

Executive summary: **Title: Global warming, what can we do about it?**

Global warming is a very big problem and we seem to not have much control over it. But we do have control over the man-made effects of global warming. Some of the major man-made effects are deforestation, car fumes and smoke from factories. We would like to know if we can help reduce man-made effects of global warming by replanting trees because deforestation is one of the man-made effects. Using Starlogo, we set up a simple model consisting of three agents – Trees, Cows and CO2. Each of these agents interacts to make an ecosystem. We then modeled our ecosystem in three phases. First, we made our ecosystem stable, meaning that the number of Trees and the number of CO2 don't go too high or too low. Second, we will add the young tree's chance of survival. Third, we will add man-made CO2 and will start to deforest. We will also replant trees in this phase.

Introduction:

Global warming is a very big problem and humans don't have much control over it because the sun's activity is the most dominant source of global warming. The sun emits infra-red and the greenhouse gases trap it and re-emit it into the atmosphere. One of the major greenhouse gases is water vapor. But when too much water vapor is in the air, it falls down as precipitation so we don't have any control over that either. What we do have control over is the man-made effects of global warming because we as humans are causing it. Some of the major effects

are deforestation, car fumes, and smoke from factories. I chose to do man-made effects because we as humans should be able to help reduce it because we caused it.

We wanted to find out how effective CO₂ is at trapping and releasing heat and what that has to do with the temperature raise, but nobody really knows, and it's beyond the scope of this research. So we did the following.

What we want to know:

We would like to know if we can help reduce the man-made effects on global warming by replanting trees because when we deforest, there are less trees to absorb CO₂ and CO₂ is a major greenhouse gas.

Explanation of the Agents

We set up a model with three agents – trees, cows, and CO₂. One tree represents 100 trees in our ecosystem and one CO₂ represents 100 CO₂ molecules. The trees absorb CO₂ when a wandering CO₂ collides into a tree. The trees produce offspring if the local population density is not too high. The cows walk around in random manner and create CO₂ every 10 seconds so that the place of the CO₂ creation is completely randomized.

Trees: Produces offspring only if there is room and absorbs CO₂ to do photosynthesis.

Cows: Moves around and creates CO₂ at random positions.

CO₂: Moves around. If it bumps into a tree, it gets absorbed.

Description of the method:

To investigate the amount of man-made CO₂, we used Starlogo and modeled our ecosystem in three phases.

The ecosystem changed in each phase. The following is a description of the ecosystem in each phase.

Phase 1

Here we examined if we could establish what we call the stable state, which means that the amount of CO₂ created by cows is not too much and not too less. This phase showed what nature would look like if it were untouched by mankind. We wanted to get results that showed that when nature was untouched by mankind, it was well balanced. So we experimented with different parameters that determined whether or not the model was balanced. (We assumed that without manmade effect, the nature maintains its balance between CO₂ and tree populations, and created the simple model consisting of three types of agents to represent such natural state.)

Phase 2

Here we added the chance of survival of young trees because in nature it is not always the case that young trees grow. In other words, the survival chance is not always 100%. In phase 2, we tried to find out what the range of survival chance can be in order to maintain the natural balance between the number of trees and CO₂. In phase one, we assumed that when the trees produced offspring, the chance of survival was 100%. To make the survival chance realistic, we made the chance of survival to be less than 35% because the number of CO₂ did not go too high or too low and neither did the number of trees.

Phase 3

In this phase, we added man-made CO₂, deforested, and replanted trees. We added man-made CO₂ by making the cows create more CO₂ because cars and factories just add more CO₂ to the ecosystem. We deforested by taking all of the trees in one area every 100 years and cutting them down. We made sure that the trees were old enough (more than 400 years) before they were chopped off because woodcutters don't cut trees that are still very young. We then replanted by creating a young tree in place of the ones that were deforested. We still made the chance of survival less than 35% because these young trees are not protected once they are replanted.

Results:

When we were creating the stable state, we experimented with different parameters. Doing so, we found that certain parameters have certain outcomes. When the trees looked around to see if the local population density (of trees) is not too high, there needs to be a radius. We changed this radius and the population density and got these results: When the radius was 100 and the population density had to be less than three for the tree to be able to produce offspring, the number of CO₂ went to the maximum point (4,000) and the trees all died out.

When the radius was 0.1 and the population density had to be less than 1000 for the trees to produce offspring, the number of trees went to the maximum point and there was just a little bit of CO₂ left because the cows produced some CO₂. When the radius was 20 and the population density had to be less than 35 for the trees to be able to produce offspring, the system was stable.

To be completed.

What we learned:

To be completed

Citations:

Wikipedia – http://en.wikipedia.org/wiki/Greenhouse_gas