Wetlands management and West Nile Virus circulation, Southern France

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Background

West Nile Virus (WNV) has been responsible for several outbreaks in horses in Southern France since the 1960's, particularly in Camargue (Rhône river delta). However no equine clinical case have been detected for the last 10 years in this area despite a regular but silent WNV circulation in wild birds being evidenced. We hypotheses the management of humid areas could play a key role in WNV circulation in this region.

This sero-ecological study aimed to assess the contribution of environmental variables related to wetlands management to the WNV circulation pattern observed in horses.

Materials & methods

Horses sampling and laboratory analysis

1159 horses non-vaccinated for WNV from 134 stables were sampled in 2007 and 2008. Serological evidence of WNV was detected using a c-ELISA. Individual characteristics were also recorded using a questionnaire.

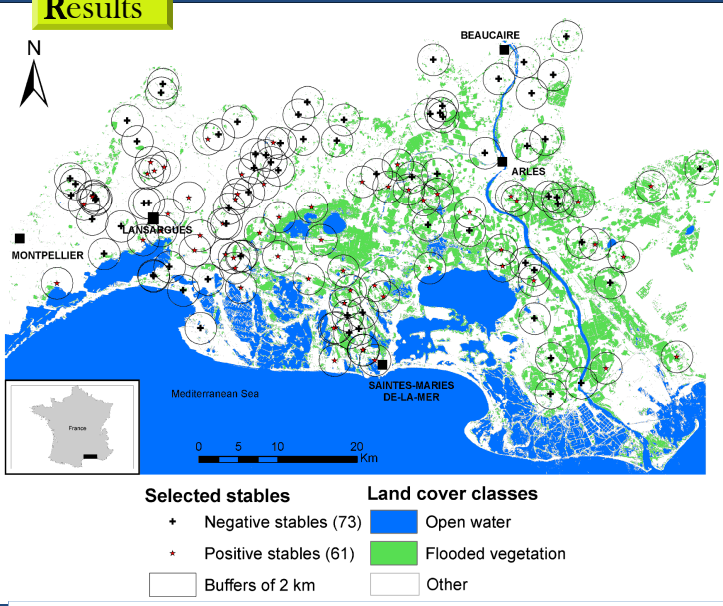
Environmental data

Fifteen Landsat images (30m spatial resolution, August 2006 to August 2008) were classified to distinguish areas with open water (coastal lagoons, marshes…) and flooded vegetation (rice fields, reed beds…). Mean percentages of areas of open water and flooded vegetation and variations of these percentages between 3 periods (November to February, March to July and August to October) were calculated for buffers of 2 km radius around stables.

Statistical analysis

Generalized linear mixed models were used to assess the influence of environmental variables on horse seropositivity.

Results



Localisation of stables in the study zone (classification of a Landsat Image of September 8th 2007). Stables were considered as positive if at least one horse was WNV seropositive.

Results

Variable	Adjusted OR	95% CI	P-value
Horse birth date: ≤ 1990	ref		
[1991–1997]	0.65	0.36 – 1.17	0.147
[1998-2004]	0.97	0.49 – 1.91	0.921
≤ 2005	0.09	0.01 – 0.93	0.043
Horse date of acquisition: ≤ 1999	1		
[2000–2004]	0.50	0.28 – 0.87	0.014
≥ 2005	0.27	0.12 – 0.62	0.002

Horses born and acquired after 2004 had significantly lower odds of being WNV seropositive.

➡ may be related to known WNV equine outbreaks in the study area.

Variable	Adjusted OR	95% CI	P-value
Differences of mean % of open water area	(2 km buffers)		
Nov to Feb minus Mar to July			
[-3.70 ; 0.01]	1		
[0.01 ; 0.14]	1.78	0.62 – 5.13	0.285
[0.14 ; 3.88]	2.33	1.03 – 5.28	0.042
Mar to July minus Aug to Oct			
[-1.03 ; 0.0]	1		
[0.0 ; 0.88]	1.10	0.33 – 3.61	0.878
[0.88 ; 8.01]	5.53	1.53 – 20.01	0.009

Seasonal variations of wetlands' sizes were associated with WNV seropositivity.

WNV spillover was more intense in areas with a strong decrease in wetlands size between winter and summer.

➡ These variations may influence the size of reservoir hosts and vectors populations around horses.

Conclusions

Results from this study suggest that , more than the size of wetlands, **variations of wetlands areas between seasons are associated with WNV horse seropositivity.**

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SVEPM 2014 Dublin, Ireland 26th – 28th March 2014