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Final Project Proposal

The phenomenon I would like to model is pollination and the declining population of honey bees. Mainly, how bees pollinate a field of flowers, and what conditions might cause the bees population decline and subsequently, the decline in the number of flowers/plants. Various factors for the decline in bees that have been named include pesticides, bee mites, deforestation and general destruction of nature, and the feeding of bees with corn syrup. This is an interesting phenomenon because the decline of honey bees in the U.S. is a real issue currently affecting different plants and the environment. With the decline of bees, bee pollination is at a low and since it is important in the growing process of crops like almonds, many of the foods Americans eat might end up at a shortage.

This is a good fit for ABM because there is a bit of randomness involved with bee pollination and their movements. It would also be interesting to be able to follow one particular bee over the course of its pollination to see how it reacts to different kinds of environments.

A driving question of this model would be what factors really cause the decline in honey bee populations? According to various resources and opinions, it is a mixture of many different factors acting together, so I want to find out what those factors are.

The agents of the model will consist of the bees, plants/flowers, and the hive. The patch agents will consist of the grass, but should be able to change colors based on what factors are affecting that patch of grass (pesticides, mites, etc).

The properties of the bee agents will be energy, speed, pollen count, and possibly birth rate. Also I want to add a mite? factor and a pollen? factor which is an on/off that states whether the bees have mites or if they're carrying pollen from another plant. The flowers should have a pollinized? Factor, a reproduction rate, and energy. The hive should have a growth rate. For the patches I hope to introduce the pesticides that discolor the patch and affect the energy of the bees.

The way the agents will interact is that the bees will start off in the hive and move around randomly until it finds a flower. Once a flower is in its vision, it will approach it and collect pollen. Then it will look for look for more flowers and repeat until its pollen count is full, from which the bee will return to the hive and deposit its pollen. At each flower the bee will have a chance of distributing pollen thus allowing the plant to reproduce and spread seeds which create new plants. When the bees being back enough pollen to the hive, the hive will grow in size (spawning another hexagon next to it). Hopefully I'll be able to implement a system where a mouse click on a patch will place a pesticide on that patch, and change its color affecting the bees and plants that touch it. Also the bees should be affected by a mite system which affects bees randomly and shortens their lifespans/energy. Later I hope to add in corn syrup diets and deforestation to the model.

The core parameters that will be exposed in the model are the number of bees and plants, and potentially their rates of growth/birth and decline. Also switches that control the various conditions (pesticides, mites, etc) will be on the interface and can be turned on and off. The measures that will be collected include the numbers of bees and plants, and their growth and death rates.