les dossiers
d'**AGROPOLIS**
INTERNATIONAL
Expertise of the scientific community

Geoinformation and Earth Observation for environment and territories

Number 9

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▲ *Swarm of migratory locusts in Madagascar.*
Crop damage associated with the last major outbreak (1996-2000) led to pesticide spraying of an area of over 4 million ha, thus highlighting the need for an operational warning network.

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Spatial analysis to prevent
locust outbreaks in Madagascar

The Malagasy migratory locust, *Locusta migratoria capito* Sauss., is able to change phase according to its population density. The solitary and gregarious phases are characterized by specific behaviours with markedly different morphological, physiological and ecological traits. In the solitary phase, these locusts are dispersed and do not threaten crops. They migrate by flying in search of suitable conditions for their development. If such suitable areas are spatially reduced, the locusts form high density groups. They can then, through a few generations, switch to the gregarious phase, where they form hopper bands and swarms that are capable of destroying crops and pastures.

An operational research project carried out by EMPA (CIRAD), in collaboration with the Malagasy National Locust Centre, is aimed at improving locust forecasting and monitoring systems in order to control this plague. This involves combining monthly information on rainfall, habitats and the biology of the locust (density, phase and stage). Spatial data can also be used to delimit potential grouping areas where the high population densities could trigger phase transformation and subsequent outbreaks.

A spatial delimitation of habitats was carried out through an analysis of around 12 high resolution Landsat images. These spatial data on habitats structures are updated monthly with field data: the rainfall levels and biological features of the migratory locust are integrated in a GIS for interpolation over the entire outbreak source area, i.e. 100 000 km². It is thus possible, on a monthly basis, to monitor the evolution of areas suitable for locust grouping and prevent outbreak risks.

Spatial monitoring of pest locusts in Madagascar, and elsewhere, represents extremely targeted research. It requires in-depth field knowledge, effective management of spatial information and long-term partners in concerned countries.

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