Land Degradation Neutrality? Achieving Sustainable Management through Strong Governance, Technology and Nature-Based Solutions

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Kariuki Muigua

Land Degradation Neutrality: Achieving Sustainable Management through Strong Governance, Technology and Nature-Based Solutions

Kariuki Muigua*

Abstract

This paper discusses how we can achieve land degradation neutrality for the benefit of people and planet. The paper observes that land degradation is one of the greatest environmental challenges of our time with negative impacts on people and planet. It defines land degradation and discusses its impacts on humanity and nature. Due to its negative effects, the paper observes that land degradation is a major threat that undermines Sustainable Development efforts. Consequently, the paper notes that achieving land degradation neutrality is a vital ideal for people and planet in pursuit of sustainability. It examines how we can achieve sustainable land management through strong governance, technology and nature-based solutions towards Sustainable Development.

* PhD in Law (Nrb),SC, FCIArb (Chartered Arbitrator),OGW, LL. B (Hons) Nrb, LL.M (Environmental Law) Nrb; Dip. In Law (KSL); FCPS (K); Dip. in Arbitration (UK); MKIM; Mediator; Consultant: Lead expert EIA/EA NEMA; BSI ISO/IEC 27001:2005 ISMS Lead Auditor/ Implementer; ESG Consultant; Advocate of the High Court of Kenya; Professor of Environmental Law and Conflict Management at the University of Nairobi, Faculty of Law; Member of the Permanent Court of Arbitration (PCA) [January, 2026].

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1.0 Introduction

Land has been identified as a key factor of production which contains vital resources including water, forests, oil, gas, coal and minerals which are crucial for human progress and development[1]. It has been argued that land and its resources underpin socio-economic development[2]. For instance, land provides and supports the availability of crucial goods (including food, water, wood, fibre and industrial products) and essential ecosystem services and functions that support both humanity and nature[3]. It has been observed that land provides humanity with food, water, raw materials and other vital resources that make the planet habitable[4]. For instance, plants provide nearly 80 percent of the human diet, and we rely on agriculture as an important economic activity[5]. Further, it has been observed that forests, which cover almost 30 percent of the planet's surface, provide vital habitats for millions of plant and animal species, are important sources of food, clean air, water and natural medicines, as well as being crucial in climate action due to their vital role as carbon sinks[6].

Land is therefore an important natural resource that plays a key role in unlocking Sustainable Development across all its dimensions. For example land supports economic growth by providing essential raw materials for many industries and supporting key economic sectors such as agriculture and mining[7]. Further, it ensures social well-being

[1] Doughan. Y., 'Factors of Production, Economic Growth, and Sustainable Development' Available at https://link.springer.com/rwe/10.1007/978-3-319-71058-7_121-1 (Accessed on 25/01/2026)
[2] Food and Agriculture Organization of the United Nations., 'Land Resources Underpin Social and Economic Development' Available at https://www.fao.org/fileadmin/user_upload/terrafrica/Knowledge_summary/KS11_ID02.pdf (Accessed on 25/01/2026)
[3] Ibid
[4] United Nations Environment Programme., 'World Environment Day turns global gaze towards land restoration' Available at https://www.unep.org/news-and-stories/story/world-environment-day-turns-global-gaze-towards-land-restoration (Accessed on 25/01/2026)
[5] United Nations Development Programme., 'Life on Land' Available at https://www.undp.org/sustainable-development-goals/life-on-land (Accessed on 25/01/2026)
[6] Ibid
[7] United Nations., 'Land tenure supports sustainable development' Available at https://www.un.org/esa/sustdev/csd/csd16/documents/fao_factsheet/landtenure.pdf (Accessed on 25/01/2026)

including through supporting livelihoods, food security and acting as a source of cultural identity and shelter[8]. In addition, land is at the heart of environmental sustainability by supporting biodiversity, providing essential ecosystem services including water and clean air and strengthening the global response against climate change[9].

Despite its vital role in ensuring Sustainable Development, it has been observed that land is being degraded globally at an alarming rate[10]. Land degradation has been identified as one of the greatest challenges facing humanity with severe consequences for both people and planet[11]. Achieving land degradation neutrality is therefore crucial in fostering Sustainable Development.

This paper discusses how we can achieve land degradation neutrality for the benefit of people and planet. The paper observes that land degradation is one of the greatest environmental challenges of our time with negative impacts on people and planet. It defines land degradation and discusses its impacts on humanity and nature. Due to its negative effects, the paper observes that land degradation is a major threat that undermines Sustainable Development efforts. Consequently, the paper notes that achieving land degradation neutrality is a vital ideal for people and planet in pursuit of sustainability. It examines how we can achieve sustainable land management through strong governance, technology and nature-based solutions towards Sustainable Development.

[8] Ibid
[9] United Nations Development Programme., 'Life on Land' Op Cit
[10] United Nations Environment Programme., 'Voices from the land: Restoring soil and enriching lives' Available at https://www.unep.org/resources/publication/voices-land-restoring-soil-and-enriching-lives (Accessed on 25/01/2026)
[11] Ibid

2.0 Land Degradation: Causes and Effects

Land degradation refers to the reduction or loss of the biological or economic productivity of land[12]. Land degradation has also been defined as the reduction in the capability of land to produce benefits from a particular land use under a specified form of land management[13]. It has been observed that land degradation is caused by human-induced actions which exploit land, causing its utility, biodiversity, soil fertility and overall health to decline[14].

It has been observed that land degradation is one of the most pressing challenges facing humanity today. For example, it is estimated that nearly a quarter of the world's total land area has been degraded[15]. In particular, it has been observed that Africa is very vulnerable to land degradation and desertification, and it is the most severely affected region in the world[16]. It is estimated that desertification and land degradation affects nearly 45 percent of Africa's land area, with 55 percent of this area at high or very high risk of further degradation[17]. It has been pointed out that with most of the world's degraded land located in Africa, the continent is disproportionately affected by land degradation and desertification[18]. Africa's forests, drylands and croplands are being degraded at an alarming rate with negative impacts on both people and planet[19].

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[12] United Nations Office for Disaster Risk Reduction., 'Land Degradation' Available at https://www.undrr.org/understanding-disaster-risk/terminology/hips/en0301 (Accessed on 25/01/2026)

[13] Ibid

[14] United Nations Convention to Combat Desertification., 'Land Degradation Neutrality' Available at https://www.unccd.int/land-and-life/land-degradation-neutrality/overview (Accessed on 25/01/2026)

[15] United Nations Environment Programme., 'Land Degradation' Available at https://www.unep.org/gef/focal-areas/land-degradation (Accessed on 25/01/2026)

[16] United Nations Environment Programme., 'The Economics of Land Degradation in Africa: Benefits of Action Outweigh the Costs; A complementary report to the ELD Initiative' Available at https://www.unep.org/resources/report/economics-land-degradation-africa-benefits-action-outweigh-costsa-complementary (Accessed on 25/01/2026)

[17] Ibid

[18] African Development Bank Group., 'Desertification and land degradation' Available at https://www.afdb.org/en/topics-and-sectors/topics/desertification-and-land-degradation (Accessed on 25/01/2026)

[19] United Nations., 'New FAO report highlights urgent need to restore Africa's degraded landscape' Available at https://news.un.org/en/story/2021/09/1101632 (Accessed on 25/01/2026)

Land degradation is primarily caused by human-induced factors. For instance, it has been observed that unsustainable land management practices including continuous cropping, repetitive tillage, continuous overstocking, overgrazing, frequent rangeland burning, and over-use or clearance of woodlands and forest decrease the productivity of land leading to land degradation[20]. Further, rapid human population growth is fuelling land degradation through activities such as urbanization, mining, infrastructure development and intensive agricultural practices[21]. In addition, land degradation can also be caused by environmental factors. For example, it has been observed that extreme climatic events such as droughts are a primary cause of land degradation by decreasing the productivity of fertile land[22]. In addition, it has been observed that coastal surges salinate land near seas and oceans decreasing its productivity[23].

Land degradation has negative impacts on both people and planet. For example, land degradation severely impacts agriculture and crop production thus affecting global food security[24]. It has been argued that land degradation intensifies poverty, food insecurity and climate vulnerability especially in drought-prone areas thus worsening fragile conditions for millions of people all over the world especially rural communities, smallholder farmers and the extremely poor[25]. Land degradation also undermines economic growth by affecting livelihoods and reducing the productivity of land which negatively impacts agriculture, an important sector of the economy especially in

[20] Woodfine. A., 'Using Sustainable Land Management Practices to Adapt to and Mitigate Climate Change in Sub-Saharan Africa' Available at https://www.ipcinfo.org/fileadmin/user_upload/terrafrica/docs/SLM_SUB-SAHARAN_AFRICA.pdf (Accessed on 25/01/2026)
[21] United Nations Environment Programme., 'Land Degradation' Op Cit
[22] World Health Organization., 'Climate change: Land degradation and desertification' Available at https://www.who.int/news-room/questions-and-answers/item/climate-change-land-degradation-and-desertification (Accessed on 25/01/2026)
[23] Ibid
[24] United Nations Environment Programme., 'The Economics of Land Degradation in Africa: Benefits of Action Outweigh the Costs; A complementary report to the ELD Initiative' Op Cit
[25] African Development Bank Group., 'Desertification and land degradation' Op Cit

developing countries[26]. Further, it has been observed that land degradation can cause social instability since people are forced to migrate in search of productive land a situation that can trigger conflicts[27].

In addition to its impacts on people, land degradation also has severe effects on the environment. For instance, land-use change, habitat loss and fragmentation and other factors involved in land degradation are driving unprecedented losses in global biodiversity[28]. Further, land degradation is also linked to climate change. It has been observed that soil is one of the biggest terrestrial carbon sink[29]. Therefore, when land is degraded, carbon that is stored in soil is released into the atmosphere making land degradation one of the biggest causes of climate change[30].

Due to its adverse impacts on people and planet, achieving land degradation neutrality is crucial for Sustainable Development.

3.0 Achieving Land Degradation Neutrality trough Strong Governance, Technology and Nature-Based Solutions

Land degradation is a negative phenomenon that undermines the productivity of one of the most important natural resources for both people and planet. It has been observed that nearly 40 percent of the world's land is degraded affecting the livelihoods, food security and well-being of billions of people while also having negative consequences for

[26] Ibid
[27] United Nations Environment Programme., 'Land Degradation' Op Cit
[28] United Nations Convention to Combat Desertification., 'Land Degradation Neutrality for Biodiversity Conservation. Briefing Note' Available at https://www.unccd.int/resources/publications/land-degradation-neutrality-biodiversity-conservation-briefing-note#:~:text=Land%20degradation%20and%20biodiversity%20loss,English (Accessed on 25/01/2026)
[29] International Union for Conservation of Nature., 'Land degradation and climate change' Available at https://iucn.org/resources/issues-brief/land-degradation-and-climate-change (Accessed on 25/01/2026)
[30] Ibid

our climate and biodiversity[31]. Land degradation contributes to food insecurity, poverty, water insecurity, climate change and biodiversity loss while also contributing to peace and security challenges due to displacement of vulnerable populations[32].

Achieving land degradation neutrality is therefore vital for people and planet. Land degradation neutrality has been defined as a state whereby the amount and quality of land resources necessary to support vital ecosystem processes and services and enhance food security remain stable or increase within specified temporal and spatial scales and ecosystems[33]. It has been observed that the concept of land degradation neutrality aims to preserve land and its resources by ensuring no net loss of healthy and productive land through measures to avoid, reduce, mitigate and reverse land degradation[34]. Land degradation neutrality aims to preserve the land resource base, by ensuring no net loss of healthy and productive land at all levels[35]. This concept is designed to maintain and improve land-based natural capital and the ecosystem services and processes that flow from it[36].

Land degradation neutrality is therefore a vital concept towards avoiding, reducing, reversing and mitigating the impacts of land degradation for the well-being of both people and planet. In order to achieve this ideal state, there is need to strengthen land

[31] The Biodiversity Finance Initiative., 'These Innovative Finance Solutions Combat Land Degradation, Climate Change and Biodiversity Loss' Available at https://www.biofin.org/news-and-media/these-innovative-finance-solutions-combat-land-degradation-climate-change-and (Accessed on 26/01/2026)
[32] Ibid
[33] Food and Agriculture Organization of the United Nations., 'Land degradation Neutrality (LDN)' Available at https://www.fao.org/platforms/green-agriculture/areas-of-work/natural-resources-biodiversity-green-production/land-degradation-neutrality/ (Accessed on 26/01/2026)
[34] Ibid
[35] Guidelines for Land Degradation Neutrality., Available at https://www.stapgef.org/resources/advisory-documents/guidelines-land-degradation-neutrality (Accessed on 26/01/2026)
[36] United Nations Climate Change., 'Land Degradation Neutrality (LDN): A Framework for Maintaining Ecosystems and Human Well-Being under a Changing Climate' Available at https://unfccc.int/sites/default/files/resource/1.11%20SPI_POSTER_web.pdf (Accessed on 26/01/2026)

governance systems and approaches. For instance, it has been observed that strong governance ensures appropriate land planning, regulation and sustainable land management practices towards halting and reversing land degradation[37]. Sound governance systems are vital to tackling human induced and environmental threats such as deforestation, land –use changes, habitat fragmentation and climate change which fuel land degradation[38]. Further, through strong and participatory governance approaches, it is possible to involve key stakeholders including indigenous peoples and local communities who possess crucial knowledge systems and approaches that can play a key role in halting and reversing land degradation[39]. For example, it has been observed that the knowledge and wisdom of indigenous peoples and local communities plays a key role towards halting and reversing land degradation through techniques such as agro-ecology, sustainable agriculture and sustainable forest management practices, which provide both environmental and socio-economic benefits[40].

Embracing technology is also crucial in achieving land degradation neutrality. It has been observed that modern technology and digital tools can enhance efforts to combat land degradation through approaches such as remote sensing and monitoring to detect and tackle drivers of land degradation, precision agriculture towards fostering sustainable land management and data analytics which can guide recovery and rehabilitation of degraded land and ecosystems[41]. Investing in technology is therefore crucial towards halting and reversing land degradation for land degradation neutrality.

[37] United Nations Convention to Combat Desertification., 'Land Degradation Neutrality for Biodiversity Conservation. Briefing Note' Op Cit
[38] Ibid
[39] Nyemeck. M-L., Canestrelli. A. P., & Edoo. R., 'Local Action on Sustainable Land Management' Available at https://www.thegef.org/sites/default/files/documents/2022-05/SGP_Local_Action_SLM_2022_05.pdf (Accessed on 26/01/2026)
[40] Ibid
[41] Food and Agriculture Organization of the United Nations., 'Land degradation Neutrality (LDN)' Op Cit

Nature-based solutions also play an important role towards achieving land degradation neutrality. Nature-based solutions involve working with nature to address societal challenges, support human well-being and enhance biodiversity[42]. It has been observed that nature-based solutions leverage on the benefits of nature and the power of healthy ecosystems to protect people and planet, optimise infrastructure and safeguard a stable and biodiverse future[43]. These interventions use nature and the natural functions of healthy ecosystems to tackle some of the most pressing global challenges of our time including climate change, biodiversity loss and land degradation[44]. They involve protecting, restoring, and sustainably managing ecosystems in ways that increase their resilience and ability to address environmental and societal challenges, while also safeguarding biodiversity and improving human well-being[45].

Nature-based solutions provide an effective approach towards achieving land degradation neutrality. For example, approaches such as integrated soil and water management practices and farmer-managed natural tree regeneration practices involving leveraging on the power of nature to combat land degradation and improve soil productivity[46]. Further, sustainable farming practices including agroforestry, conservation agriculture, mulching, integrated plant and pest management, sustainable grazing management, organic agriculture and inter-cropping involve harnessing the

[42] What is the Nature-based Solutions Initiative and what are nature-based solutions?., Available at https://www.naturebasedsolutionsinitiative.org/what-are-nature-based-solutions#:~:text=Examples%20of%20Nature%2Dbased%20Solutions&text=Protecting%20or%20restoring%20forests%20and,floods%2C%20soil%20erosion%20and%20landslides (Accessed on 26/01/2026)

[43] International Union for Conservation of Nature., 'Nature-Based Solutions' Available at https://iucn.org/our-work/nature-based-solutions#:~:text=About%20Nature%2Dbased%20Solutions&text=They%20target%20major%20challenges%20like,are%20critical%20to%20sustainable%20development (Accessed on 26/01/2026)

[44] Choi. E., Rao. R., & Czebiniak. R., 'What Exactly Are 'Nature-based Solutions'?' Available at https://www.wri.org/insights/what-exactly-are-nature-based-solutions (Accessed on 26/01/2026)

[45] What are nature-based solutions and how can they help us address climate change., Available at https://www.worldwildlife.org/stories/what-are-nature-based-solutions-and-how-can-they-help-us-address-climate-change (Accessed on 26/01/2026)

[46] Zougmore. R., Segnon. A., & Thornton. P., 'Harnessing Indigenous Knowledge and Practices for Effective Adaptation in the Sahel' Available at https://doi.org/10.1016/j.cosust.2023.101389 (Accessed on 26/01/2026)

power of nature to conserve soil and water, ensure productivity of land in the long-term and enhance efforts to restore land and its related ecosystems[47]. Harnessing nature-based solutions therefore provides a cost-effective and sustainable approach towards achieving land degradation neutrality for people and planet.

4.0 Conclusion

Land degradation is a major global environmental challenges that affects the productivity of land with severe consequences for people and planet. It is therefore imperative to strengthen land governance systems, utilise technology and harness the power of nature-based solutions towards combating land degradation[48]. Achieving land degradation neutrality is necessary and possible towards avoiding, reducing, reversing and mitigating land degradation for people and planet.

[47] Woodfine. A., 'Using Sustainable Land Management Practices to Adapt to and Mitigate Climate Change in Sub-Saharan Africa' Op Cit

[48] United Nations Convention to Combat Desertification., 'Land Degradation Neutrality for Biodiversity Conservation. Briefing Note' Op Cit

References

African Development Bank Group., 'Desertification and land degradation' Available at https://www.afdb.org/en/topics-and-sectors/topics/desertification-and-land-degradation

Choi. E., Rao. R., & Czebiniak. R., 'What Exactly Are 'Nature-based Solutions'?' Available at https://www.wri.org/insights/what-exactly-are-nature-based-solutions

Doughan. Y., 'Factors of Production, Economic Growth, and Sustainable Development' Available at https://link.springer.com/rwe/10.1007/978-3-319-71058-7_121-1

Food and Agriculture Organization of the United Nations., 'Land degradation Neutrality (LDN)' Available at https://www.fao.org/platforms/green-agriculture/areas-of-work/natural-resources-biodiversity-green-production/land-degradation-neutrality/

Food and Agriculture Organization of the United Nations., 'Land Resources Underpin Social and Economic Development' Available at https://www.fao.org/fileadmin/user_upload/terrafrica/Knowledge_summary/KS11_ID02.pdf

Guidelines for Land Degradation Neutrality., Available at https://www.stapgef.org/resources/advisory-documents/guidelines-land-degradation-neutrality

International Union for Conservation of Nature., 'Land degradation and climate change' Available at https://iucn.org/resources/issues-brief/land-degradation-and-climate-change

International Union for Conservation of Nature., 'Nature-Based Solutions' Available at https://iucn.org/our-work/nature-based-solutions#:~:text=About%20Nature%2Dbased%20Solutions&text=They%20target%20major%20challenges%20like,are%20critical%20to%20sustainable%20development

Nyemeck. M-L., Canestrelli. A. P., & Edoo. R., 'Local Action on Sustainable Land Management' Available at https://www.thegef.org/sites/default/files/documents/2022-05/SGP_Local_Action_SLM_2022_05.pdf

The Biodiversity Finance Initiative., 'These Innovative Finance Solutions Combat Land Degradation, Climate Change and Biodiversity Loss' Available at https://www.biofin.org/news-and-media/these-innovative-finance-solutions-combat-land-degradation-climate-change-and

United Nations Climate Change., 'Land Degradation Neutrality (LDN): A Framework for Maintaining Ecosystems and Human Well-Being under a Changing Climate' Available at https://unfccc.int/sites/default/files/resource/1.11%20SPI_POSTER_web.pdf

United Nations Convention to Combat Desertification., 'Land Degradation Neutrality' Available at https://www.unccd.int/land-and-life/land-degradation-neutrality/overview

United Nations Convention to Combat Desertification., 'Land Degradation Neutrality for Biodiversity Conservation. Briefing Note' Available at https://www.unccd.int/resources/publications/land-degradation-neutrality-biodiversity-conservation-briefing-note#:~:text=Land%20degradation%20and%20biodiversity%20loss,English

United Nations Development Programme., 'Life on Land' Available at https://www.undp.org/sustainable-development-goals/life-on-land

United Nations Environment Programme., 'Land Degradation' Available at https://www.unep.org/gef/focal-areas/land-degradation

United Nations Environment Programme., 'The Economics of Land Degradation in Africa: Benefits of Action Outweigh the Costs; A complementary report to the ELD Initiative' Available at https://www.unep.org/resources/report/economics-land-degradation-africa-benefits-action-outweigh-costsa-complementary

United Nations Environment Programme., 'Voices from the land: Restoring soil and enriching lives' Available at https://www.unep.org/resources/publication/voices-land-restoring-soil-and-enriching-lives

United Nations Environment Programme., 'World Environment Day turns global gaze towards land restoration' Available at https://www.unep.org/news-and-stories/story/world-environment-day-turns-global-gaze-towards-land-restoration

United Nations Office for Disaster Risk Reduction., 'Land Degradation' Available at https://www.undrr.org/understanding-disaster-risk/terminology/hips/en0301

United Nations., 'Land tenure supports sustainable development' Available at https://www.un.org/esa/sustdev/csd/csd16/documents/fao_factsheet/landtenure.pdf

United Nations., 'New FAO report highlights urgent need to restore Africa's degraded landscape' Available at https://news.un.org/en/story/2021/09/1101632

What are nature-based solutions and how can they help us address climate change., Available at https://www.worldwildlife.org/stories/what-are-nature-based-solutions-and-how-can-they-help-us-address-climate-change

What is the Nature-based Solutions Initiative and what are nature-based solutions?., Available at https://www.naturebasedsolutionsinitiative.org/what-are-nature-based-solutions#:~:text=Examples%20of%20Nature%2Dbased%20Solutions&text=Protecting%20or%20restoring%20forests%20and,floods%2C%20soil%20erosion%20and%20landslides

Woodfine. A., 'Using Sustainable Land Management Practices to Adapt to and Mitigate Climate Change in Sub-Saharan Africa' Available at https://www.ipcinfo.org/fileadmin/user_upload/terrafrica/docs/SLM_SUB-SAHARAN_AFRICA.pdf

World Health Organization., 'Climate change: Land degradation and desertification' Available at https://www.who.int/news-room/questions-and-answers/item/climate-change-land-degradation-and-desertification

Zougmore. R., Segnon. A., & Thornton. P., 'Harnessing Indigenous Knowledge and Practices for Effective Adaptation in the Sahel' Available at https://doi.org/10.1016/j.cosust.2023.101389