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Restoring Landscapes and Ecosystems for Climate Mitigation

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Restoring Landscapes and Ecosystems for Climate Mitigation

By: Kariuki Muigua*

Abstract

Climate change is the main global challenge that is affecting both developed and developing countries in their efforts towards realization of the Sustainable Development agenda. Responding to climate change has risen to the top of the policy agenda, at local, national, regional and global levels. Countries are responding to climate change through mitigation and adaptation strategies. Restoring landscapes and ecosystems has emerged as one of the nature based solutions towards climate change. This paper critically interrogates the idea of restoring landscapes and ecosystems. It argues that this concept is vital in climate change mitigation. The paper explores the opportunities and progress made towards restoring landscapes and ecosystems for climate action. It also highlights some of the setbacks facing the utilization of this concept in climate mitigation. In addition, the paper proposes measures towards embracing the idea of restoring landscapes and ecosystems for climate action.

1.0 Introduction

Climate change continues to be one of the most defining challenges presently facing the planet¹. It has been described as a global emergency that goes beyond national borders². According to the United Nations, climate change is an issue that requires international cooperation and coordinated solutions at all levels³. The impacts of climate change such as intense droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar

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Arbitration (PCA) [February, 2024].

¹ The World Bank., 'Climate Change.' Available at <https://www.worldbank.org/en/topic/climatechange> (Accessed on 06/02/2024)

² United Nations., 'Climate Action.' Available at <https://www.un.org/en/climatechange> (Accessed on 06/02/2024)

³ Ibid

ice, catastrophic storms and declining biodiversity are being witnessed across the world⁴. Climate change is therefore the main global challenge that is affecting both developed and developing countries in their efforts towards realization of the Sustainable Development agenda⁵. Due to its adverse impacts, climate change has risen to the top of the policy agenda, at local, national, regional and global levels with efforts being undertaken to respond to its impacts⁶.

The *United Nations Framework Convention on Climate Change*⁷ acknowledges the vulnerability of all countries to the effects of climate change and calls for special efforts to ease the consequences, especially in developing countries which lack the resources to do so on their own. In addition, the *Paris Agreement*⁸ seeks to strengthen the global response to the threat of climate change, in the context of Sustainable Development and efforts to eradicate poverty through holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels⁹; increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production¹⁰; and making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development¹¹. Further, the United

⁴ United Nations., 'What is Climate Change?' Available at <https://www.un.org/en/climatechange/what-is-climate-change> (Accessed on 06/02/2024)

⁵ Muigua. K., 'Achieving Sustainable Development, Peace and Environmental Security.' Glenwood Publishers Limited, 2021

⁶ United Nations Department of Economic and Social Affairs., 'Forum on Climate Change and Science and Technology Innovation.' Available at <https://www.un.org/en/desa/forum-climate-changeandscience-and-technology-innovation> (Accessed on 06/02/2024)

⁷ United Nations Framework Convention on Climate Change., United Nations, 1992., Available at <https://unfccc.int/resource/docs/convkp/conveng.pdf> (Accessed on 06/02/2024)

⁸ United Nations Climate Change., 'The Paris Agreement.' Available at <https://unfccc.int/process-andmeetings/the-paris-agreement> (Accessed on 06/02/2024)

⁹ Ibid, Article 2

¹⁰ Ibid

¹¹ Ibid

Nations 2030 Agenda for Sustainable Development¹² acknowledges that climate change is one of the greatest challenges of our time and its adverse impacts undermine the ability of all countries to achieve Sustainable Development. Sustainable Development Goal 13 calls upon countries to take urgent actions towards combating climate change and its impacts¹³.

Climate change mitigation and adaptation have emerged as key tools in enhancing global, national and local responses to climate change¹⁴. Mitigation involves reducing greenhouse gas emissions and stopping the problem of climate change from growing¹⁵. Adaptation on the other hand involves learning how to live with the existing threat of climate change and protecting humanity from the future effects of climate change¹⁶. Restoring landscapes and ecosystems has emerged as one of the nature based solutions towards climate change¹⁷.

This paper critically interrogates the idea of restoring landscapes and ecosystems. It argues that this concept is vital in climate change mitigation. The paper explores the opportunities and progress made towards restoring landscapes and ecosystems for climate action. It also highlights some of the setbacks facing the utilization of this concept in climate mitigation. In addition, the paper proposes measures towards embracing the idea of restoring landscapes and ecosystems for climate action.

¹² United Nations General Assembly., 'Transforming Our World: the 2030 Agenda for Sustainable Development.' 21 October 2015, A/RES/70/1., Available at <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf> (Accessed on 06/02/2024)

¹³ Ibid

¹⁴ World Vision., 'How is the World Responding to Climate Change?' Available at https://www.worldvision.com.au/docs/default-source/school-resources/how-is-the-world-responding-to-climate-change.pdf?sfvrsn=32021b89_0 (Accessed on 06/02/2024)

¹⁵ Ibid

¹⁶ Ibid

¹⁷ Cook-Patton. S et al., 'Protect, Manage and then Restore Lands for Climate Mitigation.' Available at <https://www.nature.com/articles/s41558-021-01198-0> (Accessed on 06/02/2024)

2.0 Conceptualizing Landscapes and Ecosystems Restoration

A landscape is defined as a socio-ecological system that consists of multiple natural and/or human-modified ecosystems, including agricultural lands, native vegetation, and human dwellings¹⁸. An ecosystem on the other hand is defined as a community of organisms and their physical environment interacting as an ecological unit¹⁹. According to the *Convention on Biological Diversity*²⁰, an ecosystem means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit²¹. Restoring landscapes and ecosystems is one of the nature-based solutions to climate change that utilise natural assets and biodiversity to mitigate, adapt to, and build resilience in the face of climate change²².

Nature-based Solutions refers to actions to protect, sustainably manage and restore natural or modified ecosystems, which address societal challenges such as climate change, food and water security and natural disasters effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits²³. They adopt the use of ecosystems and their services towards addressing societal challenges such as climate change, loss of biodiversity, food and water insecurity, and natural disasters among others²⁴. Nature based solutions embrace eco-friendly approaches towards mitigating global social, environmental and economic problems²⁵. They are intended to

¹⁸ Ifaw., 'What is Landscape Restoration?' Available at <https://www.ifaw.org/initiative/climate-change/what-is-landscape-restoration#:~:text=Landscape%20restoration%20is%20one%20of,landscape%20using%20naturally%20regenerative%20techniques> (Accessed on 06/02/2024)

¹⁹ United Nations Environment Programme., 'Ecosystem.' Available at <https://leap.unep.org/en/knowledge/glossary/ecosystem> (Accessed on 06/02/2024)

²⁰ United Nations., 'Convention on Biological Diversity.' Available at <https://www.cbd.int/doc/legal/cbd-en.pdf> (Accessed on 06/02/2024)

²¹ Ibid, S 2

²² Ifaw., 'What is Landscape Restoration?' Op Cit

²³ International Union for Conservation of Nature, 'Nature-Based Solutions' available at <https://www.iucn.org/our-work/nature-based-solutions> (Accessed on 06/02/2024)

²⁴ Cohen-Shacham et al., 'Nature-Based Solutions to address Global Societal Challenges' Available at <https://portals.iucn.org/library/node/46191> (Accessed on 06/02/2024)

²⁵ Muigua. K., 'Embracing Nature Based Solutions for Sustainable Development in Kenya.' Available at <https://kmco.co.ke/wp-content/uploads/2022/09/Embracing-Nature-Based-Solutions-for-Sustainable-Development-in-Kenya.pdf> (Accessed on 06/02/2024)

support the attainment of the development goals of a society while safeguarding human well-being through measures that reflect societal and cultural values and promote resilience of ecosystems²⁶. Landscapes and ecosystems restoration is a nature based approach that aims to restore the ecological characteristics and functions of a landscape or ecosystem using naturally regenerative techniques²⁷.

Restoring landscapes and ecosystems can be described as the process of improvement of degraded land and ecosystems on a large scale that rebuilds ecological integrity and enhances people's lives²⁸. It aims to recover the ecological functionality and enhance human well-being in deforested and degraded landscapes and ecosystems²⁹. Restoring landscapes and ecosystems has been hailed as an important approach that not only returns landscapes and ecosystems to a healthy state, but also increases the amount of carbon sequestered, improves biodiversity and the quality of soil and water in the ecosystem, and provides economic benefits for communities that depend on such landscapes and ecosystems³⁰. It has been posited that activities geared towards restoring landscapes and ecosystems should improve degraded environments by: rebuilding ecological integrity through reducing or reversing the degradation pressure³¹; reintroducing missing or declining biodiversity³²; connecting disconnected landscape elements³³; and stimulating development of a self-sustaining system³⁴. In addition, it has been pointed out that these activities should enhance people's lives by: creating related

²⁶ Cohen-Shacham et al., 'Nature-Based Solutions to address Global Societal Challenges' Op Cit

²⁷ Ifaw., 'What is Landscape Restoration?' Op Cit

²⁸ Food and Agriculture Organization., 'The Key Role of Forest and Landscape Restoration in Climate Action.' Available at <https://www.fao.org/documents/card/en/c/cc2510en> (Accessed on 06/02/2024)

²⁹ Ibid

³⁰ World Economic Forum., 'What are Natural Climate Solutions?' Available at <https://www.weforum.org/agenda/2021/09/what-are-natural-climate-solutions-ncs-alliance/#:~:text=NCS%20are%20actions%20that%20avoid,forest%20conservation%2C%20restoration%20and%20management> (Accessed on 06/02/2024)

³¹ Whitbread-Abrutat. P., 'Exploring World Class Landscape Restoration.' Available at <https://futureterains.org/wp-content/uploads/2017/11/WCMT-report-full-images.pdf> (Accessed on 06/02/2024)

³² Ibid

³³ Ibid

³⁴ Ibid

employment opportunities relevant to the restored landscape in question; building local capacity; improving local quality of life; incorporating local aspirations into a landscape vision; and continuing the human narrative of the landscape by engendering a sense of place and reaffirming cultural identity³⁵.

Approaches adopted towards restoring landscapes and ecosystems include agroforestry which involves mixing trees and shrubs with agricultural crops to improve the productivity and ecological function of agricultural land³⁶; assisted natural regeneration which is a process which helps trees and native vegetation naturally recover by eliminating barriers and threats to their growth, leaning on local knowledge of the land³⁷; mangrove restoration which entails regrowing mangroves in coastal ecosystems to protect communities, safeguard biodiversity, and store carbon³⁸; reforestation which involves planting and maintaining trees across a deforested landscape with little or no remaining forest cover³⁹; riparian restoration that entails reestablishing vegetation along a river, lake, wetland, or other water body to improve its ecological function⁴⁰; and silvopasture which is a process of adding trees to deforested pasture to improve the productivity and health of land managed by pastoralist communities⁴¹. It has been pointed out that restoring landscapes and ecosystems is a process that entails more than just planting trees – it is restoring a whole landscape to meet present and future needs and to offer multiple benefits and land uses over time⁴².

³⁵ Ibid

³⁶ African Forest Landscape Restoration Initiative., 'Restore 100 million Hectares of Land in Africa by 2030.' Available at <https://afr100.org/about> (Accessed on 06/02/2024)

³⁷ Ibid

³⁸ Ibid

³⁹ Ibid

⁴⁰ Ibid

⁴¹ Ibid

⁴² International Union for Conservation of Nature., 'Forest Landscape Restoration.' Available at [https://www.iucn.org/our-work/topic/forests/forest-landscape-restoration#:~:text=Forest%20landscape%20restoration%20\(FLR\)%20is,deforested%20or%20degraded%20oforest%20landscapes](https://www.iucn.org/our-work/topic/forests/forest-landscape-restoration#:~:text=Forest%20landscape%20restoration%20(FLR)%20is,deforested%20or%20degraded%20oforest%20landscapes) (Accessed on 06/02/2024)

3.0 Restoring Landscapes and Ecosystems for Climate Action: Promises and Pitfalls

Nature plays an important role in climate action. For example, it has been pointed out that terrestrial and marine ecosystems play an important role in regulating climate since they absorb roughly half of man-made carbon emissions⁴³. In addition, biodiversity and ecosystem services help human beings to adapt to and mitigate climate change⁴⁴. Therefore, by conserving nature and restoring ecosystems, it is possible to reduce vulnerability and increase resilience to climate change⁴⁵. Nature conservation and restoration has been identified as a major, cost-efficient approach in the fight against climate change⁴⁶. It has been observed that forest, landscape and ecosystem restoration practices have significant benefits for addressing the impacts of climate change⁴⁷. These include carbon sequestration and reduction of greenhouse gas (GHG) emissions, improving the resilience of landscapes and reducing disaster risks⁴⁸. Restoring landscapes, ecosystems and forests brings barren and degraded areas back to life⁴⁹. It has been pointed out that this restores biodiversity and revitalizes local communities while also contributing to climate change mitigation⁵⁰. For example, it has correctly been asserted that landscape restoration projects that regenerate forests create another ‘carbon sink’ that contributes to climate change mitigation⁵¹. It has been argued that restoration of forests represents the single largest natural climate solution⁵². Restoring forests not only returns forests to a healthy state, but also increases the amount of carbon sequestered therefore contributing to climate mitigation, improves biodiversity and the quality of soil

⁴³ European Commission., ‘Nature’s Role in Climate Change.’ Available at https://climate.ec.europa.eu/system/files/2016-11/nature_and_climate_change_en.pdf (Accessed on 06/02/2024)

⁴⁴ Ibid

⁴⁵ Ibid

⁴⁶ Ibid

⁴⁷ Food and Agriculture Organization., ‘The Key Role of Forest and Landscape Restoration in Climate Action.’ Op Cit

⁴⁸ Ibid

⁴⁹ International Union for Conservation of Nature., ‘Forest Landscape Restoration.’ Op Cit

⁵⁰ Ibid

⁵¹ Ibid

⁵² Cook-Patton. S et al., ‘Protect, Manage and then Restore Lands for Climate Mitigation.’ Op Cit

and water in the ecosystem, and provides economic benefits for communities that depend on that forest⁵³.

Restoring landscapes and ecosystems is therefore important in climate action. It provides two key management approaches to mitigate the effects of climate change⁵⁴. It helps in sequestering carbon through the establishment of green biomass, and the conservation and restoration of biodiversity and ecosystem services. It has been argued that restoration as a means for climate mitigation has global benefits, whereas restoration as a means of adapting to climate change has benefits at the local and regional scales⁵⁵.

The importance of restoring landscapes and ecosystems for climate action is acknowledged by the 2030 Agenda for Sustainable Development⁵⁶. The Agenda identifies natural resource depletion and environmental degradation as a key threat to sustainability as evidenced by problems such as desertification, drought, land degradation, freshwater scarcity, and loss of biodiversity⁵⁷. The Agenda seeks to protect the planet from degradation including through sustainable consumption and production, sustainably managing its natural resources and taking urgent action on climate change so that the planet can support the needs of the present and future generations⁵⁸. Sustainable Development Goal 15 seeks to Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and biodiversity loss⁵⁹. The targets under SDG 15 include ensuring the conservation, *restoration* and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and

⁵³ World Economic Forum., 'What are Natural Climate Solutions?' Op Cit

⁵⁴ Von Holle. B., Yelenik. S., & Gornish. E., 'Restoration at the Landscape Scale as a Means of Mitigation and Adaptation to Climate Change.' Available at <https://link.springer.com/article/10.1007/s40823-020-00056-7> (Accessed on 06/02/2024)

⁵⁵ Ibid

⁵⁶ United Nations General Assembly., 'Transforming Our World: the 2030 Agenda for Sustainable Development.' 21 October 2015, A/RES/70/1., Op Cit

⁵⁷ Ibid

⁵⁸ Ibid

⁵⁹ Ibid, SDG 15

drylands, in line with obligations under international agreements; promoting the implementation of sustainable management of all types of forests, halt deforestation, *restore degraded forests* and substantially increase afforestation and reforestation globally; combating desertification, *restoring degraded land and soil*, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world; ensuring the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development; and taking urgent and significant action to reduce the degradation of natural habitats, and halting the loss of biodiversity⁶⁰. The 2030 Agenda for Sustainable Development therefore sets the global targets geared towards restoring landscapes and ecosystems for Sustainable Development. It is imperative for all countries to meet these targets in order to restore landscapes and ecosystems for climate mitigation.

Restoring landscapes and ecosystems is also part of the implementation mechanisms of the UNFCCC and the Paris Agreement⁶¹. It has been observed that countries established the 'REDD+' framework to protect forests as part of the Paris Agreement⁶². 'REDD' stands for 'Reducing Emissions from Deforestation and Forest Degradation in Developing Countries'⁶³. The '+' stands for additional forest-related activities that protect the climate, namely sustainable management of forests and the conservation and enhancement of forest carbon stocks⁶⁴. Under the framework with these REDD+ activities, developing countries can receive results-based payments for emission reductions when they reduce deforestation⁶⁵. It has been pointed out that REDD+ activities have played a prominent role in restoring forest ecosystems and promoting sustainable forest management practices that reduce the depletion of carbon stock and

⁶⁰ Ibid

⁶¹ United Nations Framework Convention on Climate Change., United Nations, 1992., Op Cit

⁶² United Nations Climate Change., 'What is REDD+?' Available at <https://unfccc.int/topics/land-use/workstreams/redd/what-is-redd> (Accessed on 07/02/2024)

⁶³ Ibid

⁶⁴ Ibid

⁶⁵ Ibid

enhance forest resiliency⁶⁶. According to the United Nations Environment Programme (UNEP), REDD+ reduces deforestation through the conservation and sustainable management of forests and supporting developing countries in turning their political commitments, as represented in their Nationally Determined Contributions, into action on the ground⁶⁷. UNEP urges countries to embrace REDD+ activities such as restoration, reforestation and afforestation in order to foster climate action⁶⁸.

In addition, the *Convention on Biological Diversity* emphasizes the need to restore landscapes and ecosystems for climate mitigation⁶⁹. The Convention urges contracting parties to *rehabilitate and restore degraded ecosystems* and promote the recovery of threatened species, inter alia, through the development and implementation of plans or other management strategies⁷⁰ (Emphasis added). The Convention of Biological Diversity therefore identifies restoring landscapes and ecosystems as a key in-situ conservation strategy⁷¹. According to the Convention, in-situ conservation means the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings⁷². This is contrasted with ex-situ conservation which means the conservation of components of biological diversity outside their natural habitats⁷³. Restoring landscapes and ecosystems is therefore a key theme under the Convention on Biological Diversity. It has been argued that the well-being of the world population in the coming decades will in large part depend on conservation and restoration of ecosystems to maintain and enhance biodiversity and ecosystem services,

⁶⁶ Muigua. K., 'Boosting Biodiversity Conservation Through Sustainable Forest Resources Management' Available at <https://kmco.co.ke/wp-content/uploads/2021/11/Boosting-Biodiversity-Conservation-through-improved-Forest-Resources-Management-Kariuki-Muigua-November-2021.pdf> (Accessed on 07/02/2024)

⁶⁷ United Nations Environment Programme., 'REDD+' Available at <https://www.unep.org/explore-topics/climate-action/what-we-do/redd> (Accessed on 07/02/2024)

⁶⁸ Ibid

⁶⁹ United Nations., 'Convention on Biological Diversity.' Available at <https://www.cbd.int/doc/legal/cbd-en.pdf>, Op Cit

⁷⁰ Ibid, Article 8 (f)

⁷¹ Ibid

⁷² Ibid, Article 2

⁷³ Ibid

thereby contributing to sustainable development while reducing environment-related risks such as climate change⁷⁴. It is therefore imperative to restore landscapes and ecosystems for climate mitigation and Sustainable Development.

Restoring wetlands is also a key agenda under the *Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)*⁷⁵. The Convention acknowledges the fundamental ecological functions of wetlands as regulators of water regimes and as habitats supporting a characteristic flora and fauna, especially waterfowl⁷⁶. It requires contracting parties to formulate and implement plans towards promoting the conservation and wise use of the wetlands in their territory⁷⁷. It has been pointed out that the Ramsar Convention has fostered international cooperation in wetland conservation through actions such as establishing wetland restoration projects⁷⁸. In addition, the Ramsar Strategic Plan 2016–2024 seeks to ensure that wetlands are conserved, wisely used, *restored* and their benefits are recognized and valued by all⁷⁹. It has correctly been observed that wetlands are increasingly valuable under climate change in terms of their ecological functions, ecosystem services, and biodiversity⁸⁰. Some of the key ecosystem services provided by wetlands include carbon sequestration, maintenance and creation of clean water and soil fertility, and regulation of water and climate⁸¹. As a result, restoration and revegetation of wetlands is increasingly vital for creating resilient

⁷⁴ Convention of Biological Diversity., 'Ecosystem Restoration.' Available at <https://www.cbd.int/restoration/> (Accessed on 07/02/2024)

⁷⁵ Convention on Wetlands of International Importance especially as Waterfowl Habitat., Available at https://www.ramsar.org/sites/default/files/documents/library/current_convention_text_e.pdf (Accessed on 07/02/2024)

⁷⁶ Ibid

⁷⁷ Ibid, Article 3 (1)

⁷⁸ Ramsar Convention Secretariat., 'An Introduction to the Ramsar Convention on Wetlands, 7th ed. (previously The Ramsar Convention Manual)' Available at https://www.ramsar.org/sites/default/files/documents/library/handbook1_5ed_introductiontoconvention_final_e.pdf (Accessed on 07/02/2024)

⁷⁹ Ibid

⁸⁰ Zivec. P., Sheldon. F., & Capon. S., 'Natural Regeneration of Wetlands under Climate Change.' *Frontiers in Environmental Science.*, Volume 11 (2023)

⁸¹ Ibid

landscapes better able to respond to a changing climate without dramatic loss of biodiversity or ecosystem function⁸².

The need to restore landscapes and ecosystems is also set out under the *United Nations Convention to Combat Desertification*⁸³. The Convention defines desertification as land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities⁸⁴. According to the Convention, combating desertification includes activities which are part of the integrated development of land in arid, semi-arid and dry sub-humid areas for sustainable development which are aimed at prevention and/or reduction of land degradation; rehabilitation of partly degraded land; and reclamation of desertified land⁸⁵. The Convention therefore envisages restoring degraded and desertified land. It requires contracting parties to implement effective strategies aimed at rehabilitation, conservation and sustainable management of land and water resources, leading to improved living conditions, in particular at the community level⁸⁶. Similarly, the *Bonn Challenge*⁸⁷ and the *New York Declaration on Forests*⁸⁸ sets targets towards restoring degraded and deforested landscapes. At the Continental level, the *African Forest Landscape Restoration Initiative*⁸⁹ aims to contribute to the Bonn Challenge and African Union's Agenda 2063 through its target of restoring 100 million hectares of land across the continent by 2030.

From the foregoing, it emerges that restoring landscapes and ecosystems for climate mitigation is an agenda that is well embraced at all levels. It has been pointed out that

⁸² Ibid

⁸³ United Nations Convention to Combat Desertification., Available at https://catalogue.unccd.int/936_UNCCD_Convention_ENG.pdf (Accessed on 07/02/2024)

⁸⁴ Ibid

⁸⁵ Ibid

⁸⁶ Ibid, Article 2

⁸⁷ Bonn Challenge., Available at <https://www.bonnchallenge.org/> (Accessed on 07/02/2024)

⁸⁸ New York Declaration on Forests., Available at <https://forestdeclaration.org/wp-content/uploads/2021/10/EN-NYDF-Refresh.pdf> (Accessed on 07/02/2024)

⁸⁹ African Forest Landscape Restoration Initiative., Available at <https://afr100.org/> (Accessed on 07/02/2024)

landscape and ecosystem restoration practices have proven to have significant benefits for addressing the impacts of climate change⁹⁰. These include carbon sequestration and reduction of greenhouse gas (GHG) emissions, improving the resilience of landscapes and reducing disaster risks⁹¹. However, it has been argued that climate mitigation from restoration practices primarily stems from removals, which may be less effective than avoided emissions at lowering atmospheric GHG concentrations⁹². Additionally, it has been pointed out that restoration activities can have high costs and feasibility constraints⁹³. It has also been observed that although landscape and ecosystem restoration approaches are likely key for mitigating negative effects of climate change, they are often not widely used due to logistic and financial feasibility issues⁹⁴. It is imperative to address these concerns in order to effectively embrace the idea of restoring landscapes and ecosystems for climate mitigation.

⁹⁰ Food and Agriculture Organization., 'The Key Role of Forest and Landscape Restoration in Climate Action.' Op Cit

⁹¹ Ibid

⁹² Cook-Patton. S et al., 'Protect, Manage and then Restore Lands for Climate Mitigation.' Op Cit

⁹³ Ibid

⁹⁴ Von Holle. B., Yelenik. S., & Gornish. E., 'Restoration at the Landscape Scale as a Means of Mitigation and Adaptation to Climate Change.' Op Cit

4.0 Way Forward

Restoring landscapes and ecosystems for climate mitigation calls for adoption of techniques geared towards restoring life to landscapes. Such techniques include ecologically appropriate reforestation which entails planting the suitable trees in the right places and working with local communities to ensure that the new growth will be protected from external threats⁹⁵; farmer-managed natural regeneration which involves systematic growing and management of trees and shrubs by farmers⁹⁶; rainwater harvesting and aquifer recharge that aims at collecting rain from a roof or roof-like surface into a vessel that redirects its flow into a tank, cistern, deep pit, aquifer, or reservoir to replenish groundwater and restore natural water sources⁹⁷; agroforestry which involves integrating trees and shrubs into agricultural practices⁹⁸; permaculture which is a land management practice that involves mirroring how plants grow in nature in order to give land the same diversity, stability, and resilience that natural ecosystems have⁹⁹; and regenerative agricultural practices such as integrating livestock, maximising crop diversity, crop rotation, composting, and maintaining living root all year round¹⁰⁰.

In addition, it is necessary to improve protection and management of landscapes and ecosystems¹⁰¹. It has been argued that efficient protection and management of landscapes

⁹⁵ International Union for Conservation of Nature., 'Reviving Land and Restoring Landscapes.' Available at https://d1wqtxts1xzle7.cloudfront.net/79272785/2019-028-En-libre.pdf?1642779955=&response-content-disposition=inline%3B+filename%3DReviving_land_and_restoring_landscapes_p.pdf&Expires=1707309368&Signature=eq9qleQXVbY4wD2L5BO3hQgfcY6gmjawufzJlnm7dpIE~giFi8okLWHuWLNPOSiAVOjaIEdA-lvRZ3aghPbQcjGR90aYGIHGZ9nTOpDIuiwQ0IT-GCP3xZovu-By92bXH32yNpu~6yAAQUqOYF2wcesBjb2JjVaZWUE6U4uz8O7kKJGXXD23xX7fj9XoFPI-70eTo0FOga9N-6~W4F4cLyPxmIlgQfQf2MAU8gTh5R2GQEG7rO9sqktAeKshLOaONpM~9hq0wJYhL0eCULgwM6J3aeZeVKQyq4Px2pk9c8hDmP0zrRleuCJxQ0IfeWp85tPM1Y2k5Y2TkeXGdLB~g_&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA (Accessed on 07/02/2024)

⁹⁶ Ibid

⁹⁷ Ibid

⁹⁸ Food and Agriculture Organization., 'The Key Role of Forest and Landscape Restoration in Climate Action.' Op Cit

⁹⁹ Ibid

¹⁰⁰ Ibid

¹⁰¹ Cook-Patton. S et al., 'Protect, Manage and then Restore Lands for Climate Mitigation.' Op Cit

and ecosystems is more effective in climate mitigation since natural ecosystems can store large amounts of carbon, sequester additional carbon and represent more-stable and long-term carbon stores compared with restored lands and ecosystems¹⁰². In addition, efficient protection and management of landscapes and ecosystems offers large near-term climate mitigation objectives since restored landscapes and ecosystems may take decades to centuries to recover carbon that was initially lost when such ecosystems were initially disturbed¹⁰³. Further, effective protection and management of landscapes and ecosystems offers lower-cost mitigation potential than restoration which is usually costly¹⁰⁴.

Further, it is imperative to promote restoration of wetlands¹⁰⁵. It has correctly been pointed out that wetlands are hotspots for anthropogenic activity due to their high soil fertility and water supply, and have been subject to significant modification, degradation, and staggering losses due to factors such as climate change¹⁰⁶. The decline in wetlands has been associated with water and food scarcity with the potential to affect social, economic and political stability in most regions of the world¹⁰⁷. Restoration and revegetation of wetlands is therefore increasingly vital for creating resilient landscapes better able to respond to a changing climate without dramatic loss of biodiversity or ecosystem function¹⁰⁸. According to the United Nations, nearly 90 per cent of the world's wetlands have been degraded or lost to date, and the world is losing wetlands three times faster than forests¹⁰⁹. Therefore, there is an urgent need to raise global awareness on wetlands to reverse their rapid loss and to encourage the restoration and conservation of these vital ecosystems¹¹⁰. Wetlands play key ecosystem functions such as carbon

¹⁰² Ibid

¹⁰³ Ibid

¹⁰⁴ Ibid

¹⁰⁵ Zivec. P., Sheldon. F., & Capon. S., 'Natural Regeneration of Wetlands under Climate Change.' Op Cit

¹⁰⁶ Ibid

¹⁰⁷ Ibid

¹⁰⁸ Ibid

¹⁰⁹ United Nations., 'Why It is Time for Wetland Restoration Now to Secure a Sustainable Future.' Available at <https://www.un.org/en/un-chronicle/why-it%E2%80%99s-time-wetland-restoration-now-secure-sustainable-future> (Accessed on 07/02/2024)

¹¹⁰ Ibid

sequestration, maintenance and creation of clean water and soil fertility, and regulation of water and climate¹¹¹. Restoring wetlands is therefore necessary for climate mitigation.

It is also vital to combat deforestation and restore forest ecosystems¹¹². It has been pointed out that healthy forests play a crucial role in mitigating climate change by acting as carbon sinks, absorbing billions of metric tonnes of carbon dioxide annually¹¹³. According to the International Union for Conservation of Nature, forests help stabilise the climate¹¹⁴. They regulate ecosystems, protect biodiversity, play an integral part in the carbon cycle, support livelihoods, and can help drive sustainable growth¹¹⁵. However, forests are under threat due to deforestation and degradation¹¹⁶. It is estimated that every year the world loses 10 million hectares of forest¹¹⁷. In addition, deforestation and forest degradation accounts for approximately 11 per cent of carbon emissions and is therefore a major cause of climate change¹¹⁸. It is therefore necessary to combat deforestation and restore forest landscapes in order to foster climate mitigation. Some of the strategies that have been advocated towards this end include addressing poverty as a causation factor in deforestation, embracing technology and innovation in combating deforestation, and embracing agroforestry¹¹⁹. It is also necessary to embrace activities such as restoration, reforestation and afforestation in order to restore forest ecosystems¹²⁰.

¹¹¹ Zivec. P., Sheldon. F., & Capon. S., 'Natural Regeneration of Wetlands under Climate Change.' Op Cit

¹¹² Food and Agriculture Organization., 'The Key Role of Forest and Landscape Restoration in Climate Action.' Op Cit

¹¹³ United Nations Development Programme., 'Forests Can Help us Limit Climate Change - Here is How.' Available at <https://climatepromise.undp.org/news-and-stories/forests-can-help-us-limit-climate-change-here-how#:~:text=Forests%20are%20critical%20ecosystems%2C%20providing,metric%20tonnes%20of%20CO2%20annually.> (Accessed on 07/02/2024)

¹¹⁴ International Union for Conservation of Nature., 'Forests and Climate Change.' Available at <https://iucn.org/resources/issues-brief/forests-and-climate-change> (Accessed on 07/02/2024)

¹¹⁵ Ibid

¹¹⁶ Ibid

¹¹⁷ United Nations Environment Programme., 'Deforestation' Available at <https://www.unep.org/resources/factsheet/deforestation> (Accessed on 07/02/2024)

¹¹⁸ Ibid

¹¹⁹ Muigua. K., 'Boosting Biodiversity Conservation Through Sustainable Forest Resources Management' Op Cit

¹²⁰ Ibid

Finally, there is need to combat climate change. Climate change is a major threat to landscapes and ecosystems through loss of biodiversity, extreme weather events such as drought which can lead to desertification and drying of rivers and wetlands¹²¹. Combating climate change is therefore at the forefront in maintaining the healthy and natural functioning of landscapes and ecosystems¹²². It is therefore important for all countries to take urgent action to combat climate change and its impacts in order to enhance the resilience and sustainability of landscapes and ecosystems¹²³.

5.0 Conclusion

Restoring landscapes and ecosystems is a process that aims to recover the ecological functionality and enhance human well-being in deforested and degraded landscapes and ecosystems¹²⁴. The process offers numerous benefits such as increasing the amount of carbon sequestered, improving biodiversity and the quality of soil and water in the ecosystem, and providing economic benefits for communities that depend on such landscapes and ecosystems¹²⁵. Restoring landscapes and ecosystems plays an important role in climate mitigation. Despite progress being made towards restoring landscapes and ecosystems such as rivers, lakes, forests, wetlands, restoration activities are yet to be fully embraced due to factors such as high costs and feasibility constraints¹²⁶. In order to effectively restore landscapes and ecosystems for climate mitigation, it is necessary to adopt techniques such as reforestation, agroforestry, and regenerative agricultural practices¹²⁷; improve protection and management of landscapes and ecosystems¹²⁸;

¹²¹ United Nations Environment Programme., 'Seven Lessons on Using Ecosystem Restoration for Climate Change Adaptation.' Available at <https://www.unep.org/resources/policy-and-strategy/seven-lessons-using-ecosystem-restoration-climate-change-adaptation-0> (Accessed on 07/02/2024)

¹²² Ibid

¹²³ Ibid

¹²⁴ Food and Agriculture Organization., 'The Key Role of Forest and Landscape Restoration in Climate Action.' Op Cit

¹²⁵ World Economic Forum., 'What are Natural Climate Solutions?' Op Cit

¹²⁶ Cook-Patton. S et al., 'Protect, Manage and then Restore Lands for Climate Mitigation.' Op Cit

¹²⁷ Food and Agriculture Organization., 'The Key Role of Forest and Landscape Restoration in Climate Action.' Op Cit

¹²⁸ Cook-Patton. S et al., 'Protect, Manage and then Restore Lands for Climate Mitigation.' Op Cit

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promote restoration of wetlands¹²⁹; combat deforestation and restore forest ecosystems¹³⁰; and combat climate change¹³¹. Restoring landscapes and ecosystems for climate mitigation is a key strategy that needs to be explored at all levels.

¹²⁹ Ibid

¹³⁰ Food and Agriculture Organization., 'The Key Role of Forest and Landscape Restoration in Climate Action.' Op Cit

¹³¹ Ibid

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