

An Agent-Based Model of West Nile Virus: Predicting the Impact of Vaccinations on Horses

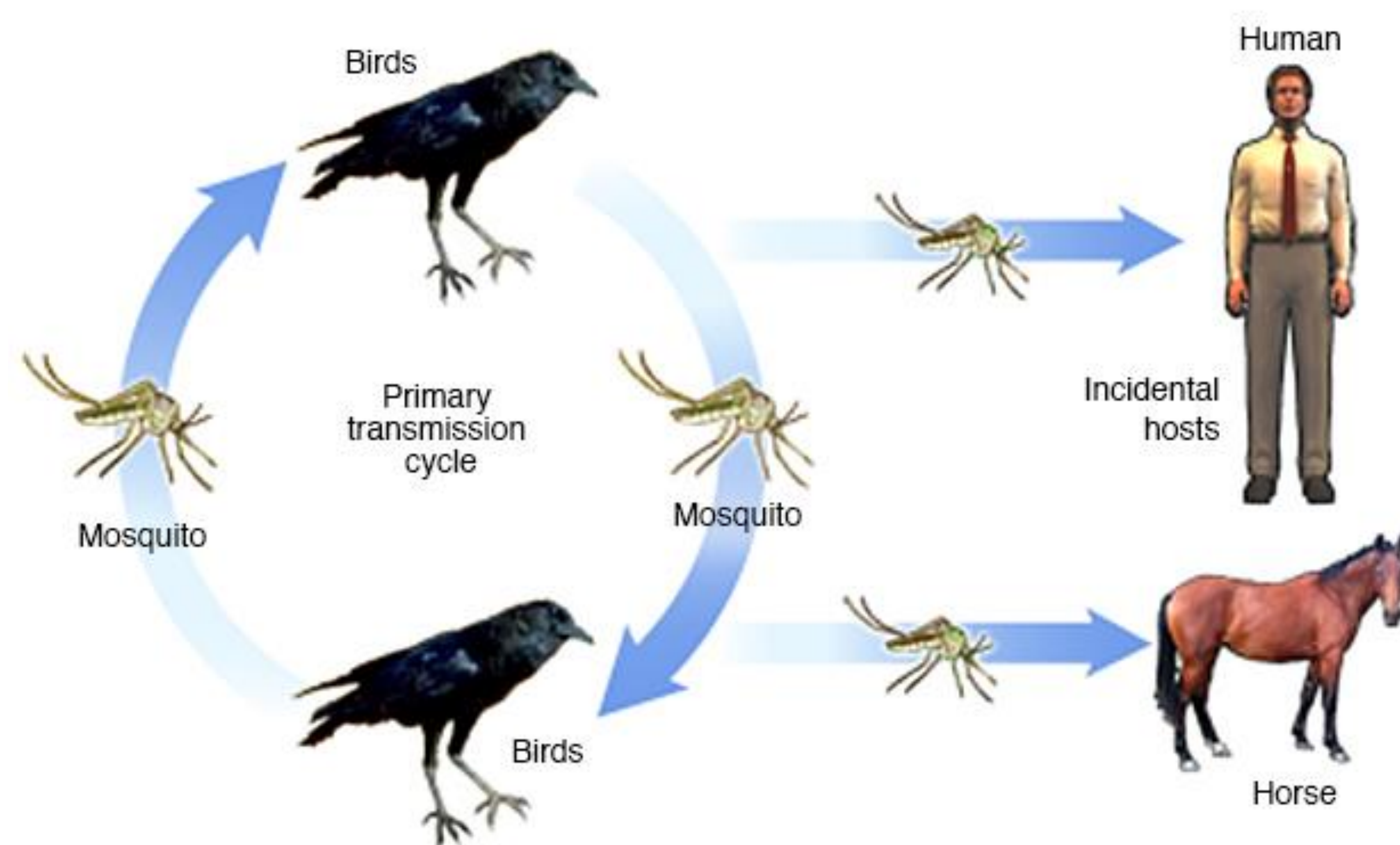
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INTRODUCTION

- West Nile virus (WNV) is a mosquito-borne virus that is contracted by birds, mosquitoes, humans, and horses.
- Birds and mosquitoes circulate the disease while mosquitoes can transmit it to various mammals.
- West Nile virus (WNV) has spread rapidly across the continent resulting in numerous human and horse infections and deaths.
- This model incorporates local temperature data to show the disease dynamics
- Our model also focuses on the impact of Public Health Agents (PHAs) and the effectiveness of horses vaccinations.

INFECTION CYCLE DIAGRAM



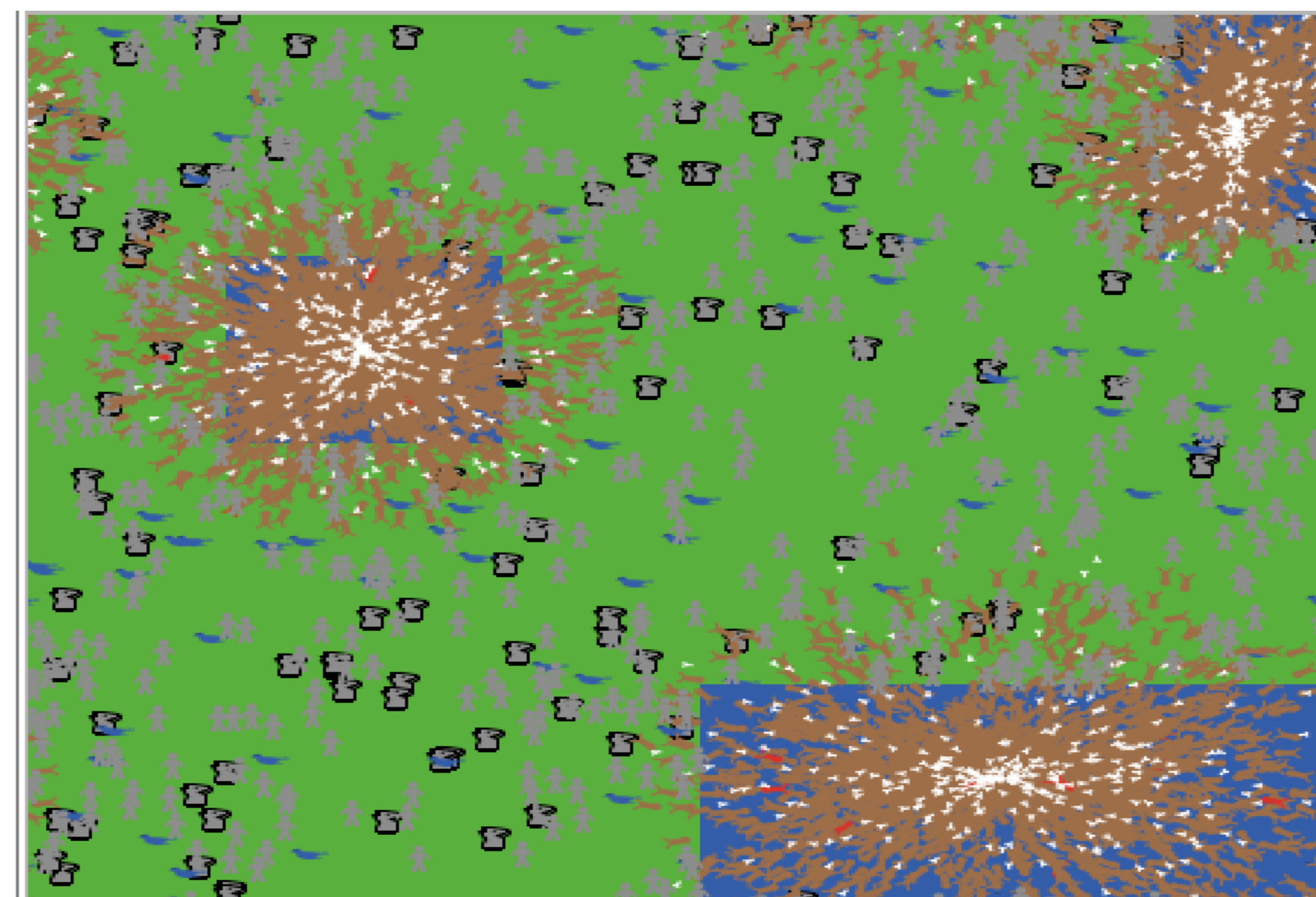
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Palmer, B. (2017, August 7). Mosquitoes Test Positive for West Nile Virus in Union County. Retrieved January 8, 2020, from <https://news.wsiu.org/post/mosquitoes-test-positive-west-nile-virus-union-county/#stream/0>.

METHODS

- We implemented an agent-based model in Netlogo to simulate the spread and effect of West Nile Virus on the populations of mosquitoes, birds, horses and humans
- Our model uses temperature data to approximate the biting rate of mosquitoes, natural mortality of mosquitoes, larval maturation rate, and human infection-rate.
- In our secondary model, "WNV-PHA", Public health agents treat by spraying and informing humans on preventative measures.
- We were also able to model the difference in simulations where the horses are and are not vaccinated.

NETLOGO DYNAMICS OF THE MODEL

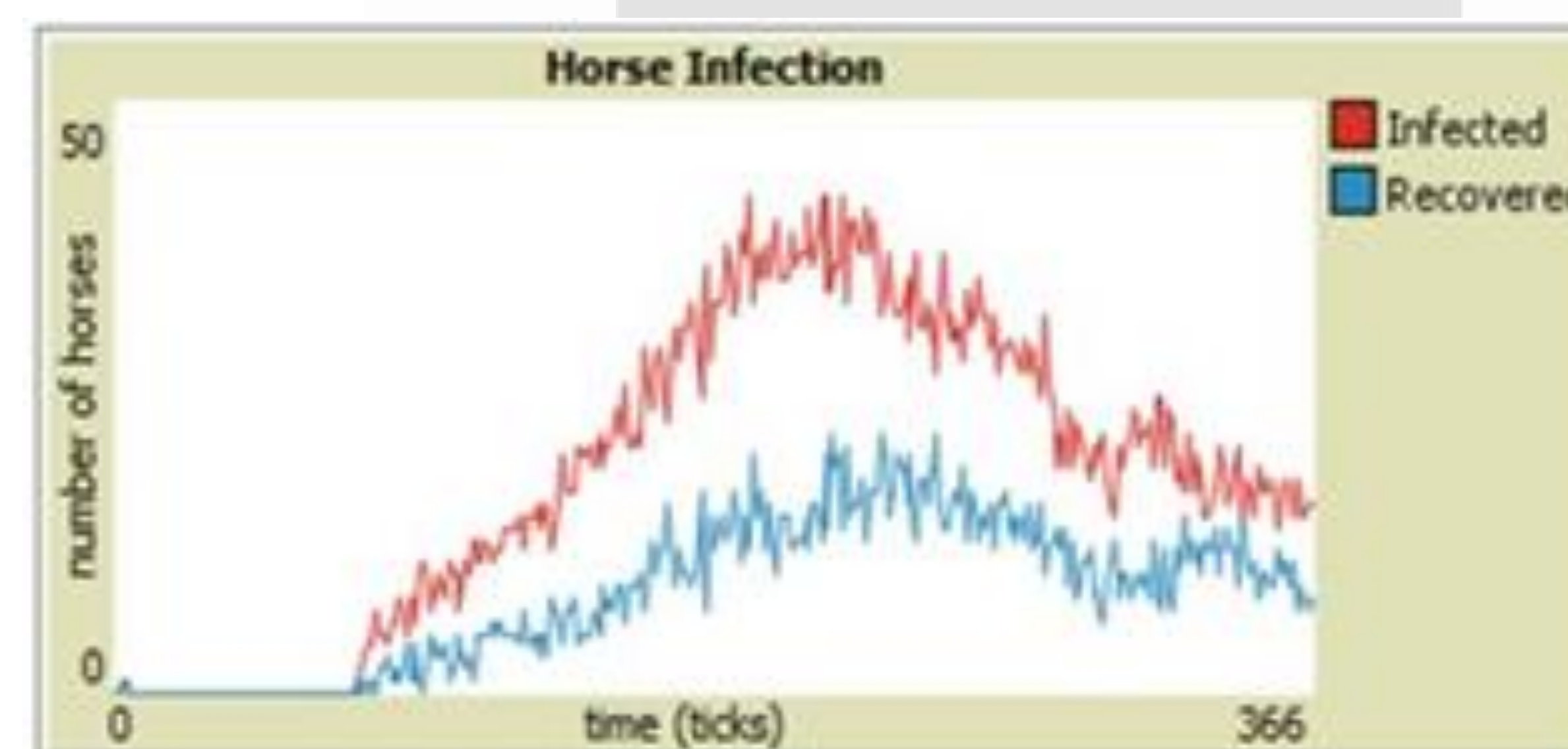


RESULTS

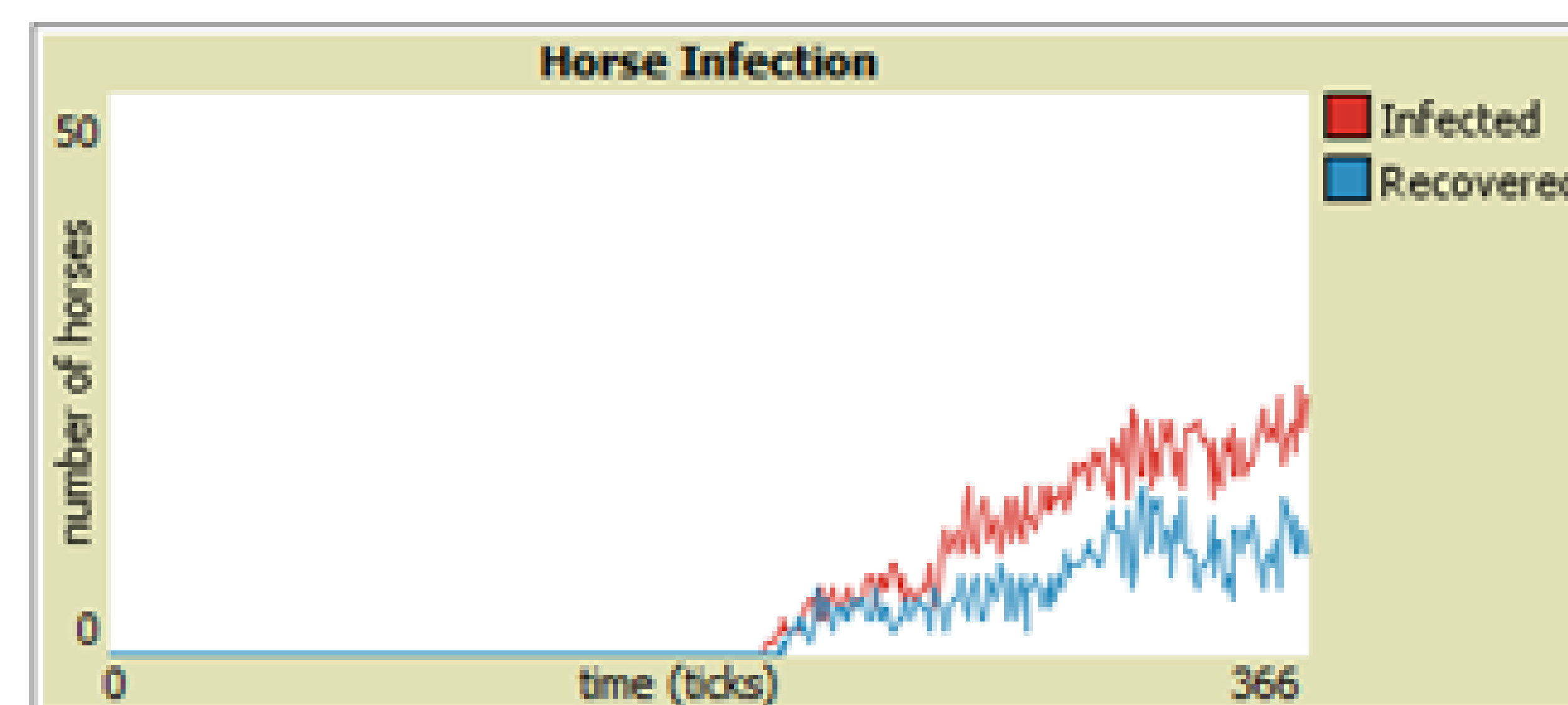
- Our simulation results show that both vaccinating horses and spraying mosquitoes are key components to mitigate the disease transmission
- Our model shows the importance of temperature and its influence in the variance of disease transmission between humans, birds, mosquitoes, and horses.

WNV MODEL: HORSE INFECTION

No Vaccinations

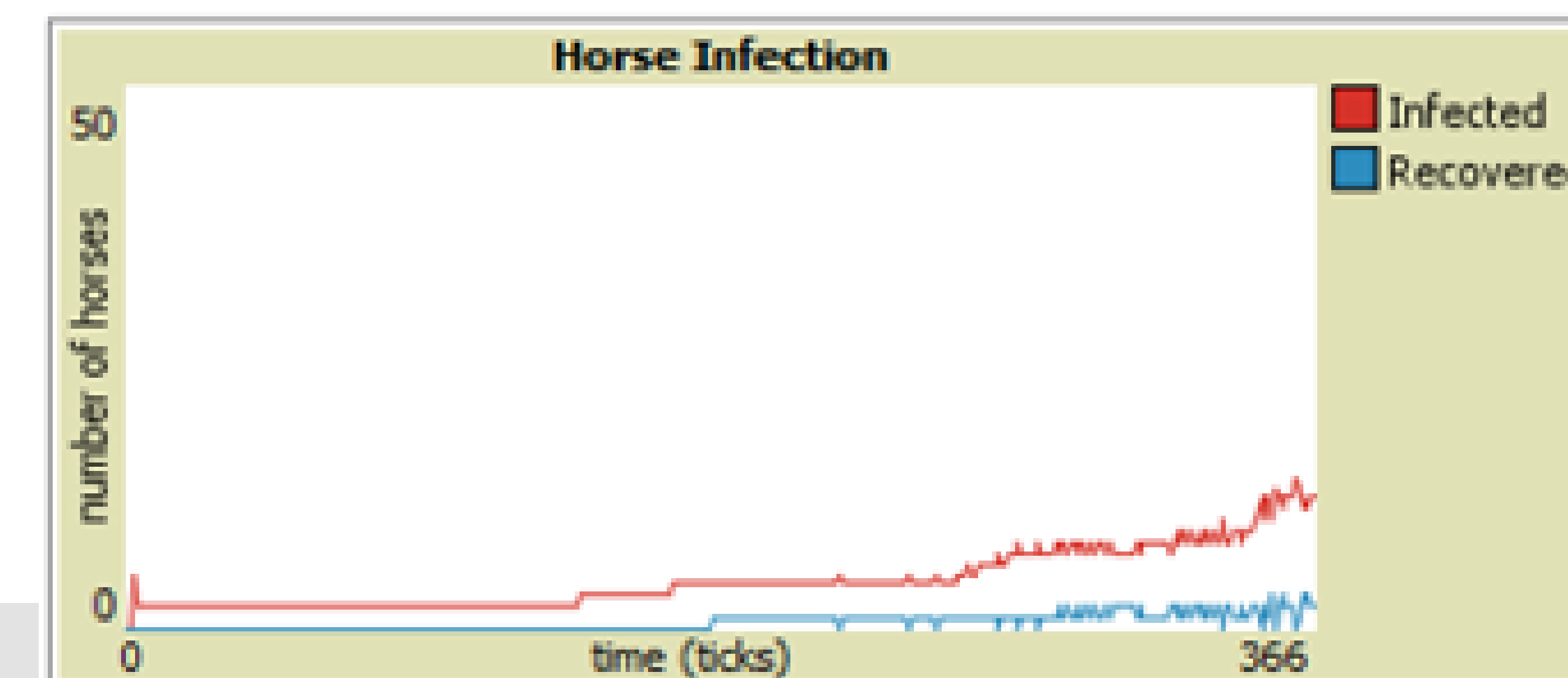


Vaccinations

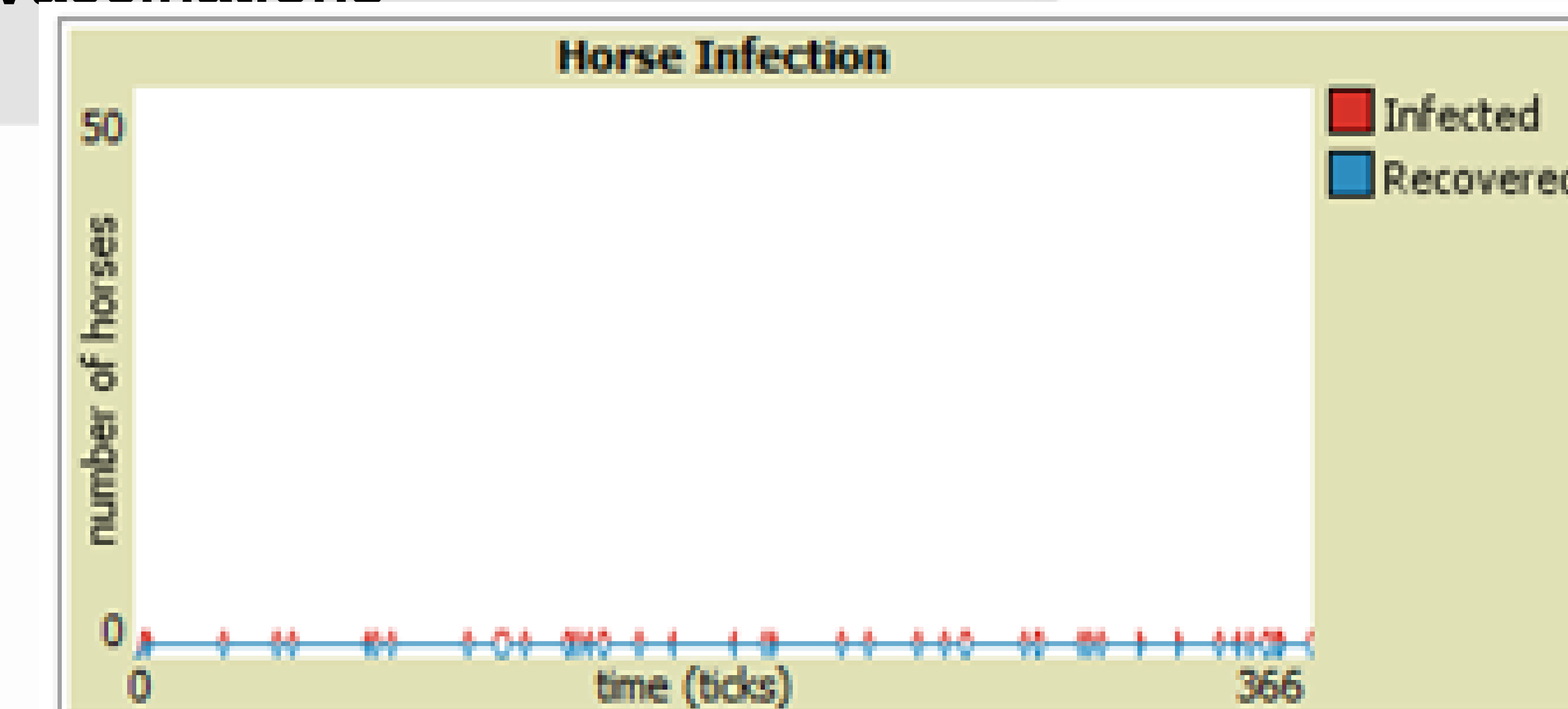


WNV-PHA MODEL: HORSE INFECTION

No Vaccinations



Vaccinations



CONCLUSION AND FUTURE WORK

- Future work will be aimed at incorporating a mathematical model into the program for WNV horse infection rate
- To continue, we hope to implement GIS maps to give more accurate local temperature dynamics and give the Southwest Abatement Center a more useful model.

REFERENCES

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