Two days National Training Workshop
On Desert Locust

During 29th & 30th June, 2017

at

Government of India

Ministry of Agriculture & Farmer's Welfare
Department of Agriculture Cooperation & Farmer's Welfare
Directorate of Plant Protection Quarantine & Storage
Locust Warning Organization, Jodhpur-342001 Rajasthan (India)

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Report prepared by: LWO Jodhpur (e-mail : lwo-jod-rj@nic.in)

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Introduction:

During the 30th Session of South West Asia Commission(SWAC) (A FAO Commission for Controlling the Desert Locust in South West Asia), it was decided that the trust fund will supplement national training workshops upon request by the member country that includes workshop date, participant, trainers, subjects and detailed budget. In order to implement the same and strengthening technical skill of officials involved in desert locust related activities, India has planned a Two days National Training Workshop on Desert Locust. In this connection, a detailed program including training schedule, training date, List of participants, estimated budget etc. prepared and sent to the appropriate authorities for approval/sanction. After detailed deliberations between LWO, Directorate of Plant Protection Quarantine & Storage and FAO, a national training program was finalized. Various improvements suggested by FAO and the Directorate for organizing the national training program were accepted and date were finalized i.e. 29th & 30th June, 2017. The Commission released Rs. 49000/- for organizing the training workshop.

Resource Persons:

In consultation with SWAC and the Directorate six numbers of resource persons have been identified as a Trainers. These resource persons had undergone FAO organized training program on **"**India National Training of Trainers (TOT) Workshop on Desert Locust Survey and Control Operations**"** at LWO Jodhpur during the period of 27th October 2014 to 1st November, 2014. Wherein based on the observation of discussions, Classroom and field exercises, demonstrations, practice training session, Pre and Post evaluation test FAO identified these Master Trainers.

These six resource persons were advised in advance for preparation of their respective lectures and other responsibilities assigned to them for smooth conducting of the national training workshop. They have been requested to report at the training venue one day before of the commencement of the training

workshop to discuss preparation and effective training. They were also advised to use latest teaching methods viz best use of Power Point Presentation, White Board, Chart Papers, Live Specimens, Models, field exercises besides the participatory approach amongst the participants during the course of training workshop. The List of resource persons is annexed in **annexure-I.**

Participants:

Locust Warning Organization, Jodhpur has its 11 Circle offices situated in the entire Scheduled Desert Area of India. Keeping in view the limited resource persons it has been decided to identified and select 24 trainees participants from different Locust Circle offices giving equal representations to each circle office. Beside two participants were identified from Locust Unit at National Headquarter Faridabad. These trainees participants are involved in field survey & related activities at their respective field offices and National Headquarter were identified to participate in the training. Initially it was decided to choose qualified, newly appointed and some old experienced person and rest will be trained in the subsequent batches. A list of trainees participants is annexed at **Annexure-II**.

Training Program:

Keeping in view the locust active season in India which commence from June month, It was decided to organize the National Training workshop during 29th & 30th June, 2017 on locust biology & behavior , survey , eLocust3 & RAMSES, field exercise, etc. Accordingly a detail schedule of training programme including date, time for each classroom and field activities was identified with respect to the training was prepared and got approved by the appropriate authorities. A copy of the programme is annexed (**Annexure-III**).

Day 1 : 29.06.2017

Registration of the participants:

The National Training Workshop began with the registration of participants / resource persons. During the registration the participants were provided Folder, Training literature, Note pad & pen.

Inaugural Session : Inaugural session started with welcome address by Dr. J. P. Singh, Joint Director (Ento.) Locust Warning Organization, Jodhpur. In his welcome address he has encouraged all the participants to adopt participatory approach during the course training workshop. It was also emphasized that the participants use their practical experience in order to improve skill of trainees' participants. In his special address Dr. B. S. Phogat, Additional Plant Protection Adviser (IPM & LC), DPPQ & S briefed about history of locust in India. He has also enumerated about the background of the national training programme and its usefulness to the participants in order to improve their skill in decision making on locust. Considering the facts that many new comers have joined the locust scheme either their first entry into the Government system or transfer from other scheme, the national training programme will provide required knowledge and exposure to these new entrants in dealing with locust related work.

Pre-evaluation Test :

In order to evaluate the skill of the participants, a pre-evaluation test was conducted. The test paper was comprising of objective questions related to biology, behavior, survey & eLocust3. All trainees participants have attempted the pre evaluation test. The comparative result of pre evaluation / post evaluation test is given at **annexure-IV.**

Technical Session :

Classroom lectures / exercises :

During classroom technical session Dr. R. P. Sharma, Assistant Director (Ento) Headquarter, Faridabad delivered lecture on desert locust introduction "What are locusts", "Desert Locust Survey introduction and survey process" by using power point presentation, writing white board. After that Shri Sahi Ram Bishnoi, APPO RPQS, Amritsar elaborated on "What Information to collect" , How

to report Survey result" and "Other source of information" by using Power Point Presentation, White board.

After lunch, technical session resumed with the topic of Shri Mahavir Sharma, Assistant Plant Protection Officer CIPMC Solan who explained "Why make survey?", How to plan survey?" and "How to organized a survey?" using all the means of training techniques followed by Shri Chandra Shekhar Sharma, Scientific Assistant, LWO Jodhpur who explained "An overview on eLocust3 & RAMSES" using PPT, eLocust3 tablet and white board, Color maps.

After a short tea break Shri P.K.Gour, Scientific Assistant, Locust Circle Office, Bhuj elaborated on "Detailed Study of eLocust3 & RAMSES" using PPT, eLocust3 tablet, white board & Color maps.

During end of the session it was a group discussion on locust situation as well as question answer session where all the trainees participants enthusiastically participated in the session which made the atmosphere charged and interesting.

At the end of first day of the training workshop Shri Mahavir Sharma, master trainer wrapped up the day's activities and thanks the participants and master trainers for their active involvement. He has further briefed the participants on mock drill exercise to be conducted next day morning i.e. on 30.06.2017.

Day 2 : 30.06.2017

Field exercise:

During second day of the training workshop i.e. 30.06.2017 at 08.00 AM, all the trainees participants along with Master trainers reached to the assigned field for mock drill. The trainees participants were divided in to four groups and each group was explained about the field exercise to be conducted. Each group is

provided eLocust3. Shri Baldev Singh Assistant Plant Protection Officer, FSIL Bikaner conducted mock drill and field demonstration of desert locust survey and Shri P.K.Gour, Scientific Assistant LCO Bhuj demonstrated the use of eLocust3 in the field. This exercise lasted for three hours. After conducting field exercise all the participants as well as Master Trainers came back to the training venue for the remaining technical session.

Classroom lectures / exercises :

During pre lunch session Shri Mahavir Sharma APPO CIPMC Solan explained in detail the "locust phases" using PPT, white board along with live specimens of desert locust species brought from FSIL Bikaner followed with the lecture of Shri Baldev Singh FSIL Bikaner on the "Life cycle of desert locust".

After lunch break Dr. R.P.Sharma, AD(E) Hqr, Faridabad explained in detail the "Migration and seasonal distribution of Desert Locust" followed by the lecture of Shri Sahi Ram Bishnoi APPO RPQS, Amritsar who elaborated on "Desert Locust Recessions, Upsurges, Plagues, Declines" which was followed by a group discussion organized amongst the all six groups where each team leader of a group has presented a brief on the two days training workshop.

Post training evaluation Test:

After completion of the technical session a post training evaluation test was undertaken to evaluate the difference in skill of the participants. Result of pre & post evaluation test is shown in **Annexure-IV**.

Wrap up : At the end of the National Training Workshop all the activities undertaken during the course of two days training were once again briefed to the participants and doubts were clarified on various topics related desert locust.

Conclusion:

The following observations are made on the two days National training workshop on desert locust:-

1. Classroom discussions & field exercises viz. demonstration on eLocust3 and locust survey provided excellent practice training session to the participants which not only improved the skill of the participants but also sensitize them to think beyond the box on all relevant issues.
2. Pre and Post evaluation test results indicates that participants have acquired the fresh knowledge on the relevant topics covered during the training workshop.
3. At the end of the programme all group leaders briefed the house with improved skill and sense of satisfaction which reflects positivity of participatory approach of the training workshop.
4. The workshop offered an opportunity to improve technical skill by learning & doing method. All participants were exchanged their knowledge and experience during the field exercise & group discussion session.
5. The participants expressed their keen interest more in practical session followed by classroom training and suggested to continue such training program frequently in future.
6. Apart from the existing participants in the national training workshop, the remaining technical officials from Locust Organisation, State department of agriculture, Rajasthan, Gujarat and Jammu & Kashmir needs to be imparted similar training for which proposal needs to be submitted shortly.
7. Entire workshop conducted in Hindi and English languages. Keeping in view of positive feedback of the participants and success of this program, it has been decided to submit a proposal for next training on “Locust Control Techniques” and other important subject.

Annexure – I

List of Resource Person

S.No.	Name of Resource Person	Designation	Headquarter
1	Dr.R.P.Sharma,	AD(E)	Hqrs, Faridabad
2	Shri Mahaveer Sharma	APPO	CIPMC, Solan
3	Shri Baldev Singh	APPO	FSIL Bikaner
4	Shri Sahi Ram Bishnoi	APPO	RPQS, Amritsar
5	Shri P.K.Gour	SA	LCO Bhuj
6	Shri C.S.Sharma	SA	LWO Jodhpur

Annexure – II

List of trainees

S.No.	Name of participants	Designation	Headquarter
1	Dr.Narasa Reddy	APPO	Hqr, Faridabad
2	Shri Ram Kumar	SA	Hqr, Faridabad
3	Shri Om Prakash	APPO	LWO Jodhpur
4	Shri Kishan Lal	TA	LWO Jodhpur
5	Dr.Pankaj Salunke	APPO	LCO Suratgarh
6	Shri K.V.Choudhary	APPO	LCO Barmer
7	Shri Ugra Ram	SA	LCO Barmer
8	Shri Manni Ram	SA	LCO Barmer
9	Shri Babu Lal Meena	APPO	LCO Jaisalmer
10	Shri Amit Kumar Meena	APPO	LCO Jaisalmer
11	Shri Rakesh Kumar	APPO	LCO Jaisalmer
12	Shri Rahul Raman	APPO	LCO Suratgarh
13	Shri Mohan Lal Tailor	SA	LCO Churu
14	Shri Manoj Kumar Meena	APPO	LCO Palanpur
15	Shri Dharma Ram	SA	LCO Palanpur
16	Shri C.K.Mehsram	APPO	LCO Bhuj
17	Shri Shobha Ram	SA	LCO Bhuj
18	Shri Ramkaran	SA	LCO Bikaner
19	Shri Kishna Ram	SA	LCO Jalore
20	Shri Rakesh Kumar	TA	LCO Jalore
21	Shri Duda Ram	SA	LCO Nagaur
22	Shri Dalip Kumar	SA	LCO Nagaur
23	Shri Pawan Kumar	APPO	LCO Phalodi
24	Shri Ranjeet Raman	TA	LCO Phalodi

Annexure - III

Schedule of Two Days Training Programme

Date	Time	event
29.06.2017	09.30-10.00	Registration of participants
	10.00-10.05	Lighting of lamp
	10.05-10.15	Welcome address by Dr.J.P.Singh, Joint Director(E), LWO Jodhpur
	10.15-10.30	Special address by Dr. B.S.Phogat, APPA(IPM & LC) Hqr Faridabad.
	10.30-10.40	Vote of thanks by Mohammad Amjad, AO, LWO Jodhpur
	10.40-11.00	Tea break
	Technical Session	
	11.00-11.20	Pre evaluation Test
	11.20-12.00	Lecture "Desert Locust Introduction" "What are Locust" by Dr.R.P.Sharma, AD (E) Hqr Faridabad.
	12.00-12.40	Lecture "Desert Locust Survey Introduction" & Survey process by Dr.R.P.Sharma, AD (E) Hqr Faridabad.
	12.40-13.20	Lecture "What Information to collect", "How to report survey result" & "other source of information" by Shri Sahi Ram Bishnoi , APPO, RPQS, Amritsar.
	13.20-14.20	Lunch
	14.20-15.00	Lecture "Why make survey", "How to plan a survey" & "How to organize a survey" by Shri Mahaveer Sharma, APPO, IPM Solan.
	15.00-15.40	Lecture "An overview on eLocust3" & "RAMSES" by Shri Chandra Shekhar Sharma, SA,LWO Jodhpur.
	15.40-16.00	Tea Break
	16.00-16.50	Lecture "Detail study of eLocust3" & "RAMSES" by Shri P.K.Gour, SA LCO Bhuj.
	16.50-17.20	Group discussion on Locust situation and question/answer session
	17.20-17.30	Wrap up
30.06.2017	8.00	Arrival to the mock drill site
	8.00-11.00	Mock drill & field demonstration of "desert Locust survey" by Shri Baldev Singh APPO, FSIL Bikaner and demonstration of eLocust3 by Shri P.K.Gour, SA LCO Bhuj.
	11.00-11.15	Tea break
	11.15-11.35	Arrival to the lecture venue
	11.35-12.10	Lecture "Locust Phase" by Shri Mahaveer Sharma, APPO, IPM Solan.
	12.10-13.00	Lecture "Life Cycle of Desert Locust" by Shri Baldev Singh APPO, FSIL Bikaner.
	13.00-14.00	Lunch
	14.00-15.00	Lecture "Migration and seasonal distribution of Desert Locust" by Dr.R.P.Sharma, AD (E) Hqr Faridabad.
	15.00-15.45	Lecture "Desert Locust Recessions, Upsurges, Plagues, Declines" by Shri Sahi Ram Bishnoi, RPQS Amritsar.
	15.45-16.45	Group Presentations
	16.45-17.15	Post training evaluation
	17.15-17.30	Wrap up and closing.

Annexure - IV

Test result : Pre & Post training evaluation

S.No.	Name of participants	Pre evaluation	Post evaluation	Difference (+/-)
1	Dr.Narasa Reddy	69	93	+24
2	Shri Ram Kumar	65	91	+26
3	Shri Om Prakash	89	98	+09
4	Shri Kishan Lal	40	58	+18
5	Dr.Pankaj Salunke	89	93	+04
6	Shri K.V.Choudhary	61	93	+32
7	Shri Ugra Ram	50	75	+25
8	Shri Manni Ram	55	83	+28
9	Shri Babu Lal Meena	54	84	+30
10	Shri Amit Kumar Meena	40	86	+46
11	Shri Rakesh Kumar	65	83	+18
12	Shri Rahul Raman	51	98	+47
13	Shri Mohan Lal Tailor	56	84	+28
14	Shri Manoj Kumar Meena	70	74	+04
15	Shri Dharma Ram	45	70	+25
16	Shri C.K.Mehsram	27	64	+37
17	Shri Shobha Ram	15	55	+40
18	Shri Ramkaran	47	81	+34
19	Shri Kishna Ram	70	87	+17
20	Shri Rakesh Kumar	47	71	+24
21	Shri Duda Ram	70	86	+16
22	Shri Dalip Kumar	26	61	+35
23	Shri Pawan Kumar	45	86	+41
24	Shri Ranjeet Raman	51	76	+25

Annexure-V

Power Point Presentation

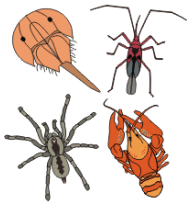
Desert Locust Introduction
What are Locust

WELCOME

Dr. R. P. Sharma
Assistant Director (E)
Directorate of Plant Protection, Quarantine & Storage
Faridabad (Haryana)

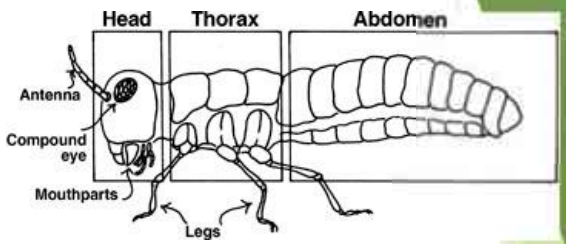
Classification of Insects

- Kingdom Animalia
  - Invertebrates
- Phylum Arthropoda
  - Exoskeleton
  - Jointed legs

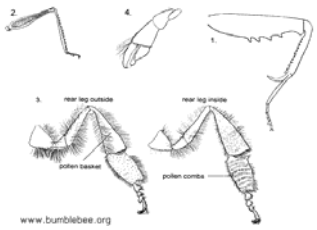


Class Insecta Characterisitics

- 3 body parts



- Six legs



Class Insecta Characteristics

- Two pairs of wings

- Two kinds of eyes
  - compound

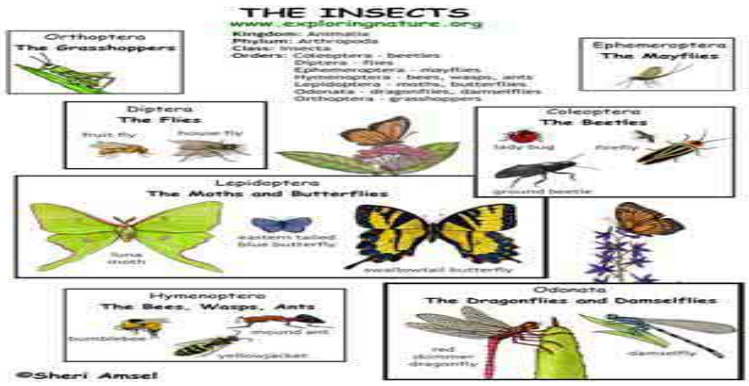
Class Insecta Characteristics

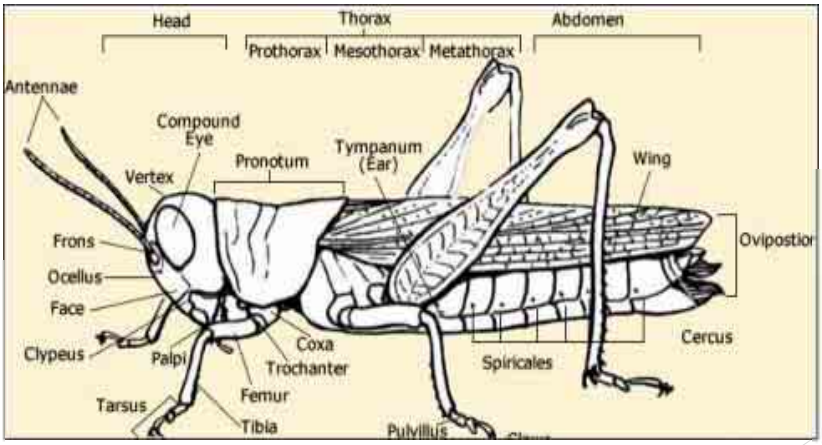
- Two Antennae

Class Insecta Characteristics

- All insects begin their life cycle as an egg.

Insect Orders

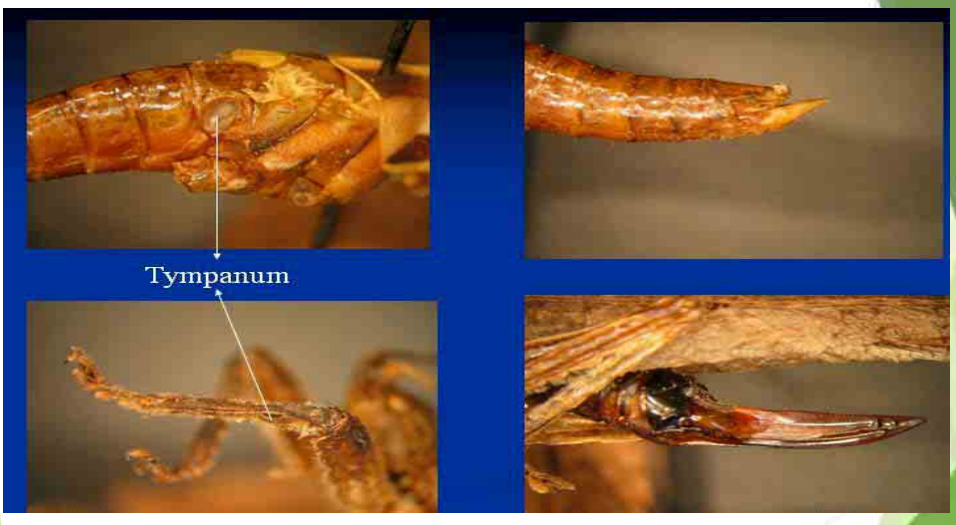




Orthoptera (Grasshopper, Cricket and katydids)

- Antenna shorter or longer than body
- Prothorax large, hind legs modified for jumping
- FW tegmina, HW membranous
- Cerci one to many segmented
- Ovipositor short or as long as body
- Gradual metamorphosis

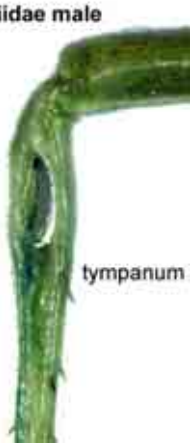
Sub order : Ensifera	Sub order : Ceilifera
1. Antenna as long as or longer than body (> 30 segments)	1. Antenna shorter than body (< 30 segments)
2. Tympanum on *fore tibia*	2. Tympanum on *1st abdominal segment.*
3. Ovipositor long and sickle or tubular shaped	3. Ovipositor *short and blunt*
4. Sound production by *alary mechanism*	4. Sound production by *femoro - alary mechanism*
Eg. Long horned grasshopper, cricket	Eg. Short hornedgrasshopper



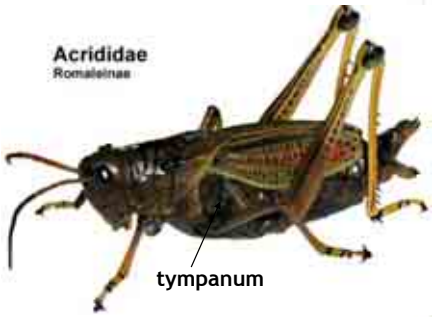
Tettigonidae (Long horned grasshopper)

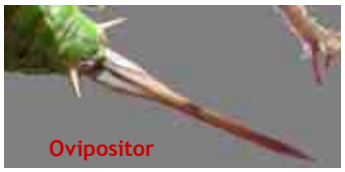
1. Antenna as long as or longer than body
2. Tympanal organ on fore tibia
3. Tarsi four segmented
4. Ovipositor elongate, tubular or sword like
5. Stridulatory organs or present on wings (Alary mechanism)

Tettigoniidae male



Acrididae
Romaleinae





Tettigoniidae

Schizodactylidae
Schizodactylus monstrosus

Gryllidae
Gryllus bimaculatus

Desert locust, *Schistocerca gregarea*

What is Desert locust ?

The Desert Locust is one of about a dozen species of short-horned grasshoppers (Acridoidea) that are known to change their behavior and form swarms of adults or bands of hoppers (wingless nymphs). The swarms that form can be dense and highly mobile. The Latin name for Desert Locust *is Schistocerca gregaria* (Forskal).

Different Types of Locusts

Although the Desert Locust is considered to be the most important species of locust due to its ability to migrate over large distances and rapidly increase its numbers, there are several other important species of locusts throughout the world:

◦

S. No.	English Name	Scientific Name
1.	The Desert Locust	*Schistocerca gregaria*
2.	The Bombay Locust	*Nomadacris succincta*
3.	The Migratory Locust	*Locusts migratoria manilensis;* *Locusta migratoria migratoria-oides*
4.	The Italian Locust	*Calliptamus italicus*
5.	The Moroccan Locust	*Dociostaurus morocannus*
6.	The Red Locust	*Nomadacris septemfaciata*
7.	The Brown Locust	*Locustana pardalina*
8.	The South American Locust	*Schistocerca paranensis*
9.	The Australian Locust	*Chortoicetes termenifera*
10.	The Tree Locust	*Anacridium* Spp.

LOCUSTS REPORTED IN INDIA

Desert locust (*Schistocerca gregaria*)		
Migratory locust (*Locusta migratoria*)		
Bombay Locust (*Nomadacris succincta*)		
Tree locust (*Anacridium* spp.)		

Difference between Grasshopper and Locusts

1. The locust is a type of a grasshopper which is short horned. The grasshopper is not a type of a locust.

2. Both belong to the order Orthoptera.

3. The grasshopper belongs to the suborder known as Ensifera while the locust belongs to the suborder Caelifera.

4. The grasshopper has 28 distinct families while the locust has only 1 family.

5. Both are short horned and have short ovipositors, two, short antennae, long back legs used for leaping, and mandibles which are strong.

6. Both adults of the locusts and grasshoppers have two wings in the front and two membranous wings in the back which are all fully developed.

7. Both are regarded as delicacies in certain parts of the world.

8. Locusts can exist in two different behavioral states which are migratory and gregarious while grasshoppers do not.

9. Locusts may change their body shape and color, fertility, and survival behavior while grasshoppers generally do not.

10. Locusts can form dense swarms and bands while grasshoppers generally do not.

Terminologies

Solitarious: Phase when individuals live mostly separate from each other.

Gregarious: Phase when large numbers of individuals gather together.

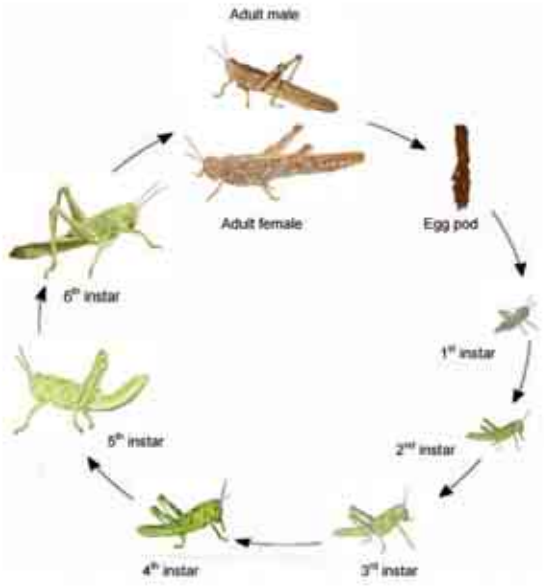
Transiens: Intermediate phase when locusts are grouping and starting to act as a single mass and are either changing from solitarious to gregarious (gregarization) or from gregarious to solitarious (dissociation).

Congregans: Part of the transiens phase during which locusts are congregating and are in transition from the solitarious to the gregarious phase. Often used for nymphs.

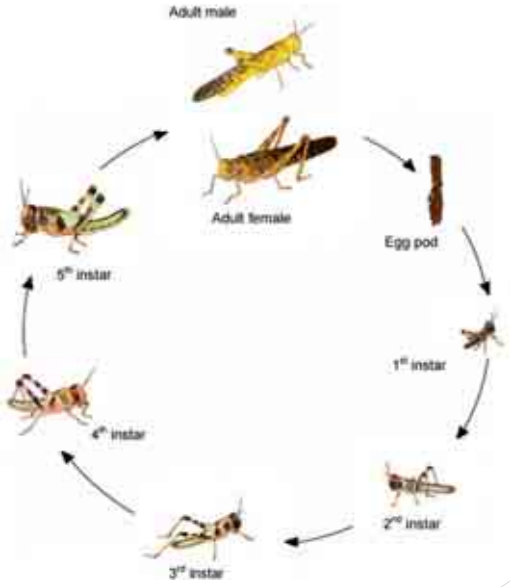
Dissocians: Part of the transiens phase during which locusts are in transition from the gregarious to the solitarious phase. Often used for nymphs.

Solitaricolour: Showing types of colour associated with solitarious behaviour.

Gregaricolour : Showing types of colour associated with gregarious behaviour



Life Cycle of the solitarious phase of the desert locust, *Schistocerca gregaria*



Life Cycle of the gregarious phase of the desert locust, *Schistocerca gregaria*.

What is the difference between hopper groups and bands?

One should carefully observe their behaviour and appearance. Groups will contain some hoppers that are starting to behave in the same manner but not all individuals will be doing this. Their colours are a mixture of those commonly associated with solitarious and gregarious individuals, that is, green with some black markings. On the other hand, bands consist of all or close to all of the locusts behaving in the same manner. Their appearance is distinctive hoppers in bands are either black (when young) or yellow with black markings

What is the difference between adult groups and swarms?

One should carefully observe their behaviour and their appearance. Groups will contain adults that are starting to behave in the same manner but not all individuals will be doing this. Their colours are a mixture of those commonly associated with solitarious and gregarious individuals, that is, a pinkish (immature) or yellowish (mature) appearance. On the other hand, swarms consist of all or close to all of the adults behaving in the same manner. Their appearance is distinctive: pink for immature swarms and yellow for mature.

Locust swarm

Desert Locust Survey Introduction & Survey Process

WELCOME

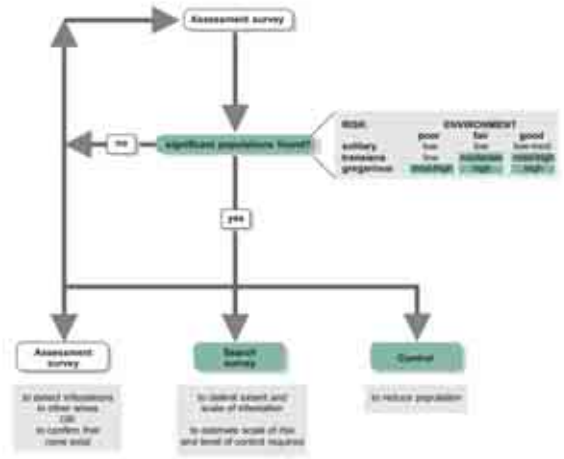
Dr. R. P. Sharma
Assistant Director (E)
Directorate of Plant Protection, Quarantine & Storage
Faridabad (Haryana)

SURVEY PROCESS

A logical approach is required in monitoring Desert Locusts and their habitat in order to collect the maximum amount of information in the shortest possible time, using the minimum resources.

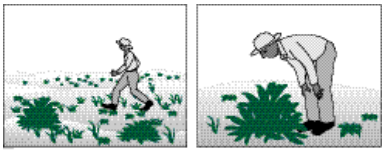
Surveys should be planned according to the locust situation, ecological conditions in the field and the risk that populations may develop further and require additional monitoring and perhaps control

Summary of the Survey Process



low
moderate
moderate-high and high
insignificant populations; unlikely to require any further assessment
significant populations; requires additional assessment
significant populations; requires substantial assessment and search

Step 1. Identify who will make a survey.



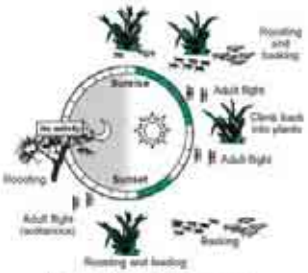
Qualified locust field officers

Local scouts, extension agents and others

1. Qualified and experienced Locust Field Officers
2. Local scouts may be employed to monitor small areas. For example, local scouts may be responsible for checking an area every month or after it rains.
3. Agricultural Extension Agents can be used in a similar manner.

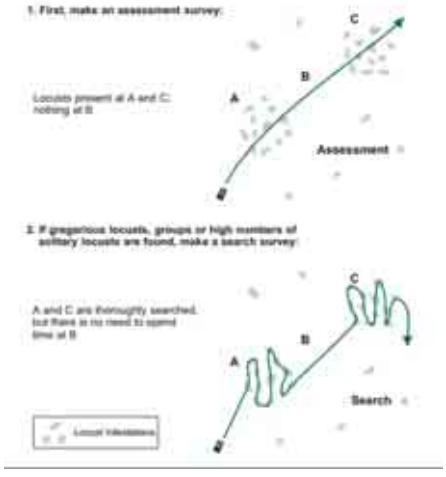
Step 2. Determine where and when to make the survey.

Where and when to survey during the year



When to survey during the day
(after sunrise to about midday + late afternoon)

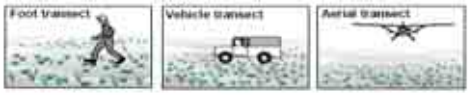
Step 3. Decide which type of survey.



Assessment surveys are first undertaken to see if locusts are present.
If significant populations are found, then the area is intensively searched (called a search survey) to estimate the total infested areas and delimit them for subsequent control operations.

Step 4. Which Survey Method to Use

1. There are three survey methods: foot transects, vehicle transects and aerial transects.



Work rate of different survey methods

	Foot	Vehicle	Aerial [1]
Distance travelled/hour	4 km	30 km	200 km
Distance travelled/day	20 km	200 km	800 km
Width of search:			
low density populations	10 m	10 m	n.a.
hopper bands [2]	0.1-2 km	0.1-2 km	0-5 km
settled swarms [2]	0.1-2 km	0.1-2 km	0-10 km
flying swarms (large)	20 km (5-50 km)	20 km (5-50 km)	30 km (5-100 km)
Area of search:			
low density populations	0.2 km²	2 km²	n.a.
hopper bands [2]	2-40 km²	20-400 km²	0-2 000 km²
settled swarms [2]	2-40 km²	20-600 km²	0-6 000 km²
flying swarms (large)	400 km² (100-1 000 km²)	400 km² (1 000-10 000 km²)	16 000 km² (3 000-50 000 km²)

[1] fixed-wing aircraft
[2] including information from local inhabitants during foot and vehicle surveys

A foot transect consists of walking a certain distance in the desert and making observations in order to collect data about locusts, rainfall, vegetation and

Summary of how to make a foot transect:
- **walk about 300 m**
- **count adults that fly up**
- **estimate transect width (locust disturbance)**
- **inspect at least 10 bushes or 10 one m2 patches on the ground for hoppers**
- **check soil moisture**
- **count when temperature >20°C and wind <6 m/s**

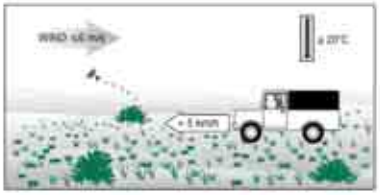
1. Stop in areas where locusts may be present, usually those that are sandy such as plains and dunes and close to seasonal rivers (wadis) where green annual vegetation is present. After stopping the vehicle, write down the date, the name and the latitude and longitude of the location using a global positioning system (GPS). If you do not have a GPS, determine the approximate position using a map. It may be necessary to ask a local person the name of the place.

2. Walk into the wind (upwind) or crosswind. If more than one person is making a transect, each one should go in a different direction. There is no need for two people to walk together. It is much better to go in different directions. Start by walking at least 100 m. Estimate this distance from the number of steps that you take.

3. As you walk, observe the greenness and density of the vegetation. Stop several times to check if the soil is moist. Count locusts that fly up in front and to the side, being careful not to count the same one more than once. A hand tally counter may be used. Note locust colour, behaviour and maturity. You may want to try to catch a few. Determine the width of your transect by estimating the distance in which adults are being disturbed when walking (usually about 1-4 m on either side, depending on the time of day, temperature and habitat).

4. Stop occasionally and closely inspect the ground and the vegetation for hoppers, noting what instar stage, colour, behaviour and number per bush or per square metre. Repeat this up to ten times. After walking at least 100 m, the Locust Field Officer should return to the vehicle by a different route at least 50 m away from the first route, continuing to count locusts . The results should be written down on the survey form or entered into a handheld computer before going to the next stop.

Vehicle transects



Summary of how to make a vehicle survey:

- drive upwind or crosswind for at least 1 km
- drive at a walking pace in low (4WD) gear
- count adults that fly up in front of the vehicle's hood
- keep track of the distance driven using the odometer
- count only when the temperature is above 20°C and wind speed less than 6 m/s

Vehicle transects are a useful method to determine if adults are present over a large area such as a sandy plain or within large areas of green vegetation. By counting the adults, an estimate can be made of how many are present in the transect. It is very difficult to see hoppers from a moving vehicle and therefore it is better to do this using the foot transect method.

Estimates of adults can be made from a vehicle by looking out of the front window and counting adults that fly up in front of the vehicle in a strip equal to the width of the vehicle, about 1.5 m in most cases . The vehicle must be driven at a walking pace in low gear. It should be driven upwind or crosswind to reduce the number of adults that are counted more than once. Most of the adults in the strip will fly up if it is sunny and warmer than 20°C and wind speed is less than 6 m/s (20-25 km/h). If you drive too fast (more than 5 km/h), the adults will not fly up and you will think that there are no locusts present. The transect distance should be measured using the odometer. Vehicle transects should be at least one km in length.

Results from vehicle transects should be noted in the comments section of the next survey stop on the *FAO Desert Locust Survey and Control Form*, simply stating the number of locusts seen in the distance (km) travelled, for example 10 locusts/1 km. Vehicles can also be used to measure the sizes of settled swarms and large hopper Bands and to delimit target blocks of bands or a scattered swarm for control.

Aerial Sprays

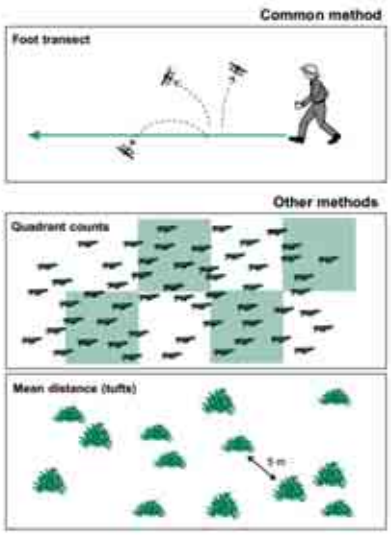
Helicopters can be used to identify areas of green vegetation and locust infestations such as swarms and hopper bands from the air. They can be used to flush out moderate to high numbers of individual adults from vegetation. Helicopters can also be used to verify unconfirmed reports of infestations and visit areas that are difficult to access by vehicle. The main advantage of using a helicopter when compared to fixedwing aircraft is its ability to land almost anywhere and allow the Locust Field Officer to get out and make a foot transect in the area of interest. For identifying areas of green vegetation, the helicopter should fly about 300 metres above the ground in a straight line, similar to that for fixed-wing aircraft. Settled swarms and large hopper bands should also be visible by looking down at an angle from this height. To determine whether an area of green vegetation contains individual locust adults, the pilot should first identify the green area, then drop down to just a few metres above the ground (as low as safely possible and not higher than 5 metres above the ground), reduce the speed to 40-50 km/h and fly over the vegetation and swing the tail from side to side. This will disturb any locusts that may be present and they will fly up from about midpoint under the helicopter. The observer should look out of the window towards the rear to see if locusts fly up behind the helicopter. Upon reaching the end of the green vegetation, the pilot should increase altitude and speed.

Some essential items that should always be taken when going on a survey.

An example of a completed *FAO Desert Locust Survey and Control Form* used for recording information.

How to record and send survey and control results to the National Locust Unit headquarters.

Other Sampling Techniques that can be Undertaken at the Survey Site



Migration and Seasonal Distribution of Desert Locust

WELCOME

Dr. R. P. Sharma
Assistant Director (E)
Directorate of Plant Protection, Quarantine & Storage
Faridabad (Haryana)

Dispersal

A. Dispersal through walking

- Immature stages of insects disperse through locomotion
  - Armyworm

B. Dispersal through flying

1.Trivial flight

- Displacement of insects with in breeding or feeding sites
- Usually movement over short distances
- Typically does not involve displacement of entire populations
  - Butterfly feeding, lightning, bug mating

2

2. Migration

- ✓ It involves displacement of **entire populations** - from breeding, feeding and over-wintering sites - flight
- ✓ Hundreds of kilometers
- ✓ Individuals predisposed to flight or transport

  Eg: Non-appetetial behaviours- un distracted by mates, food or oviposition sites
- ✓ Regular feature of seasonal cycle for some insects
- ✓ Can result in substantial mortality, only a minute fraction may locate suitable habitat

3

Migration

Mass movement of entire population where some insects return again to the area from which they had moved.

(Dhaliwal, 2003)

4

What is migration?

1. **Persistent prolonged movement**
2. **Straightened course of movement**
3. **Undistracted by usual stimuli (e.g. food, mates)**
4. **Distinct departure and arrival behavior**
5. **Reallocation of energy in advance of migration**

5

Migration within boundary layer

- ✓ That altitude at which wind speed equal to insect flight speed below the boundary layer insects can have direct flight
- ✓ Usually only a few meters high, flight of insect directly observable
- ✓ Insects control their own flight path, seem to maintain the study course

Eg: migrating butterflies (monarch butterfly), dragonflies

6

Migration above the boundary layer

A. Usually combines flight with wind aided transport

- ❖ Insect may not be in control of flight
- ❖ Transported by wind

Eg: Aphids

B. Aspects of migration above the boundary layer (Muscular system)

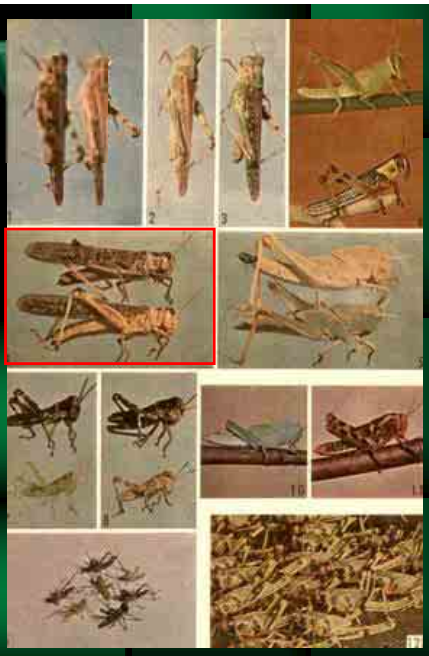
Eg: Desert locust: *Schistocerca gregaria*

7

Migratory Locust, *Schistocerca gregaria* (ORTHOPTERA)

- Gigantic ***swarms***
- Long-distance migration
- Environmentally modulated
- Food- & interaction-stimulated
- Generational ***phase change***
- ***Reproductive diapause***

8



Kentromorphism: polymorphism with generational change from a sedentary to a migratory phase.

9

Some migratory locust swarms may contain hundreds of billions of insects, weighing thousands of tons.

10

How far and how fast can Desert locust Migrate ?

Desert Locusts usually fly with the wind at a speed of about 16-19 km/h depending on the wind. Swarms can travel about 5-130 km or more in a day. Locusts can stay in the air for long periods of time. For example, locusts regularly cross the Red Sea, a distance of 300 km. In the past there have been some spectacular and very long distance swarm migrations, for example from North-West Africa to the British Isles in 1954 and from West Africa to the Caribbean, a distance of 5,000 km in about ten days in 1988. Solitary Desert Locust adults usually fly at night whereas gregarious adults (swarms) fly during the day.

Basic biology of locust migration

Breeding grounds are associated with "convergence zones" that generate predictable cyclical air movement

1) Sedentary phase for several generations.
2) Last generation crowded, female responds to abdominal contact by stress reaction on **CA**, reducing **JH** production.
3) Eggs develop into strong-flying migratory generation.
4) Mature migrants, mutually stimulated, lift off *en masse* with wind.
5) Fly for several hours, maintain swarm by visual contact edge control.
6) Drop to feed, keep flying.
7) Finally drop for final feed, production of sedentary generation.
8) Cycle continues with return migration.

12

Locust

Dociostaurus marocconus	Mediterranean countries
Locusta migratoria	Europe, Africa
Schistocerca gregaria	Northern Africa and western India
Locustana paradalina and *Nomadacris septemfasciata*	southern half of Africa
Melanoplus mexicanus	mid Western United States

13

- **Uvarov's phase theory, 1921 Species of migratory locust there is associated a more solitory, more sedentary grasshopper, differing often in colour, structure, physiology, and behaviour but actually a form or phase of the same species**
  - **Solitary phase**
  - **Gregarious phase**

14

- Migration of locust swarms appear to be more irregular and unpredictable
- Great height many swarms fly, the wind speed is greater than the maximum speed of the insects
- Wind is determining factor in the distribution and not any power of orientation in the locusts

15

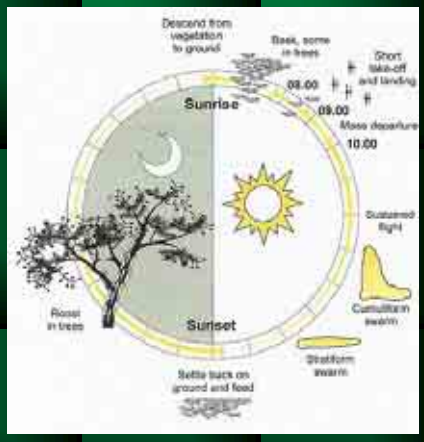
Migration of adults depends on meteorological conditions

- The migration of solitary adults occurs at night, usually 20 minutes after sunset when the air temperature is above 20-22 °C and the wind is less than 7 m/s.
- It is reported that 100% of the adults take off at > 27°C and the direction of the flight is downwind.

16

Structure of the swarms depends on meteorological conditions

Cool, overcast weather favours stratiform swarms while convective updrafts on hot afternoons promote cumuliform swarms.



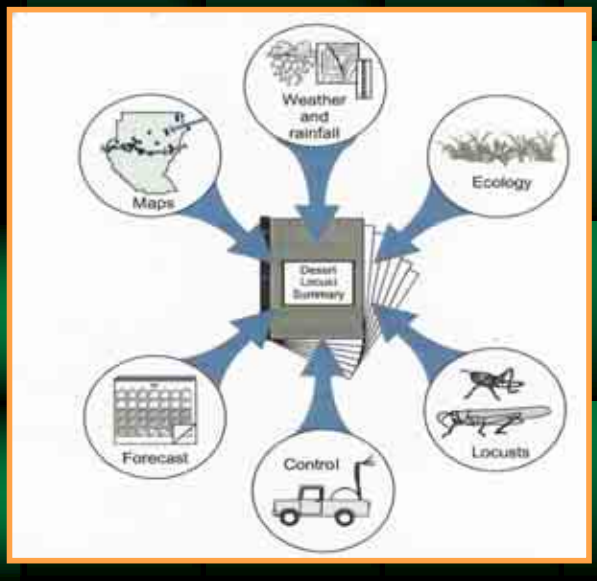
17

Swarms of locust

- Stratiform swarm : flat
- flying within few meters of the ground level
- Locusts are highly concentrated with densities 1-10/m^3
- Formed in absence of temperature gradient
- Cumuliform swarm : towering
  - ✓ towering 1000m above the ground
  - ✓ locusts are widely dispersed with densities 0.001-0.1/m^3
- Formed in presence of temperature gradient

18

Meteorological information is crucial for locust monitoring and control



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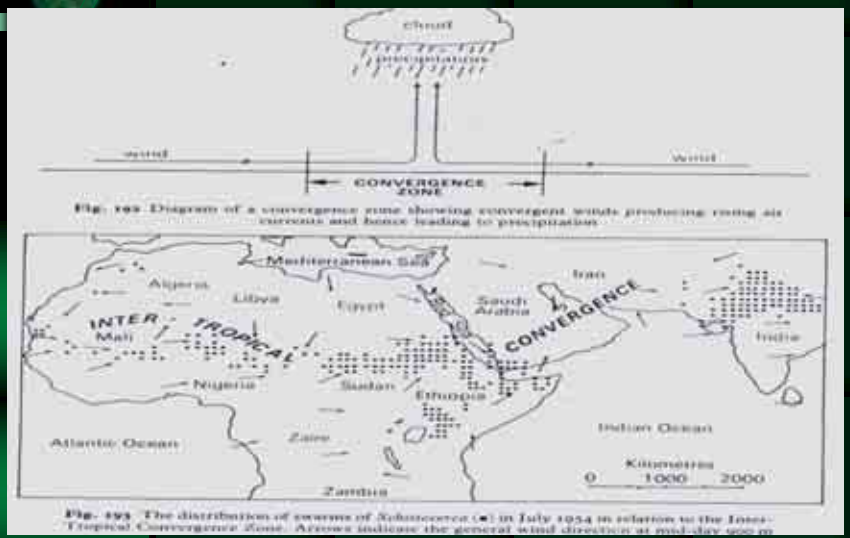
Distribution of *Schistocerca* in relation to ITCZ



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Distribution of Desert Locust in India

Desert Locust Biology & Behaviour

WELCOME

MAHAVIR SHARMA APPO
CIPMC, Solan

Desert Locust
Schistocerca gregaria

Desert Locust Phases

1. **Solitary Phase**
2. **Gregarious Phase**

Solitary Phase

- Hoppers are green in colour.
- Has six instars hoppers (six moultings)
- Adults are light brown sandy coloured
- Live individually, as adults or hoppers
- Low in numbers and scattered
- Migrate at night only for few hours
- Live longer, 90-160 eggs in the 3-4 pods.

Gregarious Phase

- Hoppers are yellow in colour with black spots.
- Has five instars (five moultings).
- Adults are pink (immature) and yellow (mature).
- Live in groups in big numbers.
- Migrate during the day for long distances.
- Live shorter, 60-80 eggs in the 2-3 pods.

Why make surveys ?

- Find what locust exist.
- Monitor changes in populations.
- Provide early warning of increase.
- Identify control targets.
- Allow better planning.
- Make accurate forecasts.
- Inform other countries.

The survey process

1. PLAN Who? Where? When?
   Survey type? (assessment, search)
   Survey method? (ground, air)
2. PREPARE Equipment
3. IMPLEMENT Collect, record & transmit data
4. FOLLOW-UP We found everything?
   assessment? Search?
   Control?

Planning surveys

- Identify who will make the survey.
- Determine where & when.
- Decide which survey type.
- Decide if by air or ground.
- Prepare vehicles and equipments.

Who make surveys?

- Qualified Locust field officers
  (RELIABLE)

- Local scouts extension agents
  (UNCONFIRMED)

Where to make surveys?
PLACES WHERE LOCUSTS ARE MOST LIKELY TO BE PRESENT

- Sandy areas with green vegetation.
- Areas of recent rainfall.
- Traditional (historical) areas.
- Previously reported places.
- Expected activity.

When to make surveys?
DURING THE YEAR

- After rainfall
- Regular basis (monthly/seasonal)
- Previous breeding
- Unconfirmed reports
- Expected invasions

When to survey during the day?

- 7 AM – NOON (SUNRISE) Roosting and basking
- 4 PM – SUNSET Roosting and feeding

DESERT LOCUST LIFE CYCLE

PRESENTED BY:

BALDEV SINGH

ASSISTANT PLANT PROTECTION OFFICER, (E)

(LOCUST MASTER TRAINER BY FAO)

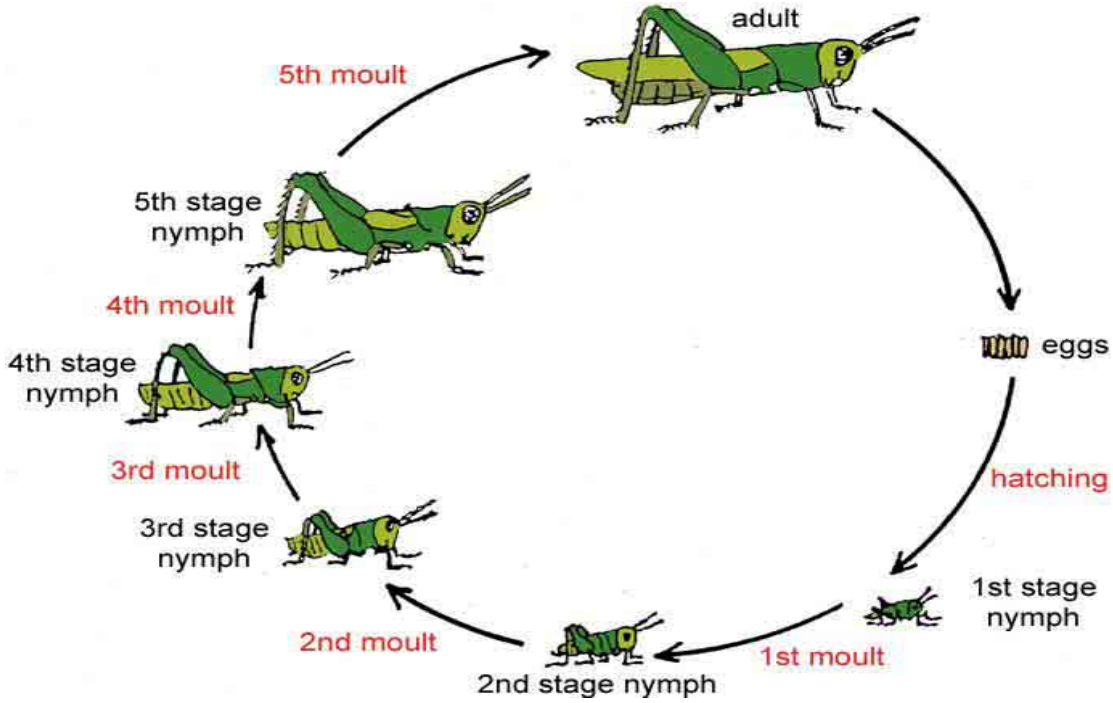
FSIL, BIKANER

DESERT LOCUST (*Schistocerca gregaria*) has a simple life cycle:-

Eggs

Nymph(*hopper*)

Adult


adult
5th moult
5th stage nymph
4th moult
4th stage nymph
3rd moult
3rd stage nymph
2nd moult
2nd stage nymph
1st moult
1st stage nymph
hatching
eggs

LIFE CYCLE

EGGS

After mating and laying,egg hatching depends on temperature and soil moisture:

.* 10-12days at soil temperature 32-35 Celcious

*Eggs do not hatch at more than 35Celcious and less than 15 Celcious.

*Egg hatching duration would be 10-65 days depends on soil Temp.and humidity.

Factors affecting rate of egg development:

*Flood and droughts * Temperatur

*Predators&Parasites *Wind

HOPPERS

Hoppers moult five(gregarious)to six time (solitarious) depends on locust phase:

*gregarious hoppers are generally yellow with black spotting,solitary hoppers are green in the first 3 instars and might continue green or changed to brown in older instars.

*Low temperature prolong the hopper stage,about 70 days at22 C and 22days at 37 Celcious,

*The final moult from fifth or sixth instar hopper to winged adult called fledgling,

*The fledgling adult is initially sexually immature.

*Maturation in favourable conditions could take 3 weeks but could take more than 8 weeks in unfavorable conditions, in cold dry conditions could reach6-8 months for maturation.

*Immature gregarious swarms migrate thousands of Kms to locate favourable conditions otherwise will never mature sexually.

ADULTS

*Gregarious immature adults pink in

colour, gregarious mature adults yellow in colour.

*Gregarious female lays 2-3 egg pods,of 60-80 eggs in each at a depth of 15 cm in soft sandy moist soil.

*Solitary adults are grey/brown in colour.

*Solitarious female lays 3-4 egg pods ,of 90-160 in each, at a depth of 15 cm in soft sandy moist soil.

*Female egg laying duration is 7-10 days, Locust could have three generations in the year.

*Adult duration is 3-5 months.

*Adults remain immature until they encounter condition that stimulate maturation.

*The period for maturation is highly variable,depending on habitate conditions, 3 weeks in favourable conditions and might reach 8 weeks in unfavourable conditions.

*Maturation may involve migration to another more favourable conditions ,adults are likely to remain immature for a longer period in cold or dry conditions.

*Male usually becomes sexually mature before female.

COPULATION

This is the mating act.The male jumps on the back of the female and holds on to her with the front pair of legs.The tip of their abdomen come into contact and the male sex cells (spermatozoa) are passed into the body of the female where they fertilize the eggs.

The time spent in copulation varies from 3-14 hours.

Two days National Training Workshop 29-30 June, 2017 LWO Jodhpur

Survey

Sahi Ram Bishnoi
Assistant Plant Protection Officer
RPQS, Amritsar

WHAT INFORMATION TO COLLECT

- Rainfall
- Vegetation
- Soil moisture
- Locust
- *Presence*
- *Appearance*
- *Behaviour*
- *Maturity*
- *Sexdetermination of adults*
- *Egg maturation*
- *Density*
- *Band and swarm sizes*
- Control operations
- Other comments

How to report Survey result

During ground or aerial surveys, information should be recorded on the *FAO Desert Locust Survey and Control Form or its equivalent by hand or entered into a handheld* computer. As soon as the Locust Field Officer returns to the field base or office, the completed form with the officer's own assessment of the results should be transmitted immediately to the National Locust Unit headquarters by facsimile or radio .

If the officer is using a handheld computer, the data may be transferred via HF radio modem or downloaded to a computer.

It is critical that the information is complete and sent very quickly to allow decisions to be made by the proper authorities as well as to send the information to FAO headquarters for further assessment. The form has been designed to allow completion in the field and transmission by facsimile or by radio If the information is sent by radio, each section and item can be referred to by the appropriate reference number on the survey form. It is not necessary to retype the results from the survey or prepare a long report because this takes time and often the information becomes summarized or mistakes are made. The Locust Field Officer should keep a copy of the report for reference.

Other sources of Information

- Nomads
- villagers
- security forces
- traders
- travelers

Recessions

The Desert Locust is normally present at low densities in semi-arid or arid areas, away from major agricultural zones. Desert Locusts do not cause significant crop damage, and hopper bands and swarms are rare or completely absent. These periods are called *recessions.*

The area within which these populations are confined and move around within isreferred to as the *recession area. It covers about 16 million km2 and includes some 30* countries.

Outbreaks

The transition from a recession situation to one of plague is characterized by outbreaks and upsurges. An outbreak occurs when there is an increase in locust numbers through concentration, multiplication and gregarization, which takes place over several months. While an outbreak is often localized and restricted to certain habitats, it can lead to the formation of bands and swarms unless it is controlled
The early stages of an outbreak are often unobserved. Hoppers may be concealed in the vegetation and easily missed during surveys. Similarly, adults may be present in such small numbers that few, if any, are found. Alternatively, adults may be brought in from a wide area by the low level convergent wind flow, which is likely to be associated with the rain required for the first successful breeding of the sequence.
During the early stages of an outbreak, much of the population is often dispersed widely at well below gregarious densities. Small patches of hoppers are produced and small low-density swarms develop. The swarms often disperse and re-form. At this stage, a large part of the population may still not be in gregariously behaving groups.

Upsurges

Upsurges are a result of successful breeding over a number of generations by an initially small population. With successive generations, the proportion of the total population in bands and swarms increases until few scattered locusts remain; the total number of locusts increases as does the size and coherence of the bands and swarms. Several outbreaks that occur at the same time followed by two or more generations of transient-to-gregarious breeding can lead to an upsurge.

This situation is dependent upon a series of substantial and widespread rains of which at least the earliest rains occur in the normally arid recession area. As the upsurge develops, there will be migration taking adults from one breeding area to the next one in the chain. More than one upsurge can occur at the same time but in different regions. Many upsurges die out without leading to a major plague. For example, of the five upsurges that have occurred since 1970, only one has led to a plague. This may result from a combination of several factors such as a failure of the rains, causing unfavourable breeding conditions, the migration of adults to an area in which they die shortly upon arrival without laying, or control operations.

The few upsurges that have been analysed carefully have been ones that led to plagues, even if short-lived ones. In these upsurges, the sequence of movements has often been different. Moreover, several seem to have started from areas where recession breeding occurs very rarely. The most commonly infested recession areas may not be the most important ones.

Locust Swarm Invasion / Upsurge Years

- Locust Warning Organisation successfully organized locust control operations in the following years of locust swarm invasion and locust upsurge

S.No	Year of Invasion (across the border)	Year of Upsurge (Locust breeding)
1	1970	1976
2	1972, 1973 & 1974	1987-88
3	1978	2002-03
4	1983	2005-06
5	1986-87	2007-08
6	1988-89	2010-11
7	1989-90	
8	1990-91	
9	1993-94	
10	1997-98	

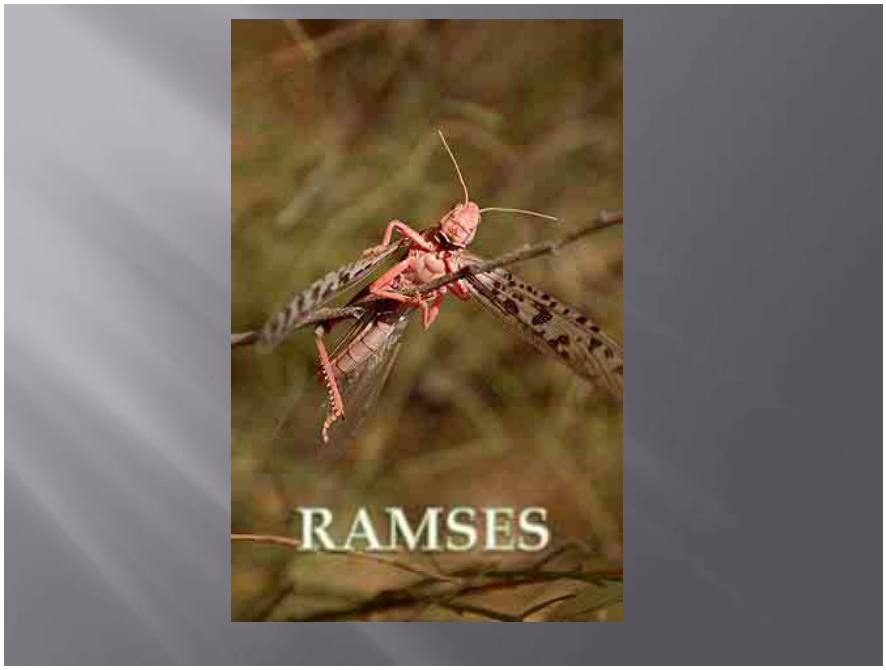
Plagues

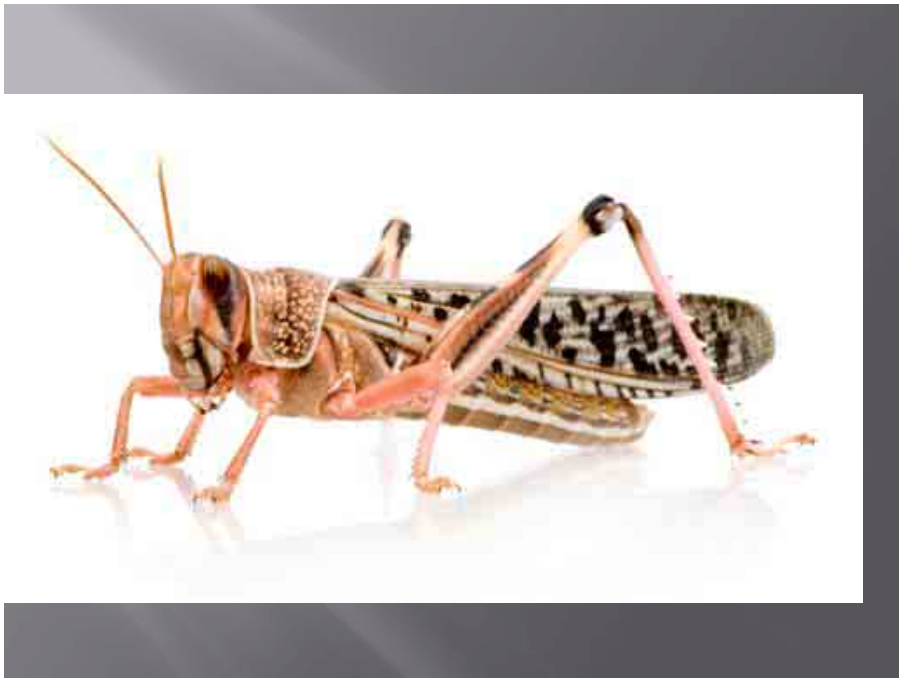
There are periods of one or more years during which there are widespread and heavy locust infestations, the majority of which occur as bands or swarms. These are referred to as *plagues. A plague can occur when favourable breeding conditions are* present and control operations fail to stop a series of local outbreaks from developing into an upsurge that cannot be contained. A major plague exists when two or more regions are affected simultaneously. Plagues are separated by recession periods during which bands and swarms are rare or completely absent, and most of the locusts are present at low densities. There have been six major plagues of Desert Locusts in the 1900s, one of which lasted almost 13 years. The area in which plagues occur covers about 29 million km2 which is nearly twice as large as the recession area, and can extend across 57

Plague

S.No	Period of locust Plague	No. of years
1	1900-1907	8
2	1912-1920	9
3	1926-1931	6
4	1940-1946	7
5	1949-1955	7
6	1959-1962	4

RAMSES & eLocust3 : by Shri Pramod Gour, SA LCO Bhuj





What is RAMSES

- One kind of Software used to analyse locust survey data to be used for forecasting and early warning

RAMSES

- Recognisance and management system on the environment of Schistocerca

In RAMSES we do

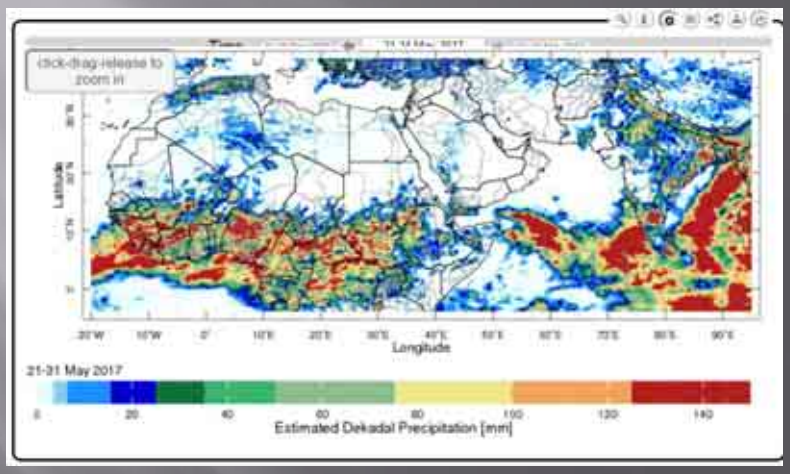
- Data compilation and maps preparations to understand the situation of the area

Source of Data:- Surveyors and FAO web sites

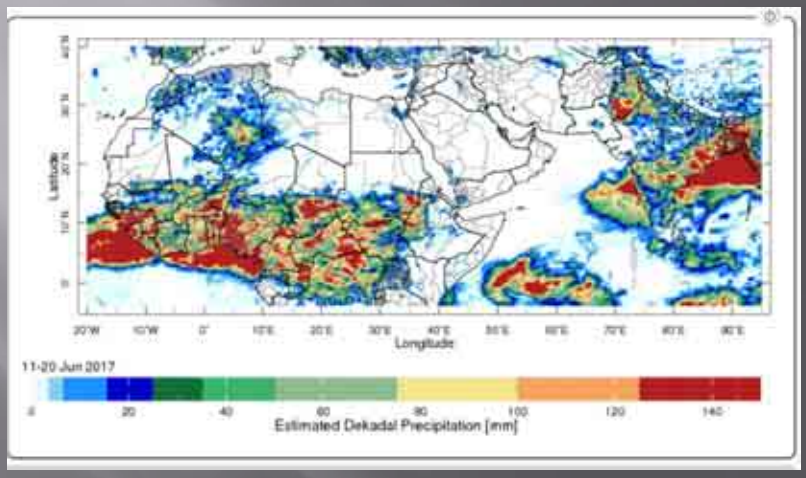
MAPS

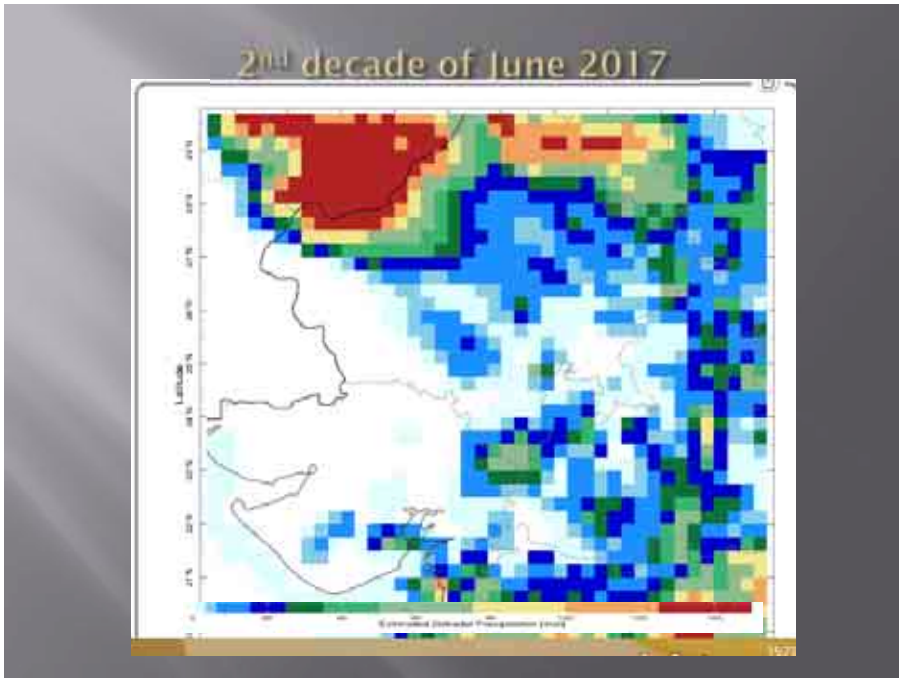
- Rainfall Estimation shows the rainfall whether it is light, moderate or heavy or Nil/ traced.
- Greenness map shows the greenness of areas along with age of vegetation and its density.

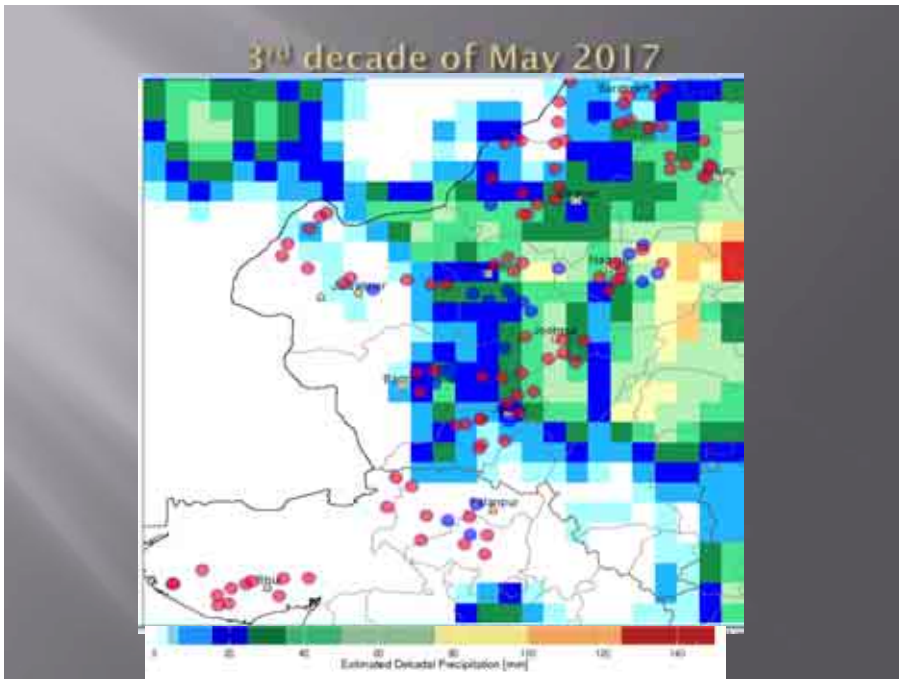
(Both maps are prepared by downloading Satellite imagery provided by FAO periodically) Three imageries in a month on interval of 10 days



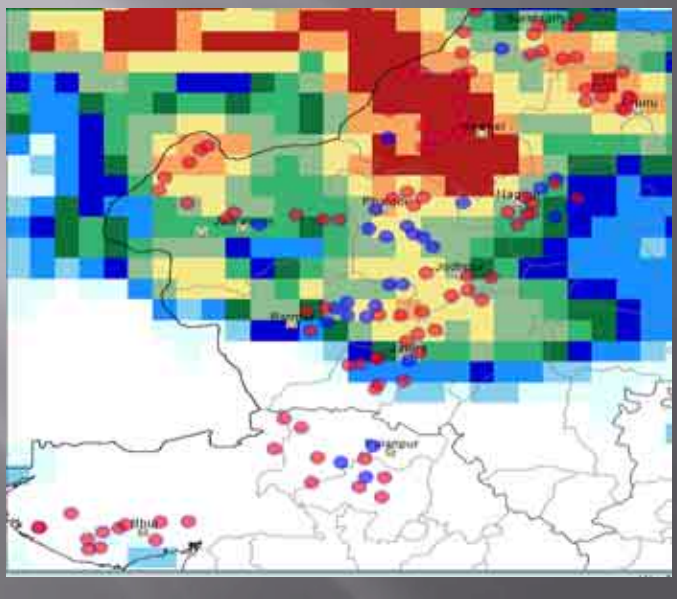
https://iridl.ldeo.columbia.edu/maproom/Food_Security/Locusts/Regional/Dekadal_Rainfall/index.html




2nd decade of June 2017

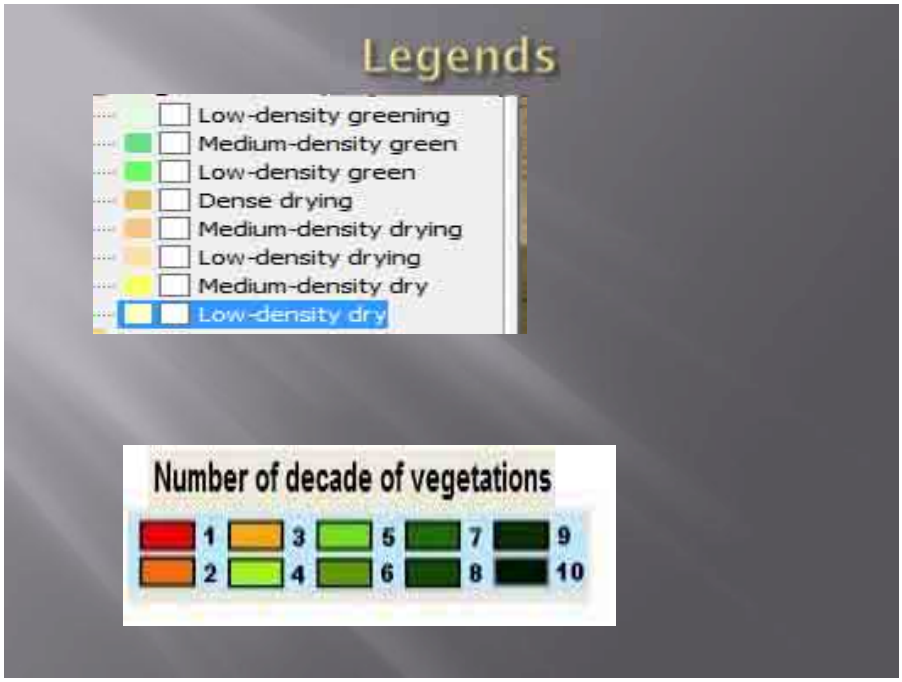

3rd decade of May 2017

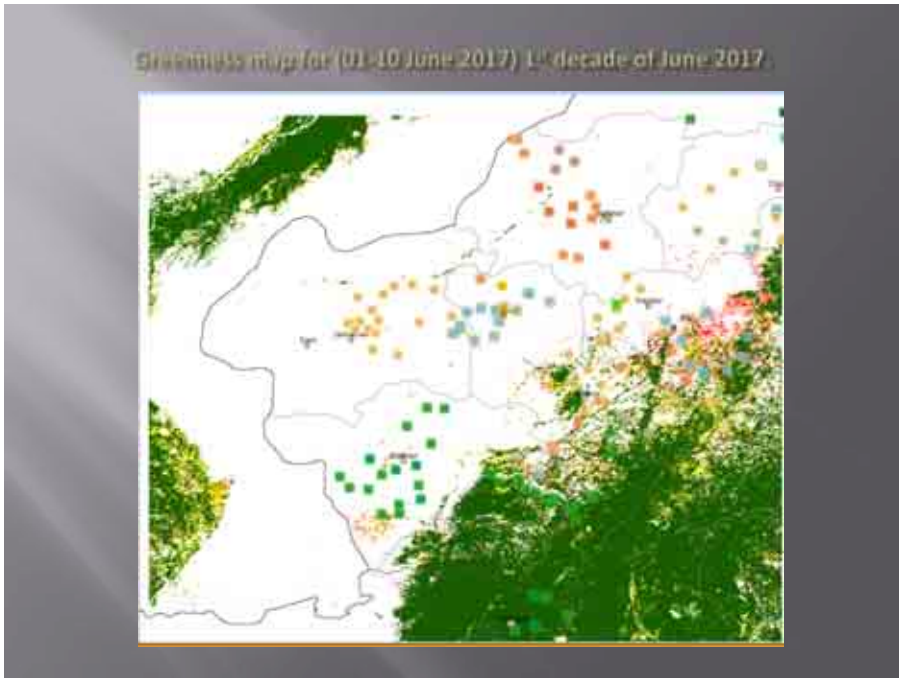
2nd decade of May 2017



- Greenness map:- Vegetation is green, greening, dry, drying & Density like low medium or dense.

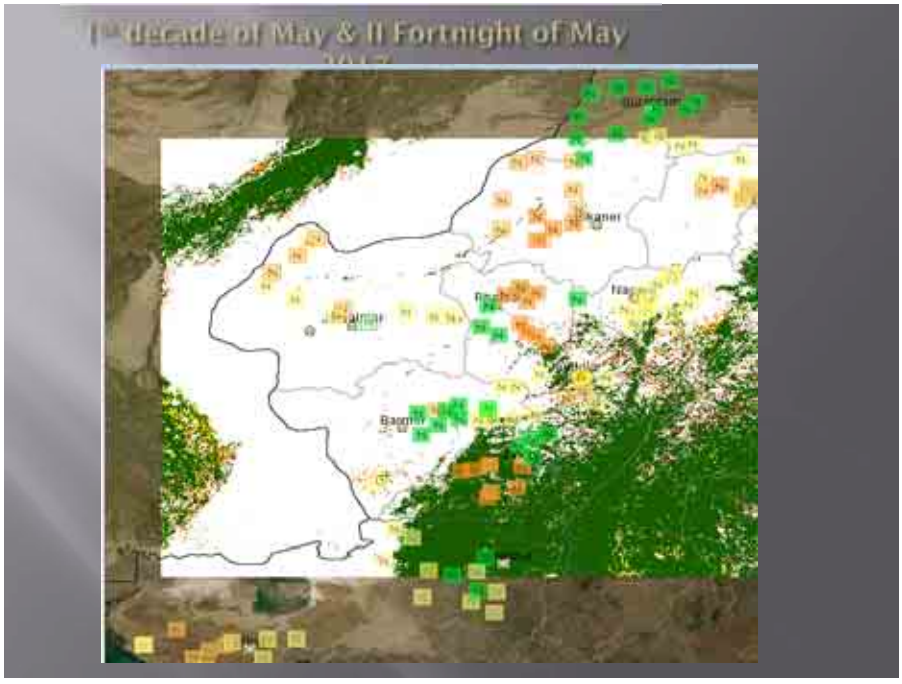
(see attached Map)


Legends
Low-density greening
Medium-density green
Low-density green
Dense drying
Medium-density drying
Low-density drying
Medium-density dry
Low-density dry
Number of decade of vegetations
1
2
3
4
5
6
7
8
9
10


Greenness map for (01-10 June 2017) 1st decade of June 2017

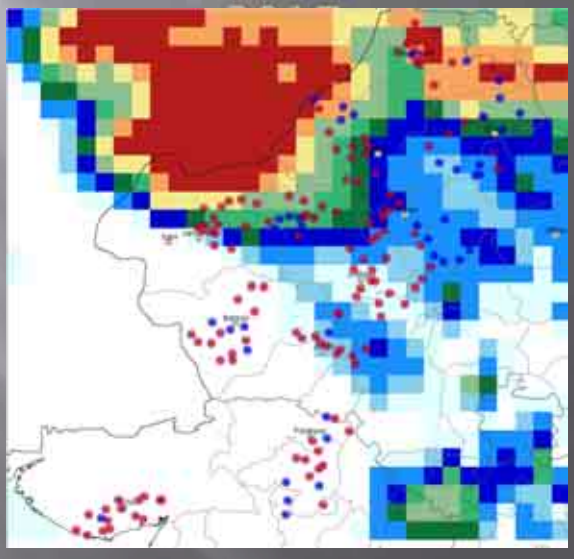
Following Maps can be prepared by the observations collected and transmitted by the Locust survey teams when they are in the field

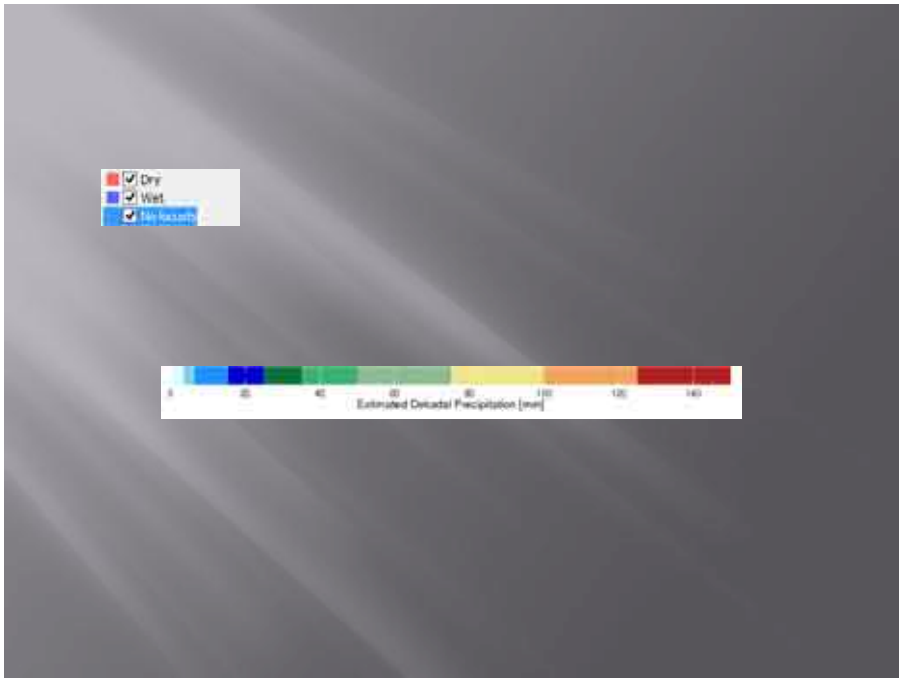
- Soil moisture map
- Presence of locust and its behaviour (Solitary, Transient, gregarious), (Adult/ Hoppers) (Mature/ Immature), (Stages of Hoppers) and many more (attached Excel file for reference) (Cont.)

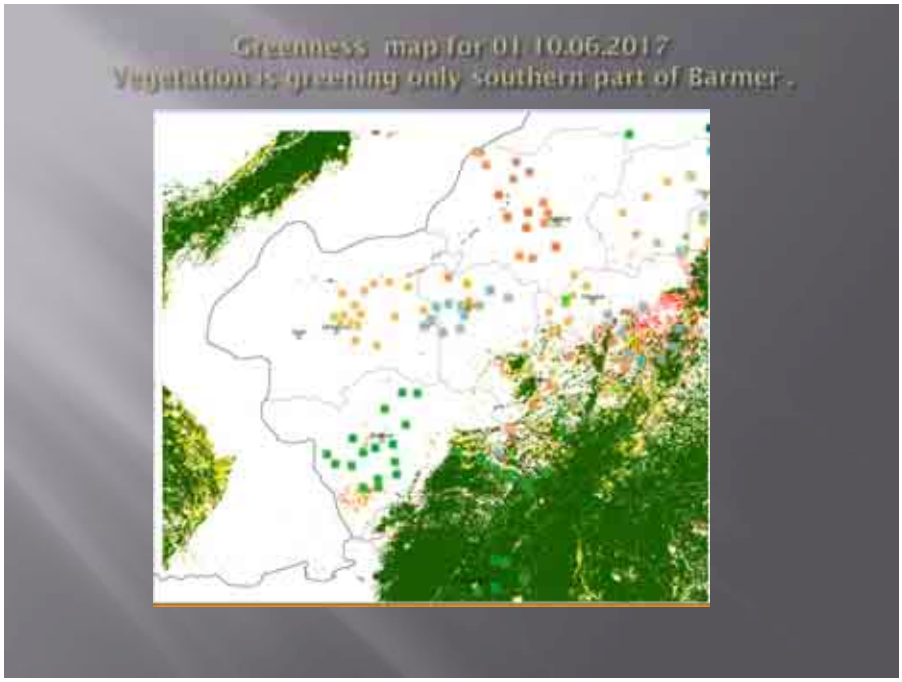


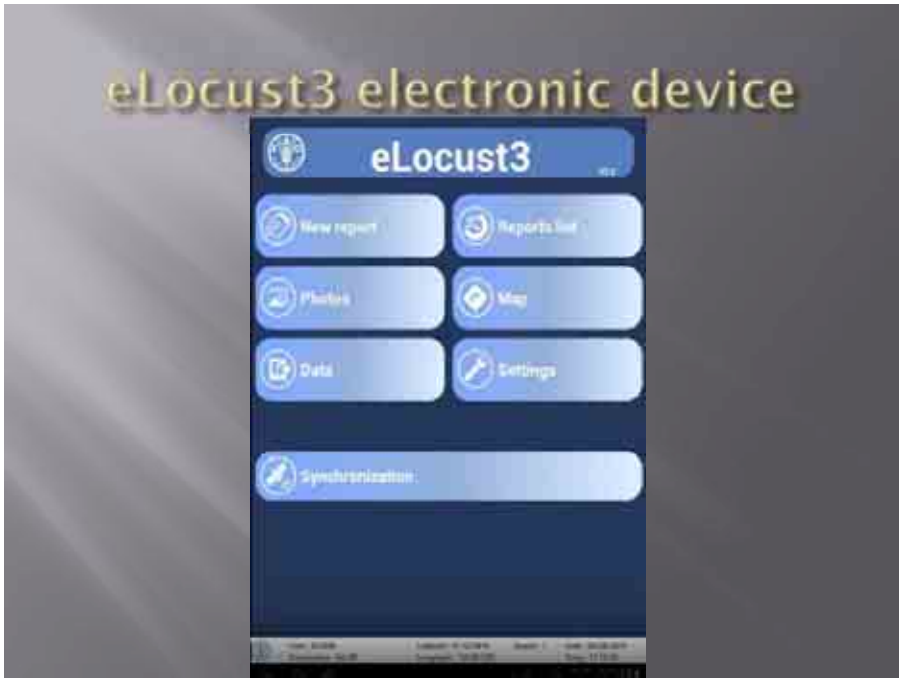
Rainfall estimation map for 11 to 20 June 2017 in which heavy rainfall was observed near the Indo-Pak border adjoining to Jaisalmer and Bikaner district. The Moderate to heavy rainfall was also observed at Suratgarh and Churu district. Moderate rainfall was observed from the area north south of Jaisalmer to Suratgarh area covering thec area of Phalodi- Bikaner and southern part of Churu. Light rainfall observed at Southern part of Phalodi, Bikaner, Nagaur and Churu. Heavy rainfall also observed at Pakistan area on large scale adjoining Indo-Pak border.

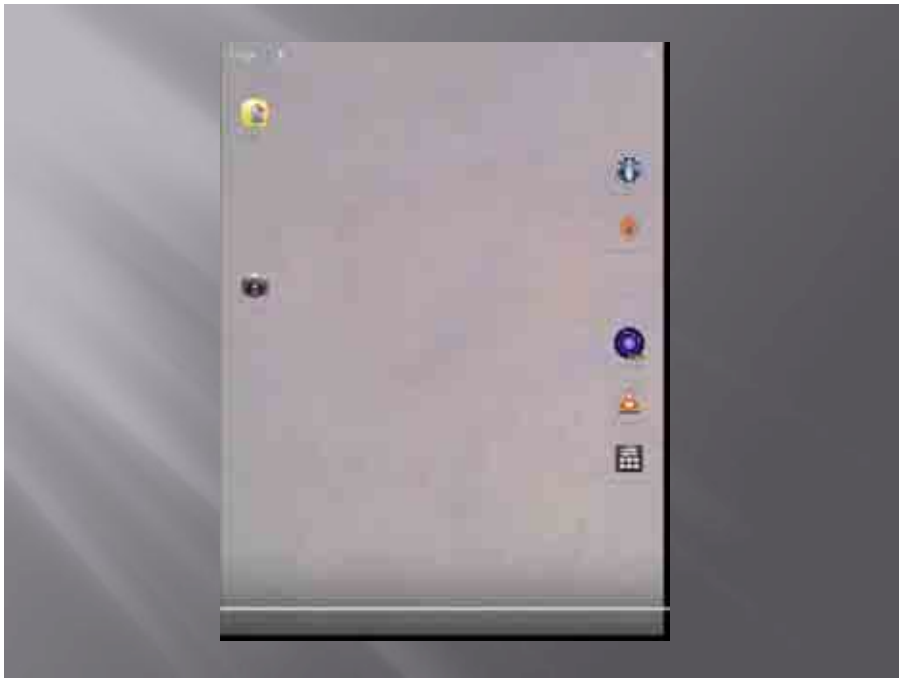
Rainfall for 2nd decade of June




Dry
Wet
Extrnated Dekadal Precipitation [mm]


Greenness map for 01.10.06.2017
Vegetation is greening only southern part of Barmer .


eLocust3 electronic device
eLocust3
New report
Reports list
Photos
Map
Data
Settings
Synchronization




WAIT
300
270
330
240
30
210
180
60
150
90
120
0/0
0
0°
52
41°52'39.035"N 012°30'12.189"E


eLocust3
New report
Reports list
Photos
Map
Data
Settings
Synchronization


Dashboard
Brightness
Auto
Speaker
Silent
Battery
Airplane
Wi-Fi
Bluetooth
GPS
Auto-rotate
Pen Calibratic


Reports list
Id Date Locust Control Status Photos
1 06/04/2014 16:59 Present Yes Queued 0
42 11/03/2014 20:47 Absent No Sent 0
41 11/03/2014 20:40 Absent No Sent 0
40 11/03/2014 20:35 Absent No Sent 0
39 11/03/2014 20:24 Absent No Sent 0
38 11/03/2014 20:18 Absent No Sent 0
37 10/03/2014 21:30 Absent No Sent 0
36 10/03/2014 21:27 Absent No Sent 0
35 10/03/2014 21:22 Absent No Sent 0
32 10/03/2014 19:27 Absent No Sent 0
29 04/03/2014 15:59 Present Yes Sent 2
28 04/03/2014 15:42 Present No Sent 1
27 04/03/2014 15:04 Present No Sent 1
Back
Delete File

- Keep the eLocust3 unit charged in advance & during transmission of data, tablet should be charged more than 20%
- First plug in the antenna and then "Press & Save" button
- Any other antenna should not be there during transmission other wise data can be transmitted by other Antenna/ ID.
- When cable is to be connected with antenna it requires half turn only. Due to previous practice some of surveyor used to turn two to three rounds which are major reason of fault in antenna/ cable. Due to such bad practice most of cable of antenna is not in good position

Suggestion

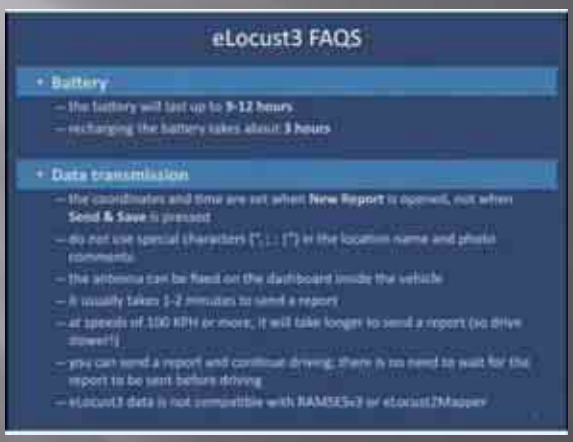
- It is better if Data is transmitted on every location or twice a day. Do not send all 4 data in same time. There may be long queue on satellite and it may create problem
- Take at least a pic in a day of survey. It will be remained in tablet. You may save in office computer. During saving please give the name of Pic "yyyyMonthDateNumber" so that the pics will always be in order. This folder can be used for future.
- Have a separate bag for Tablet if possible.
-

Be patient before press send button. Check the data before sending. By mistake if you have clicked "send" button and you need any correction, please un plug the cable soon and go to Report list and delete the data.

- Then fill the form again and send it.

Calculation of Locust population

- Divide one survey spot in 10 Part of (100X10 metre). Calculate density of locust population
- Locust population/ Hactare =No of locust seen X 10000/ (lengthX width)
- RAMSES calculate density it self but for office record and PAR this formula requires.



- In case if data do not transmit
- Make sure all cable connected properly
- Antenna is not far from Tablet
- Bluetooth is on.
- In case problem continues unplug & re-plug all cables
- Change the place from where you are trying to transmit data.

An overview on eLocust3 & RAMSES

Chandra Shekhar Sharma
SA, LWO Jodhpur

Data

03.02.1971

Jodhpur

Scientific Assistant

Airforce Road, Opp Sati Mata Ka than

Locust Office

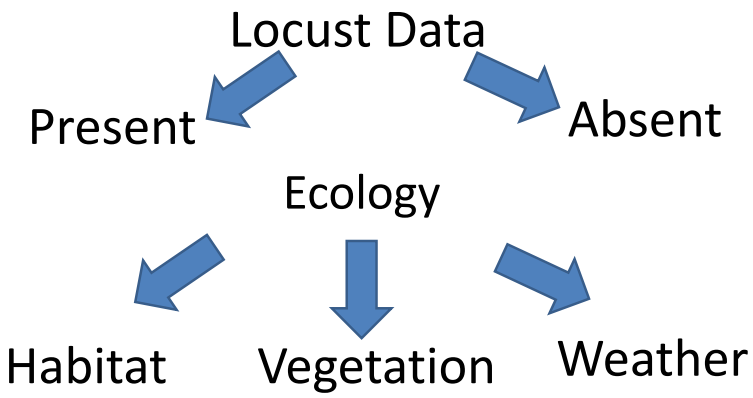
Chandra Shekhar

9636384579

Organized data (Information)

S. No.	Name of official	DOB	Birth Place	Posted at	Address	Mobile No.
1	Chandra Shekhar	03.02.1971	Jodhpur	LWO	Airport Road, Opp Sati Mata Ka Than	9636384579

Locust Data (eLocust3)



United Nations Organisation

↓

Food & Agriculture Organisation

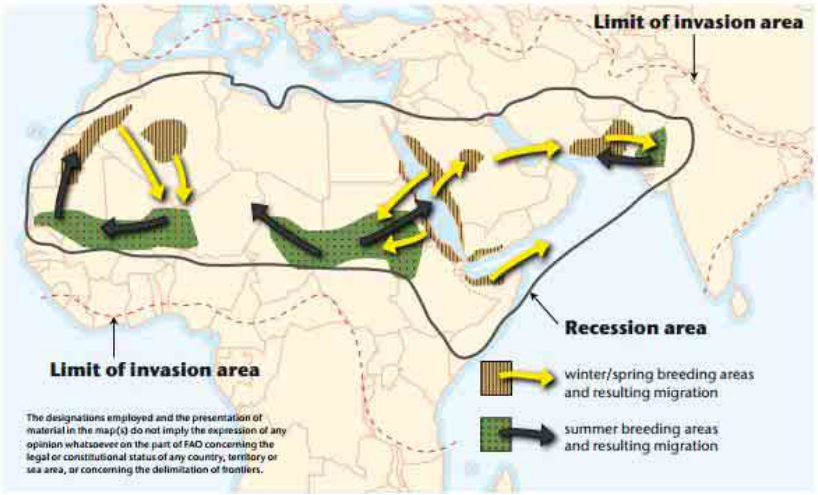
↓

Desert Locust Information Service

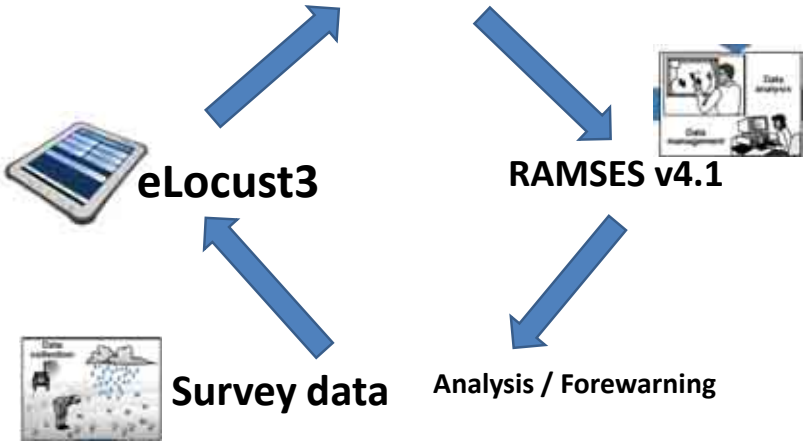
↓

National Information System

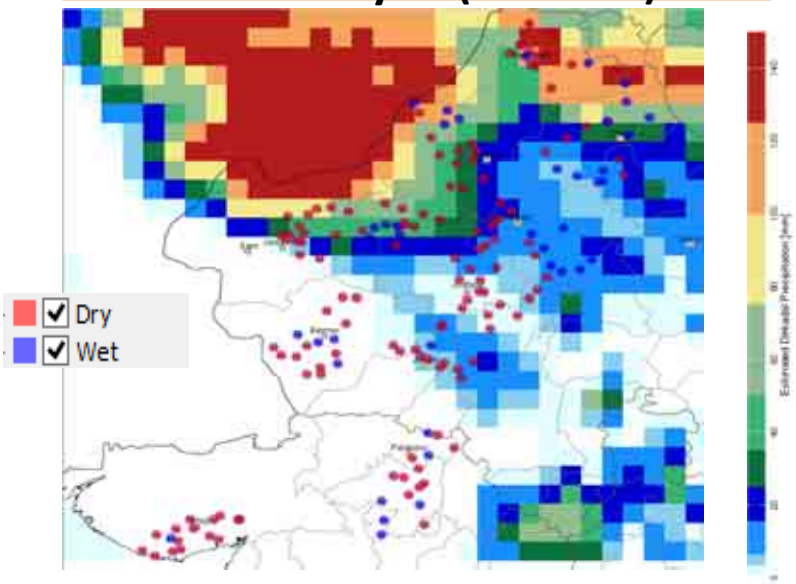
Member Countries



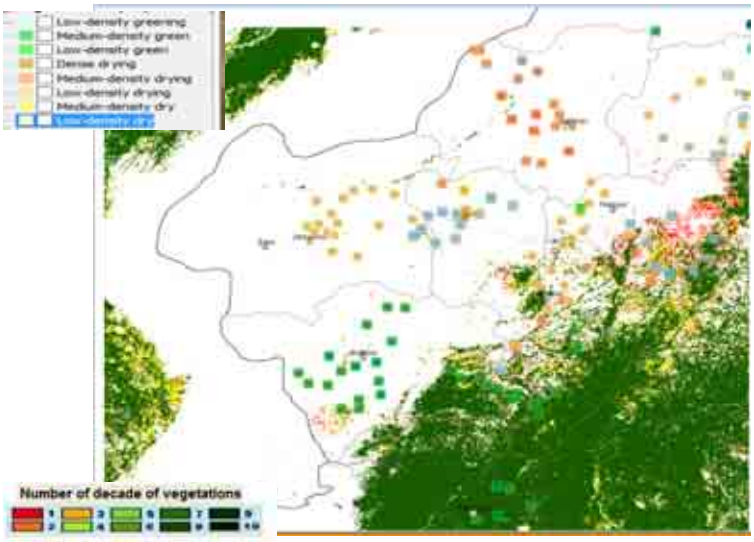
Desert Locust Information Service(FAO)



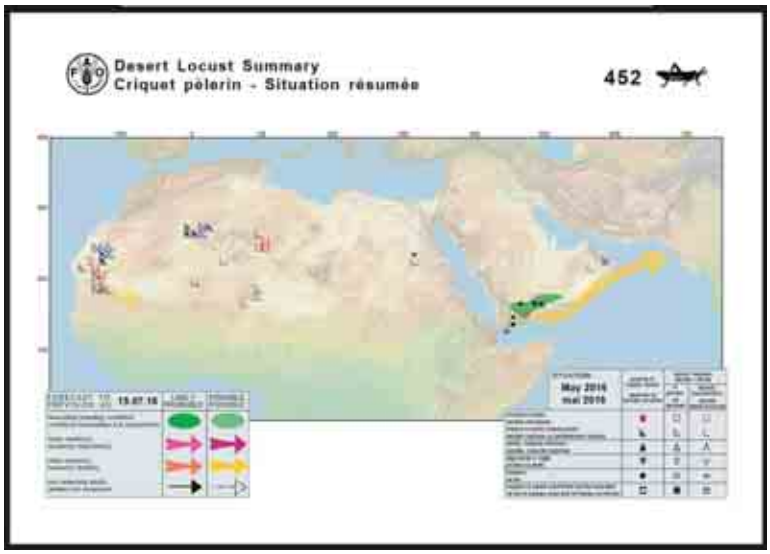
Data analysis (RAMSES)

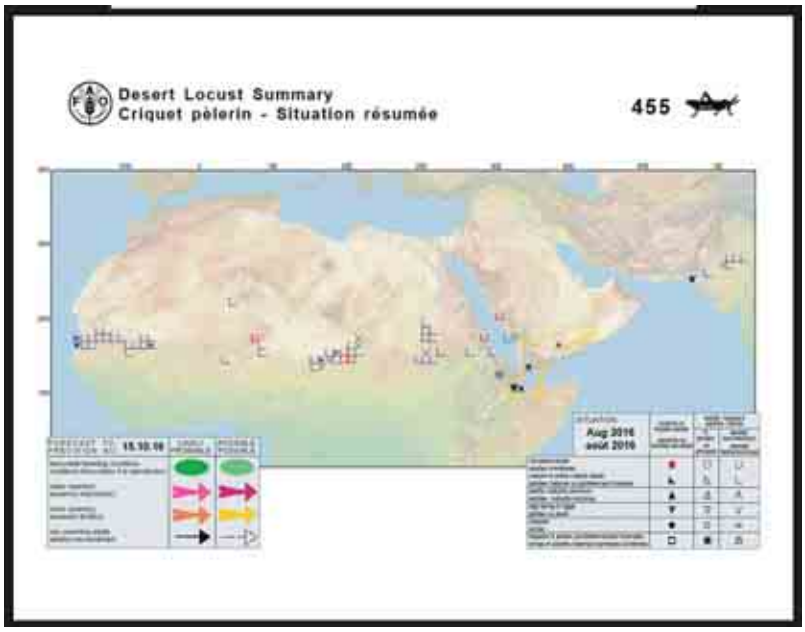


Locust Data with greenness Map



Forewarning issued by FAO





Current Locust Situation (May, 2017)

Annexure - VI

Photographs taken during two days national training workshop


Pre-evaluation Test


Lectures through PPT


Lectures through PPT


Group formation


Different groups ready for field exercise


Use of eLocust3

Group discussion in classroom

Identification through live specimen of desert locust

Apprising about windytv website for current wind direction.

Wrap up and closing