Chapter IV
Anthropic Impacts and Biodiversity

How humans have drastically changed the balance of life on Earth

A living fossil: Gymnocrinus richeri
Introduction Chapter IV: Anthropic Impacts and Biodiversity

This chapter aims to focus on the pressures exerted on biodiversity as a direct impact of human influences.

Humans have a tremendous impact on other species on the planet should it be from direct impacts (e.g. Human food consumption) or indirect impacts as a result of our activities (e.g. mining, industrialization, pollutions...).

As the human population rapidly grows, the pressures imposed on natural ecosystems and species are enormous and resulting in numerous species extinctions. It is estimated that species are disappearing at least 1000 times the natural rate.

While some of the impacts are only felt locally where the disturbance occurs, a more concerning trend now becoming a reality is that, as a result of intense pollution worldwide, ecosystems are becoming saturated on a global scale which could well lead to massive extinctions in a near future.

Pollution of oceans is one example of such large scale disturbance. Plastic residues for instance are now found in almost any location on the planet even in the most remote areas. Such residues are incorporated into food chains and can even be monitored in species themselves.

The most significant impact that humans are causing to global biodiversity will be a consequence of global warming as a result of industrialization and the addition of greenhouse gases to the atmosphere from the burning of fossil fuels.

Under current climate negotiations the rise in temperature alone will with certainty cause a wave of massive biodiversity loss onto which pollution issues will add on.
IV.1 (a) Deforestation

Deforestation is one of the major threats to biodiversity.

Forests and especially rainforests of equatorial and subtropical regions hold some of the Earth’s richest ecosystems.

Deforestation has however been increasing significantly over the past decades to the point where it has now reached alarming rates and associated species loss.

The island of Borneo forests as well as the Amazon are losing tremendous superficies of forest each year due to logging activities mostly for the construction and paper industry. Significant deforestation has also been rising in recent years in relation to agriculture and the plantation of monocultures for biofuels.

Deforestation has devastating effects on the rich biodiversity that these ecosystems hold by destroying habitats of numerous species and destabilizing the food chains resulting in the collapse of the ecosystems.
IV.1 (b)
There are very few primary forests left in the world and most of them are critically endangered.

Most of these forests are only present in national parks and in areas where human development has not intensified.

Once destroyed, a forest is either lost or will take thousands of years to recover.

Forests are vanishing around the world at an alarming rate. Forests provide habitats for numerous species. As forests disappear so is the biodiversity that inhabits within.
Many still have the misconception that because land is covered by “green” vegetation such as common grass species, we are preserving biodiversity.

This concept is wrong, if one species disappears so are many other species which depend on it to survive.

=> Preserving a diversity of plant species is crucial for preserving biodiversity of other life forms.
IV.2 (a) Mining

Mining activities are rapidly expending around the world due to the rising demand in metals and other resources.

The sole activity of mining can have devastating effects on biodiversity, especially in isolated ecosystems and bio-diverse areas.

Examples of mining activities which are putting severe pressures on the biodiversity and ecosystems can be found in areas such as Indonesia, Madagascar or New Caledonia which are all classified as biodiversity hotspots.

Terrestrial biodiversity is most concentrated in the top upper layer of the soil. Mining activities which completely wipe out the top part of the soil destroys whichever life form and habitats are present. The soil once exposed is easily eroded and carried out to sea impacting reef formations and marine life as well.

Mining activities have devastating impacts on the environment and biodiversity in particular, especially in bio-diverse locations.
IV.2 (b)  
Mining is one of the most environmental destructive and unsustainable practices. Especially in biodiversity rich areas.

Many mines are located in biodiversity sensitive areas including biodiversity hotspots like Madagascar. These mines have devastating impacts resulting from the installation of the mine (from large scale deforestation to the operation and after life of the mine).

The impacts of these mines often extend much beyond the mining area as they require the cutting of roads, heavy machinery and reject numerous toxic compounds into the environment affecting the surrounding environment on a large scale.
Many nations depend almost entirely on resources from the oceans as a primary food supply.

Most of the oceans resources are however harvested extensively by only a few industrialized nations.

Fish stocks and other marine resources are harvested far beyond their regeneration ability.

At the current rate of fishing, most fish stocks will be extinct by mid-century.

Adoption of sustainable fishing practices respectful of species reproductive rate is crucial in order to avoid the collapse of most marine ecosystems.

Fish should be harvested from farming rather than the oceans. However the current aquaculture practices are far from sustainable.
IV.3 (b)  
Traditional fishing methods have been replaced by industrialized and more productive fishing practices.

The replacement of traditional local fishing with international industrial fishing has devastating effects on the world's marine species. At the current rate, it is estimated that most large commercial fish species will be extinct by 2040.
IV.3 (C)
As industrial fishing depletes the world’s ocean resources and marine biodiversity, it also creates social problems by depleting the stocks which are no longer available for local communities to feed on...
IV.3 (d) Case study: Sharks, a Critical Problem

As the top predator in the oceans, Sharks play a very important role in maintaining ecosystems stability.

Worldwide, populations of sharks are seriously pressured from anthropic activities.

Most species of sharks are now at serious risks of extinction as a result of overfishing.

The process of shark finning is having devastating impacts on shark populations but also on entire ecosystems.

Shark fins are mostly collected to be sold as shark fin soup which is considered a delicacy in Asian countries.

Sharks have a very slow reproductive rate and only have a few young's in their life time.

At the current rate sharks are collected, numerous species of sharks could become extinct within the next 10-20 years.

The disappearance or drastic diminution of sharks in the oceans will have devastating effects on the entire marine ecosystem.
IV.3 (e) Shark Finning

All Shark species must become protected or they will face extinction within a few decades only...

Shark finning is a threat to shark populations worldwide with serious implications for marine ecosystems stability.

Shark finning is a very unsustainable practice which should become banned or at least strictly regulated.
We do not know the full extent or consequences that a sharp diminution or even disappearance of sharks will have on marine ecosystems. We however know that they play a critical role.
IV.4 Illegal Trading of Species

Illegal trading of endangered species is a growing problem.

As species become more and more under threat and on the verge of extinction, the price of such species on the black market keeps on rising.

Illegal killing and selling of endangered species has a serious impact on the stability of these fragile populations which in many instances pushes these species to extinction.

Examples of species which are valued include tigers, parrots and fish mostly originating from tropical and subtropical regions.

while some endangered species are traded as living organisms others such as elephants are killed for the sole purpose of extracting parts of the animals (e.g. ivory, tiger powder).
IV.5 (a) Agriculture

Over the past century agriculture has increased dramatically in response to the exponentially growing human population and the need to feed them.

In addition to its fast expansion, agriculture has drifted away from traditional practices to highly industrialized and optimized processes.

In order to cope with such demand, agriculture has become increasingly dependent on fertilizers and pesticides.

The use of genetically engineered plantations is also a rising threat to biodiversity. Species genetically modified, when introduced into the environment, compete with natural species.

Agriculture by its nature is also a major threat to biodiversity by spreading monocultures.

In order to find the ever increasing space required for agriculture, tremendous spaces of land initially occupied by primary forests and other ecosystems are destroyed removing in the process the diversity of species which in many instances were only found in these specific locations.

A growing problem is also the rise of lands used for monoculture plantations destined for biofuel production. This new usage has for consequence to even put more pressure and increase the need for further agricultural lands.
IV.5 (b)
Agriculture is one of the main threats to biodiversity. Worldwide, entire ecosystems are wiped out (such as forests) and reconverted for agricultural purposes which has major implications for biodiversity and has resulted in the loss of numerous species. Today this trend is even pushed further with the need for biofuel crops.

In order to preserve biodiversity we must find and shift to new food production methods not requiring such extensive land use (e.g. vertical farms?)
IV.5 (c)
Pesticides used in agriculture can affect animal reproduction adding further pressures on biodiversity.

In addition to monocultures land conversion. A very significant amount of pesticides and fertilizers are added to industrial crops. These two elements kill numerous species resulting in significant biodiversity loss going much beyond the crop areas as the substances are transmitted through food chains.
IV.6 Bio-Engineering

Genetically modified organisms (GMO) are a threat to natural species in the environment.

The genes within GMO enter in competition with natural genes occurring in the environment.

We are uncertain of the impacts that such GMO will have on other species.

However, it has been proven that GMO lead to monocultures and mutations within natural species.

By introducing GMO into the environment we are risking the loss of naturally occurring species in favor of genetically modified ones.

=> GMO are a major threat to global biodiversity.
IV.7 Industrialisation and Associated Waste

Since the industrial revolution, the rise of industries of all forms and sectors have been taking place in most nations.

This rapid change of activities has driven the rise of very diverse environmental pressures including the generation of very large amounts of chemical wastes and other disturbances such as noise and atmospheric emissions.

Pollution generated by all nations has now far exceeded local impacts and effects on a global scale are starting to arise. For instance trace amounts of certain pollutants such as residues of hydrocarbons (e.g. plastic bags) can now be found in any given place on Earth.

Such background pollution is putting further pressure on ecosystems around the world which are struggling to adapt and cope with the change in surrounding environment. Usually under natural conditions such changes in the chemistry of the environment occurs over millions of years which permits adaptive changes, however species are unable to adopt to such a rapid change now occurring over several decades only.
IV.8 (a) Pollution and Biodiversity

Pollution is a human created vision of the state of our environment.

Without a human vision of the world in which we live, the concept of pollution would simply not exist.

Pollution can be seen as an unusual level of a substance which disturbs the surrounding environment and especially biodiversity.

Due to industrialization pollution has become one of the greatest threat to global biodiversity.

Many species cannot cope with the rapid changes in physical parameters which are occurring to our environment.

High levels of pollution results in toxicity. All substances are toxic it all depends on the level of occurrence and to which capacity organisms can tolerate the substance.

=> We are releasing substances in the environment to such a level that they are becoming toxic to many organisms.
IV.8 (b)  
While some substances require large amounts to be toxic to organisms, numerous human made substances have significant impacts on organisms even in very low concentrations.

While some substances only stay in the environment for short periods of times, others stay very long. These are the most concerning pollutants as they do not deteriorate and end up entering food chains.
Eutrophication (or algal bloom) is an increase in the concentration of nutrient content to an extent that it increases the primary productivity of the water body. In other terms, it is the "bloom" or great increase of phytoplankton in a water body.

Negative environmental effects include particularly anoxia, or loss of oxygen in the water with severe reductions in fish and other animal populations. Other species may experience an increase in population that negatively affects other species in the local ecosystem.

As pollution (Nitrates & Phosphates) from sources such as agriculture increases, more and more water bodies are experiencing eutrophication which is putting pressure on the biodiversity of these ecosystems.
IV.9 (a) Climate Change and Biodiversity

Since the industrial revolution, human activities have added tremendous amounts of greenhouse gases into the atmosphere. By doing so we are changing the composition of the atmosphere which results into the Earth becoming warmer through the action of the greenhouse effect being amplified in the process.

One of the consequences of global warming will be to affect biodiversity.

Numerous species of plants and animals are already responding to warmer temperatures by moving to higher altitudes or latitudes. Many species unable to adapt or migrate fast enough will however become at increased risk of extinction.

Scientists estimate that we could lose half of all species present on the planet today through the impacts of climate change alone by the end of the century.
IV.9 (b)
Climate Change and Biodiversity loss:

It is here important to highlight and emphasize on the link between climate change and biodiversity loss.

It has taken millions of years for species to adapt to their given ecosystems. During this time numerous changes in the climate system have occurred. However, climate change that we observe today is occurring very fast (as opposed to most geological climate shifts) and is the result of mainly anthropic activities (and therefore could be slowed down).

Most species on Earth happen to have adapted to be very sensitive to even slight variations in outside parameters such as air pressure, or ambient temperature. Most scientists have agreed that numerous species will simply not be able to cope with the rise in atmospheric and oceanic temperatures which are predicted under various scenarios (including the most optimistic ones).

To further confirm the above, numerous studies on fossils and geological observations have concluded that rapid climate shifts have always resulted in massive species extinction events.

If temperatures were to rise by 2 degrees centigrade by 2100 (as predicted under most scenarios) this alone will without doubt result in the loss of a very significant portion of all species present on the Earth today (most still unknown).

It makes little sense to act to preserve biodiversity in given ecosystems today but on the other hand to ignore the much greater threat that climate change will have on biodiversity and these ecosystems in the short to medium term.

Thus acting to limit the worse impacts of climate change by reducing GHG emissions will also help in preserving species on Earth.

=> Maintaining the Earth Climate and preserving biodiversity cannot go without one another.
IV.9 (c)
Most experts agree that coral reefs around the world will not be able to survive a 2 degree Celcius rise in atmospheric temperatures.

The impact of global warming on the oceans biodiversity will be disastrous. As sea level rises and oceans become more acidic due to the absorption of \( \text{CO}_2 \), biodiversity in shallow marine ecosystems will sharply decrease.
IV.9 (d)
Coastal ecosystems and their inhabiting biodiversity will be greatly affected as a result of global sea level rise.

As sea level rises, large coastal areas will become permanently flooded. In addition, the salty waters will infiltrate further and further inland. Many species of plants and animals will not be able to cope with this change in soil salinity. Sea level rise alone will result in species extinctions...
The thought of the scale of species extinctions through climate change alone is disturbing. If predictions by the scientific community are correct, almost half of all species present on Earth today will become extinct by 2100 as a sole consequence of increased global temperatures. We must however keep in mind that in addition, there are many other factors which will drive even further species extinctions such as global pollution, habitat destruction...
Climate Change is the most serious threat to global biodiversity loss.

Despite that deforestation and other threats have already alone very significant and disastrous consequences on biodiversity, climate change will continue to affect all the planet ecosystems at increasing pressures proportional to the rise in ambient temperatures.

At the current rate of warming, the loss of biodiversity as a result of climate change will be disastrous...
IV.10 (a) Human Disturbances / Population Growth

Human population is a major threat to biodiversity.

With a current population of near 7 billion people, humans are the main cause of environmental disturbance on the planet which includes major impacts on biodiversity.

A control over the growth of the world's population is inevitable if we want to preserve the diversity of species present on Earth today.
IV.10 (b) World Population Predictions

World population is expected to exceed 9 billion by 2050.

In order to feed a rapidly growing population, agricultural fields are expanding exponentially with major impacts on biodiversity.

In order to keep up with the demand more land needs to be cultivated, more pollution occurs. This results in more and more pressures put on ecosystems.

Humans and human related activities are already the greatest threat to biodiversity.
IV.10 (c)
The environment will always be there, preserving our environment is not about preserving the Earth but whether we and future generations want to live in an environment that has suffered the impacts of human activities...
IV.11 (a) Mass Tourisms

Despite that ecotourism can have beneficial impacts on biodiversity conservation, if not well managed the impacts of mass tourisms can be disastrous.

Examples of the impacts of the tourisms industry on biodiversity ranges from the impacts of constructing an hotel in a remote location to massive arrival of tourists from a cruise ship on a beach.

In a rapidly changing world where population movements are rapidly increasing, bio-diverse areas must increasingly be protected to preserve this biodiversity.

The best way to protect biodiversity rich areas is to limit the number of people at one time in these sites with access granted on a permit basis.
IV.11 (b)
Mass tourism can have high impacts on biodiversity. While a small group of people may cause little disturbance, a few hundred or thousands in one biodiverse sensitive place at the same time can be a major disturbance.
IV.12 (a) Forest Fires

Forest fires are a rising threat to biodiversity. Despite being a natural cycle in some ecosystems where wildlife has adapted to cope (e.g. Australian bush), in many areas fires are occurring in places where they are not meant to occur frequently (e.g. Amazon).

Every year large superflcies of native forests are completely destroyed by fires which are of natural or most often unnatural causes.

When forests are burnt, the diversity of species that they hold and cannot manage to escape fast enough also disappears.

Many unknown species become extinct in fire events every year. The vast majority are small animals and plants.
Forest fires are part of natural cycles. They have occurred for a very long time and are actually necessary in many cases to regulate population numbers and even for species to spread in certain cases (e.g. Australian bush).

However, the concerning trend is that most fires occurring today are of unnatural sources. These fires are propagated by humans for various reasons (clearing of forest for farm use, pest control,...). These fires are destroying forests around the world including biodiversity sensitive areas such as the amazon.
IV.13 (a) Fragmentation of Habitats

Ecosystems are very fragile in a sense that it does not take much for these systems to collapse.

Small variations in environmental parameters or even a fragmentation can trigger such disturbance.

Fragmentation of habitats is a threat to biodiversity. Such fragmentation usually occurs when continuous ecosystems are cut into various sections for instance by a road or a track.

Plants are especially vulnerable to fragmentation.
IV.13 (b)
Fragmentation of habitats is an important threat to Biodiversity.

With the industrial revolution and a growing population also came roads. Road infrastructures around the world have the effect of fragmenting habitats which isolates certain populations and makes them more vulnerable to extinction.
IV.14 (a) Genetic Resources

Access to genetic resources is a rising threat to biodiversity.

Many large corporations are in a constant search of rare active compounds within species in order to develop new medicines, perfumes or for other purposes.

Often the discovery of such compounds leads to an unsustainable harvesting of the resource.

An ongoing debate is with the ownership of genetic resources. Often these compounds are discovered because the plants and animals they are derived from have been used by local communities for centuries.
IV.14 (b)
As numbers of individuals within species decrease, so is the genetic pool. This makes species even more vulnerable to extinction.
IV.15 (a) Alien Species

The transfer of species between countries and regions is a major threat to biodiversity.

As the world nations became more and more connected through international and national import/export trades, species are now been transferred between locations at alarming rates.

These transfers result in some species ending up in places they are not meant to be (outside of their natural habitats).

As a result, more dominant species start competing for resources with endemic species often resulting in alien species taking over.

=> The spread of alien species results in the extinction of local species.
IV.15 (b)

In the 21st Century, transportation has taken such proportion that ecosystems that have long been isolated from one another are now vulnerable to cross contaminations.

Despite measures taken by custom authorities, species are increasingly being transferred as a result of rapidly expanding human transportation and goods (shipping and air transport).
Conclusion Chapter IV

As highlighted in this chapter, life on Earth is seriously endangered mostly as a result of the action of mankind.

Probably the greatest pressure of all relies in human over-population. As the world population keeps on increasing at exponential rates, the amount of pressures put on the worlds ecosystems are simply much beyond their capacity to recover.

Species on Earth are now struggling to survive through an unprecedented accumulation of pressures which most have been enumerated throughout this chapter.

While global pollution is becoming a major issue, it usually dilutes overtime into the environment and species may be able to recover, should we limit our emissions of pollutants.

However, the main global threat to biodiversity is climate change. The impacts have started to occur and will severely intensify throughout the century leading to the disappearance of an unprecedented amount of species in recent Earth history.

Unless significant progress in global negotiations to mitigate greenhouse gas emissions are made, the rise in global temperatures will indeed result by itself in a massive species extinction event.

Time for action on climate change to save the diversity of life on Earth is now and time is running out very fast for any measures taken to significantly prevent such species loss.