GLOBAL WARNING: IT'S NOT COOL

New Mexico
Supercomputing Challenge
Final Report
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Team Number 16
Barranca Mesa Elementary School

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Executive Summary

We are modeling what will happen to CO_2 emissions if they continue at current rate. We researched population growth, emissions rates, and absorption rates of CO_2. We chose to model the U.S. and China. We set up our model in StarLogoTNG with agents for people, CO_2, and trees. We found that both the U.S. and China showed CO_2 increasing through the 25 years of our model. Because of China's large population, their overall CO_2 was much higher than the U.S. Unless things change, CO_2 will continue to rise and possibly cause an increase in global warming.

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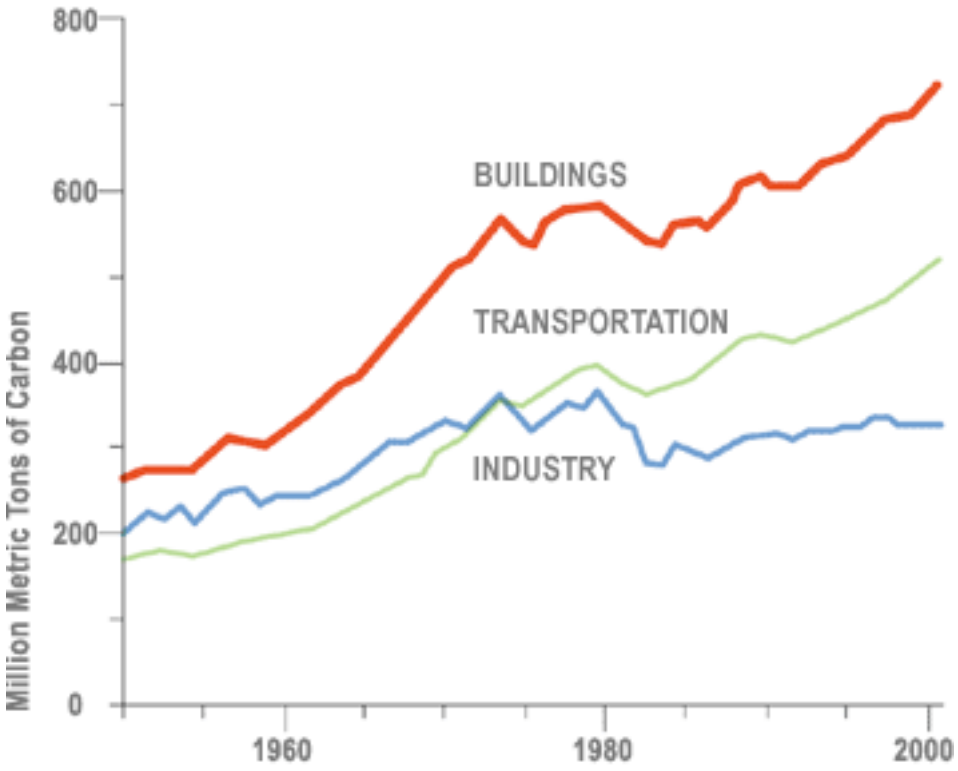
Introduction

This project is on Global Warming. It shows the amounts of the CO_2 emitted in the past few years. This report covers the following: facts about trees, the oceans, CO_2 emission rates for China, India, and the United States, and our model and model variations, along with the conclusion. CO_2 is a greenhouse gas, which means it absorbs infrared rays and traps in heat. Too much of it has caused global warming. We modeled CO_2 emissions and absorption from the people, trees, and the oceans. We relate the increase of CO_2 to global warming.

CO_2 Emissions

These are some facts about CO_2 emissions. Electricity is the single largest source of CO_2 emissions in the United States. Fertilizers are the largest source of CO_2 in agriculture. Real life emissions include coal, oil and gas in power plants, automobiles, industrial facilities, and much more. Between 1997 and 2003, the United States saved 1711 million tons of CO_2 emissions by importing stuff from China rather than making them in the United States. Every person in the United States emits about 20 metric tons of CO_2; every person in China emits about 4 metric tons of

CO_2, and every person in India emits about 1 metric ton of CO_2. Buildings were always the things that make the most CO_2. Industry used to be second, but is now third. Transportation used to be third, but is now second. Transportation is probably second now because of gasoline for cars.

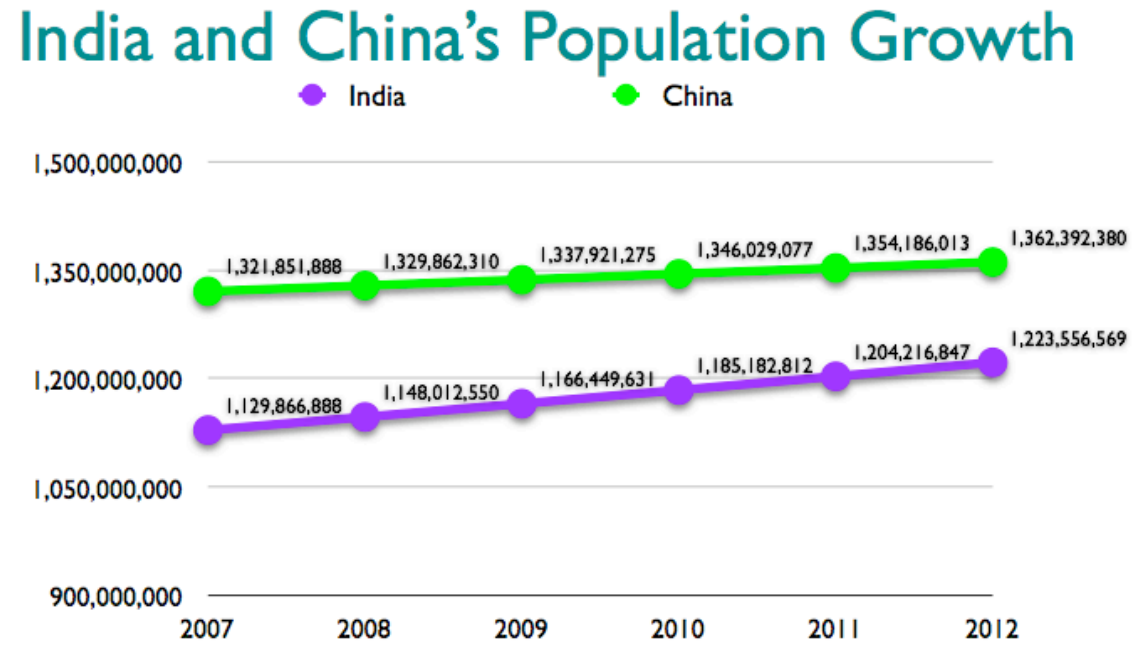


http://www.architecture2030.org

CO_2 and Population Rates

This section will cover emission and population rates and graphs. Data was found on the Internet. The current populations and population growth rates of the U.S., India, and China were

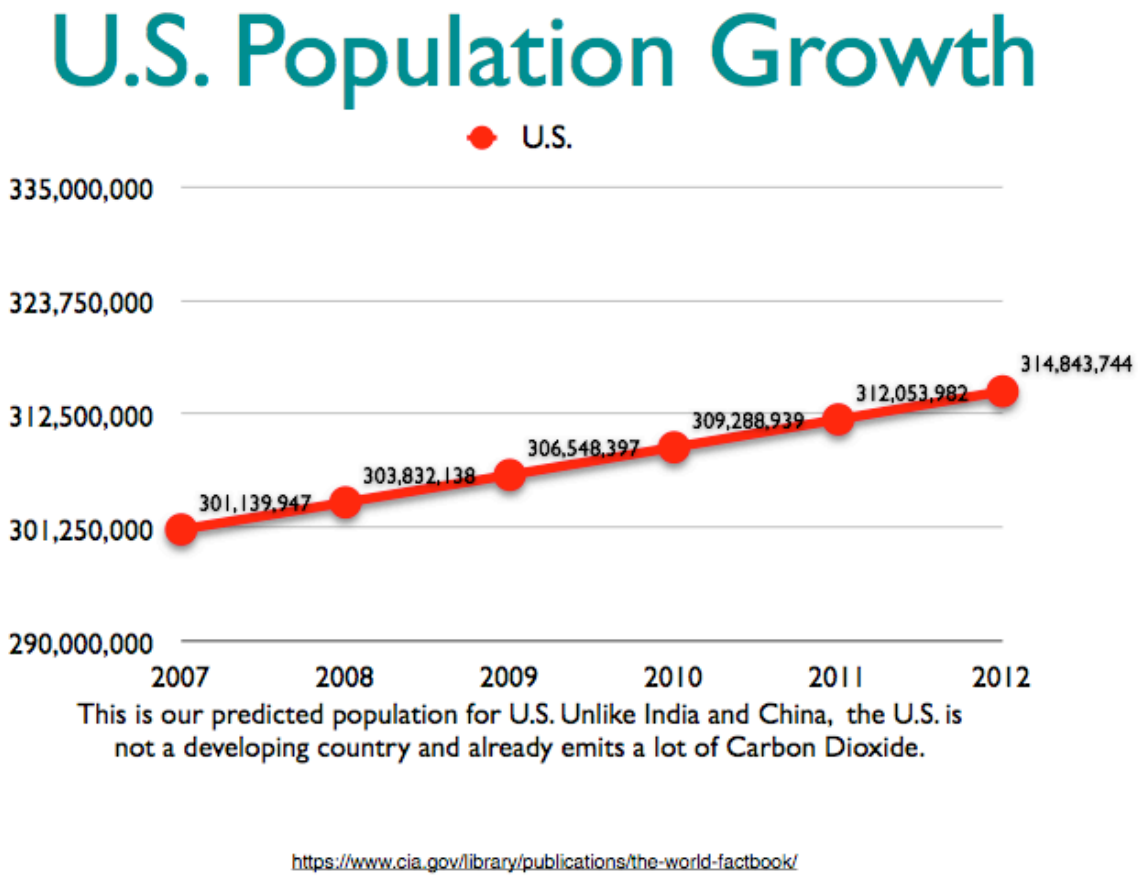
collected. Then graphs for these countries and predicted populations of the future were made.



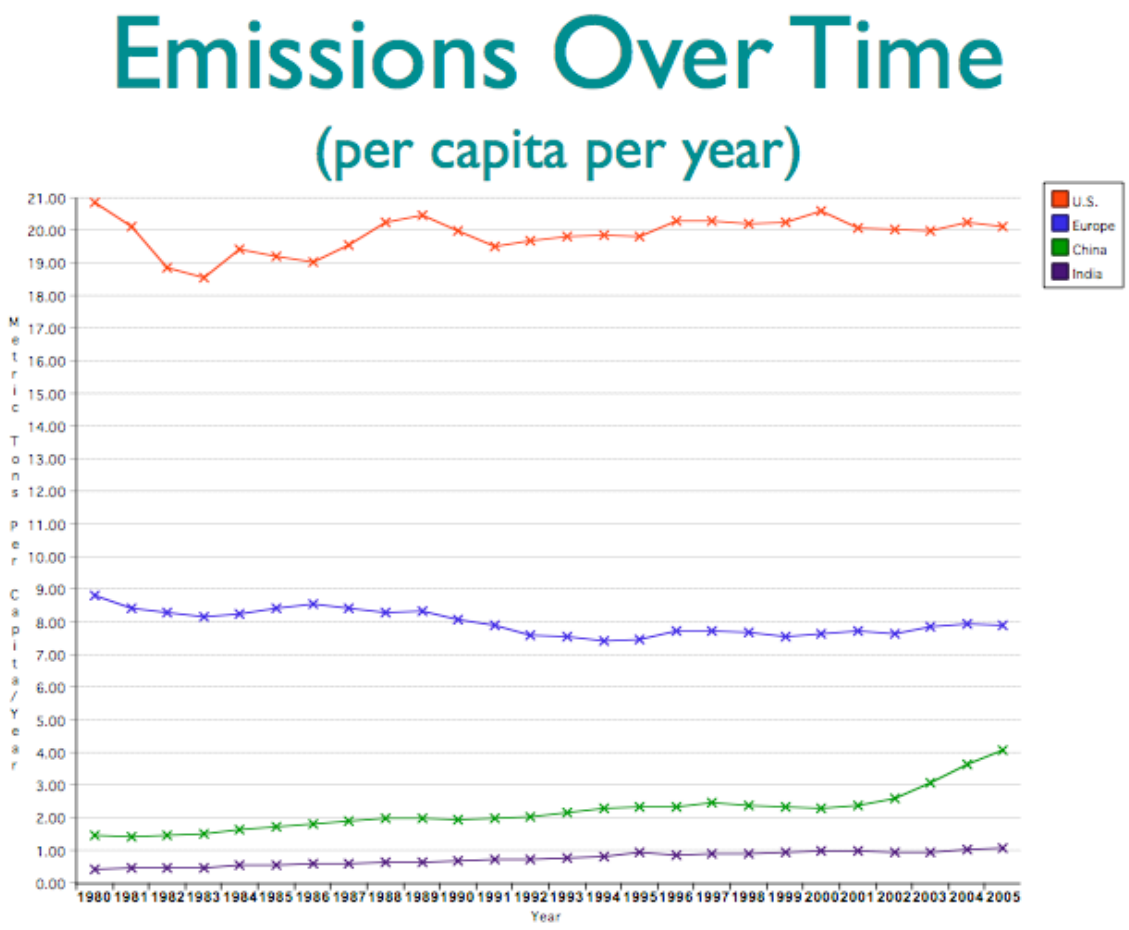
These are our predicted populations for China and India. We got the current populations and the population growth rates. As you can see, India's population is going up much faster than China.

https://www.cia.gov/library/publications/the-world-factbook/

China's current population is about 1,321,851,888 (a lot) and their predicted population in 5 years is 1,362,392,380, an increase of about 40,000,000! Next was India, which has a current population of 1,129,866,888 and a five-year prediction of 1,223,556,569. Last but not least is the U.S. with a current population of roughly 301,139,547 and a five-year estimate of 314,543,744.



A graph including the tons of CO_2 per year per capita was made. India was lowest with about 1 ton, next was China with about 4 tons, then came Europe (extra) with around 8 tons, and the U.S. is the highest with a whopping 20 tons!.



Absorptions

Oceans and trees are two things that absorb CO_2. From 1800 to 1994 the world's oceans absorbed about 118 million metric tons of CO_2, which means that they absorb about 0.6 million metric tons per year[1]. This works out to about 30-50% of CO_2 absorbed by the ocean per year[2]. An average mature tree absorbs about 13 pounds of CO_2, meaning that an acre of trees absorbs the same amount of CO_2 as is produced by driving a car 26,000 miles. Also,

[1] http://www.wiredscience.com
[2] http://www.gdrc.org/oceans/fsheet-02.html

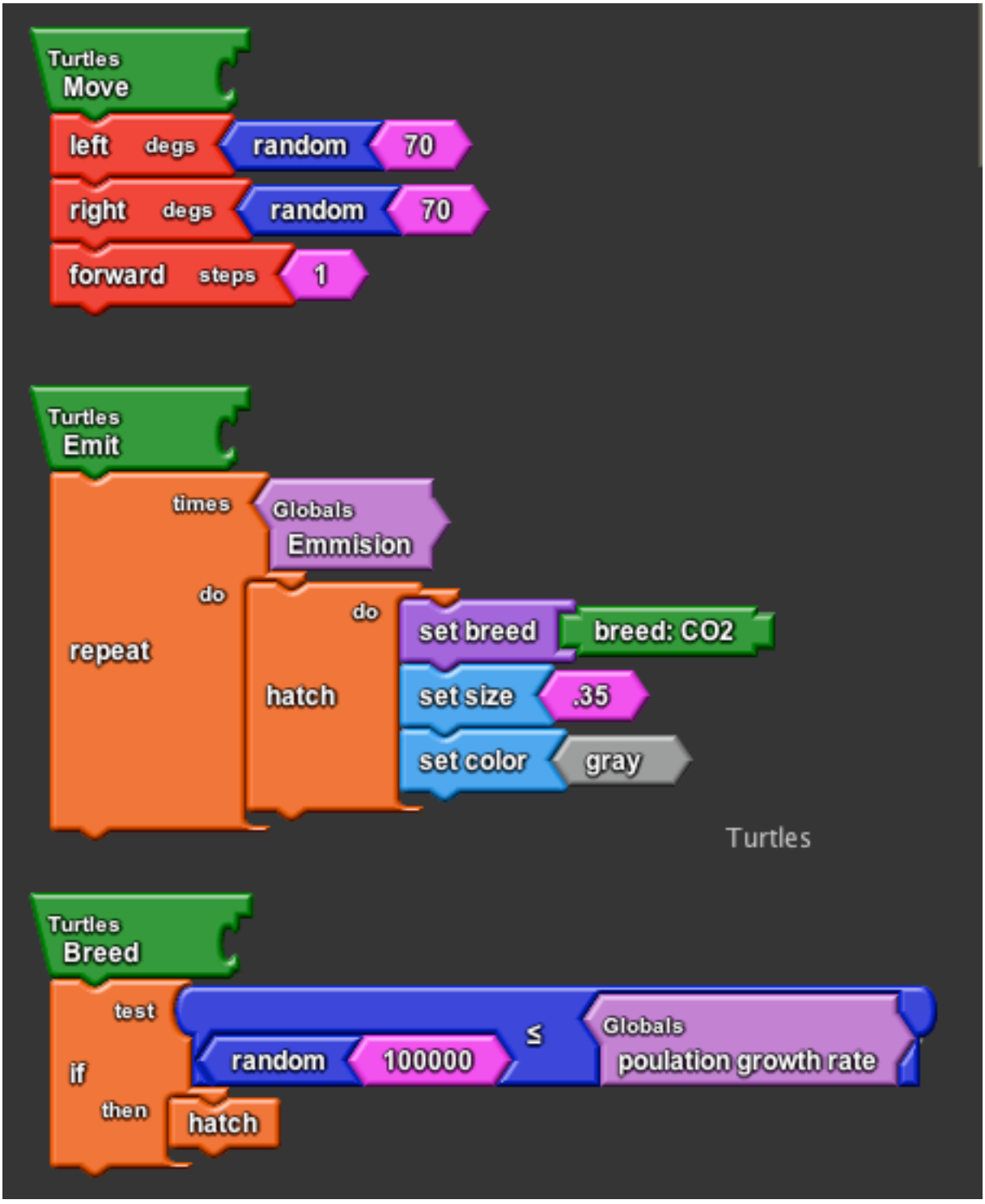
in most species of trees CO_2 absorption is greater in the first 15 years of life.

Program Data

In our program (StarLogoTNG), we had many agents, such as people, carbon dioxide (CO_2), and trees. Trees absorbed CO_2, and people emitted CO_2. We had a background removal of CO_2, which represented the ocean removing 40% of CO_2 every run (year). We created programs for two countries: the U.S. and China. Turtles would increase according to their country's population growth rate. In each country's setup we kept the staring number of turtles at 100, and the starting number of CO_2 particles at 300, to make it easier for us to model emissions and other parts. One turtle was always 1% of the population, so they totaled up to the whole populace. The CO_2 was 0.3% percent of the entire amount.

No turtles ever died, because both population growth rates were a positive number, and therefore increasing. We based the number of trees on the amount of coverage over the world, which we believed was about 10 percent. Any time a CO_2 particle came in contact with a tree, it was absorbed. We had each turtle emit three CO_2 particles every "year," or click of the Go button, unless the emission rate was more than 1 (China only). We only ran the program one year at a time. We ran each country five times, and averaged each country's stats. For each country, we just changed

the population growth rate and CO_2 emission rate. Below are screenshots from our program:




CO2
Float
left degs random 90
right degs random 90
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forward steps 1
CO2
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test
if
then
die
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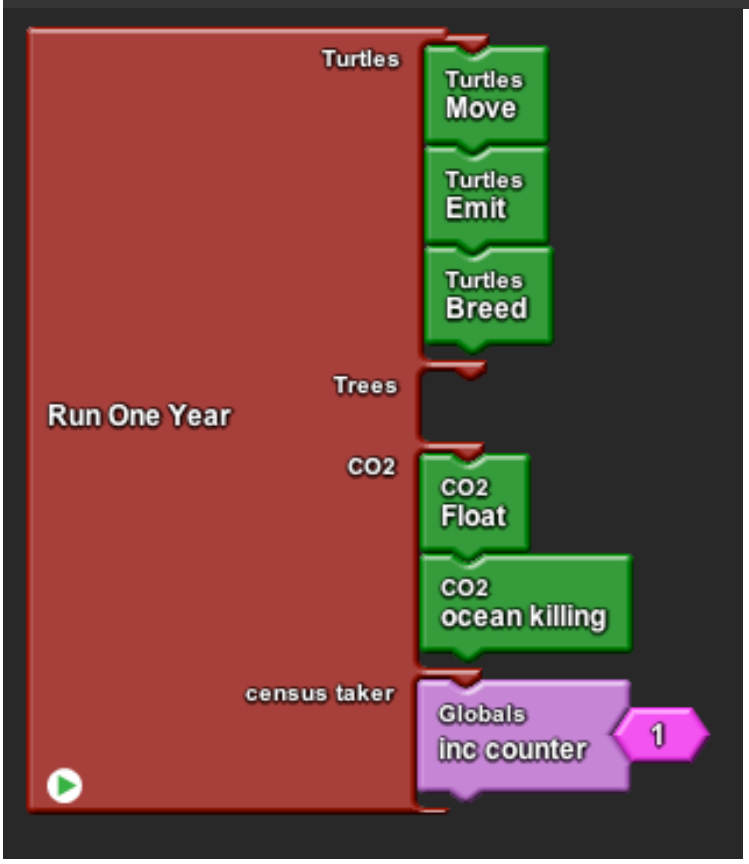
Globals
ocean absorption %


Turtles
Turtles
Move
Turtles
Emit
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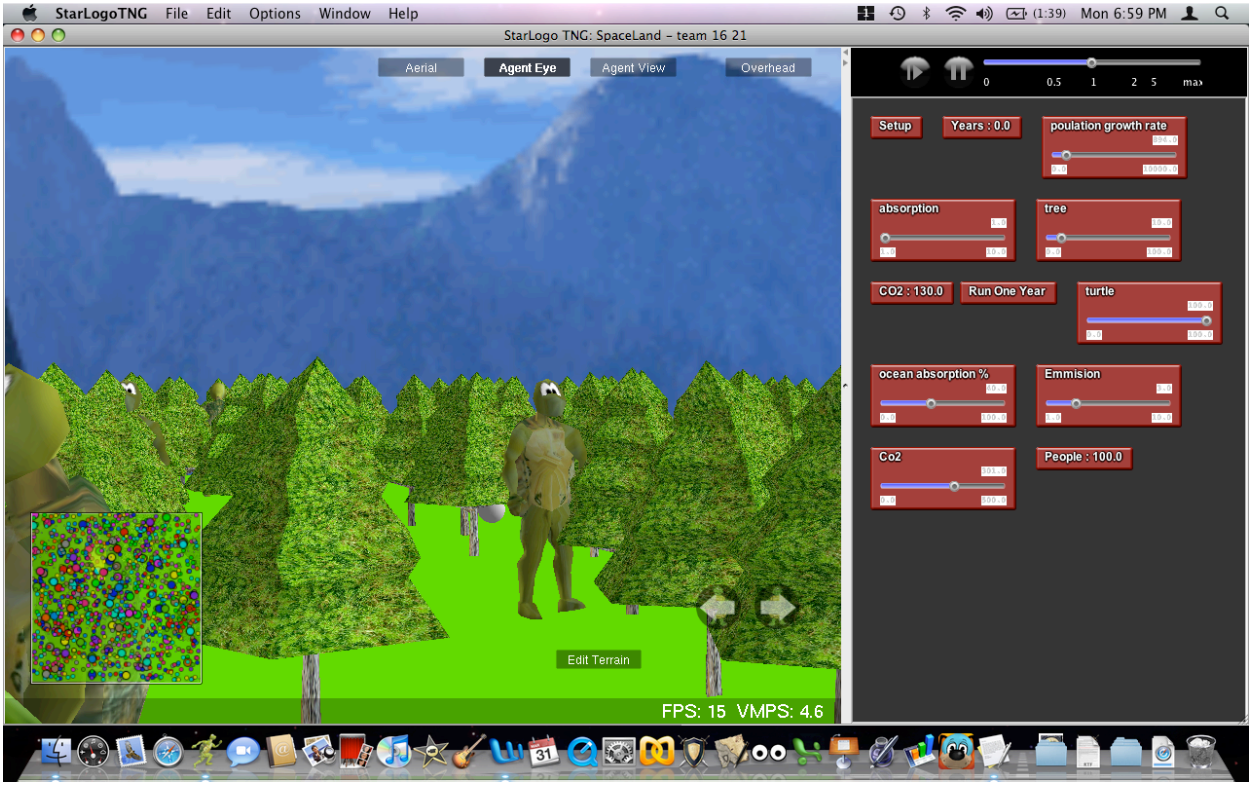
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ocean absorption %
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Co2
People : 100.0
Edit Terrain
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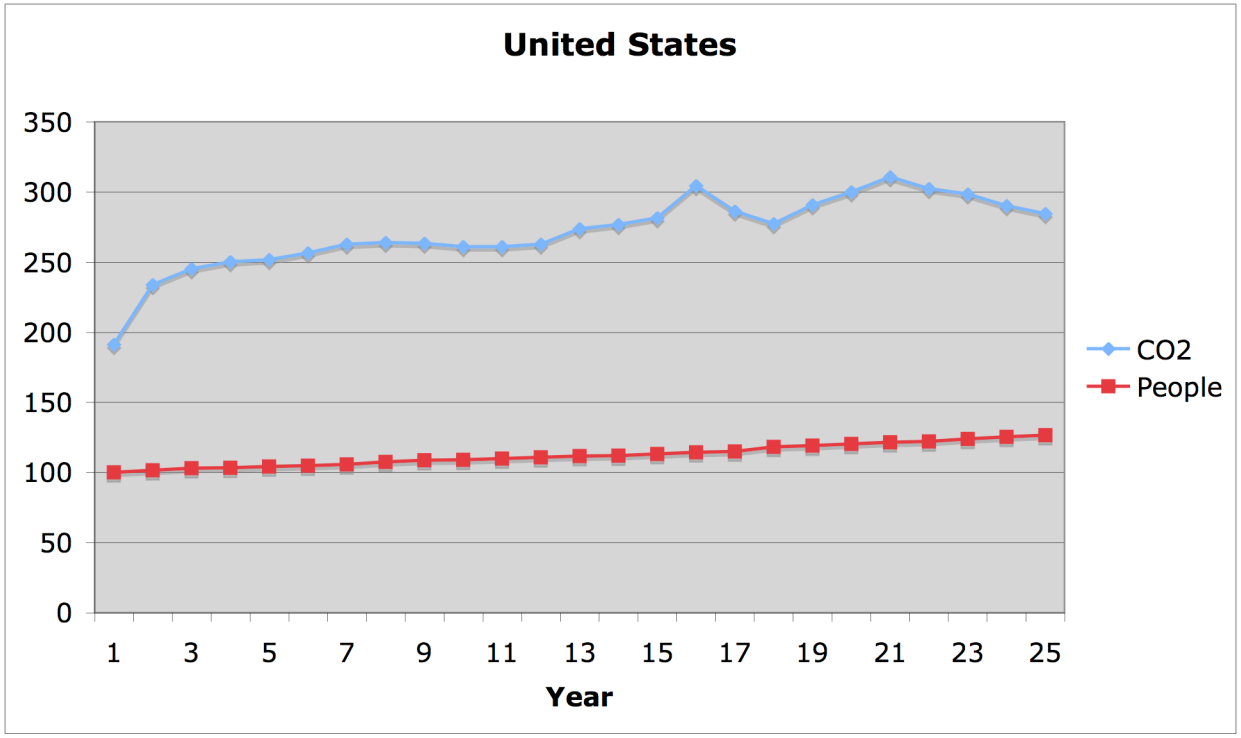
Results and Discussion

Below are the averages per year of our program runs. For both graphs, China and the United States, the first few years the showed a sharp rise in the number of CO_2 particles. The answer as to why is not clear, though it is possible that at a certain point, the CO_2 hits trees more often, thereby lowering the amount of CO_2.

The population of China seemed to increase slower than the U.S., and its CO_2 was much, much higher. That is because China's emission rate actually increases. From year 5 to 25, the U.S. CO_2 amount went from about 250 to almost 300, 2.5 CO_2 particles per year. In the same time period for China, CO_2 went from about 800 to about 1,000, 10 particles per year. After translating agents to actual CO_2, it is apparent that China's amount started much higher that the U.S., and increased much faster too. Even though China's CO_2 amount per capita is lower, they have a much larger population than the U.S., which means lots more CO_2 production.


United States
350
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150
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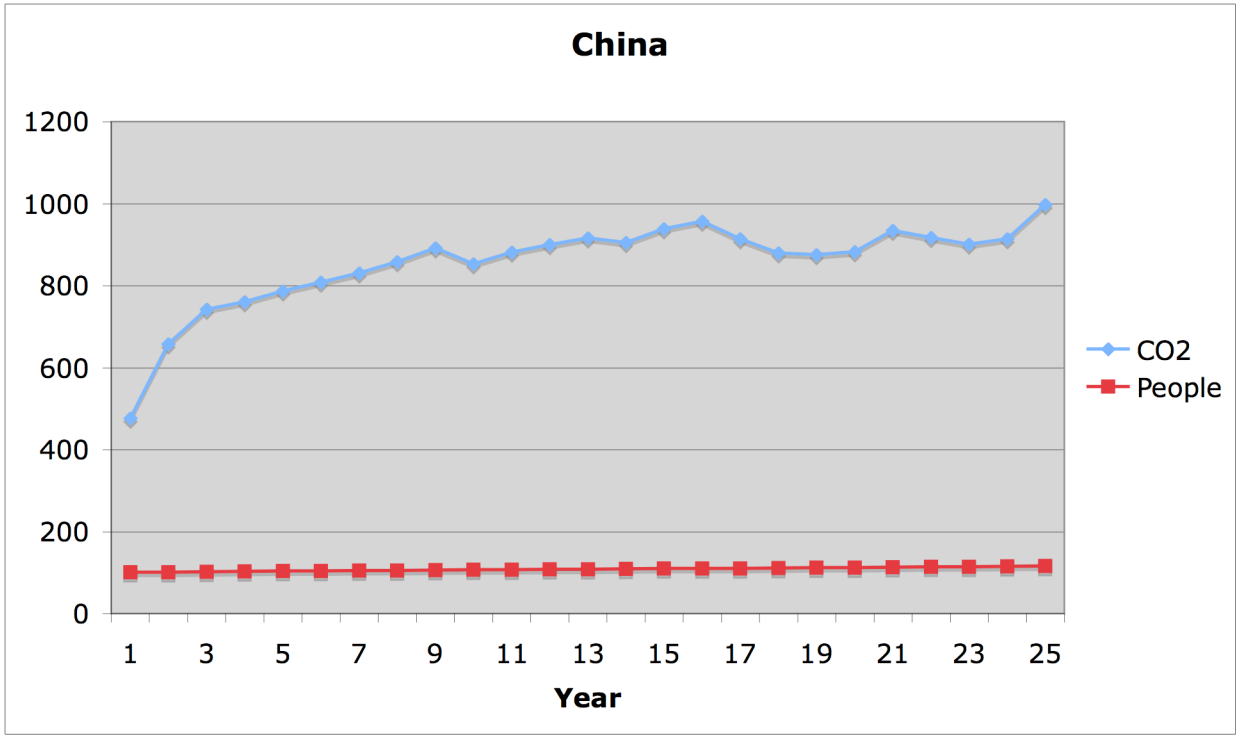
19
21
23
25
Year
CO2
People


China
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Year
CO2
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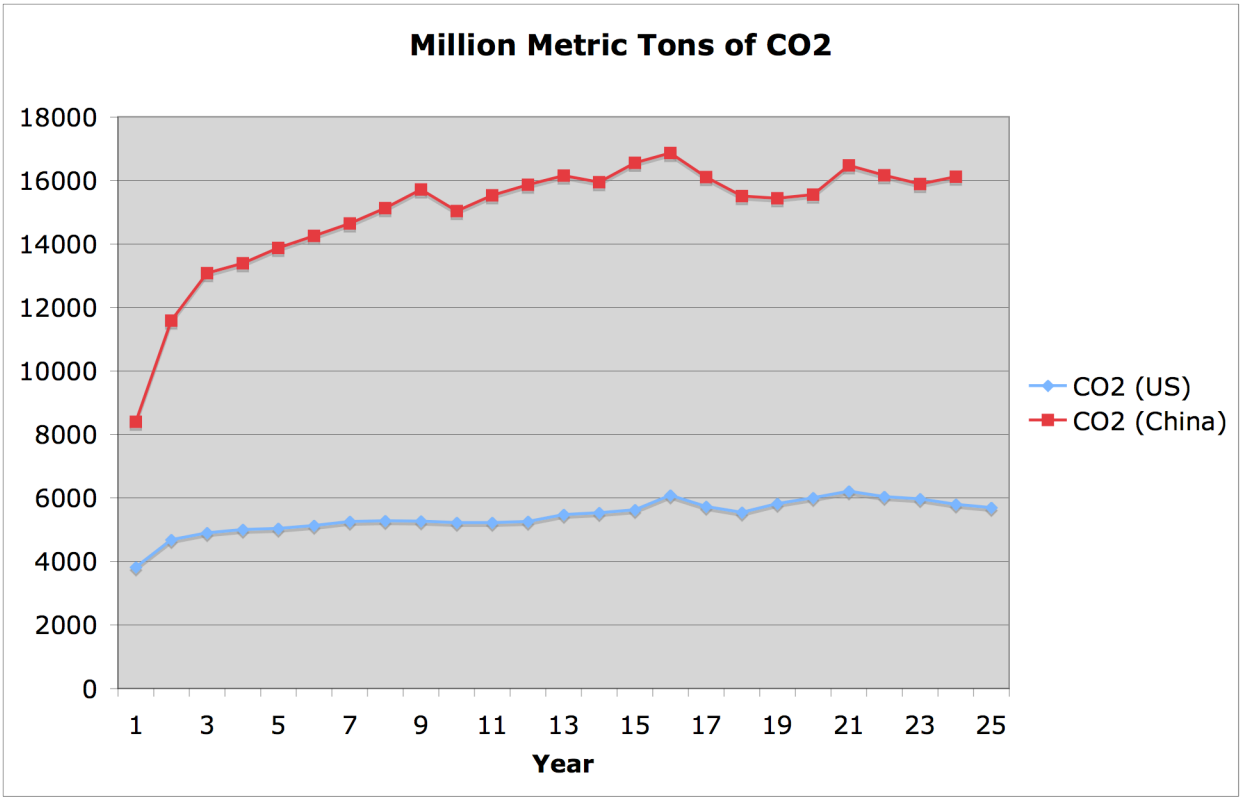

Conclusion

We chose to model CO_2 production to predict global warming. We included trees absorbing CO_2 on contact, people emitting it depending on their country, and oceans absorbing CO_2 at a constant rate. CO_2 is quickly increasing, and could cause large problems with our climate.