A GIS to assess different Malagasy migratory locust Risks

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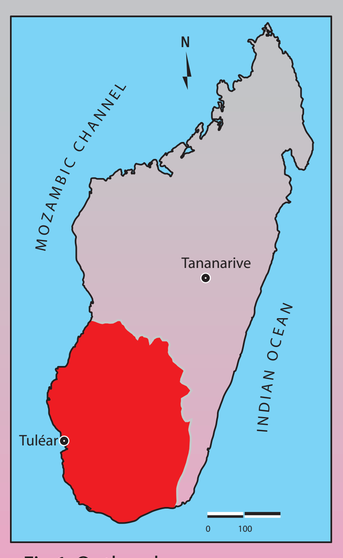

Fig.1: Outbreak area of *L. m. capito* (80 000 km²)

The Malagasy migratory locust, Locusta migratoria capito (Saussure, 1884) is the most important agricultural pest in Madagascar.

Fig.2: Damages on crops during the last plague (1997-2000). CIRAD

When solitary individuals group together, they become gregarious then causes swarm outbreaks. As rainfall discriminates annual locust population dynamics, by monitoring the eco-meteorological conditions, it is possible to locate and assess locust risk.

Fig.3: A swarm in Zomandao plain. (Lecoq, march 1999)

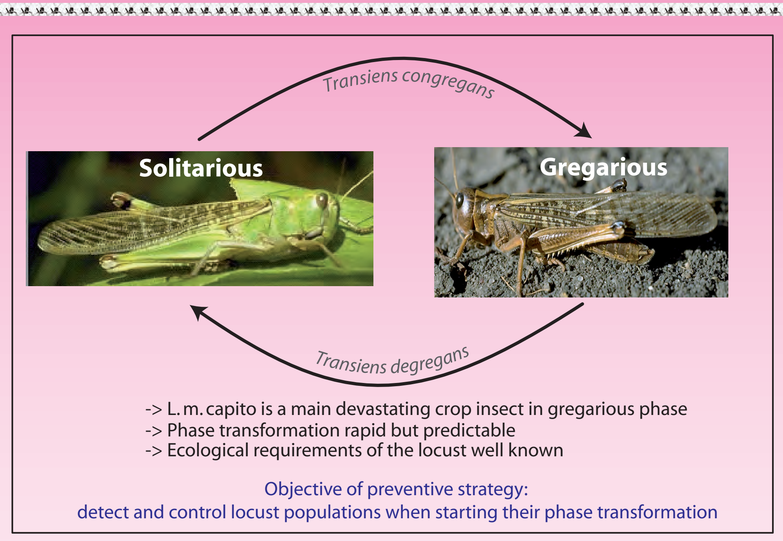

Fig.4: Phase transformation

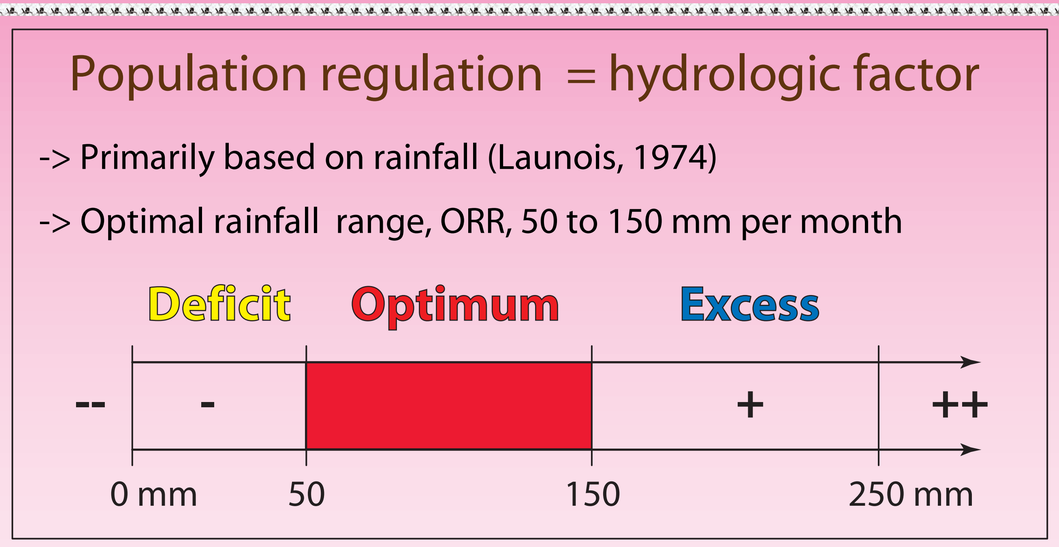

Fig.5: The Optimal Rainfall Range

Objectives :

A forecasting system is the main goal of the Malagasy National Locust Centre in running national preventive controls and establishing three levels of risk: local upsurge, major outbreak with phase transformation, and invasion.

Methods:

A Geographical Information System (GIS) had been created to delimit locust risks in the outbreak area (100 000 km²).

This system combines first locust habitats, mapped using remote sensing data, along with rainfall data to evaluate ecological potential.

Second, this ecological potential is compiled spatially in a GeoDatabase which includes locust data (density and phase) collected in the field.

From this point, several levels of locust risk can be evaluated:

- local upsurge risk;
- phase transformation risk;
- invasion risk.

These locust risks are evaluated and mapped monthly. Risk localisation can guide survey and control operations in the field to be quick and more efficient.

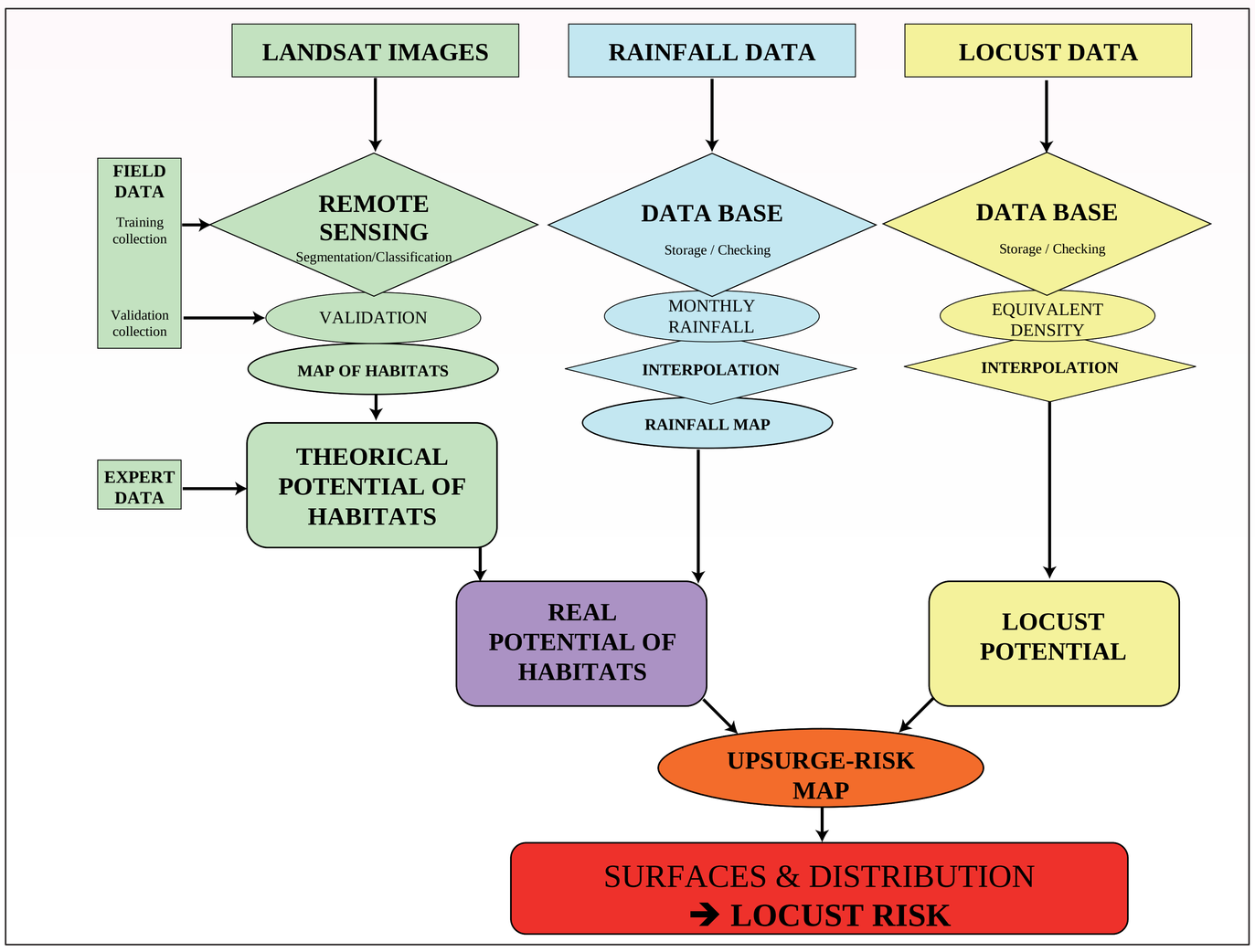

Fig.6: Conceptual model of the new prevent system process by a Geographical Information System - CIRAD

Results:

A first risk map had been validated for the pilot study area using archived data. The generalisation to the entire outbreak area is now in progress.

Key-words : Madagascar ; preventive control ; Locusta migratoria capito ; GIS

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A GIS to assess different Malagasy Migratory locust risks

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The Malagasy migratory locust, *Locusta migratoria capito* (Saussure, 1884) is the most important agricultural pest in Madagascar. When grouping of solitary individuals occurs, it causes outbreaks of swarms. As the rainfall discriminates annual population dynamics, by monitoring the eco-meteorological conditions, it is possible to locate and assess the locust risk. A forecasting system is the main element for the Malagasy National Locust Centre to run a rational preventive control. Three levels of risk can be established:

1) a local outbreak risk,
2) a gregarization risk,
3) an invasion risk.

A Geographical Information System (GIS) had been created to delimit these risks in a pilot area (the Ejeda zone). This evaluation is a combination of three kinds of data: the static components (locust habitats mapped with remote sensing) and the dynamic components (monthly locust and rainfall data coming from the field and collected in a database).

The local outbreak locust risk is defined monthly; where the optimal conditions gather together. Thanks to the outbreak risk localisation, survey and control actions can be done quickly.

To gregarize, the Migratory locust has to make at minimum two generations in the same area. Gregarization risk areas correspond with spot where the outbreak risk is defined during 3 months successively.

An invasion becomes possible when more than 100 000 ha are concerned by gregarization at the end of the rainy season. This risk is not valid for one area but is global for all the population of Migratory locust of the entire outbreak area.

The results were validated for the pilot zone using archive data. The generalisation is in process for the whole outbreak area of the migratory locust.