Bee Model Supercomputing Challenge

Our project is based on the research question, "what is happening actually with the bee population in the word?". To try to find answers we proposed to create a model that recreates how chemical products that are toxic for bees are released to the corn plantations and how the wind spread them to the flowers and finally arrives to the bees who pollinate those contaminated flowers. Therefore, "the consequence of a dying bee population impacts man at the highest levels on our food chain, posing an enormously grave threat to human survival. Since no other single animal species plays a more significant role in producing the fruits and vegetables that we humans commonly take for granted yet require near daily to stay alive" (Joachim Hagopian, 1).

We hope that by showing the dangerous and drastic effects that toxic chemicals have on bees, that we raise awareness regarding the issue. The model will show how quickly bee populations diminish when introduced to pesticides (Anexo 1, A), and how the reduction of the amount of bees will affect the plants that rely on them for pollination. "We want to prove that to protect our bees and agriculture we need to shift from destructive industrial agriculture towards ecological farming. First and important steps are: 1. Ban all bee-harming pesticides 2. Adopt a bee-action plan 3. Promote ecological farming" (Greenpeace, Np, 1).

Therefore, we hope to raise awareness through our model. Many people do not realize how much we, as humans, rely on the bees to pollinate our crops and flowers. In the absence of bees, many of our crops would die, causing an immense food shortage. "Where would we be without bees? As far as important species go, they are top of the list. They are critical pollinators: they pollinate 70 of the around 100 crop species that feed 90% of the world. Honey bees are responsible for $30 billion a year in crops." (Moate, Np). The first step to change is awareness, and we hope that once people see our model they will realize how terrible it could be for us, and for our environment, if the bees were to go extinct

In order to achieve this, our first objective was to look for background information that could help us to understand the actual situation and all the details about it. Once we had the data we needed, we started to code. We started learning some basics about coding on NetLogo and, slowly, we began to move to more complex codes that allowed us to recreate the situation we were after. For that, we used different online resources that helped us, such as tutorials or blogs. During this process, we saw all the information that we did not take into account until we began coding our model. We have also improved our teamwork by learning to organize and separate the work and how to put everything together.

However, we still have to work on adding more variables to our code and on showing the impact on the environment. For that, we need to make changes in our code focusing on the results we get once the variables are set and how to interpret the outcome of the data.

Our actual code looks like this:

```
breed [bees bee]
bees-own [energy]

to setup
  clear-all
  grow-good-flowers-and-bad-flowers
  set-default-shape bees "bee"
  create-bees number [
    setxy random-xcor random-ycor
    set energy random 10
  ]
  reset-ticks
end

to go
  if not any? bees [ stop ]
  grow-good-flowers-and-bad-flowers
  ask bees [
    move
    pollinate-good-flowers
    pollinate-bad-flowers
    reproduce
    death]
   tick
end

to grow-good-flowers-and-bad-flowers
  ask patches [
   if pcolor = black [
     if random-float 1000 < good-flower-grow-rate
     [set pcolor pink ]
     if random-float 1000 < bad-flower-grow-rate
     [set pcolor red]
   ]
  ]
end

to move
 rt random 50
 lt random 50
 fd 1
 set energy energy - 0.5
```

```
end

to pollinate-good-flowers
  if pcolor = pink [
    set pcolor black
    set energy energy + good-pollen-energy ]
end

to pollinate-bad-flowers
  if pcolor = red [
    set pcolor black
    set energy energy - bad-pollen-energy]
end

to reproduce
  if energy > birth-threshold
  [set energy energy / 2
    hatch 1 [fd 1]]
end

to death
  if energy < 0 [ die ]
end
```

Sources

- http://www.globalresearch.ca/death-and-extinction-of-the-bees/5375684
- http://e360.yale.edu/feature/declining_bee_populations_pose_a_threat_to_global_agriculture/2645/
- http://sos-bees.org/https://ccl.northwestern.edu/netlogo/docs/dictionary.html
- -http://www.bbc.com/future/story/20140502-what-if-bees-went-extinct
- https://www.youtube.com/watch?v=XJ-gO-yAwHU&list=PL8AF794C0800A6A73

Annex 1

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