

Reading 7.2 – Unchanging vs. Changing Designs

In the activity in class, you designed a population. You tested many different possible designs for the individuals, and you saw that some combinations of characteristics were more successful in contributing to the survival of a population than others.

Question 1: Why might a certain combination of traits give a population a competitive advantage for a short amount of time, but eventually become less advantageous?

In class you competed in a competition in which the environmental conditions changed over time. Some of the changes were temporary (such as grass growing back in a particular region after it was eaten). Other changes were more permanent, such as when the characteristics of the soil changed, thereby changing how much grass could grow back in a patch in the model.

Throughout the history of life on Earth, all ecosystems have undergone environmental changes. Some of the changes have been specific to a particular ecosystem, while other changes have affected the entire planet.

Question 2: If you studied data from over hundreds of millions of years, do you predict the temperature of the Earth would be relatively constant, or would show cycles and fluctuations?

Question 2: If you studied data from over hundreds of millions of years, do you predict the amount of CO₂ and dust in the air would have been relatively constant, or would show cycles and fluctuations?

Below is a series of graphs showing the average temperature of the planet, the average carbon dioxide in the air and the average amount of dust in the air over the past 450 million years.

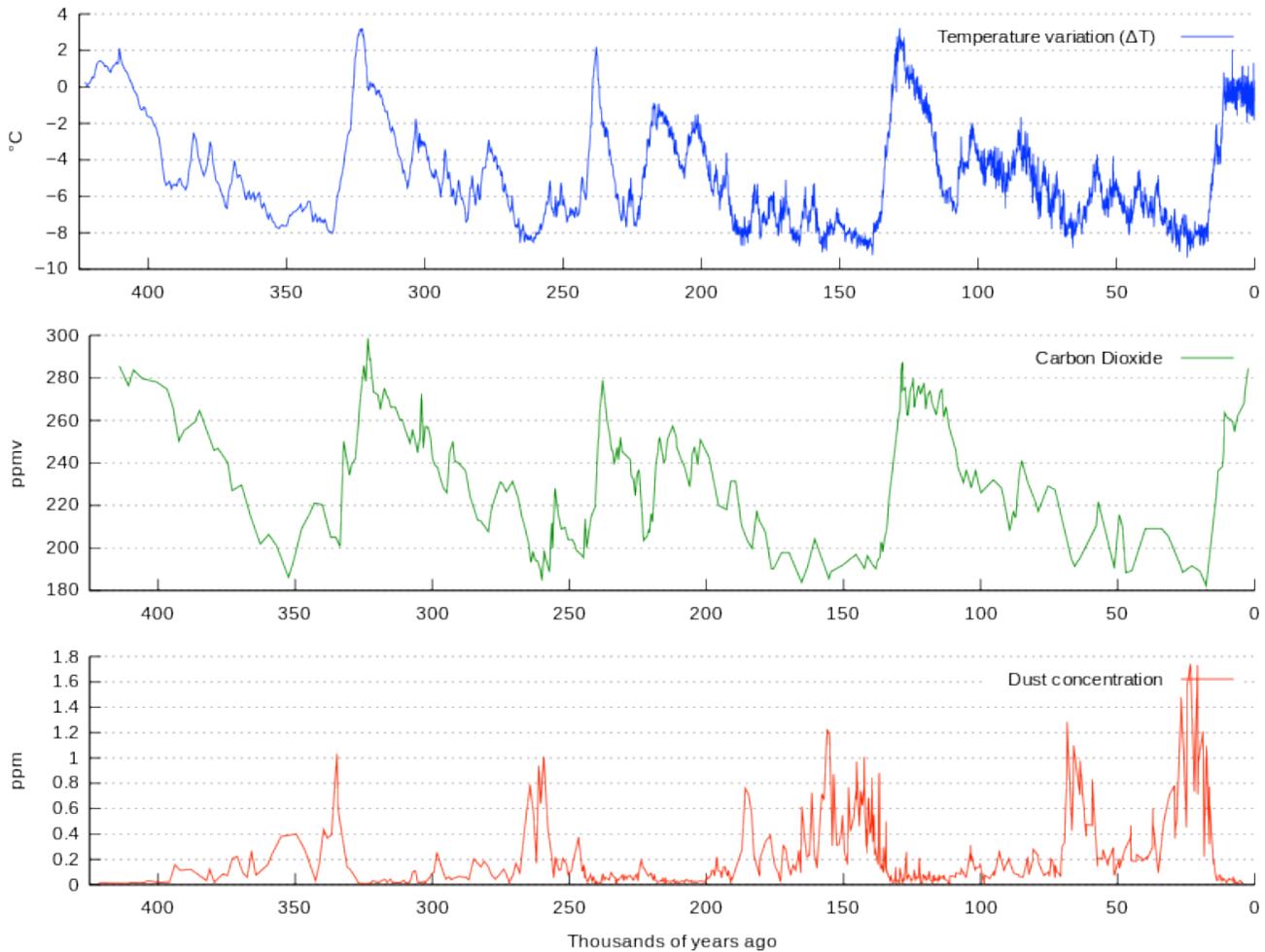


Image credit: http://en.wikipedia.org/wiki/File:Vostok_Petit_data.svg

Question 4a: Choose a point in time from the graph. What point in time did you choose?

Question 4b: At that time how did these things compare to Earth today? Circle one answer for each

average temperature: _____ (was it greater than, less than, or the same as today)

amount of CO₂ in the air: _____ (was it greater than, less than, or the same as today)

amount of dust in the air: _____ (was it greater than, less than, or the same as today)

Question 4c: How might these values have affected the amount of rainfall on Earth

Question 4d: How might these values have affected the amount of plant growth on Earth?

These are just a few of the major environmental change that has occurred over the history of the Earth. Other major types of environmental change that have occurred include:

- the movement of the continents and plate tectonics
- the number of volcanic eruptions
- slight changes in the distance that the Earth orbits around the sun
- the types and amounts of other gases that are in Earth's atmosphere
- changes in the amount of sunlight that the Sun produces
- The substances that are dissolved in Earth's oceans
- the rocks and minerals deposited on the surface of the land

Question 5: The changes listed above could interact with all the ecosystems on the Earth. Why is it very unlikely that a single combination of traits would ensure that a population would be able to reproduce and survive many different types changes as they kept occurring?

Imagine in the last competition you used a slightly different model. In this alternate competition, you are the only player that is allowed to create a population where every individual can have slightly different characteristics from one another. All other players are only allowed to create a population of individuals with identical traits.

Question 6: Compared to other players, why might your population have an increased likelihood that at least some members of the species you created will survive?

In the every computer model you have used in class so far, the organism reproduced using asexual reproduction. Because of this every offspring inherited behavioral traits were identical from its parent. Though where and when each individual was born varied, this ensured that every individual in a population interacted with its environment following the same rules (or instincts) as every other individual in the population.

Now imagine that in the last competition you used changed the model again. In this last alternate competition, you were the only student that was allowed to create a species that had offspring that were not identical to each other. Each new offspring in your population could be given a different variation in its traits.

Question 6: How do you think this special mechanism of “different variation in the traits of offspring” would affect the longevity of your population, compared to players whose populations have a “fixed and unchanging set of traits for offspring”?

In reality, we know that most offspring in most species are not identical to their parents. This is true of any sexually reproducing species, such as humans, dogs, cats, fish, horses, and birds. The observable characteristics (**phenotype**) of an organism are often referred to as its traits. Many traits of an organism are largely influenced by the genetic information the individual inherits from the parents. Both parents give genetic information to their offspring through sexual reproduction.

Question 7: In general, what type of population do you think more likely to survive major changes in the environmental conditions and interactions that occur in its ecosystem?

1. A population with no variation in traits between the individuals in the population.
2. A population with a little bit of variation in traits between the individuals in the population.
3. A population with a lot of variation in traits between the individuals in the population.

Question 8: Most of the species that have lived on Earth in the past are now extinct. Some went extinct in the past thousand years, others went extinct millions or billions of years ago. Suggest some reasons why you think this might be.

Question 9: Unlike in the model, the traits of populations has clearly changed over time. New species, with new traits, came into being at some point, that never existed before. What things do you think contributed to the emergence of new species and new designs for organisms over the history of life on Earth?
