Area-wide integrated pest management of tephritid fruit flies using the sterile insect technique

Rui Pereira, Jorge Hendrichs, Jesus Reyes and Marc Vreysen

Insect Pest Control Section

(Joint FAO/IAEA Division)

Regional Symposium on the Management of Fruit Flies in Near East Countries

6-8 November 2012, Hammamet, Tunisia

The WHO is promoting fresh fruit / vegetable consumption; the demand is growing.

Outline

1. Introduction
2. Area-wide (AW) concept
3. Phased conditional approach
4. Sterile Insect Technique (SIT) as a component of an AW-IPM
5. Male Annihilation Technique (MAT)
6. Conclusion

1. Introduction

Fruit Fly Problem

- Reduce the quality of the fruits
- Increase the production costs
- Cause problems to international trade

التمييز بين
BACTROCERA ZONATA و BACTROCERA INVADENS

كلاهما ذباب كبير وبني مع قرنا الاستشعار طويلة، الأرجل صفراء وأجنحة شفافة إلى حد كبير. انها تشبه الدبابير.

B. invadens

خلافات رئيسية

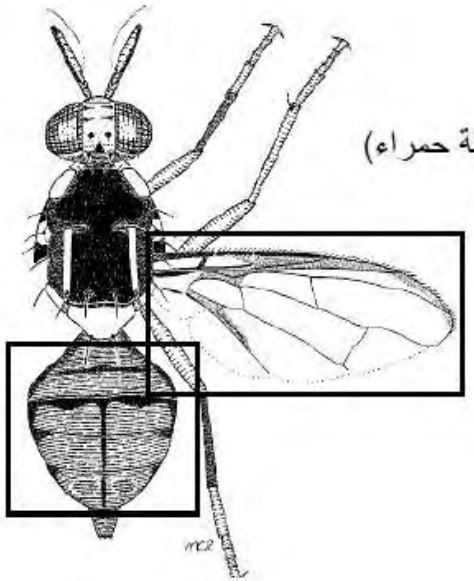
B. zonata

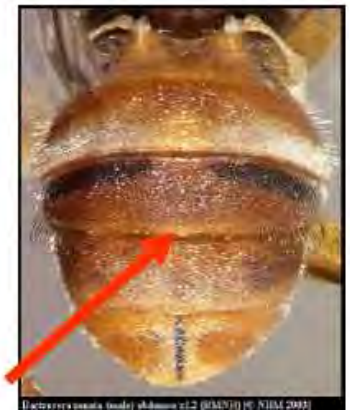
شريط داكن كامل على طول الهامش (حلقة حمراء)

الشريط الداكن خفض إلى بقع في البداية والنهاية (حلقة حمراء)

شريط شرجي داكن موجود (السهم الأحمر)

الشريط الشرجي الداكن غائب (السهم الأحمر)





By Marc de Meyer & Ian White, 2012

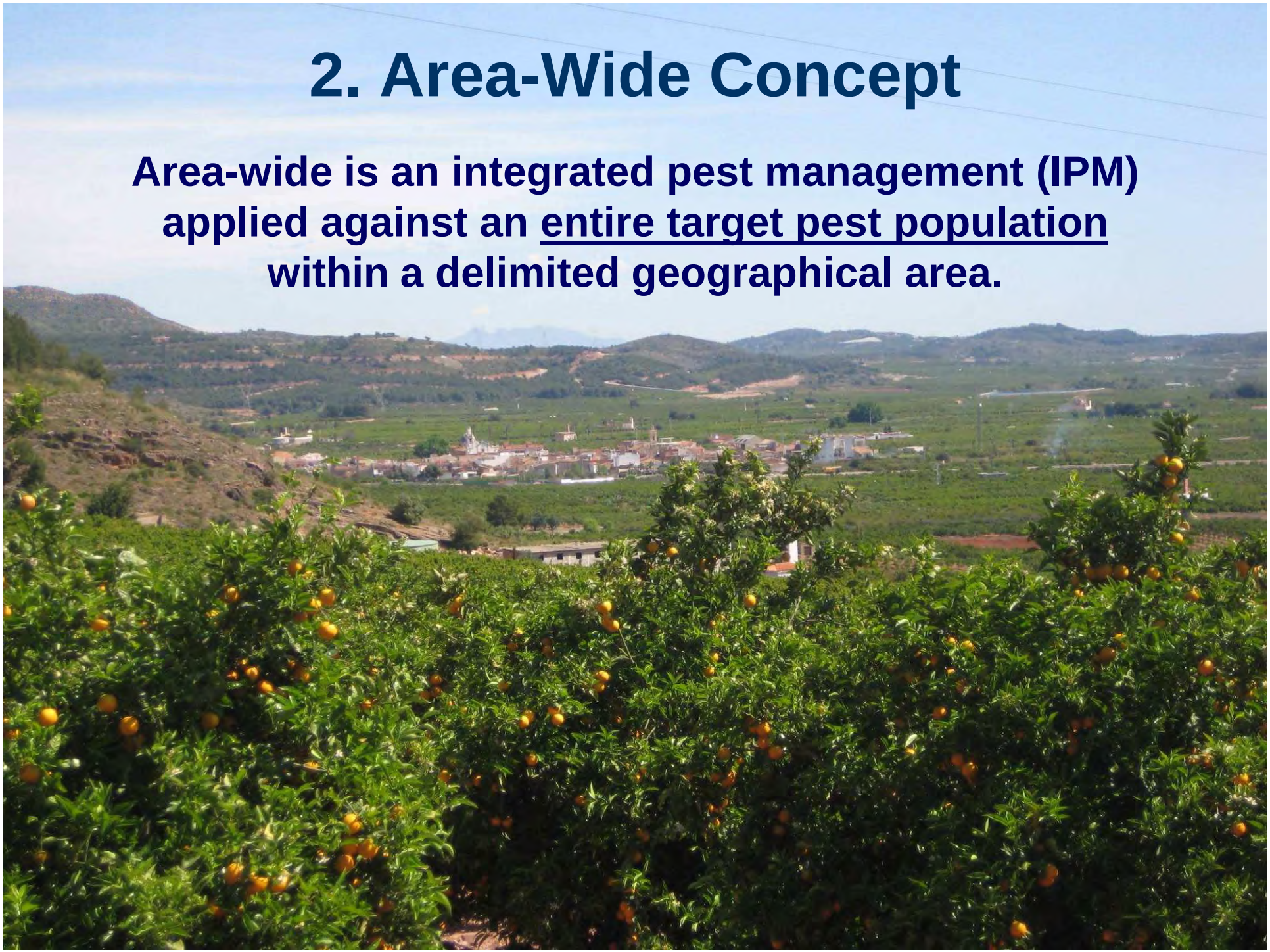
Invasive species

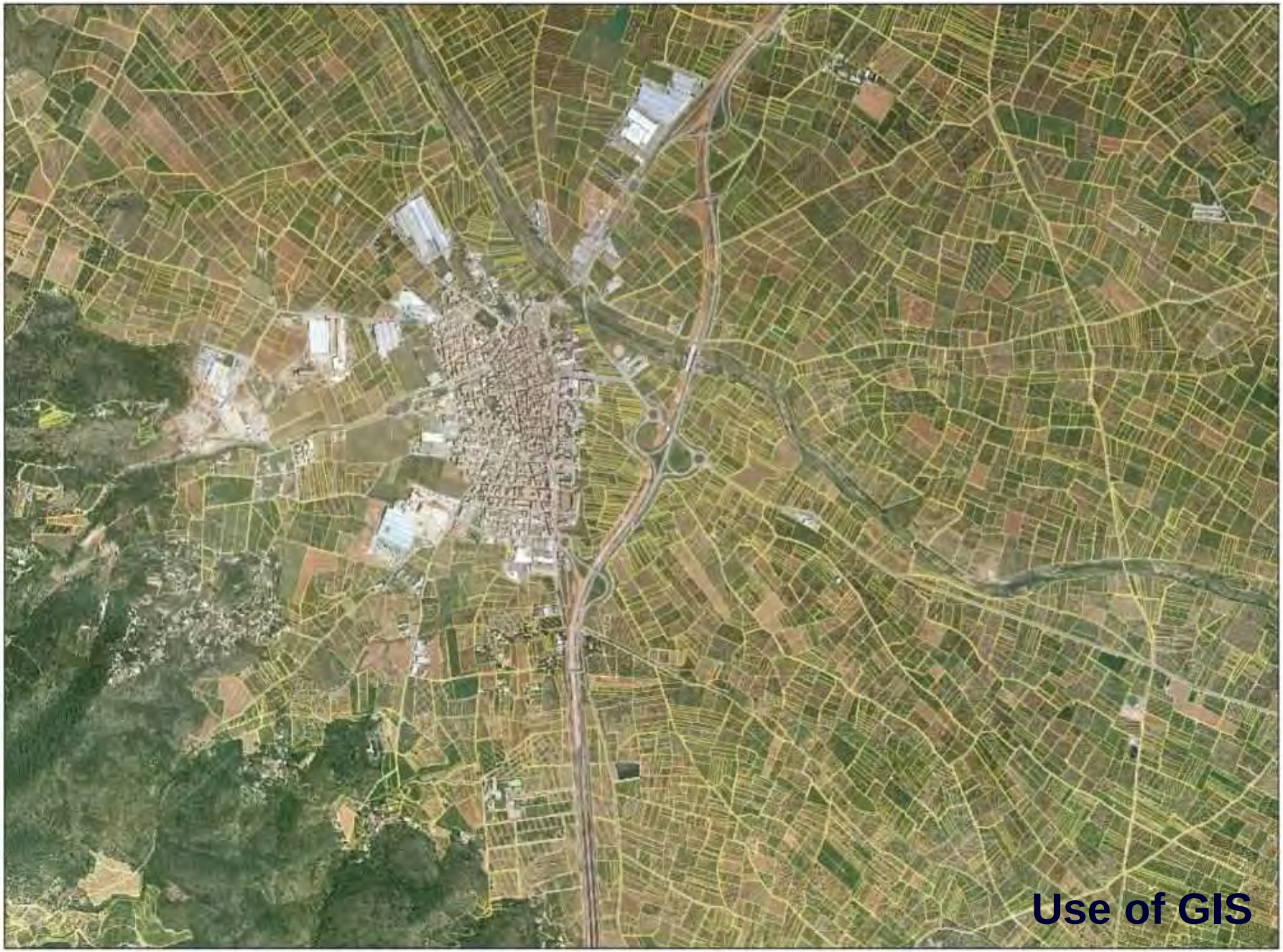
In the potential areas of tephritid fruit fly invasions is crucial to prevent these economically disruptive situations by:

- **Strengthening of quarantine,**
- **Detection,**
- **Surveillance**
- **Early response**

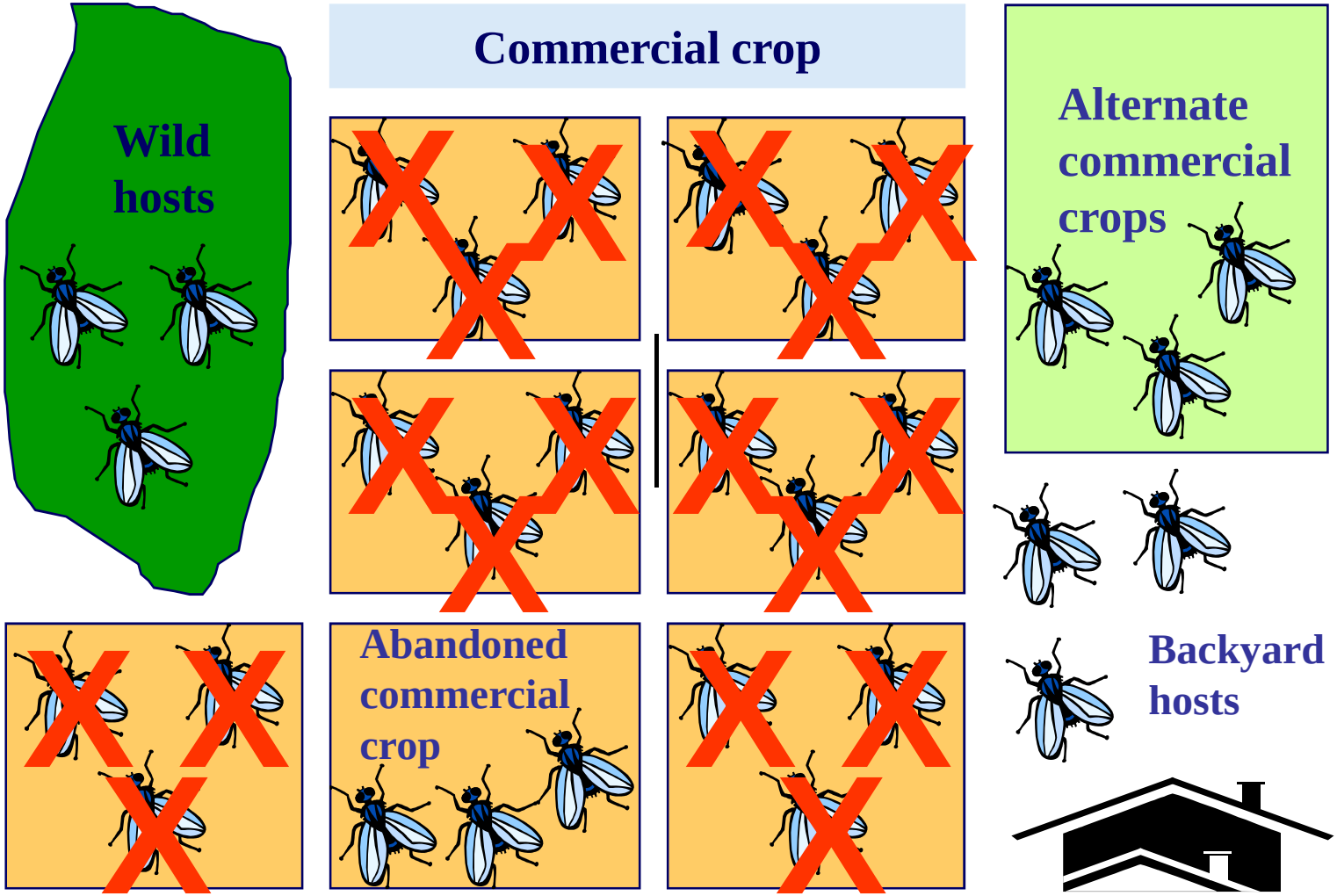
2. Area-Wide Concept

Area-wide is an integrated pest management (IPM) applied against an entire target pest population within a delimited geographical area.

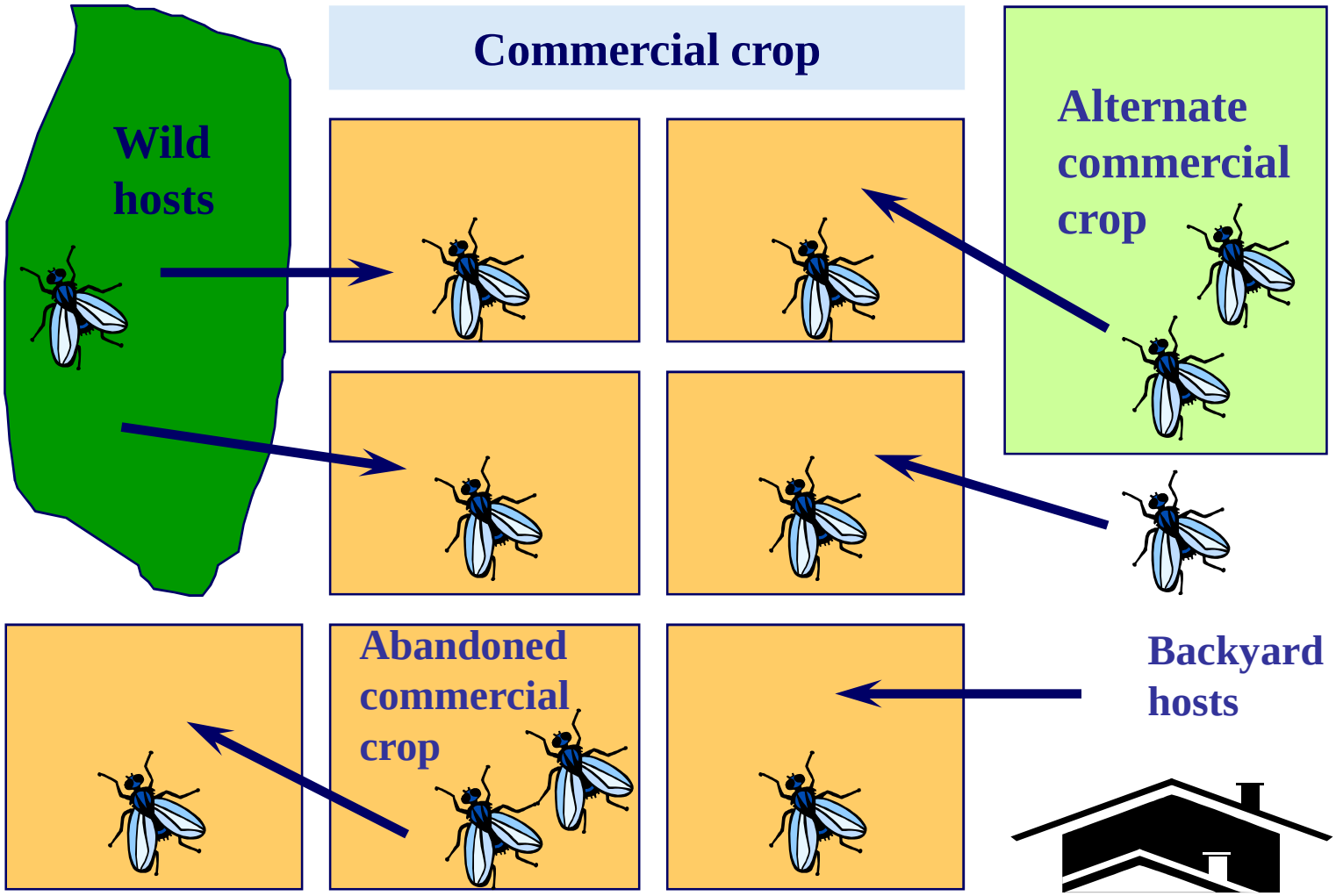



Use of GIS

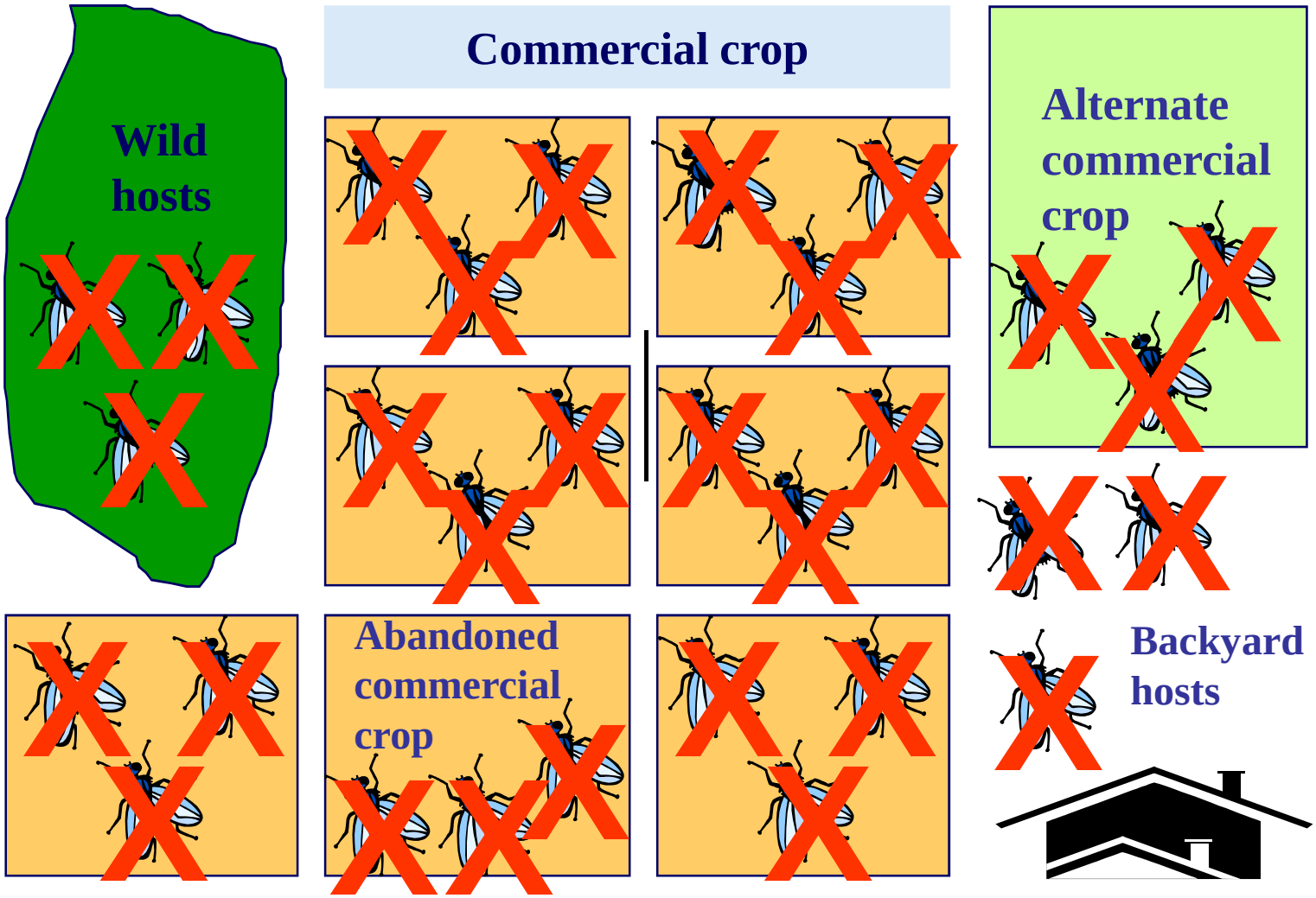
PEST CONTROL ON A FIELD BY FIELD BASIS (TEMPORARY SUPPRESSION)

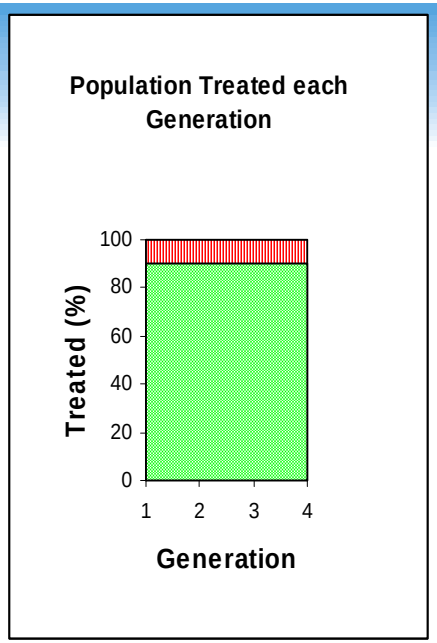


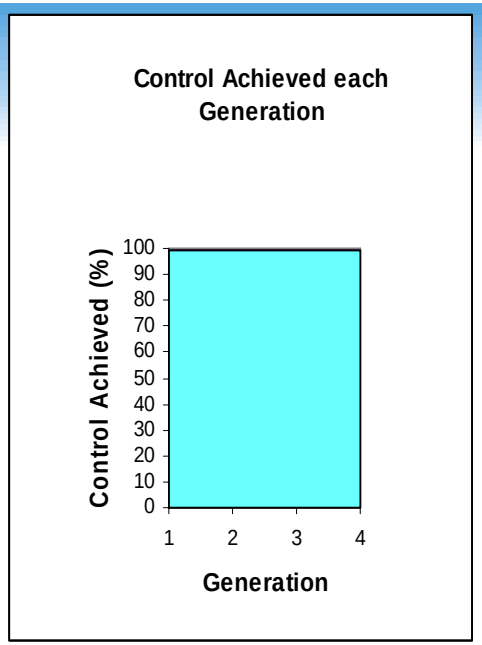
PEST CONTROL ON A FIELD BY FIELD BASIS (CONTINUOUS PEST REINVASION)

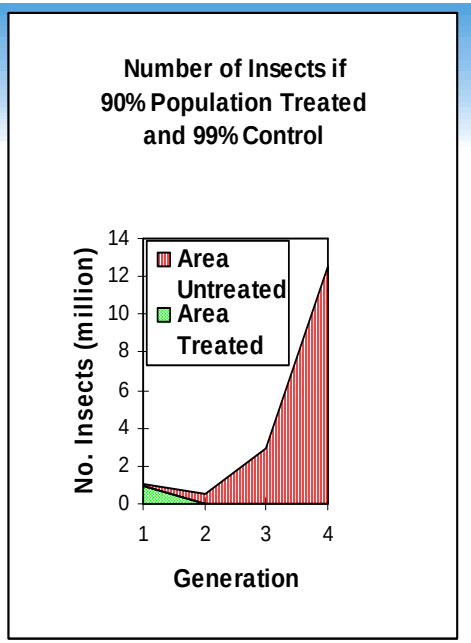


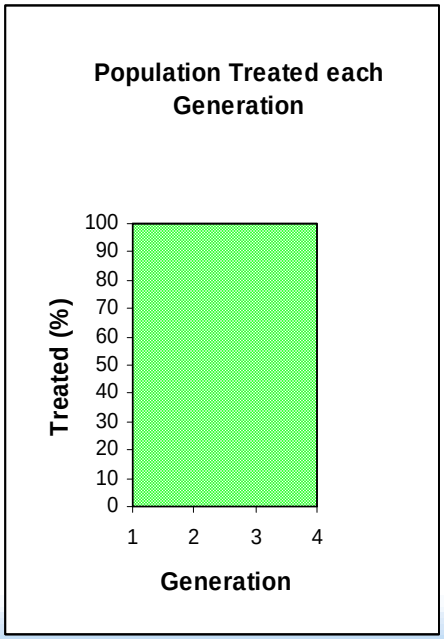
PEST CONTROL ON A AREA-WIDE BASIS (ENTIRE POPULATION LEVEL)




Population Treated each Generation
Treated (%)
100
80
60
40
20
0
1
2
3
4
Generation


Control Achieved each Generation
Control Achieved (%)
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
Generation


Number of Insects if 90% Population Treated and 99% Control
No. Insects (million)
14
12
10
8
6
4
2
0
Area Untreated
Area Treated
1
2
3
4
Generation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50
40
30
20
10
0
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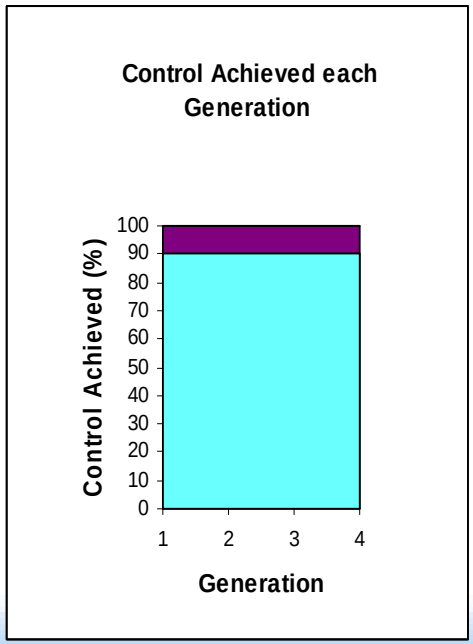
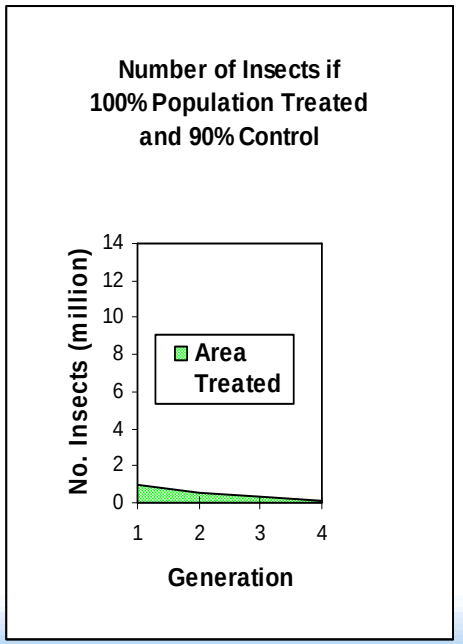
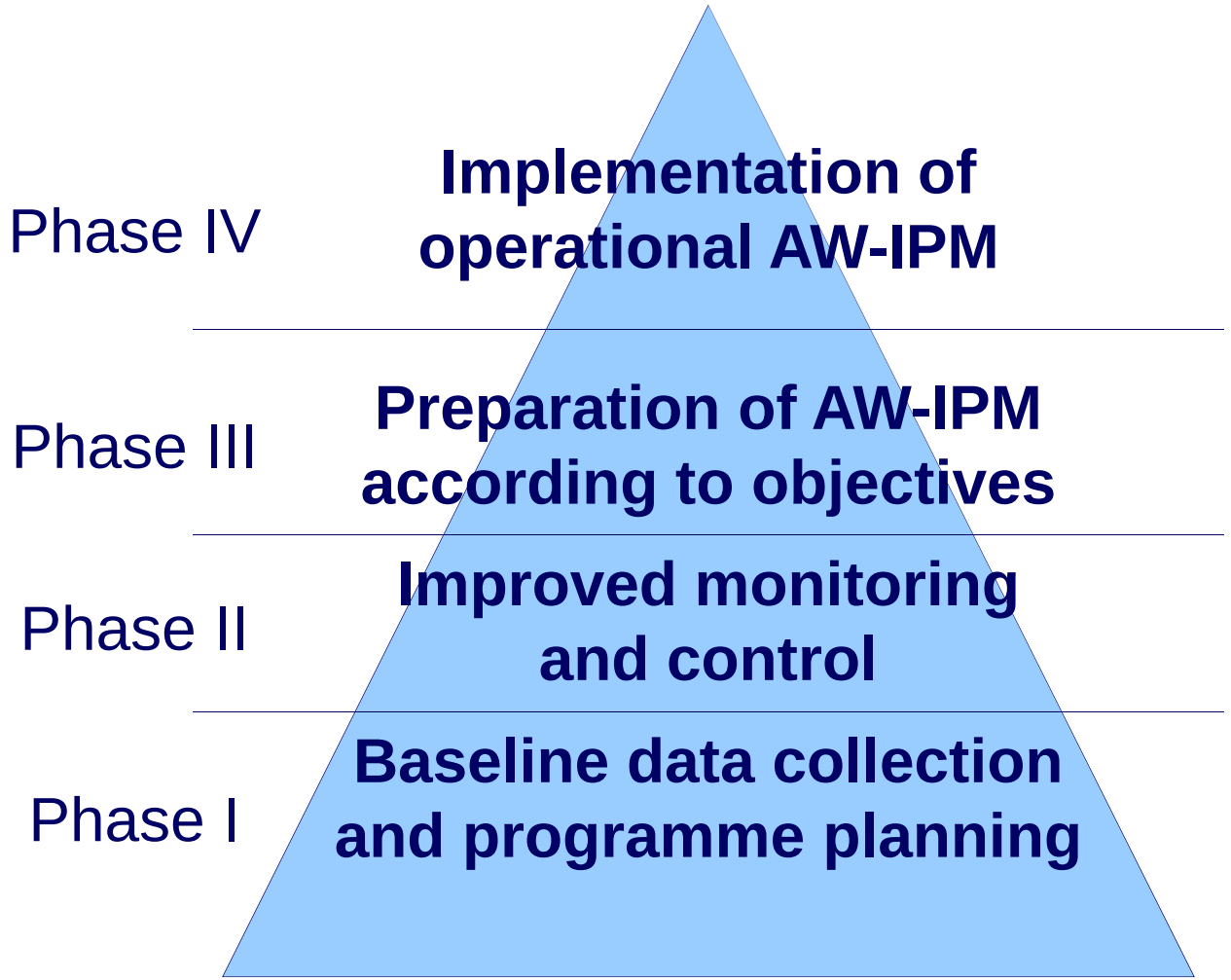
2
3
4
Generation


Control Achieved each Generation
Control Achieved (%)
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
Generation


Number of Insects if 100% Population Treated and 90% Control
No. Insects (million)
14
12
10
8
6
4
2
0
Area Treated
1
2
3
4
Generation

Examples of area-wide approach on our daily life

3. Phased conditional approach



Implementation of operational AW-IPM

A. Non discriminatory

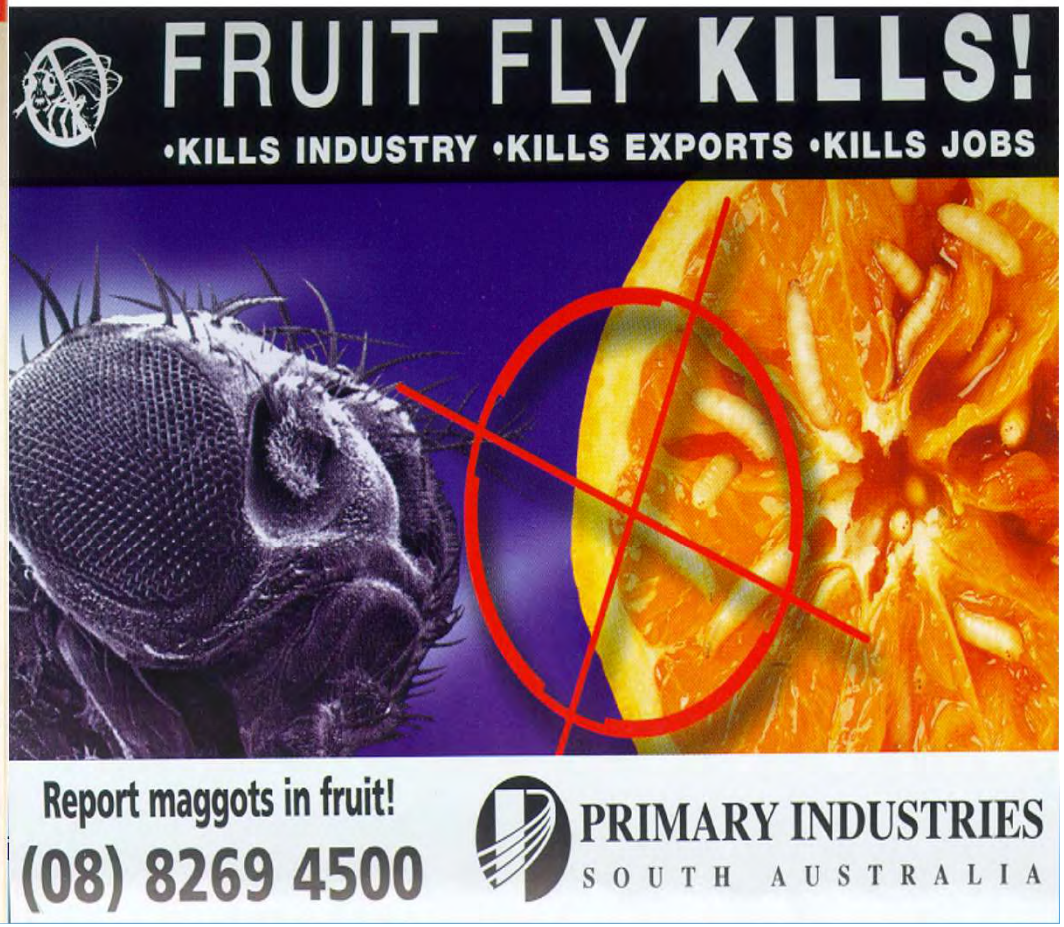
B. Low pesticide

C. Pest free

Reduction of insecticide use

Two Major Issues for FAO and IAEA Member States

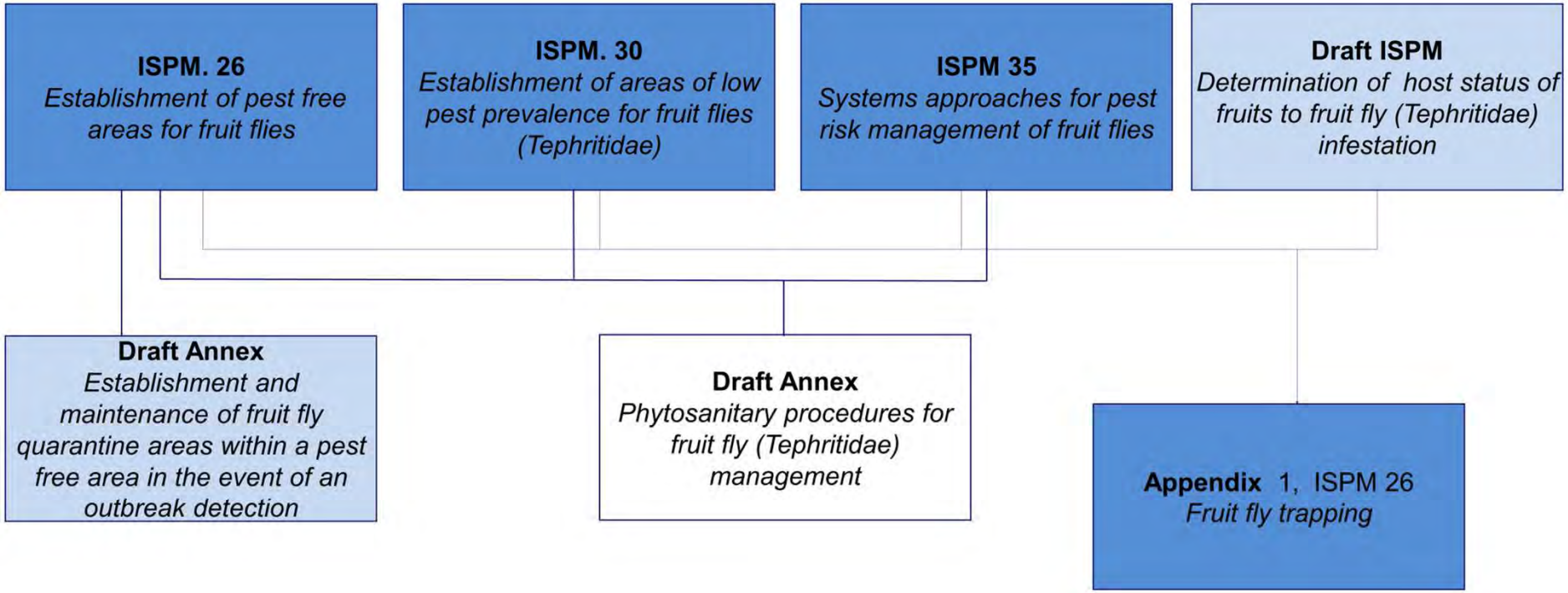
Access to export markets



Mango is produced under area of low pest prevalence for fruit flies (ALPP-FF)

- **To Japan and USA (pest free markets):** Post-harvest treatment with hot water
- **To EU (low residues markets):** Without post-harvest treatment

ISPMs on Fruit Flies



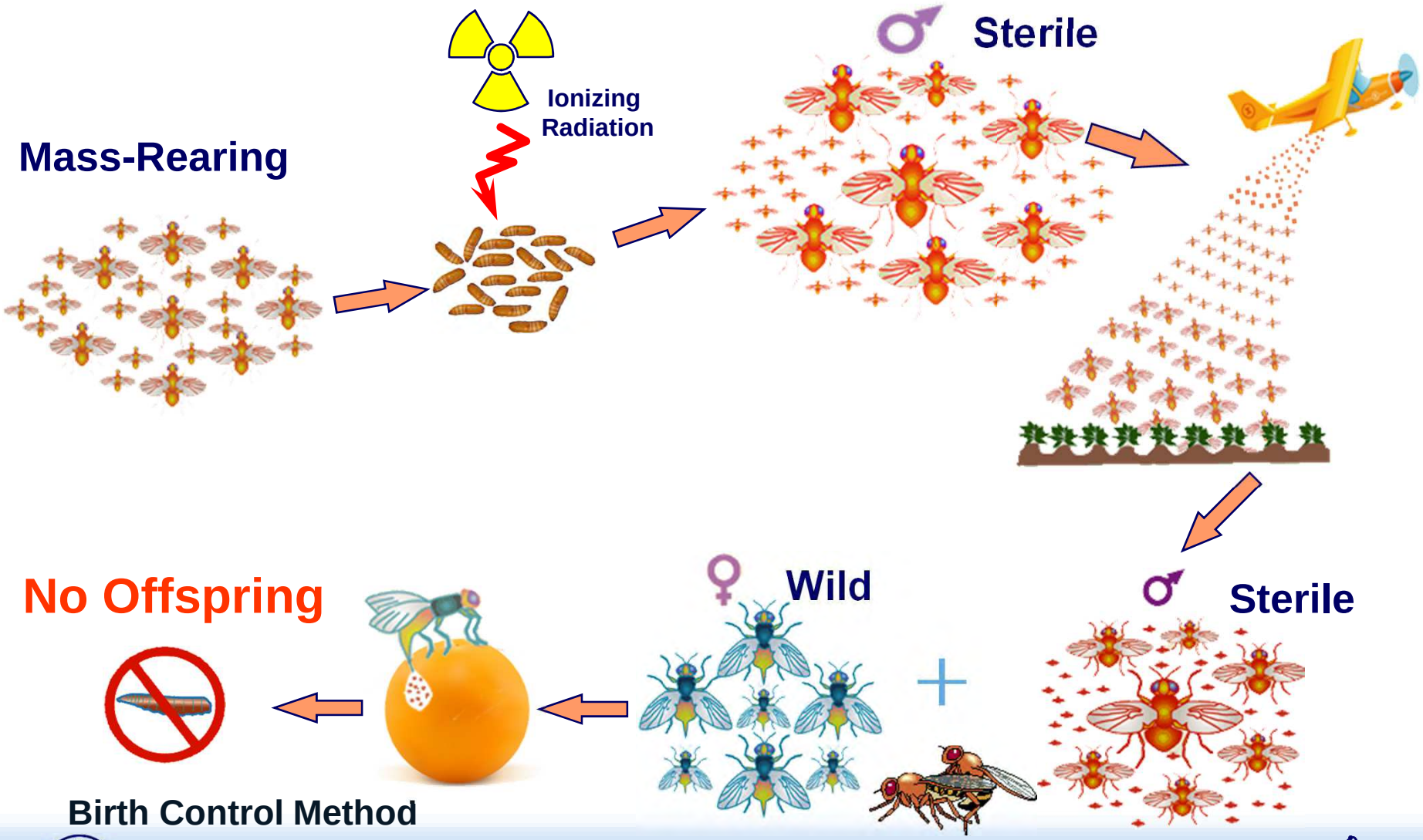
Legend:

- Adopted
- Approved for Country consultation
- Draft developed by FFTP

4. Sterile Insect Technique (SIT) as a component of an AW-IPM

The Sterile Insect Technique (SIT) is being successfully applied integrated with other suppression techniques to prevent, contain, supress or eradicate tephritid fruit fly pests as a component of an area-wide integrated pest management (AW-IPM).

Insect pest control by the use of SIT



SIT is only one more AW-IPM tool

It relies on:

- **mass production of the target species**
- **sterilization and packing**
- **inundative releases by air**
- **matings result in no offspring**

Only to be integrated in special situations

SIT : the disadvantages
Are there limiting factors?

- requires knowledge of target pest, as well as rearing, release and monitoring methods
- best started when target population is small
- it is management intensive
- requires longer term commitment
- has to be applied on area-wide basis

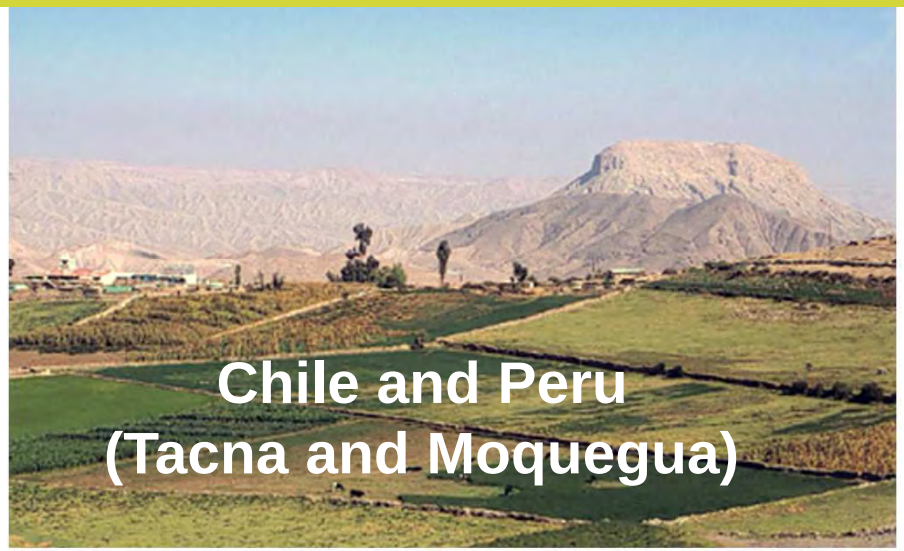
Strategic Options of AW-IPM

- ***Prevention:*** **Avoiding establishment of invasive exotic pests**
- ***Containment:*** **Avoiding the spread of introduced pests**
- ***Eradication:*** **Development of areas free of major disease vectors or facilitation of international trade**
- ***Suppression:*** **Reduction of insecticide use and crop losses, and development of low pest prevalence areas**

Preventive Release Program over Los Angeles Basin, California

(Ca. 400 million sterile males / week since 1994)

Examples of Eradication Programmes




UNITED STATES OF AMERICA
Mexicali
Tijuana
Ciudad Juárez
Nogales
Hermosillo
Río Grande
Conchos
Chihuahua
Nuevo Laredo
BAJA CALIFORNIA
Ciudad Obregón
Monterrey
Gulf of Mexico
Gulf of California
Torreón
Saltillo
Matamoros
Culiacán
La Paz
Mazatlán
San Luis Potosí
Yucatán Peninsula
Tampico
Aguascalientes
León
Bay of Campeche
Guadalajara
MEXICO CITY
Mérida
Puebla
MEXICO
Veracruz
Cuernavaca
Villahermosa
BELIZE
Acapulco
Tehuantepec
North Pacific Ocean
Gulf of Tehuantepec
HONDURAS
GUATEMALA
EL SALVADOR
NICARAGUA

Advantages SIT for Suppression

- No need of quarantines to prevent reinvasions
- Allows biological control of secondary pests
- Systems approach, combining pre-and post-harvest measures, allows exports
- Routine use facilitates commercialization
- Suppression is a continuum and does not preclude eventual pest-free status

5. Male Annihilation Technique (MAT)

The MAT involves mass trapping or attract and kill devices using male lures (ex: methil eugenol (ME), cuelure)


Attractiveness of *Bactrocera ~~philippinensis~~ dorsalis* to sweet basil

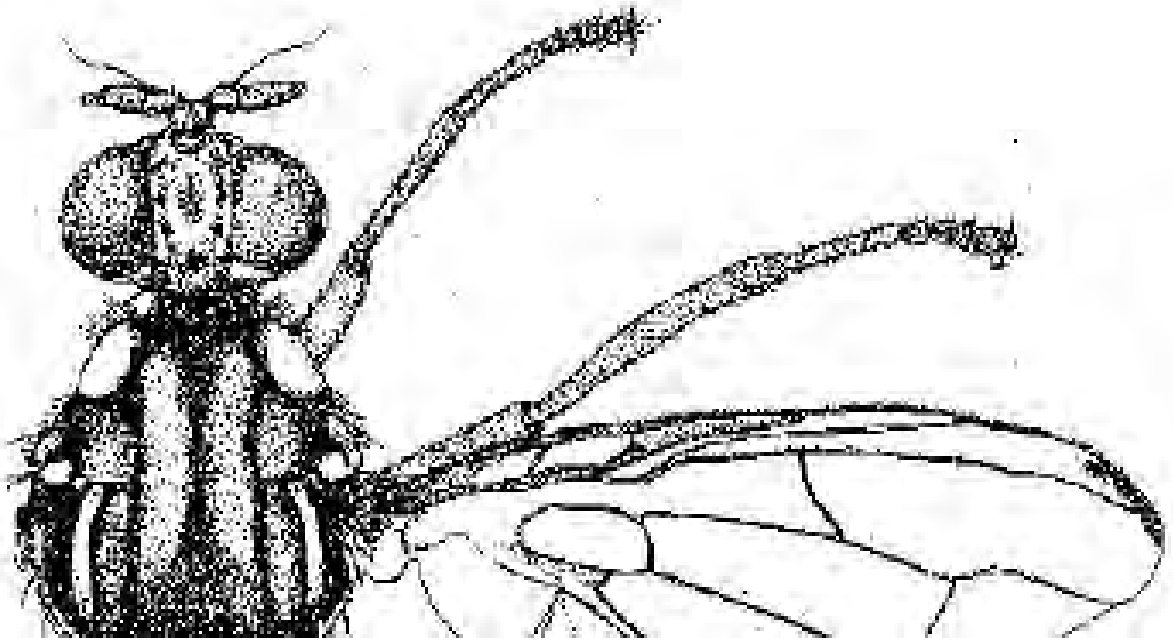
Food & Agriculture
Organisation (FAO)

International Atomic
Energy Agency (IAEA)

ACTION PLAN

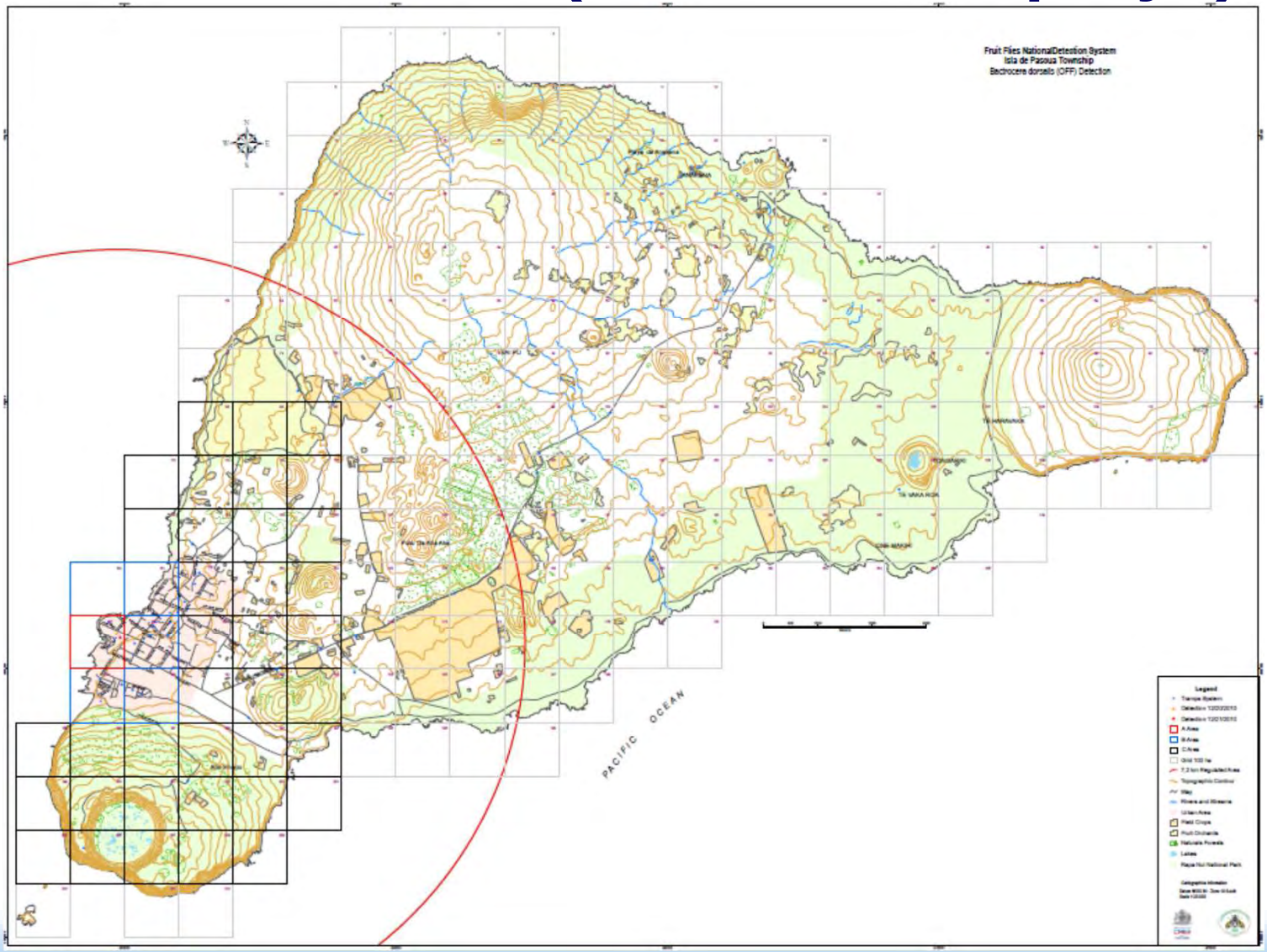
PEACH FRUIT FLY

Bactrocera zonata (Saunders)



2000

Recent eradication campaign of *B. dorsalis* in Easter Island (MAT & Bait sprays)



6. Conclusion

- **Area-wide approach should be implemented in insect pest control**
- **The SIT is environment-friendly in view that it is non-polluting**
- **SIT, MAT and other control methods should be used in an AW-IPM.**
- **As result, the farmers can produce more fruits in a sustainable way and contribute for food security**
- **We, as consumers, will benefit with better quality fruits with low pesticide residues**

Merci pour votre attention