



Highly Commended

**Science Writing**

**Year 9-10**

**Matilda Kemp**

**Faith Lutheran College**





## Are nature-based solutions the key to mitigating climate change?

### Introduction

Climate change is the defining issue of our time, and each step we take will define our future. Significant variations in global temperatures and associated weather patterns are warming and damaging Earth and its precious aspects as a result of human-induced emissions and we must begin to recognize and devise effective responses to these changes.

### Global warming

Energy from the sun known as short-wave radiation, is absorbed by clouds and the Earth's surface before being radiated back into space as long-wave radiation (heat). Earth's atmosphere consists mainly of nitrogen and oxygen gases, which allow radiation to enter and exit the atmosphere. Other natural gases, or greenhouse gases, such as carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and ozone (O<sub>3</sub>) all allow incoming short-wave radiation to enter the atmosphere. However, instead of allowing all out-going long-wave radiation to radiate back into space, the greenhouse gas molecules in the atmosphere absorb this long-wave radiation, preventing some from escaping Earth and instead re-emitting in all directions, including Earth's surface (MIT Climate, n.d.). This process is known as the greenhouse effect and is fundamental in keeping Earth habitable, without it, Earth's average temperature would be about -18C° rather than 15C° and would allow for little to no plant growth and animal survival (Greg R, 2011, p.289).

The problem we now face is that human civilization relies too heavily upon the burning of fossil fuels (coal, oil, and natural gas), which emits excess concentrations of carbon dioxide, the primary greenhouse gas into the atmosphere. These greater and unnatural greenhouse gas concentrations prevent less long-wave radiation from escaping Earth and in turn allow for the extra to be directed back to Earth's surface, thus creating increased global temperatures and correlated climate variations.

Scientists have illustrated a record of Earth's climate for the past hundreds of thousands of years, by analysing various indirect measurements from natural sources such as ice cores, rocks, tree rings, glacier lengths, pollen remains, and ocean sediments, as well as studying variations in Earth's orbit

around the sun. The record demonstrates the natural climate variations over a variety of time scales. Climate change prior to the beginning of the industrial times (in the 18<sup>th</sup> century) can be determined through natural influences, such as solar energy changes, volcanic eruptions, and natural shifts in greenhouse gas concentrations. However, natural influences alone cannot explain the recent and rapid climate changes (EPA, n.d.). Figure 1 demonstrates an approximate 0.8C° increase in global temperatures since 1880 up until 2020, with about 75% of that global temperature increase being since 1970.

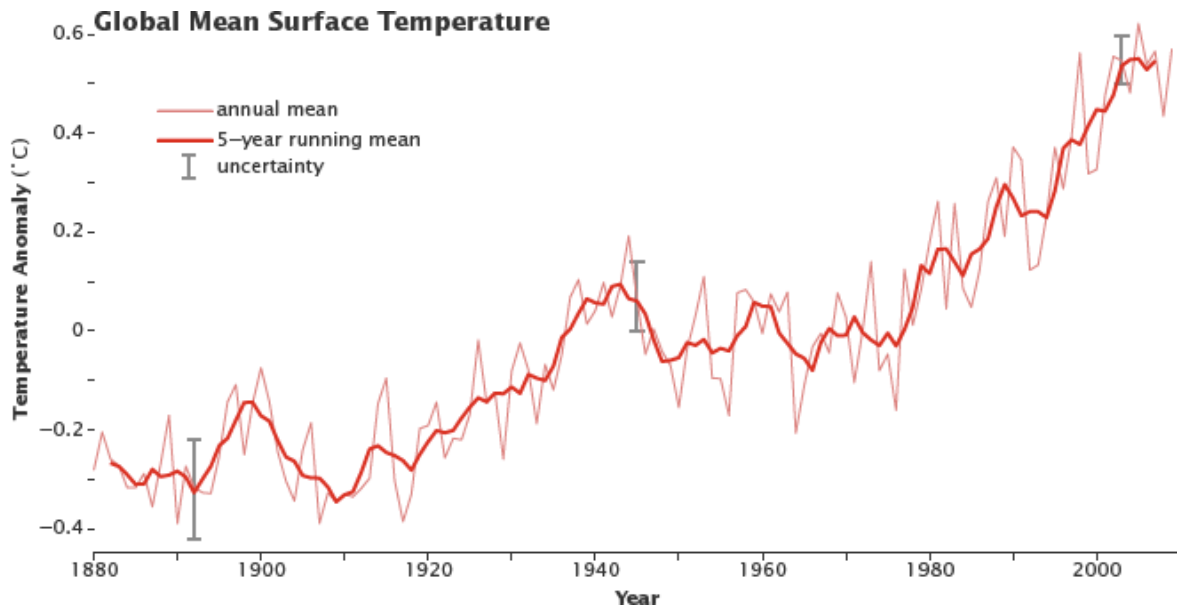
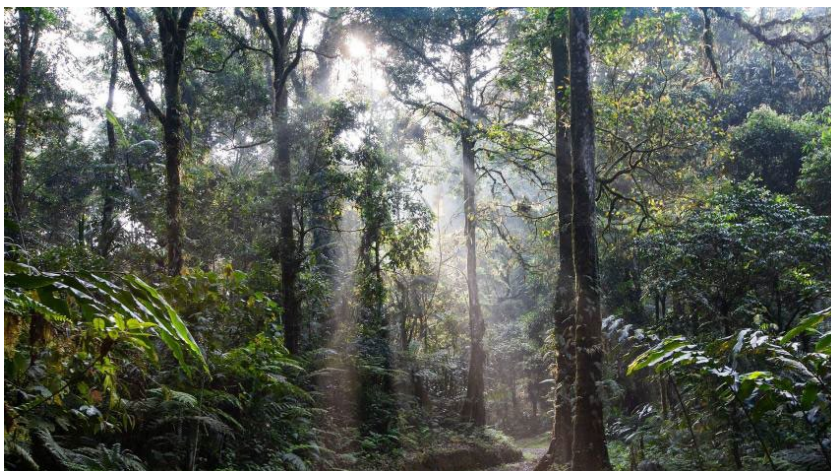


Figure 1. Source: <https://earthobservatory.nasa.gov/features/GlobalWarming>

### Potential for nature-based solutions

The natural world is considered as the centre of all life on Earth, it's what maintains the incredible wonders of which all life relies on for survival. Yet humans are rapidly damaging and destroying the physical environment through four main drivers; deforestation, contributed greenhouse gases, biodiversity destruction, and pollution. The natural world is in danger, how can we pave the way to recover our precious planet?



Rainforest view, 2019. Kanenori from Pixabay.

## Forest management and conservation

It is extensively recognized that in order to prevent catastrophic changes to the Earth's climate, the most immediate to do is to significantly reduce our global emissions by decarbonizing our energy sources. However, we must begin to introduce approaches to assist not only in reducing the already existing atmospheric emissions but also supporting and maintaining the valuable systems which we all rely on (WWF, n.d.). Forests supply invaluable environmental, social, and economic benefits for all of us, regulating ecosystems, protecting biodiversity, balancing the climate, and reducing soil erosion. Supporting the livelihoods of billions of people around the world. (UN environment programme, n.d.).

Nevertheless, human activities have immensely altered forests as well as the biodiversity and ecosystems within. Our rising population is the main driver of forest loss, requiring more land and resources, resorting to vegetation clearing, primarily forests. However, climate change has also altered the frequency and intensity of forest disturbances, including wildfires, storms, insect outbreaks, and the occurrence of invasive species (EPA, 2016). According to the UN, 88,000 sq. km of natural forest is lost globally each year. For comparison of this alarming amount, an area of forest the size of London is lost each week. Despite this, thousands of forests continue to lose their ecological value every minute, and Earth's natural balance has already begun to collapse (WWF, n.d.).



Forest restoration plays a critical role in how we rebuild Earth's natural balance. Generally, forest restoration can be initiated through three key approaches. Firstly, active restoration, in which areas of native trees and shrubs are planted where land is very degraded and/or obstacles are preventing the forest from recovering independently. Secondly, assisted natural restoration, encouraging, and allowing a former forest to regrow and sustain its ecological value. This could be done by removing invasive



The effects of deforestation, WWF.

vegetation or placing physical barriers such as fencing to reduce grazing pressures. Finally, spontaneous natural regeneration, allows trees and other native vegetation to grow naturally without human interference, including illegal tree logging (WWF, n.d.). If these key approaches within this restoration solution do prove successful against human-induced threats to forests, degradation of natural habitats should be reduced, loss of biodiversity should cease, and threatened native species should be protected from extinction.

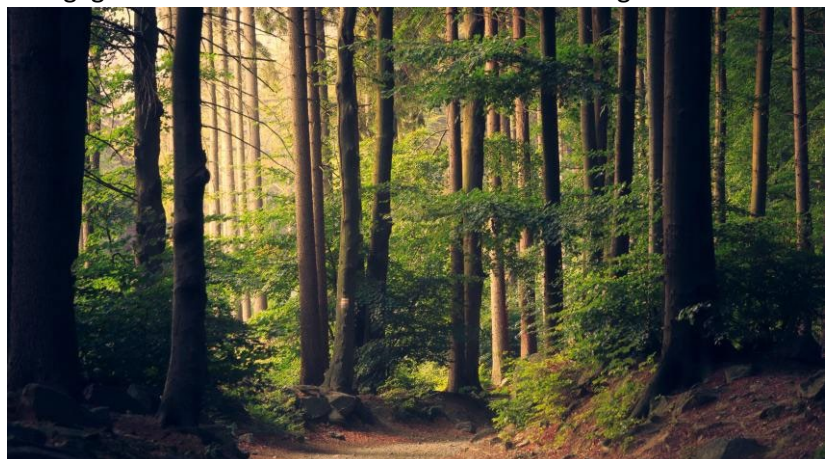
Despite growing political support for the use of this nature-based solution in mitigating climate change, numerous concerns about the effectiveness and sustainability of this solution have been raised. These include the unreliability of the extent of the contribution, especially given the challenges regarding financing and implementation. Doubts regarding whether the necessary safeguards will be put in place. And finally, worries about the use of offsets by the private sector (UN Environment programme, n.d., p.4). This has brought increasing awareness of the importance of evaluating management responses. Previous forest restoration approaches have relied too heavily on trial and error. There was often insufficient attention given to the evidence of the successful and unsuccessful past approaches. Such systemic evaluation of management was scarce relative to the work undertaken to protect forests. This has compelled the development of the criteria for evaluation (Kleeman, G, 2015, p.72).

Criterion for Evaluation of Environmental Managing Practices:

**Environmental criteria:** This criterion is used to determine the extent to which a policy or response meets its intended objectives. Effective forest management will ensure that the numerous interrelationships between terrestrial species are maintained and that intricate food chains will continue to enable the energy flow and nutrient cycling that sustain forests and their valuable systems.

**Economic criteria:** Researching, planning, and implementing management responses requires funding which is often difficult to access as environmental programs are often cut to reduce government spending. In some cases, poor financial decisions and planning are conducted, and wastage and additional costs are created as a result. Due to the expense of this management response, developing countries are often unable to participate in environmental programs, with little access to the funds required to respond to environmental changes.

**Social criteria:** It's important to recognize the importance of community involvement in forest restoration. Local communities and indigenous peoples often have valuable knowledge and understanding of the land, including the native species. Their participation in restoration efforts is essential for the success of these efforts. Engagement with local communities and involving them in planning and managing has helped build support for restoration efforts and ensure that they are sustainable.



## Conclusion

The unsustainable practices of humans, both in regard to both global warming and deforestation, have inflicted severe and somewhat permanent modifications to our planet. Climate-warming gases are being produced to a significant and unnatural extent, fragile biodiversity is suffering at the hands of deforestation, and life on Earth is depending on how we manage these changes to our climate.

Nature-based solutions are vital in mitigating climate change, whilst also simultaneously providing adaption and other benefits. Managing and conserving forests in a responsible and ethical manner will re-establish habitats, produce goods and services required for sustainable development, and support and increase green jobs whilst increasing food security and improving human well-being (Wilkie. M, 2021).

However, whilst the management of forests may be a sustainable and ethical component to strengthen both ecosystems and communities' resilience to climate change, it must not be individually relied upon to significantly mitigate the severity of climate change. Once combined with rapid subsidence of fossil fuels and other industrial fumes, mitigation in Earth's climate will finally begin. If nature-based solutions are to deliver contributions to mitigation, then the necessary safeguards identified must be implemented, this includes the environmental management criterion above.

Now is our opportunity to deploy equitable and resilient nature-based solutions. With proper strategic planning, evidence-based action, and engagement of local communities, these solutions can better manage our forestry systems, all while addressing the urgent challenges of climate change and biodiversity loss.

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