

Ecosystems- Striving for Survival

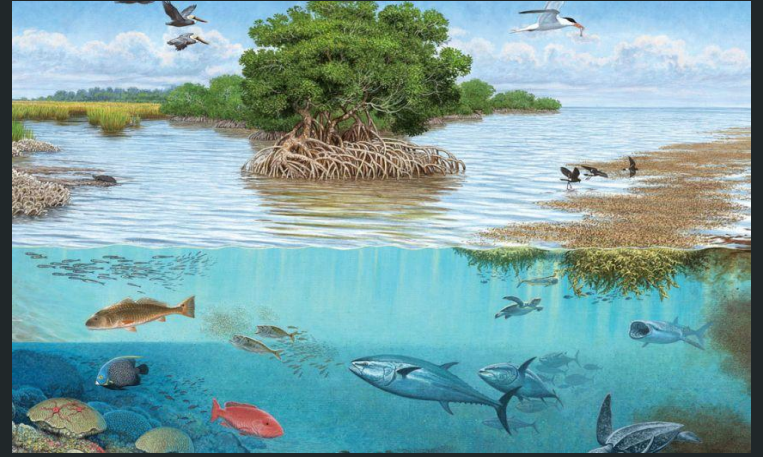


Image from National Geographic

By Navnir G. & Tanveer B.

Problem/Question

Main Problem:

What are the human influences on ecosystems, and the environment?

What are the effects of global warming on ecosystems and the environment?

Guiding Questions:

What is an ecosystem, and what is in it?

Hypothesis

Hypothesis

1. Navnir's hypothesis for the experiment is that if test 2 is testing the effects that humans have on ecosystems and the environment, then the ecosystem in test 2 might become weak, but not completely die. This is because human influence on ecosystems stems are not always that bad. Sometimes we balance out the negative things with the positive, for test 3, the ecosystem will most likely die because it will go through extreme heat and will probably suffer from a drought. The plants might end up drying up and dying.

Hypothesis Continued

1. Tanveer's hypothesis for the experiment is that since we are going to be showing the effects of humans including littering, pollution and increase of greenhouse gases. Then this means that both these tests are going to grow weak and I believe that the stem, leaves and roots of the plant will probably break off easily. This is because of the shift of the extreme temperatures (cold-hot) immensely fast, but on the other hand the test will grow weak due to the plastic trying to decompose.

Research

What is an ecosystem?

Rutledge, K, Mcdaniel, M, Teng, M, Hall, H, Ramroop, T, Sprout, E, Hunt, J, Bouderu, D and Cost. (October 14)

An ecosystem is basically an area where flora and fauna, and other organisms, weather and landscapes work together to form a circle of life. There can be many examples of ecosystems, and some can include Grasslands, Forests, Coral Reefs, the desert, wetlands, and many more.

Every part of an ecosystem depends on another part of the ecosystem. This can be either directly or indirectly. For example, if the temperature/climate changes in an ecosystem, the organisms that live there have to adapt to their environment, or migrate to another ecosystem that has what it needs.

Ecosystems can come in all different shapes and sizes. An example of this could be Tidepools (ponds left over the ocean). They are very biodiverse, and have a very strong ecosystem.

The whole surface of the earth is connected by ecosystems, and ecosystems can be connected by larger biomes (Biomes are large sections of land. Such as oceans, forests, prairies, etc)

What is global warming?

(Houghton.J(2004)

(What is climate change?/NASA)

Global warming is the warming of the planet through a greenhouse effect. On average one third of solar radiation that hits the surface of the Earth is reflected back up, the remainder of it is absorbed by the land and oceans. The greenhouse gases in the ozone layer are able to trap some of this solar radiation, then warming the planet. Some greenhouse gases include; water vapour, carbon dioxide, ozone, methane and nitrous oxide. This warms the planet by 63°F (35°C).

One of the biggest factors of global warming is cars. This is because of the high amount of methane, Co2 and overall greenhouse gases. Another factor that increases climate change is burning fossil fuels, fossil fuels generate electricity and heat but also many strong greenhouse gases like methane, nitrous oxide and much more.

Some effects of global warming include unpredicted rainfall, extreme weather events, rising sea levels. The reason this happens is because these greenhouse gases warm the Earth's surface, this warmed the Earth and caused drought melting of glaciers and much more. These changes also have many consequences for agriculture, biodiversity and even human health.

What does an ecosystem need to survive?

(National Geographic Society (October 23, 2023))

Ecosystems need basic things, like water, sunlight, space, and energy to grow and live. Although they also need specific things to survive. All ecosystems must have producers, consumers, decomposers, and dead inorganic matter.

Most of the energy that an ecosystem needs comes from the sun. Sunlight allows plants/organisms to use a process called photosynthesis to convert carbon dioxide and water into carbohydrates (carbs)

Photosynthesis is the process in which plants convert carbon dioxide (CO₂) and water (H₂O) into carbohydrates/sugar/glucose. Oxygen (O₂) is released as a byproduct of photosynthesis.

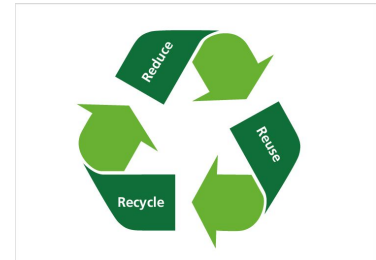
Impacts of Humans on the environment

Positive Impacts

Some positive impacts and things that us humans are doing to/with our environment are; the most common things are reducing, reusing and resulting. Many of us donate to eco-friendly organisations that are helping make our world a better place.

Reduce, Reuse and Recycle

Reduce- The meaning of reducing is to make something smaller in amount. In this case reducing would be reducing our waste, water use, plastic use and much more. This helps the environment because it is reducing greenhouse gas emissions that contribute to climate change.**Reuse-** The meaning of reusing is to use again. For us it is to reuse a ziploc bag, plastic bag/reusable bag, containers and much more. This helps the environment because it prevents pollution caused by reducing the need to harvest new raw materials.**Recycle-** the meaning of exhale is the process of reprocessing materials that would be thrown away as trash. This helps the environment because it prevents emissions of many greenhouse gases and saves energy. Recycling is not as good as reducing or reusing because plastic is only recyclable 2 time at max and then it gets sent to landfills.

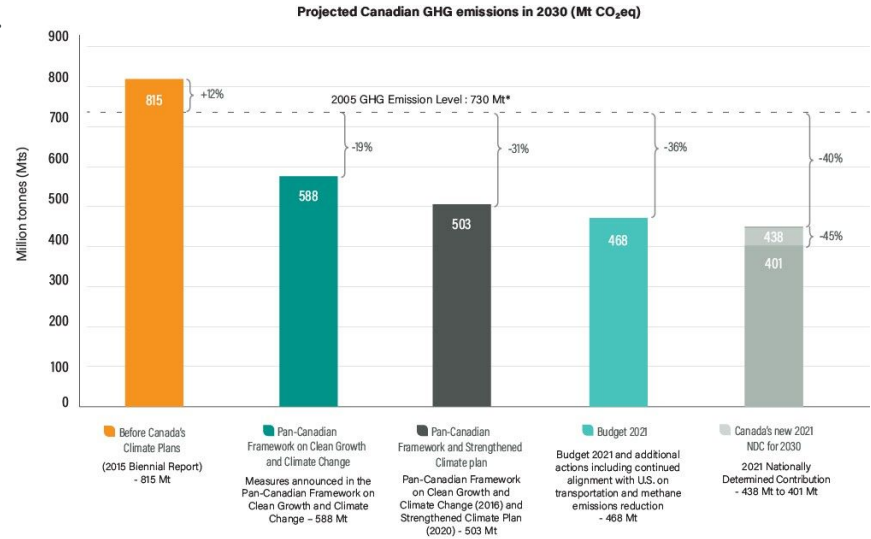


Canadian Actions

As a whole, Canada is moving step by step to make this country more sustainable. Over the past 5 or so years, Canada has taken many actions to help reduce the climate change crisis. The country is shutting down traditional coal-fired power plants, and is embracing renewable energy.

Things we can do in our day-day lives include:

- Save energy in our homes. We could do so by switching to LED light bulbs and energy-efficient electric appliances, washing our laundry with cold water, hanging things to dry instead of using a dryer
- Walking or biking instead of driving will reduce greenhouse gas emissions. For longer distances we could consider taking a train or bus or carpool.
- We could reduce our travel time. Auto planes burn a livable amount of fossil fuels and produce greenhouse gases. This makes taking fewer flights the fastest way to reduce your impact on the environment.



* 2005 historical number based on 2020 National Inventory Report

Negative Impacts

Humans have many physical impacts on the environment. Many of these include over population, pollution, burning fossil fuels and deforestation. Changes like these have triggered climate change, soil erosion, poor air quality and I drink label water.

Pollution

Pollution is basically the introduction of harmful materials to the environment. These materials are called 'pollutants'. Pollutants can be natural (such as volcanic ash) or can be created by human activity such as trash, runoff produced by factories. Pollutants damage the quality of air, water and land. There are 3 main types of pollution: Air pollution, (is pollution that is in the air/atmosphere. It is caused by activities like the emissions of harmful gases/greenhouse gases (CO₂, H₂S, SO₂ and CH₄)). Water pollution, (polluted water which looks much, smells bad or has garbage floating on top. Some polluted water can look clean but contain harmful chemicals that can't be seen or smelt by human senses).and Land pollution. (is the destruction/decline in the quality of Earth's surface/land due to human activities. This could include sources from mining, agriculture, and building).

Negative Impacts Continued

Acid Rain:

Acid rain is a form of precipitation with acidic components which includes sulfuric and nitric acid. Acid rain precipitation can fall in both dry, and liquid forms. This includes rain, snow, fog, hail, and even dust that can be acidic. In comparison to normal rain, acid rain has a pH level of between 4.2 and 4.4.

Soil Erosion:

Soil erosion is the displacement of the upper layer of soil. It happens when agricultural plants are removed and there is nothing to hold the soil. Heavy rains, and thunderstorms are also one of the biggest reasons why soil erosion happens.

Wildfires:

A wildfire is an uncontrollable fire that burns in wildland and often rural areas (forests, grasslands, savannahs, and other ecosystems). Wildfires are not limited to a particular continent, or environment. Wildfires burn vegetation located both in and above soil.

The Experiment

Materials

These materials you will need to set up the experimental setup.

- Three medium sized jars (around 44 cm squared)
 - Plastic wrap
 - Aluminium foil
 - Rocks
 - Sand
 - Subsoil
 - Topsoil
 - Grass seed/any other plants/pre grown plant
 - Source of light (Sun)
 - Clean Water
 - Contaminated water (contaminated with Detergent/cleaning material)
 - Microwave/high temperatures
 - Three Thermometers
 - Pieces of organic matter (orange peels, carrot peels, banana peels).
 - Paper waste
-

Setting up the experimental setup:

1. Grab the 3 glass jars that we collected earlier
2. At the bottom put 36-37 rocks in each jar
3. Then over top of that add around 3 teaspoons of normal beach sand
4. Over top of that, add 5 teaspoons of subsoil
5. Lastly add 7-8 teaspoons of topsoil
6. MAKE SURE YOU REPEAT THIS FOR ALL THREE EXPERIMENTS
7. Add all of your seeds/pre grown plants to the three jars. (Try to make it as same as possible)(If you are using seeds, wait for them to grow at least into sprouts)
8. Label the Jars Test 1, Test 2, and lastly Test 3
9. Instead of putting on the lid, for Test 1 and 2, add plastic wrap for it to act like an atmosphere.

Setting up the experimental setup continued

1. For Test 3 add aluminium foil to the top.
2. Take really good care of Test 1, as it is your control for your experiment, which means watering it every day
3. Then take out your garbage material and gently place it into the ecosystem of test 2.
4. Then you are going to want to make some contaminated water, you can add a few ml of chemicals which could be some detergent. This is going to be used for test 2.
5. For Test 2, make sure instead of adding clean water, you add contaminated water. You are going to use this water to water test 2 everyday.
6. In Test 3, all you need to do is put it under direct light. For test 3 water the plant with clean water everyday.
7. Then take test 3 and put it in a high temperature environment, which in our case is a microwave.
ALTHOUGH DO NOT TURN ON THE MICROWAVE! JUST LEAVE IT IN THERE AS IT IS A WARM SPACE!
8. For the next 2-3 weeks, record your observations every 15-20 hours or so.
9. You are done!

Pictures of Us Doing The Experiment



Over All Image



Aluminum Foil



Plastic Wrap



Contaminated Water



Organic Matter

Variables

Controlled:

- The jars
- The soil
- The plants
- The source of light (Sun)
- Thermometer
- Rocks
- Sand

Manipulated:

- Contaminated water
- Aluminium foil
- Organic material (orange peels, carrot peels, banana peels)
- Paper waste (paper bag,
- Place with high temperatures

Responding:

- What influence affects ecosystems the most? (Human, or Global Warming)
- The height and width of plants/tests before and after the experiment
- The colour of plants/test before and after the experiment
- What did the soil look like before and after the experiment?
- The Temperature of the environment

Observations

Raw Data

Before the
Experiment

Tests	Height & Width of plants	The colour of plants	temperature	Soil
Test 1	Height- 7cm (at average) Width- 1mm (at average)	The bottom of the plant is a yellowish colour and as you move up it gradually gets a rich green colour.	22°C	The top soil looks very fertilised and the subsoil is a lighter colour. The bottom is a much lighter colour.
Test 2	Height- 6.5cm (at average) Width- 0.7 mm (at average)	The colour of Test 2 looks the same as Test 1 and looks very healthy and green.	22°C	The soil is also a lot or the same as Test 1 and the bottom looks very 'sandy'.
Test 3	Height- 7cm (at average) Width- 1.05mm (at average)	Test 3 looks very green than the other tests (especially at ground level)	22°C	The soil looks very much blacker than the other tests, overall.

Raw Data Continued

After experiment:

Tests	Height/width of plant (cm)	Colour of plants	Soil	Temp
Test 1	Height: 17cm (average) Width: 3 mm(average)	The shorter plants are yellow, and look dead. The taller plants are very healthy and green.	Most of the topsoil layer is covered in fungi. The rest of the soil looks very moist.	24°C (average)
Test 2	Height: 2cm (average) Width: 1 mm (average)	All of the plants have turned yellow, and brown. They look as if they have been leached from all of their nutrients. They are also dead.	All of the topsoil layer is covered in fungi. The rest of the soil looks dry, and leached from all of its nutrients.	20°C (average)
Test 3	Height: 21 cm (average) Width: 4 mm (average)	Most of the plants look very healthy, although there are some plants that are yellowish and brown. Some blades of grass have grown fungi on them.	Some patches of the topsoil layer are covered in fungi. The plant's roots are visible, and the soil seems very nutrient rich.	32°C (average)

Before vs. After Pictures



Before

VS.



After

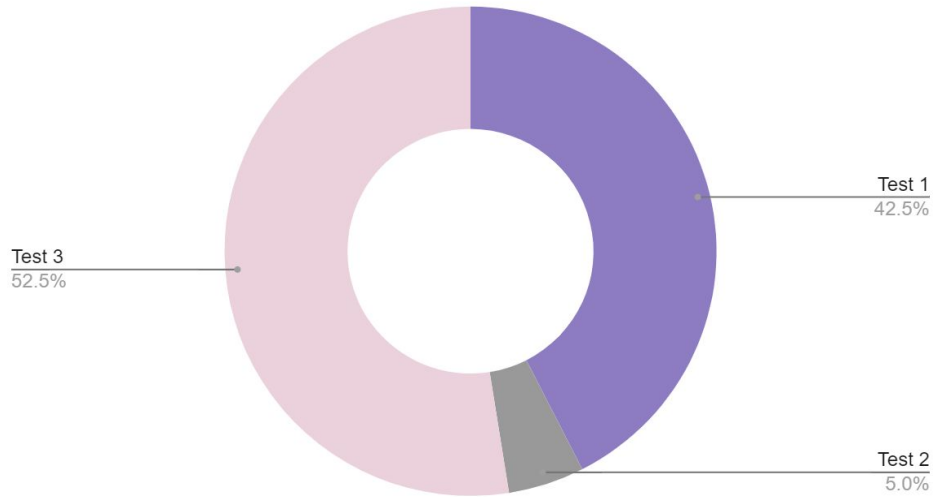
Analysis

Analysis

The experiment that we did was primarily based on the question how human impacts affect ecosystems, and how global warming affects ecosystems. One test was the control, the second test was all about human impacts on the environment, and the third one was all about global warming. The following graph that we are about to show you, showcases the information that was obtained from the experiment.

Graph 1

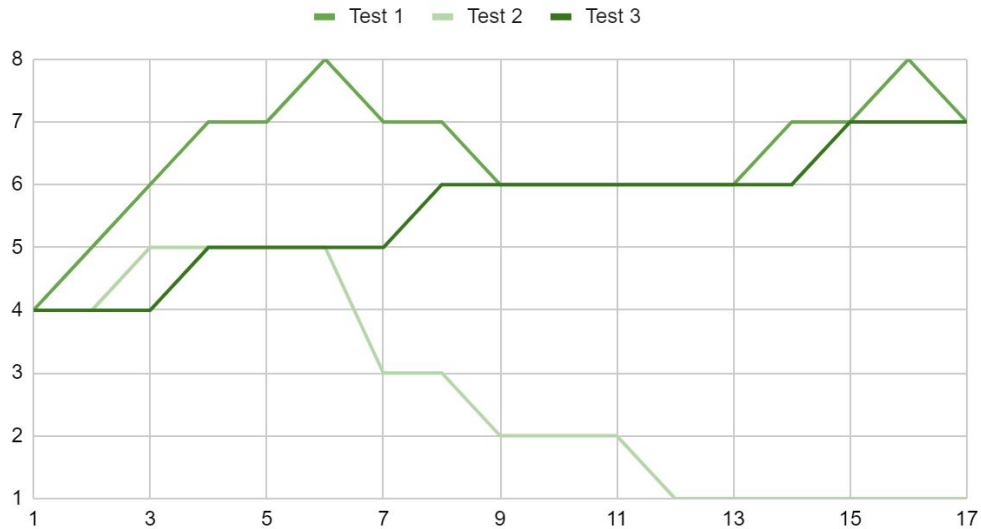
Over all health of plants



The graph shown above is a visual representation of the estimated percentage of the plant health all throughout the three experiments. These percentages were based on the plant's average height .

Graph 2

The Colour Change of all the Tests



Legend:

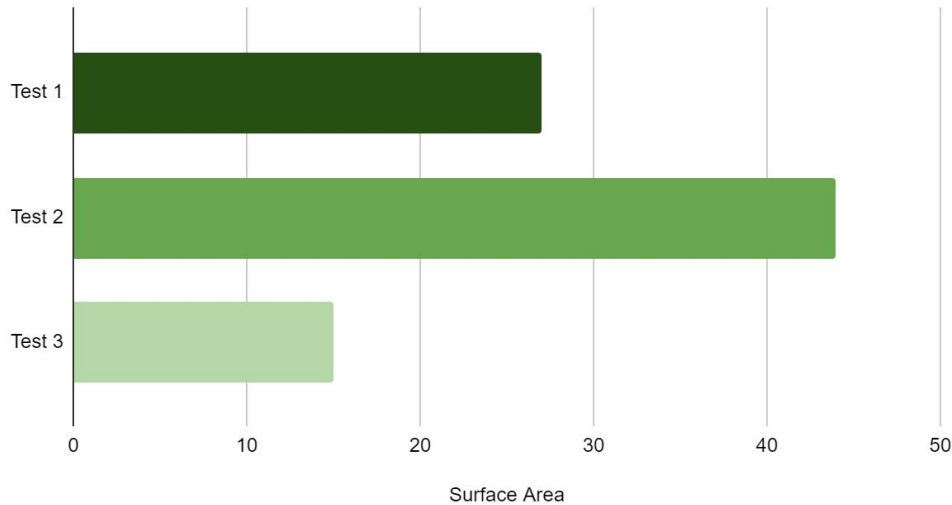
Colour	Number
Brown	1
Yellow Brown	2
Yellow	3
Yellow Green	4
Light Green	5
Green	6
Dark Green	7
Swamp Green	8

Graph 2 Continued

The graph showing above is a visual representation of the colour changes throughout the time period in which the test was recorded. The y-axis shows the colours, and the x-axis shows the days. The legend States that the numbers shown in the y-axis correspond to a colour. Each colour is the colour of the plants throughout the experiment.

Graph 3

Fungi Growth after Experiment

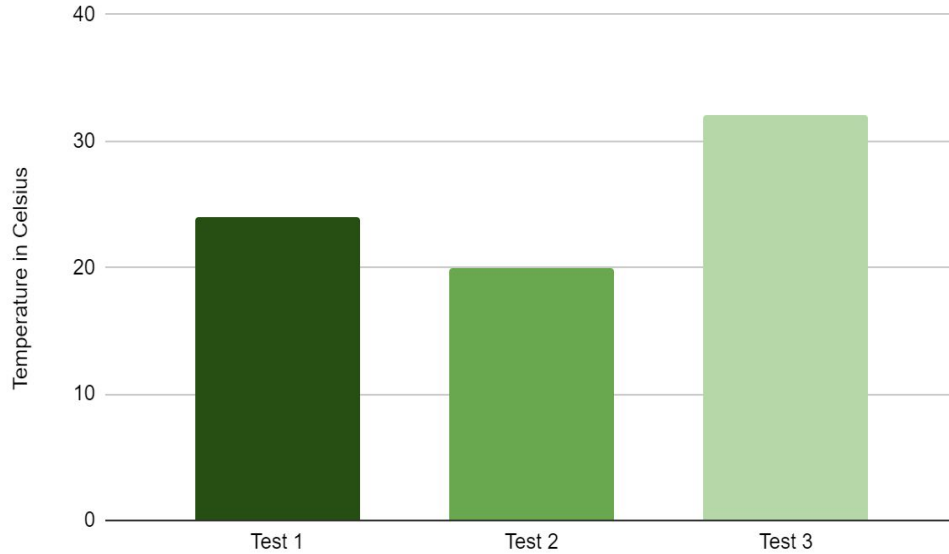


Soil is a very important component to a plant's growth as it contains nutrients and minerals for the plant. Although, in many places fungi can grow on plants and right on top of the soil this is very good for the ecosystem as fungi are important decomposers. We can see that in Test 2 it had the most fun guy growth which in turn helped it start decomposing the organic matter. In the following graph we will show you the fungi growth / amount in all of the three tests.

The y-axis on the graph above shows the three tests. The x axis shows the surface area in which the fungi grew after the experiment. The total surface area of the jars was 44 centimetres squared and the measurements on the x-axis are the fractions out of that total.

Graph 4

The Average Temperature of the Tests after the Experiment



The graph shown above is a visual representation of the temperatures in the test environments. The y-axis represents the temperature in celsius.

Analysis Conclusion

In conclusion, humans, and climate have a huge impact on how plants, and ecosystems thrive. This can be seen all throughout the world, and in our experiment. Test 1 was the control, which demonstrated a healthy ecosystem. Test 2 was Human influences on ecosystems, and Test 3 was Climate Change impacts on ecosystems. All of these manipulations had a completely different effect on the ecosystems. For example, the effects of Human, and Global Warming, the height and width of plants/tests before and after the experiment, the colour of plants/test before and after the experiment, what the soil look like before

Conclusion

The phenomenon of global warming has been a topic of scientific inquiry for many decades, with numerous studies conducted to investigate its causes, effects, and potential solutions. However, there is still much that we do not know about this complex phenomenon. One area of inquiry that has received relatively little attention is the impact of different effects of global warming on ecosystems. So this is why we try to make this problem known and in some ways we can reduce or even stop this phenomenon, also created by us humans.

The purpose of this project was to study the impact of humans and global warming through an experimental setup. After looking through different perspectives, we conclude that humans have a greater impact on ecosystems. Since humans have more chemical-based products, those products are most likely non-biodegradable.

. This means if we expose these chemicals to the environment it is very likely that they will have a detrimental effect on that ecosystem. This is supported in our experiment through different perspectives, as we concluded that the most damaged data was always in Test 2. To further explain, the contaminated water represents the chemicals that we throw into the environment. Soon after, chemicals in the contaminated water started to kill the ecosystem's plants. Hence, test 2 was considered to be the least healthy.

As we looked deeper into the data that we collected, we came to discover that test two could not be completely dead. This is because fungi were more prominent in that test. This means that the deeper parts of the soil could still be healthy and alive, which is the only explanation for why the fungi could have formed to decompose the organic matter that we planted in it. It also means that the carbon cycle was, in effect, and it was interlinking the vegetation with carbon. We concluded that test 3 was the healthiest. Since the ideal environment for a thriving ecosystem is warm and moist, that environment was given to that test. Its colour and height are very rich, compared to the other two tests, and way better. Even though test three had the least fungi growth of all the tests, it was still said that the ecosystem was driving and was healthy. Hence, test 3 was the healthiest.

After we asked our question, we formed our hypotheses, and ever since we have been wondering if our hypothesis was correct or not. Navnir hypothesised that the ecosystem has two that will die, but not completely, as with the bag we also do good things. The ecosystem in test 3 will die completely because of the extreme heat, and it might also suffer from gel and drying out. This was proven incorrect. And test two, even though we tried to give the plants sunlight and good care, they still ended up dying completely because of the chemicals in the water that was given to them. In test 3, instead of dying, it was the healthiest, which was the complete opposite of Navnir's hypothesis. Tanveer hypothesised that for both tests, they would grow to be weak, and the stems would break off easily. In the case of Test 2, this hypothesis was correct, as the plants in it were brutal and dead. In the case of test three, this is completely incorrect as test 3 was the healthiest in the end, same as Navnir's hypothesis.

At the beginning of this project, we had minimal knowledge about ecosystems and how they thrive in two different situations. Towards the end, we gained immense knowledge about this topic. Both of us had basic information about greenhouse gases, some of the effects of climate change on the environment and ecosystems, and some of the ways we humans are the biggest reasons why climate change happens. As we dug deeper and deeper, we answered more and more questions that sparked in our minds. One of the most fascinating things that we learned is how many different natural cycles there are, such as the water cycle, the rock cycle and the carbon cycle. And not only that but how those cycles help the ecosystem thrive. We also deepen our knowledge of how synthesis breaks and if there is a possible weight to make the photosynthesis equation go backwards. All those things are tied into all the amazing things that make an ecosystem so rich and beautiful.

Throughout this project, we have gained knowledge and insights about various aspects of global warming, including different ecosystems, animals, and plants. Our understanding of the relationships between all forms of life has also been enhanced through this learning experience. In both of our hypotheses we both were incorrect and also correct in different ways, the only reason to figure this out was with the help of our observations on the experiment. When we looked at our observations and made graphs, we started to do research on this topic giving us more to work with. These are only some of the areas that we researched and learnt about in our project.

Application/Future Scope

Future Scope

Real life situations that happened in past years inspired us to use this project for our science fair idea. As we did more research about this topic of ecosystems, we came to realise that doing research on this topic is important. This is because the study of ecosystems helps us to better understand the importance of Environmental Conservation, especially in future years when the greenhouse gas emissions get higher, and higher. Studying ecosystems can also help us with long term goals, such as decreasing the destruction of the ozone layer, and maybe even stopping climate change. It provides information about the benefits of the environment and judicious use of Earth's resources in ways that make the environment healthy for future generations. This is why scientists do research on ecosystems.

There are many things that we do not know about our environment, and earth itself. We are trying to put an end to climate change, and global warming, but we have probably never considered what would happen to the diverse life in ecosystems, if we do that. Since organisms would be adapted to these hot/warm temperatures, and we expose them to colder temperatures faster than they could adapt. This could end in the organism suffering from hypothermia, and more. This is why we need to find a way to reduce climate change slowly, so organisms do not have to go through that.

Areas of future research related to ecosystems, and the effects of humans, and climate change:

- Impacts of human influences on Marine Life
 - This study may include the industrial pollutants added into the marine environment, such as mercury. Marine life is a part of our food chain, which means in turn the mercury that marine life is exposed to will end up coming back to us. This leads to mercury poisoning.
- Impacts of growth of modern cities on ecosystems
 - This study may include the sustainable housing, garbage and recycling options of cities, sustainable transportation systems, etc.
- Impacts of agricultural processes on ecosystems
 - This study must include the use of pesticides, insecticides, fertilisers, and irrigation systems. As well as disposal of crop waste/residues.

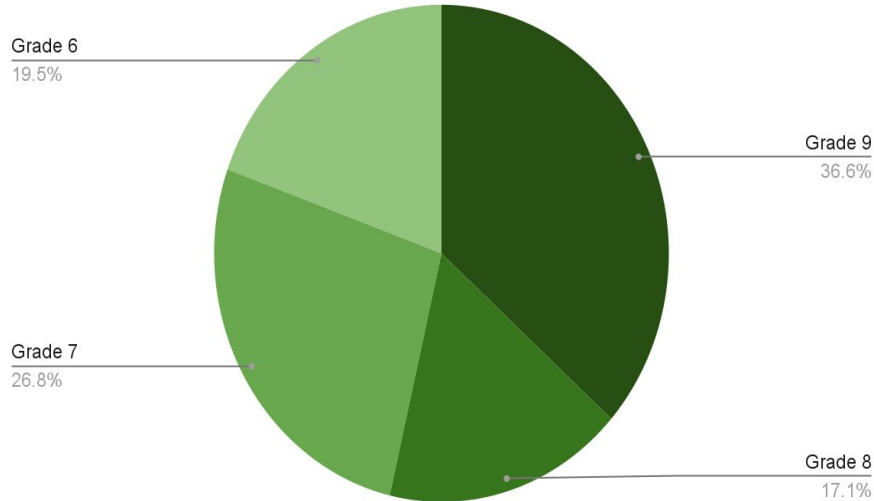
Application

Our project was all about a worldwide issue that causes problems and overall effect on the health of organisms. Our project can be used worldwide to help spread awareness/educate other students about the impacts of humans on ecosystems and the impacts of global warming on ecosystems. It can also help educate others about what ecosystems are, and what organisms live in them. Ecosystems are all around us and without them, we would not have reliable food sources, fibres, resources, and even medicine. Hence, it is important to take care of ecosystems, and the environment, because if we don't, we would not be able to obtain these important resources that we require.

During this project, we obtained information that taught us new things about the world around us. Out of curiosity, we also decided to test our classmates, and other students in other grades, knowledge about ecosystems, and how humans/global warming affect them. The reason why we did this is not only because we were curious, but also because we wanted to spread awareness about how little things we do can help add to the huge issue of global warming, as well as harming the environment, and ecosystems.

Interview Graphs

Correct Answers



The graph shown above shows the correct answers in all of the grades but in percentage form. This graph is a more visual representation of the number of people who got the most correct answers in all of the grades. It also compares the four grades that we interviewed, and concludes that the grade 9 students are the most educated about this topic: ecosystems, their health, and global warming.

Sources Of Error

- The size of the ecosystem.
 - Since ecosystems form at a much larger scale than what was represented in the experiment, that could have had a very large impact on the data collected.
- Not could have been exactly replicated
 - Since ecosystems are a complicated chain of intertwining relations, there is no way that we could have directly replicated an ecosystem. As ecosystems also consist of animals, and other organisms, those interactions were not present during this experiment, this could result in the data not being that valid.
- The exact temperature.
 - Since most of the tests were put in an environment where external conditions can interfere, the data collected for the temperatures could not be that valid. For example, where we put the tests were in a room temperature place, and when people pass by that area, and stay in that room, body heat from those people can change the climate in the ecosystem.
- The plant health.
 - The seeds/pre grown plants that we planted, we did not know if they were in a healthy condition to start with. For example, if we planted a pre grown plant that was not as healthy as the pre grown plant for another test, that could influence how we interpret the data.
- Human error
 - There could have also been a mistake in us measuring and interpreting the data collected. Resulting the data being less valid.

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