APPLICATION OF VERY HIGH SPATIAL RESOLUTION REMOTE SENSING FOR THE CHARACTERIZATION OF RISK AREAS FOR RIFT VALLEY FEVER IN SENEGAL.

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Dynamics of most of vector-borne diseases is strongly linked to environmental global and local changes *(*Hay, S.I. 1997*)*. Landscape changes are indicators of human activities or natural changes likely to modify the ecology of the diseases. Here a landscape approach developed at a local scale is proposed to test some ecological factors for the Rift Valley Fever (RVF) transmission in a small area of the Ferlo region in Senegal.

A very high spatial resolution remote sensing image provided by the Quickbird sensor (fig. 1: Clip of Quickbird Image) was used to characterize the temporary ponds which are the breeding sites of the mosquitoes RVF vectors (Pin R.., 2006). Object-based image-processing techniques, which exploit both spectral and textural information (Benz U C and al. 2004), were applied to derive three informations from the image: a pond map, a detailed vegetation map around the ponds and a general land use map. Then, landscape variables were defined for each pond in the area based on bibliographic knowledge of the vector ecology: a landscape closure index calculated within a 100, 500 and 1000 m radius buffer around the pond; a water vegetation coverage index, and a pond density index corresponding to the number of neighbouring ponds within a radius of 1 km (Fig 2: Example of landscape closure index calculated around Furdu and Niaka pond)

To identify the risk areas for RVF, a Logistic Regression Mixed Model (LRMM) was used to test the correlation between these landscape variables and sheep serologic incidence data collected in 2003 *(Chevalier V. and al,2005)*. Results indicate that the landscape closure variable is the most significant to explain the high RVF incidence rates. Other variables and combinations could not be interpreted because of the small number of locations for the serologic samples. Nevertheless, these first results highlight the potential of high resolution remote sensing to characterize the landscape structure at a relevant scale to explain the vector spatial dispersion patterns.

KEYWORDS

Remote sensing, Geographic Information System, Epidemiology, Ecology, Rift Valley fever, vector-borne disease.

References

Hay, S.I. 1997. Remote sensing and disease control: Past, present and future. *Trans. Royal Soc. Trop. Med. Hyg*. **91**:105-106.

Benz U C, Hofmannn P., Willhauck G., Lingenfelder I.; Heynen M. 2004. Multi-resolution, object-oriented fuzzy analysis of remote sensing data for GIS-ready information, Elsevier. 2004, vol. 58, no 3-4 (26 ref.), pp. 239-258

Pin. R.. 2006. Prédiction et gestion du risque d'occurrence de fièvre da la vallée du lift dans un système agropastoral: le ferlo sénégalais, thèse ; Dir : J-M Fotsing, Université d'Orléans, p239.

Chevalier V., Lancelot R., Thiongane Y., Sall B., Diaite A., Mondet B.2005. Rift Valley fever in small ruminants. Emerging infectious diseases vol.11: n°11, p. 1693-1700

Fig. 1 : Clip of Quickbird Image (date of acquisition : 5/08/2004).

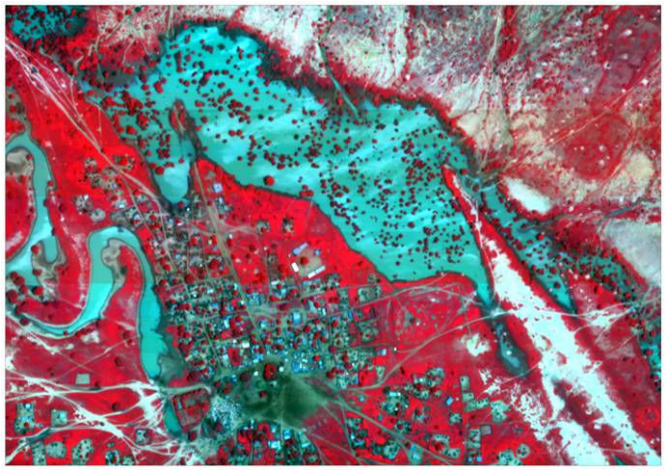
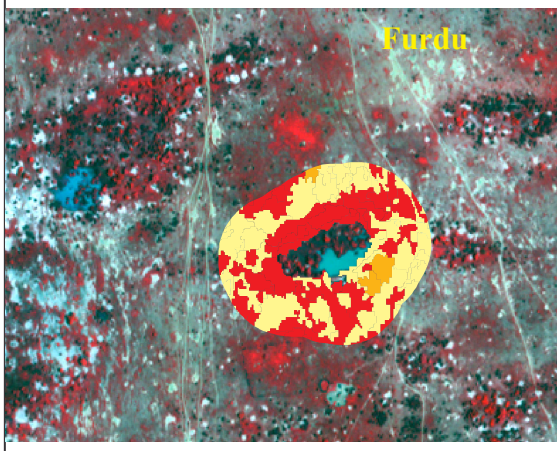
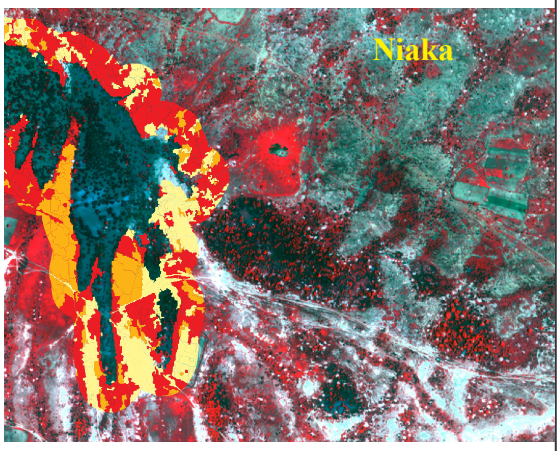


Fig 2: Example of landscape closure index calculated around Furdu and Niaka ponds

Landscape closure Index = %Closed vegetation / [%Moderatly open and Open Vegetation]





LCI = 0.49 **LCI = 0.72**