Mosquito, Don’t Bite Me!

New Mexico

Supercomputing Challenge

Final Report

March 27, 2015

Team 73

Melrose High School

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Area of Science:

Biology and Epidemics

Executive Summary

Our project is about the West Nile Virus. The West Nile Virus is carried in mosquitoes. The virus affects mosquitoes when they feed off a bird that is infected with the West Nile Virus. Mosquitoes usually mate near bodies of water. So, when there is more rain, more mosquitoes come around. This gives people (and animals) a greater chance of getting infected with the virus. One in 150 people infected experience severe symptoms. People over 50 are most at risk. About 80% of those infected show no symptoms at all. Researchers believe that people who are infected once in their life develop a natural immunity to the West Nile Virus that will last the remainder of their lives.

We chose to have our project over West Nile because one of our team member's brother's got infected. Some symptoms of West Nile are fever, headaches, body aches, fatigue, back pain, skin rash, swollen lymph glands, eye pain, stiff neck, disorientation, coma, tremors, lack of coordination, convulsions, pain, partial paralysis, or sudden muscle weakness. We have seen the devastation West Nile brings to the person and family involved. We also want to see how the virus spreads. There was five confirmed cases of West Nile in our small community of Melrose last year. If it can travel this fast in our town, we would like to see how fast it spreads anywhere.

Problem Statement

We found the lifespan of a mosquito and how hard it is for mosquitoes and people to get the virus. We founding how far mosquitoes can travel, which helped us determine how to control the spread. We used NetLogo 5.1.0 to model and solve the problem at hand. Our program models an area with houses and water sources varying in size according to rainfall. Water is

important to mosquitoes, as their life cycle depends on it. The variables that can change will be the amount of rainfall, lake size, and starting number of mosquitoes, number of houses, and the number of people. It models and determines the number of mosquitoes affected and the number of people affected. Our model will include ways for people to control mosquitoes, such as bug sprays, and insecticides.

Method

We created a computer model that has numerous variables. We have houses, lakes, and mosquitoes on our model. We also modelled the landscape around Melrose (green grass and patches of brown grass). The number of houses can be adjusted to however many houses we would like. There is also a slider for rainfall that we can adjust to change the size of the lake. We also have mosquitoes, which is another variable that we can vary the numbers. We have monitors that count how many mosquitoes there is, the number of bites there has been, and how many times mosquitoes have flown over a house. We have two sliders. One slider is for the amount of rainfall that adjusts the size of the lakes. The other slider is for how much bug spray that is used by people. If the mosquitoes fly over each other, they reproduce. The number of mosquitoes goes up, then they start biting people, they spray bug spray, and slowly the number of mosquitoes drops. Also, the mosquito season that lasts about 180 days is represented in our program by 1000 ticks. We chose 1080 ticks, because that represents six ticks per day of four hours each for a six month period.

Verification and Validation

Our model shows a realistic ecosystem for mosquitoes and how they live, move, and interact with people. Our map shows lakes, houses, and the surrounding areas, which are the breeding grounds for mosquitoes, and the location for all interactions. The number of lakes and lake size is based upon the amount of rainfall. It also shows the number of mosquitoes gradually decreasing due to people spraying pesticides, if a specific mosquito biting rate is reached.

Results

Our computer model shows what happens over a specific time period. This includes: how many people get bit by mosquitoes, how many of these people are likely to be infected by West Nile with severe symptoms, and how many mosquitoes there are remaining at the end of the time period.

We like the way our program looks and runs. It also shows a reasonable model of mosquito and West Nile activities for a specific area.

Conclusions

Using the results of our program, we showed that the worst areas were places with high rainfall, lots of houses, and people not spraying. We found that the best way to keep from West Nile is to live in an unpopulated area and always carry a can of bug spray.

Achievements

Program

We are using NetLogo 5.1.0for our programming language. The reason we chose to use NetLogo is because we have learned how to use this program at Supercomputing conferences, we have used it in past years, and really like the way it works.

Screenshots

Acknowledgment

A big thanks to Zack Perkins, Melinda Holloway, Tyler Belcher, Karen Doherty, and Chase Stagner who gave us the idea to do this project.

References:

www.mosquitoworld.net/mosquitodiseases.php

http://www.mayoclinic.org/diseases-conditions/west-nile-virus/basics/symptoms/con-20023076