INTRODUCTION TO GLOBAL WATER SCARCITY

For many people, water has never been a big story in their lives. This is because they live in communities that have good water supply systems. They turn on the tap and clean water flows, everyday of the year. This makes it very difficult for people to appreciate how precious water is.

Water is life. Plants, animals and humans all depend on this invaluable natural resource for life. Besides this, water is used in moving waste, cleaning and sanitation, manufacturing, construction and farming. Almost every human activity you can think of involves some use of water.

Water covers more than 70% of the earth’s surface, so how can there ever be scarcity?

Less than 3% of water on earth is fresh water, and the bulk of this is trapped in snowfields and glaciers and not easily accessible. The rest form the seas and oceans and cannot be used in the same way as fresh water. Only a tiny fraction (0.014%) is surface water in the form of rivers, lakes and swamps.

Naturally, the 3% should be enough for all humans and animals on earth, but unfortunately, many factors have caused a major upset in the flow and use of fresh water and has caused massive crisis in many regions of the earth.
But why should you care?
We should care because a lot of the factors that cause water scarcity are broadening and becoming more complex and uncontrollable. This means if we do nothing in terms of preserving and using it wisely, it is only a matter of time that all regions shall begin to experience water crisis and all the repercussions that come with it.

Did you know...
Experts say that a person in a developed country having a five-minute shower uses more water than the average person in a developing country slum uses for an entire day.

CAUSES OF WATER SCARCITY

Here are some important causes of water shortage:

- **Population expansion**
  Just 50 years ago, the total number of people on earth has doubled and continues to grow. This is a result of larger family sizes and access to better health care and lifestyles. This means that use of wholesome water for drinking, cleaning, cooking and sewage has tripled. Humans are a lot more careless in recent time, and we waste more water than ever before. This has placed a lot of pressure on the same amount of water that we have.

- **Urbanization**
  Cities are growing and expanding more than ever before. Cities also tend to hold more people than towns and villages. This means there an increased need to take care of sewage, cleaning, construction and manufacturing.

- **Pollution**
Water, air and land pollution together contribute to the reduction of water quality. Sewage, oil discharges from industries, waste dumping into water bodies, radioactive waste from mining activities as well as dirty water from sanitation work in hospitals, hotels, oil companies, mining, schools and restaurants all end up polluting our waters. Water contamination and wastage from some mining industries through Hydraulic Fracturing (fracking) has also been a worry for many people.

**Vegetation destruction and Deforestation**
Trees help prevent excessive evaporation or water bodies. They also enrich and condition the climate. This means the destruction of forests by fire, logging and farming has exposed soil moisture and water bodies to the sun’s intense heat, leaving them dried out.

**Climate change**
All over the world, places that used to have lots of rainfall do not have enough again and dry places suddenly are getting colder and wetter. Both cases result in clean water shortage because less rainfall means less water, and excessive rains cause flooding and which brings all sorts of debris and destroy water treatment installations.

**WHAT ARE THE EFFECTS OF WATER SHORTAGES?**

The effects of water scarcity can be grouped into these 4 broad areas— Health, Hunger, Education and Poverty.

**Health**
- In many developing countries, people are forced to drink low quality water from flowing streams, many of which are contaminated. There are many water-borne disease that people die of.

- Less water also means sewage does not flow, and mosquitoes are other insects breed on still (stagnant) dirty water. The result is the deadly malaria and other infections.
- Lack of water or quality water causes huge sanitation issues. Clinics, local restaurants, public places of convenience and many other places are forced to use very little water for cleaning. This compromises the health of the staff and people who use the facilities.
**Hunger**
It takes a lot of water to grow food and care for animals. Experts say that globally we use 70% of our water sources for agriculture and irrigation, and only 10% on domestic uses. Less water means farming and other crops that need water to grow have lower yield. It means farm animals will die and others will not do well without water. The result is constant hunger and thirst and low quality of life.

**Education**
It is a bit hard to see how water and education is related. For many people in other parts of the world children (and teen girls) have to be up at dawn to collect water for the family. They have to walk for several miles to get water. The children get tired and some have to miss school as a result. Doing this for many years take away school times and the cycle continues. In other places girls and women are not allowed to go to school at all, so that they can serve the family by getting water and and taking care of other family needs.

**Poverty**
Access to quality water is key to economic prosperity and better living standards. Businesses and schools thrive when people come to work on time and not have to spend all morning looking for water. Restaurants, hotels and shopping places need to keep clean to attract tourists and foreign investments. Manufacturing activities, commercial farms, and mining processes all need a lot of water to thrive. Lack of water means no economic activities will happen and the people will be in constant poverty.

**WHAT IS YOUR ROLE IN WATER PRESERVATION?**
Sometimes the magnitude of a problem can make one feel that there is nothing that can be done. But there is a lot you can do for water. There is a high chance that people reading this do not live in water deprived areas, and may think it is not their problem. Here is what you can do to help.

**Awareness**
Learn about water crisis, just like you are doing. If you understand a problem, you are in a better position to have a solution. Talk about it with family and friends. Look out for news and facts on water shortages and crisis areas.

**Take part**
Be part of competitions, organizations and societies that aim to preserve and defend natural resources including water. Speak to you parents about donating or helping out charity grouped to provide water to the most needy places.

**Use water wisely**
Never assume that your society is too advanced to experience water shortage. If we do not acquire the right attitude towards water, it is only a matter of time and one day there will be a shortage. Keep the tap off when not in use. Minimize the flushing of toilets and bath times. In effect, anything that you can do to save water, do it.

**Industries and Governments**
Join pressure groups that stop individuals, industries and governments from cutting down trees and doing other things that pollute and degrade the environment.
WATER SCARCITY FACT-SHEET

Agriculture
- Agriculture is by far the biggest user of water, accounting for almost 70 percent of all withdrawals, and up to 95% in developing countries.
- The water needed for crops amounts to 1000-3000 cubic meter per ton of cereal harvested. Put another way, it takes 1—3 tons of water to grown 1kg of cereal.
- The daily drinking-water requirements per person are 2-4 liters. However, it takes 2000—5000 liters of water to produce a person's daily food.

Food Security
- Between now and 2030, the world's population is expected to grow by 2 billion people. Feeding this growing population and reducing hunger will only be possible if agricultural yields can be increased significantly and sustainably.
- With so much of the Earth's water being used for agriculture, it is clear that an improvement in the management of agricultural water becomes key to the achievement of global food security.

Water
- One out of every three people is affected by water scarcity. Water researchers believe that the problem is getting worse with urbanization, population growth, industrialization and competitive commercial activities.
- Almost one fifth of the world's population (about 1.2 billion people) live in areas where the water is physically scarce. One quarter of the global population also live in developing countries that face water shortages due to a lack of infrastructure to fetch water from rivers and aquifers.
- In many poor and rural communities, people use waste-water to water their crops and farms because there is water shortage or scarcity. It is believed that 10% of all the foods we eat come from crops cultivated by wastewater. These can contain chemicals or disease-causing organisms.
HUNGER AND MALNUTRITION IN THE WORLD

Food (and water) is fuel for the body. Our muscles need this fuel to function. Without food for a couple of days, the body will convert all fats stored in the body to energy for use. If this condition is prolonged, the body begins to reduce its’ activities naturally, and the result is the slow response, activity and reaction that you see in starving people. The body has ran out of energy and cannot work.

Every now and again, you see fund-raising adverts, news and other stories on TV, newspapers and internet with extremely skinny children, together with their skinny mothers. Those are very difficult images to ignore, but they are real. In many places in the world, there are families who cannot even bring themselves to think, talk, walk or even sleep because there is simply no energy in their bodies to do so.

The United Nations Food and Agriculture Organization estimates that nearly 870 million people of the 7.1 billion people in the world, or one in eight, were suffering from chronic undernourishment in 2010-2012. Almost all the hungry people, 852 million, live in developing countries, representing 15 percent of the population of developing counties. There are 16 million people undernourished in developed countries.

It is very easy to think that people who are hungry in these countries are just lazy and hunger is the only result they deserve. That is not the case. It is just difficult for individuals to help themselves, especially if they are caught up with the usual conflicts, extreme climates, political or economic difficulties involved.

WHAT IS CHRONIC HUNGER?

Hunger is a word that is a bit tricky to define, but in the context of this lesson, we shall look at hunger in communities, countries and other places in the world.

Hunger is that painful sensation, or exhausted condition that one feels from want of food. In relation to countries, it is also scarcity of food, either for a short period (a year) or consistently for many years.

If a village’s farms are wiped out by a flood and result in no food for a couple of months, the people of that village will be hungry. We can say hunger will set in.
But in a way, it is different from a country suffering with the effects of many years of complex political, economic and climatic adversities. People in such a country have extreme food shortage year after year with no end in sight. That too, is hunger.

Also, if a group of campers get stranded on an icy mountain for days without food, they will experience hunger too. So you see, hunger is a lot more than the absence of lunch or dinner for a day.

*Hunger therefore, is the situation, surrounded by food insecurity, and results in malnourishment. The emphasis on food insecurity is important because, people suffering from hunger are constantly wondering where and when their next food will come from. Malnourishment is also key because hunger makes people eat anything to fill their tummy, with no regard to what they get from the meal. This means they can lack essential nutrients the body needs to function properly.*

Hunger gets more complex and worse when more and more communities are affected in close proximity. It looks slightly hopeful when a starving village, town or country is surrounded by others with abundance, than if they are with other starving settlements.

**MALNUTRITION — WHAT DOES IT MEAN?**

Not all food is balanced food. It is important that we eat foods that have all the necessary nutrients for a balanced development. Balanced foods must therefore contain energy, which the body needs to work with. It must also contain proteins, which is also needed for muscle development and maintenance. It is also crucial to have vitamins and minerals that help the body to heal and fight off infections and diseases.

So, malnutrition (or undernutrition) is when the body lacks some or all the nutrients needed to function properly. In fact, we have two basic types of malnutrition.

Sadly, many places with malnutrition also have poor water supply and waste disposal, and tend to be in disease prone areas. Malnourished children therefore, easily fall victim to infections and viruses, as their bodies cannot fight infections.

**HUNGRY PEOPLE OF THE WORLD**

There is hunger in almost every corner of the world, but in this lesson, we shall look at national level hunger as well as communities with persistent hunger.

**📍 Where are they located**

About 89% of undernourished people (including children) live in developing countries. The bulk (about 75%) of the world’s hungry are in the rural areas and villages in Africa and Asia. These dwellers are predominantly farmers and local craftsmen who depend on their farm produce for survival.

These folks have no other source of income and that makes them extremely vulnerable in an event of floods, fires, extreme weather and diseases. Some folks also depend on fishing and forest resources as their main livelihoods.
Hungry women and children
In the above mentioned places, women and children suffer the most. Malnourished mothers, and expecting mothers often give birth to underweight babies.

Children also remain stunted and grow up to pass on the condition to their children if their food conditions are not improved. Poor nutrition plays a role in at least half of the 10.9 million child deaths each year.

Did you know...
- More than 30% of children in developing countries (about 600 million) live on less than US $1 a day.
- Every 3.6 seconds one person dies of starvation. Usually it is a child under the age of 5.

CAUSES OF HUNGER
If you live in a city of a developed country, where the economy, political terrain and weather are all great, it is very difficult to imagine and appreciate how people in other places with no food in sight live. Experts confirm that humans produce more than enough food to feed every mouth on earth (about 7 billion of us). So how is hunger possible?

Extreme weather and climate change
Floods, storms, rains, droughts, heat and other extreme weather can cause communities a lot of destruction and wipe away farms. Some of these communities never recover fully again and begin to face many years of hardship.

Drought is now the single most common cause of food shortages in the world. In 2011, recurrent drought caused crop failures and heavy livestock losses in parts of Ethiopia, Somalia and Kenya.
Wars and conflicts
Conflicts, civil wars and tension among tribes, religious and political factions often cause people to abandon their homes and jobs out of fear. People often find themselves cut off from the rest of the world because they are trying to flee. In some conflicts, fighters may also seize and control farms, sources of food and water in an attempt to get people to comply with their terms. Sometimes water bodies are polluted and water wells are poisoned as punishment to communities that they perceive to be enemies. Young men and even children who do some economic activities are forced into fighting and the result is a massive drop in food production and economic growth. Sometimes food aid is seized and directed to fighters and their families, leaving the really needy people to suffer.

Since 2004, conflict in the Darfur region of Sudan has uprooted more than a million people, precipitating a major food crisis - in an area that had generally enjoyed good rains and crops.

Poverty
Poor families and farmers often lack the funds to acquire high yield seeds, equipment and the infrastructure to produce more. They are forced to produce just what their physical strength will allow, just to have a little to live on. They usually use a lot of family labour and children end up working on the farms, instead of going to school. As these children turn adults, they are also handicapped with knowledge and ways of producing more to secure their future. The poverty cycle continues.

WHAT ARE THE EFFECTS OF HUNGER?

Hunger and poverty go hand in hand. Let us see the effects of hunger in these 4 areas:

Health:
Hunger and malnutrition makes the body weak and vulnerable to diseases and infections as the body does not have the fuel to build muscle and fight off infections. In children, this is deadly and many children die in hunger prone areas for this reason. Pregnant and malnourished mothers also deliver underweight babies, who struggle for survival. Children often have stunted growth as a result of malnutrition.
One out of six children - roughly 100 million - in developing countries is underweight. Poor nutrition causes nearly half (45%) of deaths in children under five - 3.1 million children each year.

Education:
Without proper foods (with the right balance of vitamins and minerals) the brain is not able to develop properly. Hunger also makes it difficult to concentrate on anything, especially for children. Children suffer this most, and are unable to stay in school. Hunger also keeps children away from school, as they have to walk for miles to do some farm work to make a living with their families.
66 million primary school-age children attend classes hungry across the developing world, with 23 million in Africa alone.
Migration and Social:
Young adults who are able to migrate to nearby towns and cities end up in slums or rundown communities, as they cannot afford the high living standards in the cities. Their low education level also makes them unsuitable for many decent paying city jobs. Many of them end up doing drugs, robbery, prostitution and other crimes to make a living.

Economy:
Countries with lots of hunger tend to do poorly with the economy. This is because adults and young adults do not have the right frame of mind to work. They are constantly ill and work input and interest is very low. Fewer hands on farms also mean that there is not enough produce from the farming villages into the towns for consumption and further export.

HUNGER ALLEVIATION PROGRAMS

For many years, charities, governments, organizations and some wealthy and generous individuals have done so much to alleviate hunger and to get children stay in school. As a result, the general trend of hunger is impressively coming down, although there are a few places that are still getting worse.

HUNGER PREVENTION TIPS

It is not easy to find easy and lasting solutions to a problem with many causes and complex conditions. Now we have an idea of what causes hunger and therefore we can begin to work backwards from there. Here are a few tips to consider.

Education
People who already have information and knowledge about hunger in the world need to speak out some more about it. The more the world knows about what is going on and how children are suffering in other places, the more likely it is that people will value what they have and work harder for a more secure future.

Leadership
World leaders, celebrities and influential local leaders must do a bit more in reaching out to the needy communities. They must end all forms of support for conflicts and rather encourage peaceful dialogues among disputing factions. Additionally, they must be extremely quick to reach out during natural disasters, as they can potentially change the cause of a people for many years.

Individuals
It is overwhelming to know that there are thousands of humanitarian and aid agencies who are all knocking on your door for funds to help feed the hungry. Many of them do a fantastic job, but there are also many who are frauds. Find a trusted agency and help them if you are able to. You can also be a local organizer to mobilize funds and resources for your charity or agency of your choice. Try not to let an opportunity to help pass by, because if we all give a little to the right agencies, they can do a better job of alleviating hunger for many children.
Introduction to Climate change

Many people make Climate Change and Global Warming a scary and difficult thing to understand, but it’s not.

Scientists have warned that the world’s climate has changed a lot, and has affected many living and non-living things.

Many places that were warmer are now getting colder, and many colder regions are getting much more colder or even warmer (know as Global Warming).

For example, between 1901 and 2012, it is believed that the earth’s temperature has risen by 0.89 °C. Rainfall amounts have also risen in the mid-latitudes of the northern hemisphere since the beginning of the 20th Century. It is also believed that sea levels have risen up to about 19cm globally, with lots of glaciers melting in addition.

Some people do not believe that these are caused by human activities. They think it is all political and falsehood intended to cause panic among humans.

Well, whatever it is, we would like to know more, and take a few good points from this confusion, and use them to make our world a better place to live.

Tip...
Climate change refers to general changes in climate patterns, including temperature, precipitation, winds, and other factors.

Global warming (as well as global cooling) refers specifically to any change in the global average surface temperature. Do not confuse the two.
HOW DOES THE GREENHOUSE EFFECT HAPPEN?

The greenhouse effect is important. Without the greenhouse effect, the earth would not be warm enough for humans to live. But if the greenhouse effect becomes stronger, it could make the earth warmer than usual. Even a little extra warming of the earth may cause problems for humans, plants and animals.

WHAT BRINGS ABOUT MORE GREENHOUSE GASES?

In this new era (the age of industrialization), the earth is full of industries. Millions of vehicles, airplanes and engines are produced every year. A lot of artificial things have been produced and have ended up in waste dumps. Humans produce much more waste than ever before.
Simply put, human's reliance on artificial things, including all the things that make us comfortable at home, has contributed immensely to the emission of more greenhouse gases than before. These gases in the atmosphere have trapped more heat on the earth’s surface and made it warmer. This is Global Warming.

YOU and I also produce \textit{CO}_2 and other greenhouse gases in a way, by the things we use at home. Do you have some of these items in your house?

It is very \textbf{IMPORTANT} that you turn off all electrical appliances when they are not in use. This is good practice, and you end up saving some money too.

Everything humans have at home or workplace need power to work. This power comes from burning fossil fuels and other natural sources. The more fuels are burnt, the more \textit{CO}_2 are produced into the atmosphere.
This means each time your dad drives his car, or you turn on an electric appliance, you are indirectly adding to the greenhouse gases in the atmosphere.

\textit{But thats not all} — it must also be noted that less forest cover all over the world has resulted in less carbon absorption and storage. \textit{This is because plants absorb carbon from the atmosphere during photosynthesis. Additionally there is more methane release from permafrost due to higher temperatures.}

This is not very good, as we are all contributing to global warming and climate change.

This is a problem.
Global warming causes thermal expansion of land and water. It also causes ice sheets to melt in icy regions of the world and mountain tops. Large volumes of melted ice (water) then flows down into streams, rivers, lakes and seas. The result is rising sea and water levels, causing floods and massive destruction to low-lying towns and cities along water bodies.

*Research shows that global sea level rose about 17 centimeters (6.7 inches) in the last century, and the rate in the last decade is nearly double that of the last century.*

Changing climate may also cause the weather to become more extreme, be it droughts or violent storms and heavy rain.

Extreme changes in temperature makes people suffer breathing difficulties, head aches, body rashes and other illnesses.

Climate change also distorts the natural habitats and lives of many plants and animals. For example, the survival of polar bears and penguins in icy regions are in danger, as they cannot survive anywhere else. Other plants and animals in hot regions will die if temperatures suddenly become too cold for them.

The same amount of water in the water cycle will not be affected, but its timing, amounts, regularity and distribution will be impacted.
THINGS YOU CAN DO ABOUT GLOBAL WARMING.

Before we look at what you can do, it is important to note that big automobile industries, refineries, commercial farmers, and others are the main bodies with the highest carbon emissions. This is because we rely on them to provide products and food that we enjoy at home. This means if we reduce our reliance for these big industries, they won't have to produce more. So, a good way to solve the problem may be from our government and legislature level to regulate these big companies. We can get our leaders to make laws that discourage activities that has high carbon footprint.

Did you know... Energy production and consumption contribute greatly to emissions. This means improving energy efficiency will reduce global emissions. In modern times, new energy efficient buildings use 60–90% less energy than conventional buildings of a similar type and configuration.¹

But many of our leaders have been a bit disappointing. So it is our turn to do our bit!

WHAT ABOUT YOU? ... IN YOUR OWN LITTLE WAY?

Start by reducing your carbon footprint. Your carbon footprint is the sum of all emissions of CO₂ (carbon dioxide), which were produced by your activities in a given time frame.

Let's start with vehicles. Vehicles produce greenhouse gases.

- Go by bus!
Get your family to go to school, work, market, holiday, place of worship on a bus rather than in daddy’s car. It's cheaper too, and you save some money.

- Walk! Don’t drive.
Walk to the shop, market, farm, school and everywhere. Sometimes there are too many cars causing heavy traffic and it is better to walk. It is also great exercise.

- Ride! Don’t drive.
You can always ride down to almost everywhere. It's great fun and very good exercise!

- Protect and plant trees.
Planting trees is fun and a great way to reduce greenhouse gases. Trees absorb CO₂, (a greenhouse gas) from the air. This means the air will be fresher and also help regulate climate. You can also save old trees by protecting them from being cut down. One great way to have fun with trees is to plant one on every special day like your birthday, Christmas, National holidays or even in memory of special friends.

- Recycle, reduce and re-use items.
Recycling, reducing the use of things and re-using things is also a brilliant attitude for us to acquire. When we recycle cans, bottles, plastic and paper, we send less trash to landfill. It also helps save natural resources such as trees, oil and aluminum. When you go shopping, always look for the recycle mark on products before buying them. The mark means they have been produced from recycled materials, and you want to encourage them to do so.

If your community does not have recycling services with waste collection, this is the time to join a group to talk about it.
INTRODUCTION TO GENETIC ENGINEERING.

You may have heard that many foods (plants and animals) these days have questions around, as to whether they have been grown naturally or have been manipulated in some way. These are genuine concerns as biotechnology has entered into new areas where DNAs of plants and animals have been combined to create new DNAs that never existed.

_It is VERY important to understand what DNA and Gene is. DNA simply means Deoxyribonucleic Acid. It is a hereditary molecule that is found in almost all living things (cells). DNA carries a code (information) that genes use to make living things grow. It is found in all cells in structures called chromosomes._

_Genes are instruction manuals in our body. They are molecules in our body that explain the information hidden in our DNA, and supervises our bodies to grow in line with that information._

With that brief DNA and Gene explanation, let us see this scenario.

**A SCIENTIST Wants to Make Blue Apples:**

The scientist decides on the intent or reason for making blue apples. He can get a plant with blue fruits (say blue berries). He cuts out a piece the blueberry DNA and inserts it into the apple’s DNA. He plants the new apple seed and the apple tree produces blue apples instead of red.

But it is not plants alone — if he wants a cow to have some desired traits such as high milk production, he can get the DNA of a cow with that trait and fix its DNA into the new cow, so that the recipient cow will have a high milk production trait.

**What Are Genetically Modified Organisms (Foods)?**

The words Genetically Modified Organisms(GMO), Genetically engineered (GE) and Biotechnology are often used interchangeably, but Genetic modification is simply the addition of new DNA to an organism or living thing, thereby modifying its genetic make-up.

It is the use of modern biotechnology (or gene technology) tools to introduce new traits (characteristics) into organisms, either from related and non-related organisms.
For example, a DNA from a plant (Plant X) that has high resistance to pests can be copied and introduced (added) to another plant (Plant Y), so that, the Plant Y will have the pest resistant trait.

Note that the DNA of an organism (e.g fish) can be modified by a DNA from a plant, which is a completely non related organism.

Another example is that, sometimes chemicals used in farming, such as herbicides end up killing lots of the crops planted, together with the weeds. Here, DNA from a herbicide resistant plant can be copied and added to the cells of the food crop so that the food crop will withstand herbicides when they are applied to the crops.

The concept of genetic engineering is not new, in fact it has been used to produce many blood, milk, lab mice types for research and pharmaceutical purposes for many years now. In recent time, the technology has been applied to plants and animals for food purposes, and that is why the argument has heated up.

You may not be able to tell a genetically modified fruit (e.g. strawberry) from its natural counterpart. They may look the same, but their cell DNA make-up will be different. Both fruits come from strawberry shrubs, but the shrub of the GM fruit would have produced fruits in a relatively shorter time period, or the GM fruit may have some toxin DNA in it which made it resistant to pests and diseases.

**WHY DO WE NEED GMOs?**

The developers of GM foods believe that genetically modified organisms will have lower prices, higher nutritional value and taste, and durable in terms of produce quality. More importantly, they believe that the plants will be more resistant to droughts, pests and weeds. Earlier, the main aim was to increase crop protection, but its perceived success has empowered the developers to explore into new areas of modifying organisms to yield even more radical results.
Some organisms are constantly being attacked by pests and some insects, and traditional methods of fighting them are just too costly and painful. So just like a flu shot, researchers believe the DNA from a virus can be fixed into the DNA of the crop, and make it more resistant to that virus.

Before we look at the argument for and against this technology, here are a few reasons why GM foods are produced: to be insect resistant, virus resistant, and/or herbicide tolerant.

To this end, scientists have:

- Introduced genes for toxin production into crops, making the crops require less insecticides on the lands on which they are planted
- Introduced genes from some viruses into the crops, thereby making them less susceptible to diseases and therefore increasing its produce
- Introduced some genes from some bacterium that makes the crops resistant to some herbicides.
  The net results for all of this, is increased crop yield and higher production.

**GENETIC ENGINEERING DEBATE:**

**Uncertainty**
The biggest worry in GMO technology perhaps is the uncertainty surrounding it. Many people feel that we may be going onto an area that we cannot control if it gets out of hand. Maybe it is too late now, because we have all (very likely) already consumed lots of GM foods. While there is little long term research on the real effects of GMO on human health, it is widely known that GM foods are generally safe for consumption, at least in the short term. The debate is a very heated one.
Food redistribution and food waste
But people speaking against GMO have a different point of view. They argue that feeding the worlds hungry and malnourished can be achieved by redistribution of food supplies. They argue that there is a lot of food waste in many of the countries that are pushing for GMO. If they really did care, they could invest in cutting the waste and distribute the surpluses to the most needed places. That sounds great, but is that possible?

Environment
There is also concerns about the environment. The use of heavy chemicals on crops means that the land will absorb the chemical residue. Weeds that were killed will contain chemical residue, posing a threat to soils and living organisms in them.

Food supply
Hundreds of millions of people in the world are malnourished and hungry. Where is the food going to come from if we depend on natural farming practices that we have used all along? Many people speaking for the use of GMO say that the technology will make farmers in developing world (and all over the world) combat drought, pests and weeds more effectively and increase yields at local levels. Local farmers will need less effort to produce a higher yield.

Pros/Benefits of GMOs?
The government and agribusiness tout the benefits of GMOs to the public. Some of the benefits they see are as follows:

- Better food quality and taste: Genetic modification can be used to make corn sweeter, peppers spicier, pears taste more like apples and fruit and vegetables keep longer. Studies done on tomatoes have shown that most people prefer the taste of the genetically enhanced tomato over those that have not been enhanced.
- Fewer animal health problems: Genetic modification can result in animals that are resistant to diseases and can better withstand typical factory farm conditions.
- More efficient production of food: Genetic modification can help farmers skip steps in the process, such as spraying their crops with pesticides, because the foods are already resistant to pests.
- More benefits in the foods themselves: Some foods like “Golden Rice” have been modified to contain additional vitamins and minerals like Vitamin A. These are used to help people in countries where an adequate supply of a variety of foods is not available.

Cons/Drawbacks of GMOs?
Top critics of genetic modification include environmentalists and proponents of organic foods. Some scientists agree, and studies are being carried out on the potential drawbacks to GMOs:

- Environmental risks: Introducing plants and animals that do not naturally occur into the ecosystem could have devastating effects on current species due to cross breeding and cross pollination. Herbicide resistant plants could spread their qualities to weeds, which would make them harder to kill.
- Making plants and animals that are resistant to bacteria can cause bacteria to become stronger and harder to kill. Making plants herbicide resistant can lead to weeds that are herbicide resistant as well.
- Failure to yield: Despite claims that GMOs increase crop yields, studies have found this claim to be untrue; the genetically modified foods take just as long to grow as standard foods. This means that GMOs do not save time or money and do not lead to decreased food prices.
- No long term testing: GMOs are relatively new to the marketplace. While they have been described as safe, many studies carried out stress that there are no long term studies done on the products that may yield different results.
- Sick or dying animals: There have been isolated incidents of animals dying after eating genetically modified foods that are identical to foods being sold to humans.
- Allergies: Genetically modified foods have the potential to cause increased allergic reactions in people. Some people with specific sensitivities have been reporting increased allergic reactions to GMOs.
People who would rather not deal with GMOs, either the pros or the cons, can buy food that is labeled “USDA Organic”. Any food that is labeled "100% organic," "organic" or "made with organic ingredients" cannot include any ingredient that is genetically modified. Right now, this is the only way to insure there are no GMOS present in a product, although individual manufacturers sometimes apply what's known as negative labels to their products. One common negative label is seen on thousands of cartons of milk. It asserts that the cows used to produce it do not receive bovine growth hormone, also known as rBGH or rBST.
PRO/CON: Putting GMO Information On Our Food Labels

PRO: Many believe GMOs unsafe, want them labeled
Health and food safety are scary subjects for millions of Americans. They should be. Polls show Americans are alarmed over what's in their food. Americans are worried about pesticides, antibiotics, hormones and other unnatural things added to food. They are especially concerned about genetically modified organisms (GMOs).

GMOs are plant or animal products. They have been created by scientists in a lab. They use DNA from bacteria, viruses or other plants and animals. The purpose is to make seeds produce more or stronger crops. The crops can be more resistant to insects and low rainfall. A recent poll found that 93 percent of Americans want GMOs labeled. Already, 64 nations require such labels.

PRO: Buying Non-GMO Food
Two-thirds of Americans believe that GMOs are unsafe. Millions of Americans are switching over to non-GMO, organic foods. Indeed, Americans now spend more on organic food. More than 10 cents of every dollar Americans spend on food and drink is for products labeled “organic,” “non-GMO” or “natural.”

GMO labeling laws were voted on in California, Washington and Oregon. The big food companies like Coca-Cola spent millions of dollars to sway voters. Chemical companies did, too. Monsanto, the world's largest maker of genetically modified seeds, spent millions. They were successful in stopping these labeling laws from passing.

Vermont, Maine and Connecticut have passed laws requiring the labeling of GMOs. Vermont’s GMO labeling law goes into effect in July 2016. Already, it is causing major food brands to panic. They know they've got a problem. They have to make a choice. One option they have is to remove all GMO ingredients from their products. That's exactly what happened in European countries after GMO food labeling became required in the European Union in 1998. The other choice by food companies is to add a GMO label on the front of their packages and bottles.
Eighty percent of supermarket foods now contain GMOs. They also contain the toxic chemicals sprayed on GMOs.

**PRO: Dangers Of One Herbicide**

In March 2015, the World Health Organization of the United Nations (WHO) studied Monsanto’s Roundup herbicide. It is made from glyphosate. The WHO said it probably causes cancer. That prompted several dozen countries to stop the use of GMOs in farming. The state of California agrees about the danger. It added Monsanto’s herbicide to its list of cancer-causing chemicals.

In the United States, glyphosate herbicide is sprayed heavily on most GMO crops. Corn, soybeans, beets, wheat, beans and rice are all sprayed with it. The U.S. Environmental Protection Agency (EPA) has said that over time glyphosate can damage the kidney and reproductive organs of humans. And a scientific report last year connected glyphosate to damage to the human gut and digestive system. Glyphosate use has also resulted in uncontrollable, herbicide-resistant superweeds on much of U.S. farmland. Meanwhile the EPA, U.S. Department of Agriculture (USDA) and the Food and Drug Administration (FDA) have given the green light to a scary new generation of GMO crops. They are allowed to be sprayed with strong toxicides. One of these was used to destroy crops and forests during the Vietnam War.

Billions of pounds of glyphosate and other toxic pesticides are now being sprayed on our food. They prevent insects from ruining crops. In addition, billions of pounds of chemical fertilizers are added to crops. They help them grow, sure. Yet they pollute the environment at the same time.

**PRO: Our Health Is At Risk**

GMOs and the chemicals used on GMO crops are destroying our health. They also poison our soil, water and air. Americans want GMO labeling. Unfortunately, Monsanto and the other big food companies don’t want that. Working with them are the members of Congress who receive money donated by those companies.

In December of 2015, Congress began looking at a law. It is called the Safe and Accurate Food Labeling Act of 2015. It would take away the rights of states to require labels on GMO foods. The law would also let GMO foods be labeled as “natural.” This is wrong. Americans could help stop laws like this from passing. Tell Congress you want labels on GMOs.

**CON: GMO foods are safe, no need for labels**

Eighty percent of supermarket foods now contain genetically modified organisms (GMOs). But labeling these foods is certainly not about food safety. No humans have been harmed by GMO products — ever. And it’s also not something that the Food and Drug Administration (FDA) can legally do right now. There is no scientific difference between GMO foods and regular foods. By the year 2025, the World Wildlife Fund (WWF) estimates that two-thirds of the world’s population will confront a water shortage. Ecosystems will also suffer. Food will become harder to grow.

One way to make this scenario less dangerous to our food supply is to use GMO foods. They reduce the need for plowing fields. This allows the soil to stay moist. Then plants can retain more water.
In some cases, this will make the difference between a harvest or crop failure. Results show crop yields increasing significantly. Right now, nearly 1 person in every 9 does not have enough to eat on this planet. GMOs can help.

**CON: GMOs Mean Fewer Pesticides**
Another way that GM foods help us is that they use less pesticide. One study found that it reduced the amount of pesticides and their costs by more than one-third. Pesticides get a bad rap. They don't deserve it. The truth is that there are only tiny amounts of pesticides in the foods you eat. You are totally safe.

Toxicologists study how chemicals affect living things. As one put it, there are more cancer-causing substances in a single cup of coffee than there are in all the small amounts of pesticides you eat and drink in a year. That doesn’t mean that coffee will give you cancer. All it means is that there are very few pesticides in what we eat and drink. An increase in crop yield and a decrease in pesticide costs will lower the price of food. That’s a good thing, particularly if you don't have much money.

It’s amazing people are even fighting over GMOs. They have been around for 20 years. In fact, people have been changing food genes forever. GMO crops are just a newer version of natural plant breeding that began more than 8,000 years ago. Back then, farmers bred plants by choosing the best ones to save for planting in the following year.

The corn we eat today, for example, is the result of genetically modified plantings from thousands of years ago. Within the last few hundred years, farmers began mating or cross-pollinating plants to grow more crops.

**CON: We Can't Afford To Label GMOs**
GMO foods are no different. They just use modern technology. GMO foods also allow scientists to tackle certain problems with crops. These crops produce foods that keep better. They spoil less from mold, don’t cause allergies, and can even grow medicines in them. Take the example of Golden Rice. It is a GMO food that contains beta carotene (Vitamin A) which helps to reduce blindness. It even prevents up to 2 million deaths annually in poor countries.

Labeling GMO products would be expensive. It could also discourage companies from making better GMO seeds. Labels may seem like a simple way to share information. Yet they will cost food companies more. That will force them to raise food prices. Many people simply cannot afford that. Those who wish to buy non-GMO foods can buy organic. However, if you buy organic, you are actually putting yourself more at risk.

Organic foods are four to eight times more likely to be contaminated with microbes. And for that, you are paying a lot more.

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