

The future of world is in our hands

A pair of hands is shown from the bottom, cupping a glowing Earth. The Earth is illuminated from the right, showing a bright horizon and a dark side with glowing city lights. The background is a dark space with a few stars.

2050

By Anita, Rosa and Caitlin

For the world.

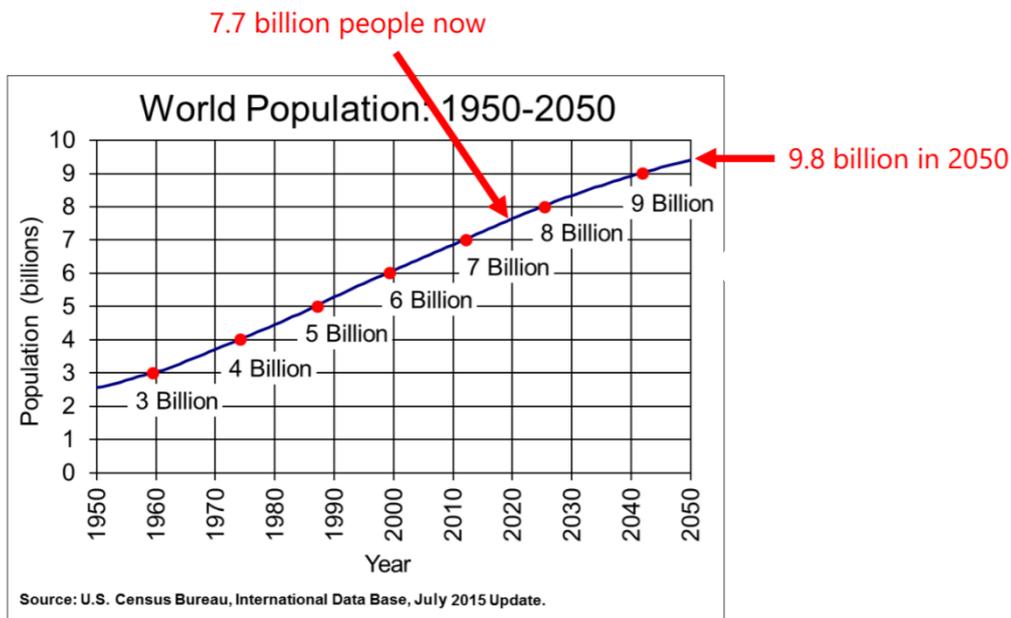
Table of Contents

Overview.....	4
Big question.....	5
Overpopulation.....	6
Poverty.....	11
Climate change.....	15
Aquaponics.....	21
Consumption.....	25
Making Space for increasing population.....	27
Seaweed and Carbon Reduction.....	29
Butterfly Effect.....	33
Q & A with Monika Doblin.....	34
Conclusion and Answer.....	36
Reflection - Anita.....	38
Reflection - Caitlin.....	39
Reflection - Rosa.....	40
Acknowledgments.....	41
Bibliography.....	42

Overview

At the rate of exponential population growth and the impact of climate change we are currently experiencing, our lives in 2050 will be undeniably different, leaving our society to adapt and us to wonder...

How will we combat the issues that are arising because of the population increase and climate change in 2050?



In the coming years, the global challenges we are facing currently will only be exacerbated and new problems will arise.

Let's consider what the world will look like in 2050 if humanity continues to increase in size, burn oil, gas, coal and forests at the current rate. The planet will be more aggressive and less fertile in 2050, as well as more crowded and less diverse. There are more trees, but less forests, more concrete, but less stability, than in 2021. "By 2050, if we fail to act, many of the most damaging, extreme weather events we have seen in recent years will become commonplace," alerts Michael Mann, the director of the Earth System Science Centre. "In a world where we see continual weather disasters day after day, our societal infrastructure may well fail ... We won't see the extinction of our species, but we could well see societal collapse." Some of the most predominant issues that humankind will have to face are the rapid rate of overpopulation, poverty gap and economic inequality as well as the devastating impacts of climate change and global warming. These overarching concerns are the roots of a majority of contemporary issues such as water scarcity, food security and land management and urbanisation.

We, as the global population of the homoserine species are under moral obligation to our planet, the Earth. To combat world issues means that even if there are no complete solutions then surely there are prevention methods and the like.

The rapid rate of overpopulation, poverty gap, and economic inequality, as well as the catastrophic effects of climate change and global warming, are some of the most pressing problems that humanity will encounter during 2050.

The problems we are encountering currently will only dramatically worsen and new issues will arise. This is due to both the destructive nature of humanity and the lack of education and knowledge around these issues. New and possibly more damaging issues are arising everyday across the globe.

How will **we combat** the **issues** that are **arising** because of the **population increase** and **climate change** in the **future**?

Human overpopulation is one of the most pressing environmental and social issues. Overpopulation describes a situation in which a population in their ecosystem has limited resources to survive. According to the most recent United Nations estimates, the current world population is 7.8 billion and is expected to increase to around 9.7 billion in 2050. If the population continues to grow, there are multiple issues and concerns that will affect humanity's availability to live and sustain the planet.

Climate Change, as one of the most prevalent issues faced today, poses a significant challenge to humanity and is predicted to worsen over the next 30 years. Climate change is currently impacting every country on the planet causing weather patterns to drastically shift, sea levels to rise, and extreme weather events to become more frequent, not to mention disrupting national economies and impacting countless lives.

The period of time in which we are classifying the 'future' for this book is 2050, as it is not only a landmark for many countries in regards to goals and achievements, it is not too far in the future, and not too close so we are able to prepare and possibly implement some of these solutions.

Overpopulation

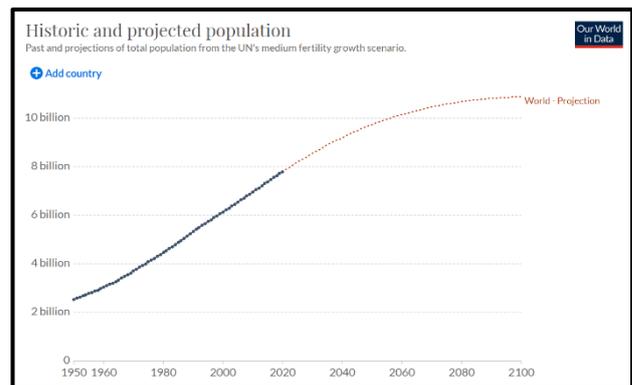
What is Overpopulation?

As defined by Britannica, overpopulation is 'a situation in which the number of individuals of a given species exceeds the number that its environment can sustain.' Therefore, overpopulation describes a situation in which a population in their ecosystem has limited resources to survive.

The population Earth can sustain long term is 1.9 billion people, which is roughly the global population 100 years ago in 1919. According to the most recent United Nations estimates, the current world population is 7.8 billion as of March 2021. The population is expected to increase by 2 billion people in the next 30 years, with around 9.7 billion in 2050 and could peak to nearly 11 billion around 2100.



Dhaka Bangladesh train full of passengers due to overpopulation



Historic and Projected Population Graph for 2050

What are the issues stemming from overpopulation?

Human overpopulation is one of the most pressing environmental issues. Global warming, deforestation, biodiversity destruction and the use of scarce natural resources such as fresh water, arable land, and fossil fuels at rates greater than their rate of recovery are all exacerbated by human overpopulation. 4 of the main issues stemming from overpopulation include:

Loss of Freshwater:

According to UN-Water, 97.5% of Earth's water is ocean and 2.5% is freshwater. Most of the freshwater resources are either unreachable or too polluted, leaving less than 1% of the world's freshwater, or about 0.003% of all water on Earth, readily accessible for direct human use. According to the Global Outlook for Water Resources to the Year 2025, it is estimated that by 2025, more than half of the world population will be facing water-based

vulnerability and human demand for water will account for 70% of all available freshwater.

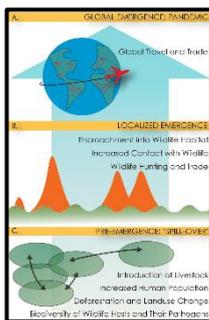
Depletion of natural resources:

As the human population continues to boom, natural resources, such as fossil fuels, fresh water, arable land, coral reefs and frontier forests, continue to plummet, which is placing competitive stress on the basic life sustaining resources and leading to a diminished quality of life. By the year 2050, 2.5 billion people are expected to move into cities and the growing global middle class will strain natural resources.



Person Walking ground affected by Drought

Increased emergence of new epidemics and pandemics:



Pandemics Diagram

A World Health Organisation report shows that environmental degradation, combined with the growth in world population, is a major cause of the rapid increase in human diseases, which contributes to the malnutrition of 3.7 billion people worldwide, making them more susceptible to disease. Overpopulation exacerbates many social and environmental factors, including overcrowded living conditions, pollution, malnutrition and non-existent health care in developing countries.

Food production:

As the world's population grows to more than 9 billion people by 2050, global meat consumption is expected to rise by as much as 76%, resulting in more biodiversity loss and increased GHG emissions. The Population Institute estimates that increase in food production will also have to take into account increases in energy prices, as well as factors such as the groundwater depletion, the loss of farmland to urbanization, and potential flooding and droughts caused by climate change.

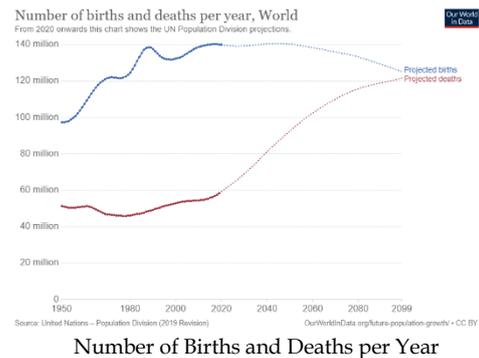


Crops in Farmland

What conditions contribute to population increase?

Population increase is argued to be a cause from decreasing death rate, increased fertility rates, increase in average human age, increase in immigration and a depletion of resources.

When overpopulation occurs the available resources become too limited for the entire population to survive comfortably or at all in long term. Population growth started to decline after 1965 because of decreasing birth rates, however, by 2000, the population began to grow again, counting 6 billion people. This leads to exceeding the capacity of a geographical area and damaging the environment faster than it can be replenished. By 2050, it is argued that human overpopulation can potentially lead to demographic push, or even ecological or societal collapse and human extinction.



Is population growth good for the economy?

Time magazine's Stephen Gandel says 'low population growth will help the country by raising wages and reducing government spending on the needy: For the economy, a slower increase in the population raises concerns about American competitiveness.'

Population growth is beneficial to an economy due to the fact that population growth is correlated to technological advancement. Rising population promotes the need for technological change in order to meet the rising demands for certain goods and services. However, overpopulation will cause lack of food, and as the rate of growth of population exceeds the rate of production, economic development is hindered.



There may not be enough for everyone. Photo: caglecartoons.com

What does overpopulation look like in 2021?

For billions of poor people living in unstable conditions around the world, overpopulation already exists: on unsuitable land, in unsafe homes, lacking fresh water, or in highly contaminated ecosystems. Natural disasters such as drought, floods, and earthquakes can kill people, but so does overpopulation, by severely increasing vulnerability. The media, on the other hand, rarely reports on this fact.



Overpopulation in India

Due to overpopulation in crowded mega-cities, many residents have never seen a native landscape. Even small patches of green are vanishing in heavily populated urban areas, which will continue to become increasingly crowded as population growth and urbanisation continue. The consequences of overcrowding and a lack of connection to nature have been established.

How will overpopulation impact life in 2050?

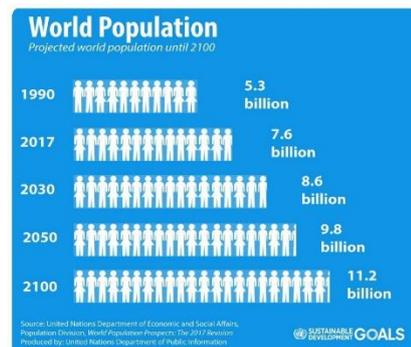
If the population continues to grow, The United Nations predicts the global population to rise to 9.7 billion by 2050, and by 2100 there will be an increase of almost 3.5 billion from 7.8 billion if current patterns continue. If we compare the population in 1960 (3 billion) to today's, questions are raised such as:

“How serious will climate change be if the world's population remained at 3 billion?”

“How many fewer people will have died as a result of starvation, conflict, or war?”

“How much less pollution and plastic waste would have been generated?”

“How much less food would have been needed, and how many millions of acres of forests, grasslands, wetlands, and other habitats would have been saved from agricultural conversion?”



Projected World Population until 2100

With a projected population of 9.7 billion in 2050, there are more than two billion more people to feed than today, global food production would require doubling. The United Nations' International Panel on Climate Change expects food production to decline by 2% to 6% in each of the coming decades because of land-degradation, droughts, floods and sea-level rise. This means with food production declining and population increasing.

Currently, tens of millions of people around the world go to bed hungry. In 2050, continued population growth, combined with the uncertainties of climate change, could result in even greater food insecurity. Meanwhile, the effort to feed an ever-increasing population would eventually deplete Earth's remaining biodiversity, diminishing wild lands and eradicating thousands of species.

However, it is critical to recognise that overpopulation occurs in many rich countries now and will continue to increase by 2050, with excessive consumption rates as well as in many poor countries with excessive fertility rates. Every effort should be made to reduce consumption rates as well as high birth rates; with these two steps taken, a much better future will be seen for humanity.



Overconsumption in rich countries

Political officials, the news media, and even many environmentalists rarely use the term "overpopulation." However, according to a recent international survey by Global Challenges Foundation (GCF), many citizens in many countries see overpopulation as a serious issue. 70% of all respondents believe that population growth is a global catastrophic risk and 23% believe it needs an urgent response, but what is an urgent response? In this situation, the common people seem to be ahead of their government. They're also more open to futures that don't depend on unrestricted development, which is an ecological impossibility on the world.



Environmental Sustainability

The good news is that global population growth can be halted equally and without intimidation by 2050. Difficult strategies have already helped hundreds of countries stabilise their populations, and several more have made significant progress. Such as China's plan of one-child policy, in order to curb a surging population and alleviate social, economic, and environmental problems.

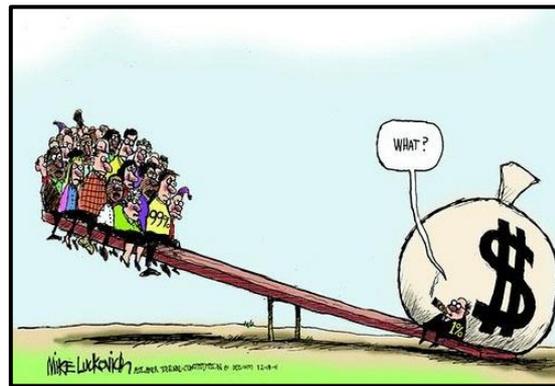
However, this one-child policy did have its consequences as it was said to violate the constitution's guarantee of human rights.

Ending population growth and then enabling population levels to fall as a result of lower fertility rates are essential steps towards developing ecologically healthy communities. They will help potential human communities in flourishing well into the future.

Poverty

What is poverty and what issues stem from poverty and lack of opportunity?

As defined by the UN, poverty is “a condition characterized by severe deprivation of basic human needs”. According to World Vision around 9.2% of the global population or roughly 689 million are living in extreme poverty (as of October 2020) which is classified by the World Bank as living on under 1.9 dollars (USD) a day. Whilst the situation is visibly improving, one in ten people in developing nations still lives on less than US\$ 1.90 a day and up to a shocking 42% of the sub-Saharan African population continue to live under this poverty line.



A cartoon by Mike Luckovich illustrating the extreme economic inequality

A question many will ask is why does poverty occur and why is it so prevalent in today's world? The answer is that poverty has numerous dimensions, but its causes include social exclusion and high vulnerability of particular populations to disease and other similar phenomena which contribute to the ceasing of productivity in those countries. Contrary to popular opinion, poverty does not only entail the



People living in severe poverty

absence of money and other assets to support livelihood but also affects humans in other ways. Malnutrition and hunger are immediate results of this but restricted admittance to schooling, the lack of decision-making capabilities and social exclusion and discrimination are the lesser known, arguably more prevalent effects of poverty.

What is the difference between developed and developing nations?

The gaping divide between developed and developing nations has arisen as a result of unequitable wealth distribution and this rapidly increasing problem has been a focus for scientists for a while. The origins of this issue are believed to have stemmed from the industrial revolution and the age of Enlightenment (from the late 18th century to early 19th century) which was able to bring about an incredible progression which shaped our lives today but also left other nations in the dirt. The stark difference between developed and developing nations is considered a major inequality and needs to be addressed globally.

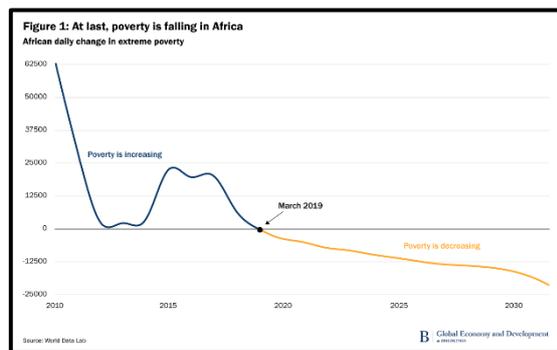
As a global population, we need to combat the divergence that is appearing more and more in modern society and move towards convergence between all the nations of the world. Scientific and technological advancement is not actually that beneficial or relevant when 70% of the world's population live in developing countries. So, what actually is a developing nation? Whilst hard to define, a developing country, as opposed to a developed country is characterised by a couple of key factors. These are namely percentage of families working in the agricultural industry, widespread poverty, limited imports and exports, education opportunities and difficult physical conditions. A developed nation on the other hand, is a more economically and technologically advanced, industrialised and more widely resourced country.



An infographic detailing the characteristics of a developing nation

How does poverty impact a country's ability to combat issues such as climate change and overpopulation?

With poverty comes so many other related issues such as lack of education, which if you think about it, can be detrimental to the progression and harmony of society. For example, people in many countries, especially in Africa, have historically far more children than in Western society with the knowledge that not all of them would survive to adulthood. Although the mortality rate for children in African countries is improving this issue is not purely historical and it is the case in a lot of countries. It is also useful to have many children because then they can all work domestically on tasks such as collecting water from a distant source and contribute to the household and the family's income.



Poverty in Africa Graph

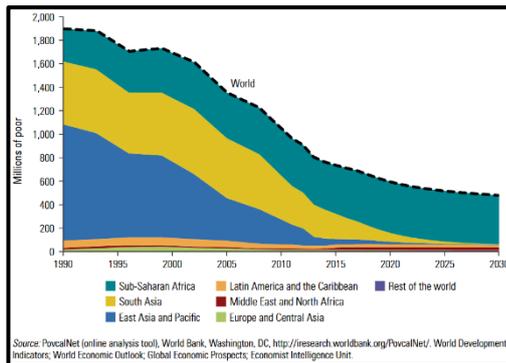


Women, aged 37 has given birth to 38 children

From an individual perspective, having lots of kids is full of benefits and for them, it is but for the world it reinforces the already looming issue of global overpopulation. The basis of the need to have many children is poverty and we cannot simply tell people to not have lots of children. As some of the more privileged members of society who have been educated we have to start

thinking about solutions to poverty. A solution to world poverty seems like a crazy concept because it is such a massive, disastrous issue and yes, there may not be a complete solution but we need to do something. If the poverty rate can be sufficiently reduced, through means that will be discussed later on, then we can start to fix the lack of education which will allow people living in African and lower socio-economic status countries the knowledge about these issues and therefore the contribution of a large portion of the global population.

Poverty is not expected to be eliminated anytime soon, maybe ever, but the sooner we start working towards a goal of relative economic equality, the sooner the necessity for many children will no longer exist. So in answer to this question,

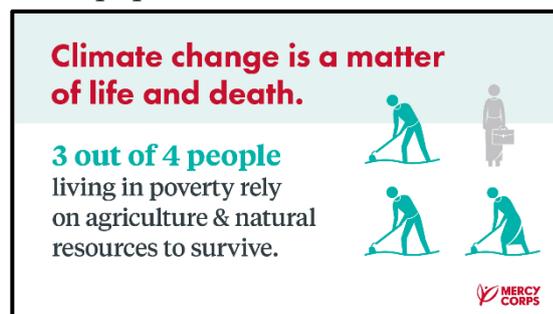


Graph which illustrates poverty in Africa compared to the rest of the world

poverty has a severely damaging consequential impact on a nation's ability to respond or even acknowledge the issues of climate change and overpopulation. People living in poverty will not be thinking of what life will be like in 30 years or so, they don't have that luxury, they will be thinking of how they can provide food and security for their family today and for the next few days.

How poverty is related to overpopulation and climate change?

Climate change places obvious stress on the environment but also on global social, economic and political systems. Recent research indicates that Earth has lost one third of its cultivatable land in the past 40 years as a result of climate change and inadequate conservation. A scarily large portion (approximately 1.3 billion people) of the world's population live and work on slowly degrading agricultural land. This can lead to minimal harvests which can consequently cause poverty, hunger and displacement to worsen due to the lack of income arising from poor crop growth. With overpopulation and climate change, it can work causally either way. For example, 26 million people sink into poverty each year as a repercussion of natural disasters, but poverty can not necessarily cause natural disasters and other effects of climate change in the same way. However overpopulation can be both the cause and effect of poverty in the way that poverty is a leading cause which can partially be attributed to a lack of education about reproduction so that families are having an excessive amount of children in order to compensate for the copious amount of domestic work.



Poverty in relation to climate change

“Climate change increases the risk of conflict. It degrades land and leads to competition over precious natural resources. Over time, conflict can displace entire communities and lead to life-threatening hunger. But we can prevent it, if we proactively focus on these environmental risks and bring communities together to find solutions.”

– Jenny Vaughan, Mercy Corps Director of Peace and Conflict

How is poverty impacting life now and how will it impact life in 2050?

The first of the United Nations 17 goals for Sustainable Development is to end poverty by 2030 and it is rightfully so. “The COVID-19 pandemic will push an estimated 71 million additional people in to extreme poverty” according to a UN infographic, that’s almost triple the Australian population. The Covid-19 pandemic that we have lived through is only worsening the already declining situation, reversing the positive changes and reductions that have been made in the last decade or so. Poverty is becoming more and more prevalent and it’s implications are becoming more and more drastic.



Children in poverty enjoying simple things

One example of this is that children born and raised in lower-income households are most commonly less prepared for schooling (if even available) and according to a 2007 study by RPS Gupta, this has been found to affect their cognitive abilities later in life. Another threatening impact of poverty is the potential for rapid disease spread in overcrowded areas with poor living standards. There are a wide array of goals and programs in place to target poverty and the worsening divide between developed and developing nations. The question is, will we be able to overcome poverty and therefore it’s worsening causes such as climate change?



United Nations 17 Sustainable Development Goals

Climate Change

What is climate change?

As defined by the National Geographic Society, climate change is “Climate change is a long-term shift in global or regional climate patterns, attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.”

Climate Change, as one of the most prevalent issues faced today, poses a significant challenge to humanity and is predicted to worsen over the next 30 years. Climate change is currently impacting every country on the planet causing weather patterns to drastically shift, sea levels to rise, and extreme weather events to become more frequent, not to mention disrupting national economies and impacting countless lives. Over the past 100 years, the average surface temperature for our planet has risen by 1.18 degrees Celsius, and is predicted by NASA to increase drastically during the next years.

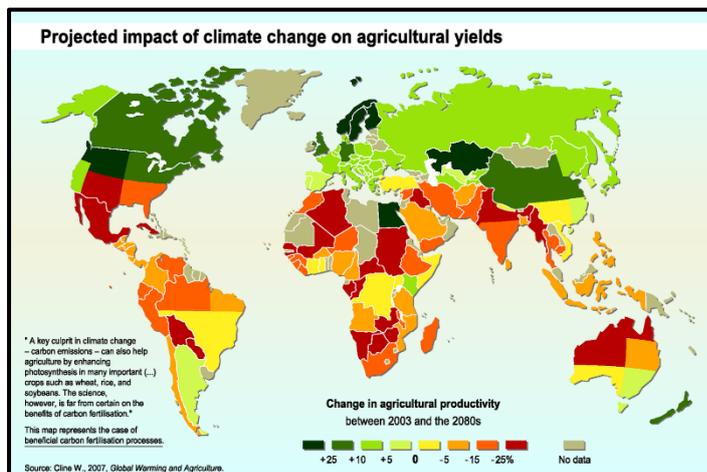


Effects of Climate Change

How will climate change impact both the natural and economic environment?

Global climate change is influenced by a variety of factors, and entails numerous consequences which effect countless lives and liveability of our planet.

Global warming, one of the key consequences of climate change, not only effects the heat and temperature of an area, but may also threaten the growth of certain food crops, and dry up natural water sources, affecting both water and food security. Not only does this cause greater variation in rainfall, it can also result in prolonged droughts, further decreasing the water availability on our planet. Global warming and lack of rainfall can also cause the soil which is used to agriculture to become dry



Projected impact of climate change on agricultural yields

and therefore lack the vital minerals and nutrients needed to grow plants. According to the Food and Agriculture Organisation of the United Nations, 33% of the World’s soil is degraded, and it is predicted that over 90% could become degraded by 2050. At the moment, soil erosion and degradation is responsible for the loss of 50% of all crops. If the soil

which we used for farming was not degraded this could potentially lead us to double the number of crops which we are able to harvest. Additionally, if climate change causes droughts throughout our planet, which can lead water shortages in an area which is primarily dependent on agriculture, this can not only risk the animal and crop health, the farmers and communities which rely on these crops would be put at risk. Not only does this severely effect the economy, by placing the livelihood



Woman trying to plant crops on dried out soil

of millions of citizens around the globe at risk, but loss of animals and crops can result in a worldwide famine.

Additionally, with the rapid population increase, the food industry will need to produce double the amount of food by 2050 to sustain the population. If half our food is being lost as a result of climate change, this result will be unattainable.

As stated by the IPCC (Intergovernmental Panel on Climate Change) climate change “has detectably influenced several water-related variables that can influence and contribute to floods”, such as rainfall and snow and polar ice melting. It is evident that while global warming may not directly influence floods, it can exacerbate factors cause severe flooding. Almost 60 million children who used to live in areas which have low levels of access to water and are now at a greater risk of drought or flood. Although on the surface, flooding may seem like a beneficial result in regards to water scarcity, this means that when the area floods the small amount of pure, non-contaminated water which the communities rely on will now become contaminated from all the dirt and even faeces which line the ground in rural areas. Flooding can cause the infrastructure of numerous buildings to fail, crop destruction and loss of livestock. Not only does the country have to pay to fix all the damages to their cities, but food and water can become scarce, leaving many thousands of people unable to afford clean water and food.



Town flooded due to climate change

What are the issues stemming from climate change?

Climate change is one of the most pressing environmental issues. Declining water and food supplies which are the result of floods and droughts exacerbated by climate change.

Declining water and food supplies as a result of Floods

Water supplies is one of the areas in which the effects of climate change are the most critical. As the climate changes, and floods and droughts become increasingly prevalent, which cause drastically decrease the amount of non-contaminated water. As previously stated, floods can cause many sources of



Declining global food supplies

water to become contaminated, which can deplete any existing water sources which are not properly packaged.

Contaminated water can lead to the development of numerous diseases such as Typhoid, which is one of the most common worldwide bacterial diseases, causing 18.97% of deaths of

citizens in India alone. Additionally, there are many social, economic and environmental consequences as a result of floods for both individuals, communities and even countries who experience floods. On the surface flooding has immediate consequences such as loss of life, property damage, crop destruction and livestock loss. Crop destruction and livestock loss does not only affect a farmer's livelihood, as they now have no source of income, but it can cause food scarcity, meaning the original prices of food may increase to an extent where it is not affordable for the majority of the community. Floods can also cause degradation of health due to waterborne diseases, and many communication links and infrastructures including power plants, highways, and bridges can become damaged or disrupted, forcing people to flee their homes and disrupting normal life. This damage can result in extremely costly repairs for countries buildings and infrastructure after destructive floods. In Australia, floods are one of the most expensive natural disaster to fix, with direct costs averaging at \$377 million per year. As a result, flooding can indirectly jeopardise a country or cities ability to function and place them in extreme debt.

Declining water and food supplies as a result of Droughts

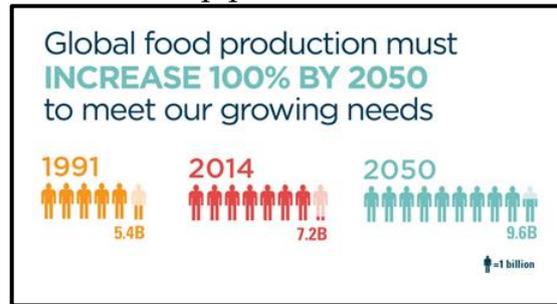
Not only does climate change cause greater variation in rainfall, it can also result in prolonged droughts, further decreasing the water availability on our



Southern Iraq where drought threatens agriculture due to declining water supplies

planet. Nearly 40 percent of the world, an estimated 1.3 billion people, rely on agriculture as their main source of income. There are three main types of droughts, which all effect water supply and farming. Meteorological drought is probably the type of drought that comes to mind, in this type of drought, water

precipitation levels are extremely low. This drought very closely interconnects to hydrological drought, which is when limited precipitation can cause degraded soil and can cause lakes to not receive enough additional moisture, resulting in unhealthy environments for the animals which live there. Finally, agricultural drought is when water supplies which are available not prevalent enough to meet crop water demands. Although it may look like a country is receiving enough rain, if it is not able to sustain crop production, this would be classified as an Agricultural drought. There are a variety of reasons which an Agricultural drought can occur such as limited water supplies or not enough precipitation, making it possible for an agricultural drought to occur, without a meteorological drought.

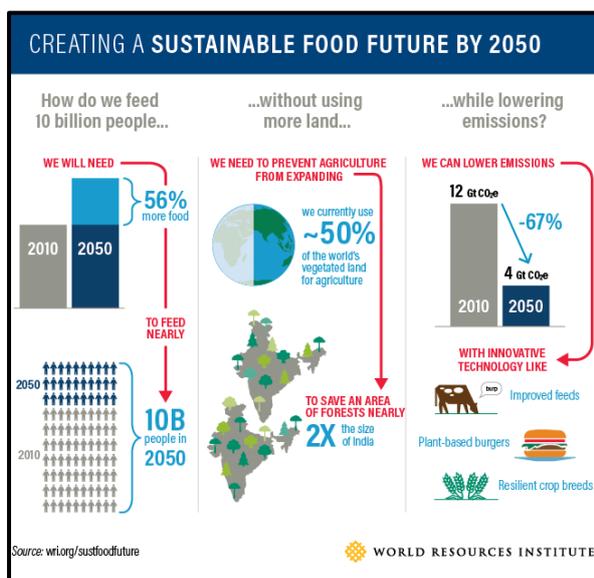


Food production needs to increase by 100%

How can we appropriately manage the Earth’s land?

As defined by the United Nations, sustainable land management is “the use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions”.

Although our population is growing, our Earth is not. Therefore, making it critical that our society can preserve the landscape for years to come, so future generations are able to inhabit and thrive on the Earth. To ensure this is the case, we need to be able to sustainably manage our land to ensure that we are not wasting our land space.



Steps to creating a sustainable food future

By 2050, the amount of food which farmers have to produce is expected to double, as our population hits 10 million. For this to occur, farming also has to double, meaning more and more land will be used for growing crops and farm animals. However, this may not be a sustainable solution. According to the U.N. Food and Agriculture Organization (FAO), “approximately \$1 trillion of food is lost or wasted every year”, which is approximately one-third of the world’s food. If this food was not wasted, this would provide enough food to feed 2 billion people, which is more than twice

the number of citizens around the world who are malnourished. Although not all of this food is lost during farming, this still accounts for a very large proportion of this total. To reduce the amount of land which farming could potentially take up, there are a variety of solutions which could potentially be put in place. Some of these solutions, which will be explored further throughout the book, include, Aquaponic Farming, and eating less meat. In Aquaponic Farming plants are grown in water instead of soil, resulting in denser plantings in which plants still gain the same amount of nutrients, water stress during hotter climates is reduced as the water is recycled, reduces soil diseases significantly and the final produce looks fresher and lasts longer.

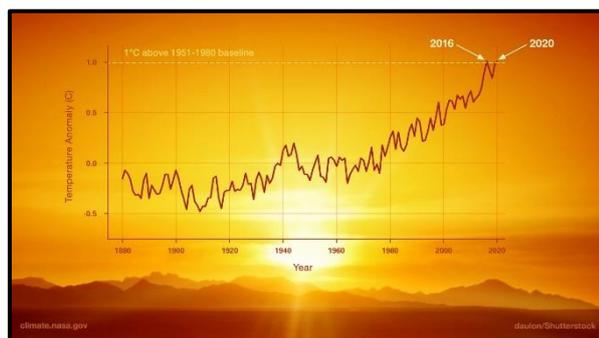


Aquaponic farming plant

Furthermore, due to our growing population, improving life expectancy and high fertility rates, it is expected that 2050 by our planet will not be able to sustain our civilisation if we continue this way. Karen Seto, a professor of geography and urbanisation at Yale University believes that the more urgent issue is “the large threat of the world’s rainforests all being taken over by cities,” due to “the indirect impact of urbanisation on those landscapes.” As cities require wood and many other natural resources for creating buildings and furniture, more agricultural land for farming, and waste disposal areas, creates an immense threat that the rainforests may be consumed for recreational our worlds growing needs. It is up to our generation to come up with, and implant many of the possible solutions regarding city and population management, while still keeping and forest areas to allow wildlife and other animals to survive and thrive. Some examples of potential solutions, which will be explored further throughout the book, include.

How will climate change impact life in 2050?

Climate change in 2050 is expected to peak, with the subtle changes we are now witnessing, such as hotter climate and more extreme weather will become more pronounced. Emile-Geay, a professor of Earth sciences currently at the USC Dornsife College of Letters, Arts and Sciences, believes that, due to data which he examined which portrayed the 20th century as Earth’s warmest period in nearly 2,000 years, we have



Graph depicting the rise in global warming

not yet reached the warmest peak. He believes that if we do not solve this climate crisis, sea level rise, droughts and extreme heat could render some areas of the

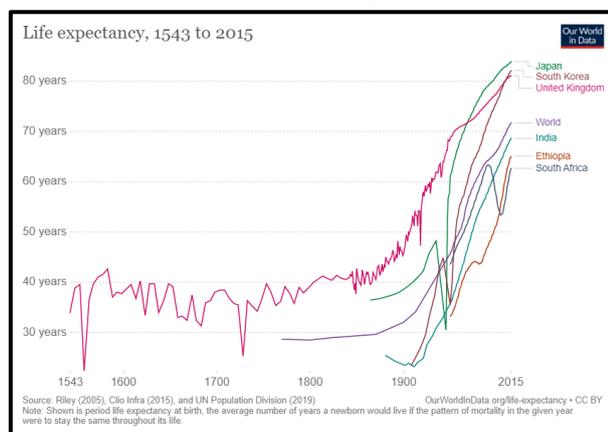


Poor air quality and pollution in India

planet unsafe for the general public and even uninhabitable. If this was to become the case, people leaving their community for a more liveable climate could lead to wasted land and overpopulation. Following this, by The World Bank predicts that by 2050, as many as 140 million people could be displaced due to the climate crisis.

Additionally, climate change could cause dangerous air quality. As the temperature increases, so does the bad quality ozone. This type of ozone forms at ground level due to pollutants from industrial sources, such as cars which react to the sunlight. According to Antonio Bento, a professor from the USC Centre for Sustainability Solutions. "Ozone is dependent on temperature, sunlight and heat waves, that means that higher heat brings on worse air quality." According to the National Climate Assessment, the effects from climate change could drastically increase the temperature and cause dangerous air quality in an area, which can cause asthma, lung damage and premature death as a result of bad air quality. However, dangerous air quality and increased temperature won't only affect the populations health, it can also jeopardise the ability to grow and produce crops and for adequate amounts of water to be farmed. As greatly fluctuating temperature or high temperatures can affect a plant's ability to grow and produce food, as many plants only grow at certain temperatures, which are not that high. Additionally, all plants require various amounts of water in order to grow, however if higher temperatures dry up the majority of clean, fresh water found in lakes and river, the main priority would be to get clean water to the citizens, leaving little to no water for the crops. Additionally, lack of water could a major water shortage which would jeopardise the lives of millions of people around the globe.

However, not everything is negative. There are many small changes which we could make which would positively impact our future regarding overpopulation, food and water scarcity. This book delves into some individual and societal solutions which could potentially save our civilisation in the future and lead us on the path to a more sustainable life.



Graph depicting the rise in life expectancy

Aquaponics

Food and Water Scarcity in 2050

By 2050, the amount of food which farmers have to produce is expected to double, as our population hits 10 billion. For this to occur, farming also has to double, meaning more and more land will be used for growing crops and farm animals. However, this may not be a sustainable solution. According to the U.N. Food and Agriculture Organization (FAO), “approximately \$1 trillion of food is lost or wasted every year”, which is approximately one-third of the world’s food. If this food was not wasted, this would provide enough food to feed 2 billion people, which is more than twice the number of citizens around the world who are malnourished. Although not all of this food is lost during farming, this still accounts for a very large proportion of this total.



Food Waste vs Food Loss Diagram

Water shortage is one of the most critical challenges our population may face in the near future, if we don't act quickly. As the climate changes, and floods and droughts become increasingly prevalent, which cause drastically decrease the amount of non-contaminated water. As previously stated, floods can cause many sources of water to become contaminated, which can deplete any existing water sources which are not properly packaged. Additionally, droughts throughout our planet can lead water shortages in an area which is primarily dependent on agriculture, this can not only risk the animal and crop health, the farmers and communities which rely on these crops would be put at risk. Not only does this severely effect the economy, by placing the livelihood of millions of citizens around the globe at risk, but loss of animals and crops can result in a worldwide famine.

To help reduce food and water scarcity and reduce the amount of land which farming could potentially take up, Aquaponic Farming is a potential solution.



Floods affecting agriculture farming



Droughts affecting agriculture farming

What is Aquaponic Farming?

Aquaponics is a combination of Hydroponics and Aquaculture, in which plants are grown in water which contain other living aquatic creatures instead of soil, resulting in denser plantings in which plants still gain the same amount of nutrients, water stress during hotter climates is reduced, the final produce looks fresher and lasts

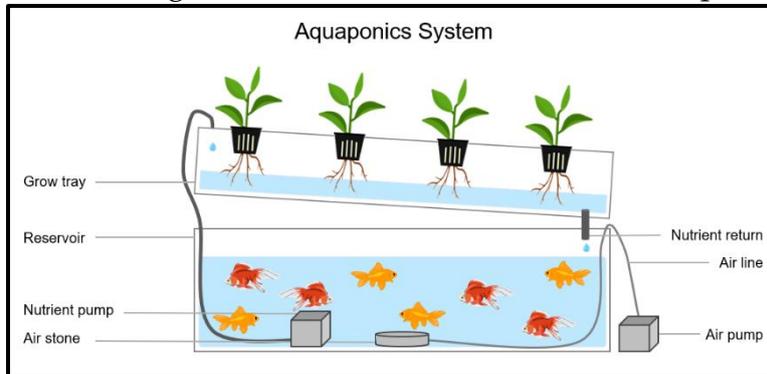


Diagram of the Aquaponics system

longer.

In Hydroponics, plants are grown in water without any aquatic creatures, and although this still is a viable solution, it does not aid our environment to the extent in which Aquaponics does.

In Aquaponic Farming the nutrients which the plants would normally receive from the soil, are controlled in the water, as plants are fed the waste from the aquatic animals which inhabit the tank. This makes it easier and quicker to deliver the nutrients to the plants, rather than having them scattered through the soil, where the plant needs to expend precious energy just to find food. By feeding the plants the aquatic animals waste, they are essentially cleaning the tank for the animals which live there. According to a study conducted by the Islamic Network on Water Resources Development and Management the special bacteria found in water ecosystems which is prevalent in Aquaponic farming, promotes faster growth in plants. As a result, plants grown using Aquaponic Farming grow faster and are therefore ready to harvest faster, meaning more plants can be grown in a shorter amount of time.

What are the benefits of Aquaponic Farming?

Aquatic Creatures

As the fish and other aquatic creatures will be creating this environment for the plants to grow and thrive, the fish too will also be able to be sold and even used as a potential substitute for catching fish from the sea. Although the types of fish may vary in each tank (as fish that live in warmer waters will not be able to live in colder water (which some plants prefer) there will still be



Fish living in aquaponics system

many fish which are edible which are able to be contained in such a tank. Additionally, the tanks which the fish will be kept in will not be small, as the plants need adequate room to grow and live. This could potentially encourage the use of larger tanks for fish, however could create a potential problem for the quality of life for the

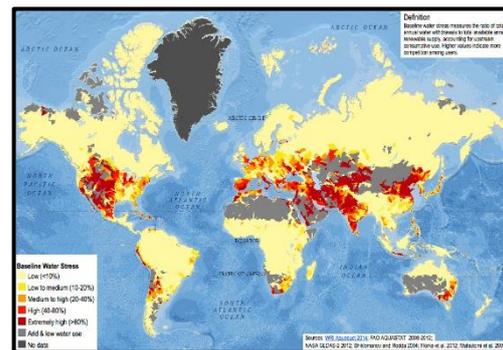
fish, as some owners could potentially start crowding the tanks with fish so they can create more waste for the plants to eat. However, if this does occur, it should not last long as too many fish can create too much waste and would actually reverse the effects of aquaponics. This would therefore not be a problem as if someone did try to increase the number of fish so that their quality of life was severely reduced then the plants would most likely die due to too much waste inside the water, meaning that this would not be attempted again.



Outdoor Aquaponics System

Water Scarcity Reduced

Additionally, this solution greatly reduced water scarcity issue, as it has been shown by a study conducted by the INWRDM (Islamic Network on Water Resources Development and Management) that aquaponic gardens use 1/10th of the water that is currently used for a garden of a similar size, since all water used is recycled. Furthermore, the water that is used is taken gradually over a long time, as once the initial water is placed into the tank, only small amounts of water need to be changed between the growing of new crops. This places significantly less stress on water than agricultural farming does, as x10 the amount of water is needed at specific periods in time between the growing of new crops.



Water scarcity and stress per region

Food and Land Benefits

The primary use of aquaponics is to provide an alternative to growing food in a non-efficient way, and so this solution provides an effective way to grow and produce food. By using aquaponics, the food which is produced is fresher and lasts longer, due to the larger quantities of healthy minerals produced by the fish. Additionally, as the plants are growing in water, the nutrients are evenly mixed throughout the water. Consequently, the plants do not need to expend their energy trying to find water and nutrients, and can focus on growing. Additionally, aquaponics allows you to grow more plants in a small space since plants do not need to compete with themselves and weeds for the nutrients and water, as is delivered straight to them in the water. This means that less land can be used to grow the same amount of food. Additionally, while using aquaponics to grow food, it can be grown above and below ground, increasing the amount of space which can be used. Furthermore, as

the plants are not grown in the ground, this reduces the risk of plants dying due to dehydration, soil diseases, erosion and many other factors which highly contribute to the death of 1/3 of our planets crops yearly.

What are the potential problems with Aquaponics?

One of the most common problems regarding Aquaponics is green algae growth within the fish tank. In order to remove the Algae, the whole tank needs to be emptied of water, and the plants removed. This not only disrupts the growth of the plants, but too much algae can cause the fish inside to die or develop diseases which



Algae growing inside tank

can then affect the plant. Additionally, green algae is one of the most rapid growing types of algae which have been discovered. However, small number of green algae have been shown to improve the health and provide nutrients for the fish. As this balance is extremely hard to keep, a solution has been developed by fish keepers. The Nerite Snail, a common freshwater snail found in water bodies all around the world, are keen algae consumers and (although they are not too fast) are able to keep a constant healthy balance of algae in tanks.



Nerite snails

Feasibility of Aquaponics

Although the beginning of implementing aquaponics requires more attention and work to set up the whole system of fish and plants inside a large tank, it is undeniably worth it. The first aspect to implementing aquaponics around the world is to encourage farmers to read up about and understand how Aquaponics works so they can independently understand the process. Once farmers and other civilians are able to understand not only the benefits of Aquaponics for our planet, but for each individual person (cost related) as they would be able to sell more plants, this should encourage them to try and implement this potential solution.

Pei Wei Lai, the designer of the Melbourne University Aquaponics building believes that “Aquaponics is a sustainable method of fish farming that reticulates water” while also allowing the farming of fresh fruits and vegetables. She has been working with her colleagues to try and develop an Aquaponics building as she believes that Aquaponics could be the farming of the future. Additionally, the building which her team is constructing is designed to promote sustainable technologies by exhibiting water recycling techniques and farming technology. One of the primary aims for this building is to raise awareness for Aquaponics, which will potentially serve as a viable solution for farming in the future.

Consumption

The demand for new cropland and animal pastures is responsible for 80% of current deforestation around the world, wiping out vast areas of rich biodiversity and trees that serve as natural sinks for greenhouse gases. However, according to the executive director of the California Academy of Sciences, Jonathan Foley, this is not the only way to do it. "The way we use land right now is extremely inefficient," he says. "So much of our land is being used to grow food for livestock - 75% of the world's agricultural land is used for feeding animals that we then eat ourselves. About 40% of the food grown in the world is also never eaten by anybody - it is thrown away. That means all that land it is grown on is being wasted." Some of this land is also degrading due to poor land management, deforestation, soil erosion, salinity, acidity and heavy metal contamination.



Degrading lands- images by Gary Naylor

So, a possible solution was recommended: eat less meat and throw less food away.

A study reported in the journal *Scientific Reports* stated that if everyone in the country reduced their consumption of meat by a quarter and substituted plant proteins, we'd save about 82 million metric tons of greenhouse gas emissions per year. Currently, "there is progress being made," says Foley. "China is already talking about reducing meat consumption and there are efforts to reduce food waste in Europe and US." Reducing consumption habits can result in less agricultural land being used.

Throwing out edible food wastes not only one person's meal, but also the money, resources, water, time, and physical effort that went into growing and producing it. By wasting less food for an individual, money is saved and carbon footprints



Food requires production animals to be fed

reduced. For society, methane emissions from landfills reduce, energy and resources are conserved and prevented pollution involved from growing, manufacturing, transporting, and selling then hauling the food waste into landfill.

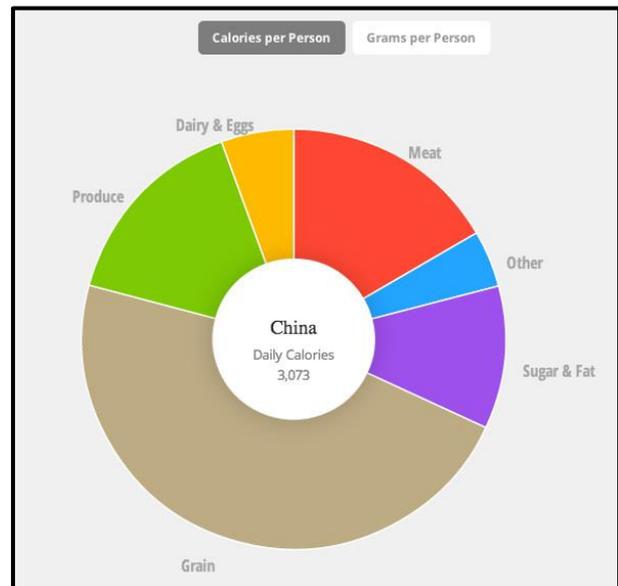
For a healthy lifestyle, planet and diet, less intake of meat is crucial. For individuals, a diet based heavily on meat increases the risk of obesity, cancer and heart disease while also impacting the planet. There is currently not a strong need to persuade everyone to become vegan or vegetarian. Even reducing meat intake, by one to two serves a week, has a protective effect,; weight loss and lower risk of heart disease. However, as the population rises, land inefficiency continues and meat intake rises, a stronger demand to become vegan and vegetarian will be forced upon humanity without much choice. For society, a reduction in consumption of meat is essential to avoid further negative environmental impacts. Reducing meat consumption will almost immediately create benefits through reduction of greenhouse gas emissions and decreased pressure on land and water use.



Meat and Dairy photo

However, there is a significant difficulty in achieving this, largely because it involves changing current human behaviour. Meat is an established part of people’s daily dietary intake and provides the main source of protein in diets. While there remains access to meat, people will continue to purchase and consume it. Large human behaviours would need to be altered if reduce meat consumption is to be successful.

To solve this, producers needs to reduce meat production and availability therefore effectivity forcing people to find alternative protein-based foods for their diets. The cost of the alternatives needs to be accessible to all income levels. The other way to change people’s behaviour towards meat is to offer a meat alternative that tastes good. While an increasing number of meat alternative products are appearing on supermarket shelves, the limited uptake can largely be contributed to bland, tastelessness.

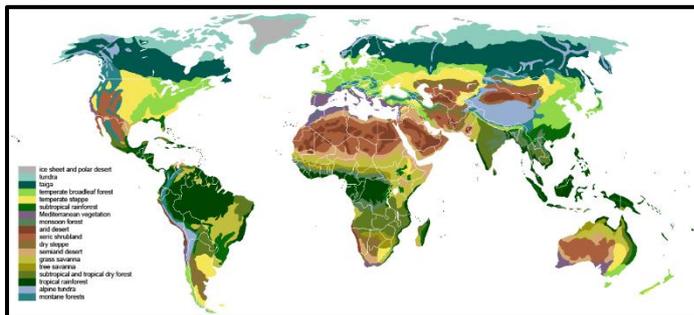


Pie Diagram that illustrates the percentage of meat consumed in regard to a person’s whole diet

Making space for the increasing population

According to the latest United Nations projections, by 2050, there will be 9.8 billion people jostling for space on Earth. Rising populations are putting increased pressure on the land, with 83 million more people arriving in the world each year. Each person will need a place to live, a place to work, and access to sufficient food options.

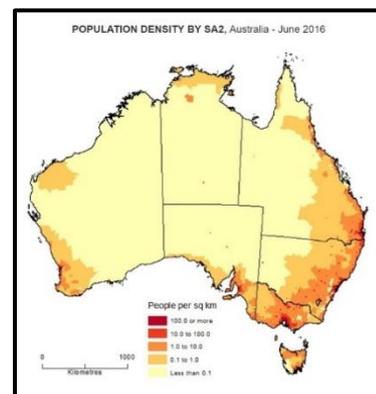
A study by researchers at Stanford University estimated that to feed the world growing population, between 2.7-4.9 million hectares of additional land will be required. Physically, Earth's land can easily accommodate 11 billion people as the



Land features in the world

Earth's total land surface area is approximately 57.5 million square miles, with about 33% of desert and 24% of mountain ranges. When the uninhabitable 57% of the land area is subtracted from the overall land area, only 15.77 billion acres of habitable land remain.

Large areas of land remain practically uninhabitable due to their conditions and remoteness such as the huge landmass at the centre of Australia which is too dry to support large numbers of humans, and as a result the majority of the population is clustered along the coast. This clustered population on habitable land then faces challenges like crowded cities and growing populations. These expanding cities are also taking crop land and by 2050 more than 50% of the population will live in cities. Urban areas cannot keep growing as they are trapped by the natural landscape that surrounds them, e.g. ocean or mountains.



Australia's population spread

Experts believe it's a mistake to concentrate only on population numbers and whether the world has enough room to accommodate everybody:

"It is not the number of people on the planet that is the issue – but the number of consumers and the scale and nature of their consumption," says David Satterthwaite, a senior at the International Institute for Environment and Development. He quotes Gandhi: "The world has enough for everyone's need, but not enough for everyone's greed."



Canada's farmland loss

"If you have that many people, there will obviously be a much greater demand for natural resources and food production," says John Wilmoth, director of the UN's Population Division. "But there has been a lot of misplaced attention that has tried to look at population control or limitation as a solution."

"The countries where populations are growing the most are actually using the least of the Earth's resources per person," warns Jonathan Foley, executive director of the California Academy of Sciences. "Those of us in the rich and developed world consume far more than our fair share."

Given the difficulties in reducing population numbers, any solution needs to look at how better to house, educate and provide for the growing population. Currently, in a city like Melbourne, urban planners are trying to increase housing density closer to the city centre. This means more apartment buildings and multi dwellings per block. This allows more people access to all the infrastructure such as shops, public transport, hospitals and schools. However, this means more crowded streets with fewer green spaces. In addition, the global covid-19 pandemic has demonstrated how difficult a viral outbreak is to contain in crowded city spaces, where social distancing became a key control measure. Rather than focusing everything on one major city, you spread your population density throughout different regional hubs with equal amounts of resources and access to key infrastructure in regional centres which would encourage people to live outside of the current major city centres.



More people using public transport access in the city

While listening to an online lecture by Dr Swati Nagpal, she helped to develop an awareness about the Sustainable Development Guidelines (SDGs). They are a collection of 17 global goals set by the United Nations General Assembly in 2015, which they hope will be achieved by 2030. Attainment of the goals by 2030 necessitates urgent, innovative and far-reaching action. As challenging as they may seem, they present a huge opportunity for humanity to rethink business, development and growth and send us all towards a sustainable and inclusive future.



World sustainable goals

These goals include things such as clean water and sanitation, no poverty, quality education, climate action, responsible consumption and production. We will be exploring some of these goals by illustrating some of the proposed solutions and our own recommended solutions based on scientific evidence and reasoning.

Seaweed and Carbon Reduction



Plans for Paris' urban forest

Long known to humankind as a solution to increasing carbon production is the plantation of trees in areas that do not infringe on land needed for crop growth. Trees and foliage have a large range of qualities that enable them to improve diminishing air quality and high pollution levels and cities around the world are beginning to catch on and implement tree-based solutions to the systemic problem of climate change.

An example of these progressive movements is a "green necklace" of trees and other plants that China's Hebei Province, home to the second largest city (by population size) in China – Beijing, has been working on in order to counteract the pollution stemming from mass factory production. Additionally, Paris has publicised plans to create an urban forest, encompassing some of the city's most famous architectural landmarks such as the Palais Garnier, the Gare de Lyon, Place de l'Hotel de Ville and along the banks of the river Seine. This scheme follows the strong stance on climate change action held by Mayor of Paris Anne Hidalgo who has also more recently initiated a progressive campaign to minimise the use of cars in France's capital. The forestation planting scheme undoubtedly comes as an aspect of the goal to become carbon neutral by 2050 which has also been adopted by many countries around the world. "I am convinced that Paris must adapt to changing temperatures," she told Le Parisien newspaper. "The Intergovernmental Panel on Climate Change forecasts heatwaves at 50 degrees Celsius by 2050. We have an obligation to act today."

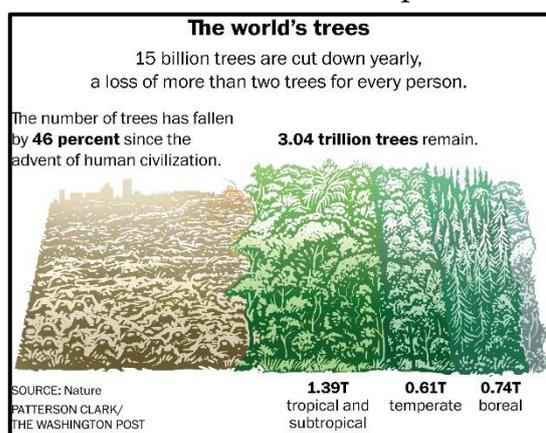


Diagram of how the world's trees are used

So how do trees actively reduce carbon in the atmosphere? Trees, and in fact all other plants too, use the energy generated by sunlight to undergo the process of photosynthesis in which they absorb carbon dioxide (CO₂) from the air and water from the ground and are able to convert it into glucose and oxygen (O₂). Theoretically, we shouldn't have to be reducing the carbon already in the atmosphere if humanity hadn't have produced it in the first place which does suggest that it would be to the most success if we were able to reduce carbon reduction at the root by ceasing or lessening wood, coal, natural gas, gasoline, and

oil fuelled production. However, if land area approximately the size of the United States was employed as forest plantations it would have the potential to cut the carbon in the atmosphere by 25%, erasing nearly 100 years worth of carbon emissions. So whilst not the most direct approach, planting trees is certainly a viable solution which is already being utilised as a tool to combat climate change. Long considered the most efficient natural tool humanity has in the battle against climate change, research has discovered an innovation which has proved more effective in removing carbon emissions from the atmosphere than the mass plantation of trees. An innovation which could alter the current path of humanity. Seaweed.



Family planting trees.

What is seaweed as a solution and what benefits does it entail?

Like any other plant, seaweed undergoes the biological process of photosynthesis and therefore absorbs carbon dioxide in the midst of producing oxygen. Given that approximately 71% of the Earth's surface area is comprised of water and 96.5% of all water on the planet is found in ocean form, the implementation of seaweed growth appears to be a feasible solution to combat climate change and the dangerous increase of carbon dioxide in the atmosphere. Some species of seaweed can absorb enormous amounts of carbon (CO₂). A seaweed farm or forest is very similar to an artificially planted forest in terms of intention except a seaweed farm/forest is obviously underwater which actually is a very beneficial factor because it means there is zero risk of fire. Seaweed also has the power to, at least to a certain extent, restore deteriorated marine ecosystems and produce marine protein – vital to almost all forms of marine life. It is also a particularly advantageous organic substance to be deployed in forms of biofuel. The reasoning behind this is related to the fact that seaweed is comprised of roughly 85 - 90% water making it a prime candidate for the



Underwater seaweed farm in Offing

production of biofuels such as bioethanol. Another one of the abundant benefits of seaweed is the ability seaweed has to absorb nutrients from the water and the ground other than carbon dioxide; phosphorous and nitrogen. Naturally it doesn't require freshwater or fertilisation because the necessary nutrients to support its growth and development are already

in the water and in addition to that it is easily one of the most efficient and productive species of plant, on land or under the water. Similarly to aquaponics farming systems, seaweed growth requires far less water than is needed for plants in soil as obviously the seawater is already in great abundance and growing seaweed requires no extra. Due to its fast growing nature - seaweed is able to grow up to 26 dry tonnes per hectare which is extraordinary in comparison to the relevant 5.1 tonnes corn and 2.3 tonnes of soya that is able to grow per hectare. The intention is similar to that of vertical farming - to preserve Earth's land so we are able to accommodate for the massively increasing population. In fact, there are methods of vertical farming implemented underwater with one of the most successful, useful and versatile species of seaweed; sugar kelp. GreenWave is a non for profit American organisation founded in 2013 with the aim of using aquaculture and ocean farming techniques to protect the planet against the harmful effects of climate change which has created a successful system of vertical ocean farming. There are clearly countless benefits of seaweed so why is it not a readily accessible solution yet? Why is there hesitance about implementing these underwater farming systems?

“When you look at how we are going to feed the world population by 2050 in a way that doesn't harm the environment, there is only one pathway,” says Carlos Duarte, a researcher and professor in biological oceanography and marine ecology. “To scale up seaweed farming.”



Seaweed farm off tropical coastline

Potential problems and possible solutions:

One of the problems that can possibly arise as a result of mass farming of seaweed in a particular area is that it can affect and alter the local ecosystem and how the food chain functions. Growing large amounts of seaweed in the sea can drain a lot of vital nutrients out of the water, leaving less and therefore altering the growth of other marine life higher or lower in the food chain within that local ecosystem. There are many potential solutions to stop this from becoming an issue but one of the most viable and valid is to create seawater tanks or artificially dug bodies of water very similar to the large aquaculture tanks and systems already in place, such as the fish farm below.

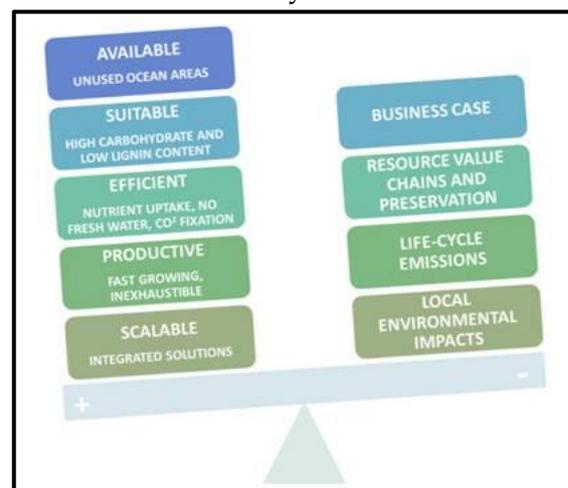
Another issue that could arise that would prevent the spread of seaweed farms is their geographical location requirements. In a fully underwater system a seaweed plantation would have to be just off the coast in order for it to be readily accessible



A fish farm in North Queensland, Australia.

and in an inland water tank or source like suggested it would still have to be situated very close to the coast in order for a zero emissions water transportation system to work (for example pipes). The main issue here is that land-locked inland countries, especially those experiencing drought, will struggle to implement this system without

a large area of coastline. This is a particularly hard issue to solve because it is an ethical dilemma of whether it is morally right to transport water across the country – emitting carbon. Maybe a solution is to consider a more global, holistic perspective where these seaweed farms can be implemented underwater around the coast of all the continents and islands where available. Possibly even in the ocean between two landmasses because electric boats can be utilised to travel out there to maintain the seaweed growth whilst emitting no carbon into the atmosphere like a regular boat does. Seaweed farms are very uncommon and so there are few examples on which to draw a idea of what both emissions and cost would be like exactly but the main factors that would contribute both to emissions and cost are the manufacturing of nets and the maintenance and harvesting processes both of which could be reduced through wider change. The last issue to mention is the business aspect of biofuels – since there is not a sufficient market for them, especially seaweed generated fuel, the industry is not currently developed enough to sustain a lot of action or encouragement. The solution to this is simple – more use.



Pros and cons of seaweed farms.

Seaweed as a solution to a variety of climate change-based issues is feasible because it is not a very expensive undertaking and can be implemented in the developing world as well with the help of foreign aid. Another aspect of its feasibility is the short timeline into which it can be adopted in the world and its simplicity can be understood by governments and societies alike all over the world. One of the last reasons for it's feasibility as a genuine solution is the availability of the space, as sea levels are unfortunately increasing as a result of climate change we may as well take advantage of the seawater in an effort to control the rate of climate change or ideally to solve it.

Butterfly Effect

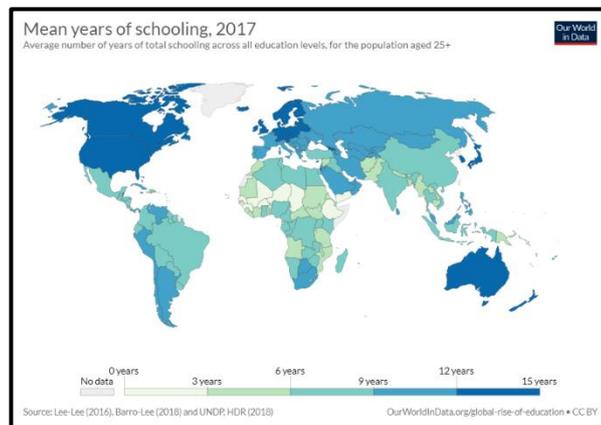
What is the butterfly effect?

The butterfly effect is the idea that one small change can make a much bigger chain reaction of things to happen, either for the better or the worse. The notion comes from the idea that a flutter of a butterfly's wings may ultimately cause a disaster such as a typhoon halfway across the world. A small change in the atmosphere can lead to mass destruction or positive change as well.

Education:

One in six adults on the planet cannot read or write. 115 million children between six and eleven—one in five—are not in school. Of those who go to school, one in four drops out before completing five years of basic education.

Education is key to building the sense of global citizenship to solve global problems, "Education is the most powerful weapon which you can use to change the world," Nelson Mandela said. It helps people become better citizens, get a better-paid job and live healthier and happier lives.



Graph of mean years of schooling in 2017

When access to education and learning grows, the ripple effects on communities and countries is remarkable. Education is one of the most simple but powerful solutions for reducing poverty and inequality, slowing the population growth and creating a more sustainable and environmentally friendly Earth. For example, studies conducted by Mr Lutz and his team stated that, on average, uneducated Malian women gave birth to almost 7 children. For the better-educated, the number was about four. "Education leads to lower birth rates and slows population growth," he says. "This makes it easier for countries to develop. A more-educated workforce also makes poverty eradication and economic growth easier to achieve."

Anand Kumar, founder of the Super 30 mathematics program once said that "Today, if I am here, only because of education.

Education has the power to usher in a silent revolution and bring about generational change. It is the best bet to beat poverty and help build an egalitarian society by giving the deserving their due and rewarding merit."



Woman who gave birth to 69 children

Q & A with Monika Doblin

Q. Can the issues of overpopulation, climate change and poverty be solved?

A. "It's a good question and one I can't answer because we're not at 2050 yet. You're right, there will have to be a coordination of activities, for one, both at a local level, and that's just in Melbourne, let alone state wide and countrywide. It's really complex to solve these issues and there're going to be different at the different scales. It's going to depend how quickly we can come together and mobilise our different resources. So don't forget, from a food perspective, it's not necessarily that we have to produce so much more, because we waste around 30% of what we purchase anyway.

We're going to use a variety of strategies to combat this issue of not having enough food. It's related to timing and to climate change overlay to that. We've had a very mild summer with perhaps less bushfires than in the previous year but because they're sporadic events - and who would have thought Covid would happen - farmers need to accommodate that and in every five years they have to figure we're going to have two lean years in that. They're going to have to adapt right through the entire scale of production, right through to supply chain and then to development of new strains. What would be useful in our context is going to be different to someone in sub-saharan Africa or the American Great Plains, so we're going to have to work at all those different levels to solve this problem. We might solve it in some places, but in others, it might be too difficult. "



Associate Professor of animal, plant and soil sciences

Q. What is your opinion on Aquaponics and other farming solutions?

A. "I think it depends, I mean, vertical farming is also a solution. Aeroponics, where you're also using very little water or hydroponics, so you're essentially growing plants in a water base, and washing nutrients through that. The substrate is water if you like, rather than soil. I think it would depend on the crop, so things like, for example lettuce, you know, would grow vertically. It's a big leaf, it doesn't take long to grow. Micro-herbs, they're little plants and they grow well and quickly under artificial light as well as sunlight. The benefit of indoor environments too is that you can keep pests away. If you're using really sterile conditions you can grow quite a lot of plant material without the issues of growing it outdoors."

Q. How do you feel about using seaweed as a solution?

A. "The underwater issues are, you still need to cast an eye over what's going on underground, so it's still a close to land solution, even if it is underwater. So I think

the benefits, perhaps would be, so, yes, you can capture carbon and I agree, my other twin sister who is a marine biologist, yes, there is a lot of carbon capture that possible in water, and let's face it, it covers most of the earth, it is a good solution. If what you want do is, look at a food solution, then things like an edible seaweed would be useful in a way, so you can capture the carbon and you can also use it as a food source. In a way, trying to make sure you utilise any material to its full extent, so you're not just producing the biomass and then you've got no purpose or use for it afterwards but you can use it for something else. You could mulch it up and that particular algae has some plant stimulants that could be put onto plants and used to boost production because they make cereals grow better or whatever. You're repurposing the carbon in a way that helps increase output. The other example is vegetables. You might eat a part of vegetable, say potatoes, you're eating the tubers but what happens to the green stuff, what are we doing with that? Rather than just composting, can we do something else to repurpose that biomass in a way that's useful that you can get some additional benefit from growing it. In a way, recycling biomass. Basically, use it for a dual purpose if you like. "

Analysis:

Dr Doblin has provided some very insightful opinions as to what the state of the planet will be in 2050 and the years beyond. About whether the issues of climate, change, overpopulation, water scarcity and food production and security can actually be resolved by 2050 and if so what is the best solution or combination of solutions and how we as a society can implement and adopt that. If not, what we can do to control the rapid rates of these issues worsening and how we on individual scale can adopt practices into our lives that will ultimately help preserve the planet for many more years to come. Climate change for example is a very complicated problem to solve because it would require coordination of solutions from multiple levels of authority (from individual lifestyle changes all the way to global governments and boards) on different scales. She reminded us that it does not stop at 2050, we must continue to work hard on combatting these issues every year after that. 2050 is simply a milestone, when a lot of country's aims have set to be achieved and in this current moment, a lot of these goals are looking unlikely due to the lack of effort and attention given to them. Although the main focus of her lecture (food) does not exactly align with our wider primary principle of global issues, there was still a lot of relevant information collected. As we do "waste around 30% of what we purchase" the issue doesn't lie in doubling the production of food, it lies in preserving the food we have access to and reducing wastage. She also posed some very interesting questions that left us to tweak and alter parts in our project mainly in regards to overpopulation, such as do we genuinely need to reinstate some form of the one child policy in China in order to keep the rapidly increasing population under control. She was able to provide examples that will enhance the credibility of our solutions such as algae concept where the leftover algae biomass is recycled and used as a fertilising tool for particular crops. One of her main messages in response to our second question appeared to be - employ the solutions with multiple benefits and those are the solutions that we have touched on thus far

Conclusion and Answer:

“With 2050 just a few decades away, major issues await the world. Science and technology need to start focusing on solutions to make the future better than the terrifying reality approaching.”- Christina Sterbenz, Erin Brodwin from the Business Insider

Our lives in 2050 will be undeniably different, leaving our society to adapt and needing to address the question: How will we combat the issues that are arising because of the population increase and climate change in 2050?

Some of the most predominant issues that humankind will have to face are the rapid rate of overpopulation, poverty gap and economic inequality as well as the devastating impacts of climate change and global warming.



Fires, droughts and cyclones are caused by climate change

Overpopulation is one of society's most pressing issues. The environmental issues of reduced access to freshwater, depletion of natural resources, increased emergence of new epidemics and pandemics, and decreased food availability are all exacerbated by human overpopulation. If the population continues to grow, the United Nations predicts the global population to rise to 9.7 billion by 2050, this will require global food production to double. Climate change places obvious stress on the environment, in 2050 it is expected to peak, with the subtle changes we are now witnessing, such as hotter climate and more extreme weather will become more pronounced. Poverty is becoming more prevalent and its implications are becoming increasingly drastic. The question is, will we be able to overcome poverty and therefore it's worsening causes such as climate change and overpopulation?

In the coming years, the global challenges we are facing currently will only be exacerbated and new problems will arise.



Overpopulation is becoming a pressing concern for our future

After weeks of research and consideration we have come to the conclusion that there is no one answer to our big question. There is no one way to address the issues of 2050. To combat these issues we will need a variety of diverse solutions. As discussed by Monika Doblin, it does not stop here, 2050 is only the beginning, more

problems will arise and need adequate solutions or adaptations relevant to these problems. We as humanity have an obligation to future generations to protect and preserve the planet.

Each country has its own unique conditions, whether it involves weather, economy, land usage or accessibility, meaning each nation needs to take an individual approach to address these issues in the context of their environment.

Some solutions may work globally such as aquaponics, especially within areas with little water or areas with bad soil as it is a system of plants grown in water instead of soil, resulting in denser plantings in which plants still gain the same amount of nutrients. Education is also a global solution as it creates a ripple of effects, reducing poverty and inequality, slowing the population growth and creating a more sustainable and environmentally friendly Earth. While other solutions such as reducing consumption and making space for the increasing population, may be more specific for a country such as Australia as we are high consumers and despite a large land mass, have high density city centres. Finally, a solution that can also be effective in the developing world is seaweed farming so they can use their land for crops and this method is not very expensive to undertake.

Looking forward to 2050, to combat the issues, multiple approaches are required from different countries but globally every nation must make changes or there will not be much to look forward to.



Aquaponics is being used to grow plants in Italy



Education is one of the most vital solution

Reflection - Anita

Although I found this unit very challenging, I thoroughly enjoyed this experience and if given the opportunity I would definitely do this exact unit again. During the beginning when we were first introduced into this unit, I was very apprehensive, and I knew that I would have to plan my time carefully as it was a lot of work which we had been introduced to. However, from the first moment I heard about it, I also knew that I would certainly enjoy this unit, as I am very passionate about science and I love learning about the future and discussing future possibilities. Although my predictions and thoughts before beginning of the unit were correct to an extent, I would never have imagined that I would enjoy this unit as much as I did.

The first time that I visited the La Trobe University Campus, I was ecstatic to listen to all of the lecturers, as I had conducted a variety of background research and I had already learnt a great variety of information and I was well prepared to learn more. After I had listened to all four of the lectures, I was already certain about what topic I would like to explore further. Monica Doblin's lecture on the food issues which would arise in the future really created a longstanding impression on me, as it was a real-life issue in which time was running out to solve, and I felt like we needed to explore this issue to learn if it would be possible to combat these issues. Although from past experiences and projects I knew what I believed to be a large amount of information about the solutions and problems for 2050, from the very beginning I had a key thought in my mind of what aspects of the future I wanted to explore and I was extremely surprised by my lack of knowledge.

The main factor that led me and my group into selection this question and our topic, aside from the fact that we all were exceptionally interested in 2050, was my desire to talk about and explore the solution of Aquaponics. I remember that in Primary school, our whole class had watched some films about 2050, and that Aquaponics was briefly mentioned. At the time, I found this concept of growing plants in water where fish lived fascinating, but I never expanded my knowledge. I saw this topic as a great chance to finally understand and explore this potential solution. Through this, our group developed our question, which would be able to explore Aquaponics as a potential solution.

Throughout the lessons, our group worked exceptionally well and stayed ahead of our timeline. We were able to form our group and complete all our questions and divide them out in the first lesson. From then on, we continued to work ahead and split up the work accordingly. I feel that everyone definitely pulled their weight in this group, however everyone worked at a different speed. Although towards the end we became a bit behind, as we wrote a lot of words and did not have much time, however we managed to get it all done on time, with not much stress or extra work.

Reflecting back on this whole unit, if I were to do it again, I would not actually change much, as I learnt a lot and was able to collaborate well with my group. I really enjoy group projects, and having a group who pulled their weight and were all interested in the same topic really made it more enjoyable. However, I might have written a little bit less, or worked on it a bit more, as the night before it was due, there was still a bit to do, and although we got it done with not much stress, it still could have been avoided. I definitely learnt a lot from this experience, not just about 2050 and the potential problems, but about group projects and time management. Although we only created a time plan half way through the assignment, I would have liked to make one at the start, just so we could make sure that we were on track for the whole group project, even though some parts were changed and other parts weren't. Other than that, I completely enjoyed this and I would not change anything else in the future and I can't wait to do the next Sol unit!

Reflection - Caitlin

My name is Caitlin and I am a year nine student from Ivanhoe Grammar School, University Campus. As part of our current TDU we have been studying "Science of Life". This is an inquiry based learning program where we have the ability to question the world around us and develop a stronger understanding of some of the key issues facing our planet. As this was our first inquiry rotation, before going into this unit I had unknown expectations regarding how to conduct inquiry based learning. The task was to work in groups of three to construct a big question related to a scientific dilemma. The aim was to research the issue and provide appropriate ideas that can solve the problem. The research was formatted into a book, which presents the findings and future ideas for the question. My group's big question concentrated on combating the issues of 2050. Hence, our big question, "How will we combat the issues that are arising because of the population increase and climate change in 2050?" We selected this question because as a part of the Science of Life unit we attended many lectures with La Trobe academics who specialised in global issues and we were most interested in the lectures on 2050. My classmates and I were fortunate to further interact with Dr Monika Doblin, who works under the department of Food Security. Her presentation, 'Food for Thought', led and inspired us to consider the further issues that may arise in 2050.

My fellow classmates, Rosa and Anita and I were able to collaborate really well throughout this unit as everyone completed their fair share of work and worked to agreed timelines to get our individual sections completed. We were also able to meet up on a Sunday and during lunch time at school to complete the shared sections of the task, such as introduction and formatting. I found it quite enjoyable to work with these students as they helped to expand my knowledge and views on our topic of 2050.

During the research stage, we were trusted and given the freedom to investigate our topics. I found news articles, videos and websites very useful to further expand my knowledge to find the best answer for our big question. One of my favourite discoveries from this unit has been the current solutions that countries are exploring to solve the problems of overpopulation, poverty and climate change and how these solutions differ based on developing and developed countries. Previously, I had no idea how drastic these problems were for life in 2050, and it shocked me how big an impact these could make on life in the future!

From this experience, I have learnt better ways to research information and how to use the information to come up with my own solutions and strategies, rather than just using the information from the internet. This will benefit my skills and increase my confidence to share opinions and ideas in other inquiry units.

If I was to complete this project again, I would like to speak to the lecturers further about their opinions on our proposed solutions to see if they are viable and relevant. Our detailed research on the topic enabled us to introduce ideas to solve the issues currently needing to be faced by 2050. I thoroughly enjoyed this learning experience and hope you enjoy our book that includes research, findings, and future ideas to this scientific inquiry.

Reflection – Rosa

The concept we explored was one I am genuinely fascinated by so I thoroughly enjoyed researching and completing majority of our project. Before partaking in this assessment, I was envisioning the final product to be a presentation at an exhibition in a similar format to Night of Notables. I was unaware that we would have to present our findings in a written format such as a website or book. I was also unaware of the great depth of thought this project required and how much we would end up writing. When I think about it now, its quite monumental. After listening to the five lectures from the Latrobe academics, I already knew what I was most interested in. Climate change action has always been a mad passion of mine and I've attended protest marches in the city and the like. All throughout primary school I have been fighting for further action on climate change and poverty and so I almost immediately knew along the lines of what I wanted to do. When we split off into groups I was able to form a group with Caitlin and Anita very quickly and we were able to get started with a big question formed almost instantly. Our rapid start in that lesson enabled us to stay ahead for the rest of the project. I believe my group and I worked very well together and we were able to adequately split up tasks and work individually when required but we were also able to collaborate on sections that utilised all our input. I would say I coped well but the night before it was due was a bit rushed because I still had to finish writing about my solution and I was meant to send it to Anita (she is the one with the Word Document) before 6pm. I unfortunately didn't manage to make that deadline and I started to get pretty stressed but I pulled through in the end and completed all the work I needed to do. One strategy we maximised the use of was creating a planning document, I am going to take this into all the other inquiry units because I believed it personally assisted my rate of work production so much. We broke down all our big sections into smaller parts and set goals of what night we were aiming to have that part done by. If I were to redo this project, the main piece of advice I would give myself is to not write so much. I felt that we wrote more than was necessary and that maybe inhibited our ability to create a clear, cohesive piece. I have learnt so much over the course of this unit and it is not just information you learn in school and forget. I have learnt about real world problems and real world applications of solutions, solutions that as weird as they may seem, can change the path of the future for generations to come.

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