areas along the Indo-Pakistan border this year, and the situation should remain calm throughout the region for the remainder of the year.

Desert Locust Joint Survey

in the Spring Breeding Areas of the I. R. Iran and Pakistan

April 2022

Introduction

Agriculture holds an important place in the economies of both I.R. Iran and Pakistan. A sizeable geographic area is shared between both countries that is potentially vulnerable to attack by Desert Locust. If locust activity is not detected or controlled in this area, then there are ample chances that the cultivated areas of not only these two bordering countries but of the entire region will be damaged by locust epidemics. Both countries used to conduct joint surveys since the establishment of the FAO Commission for Controlling the Desert Locust in South-West Asia (SWAC) in 1964. This activity was stopped for 20 years and was resumed in 1995 on an annual basis during the spring breeding season of Desert Locust as a means to reduce the frequency and severity of serious locust epidemics within the region.

The joint survey is primarily designed to be conducted jointly by the locust experts of I.R. Iran and Pakistan. But due to the security situation in Pakistan for the last few years, both countries were undertaking simultaneous surveys during April in their respective areas by themselves and their representatives meet alternately in Tehran, I.R. Iran and Karachi, Pakistan for agreeing on a final consolidated report of the joint survey.

In 2019, the locust experts from the Plant Protection Organization (PPO) in I.R. Iran and the Department of Plant Protection (DPP) in Pakistan conducted the 25th joint survey together as single team for the first time after many years of undertaking the joint survey as separate surveys simultaneously carried out in their own national territories. Unfortunately, the joint survey could not be conducted the following two years, 2020 and 2021, due to COVID19 restrictions.

The 31st Session of SWAC (12–14 December 2020) reaffirmed two options for the itinerary of the joint survey as those that had been previously agreed upon:

- **Option A:** The routine, normative joint survey in which a single joint team consisting of locust officers from both countries carry out the first half of the survey in Baluchistan, southwest Pakistan and undertake the second portion of the survey in Sistan and Baluchistan, Hormozgan and Kerman provinces of southeast I.R. Iran. At the end of the survey, the locust heads and information officers from both countries join the team to draft a single joint survey report that is submitted to FAO.
- **Option B:** The joint survey is carried out by a national survey team in its own territory, that is, a Pakistani team carries out the survey in Baluchistan, Pakistan and an Iranian team undertakes the survey in Sistan and Baluchistan, Hormozgan and Kerman provinces in I.R. Iran. At the end of survey, team leaders, national locust heads and information officers from both countries meet together to discuss the survey results, exchange information and draft a single joint survey report that is submitted to FAO.

Methodology

Team composition

In I.R. Iran, the team consisted of a Team Leader, one Locust Officer, one Locust Assistant and three drivers. In Pakistan, the team consisted of a Team Leader, one Locust Officer, one Maintenance Assistant, one cameraman, and two drivers (Appendix 1). One locust officer from India participated in a portion of the joint survey along the coast of southeast Iran on 11–18 April 2022. Unfortunately, the locust officer from Afghanistan could not join the joint survey this year due to visa delays.

Area covered

The survey teams in I.R. Iran and Pakistan travelled on the ground for a total of 16 993 km on both sides of the border and made 483 survey stops, checking an estimated area of 70 200 ha (Appendices 2 and 3).

In I.R. Iran, the survey team used two 4x4 pickup vehicles and one additional vehicle from Chabahar to Bandar Abbas to accommodate the Indian locust officer. In all, the team covered a distance of 9 328 km and made 192 stops in potential breeding areas of the interior (Mehrestan, Bampur and Saravan valleys, and the Jaz Murian Basin) and the southeastern coastal plains from Chabahar to Bandar-e-Lengheh. The total stops that were made represented an approximate survey area of 10 320 ha. In Pakistan, the survey team used two 4x4 pickup vehicles to cover a distance on the ground of 7 665 km in which 291 stops were made to check a total estimated area of 59 880 ha in potential breeding areas of the interior (Nushki, Dalbandin, Mashkel, Kharan, Washuk, Panjgur, Turbat, Khuzdar and Qalat) and the coast (Jiwani, Gwadar, Pasni and Lasbela).

Equipment

Both teams used the eLocust3 tablet and the PRO version of the eLocust3mAndroid smartphone app during the entire joint survey to record field observations and transmit the real-time survey data by satellite (eLocust3) and cell network (eLocust3m) to PPO in Tehran, DPP in Karachi, and the Desert Locust Information Service (DLIS) at FAO HQ in Rome. In addition, laptop, GPS, standard forms, 1:500 000 scale Tactical Pilotage Charts (TPC) maps and walkie talkie were used during the survey. The *FAO Desert Locust Standard Survey and Control Form* was used to manually record observations made at each survey stop as a backup copy. These were the same observations that were entered into eLocust3 and eLocust3m. Both teams used the digital camera on their smartphone to snapshot ecological conditions and team activities, specifically one overview photo of the habitat and one closeup photo of the vegetation or locust (when present) at each survey stop, which was submitted with the data in eLocust3m. A compass was used to find directions along the survey route. Walkie-talkies were used to communicate between the vehicles during driving and between team members during foot surveys. Each day, the team used a map to review the areas that were surveyed and confirm the survey itinerary for the next day. A laptop was used to prepare daily reports.

Survey stops

Both teams determined priority places for making surveys based on previously surveyed and treated areas, information from district locust officers, and knowledge from the local inhabitants about recent rainfall, green areas and traditional locust habitats in Baluchistan, Pakistan and Sistan-

Baluchistan, southern Kerman and eastern Hormozgan of I.R. Iran. Consequently, the survey route was often slightly refined and adjusted accordingly.

Foot transects

At each stop during the survey, team members went out of the vehicle and made foot transects. The team members did not make a single foot transect together but they selected different directions and each person walked about 400 m to observe the ecological conditions and look for locusts by checking the ground and bushes. The team spent about 15–20 minutes making the foot transects at each survey stop.

Recording observations

Both teams entered their observations about the location, habitat, vegetation, weather and locusts into eLocust3, eLocust3m and the *FAO Desert Locust Standard Survey and Control Form* after completing the foot transects at each stop. The same data were recorded on all three devices. Two photos were also included with the data in eLocust3m. Prior to transmission, the data are automatically saved on the tablet and smartphone in eLocust3 and eLocust3m respectively. The eLocust3 data was transmitted in real time via satellite. The eLocust3m data was transmitted in real time when cell network was available or later automatically once it became available. If the cell network was weak, then eLocust3m sent only the survey data, waiting to send the photos automatically once the strength increased. For this reason, eLocust3 and eLocust3m were kept on throughout the day from the start of the survey until the end so that all data and photos were sent by the end of the day. Despite undertaking surveys in remote areas, neither team faced any problems concerning data transmission from eLocust3m, confirming that it is a very reliable and convenient means of recording and transmitting data. A GPS was also used to counter check the coordinates at each survey stop.

Of the 483 data that were transmitted during the joint survey, only three records had errors, two in I.R. Iran and one in Pakistan, in which a coordinate was accidentally entered in the Area to be treated section. In the RAMSES GIS, the DLIO deleted the coordinate in this section and then the record could be imported successfully into the database. One other record in I.R. Iran had incorrect coordinates, which was discovered during the final meeting when reviewing the data in RAMSES. This was corrected by referring to the *FAO Desert Locust Standard Survey and Control Form* for that particular survey stop.

Results

Please refer to the maps and data in Appendices 4–5 for more details

Ecological conditions

In I.R. Iran, rainfall this year was not very good and was well below normal. In January, there was good rain that was quite widespread. For example, heavy rains fell in the mountains between Bandar Abbas and the western Jaz Murian Basin (Manojan) and also on the northwestern edge of Jaz Murian (Rodbar) that may have flowed into the western portion of the basin. Thereafter, very little rain fell during February and March with only very light showers in parts of Jaz Murian.

As a result of the poor rains this year, vegetation was only green at five localities (less than three percent) out of 192 localities checked in I.R. Iran while it was drying at 181 localities and dry at seven places. Similarly, soil moisture was found dry at 183 localities and wet at only nine localities.

In Pakistan, rainfall in general was much lower this year than in previous years, similar to I.R. Iran. The Pakistan Meteorological Department indicated that no rain of significant fell in Baluchistan during February while locals reported some light rain at mid-month. In March, light rain fell mainly to the northwest of Lasbela. No significant rain fell during April except in the Khuzdar area where light rains occurred on the 18th and 19th. Consequently, vegetation was observed drying at 256 localities, dry at 22 localities, greening at nine, and green at four places out of 291 localities checked during the joint survey. Similarly, soil moisture was found dry at 281 localities and wet at only ten localities. Due to the poor rainfall this year, vegetation and soil conditions to be dry throughout Baluchistan.

Locust situation – coastal areas

The coastal portion of the spring breeding area extends from Bandar Abbas, Bandar Khamir, Bandar-e-Lengeh, Minab, Sirik and Jask to Zarabad, Konarak, Chabahar and Gwatar in I.R. Iran and from Jiwani, Gwadar, Pasni, and Ormara to Lasbela and Uthal in Pakistan.

In I.R. Iran, isolated mature solitarious adults were seen at four stops along the southeast coast near Chabahar and Zarabad and a single solitarious fourth instar hopper was seen near Chabahar. Vegetation conditions in most of the coastal areas were dry except one location in on the Vashnum Plains to the northeast of Chabahar where medium-density green vegetation was present. Soil moisture was dry in all areas.

In Pakistan, vegetation and soil moisture were found to be dry at all survey stops. Low-density immature and mature solitarious adults were seen at four localities in the areas of Jiwani and Kolanch Valley. Low-density solitarious and *transiens* hoppers were observed at one locality (Ganz 2) on 16 April. Low density solitarious hoppers and fledglings were also seen in Kocho area (Kolanch Valley) on the 18th.

The fact that there were a few late instar hoppers present in the above areas suggest that there must have been some rainfall in January or early February to allow for egg-laying to take place from the last week of February to mid-March. As a result of this egg-laying, hatching most likely began in the second week of March and continued until the end of the month.

Locust situation – interior areas

The interior part of the spring breeding areas in I.R. Iran includes the Khash, Saravan, Suran and Mehrestan valleys and the Jaz Murian Basin. The latter consists of the eastern (Iranshahar and Bampur), the southeastern (JolgehChahHashem), the northern (Zehkalut, Dalgan), the southwestern (Sowlon) and the western (GalehGang and Jaz Murian) portions.

Vegetation was drying except at two stops in Suran and one stop each in Zaboli and Jaz Murian where it was green. Soil moisture was dry at all stops.

In Pakistan, vegetation and soil moisture were observed to be dry in all interior potential locust breeding areas. In addition, no locusts were observed.

The locust infestation rate of this year's joint survey was 1.9% (2.6% in I.R. Iran, 1.4% in Pakistan) compared to 60% (76% in I.R. Iran, 34% in Pakistan) for the last joint survey in 2019, which coincided with the onset of an upsurge, good rains and excellent breeding conditions.

Discussion

The survey results indicate that the current Desert Locust situation in both countries is extremely calm. It is worthwhile to note that spring breeding this year was unusually low and very limited because of the poor ecological conditions caused by a lack of sufficient rain.

Although low numbers of solitary adults and hoppers were present in a few places along the coast in southeast I.R. Iran and southwest Pakistan, there is no chance of significant developments occurring during the remainder of the spring season from now until June. This is because ecological conditions are unfavourable in the majority of all areas and breeding is not expected to take place in the coming months because of the poor current conditions and the low probability that more rain would fall in May.

In conclusion, the results of this joint survey indicate that spring breeding this year was lower than normal; hence, there is no threat of any large scale movement or invasion of the Indo-Pakistan summer breeding areas from the spring breeding areas in I.R. Iran and Pakistan this year. Consequently, the locust situation will remain calm in the region during the remainder of the spring and in the upcoming summer period.

Suggestions

At the end of the survey, the Iranian Team Leader, Locust Head and Locust Information Officer met with their Pakistani counterparts and the FAO Senior Locust Forecasting Officer in Karachi on 28–29 April 2022 to discuss the survey results and finalise the consolidated report.

During the final meeting, it was agreed that despite security issues, it is important to maintain the joint survey on annual basis every spring as it is the primary activity in the region and is very useful for the biosecurity of three frontline member countries.

A number of suggestions for future joint surveys, including tips for the effective use of the joint survey tools (Appendix 6) and the proposed itinerary for the 2023 joint survey (Appendix 7), were agreed upon with slight amendments:

1. If the survey is carried out separately by both the countries under Option B, it should start from Uthal instead of Nushki in Pakistan.
2. Mashkhel area should be surveyed from Nokkundi instead of Washuk and Plantak due to rough terrain and long distance.
3. An extra day should be added in I.R. Iran after Nikshahr to cover the Rask area, and in Pakistan to cover the Mand area from Turbat.
4. The joint survey could benefit by having a greater number of manpower available at the various locust stations and field offices to assist the team during the survey as they are familiar with the locals and the habitat in their area. This was not possible in some areas due to a lack of sufficient staff.

5. The team members should be nominated well ahead of time and each member of the team should have specialized training on every aspect of the joint survey. The national master trainers for this purpose should be properly updated in the latest technologies and have recent experience in desert areas.
6. There should be exchange of expertise among SWAC members. The Team Leader and other members of the joint survey team in one country could serve as a master trainer or resource person in the other country for imparting training.
7. Locust officers from SWAC member countries (Afghanistan and India) are encouraged to participate in future joint surveys.
8. At least one driver in each country should be from the Baluchistan region while all drivers must have experience and familiarity with off-road driving in tough desert, sandy and mountainous terrains.
9. One of the drivers in each country should also be a mechanic and be well equipped with the necessary tool kit and emergency spare parts.
10. The drivers should be responsible for taking photographs of the habitat, survey activities and any locust infestations during the joint survey.
11. The eLocust3m app should be the primary tool for data collection and transmission by using the PRO version. It is encouraged that an updated version will have navigation functionality if possible. The eLocust3 tablet should be used as a secondary option for recording and transmitting the survey data from each survey stop. The *FAO Desert Locust Standard Survey and Control Form* can continue to be used as a manual analogue backup to both digital devices.
12. The payment of DSA and GOE for the Iranian portion of the joint survey should be resolved.
13. Explore the possibilities for the joint survey team to also use the Rimdan Border Crossing on the coast, in addition to the Mirjavah/Taftan Crossing in the northern interior, so that future joint surveys would benefit from a circular itinerary (Option A) to reduce the need to retrace the route.

APPENDICES

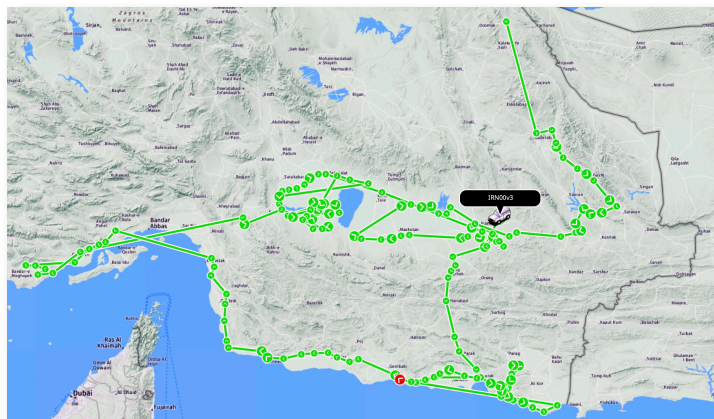
Appendix 1. Participants

	Name	Title/Position	Place of posting
I.R. Iran	Mahmoud Chalakizabardast	Team Leader	PPO, Tehran
	Javad Ravandeh	Locust Officer	Jihad-e-Agriculture Organization, Sistan-Balochistan (Zahedan)
	Bahram Salari	Locust Assistant	Jihad-e-Agriculture Organization, Hormozgan (Bandar-e-Lengheh)
	Fardin Mirzaie	Mechanic/Driver	PPO, Tehran
	Parviz Bolydeh	Driver	Jihad-e-Agriculture Organization, Sistan-Baluchistan
	Abdolkarim Haghtalab	Extra Driver	Jihad-e-Agriculture Organization, Sistan-Baluchistan (Konarak)
India	Pankaj Salunke	Asst. PP Officer	Locust Warning Organization, Jodhpur
Pakistan	Fakhar ul Zaman	Team Leader	DPP, Multan
	Shahbaz	Locust Officer	DPP HQs, Karachi
	Shakeel ur Rehman	Photographer	DPP HQs, Karachi
	Allah Wadhaya	Driver	DPP, Khuzdar
	Jawed Khan	Driver	DPP, Uthal
	Jalil Ahmed	Maintenance Asst.	DPP HQs, Karachi

Appendix 2. Overview of area surveyed

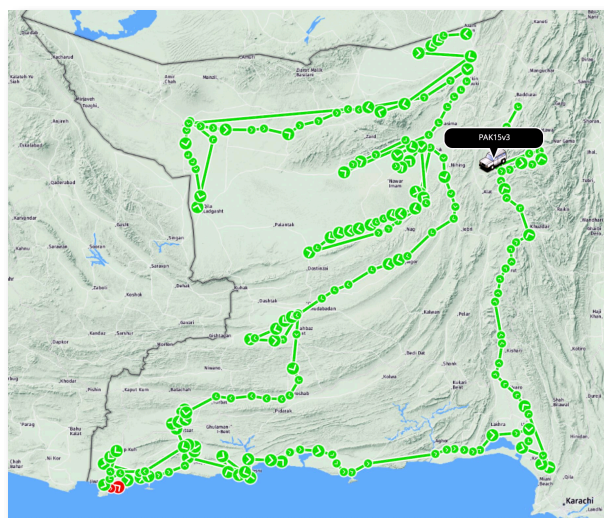
	I.R. Iran	Pakistan	Total
Total survey area (ha)	10 320	59 980	70 200
Total survey area (km)	9 328	7 665	16 993
No. of survey stops	192	291	483
No. of survey stops with green vegetation	5 (2.6%)	4 (1.4%)	9 (1.9%)
No. of survey stops with wet soil	9 (4.7%)	10 (3.4%)	19 (3.9%)
No. of survey stops with locusts	5 (2.6%)	4 (1.4%)	9 (1.9%)

Appendix 3. Itinerary



I.R. Iran (5–25 April 2022, 21 days)

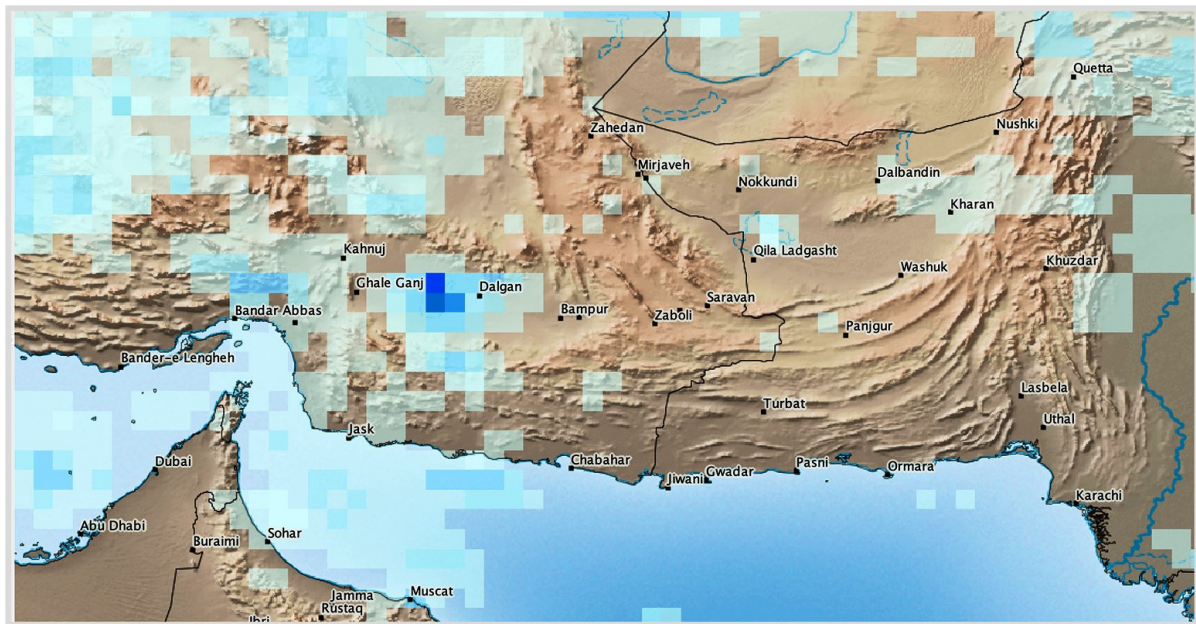
Day	Date	Route	Night halt
1	05/04/2022	Start survey in Zahedan	Zahedan
2	06/04/2022	Zahedan → Khash → Gosht → Saravan	Saravan
3	07/04/2022	Saravan → Soran → Mehrestan → Iranshahr	Iranshahr
4	08/04/2022	Iranshahr → JolgehChahHashem → Dalgan	Dalgan
5	09/04/2022	Dalgan → Dalgan areas → Iranshahr	Iranshahr
6	10/04/2022	Iranshahr → Espakeh → Nikshahr	Nikshahr
7	11/04/2022	Nikshahr → Konarak areas → Chabahar; IND+AFG officers arrive	Chabahar
8	12/04/2022	Chabahar → E Vashnam → Kambel → Kohdim → Chabahar	Chabahar
9	13/04/2022	Chabahar → W Vashnam → Maleki → Berijdar → Avan → Chabahar	Chabahar
10	14/04/2022	Chabahar → Beris → Sham → Gowatar → Chabahar	Chabahar
11	15/04/2022	Chabahar → Zarabad → Jask areas → Jask	Jask
12	16/04/2022	Jask → Jask Kohneh → Koh Mobarak → Sirik → Minab → B. Abbas	B. Abbas
13	17/04/2022	Bandar abbas → Bandar Khamir → Bandar Lengeh → Bandar Abbas	B. Abbas
14	18/04/2022	<i>Report day, prepare 1st half JS results; IND+AFG officers depart</i>	B. Abbas
15	19/04/2022	Bandar Abbas → Manujan → GhalehGanj → Sowlan	GhalehGanj
16	20/04/2022	QalehGanj → Jaz Murian → GhalehGanj	GhalehGanj
17	21/04/2022	QalehGanj → Jaz Murian → GhalehGanj	GhalehGanj
18	22/04/2022	GhalehGanj → Zehkalt → Dalgan	Dalgan
19	23/04/2022	Dalgan → Sangan → Sardegal → Bampur → Iranshahr	Iranshahr
20	24/04/2022	Iranshahr → Zahedan; report day for 2nd half of survey	Zahedan
21	25/04/2022	<i>Report day for 2nd half survey results</i>	Zahedan
	27/04/2022	<i>Iranian participants travel to Karachi</i>	Karachi
	28/04/2022	<i>Meeting of Team Leaders and Locust Heads of Iran and Pakistan</i>	Karachi
	29/04/2022	<i>Meeting of Team Leaders and Locust Heads of Iran and Pakistan</i>	Karachi
	30/04/2022	<i>Submit the final JS report to DLIS; Iranian participants depart</i>	



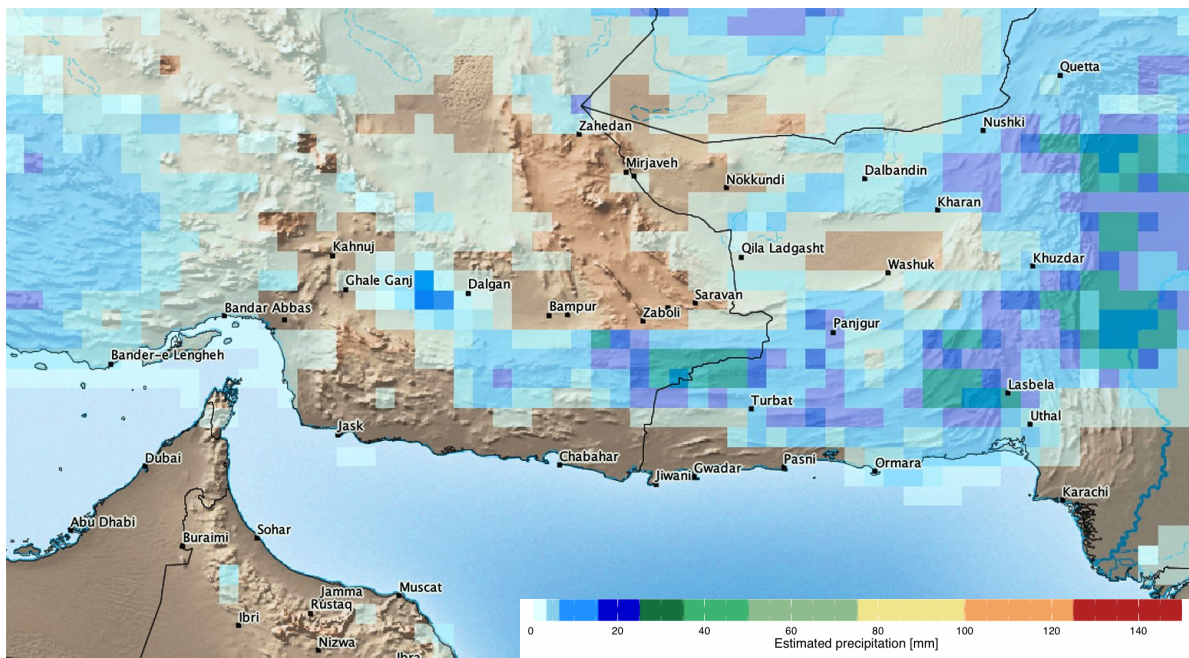
Pakistan (2–24 April 2022, 23 days)

Day	Date	Route	Night Halt
1	02/04/2022	Quetta → Nushki → Nushki area → Nushki	Nushki
2	03/04/2022	Nushki → Dalbandin → Nokundi	Nokundi
3	04/04/2022	Nokundi → Dalbandin → Nushki	Nushki
4	05/04/2022	Nushki → Kharan → Ormagai area → Kharan	Kharan
5	06/04/2022	Kharan → HajiChah → Jamukh → Kharan	Kharan
6	07/04/2022	Kharan → Ziarat → Shamshi → Washuk	Washuk
7	08/04/2022	Washuk → Palantak → Mashkhel desert → Mashkhel	Mashkhel
8	09/04/2022	Mashkhel → Mashkhel desert → Palantak → Washuk	Washuk
9	10/04/2022	Washuk → Borko desert → Borko	Borko
10	11/04/2022	Borko → Basima → Nag → Panjgur	Panjgur
11	12/04/2022	Panjgur → Prom area → Panjgur	Panjgur
12	13/04/2022	Panjgur → Hoshab Area → Turbat	Turbat
13	14/04/2022	Turbat → Soliaka Area → Turbat	Turbat
14	15/04/2022	Turbat → Sunstar area → Gawadar	Gwadar
15	16/04/2022	Gwadar → Jiwani → Gwadar	Gwadar
16	17/04/2022	<i>Report day, prepare 1st half survey results</i>	Gwadar
17	18/04/2022	Gwadar → Kolanch area → Pasni	Pasni
18	19/04/2022	Pasni → Pasni area → Pasni	Pasni
19	20/04/2022	Pasni → Ormara coastal area → Uthal	Uthal
20	21/04/2022	Uthal → Uthal area → Uthal	Uthal
21	22/04/2022	Uthal → Wad → Khuzdar	Khuzdar
22	23/04/2022	Khuzdar → Qalat area → Quetta	Quetta
23	24/04/2022	<i>Report day for 2nd half survey results</i>	Quetta
	28/04/2022	<i>Meeting of Team Leaders and Locust Heads of Iran and Pakistan</i>	Karachi
	29/04/2022	<i>Meeting of Team Leaders and Locust Heads of Iran and Pakistan</i>	Karachi
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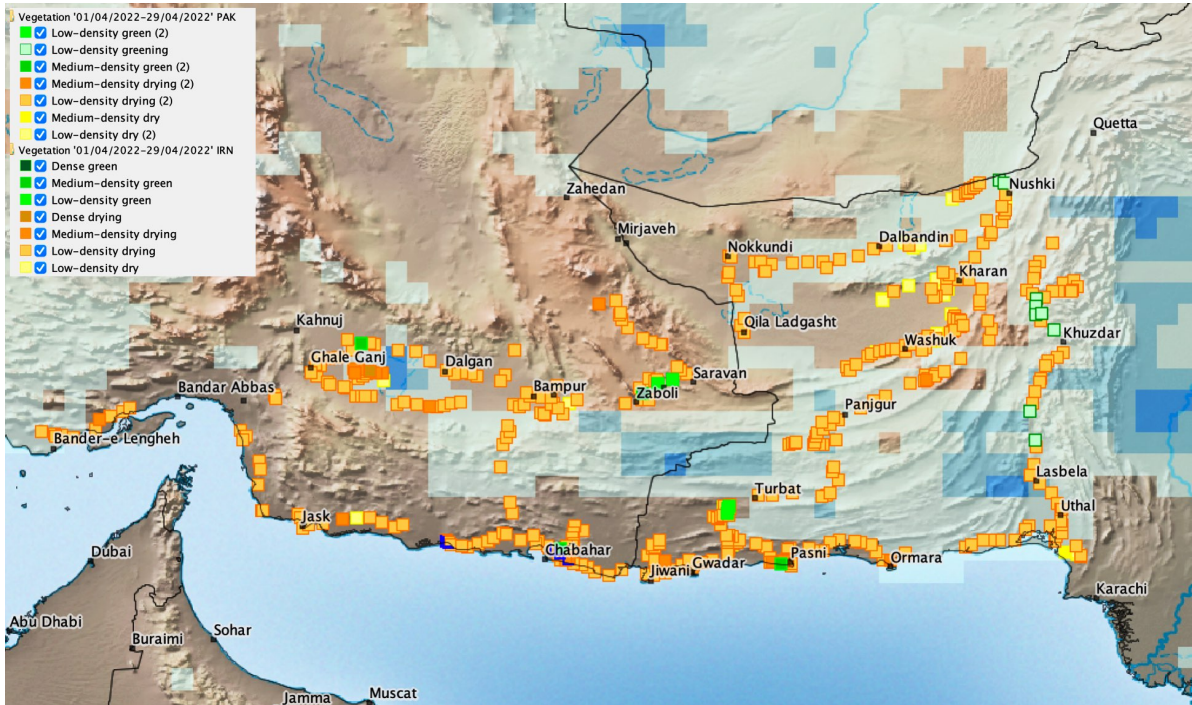
Appendix 4. Rainfall, soil moisture, vegetation and locust maps



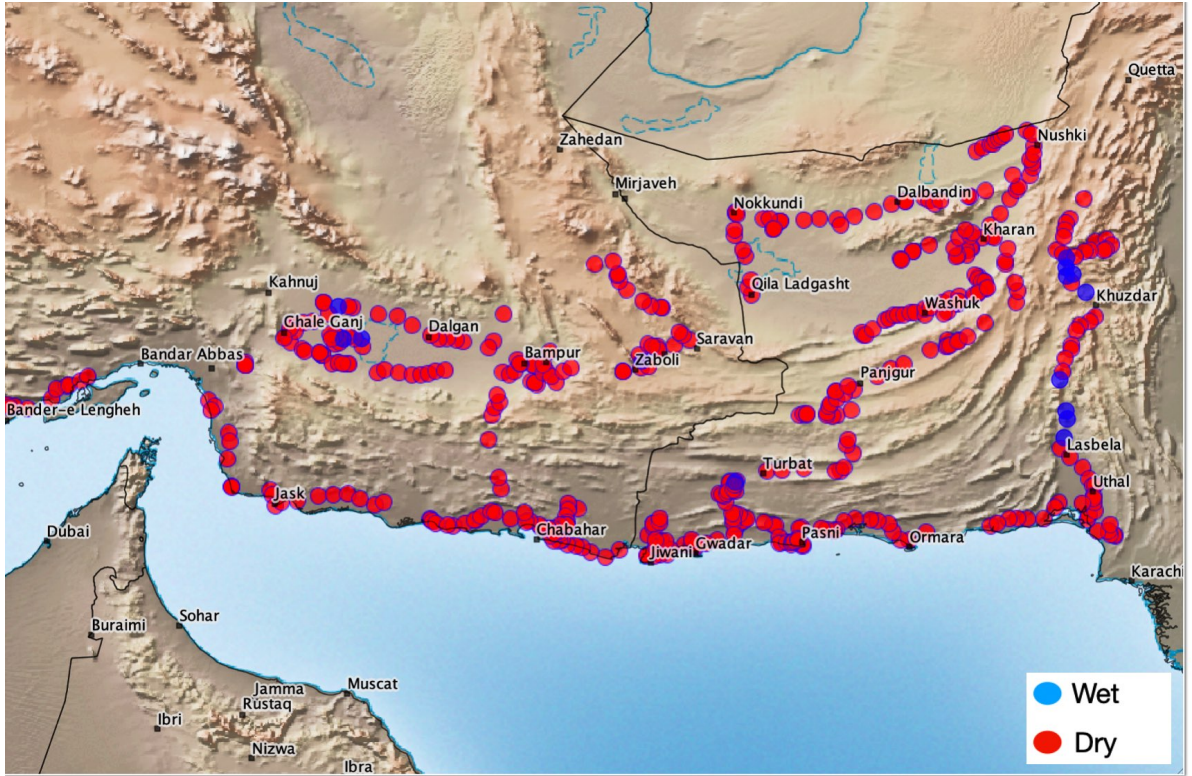
RAINFALL (February). Rain that fell previously in I.R. Iran during January may have flowed into the Jaz Murian Basin. In February (see map), very little rain fell in coastal and interior areas of the southeast except for light rain at times in the Basin. In Pakistan, locals reported light rain near mid-month in a few places of Baluchistan.



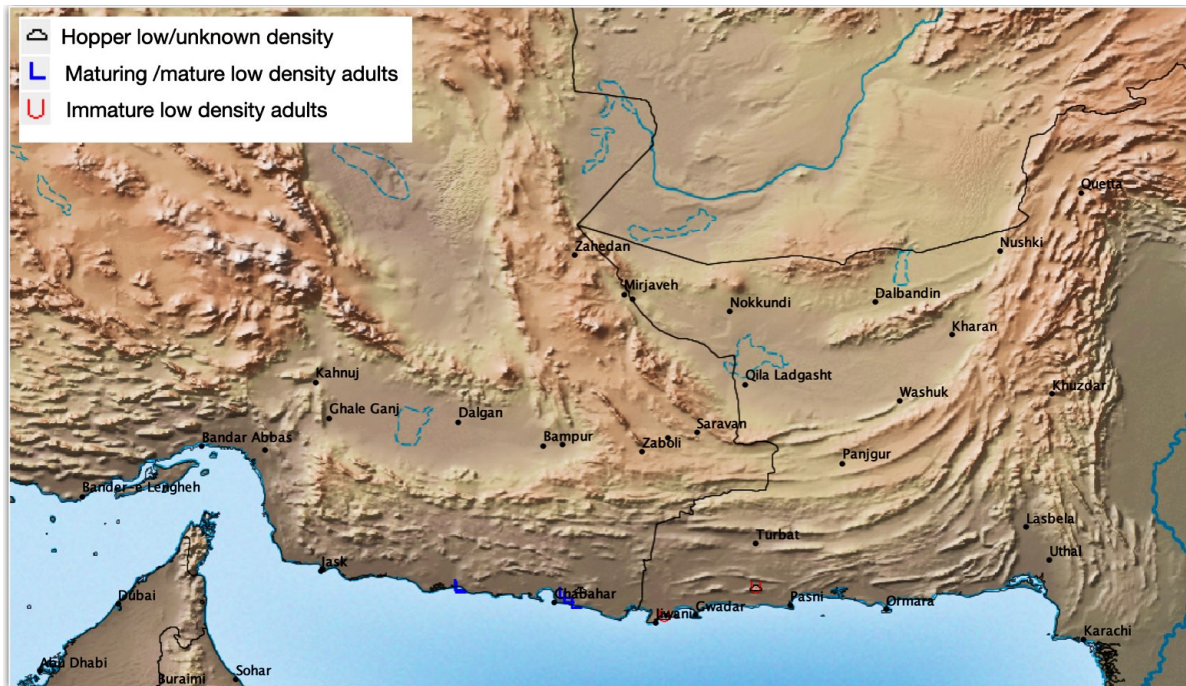
RAINFALL (March). A few showers occurred northwest of Lasbela in March and no significant rain fell in April apart from light rains near Khuzdar shortly after mid-month.



VEGETATION. Due to the unusually poor rains, vegetation was green at less than three percent (5/192) of the stops in I.R. Iran: on the southeast coast near Chabahar (1) and in the interior near Suran Valley (2), Zaboli (1) and Jaz Murian (1). Similarly in Pakistan, vegetation was green at less than two percent (4/291) of the stops in the Shooli Valley south of Turbat and on the coast near Pasni, and greening at three percent (9/291) of the stops in the interior near Uthal, Khuzdar and Nushki. [March rainfall shown on map]



SOIL MOISTURE. Soil moisture was mainly dry except at 9/192 (4.6%) stops in the interior of I.R. Iran near Jaz Murian (3) and Zaboli (1) and at 10/291 (3.4%) stops in Pakistan of which one was in the Shooli Valley south of Turbat and the remainder were on the eastern edge of the interior between Uthal and Khuzdar.



LOCUSTS. Isolated adults were present in a few places on the southeast coast of I.R. Iran near Zarabad and Chabahar and in adjacent areas along the coast in southwest Pakistan near Jiwani. Limited breeding occurred near Chabahar and in Pakistan near Jiwani and in the Kolanch Valley near Pasni.

Appendix 5. Rainfall data

Unusually good rains fell in the mountains to the north and south of the western portion of the Jaz Murian Basin during January as indicated by rainfall totals reported from Roudbar (northwest of Jaz Murian) and Manujan (southwest of Jaz Murian). As a result, it is likely that water flowed into the western part of the Basin that may have allowed sufficient ecological conditions for locust survival and limited breeding, helping to explain why a few areas still had moist soil and green vegetation during the joint survey. However, as no significant rain fell after January, locusts were not detected and breeding did not occur during the spring in the Jaz Murian Basin this year.

I.R. IRAN	Khash	Zarabad	Iranshahr	Konarak	Nikshahr	Jask	B.Abbas	Roudbar	Manujan
13/01/2022	0.5	-	1	4.7	1	-	-	57	20
16/01/2022	-	-	-	-	-	-	6	12	35
17/01/2022	-	1.5	-	-	0.5	-	8	33	100
18/01/2022	-	-	1	-	-	2	-	60	63
Total Jan	0.5	1.5	2	4.7	1.5	2	14	162	218
12/02/2022	-	-	-	-	-	4	11	-	-
18/02/2022	-	-	-	-	-	1	-	-	-
Total Feb	0	0	0	0	0	5	11	0	0

(values in mm)

There was no station data from Baluchistan, Pakistan because of a lack of rainfall this year.

Appendix 6. eLocust3 and eLocust3m tips for usage

A number of tips for eLocust3 and eLocust3m were found to be useful during the joint survey that should be followed in future joint surveys.

- Use the latest versions for eLocust3 (v19.1.1) and eLocust3m
- Check to make sure the tablet and smartphone are working and turn on **before** leaving in the morning when there is a connection
- Make sure you have all eLocust3 components (vehicle charger and cables, antenna, Bluetooth cable) before leaving for the survey, and do not lose any of these components
- Always keep the tablet and smartphone turned on during the survey day from start to end so that the GPS remains active; the display can be turned off
- The tablet can be charged via the cigarette lighter when data are not being transmitted
- Always make sure coordinates are visible on the Report Page **before** pressing *Save & Send*
- If the coordinates are **not** visible:
 - Use GPS app to confirm that the GPS is working on the tablet
 - If coordinates do not appear, then turn disable/enable the GPS in the Dashboard (eLocust3) or restart the smartphone (eLocust3m)
- Compare the GPS coordinates on the Report Page with a those on a handheld GPS
- Make sure the handheld GPS coordinates format is **DDMMSS**
- Never tap on GetCoords unless there is an area to be treated; if GetCoords are accidentally tapped, then Cancel and open a New Report
- Do not use special characters in the Name – use only letters and numbers
- There is no need to enter non-mandatory data (e.g. AnnVeg, PerenVeg, Temp, Wind)
- Hold the tablet and smartphone vertically to take photos
- Two photos should be taken at every stop, one that shows a broad overview of the area and one that shows a closeup of the vegetation or locust (if present)
- When transmitting data from eLocust3, the following status will be indicated in this order:
 - Idle – no activity
 - Connecting to BT – the tablet is connecting to the Bluetooth
 - Connecting to SAT – the antenna is connecting to the satellite
 - Sending – report is being sent from tablet via Bluetooth through the antenna
 - Sent – report has been sent successfully
- If there is no Bluetooth connection on eLocust3, move closer to the vehicle and open the door (if you are outside) or sit in the front seat of the vehicle
- On eLocust3, press **Synchronize** to transmit the report immediately rather than waiting for automatic resend after several minutes
- More than one tablet can use the same antenna, but reports can be sent from only one tablet at a time while other tablets are turned off or are more than 15m from the antenna
- On the tablet, send all reports before the end of the day so that the Queue=0
- Keep the smartphone on and eLocust3m open for some time after arriving at the end of the day where there is connection to allow all photos to be sent

Appendix 7. Proposed itinerary for 2023 Joint Survey

Option A. Single joint I.R. Iran/Pakistan survey (30 days, 25 April – 24 May 2023)

Day	Date	Route	Night halt
1	25/04/2023	<i>I.R. Iran team cross Mirjavah, I.R. Iran to Taftan, Pakistan</i> Tatan → Nokkundi	Nokkundi
2	26/04/2023	Nokkundi → Mashkel	Mashkel
3	27/04/2023	Mashkel → Washap → Panjgur	Panjgur
4	28/04/2023	Panjgur → Sar-i-Parom → Panjgur	Panjgur
5	29/04/2023	Panjgur → Hoshab → Turbat	Turbat
6	30/04/2023	Turbat → Mand → Turbat	Turbat
7	01/05/2023	Turbat → Suntsar → Gwadar	Gwadar
8	02/05/2023	Gwadar → Jiwani → Tamp Kuh → Gwadar	Gwadar
9	03/05/2023	Gwadar → Kolanch → Pasni	Pasni
10	04/05/2023	Pasni → Ormara → Uthal	Uthal
11	05/05/2023	Uthal → Kharan	Kharan
12	06/05/2023	Kharan → Hurmagai → Jamukh → Kharan	Kharan
13	07/05/2023	Kharan → Ziarat → Shamsihi → Washuk → Kharan	Kharan
14	08/05/2023	Kharan → Nushki → Zaro Chah → Nushki	Nushki
15	09/05/2023	Nushki → Chagai Hills → Dalbandin → Taftan	Taftan
16	10/05/2023	<i>JS team cross Taftan, Pakistan to Mirjavah, I.R. Iran</i> <i>Report day, prepare 1st half JS results for Pakistan</i>	Zahedan
17	11/05/2023	Zahedan → Khash → Gosht → Saravan	Saravan
18	12/05/2023	Saravan → Suran → Mehrestan → Iranshahr	Iranshahr
19	13/05/2023	Iranshahr → Bampur → Espakeh → Nikshahr	Nikshahr
20	14/05/2023	Nikshahr → Qasr-e-qand → Pishin → Rask	Rask
21	15/05/2023	Rask → Polan → Matruk → Vashnum → Chabahar	Chabahar
22	16/05/2023	<i>Rest day; IND/AFG officers arrive in Chabahar</i>	Chabahar
23	17/05/2023	Chabahar → Beris → Sham → Gowatar → Chabahar	Chabahar
24	18/05/2023	Chabahar → Vashnam → Dashtiari → Negur → Chabahar	Chabahar
25	19/05/2023	Chabahar → Zarabad → Jask → Jask area	Jask
26	20/05/2023	Jask → Sirik → Minab → B. Abbas	B. Abbas
27	21/05/2023	<i>IND/AFG officers depart in B. Abbas</i> B. Abbas → Ghalehganj → Jaz Murian → Ghalehganj	Ghalehganj

Day	Date	Route	Night halt
28	22/05/2023	Ghalehganj → Sowlan → Jaz Murain → Zehkalut → Dalgan	Dalgan
29	23/05/2023	Dalgan → Sangan → Sardegal → Iranshahr	Iranshahr
30	24/05/2023	Iranshahr → Zahedan; <i>prepare 2nd half JS results for Iran</i>	Zahedan
	25/05/2023	<i>JS Team Leaders & Pakistan Locust Head & Info Officer travel to Tehran; Pakistani Team cross the border to Taftan</i>	
	26/05/2023	Locust Heads, JS Team Leaders & Info Officers prepare JS report	Tehran
	27/05/2023	Locust Heads, JS Team Leaders & Info Officers submit JS report	Tehran
	28/05/2023	<i>Pakistan Locust Head, Team Leader, Info Officer fly to Karachi</i>	

Option B. Separate joint surveys in I.R. Iran and Pakistan

I.R. Iran (18 days, 26 March – 12 April 2023)

Day	Date	Route	Night halt
1	26/03/2023	Start survey in Zahedan	Zahedan
2	27/03/2023	Zahedan → Khash → Gosht → Saravan	Saravan
3	28/03/2023	Saravan → Soran → Mehrestan → Iranshahr	Iranshahr
4	29/03/2023	Iranshahr → Allahabad → Sar Thakhte → Espakeh → Nikshahr	Nikshahr
5	30/03/2023	Nikshahr → Qasr-e-qand → Pishin → Rask	Rask
6	31/03/2023	Rask → Polan → Matruk → Chabahar <i>IND/AFG officers arrive in Chabahar</i>	Chabahar
7	01/04/2023	Chabahar → E Vashnam → Kambel → Kohdim → Chabahar	Chabahar
8	02/04/2023	Chabahar → W Vashnam → Maleki → Berijdar → Avan → Chabahar	Chabahar
9	03/04/2023	Chabahar → Beris → Sham → Gowatar → Dashtiari → Chabahar	Chabahar
10	04/04/2023	Chabahar → Zarabad → Jask areas → Jask	Jask
11	05/04/2023	Jask → Jask Kohneh → Koh Mobarak → Sirik → Minab → B. Abbas	B. Abbas
12	06/04/2023	B. Abbas → B. Khamir → B. Lengeh → B. Abbas	B. Abbas
13	07/04/2023	<i>IND+AFG officers depart</i> B. Abbas → Manujan → Ghalehganj → Sowlan	Ghalehganj
14	08/04/2023	Ghalehganj → Jaz Murian → Ghalehganj	Ghalehganj
15	09/04/2023	Ghalehganj → Sowlan → Jaz Murain → Zehkalut → Dalgan	Dalgan
16	10/04/2023	Dalgan → Sangan → Sardegal → Bampur → Iranshahr	Iranshahr
17	11/04/2023	Iranshahr → Zahedan	Zahedan
18	12/04/2023	Report day for results of JR Iran	Zahedan
	13/04/2023	<i>JS Team Leader travels to Tehran</i>	Tehran
	15/04/2023	Locust Heads, JS Team Leaders & Info Officers prepare JS report	Tehran
	16/04/2023	Locust Heads, JS Team Leaders & Info Officers submit JS report	Tehran
	17/04/2023	<i>Pakistan Locust Head, Team Leader, Info Officer fly to Karachi</i>	

Option B. Separate joint surveys in I.R. Iran and Pakistan

Pakistan (18 days, 26 March – 12 April 2023)

Day	Date	Route	Night halt
1	26/03/2023	Uthal → Bela → Wadh → Khuzdar	Khuzdar
2	27/03/2023	Khuzdar → Basima → Kharan	Kharan
3	28/03/2023	Kharan → Hurmagai → Jamukh → Kharan	Kharan
4	29/03/2023	Kharan → Ziarat → Shamsihi → Washuk	Washuk
5	30/03/2023	Washuk → Palantak → Washuk	Washuk
6	31/03/2023	Washuk → Borko Desert → Kharan	Kharan
7	01/04/2023	Kharan → Nushki → Zaro Chah → Nushki	Nushki
8	02/04/2023	Nushki → Chagai Hills → Dalbandin → Nokkundi	Nokkundi
9	03/04/2023	Nokkundi → Mashkel	Mashkel
10	04/04/2023	Mashkel → Washap → Panjgur	Panjgur
11	05/04/2023	Panjgur → Sar-i-Parom → Panjgur	Panjgur
12	06/04/2023	Panjgur → Hoshab → Turbat	Turbat
13	07/04/2023	Turbat → Mand → Turbat	Turbat
14	08/04/2023	Turbat → Suntsar → Gwadar	Gwadar
15	09/04/2023	Gwadar → Jiwani → Tamp Kuh → Gwadar	Gwadar
16	10/04/2023	Gwadar → Kolanch → Pasni	Pasni
17	11/04/2023	Pasni → Ormara → Uthal	Uthal
18	12/04/2023	Uthal area; report day for results of JS Pakistan	Uthal
	14/04/2023	<i>Pakistan Team Leader, Locust Head & Info Officer travel to Tehran</i>	
	15/04/2023	Locust Heads, JS Team Leaders & Info Officers prepare JS report	Tehran
	16/04/2023	Locust Heads, JS Team Leaders & Info Officers submit JS report	Tehran
	17/04/2023	<i>Pakistan Locust Head, Team Leader, Info Officer fly to Karachi</i>	

Appendix 8. Photos



I.R. Iran team (L-R): Fardin Mirzaie (Driver), Parviz Bolydeh (Driver), Abdolkarim Haghtalab (Extra Driver), Pankaj Salunke (India Locust Officer), Bahram Salari (Asst. Locust Officer), Javad Ravandeh (Locust Officer), Mahmoud Chalakizabardast (Team Leader)



Using eLocust3 and eLocust3m in I.R. Iran



Checking soil moisture at each stop in I.R. Iran



Solitary adult seen on the Vashnam Plains, I.R. Iran



Typical annual vegetation seen during the survey



Coastal habitat at Zarabad-Darak, I.R. Iran



Undertaking foot transects at each stop in I.R. Iran



Undertaking foot transects in Pakistan



Checking soil moisture during survey stops in Pakistan



Using eLocust3 and eLocust3m at each stop in Pakistan



A fourth instar *transiens* hopper near Jiwani, Pakistan



Fledging in the Kolanch Valley, Pakistan



Solitarious adult seen in the Kolanch Valley, Pakistan



L-R: Muhammad Ishfaque (Pakistan), Mohammad Ahmadifar (Iran), Mahmood Chalakizabardast (Iran), Muhammad Tariq Khan (Pakistan), Keith Cressman (FAO), Allah Ditta Abid (Pakistan), Muhammad Hassan (Pakistan), Fakhar ul Zaman (Pakistan), Akhlaque Hussain (Pakistan), Shahbaz (Pakistan)