In the Heat of Starvation

A Computer Simulation of Global Warming's Affect on Coral Reefs

New Mexico

Supercomputing Challenge

Final Report

April 4, 2007

Team # 104

Socorro High School

Team Members

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Teacher

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Project Mentor

Mr. Greg Coyle

Executive Summary:

The purpose of this simulation is to effectively demonstrate the death of coral reefs world wide as a direct result of global warming.

Our goal was to create a computer simulation using StarLogo that effectively shows how Global Warming is causing the devastation of a delicate ecosystem by a process called coral bleaching, a deadly event in which the coral spit out essential zooxanthellae that allow corals to eat as well as reproduce.

After downloading StarLogo, we began designing "coral" agents. We then began constructing a panoramic view of a coral reef. We used eight different "species" (colors) of corals while constructing the live part of the reef. Then, using information we had gathered on temperatures at which coral can survive, current oceanic temperatures and the rate at which oceanic temperatures are rising, we determined the length of time it would take for temperatures to get above where the coral could survive. Then, we designed a specific procedure in which the warmth of the water increases, and the coral are stationary. After the temperature rises 5° Celsius (50 years), the first species of coral (red) dies. After that, one species dies per every 1° Celsius increase (10 years), until there is only one type of coral left. That species of coral dies after just a 0.1° Celsius augmentation of temperature. By the end of this simulation, all coral agents are annihilated.

If the information we found was accurate, our diagrams showed an approximation of what will happen to coral reefs around the world. The only problem with our simulation is that it only includes one of the many problems that occur concurrently with Global Warming. The other two main factors would be oceanic water level increase and pollution (such as oil spills and exhaust fumes in the water). However, these factors seemed rather insignificant compared to the rapid rise in temperature that is occurring. For instance, the water level would have to rise 180 feet at a rate of 0.08 inches per year for it to have the same effect as the rising temperatures. As for the matter of pollution, there is no accurate data for a general annual contamination of oceans, for it can be fairly sporadic. There are ways in which we can delay the death of these precious and fragile creatures, but first we must realize that there is indeed a problem which needs to be resolved. Some things that will assist the postponement of the extinction of coral reefs around the world are the usage of renewable energy, reducing the amount you drive by cycling or walking, consuming less, planting trees, etcetera. First and foremost, our project is meant to serve as a warning of what is to come if we do not change our way of living.

Purpose:

The purpose of this simulation is to effectively demonstrate the death of coral reefs world wide as a direct result of global warming.

Hypothesis/Goals:

Our goal is to create a computer simulation using StarLogo that effectively shows how Global Warming is causing the devastation of a delicate ecosystem by a process called coral bleaching, a deadly event in which the coral spit out essential zooxanthellae that allow corals to eat as well as reproduce.

Procedure:

After downloading StarLogo, we began designing “coral” agents. We then began constructing a panoramic view of a coral reef. We used eight different “species” (colors) of corals while constructing the live part of the reef. Then, using information we had gathered on temperatures at which coral can survive, current oceanic temperatures and the rate at which oceanic temperatures are rising, we determined the length of time it would take for temperatures to get above where the coral could survive. Then, we designed a specific procedure in which the warmth of the water increases, and the coral are stationary. After the temperature rises 5° Celsius (50 years), the first species of coral

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Results:

We discovered that our hypothesis was true. Corals cannot continue to survive if current climate trends continue. It is very simple: the temperature rises, the coral dies. Different species react differently…and will survive better or worse as temperatures increase…and will not come back if the temperatures decreases again after the damage is done.

Conclusions:

If the information we found was accurate, our diagrams showed an approximation of what will happen to coral reefs around the world. The only problem with our simulation is that it only includes one of the many problems that occur concurrently with Global Warming. The other two main factors would be oceanic water level increase and pollution (such as oil spills and exhaust fumes in the water). However, these factors seemed rather insignificant compared to the rapid rise in temperature that is occurring. For instance, the water level would have to rise 180 feet at a rate of 0.08 inches per year for it to have the same effect as the rising temperatures. As for the matter of pollution, there is no accurate data for a general annual contamination of oceans, for it can be fairly

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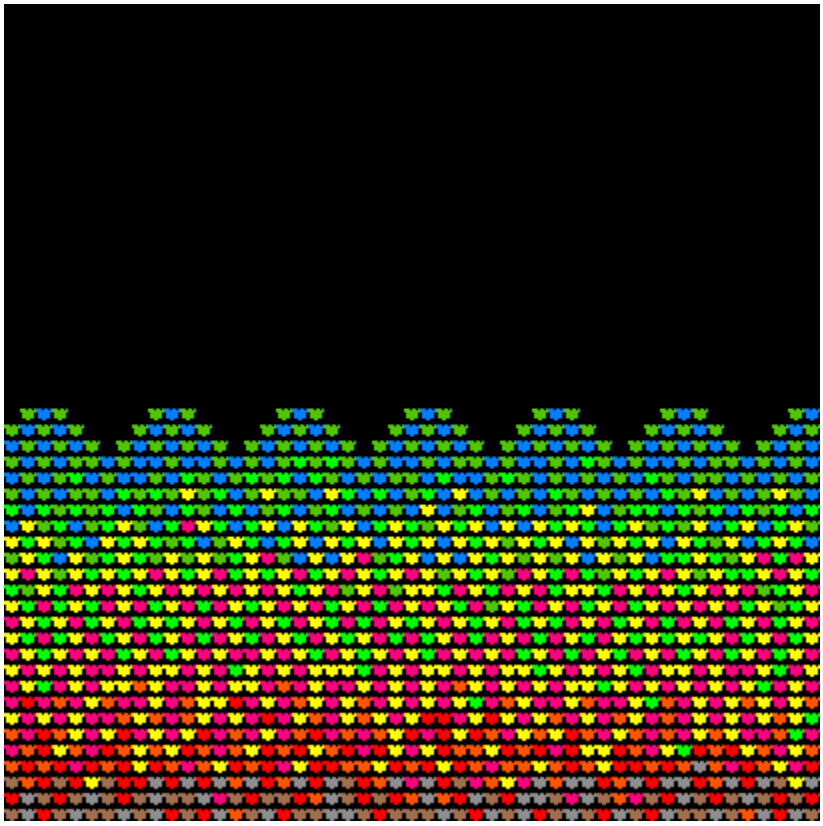
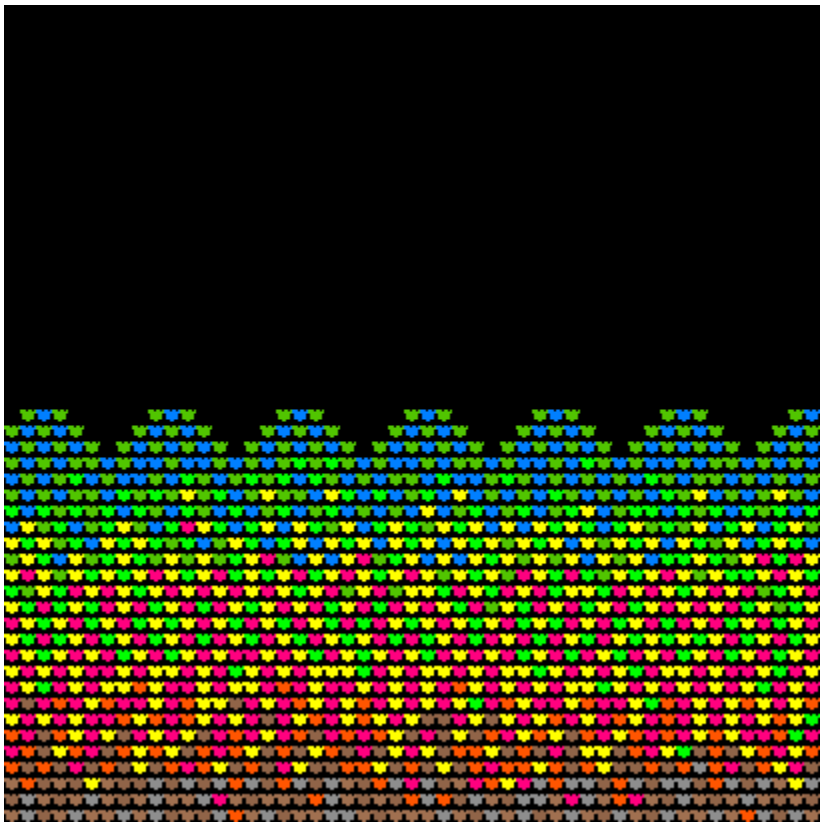
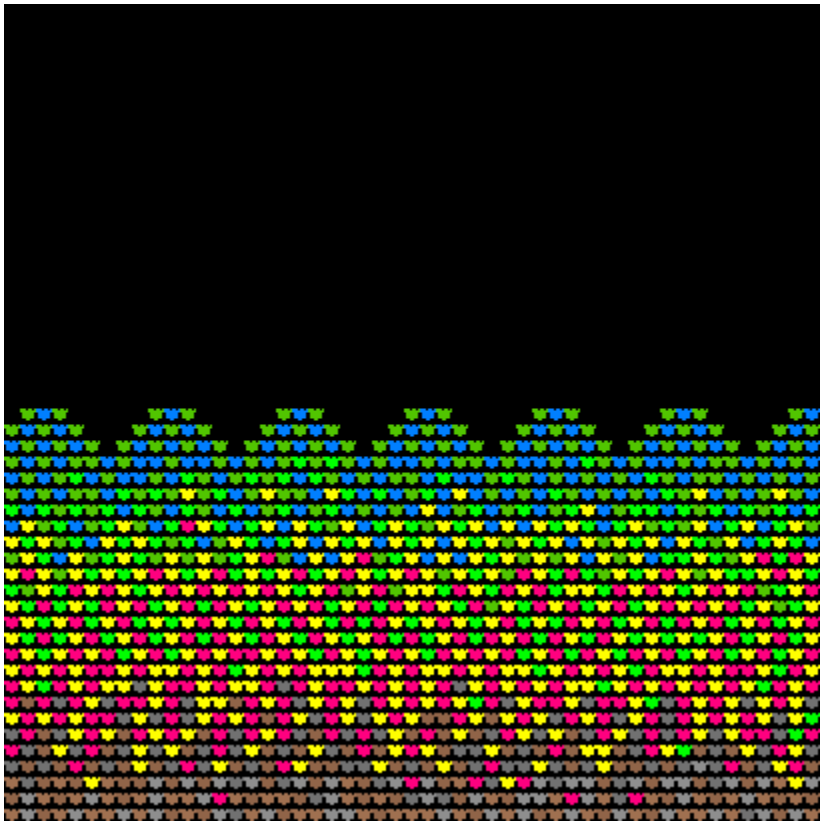
Tables:



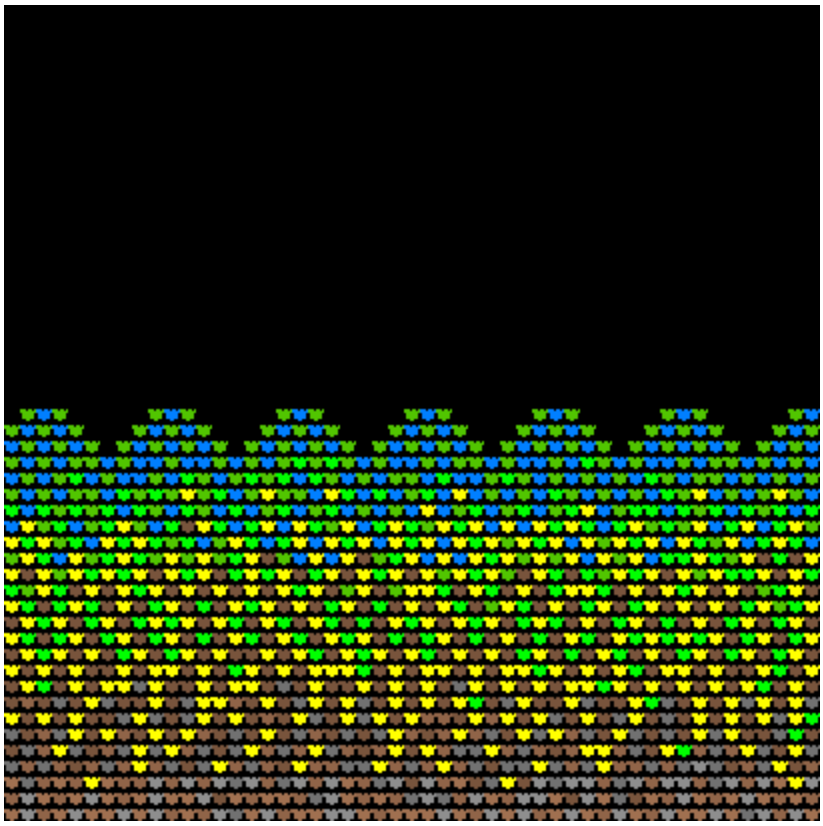
Year 0
(Approximately 2005)



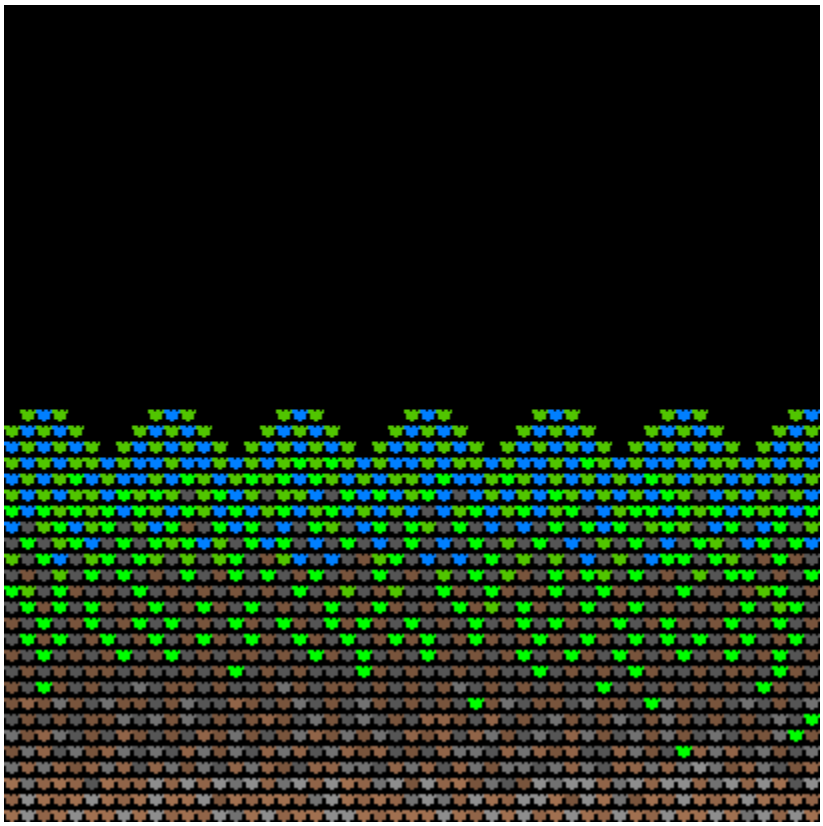
50 Years
(Approximately 2055)



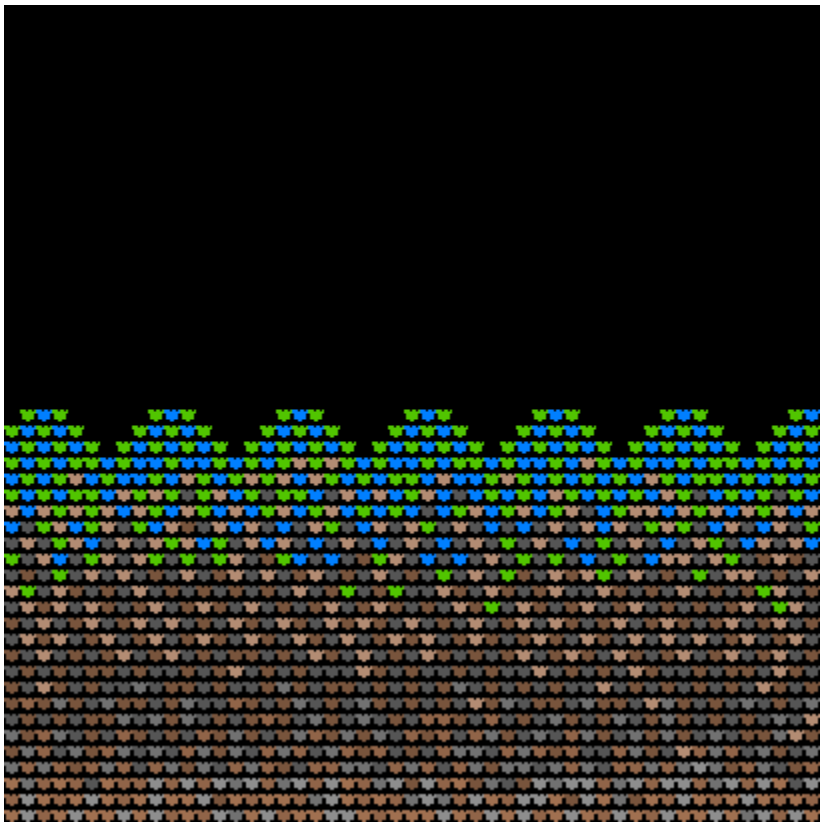
60 Years
(Approximately 2065)



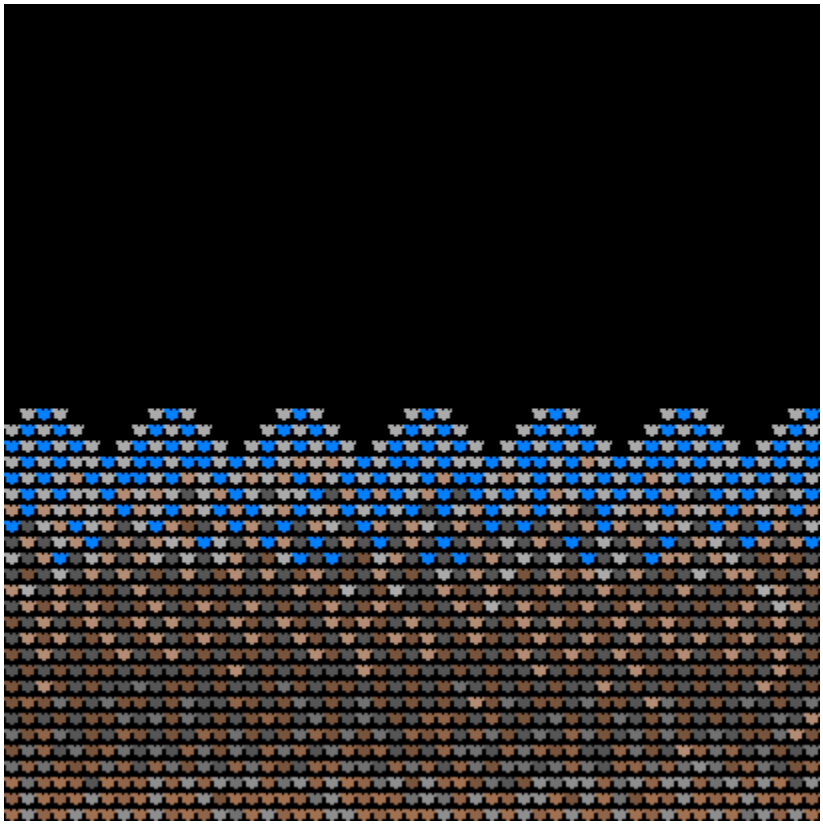
Year 70
(Approximately 2075)



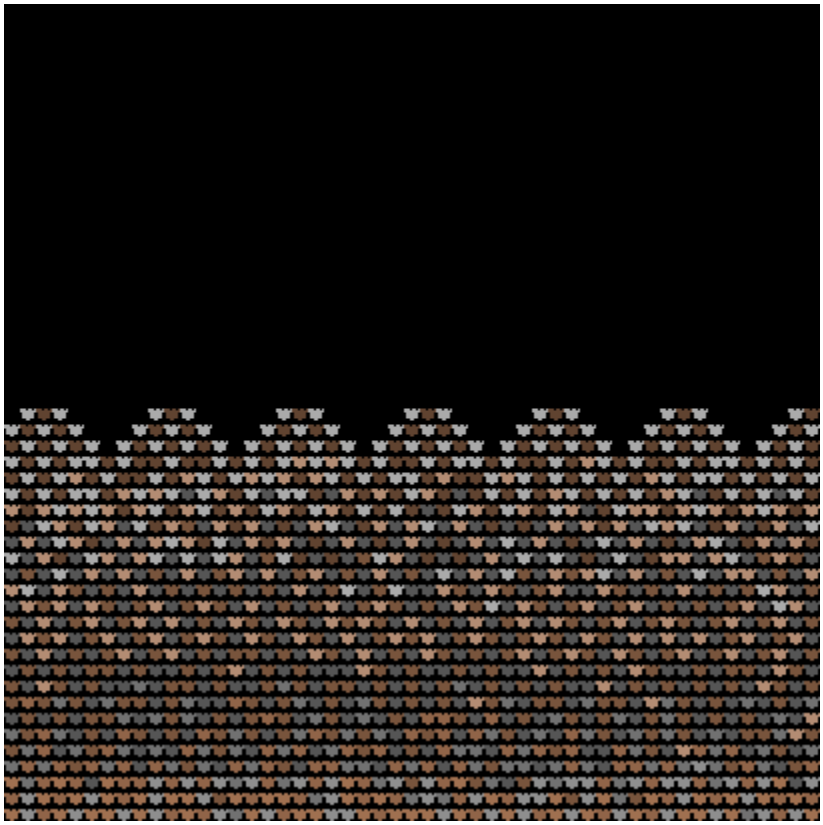
Year 80
(Approximately 2085)



Year 90
(Approximately 2095)



Year 100
(Approximately 2105)



Year 101
(Approximately 2106)

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- High Tide (Mark Lynas, 2000)
- Boiling Point (Ross Gelbspan, 2004)
- The Weather Makers: How Man Is Changing the Climate and What It Means for Life on Earth (Tim Flannery, 2006)
- Life and Death in a Coral Sea (Jacques-Yves Cousteau, 1971)
- Reef: A Safari Through the Coral World (Jeremy Stafford-Deitsch)
- StarLogo (www.education.mit.edu/starlogo/)

Our Most Significant Original Achievement:

We have several achievements, both as a team and individually.

Our team achievement is that we finished what we set out to do, and learned important stuff about our world.

Lisa says: “I have overcome my fear of public speaking.”

Jack says: “We actually got it done!”

Elizabeth says: “I learned how to program StarLogo...yay!”

Mr. Bala says: “Get to work!”

Acknowledgements:

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Mr. Settu

Mr. Coyle

and last (but most very certainly not least) everyone at Consult