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Influence of water on the circulation of the West Nile Virus in horses in Southern France

Sophie Pradier[1,2*], Alain Sandoz[3], Gaëtan Lefebvre[3], Annelise Tran[4], Sylvie Lecollinet[5], Agnès Leblond[2,6]

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Background

West Nile Virus (WNV) affects humans and horses, potentially causing severe neurological manifestations. Recent outbreaks of West Nile fever in horses were reported in Camargue (2000, 2004), Var (2003) and Pyrénées Orientales (2006). The circulation of this virus is strongly influenced by environmental conditions. This study aimed at explaining the circulation of WNV in horses by quantifying water bodies around equine stables using Landsat images.

Methods

A total of 135 stables were selected in three French departments (Hérault, Gard, Bouches-du-Rhône) and 1161 horses were tested by serological analysis between 2007 and 2008.

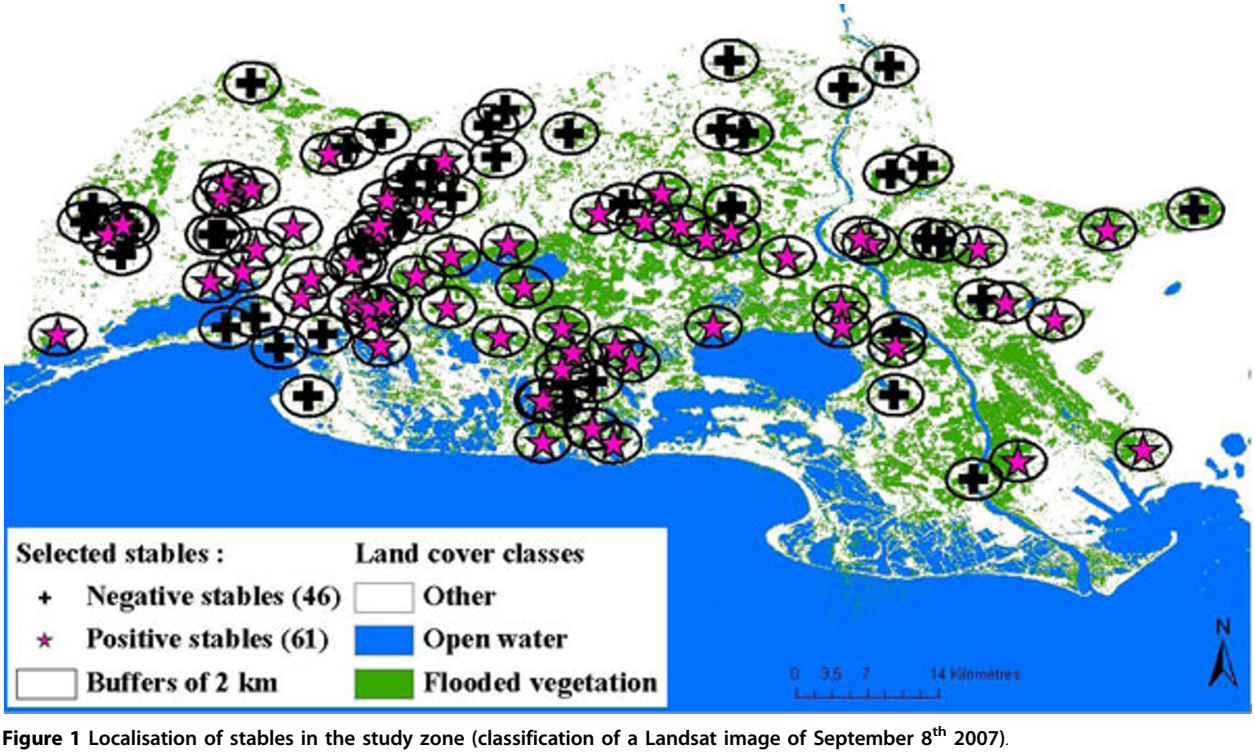

Figure 1 Localisation of stables in the study zone (classification of a Landsat image of September 8th 2007).

* Correspondence: spradier@vet-alfort.fr
[1]Clinique équine ENVA, Maisons-Alfort, France

15 Landsat images (August 2006 to August 2008) were classified into 3 classes: open water, flooded vegetation and other. Surface areas of the first two classes were calculated for buffers of 2 to 5 km around each stable and for each date.

Two multivariate analyses were conducted: GLMs to identify which environmental variables were involved in the viral circulation in stables and GRMs to identify the horse variables linked to WNV circulation after retrieving the effect of the environment.

Results

The best model distinguishing 46 negative stables (no positive horse considering an error threshold of 0.15) from 61 positive stables (at least 1 positive horse) used 2 km buffers and included mean area of flooded vegetation, total number of horses present in the stable, mean area of open water and X and Y geographic coordinate. The first two variables had a positive effect and the other three a negative effect. The model predicted correctly 73% of positive stables and 71% of negative ones. At the horse level, breed, activity and age were significant. See Figure 1.

Discussion

These results can be used to target the surveillance of this human and equine disease in Southern France.

Author details
[1]Clinique équine ENVA, Maisons-Alfort, France. [2]UR 346 Epidémiologie animale INRA, Saint Genès Champanelle, France. [3]Tour du Valat, Arles, France. [4]CIRAD Agirs, Montpellier, France. [5]UMR 1161 Virologie INRA AFSSA ENVA, Maisons-Alfort, France. [6]Clinéquine ENVL, Marcy l'étoile, France.

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