

The Relationship Between Subdivision Construction and the Risk of West Nile Virus Transmission



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Abstract

- West Nile Virus (WNV) is a potentially serious and life threatening virus that most severely affects the young, the elderly, and the immunocompromised.
- Mosquitoes, which transmit WNV, use pools of stagnant water to lay their eggs and breed.
- Health units in Ontario employ larvicides, as a mosquito control method, but targets can only be reached if they exist on public lands.
- Stagnant pools of water are typical features of construction sites, particularly new subdivisions.
- Under the *Trespass to Property Act* (1990) construction sites are considered private property, and anyone who enters a property “without the express permission of the occupier...is guilty of a [trespassing] offence (GoO, 2016).”
- The purpose of this study was to investigate whether subdivision construction caused an increased risk in the transmission of WNV to individuals living and working in the surrounding area.
- Results of the analysis indicated that there was no correlation between the presence of subdivision construction and increases in any traps mean weekly collection number, and, hence, WNV transmission risk for the associated summer(s).
- The results of this study indicate that it is likely weather that is the primary factor that affects WNV transmission risk.
- Based on the results of this study no changes are recommended for the *Trespass to Property Act* (1990).

Figure 1. *Culex pipiens* mosquito, primary vector for WNV



Background

- In its most severe form WNV causes damage to the central nervous system that can be permanent, and, in some extremely severe cases, can cause death (CDC, 2016) (GoC, 2015).
- Previous studies have indicated that both construction, and proximity to breeding sites increases the risk of acquiring a mosquito-borne disease, like WNV (Staedke et al., 2003) (Brown et al., 2014).
- However those two variables have never been studied together, nor have either of them been studied in Canada.
- Municipalities operate mosquito control programs to reduce the risk the public faces, but under the *Trespass to Property Act* (1990) program workers cannot conduct their work on construction sites without committing a trespassing offence (GoO, 2016).
- The mean flight distance for the *Culex pipiens* species of mosquito, the vector of primary concern for WNV, was around 1.3 km, and as such 1.5 km was selected as the cut off distance for this study – to be conservative (Ciota et al., 2012) (Hamer et al., 2014).

Methods

- For each mosquito trap in the Region of Peel the mean number of mosquitoes caught per batch was calculated for the years 2005 through 2016, and from there the standard deviation was calculated, using Microsoft Excel.
- Any subdivision construction site was identified using Time magazine, and Google Earth’s global time-lapse tool.
- The distance and eligibility of the site was confirmed using Google Earth’s GIS function.
- The subdivisions assumption date was attained by contacting the appropriate municipality’s building department to mark the time when mosquito control activities began and terminate eligibility.
- The data in the Excel spreadsheet was then transferred into a graph where it was descriptively analysed.
- Then the data was analysed using a Mann-Whitney test.

Results

Descriptive Analysis:

- There were some very large outlier results.
 - One particular trap, B2, had a consistently high mean number of mosquitoes trapped per batch, it also had the largest outlier result which was not influenced by subdivision construction *Figure 2*.
 - If the large outliers are removed, *Figure 4* reveals a rough wave pattern which indicates that changes to the mean number of mosquitoes caught per batch are likely affected, primarily, by weather patterns.
- ### Mann-Whitney Test:
- Because the data were not normally distributed, a non-parametric Mann-Whitney test was conducted to test the association between the mean number of mosquitoes caught per batch, and proximity to subdivision construction.
 - The P-value of the Mann-Whitney test was 0.0594 indicating that there was no statistically significant relationship between subdivision construction and an increase in the mean number of mosquitoes caught per batch.

Figure 3. Mann-Whitney test results

Two-sample Wilcoxon rank-sum (Mann-Whitney) test				
Constructi-o	obs	rank sum	expected	
0	273	48935.5	50641.5	
1	97	19699.5	17993.5	
combined	370	68635	68635	
unadjusted variance	818704.25			
adjustment for ties	-56.73			
adjusted variance	818647.52			
Ho: TrapMe~r(Constr~o==0) = TrapMe~r(Constr~o==1)				
z = -1.886				
Prob > z = 0.0594				

Figure 2. Graph of relationship between mean number of mosquitoes per batch and proximity to construction

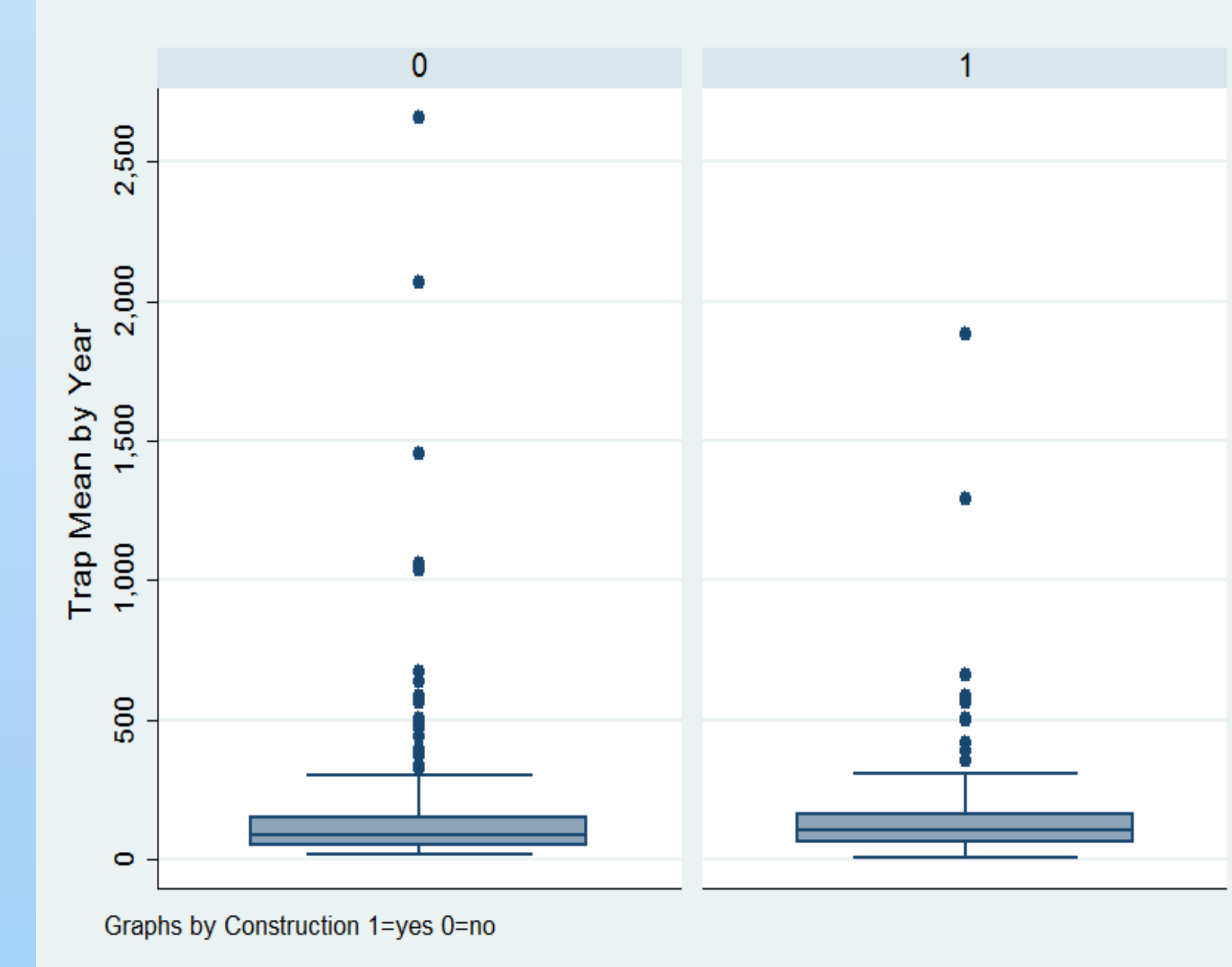
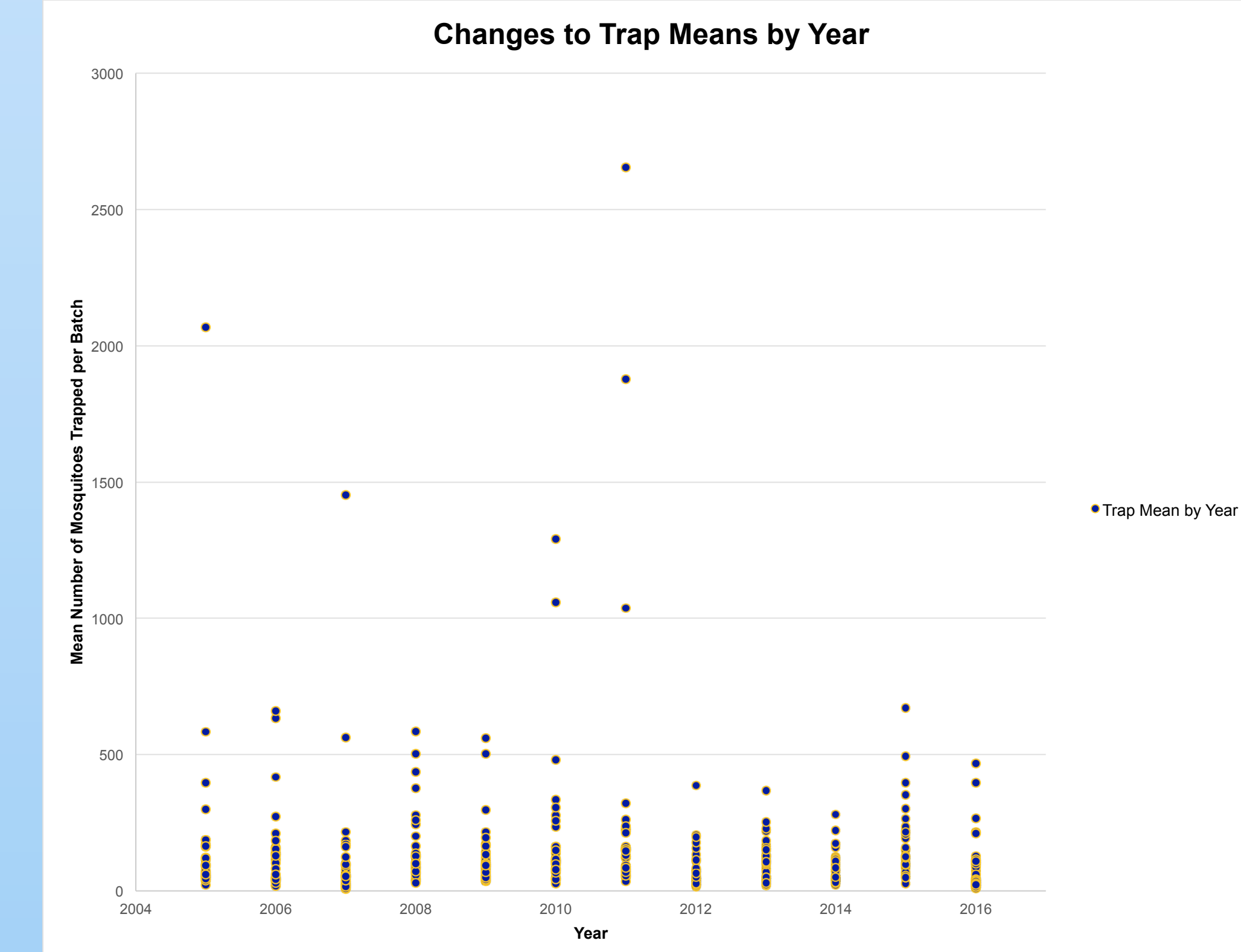


Figure 4. Graph of changes to trap mean by year



Conclusion

Based on the results of this study, being within 1.5 km of subdivision construction does not increase the transmission risk of WNV. The results of this study indicates that it is likely that weather has the greatest effect on WNV transmission risk. It would be unwarranted to make changes to the *Trespass to Property Act* (1990). This topic should be further studied in the future, because the scope of this study was fairly small.

References

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