Insect-O-Rama

New Mexico
Supercomputing Challenge
Final Report
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Executive Summary

Do you have bugs in your house? Bugs are a major problem in many households. People spend millions of dollars a year trying to get rid of these pests, whether it's by calling exterminators or by using many of the harsh chemical products made today. In our project we are using StarLogo to find out how bugs in the human household interact with one another and how we could limit the bug population in an average home. To make this work we picked 3 major bugs in our area: ants, spiders, and flies. We are using certain bugs to see if they would be able to lower the population of other insects living in homes by killing one another. That it may limit the population of other bugs. We found out how they interacted with one another. We will also have a human interaction with them.

Table of Contents

Problem

The fact of bugs infesting our homes is not ignored. All of us hate it and are disgusted by it. So this project is bringing up the problem of infestation and why it is and how it works. It is also going to try and recognize the interaction of the insects and humans.

To solve this problem, we are going to use the computer program StarLogo. We have designed our model for our house and its surroundings. We've selected and have placed the representative insects. We have researched and learned each insect's life cycle, styles, environmental needs, and the predator/prey relationships for our model. These are some of the things that are needed to be included in this project to solve our problem.

Introduction

Bugs here, bugs there, bugs everywhere. Our world is populated with bugs. We start caring about them being around is when they are in our household. They are nothing but pests and do no good. On the contrary my friend, insects play a role in this life cycle just like humans.

The insects we have chosen for our project that will explain this process are ants, spiders, and flies. Ants may be something like a garbage truck; they are always collecting the junk we leave laying around. Spiders help by decreasing the insect population. Flies tend to just bug. This is why we are experimenting with this project, to have a better understanding of the interaction with all the insects and humans in the real world. This is going to be done by using StarLogo.

Description

We used StarLogo to make a model that shows a yard, house, shed, pond, and trees; all of the places that bugs would live. We are having the bugs that are predators and prey. The predators are spiders, and sometimes ants. The spider's prey is flies and ants.

Spiders can eat any one of these bugs if it can catch them. Ants can eat larger insects, however there has to be more than one ant and an ant can be eaten by most bugs when alone. Flies mostly eat rotten food and get eaten by spiders. The predators can make the number of the prey go down. There are several things that can affect the bugs but we couldn't put all of them in our model. We picked 3 bugs that are a big problem in everyday life. We found a lot of information on them.

A few facts about the bugs are; the ants have four different types of ants in a colony, the queen, workers, soldiers, and males. An ant has four stages of life: egg, larva, pupa, and adult. Their life usually lasts from 6 to 10 weeks. The queen can live over 15 years. Some workers can live for up to 7 years.

A spider starts life inside an egg. The mother spider lays many eggs. Sometimes the mother spider dies after laying her eggs. The eggs usually hatch in a very short time. A baby spider is shaped like its mother, but may be lighter in color. The baby spider is soon able to spin its own web and capture its own food. It does not have to be taught. This is a natural instinct. The spider's skeleton is on the outside of its body. When the baby spider, or spiderling, grows too big it must shed its skeleton. The old skeleton splits and the spider steps out of it. This soft, new skeleton soon grows hard. The spider is now an adult.

For flies breeding continues throughout the year in warm parts of the country. In colder climates the larva or pupae over winters and adults enter a resting state in sheltered situations. Mating may occur within 24 hours of emergence from the puparium and one successful mating is sufficient to fertilize the female for her lifetime. Under normal conditions, houseflies are sexually mature in 3-4 days and commence depositing eggs from the ninth day after emergence. Egg laying may continue throughout the lifetime, for more than two months. Eggs are laid singly with 100-150 piled up into a mass and 2-7 batches may be deposited by a single female. The average

production from one fly may be 500 eggs, however there is a record of 21 batches totaling 2,387 eggs laid during 31 days from emergence. The whole life cycle from egg to adult may be completed in 8-20 days depending on ambient temperature and a new generation may be started anywhere from 2-20 days later. Under favorable conditions the eggs hatch in 8-30 hours and larval development through three instars is completed in 5-14 days. Pupation occurs over 3-10 days and the pre-oviposition period ranges from 2-23 days. Adults may live from 19-70 days. Some 10-12 generations can be completed during the warmer months.

Method

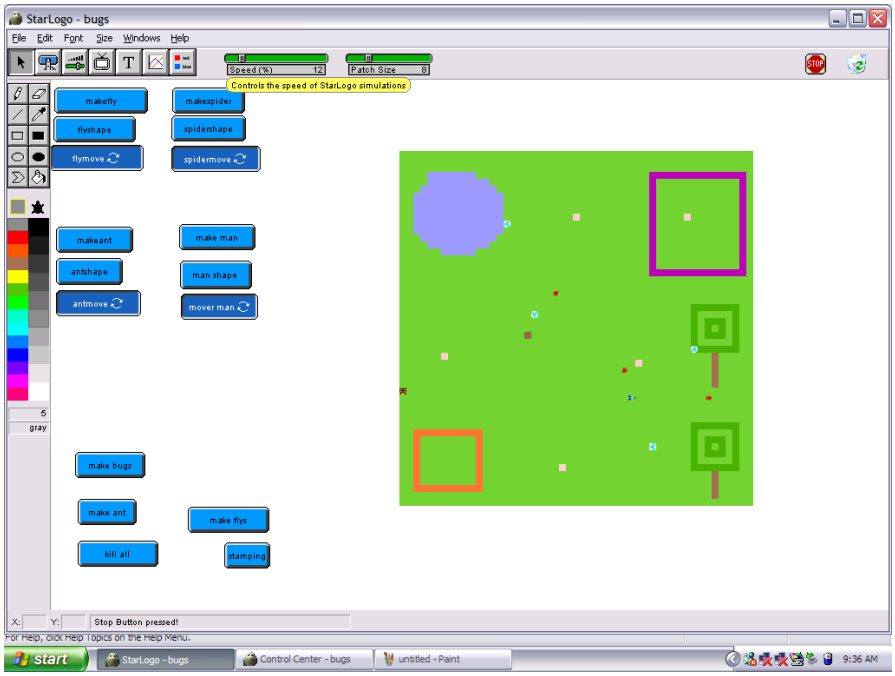
We used StarLogo because it shows better biological models and it's easy to create example of some of the codes we are using and cheap for modeling our project. Here is an example:

```
to flymove
  rt random 360
  fd 5
end



to spidermove
   jump 5
   rt random 360
   water
   jump 10
   water
end

to antmove
    fd 1 rt 90  fd 2 if pc-ahead = 108 [die] rt 90  fd 3 rt 90  fd 4 if
pc-ahead = 108 [die] rt 90 fd 5  if pc-ahead = 108 [die] rt 90 fd 6 rt
90 fd 7 rt 90 fd 8 rt 90 fd 9 rt 90 fd 10 rt 90 fd 11 rt 90 fd 12 rt 45
    if pc-ahead = 108 [die]
end

to manmove
    rt random 360
    fd 2
    if shape = man [grab-one-of-turtles-here] [partner die]
end

to water
     if pc-ahead = 108 [die]
end
```

Results

After researching each insect's life styles, instincts, and interactions, we applied them to our StarLogo and got to work on it. Functionally we placed a house, shed, pond, yard, and one anthill that gave us a start. Next the insects were shaped out and were given a code to be made and move around like they should. Soon after we were able to get them to die in places were they could not go.

StarLogo Layout



This shows a diagram of our StarLogo.
Purple= house
Blue= pond
Orange= shed
Dark Green= trees
Light Green= grass
Pink= food
Dark Brown= ant hill

Original Achievement

We designed and programmed a math model of insects using parameters. We decided what 3 different bugs to use that are common to all of New Mexico. The places we used are places that the bugs would thrive, and that everyone could relate to as part of their 'personal environment'.

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