

## 30cm by 2050: is sea-level rise so bad?

Sea-level rise is a significant consequence that is occurring due to global warming (Bradford and Pappas, 2017). Global warming is the result of greenhouse gases, such as carbon dioxide (CO<sub>2</sub>) and methane, which are both released into the atmosphere after processes such as the burning of fossil fuels. These greenhouse gases keep the heat in our atmosphere which is essential for maintaining our climate. However, there is an excessive amount of greenhouse gases being released into our atmosphere as growth in the burning of fossil fuels continues, which then results in unwanted heat on our planet. Given that, our oceans absorb around 90% of this heat which in turn leads to the melting of ice sheets and glaciers. This rises the sea-level which can have devastating effects on the planet. It increases the probability of coastal erosion as well as damage to ecosystems and cities. Large amounts of birds and animals of various species are having to relocate from their normal breeding and feeding habitats on beaches and wetlands. Also, marine plants and other organisms are having their natural habitats altered dramatically, meaning that they need to adapt according to new conditions (Penman, 2018). Agricultural farms and practices that are within a close proximity to the ocean may find that their crops are dying from saltwater soil contamination, which may potentially impact the surrounding environment as well as the agricultural economy (Chen and Mueller, 2018). In the last 40 years, average sea-levels have risen by just over 23 centimeters and it is predicted that by the year 2100, they will have risen another 30-80 centimeters, along with the sea warming by 1.5 degrees Celsius (Nunez, 2019). The causes and effects of sea-level rising must be examined, and actions undertaken so that we can hopefully stage an effective intervention in the hope of controlling the already accelerating consequences of climate change before it becomes too late for the planet and ourselves.

One major consequence of sea-level rise is the rapid acceleration in coastal erosion. High energy waves, abrasion, corrosion and hydraulic action are all potential consequences of our sea-levels rising (BBC Bitesize, 2019). Over time these erosive processes are predicted to gradually wash away beaches, saltmarshes and wetlands as well as damage coral reefs. This projected erosion may dramatically alter the conditions and natural habitats for many marine and coastal organisms. Cities and communities that are low-lying and are close to the waterfront are particularly susceptible to flooding and erosion caused from rising

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sealevels. It is predicted that by the year 2050 over 500 cities around the world may become partially submerged up to half a metre (C40, 2012). This highly likely prospect of erosion could have devastating effects on infrastructure including flooding to underground foundations, short-circuiting electrical systems and an increase of damage to buildings and architecture. Sea-level rise is likely to lead to sewerage backup, as well as treatment facilities becoming susceptible to inundation and storm surge risks (Ware, 2016).

The Bruun rule was first published in 1962 for estimating the retreat or erosion of a shoreline in response to changing sea-levels. (coastadapt, 2017). It was the first official study to observe the close relationship between coastal recession and sea-level rise. The Bruun rule clearly shows why sea-level rise is not a direct consequence of inundation. It states that an approximate one centimetre rise in sea-levels will result in an approximate one metre of coastal recession. As our sea-levels continue to rise globally, it is to be expected that there will be a substantial impact to social, economic and environmental factors.

As sea-levels continue to rise, various coastal agricultural communities will continue to be flooded with saltwater from the oceans which overtime contributes to gradual contamination of the soil (Nunez, 2017). This increased amount of salt in the soil has a negative effect on the growth of organism and decreases the germination rate of plants. As plants use water to photosynthesize to enable them to grow, this flooding by seawater means that plants are simultaneously trying to grow while allocating large amounts of energy to try and eradicate water out of the salty soil. This additional energy burden often stunts plant growth and can even lead to the death of the plant (Shrivastava and Kumar, 2015). Studies have shown that if the salinity in the soil is high enough, the water in the roots will actually seep out into the soil causing the plant to dehydrate, and then eventually die (Provin and Pitt, 2018). Farmers in countries that have agricultural practices close to the ocean have already begun to adapt to this and change accordingly. For example, some farmers in Bangladesh have made the transition from growing rice on their properties to raising shrimp, as the saltwater provides the perfect environment for this form of farming (Chen and Mueller, 2018). Many plants that depend on groundwater compared to irrigation

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are predicted to struggle with growth, repair and reproduction processes in these new salty conditions. This is likely to pose threats to the environment, agriculture and infrastructure which in turn could potentially have a major impact on the farming economy (waterquality, 2019). Overall, the relationship between sea-level rising and saltwater soil contamination demonstrates many reasons that we should be concerned about how this is going to affect the farming and trading economy globally.

Many animals, birds and plants that currently live and thrive in coastal areas are, and will continue to be, severely threatened with inundation due to the rising sea-levels (Penman, 2018). Turtles and other marine animals that would typically use beaches for breeding and feeding purposes, may soon be unable to do so, as beaches are predicted to gradually wash away. Birds that nest on shorelines may have to migrate as the changing sea-levels are likely to wash away their natural habitats. However, it is not only animals and birds that are heavily impacted by sea-level rise. Many marine organisms are becoming increasingly threatened as well. As the ocean levels rise, the sunlight levels that are normally able to reach marine plants will decrease. Numerous plants depend on photosynthesis to survive and so without this essential sunlight for their growth, repair and reproduction, there is an extremely high possibility that they will perish (WWF, 2019). There are some species of phytoplankton that depend on sunlight to survive and so as sea-levels rise, these species will likely die. This is particularly concerning as phytoplankton forms the basis of most marine food chains and its loss will have significant repercussions up the food chain, otherwise known as trophic cascades. (WWF, 2019). Even though no marine organisms have currently become extinct solely due to sea-level rising, this does not mean that it will not happen in the near future. It is for this reason that we must find an effective solution that can help prevent all living organisms from damage, relocation or potential extinction.

Overall, there are many negative impacts and effects that are caused by sea-levels rising as a consequence of global warming, including rapid acceleration of coastal erosion and the increased probability of flooding to coastal communities. The destructive saltwater contamination in coastal agricultural practices that severely threatens the farming economy and loss of animal and bird habitats and breeding places, along with changing conditions in

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the ocean, can threaten extinction of a variety of marine organisms. The impacts of rising sea-levels clearly demonstrate reasoning as to why it is of significant global concern, including its effect on social, economic and environmental factors on a large scale. Countries around the world need to recognise sea-level rise, as well as other consequences of global warming and work together to find effective solutions that could potentially prevent the exacerbation of climate change from getting worse than it already is. If we are to have any hope in saving our planet, it is clear that there will need to be a major shift in attitude by many world leaders who do not prioritise climate change as a global issue requiring immediate action.

### **Acknowledgements:**

Mr Thomas Coad – Planning, Review and edit of draft.

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