

We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

6,900

Open access books available

185,000

International authors and editors

200M

Downloads

Our authors are among the

154

Countries delivered to

TOP 1%

most cited scientists

12.2%

Contributors from top 500 universities



WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.
For more information visit www.intechopen.com



Delineation and Dimension of Deforestation

Moses Z. Sithole and Isaac A. Agholor

Abstract

Deforestation is induced by human activities, cascading into associated cost and economic benefits. The concepts, dimensions and, deforestation caused by deliberate human activities were extensively examined. The chapter also highlighted the rationale for deforestation, environmental dimension to deforestation and contributions of forestry and forest by products to livelihoods. The segmented cases and experiences to create awareness on the need to discourage deforestation were explored. While recognizing that forest provides useful support for majority of rural dwellers, the justification for forest protection is advocated. Some communities depend on forests for their main livelihood, and use medicinal therapies derived from indigenous plants found in the forest. Forest remains an important pool of biodiversity and deforestation must be avoided. The chapter conclude that awareness of the impact of deforestation by the citizenry should be encouraged and supported by policies.

Keywords: deforestation, biodiversity, water cycle, soil erosion, air quality, flooding and natural habitats, climate change and human health. Rationale for deforestation

1. Introduction

Trees play a very pivotal role in the lives of both human beings and animals. Particularly, to human beings, trees plays a huge role. Trees takes up carbon dioxide and make use of it to produce the oxygen needed by human beings [1]. Not only that, trees are a source of food, medicine, shade and supports biodiversity. Moreover, trees provide the wood we need to make papers, furniture and shelter. Trees also helps control temperatures, reduces soil erosion as well as soil salinity [2]. Significantly, trees remain the source of and provides food. Shade, medicine, and enhancement of biodiversity is realized from trees [1]. Therefore, it is beyond any shadow of doubt that trees are important for human life to be sustained. However, there is an ever-growing challenge across the world. The challenge attributed to, is the clearing of our forests for some reasons. Human settlement, construction of roads, and medicinal extraction as well as agricultural purposes are some reasons, among others, that lead to clearing of our forests.

A forest is an enormous area that is covered with trees and vegetation, which is also known as undergrowth [3]. It is also regarded as a very multifaceted ecosystem dominated with trees that safeguards the earth and also support a myriad of life forms [4]. Trees are very much important as far as environmental components is concerned. This is mainly because of the very benefits of trees on the myriad of life forms it supports. In as much as a forest is of great importance to life, there are two processes which determines its existence. That is the processes of afforestation and

deforestation. Afforestation is defined in simple terms as a process of planting trees in a particular land [5]. This promotes vegetation and canopy for soil protection and leads to the balance of the ecosystem. Afforestation is a method sought, so incredible, by humankind, in the quest to fighting the effects of climate change, dealing with issues of soil degradation and maintenance of soil organic carbon levels [6]. This is on technique of humankind to prevent desertification.

On the other hand, deforestation as defined by [1], is the clearing of trees in forests. Significantly, deforestation can be traced to manmade and natural processes. The natural process of deforestation includes: plant diseases, damage of trees by other plants, damage of trees by animals feeding or habiting on the trees, storms and wind, as well as other climatic conditions such as flood and veld fires [4, 7, 8]. While manmade processes involves: construction developments, agricultural engagements, and clearing of trees for medicinal purposes and usages [9]. It is furthermore, of paramount importance to note that deforestation is the major and lead factor to climate change. Climate change refers to the alterations of climatic patterns regionally as well as worldwide [10]. Deforestation comes with a number of consequences. During the clearing the forests, good and developmental cost can be tabled. However, the cost and consequences of deforestation are punitive to both human kind and animals (both aquatic and wildlife).

The rationale for deforestation are highlighted and it includes: soil degradation, increased chances and levels of soil erosion, increase in the reflected radiation of solar, increase in the migration of animal species in search for habitat and greener pastures, and increased economic instability [1–2, 8]. Moreover, it is evident from research that the increase in the rate at which population grows as well as the changes in the ways and technologies of cultivation are the primary reasons of deforestation [11]. This research facts points to us the danger that continues to loom around the myriad of life forms. Therefore, the task of preaching the importance and practice of sustainable development remain pivotal. Hence, this chapter, draws on the meaning of deforestation, shades light on the rationale and consequences of deforestation.

2. Delineation and dimensions of deforestation

2.1 Delineation of deforestation

The conversion of forested areas into permanent non-forest areas and lands is known as deforestation [6]. Deforestation is defined also as a process of shrinking the areas of tropical forests for agricultural, grazing and construction purposes [4]. Other authors have presented some more definitions of deforestation. Tariq and Aziz [1] opined that deforestation is the degradation of the environment that threatens the quality of the existing forests. Notably, deforestation can be intentional and non-intentional clearing of the existing forests, through human activities [3, 12]. These land use changes come with enormous economic benefits for improved livelihoods across the world [13]. However, these benefits, could only be sustainable with good forest management practices [1, 6]. Therefore, it is important to create sustainable use of forest resources across the world, for sustainable development.

Deforestation involves the process of reducing vegetal cover in the forest's lands. This reduction of vegetation can either be man-made or be naturally enforced [14]. Deforestation occurs because of natural phenomenon such as wind and storm, veld fire and plant diseases. Moreover, deforestation comes in two groups, that is: 1) the change in land use and 2) the change in the land cover [3, 8]. These two groups can then be described as the categories of deforestation. Therefore, the **Table 1**, below, shows the examples of the two categories of deforestation:

Pareta and Pareta [12] argued that deforestation is the wasting of existing forests vegetation and resources. Vegetation refers to all characteristics of plant cover in an area. Therefore, deforestation is the process of engaging in removing and reducing vegetation in the existing forest. The resources involve: stable soils, wildlife, balanced biodiversity, wildlife habitats, air and clean water. Significantly, in the process of clearing forests, humankind deprive themselves the wonderful God-given resource that is the beauty of the environment [14]. Of which, if it is taken care of, it offers great opportunities for recreation and tourism [6]. Recreation and tourism can be of economic importance as far as livelihood is concerned. Therefore, it is certain that the use of forest resources must be accompanied with sustainable use of readily available resources, for the betterment of the livelihoods of the current generation, without compromising the future generation.

2.1.1 Deforestation and human activities

In the quest for the betterment of the current generation’s livelihood, mankind exploits the readily available resources. In as much as powerful and convincing reasons can be tabulated, it remains a fact that most of the activities of mankind are in a way leading to more environmental problems. Hence, some authors came up with some definitions of deforestation in relation to human activities: As the alteration of afforested lands to non-forested lands which can be intentional and non-intentional [15]. Some of the activities of humankind that leads to deforestation are reflected in **Table 1** above. Significantly, the clearing of trees in the existing forests for commercial usage is entails deforestation. Commercial usages of the tree materials collected from the forest includes: firewood harvesting, production of charcoal, mining of timber, logging, hunting, tourism and agricultural activities [1–3, 6].

On the other hand, [9] consider deforestation as the clearing of a significant number of trees in a forestland. Particularly, in the context of human activities as compared to natural causes. Deforestation is the process of degrading trees in the forest by human activities. Notably, the collection of all unsustainable forestry practices, such as use of firewood and timber, and these practices neglect the principle of enduring development which involves the sustainable use of resources while ensuring that the needs of the future generations are not compromised [16]. Human, also cause reduction in forest resources through clearing all vegetation from the existing forestlands without recognizing the need of environmental conservation [17].

Furthermore, human activities transcends the cutting down of trees to mining, logging, agriculture, human habitation, and industrialization [7–8, 18]. Therefore, deforestation is anti-livelihoods support and development. Afforestation is the

Categories of deforestation	
Change in land use (man-made)	Change in land cover (man-made)
Alteration of forest land for agricultural purposes (ranching and farming activities).	Clearing of trees for firewood and charcoal production
Alteration of forest lands for mining purposes (mining of underground minerals, timber mining and stone mining)	Clearing of trees for logging
Alteration of forest lands for areas of settlement (formal and informal settlement)	Clearing of trees for medicinal purposes (both authorized and non-authorized persons)
Alteration of forest lands for road construction and industrialization	Loss of trees, plants and grasses due to veld fires

Table 1.
The categories of deforestation.

only way out of the devastating consequences of deforestation, backed with implementation of policies on afforestation. As a matter of fact, if trees are extinct, then human and animal life itself is endangered and destroyed.

Human and animal life is encored and supported by plant life and the shortage of trees, will result to inadequate supply of woods for shelter, furniture, and the paper products used today [2–4, 19]. Furthermore, the availability and flow of oxygen is dependent on vegetation used to sustain human life. Therefore, understanding what deforestation is, becomes of paramount importance. Hence, [6–9, 16] examined deforestation as the clearing of trees from the existing forest lands due to bad agricultural practices, lumbering activities, change in climatic patterns, urbanization, air pollution, tourism, and overgrazing. On the other hand, [2–4] submits that the destruction of vegetation cover in the existing forestlands is referred to as deforestation. While [6–8] delineates deforestation to be the quest for economic productivity through agricultural endeavors, mining, and urbanization leading to land degradation. Therefore, it is clearer and undisputable, that the standing delineation of deforestation in the context of manmade processes is that deforestation is the cutting down of a huge number of trees leading to clearing of the existing forests for the purpose of livelihood betterment while compromising the future generations, by avoiding replenishing the cleared forests in ignorance or intentionally.

2.2 Rationale for deforestation

Numerous studies, [1–4, 9, 13] indicated the flux inherent in environmental deforestation. Nevertheless, increases in environmental awareness and activism across the world, on deforestation have also been reported to be on the increase as well. Therefore, there is a need to create continuous awareness campaign of deforestation. Significantly, deforestation is traceable to the following reasons: Change in ways of farming, intensified ranching and overgrazing, tourism, urbanization, wars and military affairs, mining, population growth (overpopulation), medicinal purposes, undervaluing forestry, logging, firewood harvesting and charcoal production, policy failure, poor land-use planning, damage of trees and plants by mammals, damage of trees by other plants, death and decay of trees, wind and storms, and veld fires [1–9, 13, 20].

2.2.1 The deforestation caused by deliberate human activities

The rationale for deforestation as shown on **Figure 1** below, occur in two broad categories: the intentional and the non-intentional. Intentional deforestation involves the human activities resulting to deforestation. It encompasses all the processes and activities that humankind engaged in without careful and sustainably approach to protect the environment. For example, clearing forest lands for agricultural purposes, mining, and industrialization. This is an intentional approach to deforestation, since, there are no careful considerations towards afforestation.

Agriculture is one of the major drivers of deforestation [12]. On the other hand, the agricultural sector is one of the major contributors towards economic growth and it employs most of the rural people [1]. As for employment and wealth creation, 60% of the world's population depend on the agricultural sector [8]. However, agricultural activities contributes 60% of deforestation worldwide [13]. Gorte and Sheikh [20] argued that agricultural activities leading to massive deforestation is mostly associated with cultivation shifts. This happens when a forest is cleared by means of burning trees and cutting down trees so to avail space for cultivation. Agricultural activities varies from nation to nation, but it occurs at three levels,

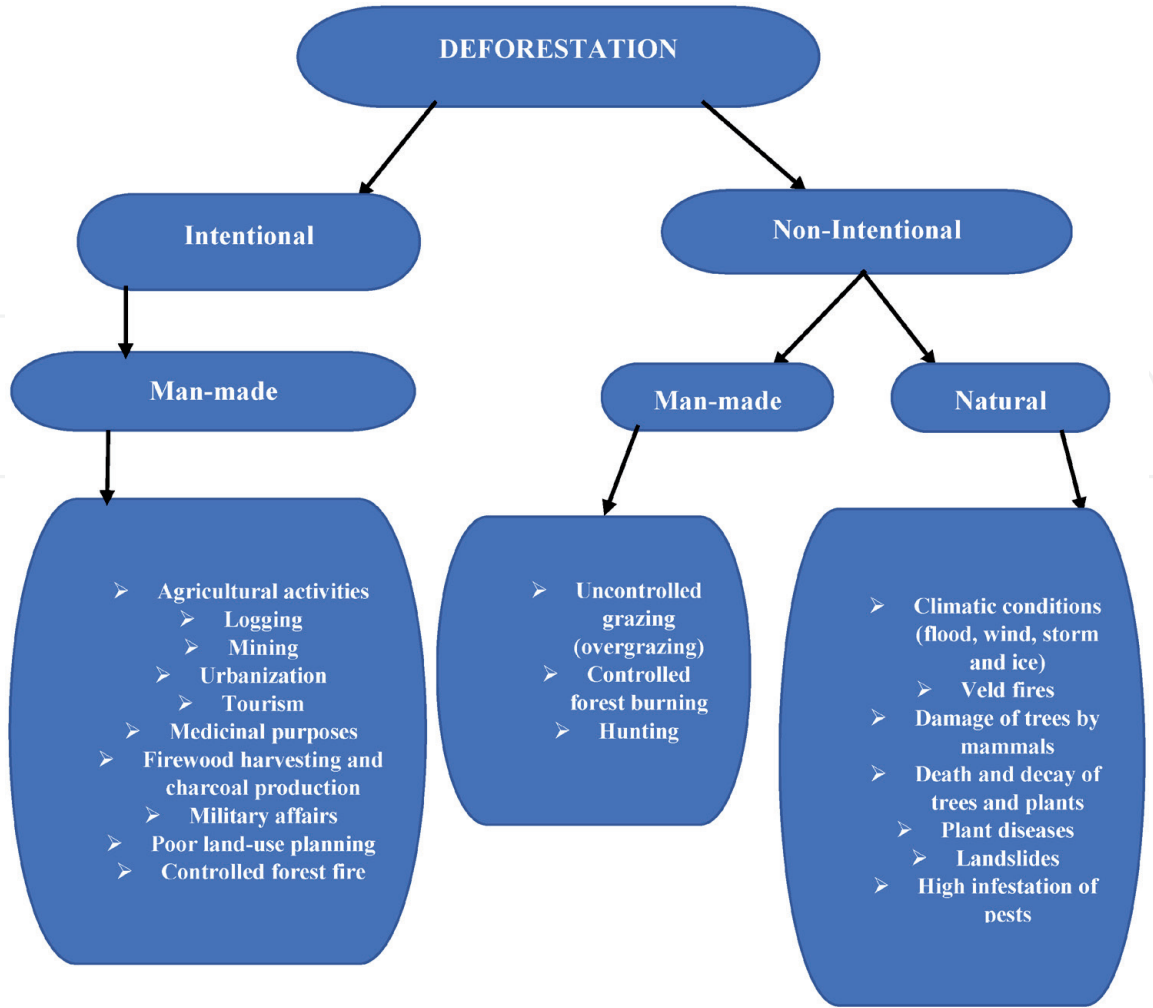


Figure 1.
Schematic illustration of deforestation.

namely: commercial, small-scale and subsistence farming levels [1–2]. Moreover, agriculture is known to contribute 12% of towards the greenhouse gas emissions worldwide [6]. This mainly happens when the forest is burnt down for agricultural purposes as well as when farm implements are in use [4].

On the other hand, logging and mining are reported to be other reasons of deforestation. Logging is the commercial clearing of forest by cutting trees down for the purpose of making paper [13]. While mining involves all activities whereby minerals are extracted either from the ground or forest. Mining in forest clearing happens when people are mining timber for construction and paper making. However, mining also happens in terms of underground minerals mining, such includes mining of gold, iron ore, coal, diamond and oil [1–3]. Moreover, mining of stone and sand does happen from the surface of the earth. Particularly, trees are cleared to give space for sand and stone mining. Logging is one of the economic growth contributors, globally. However, unsustainable commercial logging, results in deforestation. Pareta and Pareta [12] argued that logging is not the cause of deforestation. On the contrary, [3] argued that logging practiced in an unsustainable way is a direct cause of deforestation. Therefore, sustainable extraction of wood form the forests is to be practiced.

Population growth increases urbanization and rural settlement, and there are activities that creates ever-growing demands for space in the environment [1]. In the quest for human settlement, industrialization, employment, and wealth creation, causes deforestation to occur [20]. Urbanization is a necessity for development. However, it must follow a planned, managed and controlled manner [18]. On the

other hand, tourism sites are preferred for recreation and wealth creation [2]. However, if unsustainable practices are employed, that will result in massive vegetation cover loss [1–2, 20]. Therefore, it is an undisputable fact that urbanization and tourism are key role players in economic growth and development. Hence, urbanization and tourism must be done with careful planning, management and control.

Firewood and charcoal production is reported by [1] to be among the main drivers of deforestation, globally. Firewood harvesting is one of the reasons of deforestation that needs to be governed. As a matter of fact, [7] reported that their study found that 90% of the respondents in their study, uses firewood for cooking. This follows findings by [1], that there is a cumulative demand of firewood and timber for domestic use as the populations of nations continues to grow. This further leaves the tress at mercy of the ever-growing population. Kissinger et al. [15], asserted that timber accounts for almost 70% of deforestation, globally. The timber collected is then used for both firewood and charcoal production. However, the major drivers of deforestation includes: firewood harvesting, charcoal production and overgrazing of livestock [2].

Timber is, significantly, needed and utilized almost by everyone in construction of shelter. While firewood and charcoal is used for cooking and warming in winter season [15, 16]. Considering the human demand on forest and forestry products, the enactment of policies to govern the harvesting of timber becomes critical. More so, to create an awareness about the impact of deforestation and the apparent need for forest conservation.

Another reason for deforestation is the uncontrolled cutting down of trees and shrubs for medicinal purposes [1]. In this case, trees and plants with medicinal benefits are destroyed. Notably, this action does not only result in deforestation, but it also endangers the environment for human habitation. In most instances, trees are used for medicinal purposes by villagers and people surrounding forestlands. While others sell herbs obtained from the forest for income generation.

2.2.2 Deforestation: non-intentional activities and processes

As illustrated in **Figure 1**, above, deforestation also is as a result of non-intentional activities and processes. These processes and activities involves both natural and man-made activities and processes. Natural processes leading to non-intended deforestation involves: death and decay of trees and plants, plant diseases, landslides, damage of trees by other plants, high infestation of pests as well as climatic conditions such as veld fires, floods, and winds and storms [2–4]. On the other hand, man-made processes and activities involves: uncontrolled grazing which leads to overgrazing, hunting as well as controlled forest burning [4–5, 9]. Therefore, this section examines the natural and manmade processes and activities leading to deforestation at a non-intended approach.

Climatic conditions and landslides causes serious environmental damage to lands used for forestry and agricultural activities. The massive environmental harm comes in the form of deforestation and land degradation [13]. Climate change is one of the environmental issues across the whole world. Significantly, climatic conditions and climate change are both regarded as the drivers and the effect of deforestation and degradation of forests. As drivers of deforestation, climatic conditions are recognized in the form of tropical storms and winds, floods, ice, droughts, heat waves and veld fires [4, 7, 8]. On the other hand, landslides refers to mass wasting. Mass wasting is an occurrence of the movements of mass rocks, debris and earth downslope. This occur in five forms, namely: falls, topples, slides, spreads and flows. As a result of this phenomenon, destruction of forests occurs as well. Hence, landslides and climatic conditions are both drivers of deforestation across the world.

Deforestation occur as a result of unavoidable death and decay of trees and plants, plant diseases, high infestation of pests, damage of trees by other plants in the forestlands [8, 13–16]. With robust attention and huge budgets given to plant protection in the agricultural sector [7, 20]. Therefore, the lack of forest management policies, inadequate and ineffective management of the existing forests puts our existing forests at a risk of deforestation.

These are human activities resulting in unintended deforestation. These include uncontrolled grazing resulting in overgrazing, uncontrolled forest burning and hunting [20]. Hunting is one of the means of livelihood, particularly, for rural communities. In as much as hunting, poaching and snaring provides rural people with food harvested from wildlife, in terms of bush meat, it remains a factor causing deforestation [16, 20]. Hunters cut down trees in the forests to setup traps and this traps and snares are sometimes made on living plants and trees [21]. Furthermore, the traps set on living trees, then causes damage which can result in death and decay of the affected tress in the forest.

2.3 Dimensions of deforestation

Human activities tend to justify deforestation as good actions because it support livelihoods. However, as depicted on **Figure 2**, below, deforestation comes with its attendant environmental and socio-economic consequences. The rationale for deforestation includes: shortages of food, shortages of wood, mass destruction of wildlife and high wildlife migration rate, alteration of vegetation cover and structure, damage and loss of flora and fauna essential for recreation and tourism, desertification, disturbed water cycle, soil erosion, flooding, landslides, and land degradation, reduced atmospheric moisture, destruction of biodiversity, hardening of iron-rich soils to form laterite, changes and imbalances in nutrient cycle and energy, declined pollination, increased poverty levels, decline in soil fertility, decline of medicinal herbs production, decline in income generation, water loss as well as loss of natural flood and erosion control [2–7, 22]. All these activities contribute to deforestation.

2.3.1 Environmental dimension of deforestation

As shown in the **Figure 2**, below, deforestation have a number of environmental impact. These are: loss of biodiversity, mass destruction of wildlife and high rate of wildlife migration, alteration in the composition and structure of vegetation, damage of flora and fauna, desertification, soil erosion, flooding and the hardening of iron-rich soils to form laterite.

Biodiversity refers to all the desirable and important variety of animal and plant life in a habitat. The variety of animal and plant life is also referred to as the fauna and flora. Biodiversity is also known as the foundation of the ecosystems linked to humankind [9, 20]. Furthermore, within an ecosystem, there are wide range of animals and plants that supports production of biomass, water and nutrient cycle and energy, as well as soil formation and maintenance [7, 16]. However, deforestation and the degradation of forests destroys the biodiversity. When the biodiversity is destroyed, animals may migrate while some animal species may be extinct.

Significantly, the loss of biodiversity, because of deforestation have harsh impact particularly, on human health. This is due to the fact that biodiversity supports and benefits human life in many different ways [16]. Conservation of nature, is therefore, threatened by the destruction of biodiversity [8]. Which also leads to human-animal conflict. Human-animal conflict happens due to the declines in the

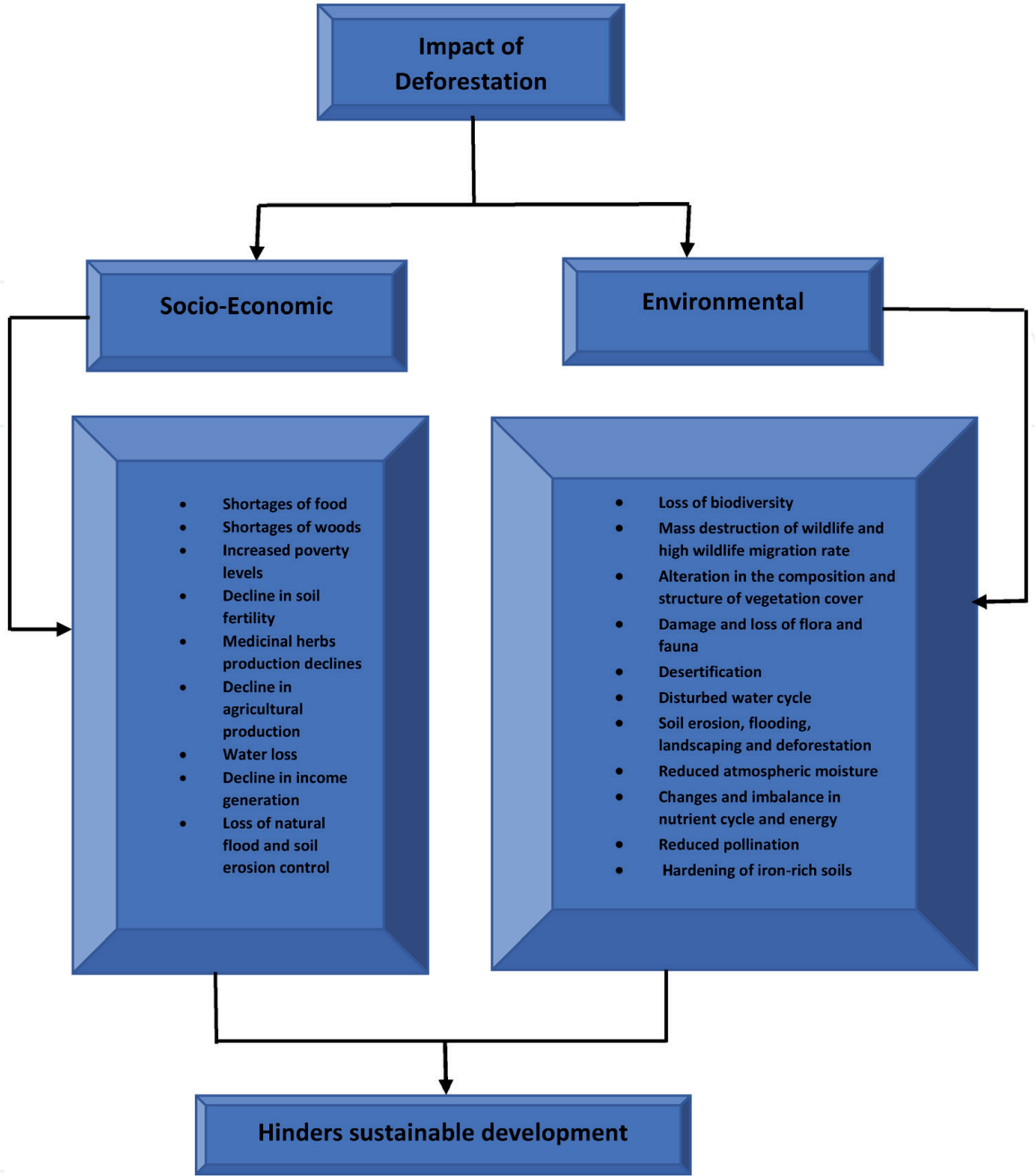


Figure 2.
Impact of deforestation.

agricultural productivity. These decline in agricultural productivity results from the effects of climate change which resulted from deforestation [23]. Thus, hunting, poaching and snaring becomes the way out of poverty for many rural people. Therefore, conservation approaches must be considered so to conserve the biodiversity that supports our health system and human existence.

Forests are not only the source of wood, but are important for human life support [15]. The trees growing in the forests make use of the carbon dioxide to produce the oxygen we need to sustain life [1]. In as much as trees are beneficial to human life, there is an ongoing threat to forest and plant life. This is because of all the natural and man-made processes resulting in deforestation. Deforestation has the ability to disrupt the normal weather conditions and create extremely hot and drier weather conditions [17]. Hence, it is believed that deforestation leads to the change in climate. Climate change manifest in increased temperatures, increased drought and prolonged drought seasons, delayed rain seasons, floods and displacement of vegetation cover, very heavy winds, and tropical storms [2–4, 16]. All these

changes in climatic conditions have serious implications on human and animal life. The imbalances of the atmospheric nutrient cycle, reduction of atmospheric moisture, increase in the high concentrations of Chloro-Floro Carbons (CFSs) in the atmosphere [4]. All these are results of deforestation and have serious implications on human health and existence. Therefore, deforestation is not only a theoretical concept, but a reality with detrimental impact to human health and life. Hence, measures to replenish our existing forests are critical to be implemented with careful consideration for sustainable development.

2.3.2 Socio-economic impact of deforestation

As shown in the **Figure 2**, above, deforestation have a number of socio-economic consequences. These are: shortages of food, shortages of wood, increased levels of poverty, decline in soil fertility, loss of medicinal therapies, loss of valuable agricultural land, water loss and, inadequate income. These consequences are intertwined with sustainable development. In most communities, forest is valued to an extent that, its destruction amounts to the destruction of their values, beliefs, norms and cultures [4]. This further shows that deforestation is not only an environmental issue but is a social and economic issue. Deforestation result in shortages of woods [21]. Woods from the forests are used for different purposes which includes making and production of paper, making of furniture, construction as well as firewood and charcoal production.

However, sustainable management of our existing forests will ensure that we do not run short of wood. Significantly, [1] presents that deforestation results in decline of soil fertility. However, land degradation because of deforestation render the soil infertile. Furthermore, decline in soil fertility leads to failure in agricultural productivity. And poor agricultural productivity means that we are unable to produce adequate and quality food [24]. This then result in food shortages. Food shortages at the extreme leads to food insecurity which is linked with many heath issues. Therefore, conservation of natural resources is necessary for economic and social needs of communities.

Daramola et al. [24] defines sustainable development as a process of economic development that does not compromise the future generations but conserves the natural resources for them. Murphy [22] suggests that the development that satisfies the needs of the current generation, no depriving the future generations the ability to satisfy their needs is sustainable development. Sustainable development is mostly known for its three (3) pillars, namely: social, environmental and economic sustainability [2, 22–24]. This means that any development happening, must be economic equitability, it must be socially bearable, and environmental viability (**Figure 3**).

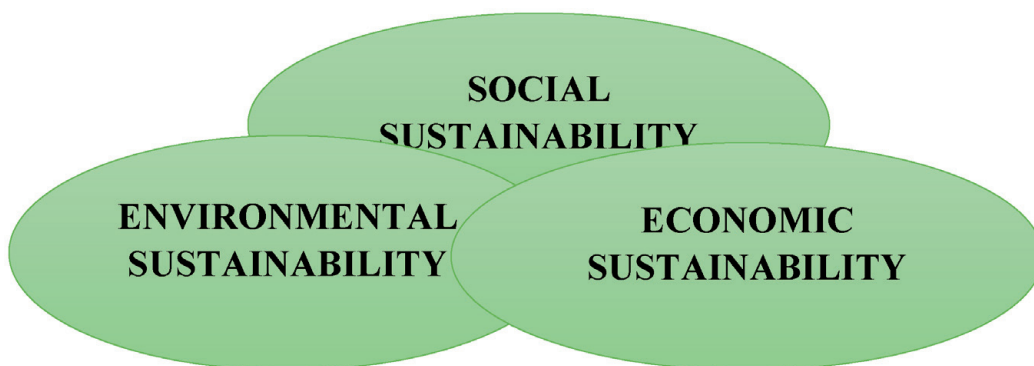


Figure 3.
Pillars of sustainable development (SD).

Therefore, sustainable development aims to promoting conservation of nature and all natural resources for the use by future generations. However, **Figure 2**, reveals that deforestation, as one of the environmental issues, globally, and hinders the achievement of sustainable development objectives.

3. Conclusion

Deforestation result from human activities in the environment. It may be unexpected, and sometimes deliberate action supported by livelihood needs. The concepts and dimensions of deforestation, human activities in relation to deforestation, the rationale for deforestation, environmental dimension to deforestation and contributions of forest and forest by products to livelihoods were examined in this chapter. The authors segmented cases and experiences and, highlighted efforts to create awareness on the need to discourage deforestation. Nevertheless, forest remain an important pool of biodiversity and deforestation must be avoided. The chapter conclude that awareness of the impact of deforestation should be supported by policies. Therefore, it is the authors believe that policy discourse will assist to provide enduring forest conservation and management.

Conflict of interest


The authors declare no interest.

Author details

Moses Z. Sithole* and Isaac A. Agholor
Faculty of Agricultural and Natural Sciences, University of Mpumalanga,
Mbombela, South Africa

*Address all correspondence to: apostle12352@gmail.com

IntechOpen

© 2021 The Author(s). Licensee IntechOpen. This chapter is distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. 

References

- [1] Tariq, M., and Aziz, R. 2015, "An Overview of Deforestation Causes and Its Environmental Hazards in Khyber Pukhtunkwa", *Journal of Natural Sciences Research*, Vol. 5 (1), 52-58.
- [2] Kassa, H., Dondeyne, S., Poesen, J., Frank, A., and Nyssen, J., 2017, "Impact of Deforestation on Soil Fertility, Soil Carbon, and Nitrogen Stocks: the Case of the Gacheb Catchment in the White Nile Basin, Ethiopia", *Journal of Agriculture, Ecosystems and Environment*: <http://dx.doi.org/10.1016/j.agee.2017.06.034>.
- [3] Tejaswi, G., 2007, "Manual on Deforestation, Degradation, and Fragmentation Using Remote Sensing and GIS", *Monitoring, Assessment and Reporting on Sustainable Forest Management (MAR-SFM) Working Paper 5/2007*.
- [4] Okia, C.Z., 2012, "Global Perspectives on Sustainable Forest Management". Intech Publishers, Rijeka, Croatia.
- [5] Bennett, L., 2017, "Deforestation and Climate Change", the Climate Institute, Washington, DC.
- [6] FAO (Food and Agriculture Organization of the United Nations), 2010, "Global Forest Resources Assessment", Rome, Italy.
- [7] Tariq, M., Rashid, M., and Rashid, W., 2014, "Causes of Deforestation and Climatic Changes in Dir Kohistan", *Journal of Pharmacy and Alternative Medicine*, Vol. 3 (2), 28-37.
- [8] Gebru, T.D., 2016, "Deforestation in Ethiopia: Causes, Impacts and Remedy", *International Journal of Engineering Development*, Vol. 4 (2), 204-209.
- [9] Hosonuma, N., Herold, M., Sy, V., Fries, R.S., Brockhaus, M., Verchot, L., Angelsen, A., and Romijn, A., 2012, "An Assessment of Deforestation and Forest Degradation Drives in Developing Countries", *Environmental Research Letters*, Open Access: doi:10.1088/1748-932/7/4/044009.
- [10] Bindoff, N.L., Stott, P.A., AchutaRao, K.M., Allen, M.R., Gillett, N., and Gutzler, D., 2013, 'Detection and Attribution of Climate Change: From Global to Regional'. In: Stocker TF et al. (eds.) *Climate Change 2013: The Physical Science Basis*, Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- [11] Abere, S.A., and Opara, J. A., 2012, "Deforestation and Sustainable Development in the Tropics: Causes and Effects", *Journal of Educational and Social Research*, Vol. 2 (4), 105-109.
- [12] Pareta, K., and Pareta, U., 2011, "Forest Carbon Management using Satellite Remote Sensing Techniques: A case Study of Sagar District", *International Scientific Research Journal*, Vol 3 (4), 335-348.
- [13] Goll, N.B., Li, J., McKay, J., and John, S., 2014, "Analysis on the Causes of Deforestation and Forest Degradation in Liberia: Application of DPSIR Framework", *Research Journal of Agriculture and Forestry Science*, Vol. 2 (3), 20-30.
- [14] Phua, M., Tsuyuki, S., Furuya, N., and Lee, S., J., 2008, "Detecting Deforestation with a Spectral Change Detection Approach using Multitemporal Landsat Data: A Case Study of Kinabalu Park, Sabah, Malaysia". *Journal of Environmental Management*, Vol. 88, 784-795.

- [15] Kissinger, G., Herold, M., and Sy, D.V., 2012, "Drivers of Deforestation and Forest Degradation", A Synthesis Report for REDD and Policymakers, Lexeme Consulting, Vancouver, Canada.
- [16] Moutinho, P., 2012, "Deforestation around the World", Intech publishers, Rijeka, Croatia.
- [17] Ekiti, A., 2017, Effects of Deforestation on Land Degradation", ResearchGate: <https://www.researchgate.net/publication/318921682>.
- [18] Mujuri, E. K., 2007, "Deforestation and Afforestation, A World perspective". A Class Paper, International Resource Management.
- [19] Ahmad, S.S., Abbasi, Q, Jabeen. R., and Shah, M. T., 2012, "Decline of Conifer Forest Cover in Pakistan: A GIS Approach", Pakistan Journal of Botany, Vol. 44 (2), 511-514.
- [20] Gorte, R.W., and Sheikh, P.A., 2010, "Deforestation and Climate Change", Congregational Research Service (CRS) Report for Congress, March 2010.
- [21] Boateng, R., Heeks, R., Molla, A. and Hinson, R., 2008, "E-commerce and Socio-Economic Development: Conceptualizing the Link", Journal of Internet Research, Vol. 18 (5), 562-592.
- [22] Murphy, K., 2012, "The Social Pillar of Sustainable Development: A Literature Review and Framework for Policy Analysis", Journal of Sustainability, Science, Practice and Policy, Vol. 8 (1), 15-29.
- [23] Porter-Bolland, L., Ellis, E.A., Guariguata, M.R., Ruiz-Mallen, I., Negrete-Yankelevich, S., and Reyes-Garcia, V., 2011, "Community Managed Forests Protected Areas: An Assessment of their Conservation Effectiveness Across the Tropics", Forest, Ecology and Management Journal: doi:10.1016/j.foreco.2011.05.034.
- [24] Daramola, A., Adeoye, A., Akinola, R., Alagbe, W., and Ajayi, S., 2010, "Sustainable Development and Environmental Protection: Strategies and Procedures for Developing Nations", Institute for Environment Research and Development, Benja Ota, Nigeria.