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A Pedagogical Approach Towards Ameliorating the Global Effects of Covid-19 Pandemic Through Forest Restoration and Environmental Sustainability

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ABSTRACT
This study investigated a pedagogical approach towards ameliorating the global effects of the COVID-19 pandemic through forest restoration and environmental sustainability. This research is considered apt and timely as it underscores the urgent need for forest restoration and environmental sustainability solutions in our fragile ecosystems amidst the ongoing COVID-19 pandemic and its associated challenges, such as forest degradation and the complexities of forest conservation. The study was conducted using a systematic review of the COVID-19 pandemic and its imminent challenges towards achieving forest restoration and environmental sustainability, drawing insights from renowned international academic journals, electronic publications, Google Scholar, and other academic websites. Pedagogically, integrating these findings into rural education curricula can significantly enhance students' understanding of environmental issues and the importance of sustainability. By incorporating concepts of forest conservation and environmental sustainability into classroom teachings, educators can foster a sense of environmental stewardship among students. Specifically, in rural education, equipping students with knowledge about sustainable practices and the challenges posed by the COVID-19 pandemic empowers them to engage in local conservation efforts and advocate for sustainable development within their communities. This approach not only prepares students to address environmental challenges but also promotes holistic development and improved quality of life in rural areas. Suggested strategies for curbing the adverse effects of COVID-19 include reforestation, preservation of wildlife habitats, and controlling human population growth and urbanization. This study provides recommendations on forest conservation and environmental sustainability to mitigate the impacts of the COVID-19 pandemic.

KEYWORDS
Biodiversity; ecological systems; environmental sustainability; education curricula; forest conservation; global pandemic; pedagogy; rural schools; vegetation land use/ land cover (LULC).

INTRODUCTION

According to A-Madhi et al. (2020), the COVID-19 pandemic has highlighted the interconnectedness of human health, environmental sustainability, and global resilience. Amidst the crisis, forest conservation and environmental sustainability have emerged as critical strategies for mitigating the pandemic's long-term impacts (Bar, 2021). This study investigates how forest restoration and sustainable environmental practices can help ameliorate the global effects of the COVID-19 pandemic. The urgency of this research is underscored by the need to address forest degradation and the complexities of conservation within fragile ecosystems, which have been exacerbated by the pandemic (Bates et al., 2020). In addition to its environmental focus, this study emphasizes the importance of integrating these concepts into educational curricula, particularly in rural areas. By incorporating forest conservation and environmental sustainability into teaching and learning, educators can provide students with a comprehensive understanding of the relationship between human activities and environmental health (Zikargae et al., 2022). This integration fosters critical thinking and environmental stewardship, equipping students to engage in sustainable practices and local conservation efforts (Brown, 2021). Pedagogically, this approach benefits both urban and rural education. In rural areas, where communities are often directly impacted by environmental changes, equipping students with knowledge about sustainable land management and conservation practices is crucial (Damoah & Adu, 2022; Dube et al., 2023; Mattingly & Schaefer, 2021). This empowers them to advocate for and participate in local initiatives aimed at preserving their natural surroundings (Zikargae et al., 2022). By aligning education with real-world challenges, students develop practical skills and a sense of responsibility towards their environment, contributing to sustainable development and improved quality of life in their communities (González-Salamanca et al., 2020). This study provides a comprehensive review of the COVID-19 pandemic's challenges and explores forest conservation and sustainability as viable solutions. Drawing from renowned international academic journals, electronic publications, Google Scholar, and other academic sources, it offers strategies such as reforestation, wildlife habitat preservation, and controlling urbanization.

According to Olatoye (2021), the livelihoods, income generation, and subsistence of over 1.5 billion people depend on forests, with more than 200 million indigenous people worldwide solely reliant on them (Shackleton & de Vos, 2022). Therefore, afforestation and reforestation programs are crucial for forest management to combat global warming and increase climate resilience (Hazarika et al., 2021). Climate change, exacerbated by excessive pressure on forest resources, worsens existing inequalities (Rajasugunasekar et al. (2023), disproportionately affecting marginalized countries and communities with limited human and technological resources (Olatoye, 2021). This situation forces underprivileged communities to further exploit forest resources for their survival (Everard et al, 2020). The reduction of forest resources by over 40% in the last three decades in underdeveloped and developing countries requires urgent attention (Tyukavina et al., 2022). Globally, forest area covers about 31% of the earth's land

surface, yet over 3.2 million hectares are lost annually to deforestation and other land uses with less than 40% of forest cover in good condition (Wade et al. 2020). For example, Nepal lost over 22,300 hectares of forest from 2000 to 2010, gaining only 13,600 hectares, resulting in a net decrease of about 8,700 hectares. Over 70% of the earth's terrestrial ecosystem has been severely altered by human activities, leading to biodiversity loss and deforestation, which are major causes of zoonotic diseases transferred from animals to humans (Aronson, 2014; Chen, 2012). Changes in land use, such as deforestation, increase the vulnerability of livestock and humans to zoonotic diseases, correlating with human-animal interactions (Chakravarty, 2012; Olatoye, 2019).

The COVID-19 pandemic is considered a major global health disaster and the greatest challenge since World War II, disproportionately affecting the underprivileged in African urban environments and overwhelming health systems with inadequate public health infrastructure (Chakraborty et al., 2020). The pandemic has the potential to compromise global commitments to the 2030 Sustainable Development Agenda (Wardman, 2020). The crisis is exacerbated by hunger, poverty, weakened health systems, lack of education, global cooperation, potable water, and proper sanitation (Buheji et al., 2020). Human activities face significant risks due to extreme anthropogenic interventions (Janhäll, 2015). The World Health Organization Report (2020) revealed that human activities threaten over one million species, with over 15% of wild animals adversely affected by wildlife trade. To prevent future pandemics, long-term ecological solutions are imperative. Thus, a COVID-19 stimulus package is essential to save lives, preserve biodiversity, safeguard nature, and protect livelihoods, reducing future pandemic risks (Sarkodie & Owusu, 2021).

Integrating these findings into rural education curricula is vital. By teaching students about the importance of forest conservation, environmental sustainability, and the link between human activities and pandemics, educators can foster a generation that values and actively participates in sustainable practices. This knowledge empowers rural students to engage in local conservation efforts, advocate for sustainable development, and build resilience in their communities. Pedagogically, this approach promotes critical thinking, environmental stewardship, and a practical understanding of global challenges, contributing to the overall development and well-being of rural populations.

Research Problem

The global COVID-19 pandemic has underscored the urgent need for effective strategies to address environmental degradation and promote sustainability, particularly through initiatives like forest restoration. However, there is a significant gap in understanding how educational methods and pedagogical approaches can be leveraged to enhance these efforts (Saxena et al., 2021). The research problem centres on the lack of a structured pedagogical framework that integrates the principles of forest restoration and environmental sustainability into educational curricula to address the pandemic's global effects. This gap highlights the need for a comprehensive approach that not only educates and engages individuals about the importance

of environmental stewardship but also translates this knowledge into actionable strategies that contribute to mitigating the pandemic's environmental impact. Developing and implementing such a pedagogical approach could potentially lead to more effective and widespread adoption of sustainable practices, ultimately contributing to both recovery from the pandemic and long-term environmental resilience.

Rationale for the Study

The rationale for this study stems from the urgent need to integrate environmental sustainability and forest restoration into educational frameworks as a response to the global impacts of the COVID-19 pandemic (McNeely, 2021). The pandemic has underscored the interconnectedness of health and environmental systems, revealing the profound effects that ecological degradation can have on global well-being (Rai et al., 2022). However, traditional educational approaches often fail to address these issues in a holistic manner, leaving a significant gap in both awareness and actionable knowledge (Robinson et al., 2022). By focusing on a pedagogical approach that emphasizes forest restoration and environmental sustainability, this study aims to fill this gap by developing educational strategies that not only enhance understanding of these critical areas but also promote practical skills for real-world application. The rationale is thus grounded in the necessity to equip learners with the tools to address both the immediate repercussions of the pandemic and the ongoing environmental challenges, ultimately fostering a generation of informed, proactive individuals capable of driving meaningful change.

Justification for the Study

This study is justified by the critical need to address the compounded challenges posed by the COVID-19 pandemic and environmental degradation through an innovative educational framework. The pandemic has intensified global environmental issues, highlighting the urgent need for robust solutions that integrate sustainability into recovery efforts. Despite the significant role that forest restoration and environmental sustainability play in mitigating these challenges, there remains a lack of pedagogical approaches that effectively incorporate these elements into educational systems (Reid et al., 2021). By developing a comprehensive pedagogical strategy, this study aims to bridge the gap between environmental education and practical action, thereby empowering individuals with the knowledge and skills needed to contribute to both immediate pandemic recovery and long-term ecological resilience. Such a framework could enhance public understanding and engagement with sustainable practices, leading to more effective environmental stewardship and recovery efforts. The study's focus on integrating these critical elements into education systems provides a timely and relevant contribution to addressing both the educational and environmental crises exacerbated by the pandemic.

Research Question

The research question for this study is as follows:

"How can a pedagogical approach be developed to mitigate the global impacts of the COVID-19 pandemic through forest restoration and environmental sustainability?"

Aim of Study

This study aims at investigating the global effects of covid-19 pandemic through forest conservation and environmental sustainability, with a pedagogical approach.

METHODOLOGY

The study employed a Systematic Literature Review (SLR) to gather evidence from a wide range of studies. As described by Tashakkori et al. (2020), an SLR is a comprehensive, systematic, and replicable approach to identifying, evaluating, and synthesizing existing research on a specific topic or question. This method involves a well-defined search strategy, including the selection of relevant databases, the establishment of inclusion and exclusion criteria, and the use of standardized methods to assess the quality of the studies. The purpose of an SLR is to reduce bias by following a rigorous and transparent process, thus providing a reliable and objective summary of the available evidence. Such reviews are crucial for informing policy, practice, and future research by identifying gaps in current knowledge and offering a consolidated overview of what is known on the subject. This systematic review adhered to the guidelines set by Laher and Hassem (2020). During this study, five academic databases were used namely, Google Scholar, JSTOR, Scopus, PubMed and Web of Science. The keywords used in searching for resource materials for the study include geospatial technologies, rural education and South Africa. The initial database search identified 81 papers through keyword searches. After excluding 14 articles that did not align with the topic, 67 papers remained. Further scrutiny led to the exclusion of 24 additional articles due to their lack of relevance, leaving 43 articles. Six more articles were added based on eligibility, resulting in a total of 55 articles used in the study.

LITERATURE REVIEW

The Impact of Covid-19 on Forestry and Pedagogy

According to Gastón (2016), more than 30% of the Earth's surface consists of woodlands. Unfortunately, significant portions of these forest resources are lost due to urbanization and increasing human populations, resulting in deforestation to provide raw materials for industries, support livelihoods, and create arable land for commercial agriculture or grazing (Olatoye, 2019; Olatoye, 2021). This loss of forest cover adversely impacts human health and ecosystems worldwide, exacerbated by rising ocean levels, increasing average temperatures, and extreme weather events. Afelt (2018) and Chakraborty (2020) note that deforestation and environmental degradation in various parts of the world are linked to bat-borne viral diseases and other zoonotic infections, such as the COVID-19 pandemic, which is believed to have originated from bats. Billions of dollars have been spent on developing medicines, vaccines, and diagnostic treatments to mitigate the effects of this outbreak (El-Said, 2020; Brüssow, 2021).

Despite the neglect of precautionary measures like afforestation, reforestation, and wildlife habitat protection, the COVID-19 lockdown period saw some recovery of forest vegetation, with forests becoming denser in several areas. Reduced human activity led to decreased poaching and less disturbance of wildlife, allowing ecosystems to recover and biodiversity to thrive (Bar, 2021). This natural recovery contributed to better agroforestry practices, enhanced food security, improved micro-climatic conditions, and promoted social well-being. Agroforestry is an economical strategy for mitigating climate change because tree-based farming systems and forest trees are effective carbon storehouses, thus reducing greenhouse gas emissions (Khatun & Palit, 2024). The significant carbon sequestration capabilities of agroforestry are due not only to high carbon density but also to the large coverage areas that can support these practices, including many degraded ecosystems. Consequently, forestry and agroforestry contribute significantly to food security and the adaptation and mitigation of climate change (Gautam et al., 2022). Integrating these insights into rural education curricula can have profound impacts. For example, in countries like Nepal, where deforestation has been significant, students can learn about the benefits of forest conservation and agroforestry practices, fostering a culture of sustainability from a young age. In Brazil's Amazon region, teaching students about the relationship between deforestation and zoonotic diseases like COVID-19 can underscore the importance of preserving natural habitats. In Kenya, incorporating lessons on the benefits of reforestation and carbon sequestration can help students understand how local actions contribute to global climate change mitigation. These educational initiatives can empower rural students to become advocates for environmental sustainability, promoting practices that enhance food security, improve local climates, and protect biodiversity. By emphasizing the role of forests in maintaining ecological balance and human health, education can play a critical role in fostering a generation committed to sustainable development and resilient communities (Khatun & Palit, 2024).

In Finland, forest schools integrate outdoor learning into the curriculum, allowing students to engage with nature directly. This hands-on approach helps students understand the importance of forests, biodiversity, and sustainable practices, fostering a deeper connection to environmental conservation. As regards Canada’s environmental education programs, the country’s school systems incorporate extensive environmental education programs, where students learn about forest ecosystems, the impact of deforestation, and the importance of sustainable resource management. These programs often include field trips to national parks and conservation areas, giving students practical exposure to forestry practices and environmental stewardship. According to Shattuck, (2022), Kenya's Green Belt Movement project, which was initiated by Nobel Laureate Wangari Maathai, includes educational programs that teach students about the importance of tree planting and forest conservation. Schools participate in tree planting activities, integrating environmental science with practical conservation efforts. According to Srivastava et al. (2021), students learn about the benefits of integrating trees with crops, which helps in improving soil fertility, providing shade, and

enhancing biodiversity in Ghana's Rural School Farms Project. Furthermore, the School Farms Project incorporates agroforestry into school curricula in rural Ghana. This hands-on approach not only educates students about sustainable farming but also provides food for school meals. In the same vein, the Eco-Schools program in South Africa encourages schools to create environmentally friendly and sustainable campuses, and students participate in activities like tree planting, recycling, and energy conservation (Kumar et al, 2020). The program also includes a curriculum that covers environmental issues, helping students understand the importance of preserving their natural surroundings (Dzerefos, 2020). In the Eastern Cape, educational initiatives focus on teaching students about the integration of trees and agriculture, and programs emphasize the role of agroforestry in enhancing food security and climate resilience. Students learn about the benefits of trees in farming systems, such as improved soil health and increased biodiversity (Gqesha, 2021).

Practical Implications of Forest Conservation and Agroforestry for Pedagogy and Rural Education

forest conservation and agroforestry are critical strategies for promoting environmental sustainability and resilience against climate change. Integrating these concepts into pedagogy and rural education provides practical benefits, equipping students with the knowledge and skills necessary to address environmental challenges (Mohan et al, 2021). By incorporating hands-on learning experiences, community-based projects, and interdisciplinary approaches, educators can foster a deeper understanding of sustainable practices. This integration not only enhances academic learning but also empowers rural communities to protect and manage their natural resources effectively, ensuring long-term ecological and economic benefits. Some practical implications of forest conservation and agroforestry for pedagogy and rural education include the following:

Interactive Learning Modules: Schools can incorporate interactive learning modules that focus on forest conservation and agroforestry. For example, virtual simulations can show the impact of deforestation and the benefits of reforestation. This approach can be particularly effective in remote rural areas where access to forests is limited.

Community-Based Learning: In rural areas, education programs can involve the entire community. Schools can collaborate with local farmers and conservationists to create practical learning experiences. For instance, students can participate in local reforestation projects or help in creating community gardens that incorporate agroforestry principles.

Curriculum Integration: Environmental education should be integrated into various subjects, not just science. For instance, in geography classes, students can learn about the role of forests in climate regulation. In economics, they can study the impact of sustainable practices on local economies. This multidisciplinary approach helps students see the interconnectedness of environmental issues with other areas of study.

Use of Technology: Leveraging technology can enhance environmental education. For example, students can use Geographic Information Systems (GIS) to study changes in land use and forest

cover. They can also use mobile apps to identify plant species and understand their ecological roles.

Global and Local Case Studies: Incorporating case studies from different parts of the world can provide students with a broader perspective on environmental issues. For instance, studying the Amazon rainforest's deforestation and comparing it with local forest issues can help students understand the global nature of these challenges and the importance of local actions. The integration of these practical examples and pedagogical strategies will foster rural education, environmental awareness and promoting sustainable practices among the next generation. These efforts will not only enhance students' understanding of their local ecosystems but also empower them to become active participants in global environmental conservation efforts.

Figure 1.

Advantages of Agroforestry Systems in Southern Africa for the Mitigation of Climate Change Impacts (Source: Sheppard et al., 2020)

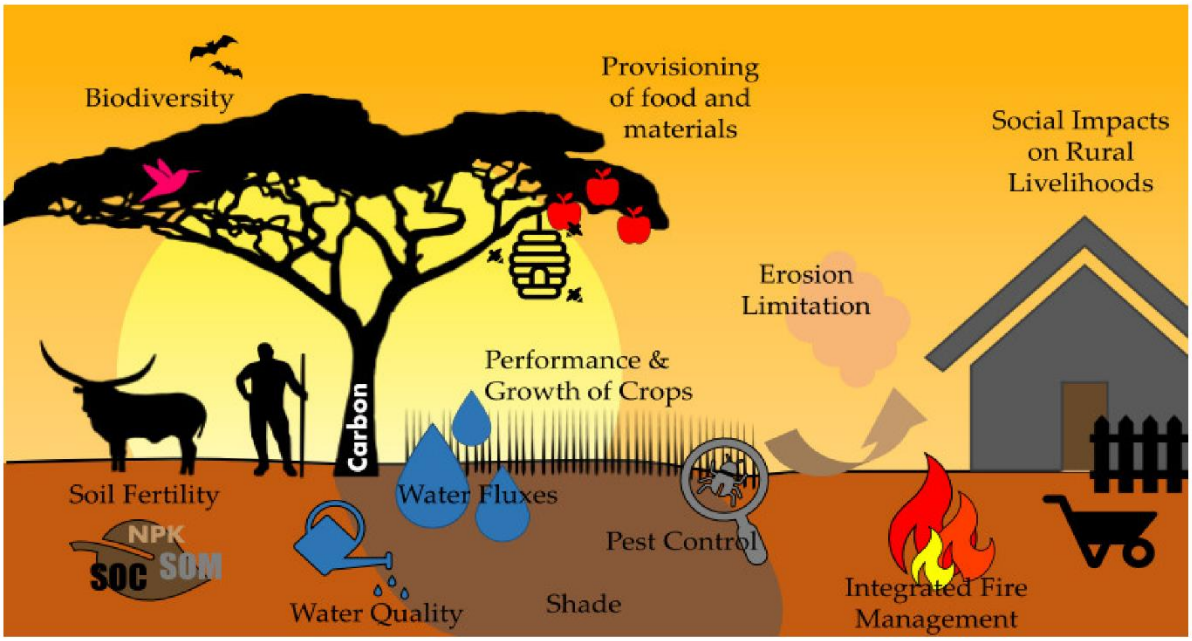

Figure 1 depicts the advantages of agroforestry systems in southern Africa for the mitigation of climate change impacts. Agroforestry systems (AFS) in the southern African region offer significant on- and off-site benefits that directly and indirectly mitigate predicted climate change impacts. On-site, AFS enhance soil fertility and moisture retention, reduce erosion, and increase biodiversity, leading to more resilient agricultural landscapes. These systems also sequester carbon, thus reducing greenhouse gas concentrations. Off-site benefits include the mitigation of climate change through the reduction of land degradation and deforestation rates, which contribute to broader environmental stability. Additionally, AFS promote sustainable livelihoods for rural communities by diversifying income sources and improving food security, thereby reducing vulnerability to climate-induced stresses. The integration of trees with crops and livestock not only boosts agricultural productivity but also fosters ecological balance, making agroforestry a vital strategy for climate adaptation and mitigation in the region.

Impact of Covid-19 on the Conservation of Global Ecosystems

From the advent of civilization, human interventions have greatly manipulated ecosystems for the benefit of man, in the process of meeting up with the demands of urbanization, industrialization as well as population increase (Olatoye, 2021), and this has had detrimental environmental consequences in numerous ways, such as climate change, water/air pollution, global warming, the depletion of the ozone layer, reduction in ground water levels, reduced biodiversity, environmental degradation, and so on. Increased concentration of greenhouse gases (such as N_2O, CH_4 CO_2, etc.) culminates into global warming (Singh, 2017). Thus, it is germane to state that environmental pollution has become a major global concern all over the world, due to the unexpected covid-19 epidemic, many countries were placed under total or partial lockdown for several months (Bates, 2020). Various social, cultural, religious, scientific, political, and sport mass gathering events were put on hold. Many industries were not operational, local and international travels were cancelled so as to restrict movement and the transmission of the coronavirus (A-Madhi, 2020). Conversely, these efforts have had positive environmental consequences on forest conservation globally. For example, industrial waste emissions decreased due to the non-functioning manufacturing industries, and vehicles hardly travelled on the roads resulting into nearly zero emissions of greenhouse gases to the environment (Cheshmehzangi, 2020). The use of fossil fuels, power in industries and other energy sources were of lesser demand, and biodiversity in ecosystems were greatly restored, while the inhabitants in many big cities experienced clear sky which is uncommon in their lives, as pollution levels in recreational centres such as conservation areas, national parks, hills, sea beaches, forest areas, etc. have drastically reduced, thereby culminating into the revival of the ozone layer to a large extent. In a nutshell, while the pandemic has had devastating consequences on human existence and livelihoods on one hand, it has positively influenced the conservation of global ecosystems on the other hand. It is on this premise that scientists and ecologists have urged national governments across the world to enforce permanent ban of wildlife trading and marketing, so as to promote ecosystems conservation, preserve human lives, ensure national security, promote biosafety/public health and avert negative occurrences associated with future pandemics such as Covid-19 (Sekalala et al., 2020).

Figure 2.

Impact of Covid-19 on the Conservation of Global Ecosystems

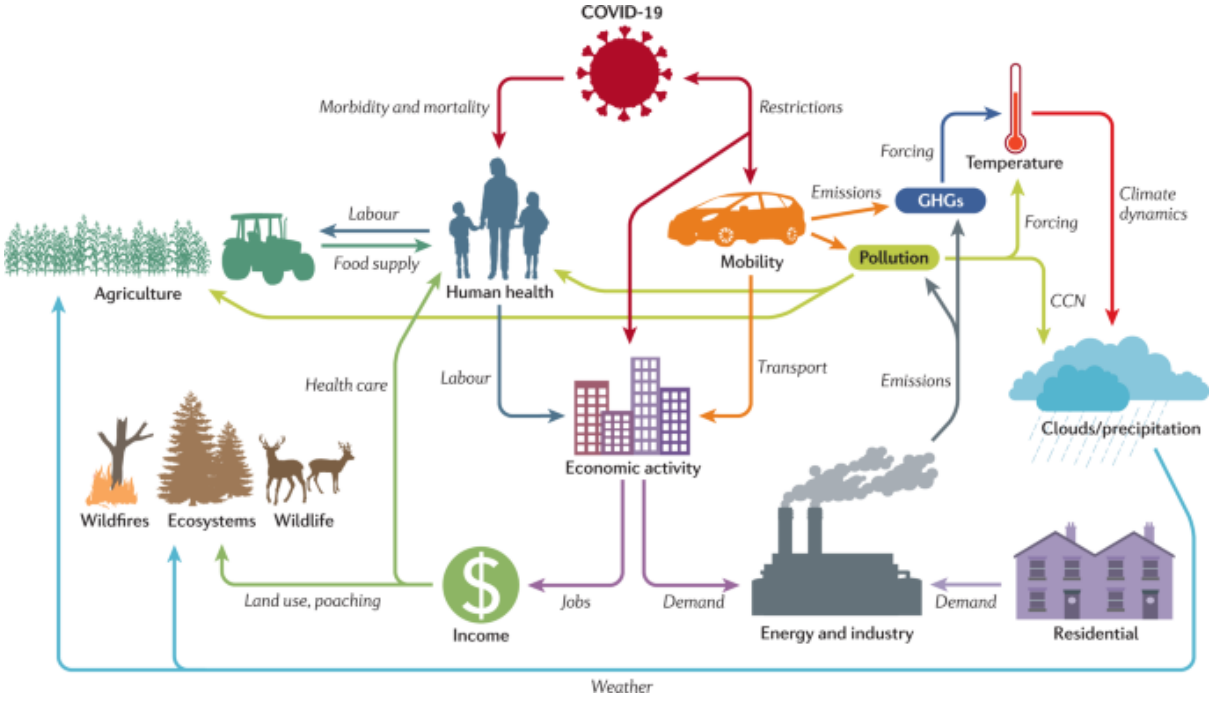

Figure 2 illustrates the impact of covid-19 on the conservation of global ecosystems. The COVID-19 pandemic has significantly impacted global ecosystems through its effects on economic activities, land use, energy and industry, and agriculture. The abrupt halt in industrial activities during lockdowns led to a temporary decrease in pollution levels and greenhouse gas emissions, offering a brief respite to many ecosystems. However, the economic downturn also exacerbated unsustainable land use practices as communities, especially in rural areas, turned to deforestation and illegal logging for livelihood (Kruger, 2020). Energy consumption patterns shifted, with a decrease in fossil fuel usage but an increase in demand for renewable energy sources, which holds potential for long-term positive effects on ecosystems if sustained. In agriculture, the pandemic disrupted supply chains and prompted a re-evaluation of food production systems, highlighting the need for sustainable practices that do not degrade land and water resources. Nevertheless, the overall impact of COVID-19 on conservation is mixed; while some short-term environmental benefits were observed, the economic pressures have led to increased exploitation of natural resources, underlining the urgent need for integrated policies that balance economic recovery with environmental sustainability.

Impact on Climate

The release of carbon-dioxide (CO_2) and other greenhouse gases into the atmosphere decreased during the covid-19 pandemic, thereby enhancing the quality of environmental health in most cities of the world (Kumar & Nayar, 2021). This assertion is confirmed by Liu et al, (2020) stating that the financial implications associated with the pandemic witnessed resulted in a reduction

in CO_2 outflows in the course of the year. For example, research findings from the North American Space Agency (NASA) revealed a 25% reduction in atmospheric carbon content in China during the period of lockdown. Hence, the covid-19 pandemic has encouraged research aimed at carbon sequestration and other carbon-reduction initiatives in the long term. Also, the dangers associated with covid-19 is for a short period, but the implications of climate change (such as surges, prolonged dry seasons, as well as extraordinary storms will stay for a long time, hence the need for long-term adaptive and mitigating strategies. It is also germane to state that as all interventions that impact the environment greatly affects man also, because humans are an essential component of the ecosystem (Summers, 2012). Although it is important to state that no one thought of the reduction of carbon emissions this way, the covid-19 pandemic has negatively affected human lives, means of livelihoods, healthcare systems, as well as the mental wellbeing of individuals across the globe (Kumar et al., 2021). Hence, environmental conditions during the lockdown were generally characterized by cool, clean and healthy environments, void of pollution, nor contaminated air, with increased periodic rainfall and reduced drought.

Figure 3.

Effects of Covid-19 on Ecosystems Functioning

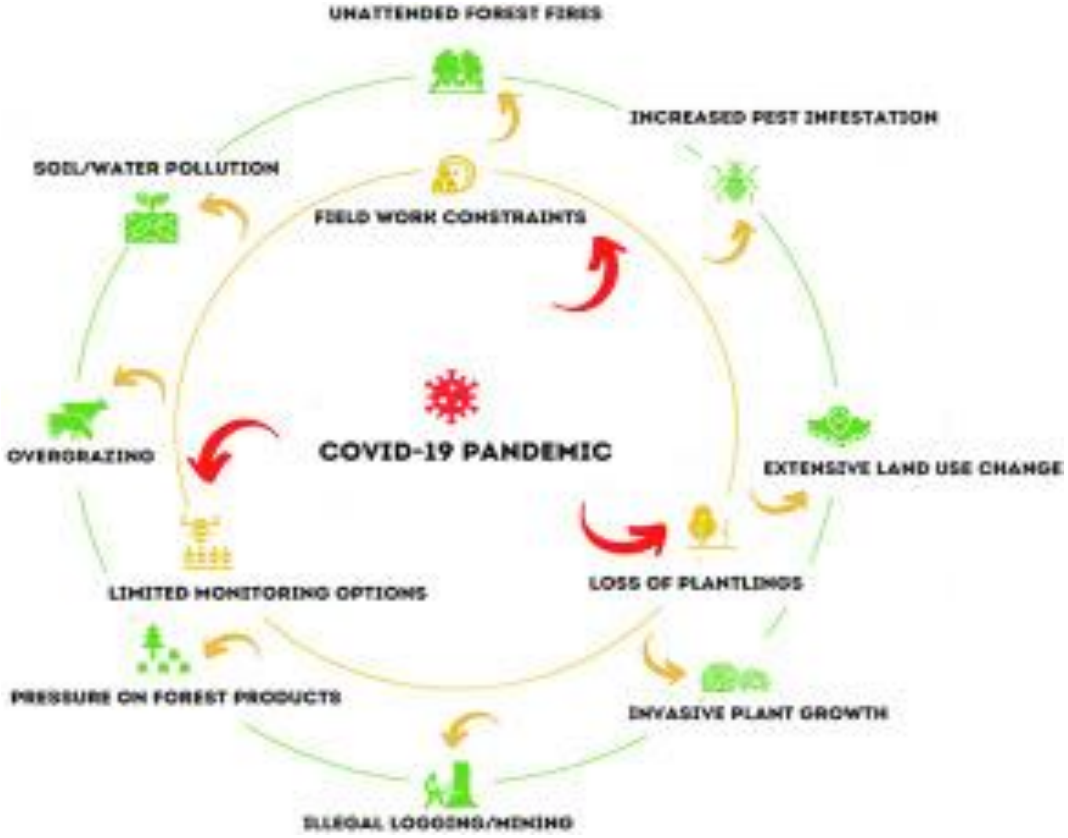

Figure 3 depicts the effects of covid-19 on ecosystems functioning. The COVID-19 pandemic has had profound effects on ecosystem functioning, contributing to soil and water pollution, increased infestation, extensive land use change, invasive plant growth, illegal logging, and heightened pressure on forest products. With reduced industrial activities during

lockdowns, temporary improvements in air and water quality were noted; however, the economic fallout led to greater reliance on natural resources, exacerbating soil and water pollution due to intensified agricultural activities and insufficient regulatory oversight. The disruption of regular maintenance and monitoring allowed for increased infestations and the spread of invasive plant species, further destabilizing local ecosystems. Extensive land use changes occurred as marginalized communities turned to deforestation and illegal logging to secure income, thereby putting immense pressure on forest products. This surge in illegal activities not only diminished forest cover but also threatened biodiversity and undermined efforts at sustainable forest management. Thus, the pandemic highlighted the fragile balance between human activity and ecosystem health, underscoring the need for comprehensive strategies to mitigate environmental degradation while supporting economic resilience (Kumar et al., 2021).

FINDINGS AND DISCUSSION

The study revealed that incorporating a pedagogical approach focused on forest restoration and environmental sustainability can significantly contribute to mitigating the global effects of the COVID-19 pandemic. Findings indicate that educational programs designed around these themes not only enhance students' understanding of ecological principles but also foster a proactive attitude towards environmental stewardship (Thor & Karlsudd, 2020). By integrating practical, hands-on activities related to forest restoration, such as tree planting and habitat restoration projects, into the curriculum, students gain firsthand experience and a deeper appreciation for the role of healthy ecosystems in supporting global health. The study also found that a curriculum emphasizing environmental sustainability equips learners with essential skills for addressing complex environmental challenges, thereby aligning with broader sustainability goals. The discussion highlights that these educational strategies promote resilience by linking environmental health with public health, illustrating how restoration activities can reduce the spread of zoonotic diseases and mitigate environmental degradation exacerbated by the pandemic. Additionally, the study underscores the importance of interdisciplinary approaches, combining science education with community engagement, to create a comprehensive learning experience. The integration of these pedagogical elements not only prepares students to tackle immediate pandemic-related issues but also empowers them to contribute to long-term environmental and public health solutions. Thus, the findings suggest that embedding forest restoration and sustainability into educational frameworks can play a crucial role in fostering a more informed and engaged citizenry, capable of addressing both current and future global challenges.

Limitations of the Study

The study's limitations include the reliance on secondary data sources, which may lead to variations due to the differing methodologies of the original studies. The temporal scope of the data might not fully capture long-term trends or recent developments. In addition, the focus on

geographic regions or case studies may limit the generalizability of the findings to other contexts.

CONCLUSION

It is expedient to state that a workable health policy should be enforced in order to protect our planet earth. From the forgoing, efforts made by the Government of Nepal should be adopted all over the world, as the country recently granted approval for the protection of humans, animals and the ecosystem in general, through Nepal's "One health strategy initiative of 2019. Going forward, there should be proper surveillance checks, constant wildlife human and environmental monitoring as regards their interactions, early detection, as well as risk assessment to diseases and this strategy should be implemented through a multidisciplinary research approach is required. The importance of forests for man and ecosystems protection cannot be overemphasized. Forests, which are known to sustain livelihoods all over the world through the provision of both wood and non-wood products also help in the containment of diseases. Further, forests support about 1.6 billion people for their livelihoods, and are home to over 75% of the global terrestrial biodiversity, and absorbing about 40% of the atmospheric CO2 emissions. Hence, it is the responsibility of all and sundry to ensure the reduction of deforestation so as to keep global warming below 1.500 Celsius. Additionally, forests serve as lungs of the biosphere, hence, biodiversity conservation should occupy the centre stage as regards long-term ecological solutions which must incorporate the control of deforestation, ban on live animal markets and wildlife trade, adoption and implementation of the one health policy, monitoring and surveillance, and accelerating research and developmental works. Man's continuous alteration of the global ecosystem has culminated in the destruction of nature and wildlife habitats, thereby putting the earth at great risk. Additionally, biodiversity loss and deforestation, which is hinged to human interventions have led to the outbreak of numerous global contagious diseases. Hence, it is envisaged that all countries of the world will learn this time from the devastating effects of covid-19 pandemic, and initiate workable solutions geared towards the protection and preservation of our planet so as to make it healthy and habitable for humans, wildlife and other components of earth's ecosystem.

While it is expedient to ensure the sustainability of global forest ecosystems, it is equally important for local communities to be actively involved in the actualization o the aforementioned tasks. For instance, the management of forests through community-based initiatives in Ethiopia, Bangladesh and Nepal were successful on account of high levels of local support. Subsequently, greater levels of involvement from local communities is essential, and participatory evaluations of the needs, culture, customs, social relations as well as the socio-economic structures of the forest host communities' should be undertaken on regular basis. However, the covid-19 pandemic has culminated in the creation of new barriers because many ecologists, environmentalists, afforestation professionals and other stakeholders in ecosystems

conservation are being infected from covid-19 and billions of dollars have been expended by responder agencies towards mobilizing immense health emergency assistance.

Recommendations for Environmental Sustainability Towards the Amelioration of Covid- 19 Pandemic

According to Luengo-Oroz, et al, (2020), a global response which involves governments and major stakeholders in all countries all over the world is required to prevent and control the covid-19 pandemic. Also, with the newly discovered covid-19 variant known as omicron, it is necessary to put control measures in order to prevent the spread of the disease (Petersen et al., 2021). From the foregoing, some suggested strategies are elucidated below for the amelioration of covid-19 disease.

Reforestation and Preservation of Wildlife Habitats

It is estimated that over 30% of the surface of the earth is consists of forest cover (Bastin et al., 2017), but unfortunately, population increase, and uncontrolled urbanization have culminated in the depletion of forest resources, and consequent conversion of forest land use for agricultural development, industrialization, transport infrastructure and/or grazing for livestock (Olatoye et al., 2021). Also, the rise in sea levels and increased atmospheric temperature have adversely affected not only ecosystems, but also human health as well (Hauer et al., 2020). There is also a significant correlation between deforestation and the outbreak of different types of diseases caused by birds, or bat-borne virus (Nabi, 2020), and covid-19 pandemic was caused by bats. Hence, a lot of resources in billions of dollars have been expended on diagnostic research, treatment, as well as vaccines and medicines, while the primary tools of prevention such as afforestation and preservation of wildlife habitats are greatly neglected. It is on this premise that the general public should be orientated on the significance of the forests, as well as the need to encourage afforestation throughout the world.

Controlling Human Population Growth and Urbanization

The concomitant effect of population increase is urbanization, resulting in the exploitation of virgin ecosystems to meet higher demands on transportation, housing, and other basic urban infrastructure to address the needs of the teeming population. Similarly, Olatoye et al. (2019) elucidated the demerits of high human population on biodiversity conservation, fauna and flora habitat loss and reduction in ecosystem service delivery. While healthy ecosystems are imperative for environmental conservation because of their potentials for sustaining ecosystem services on one hand, ecosystems become vulnerable in providing the required ecosystems provisioning and regulation. Thus, it is expedient to implement prompt and proactive interventions geared towards ecosystems conservation in order to curb the massive depletion of endangered ecological resources due to uncontrolled urbanization (Olatoye et al., 2021).

Monitoring spatio-temporal features of deforested regions using remotely-sensed satellite technology

Satellite remotely-sensed data should be utilized in the identification of hotspot deforested areas during the covid-19. Hence, early indications of forest loss can enable law enforcement

officers to allocate resources in the face of budget limitations during the covid-19 pandemic to the affected locations in a timely manner. The conceptualization of forest loss patterns will allow policy makers and other stakeholders study the specifics associated with forest management, and thereby help in the identification of underlying patterns and other exigent issues geared towards the upgrading of region-specific reforestation strategies and policies. Also, the utilization of remotely-sensed satellite technology is encouraged in the determination of the exact causes of deforestation and forest land use land cover change detection.

Constant monitoring of illegal logging activities

Efforts aimed at reducing deforestation through illegal logging should be encouraged in forest communities so as to curb such activities during times of pandemic, disasters and emergencies. From the foregoing, it is suggested that such measures are not discontinuous and should be expedited without interruptions. It is further recommended that forest communities should be supported through sensitization programs on the need to prevent forest loss through illegal logging activities and its negative effects on ecosystems. Further, capacity building of local communities' should be harnessed in relation to the identification, monitoring and reporting of illegal logging activities to the designated environmental protection authorities. For instance, the Worldwide Fund for Nature in Nepal reported an alarming increase of over 220 percent of illegal logging in the country within the first month of the covid-19 lockdown in the year 2020. Hence, this study recommends the development of appropriate tools, strategies as well as the required technologies for monitoring and reporting illegal logging activities on real-time basis.

Ensuring Conservation through Forest Regrowth

One of the implications of the covid-19 pandemic is that it has revealed the necessity to take inventory of and promote conservation through monitoring of ecological dynamics of newly fragmented forests, because fragmented forests unfavorably influences the spread of zoonotic diseases within the affected areas. Thus, it is crucial track fragmented forests and evaluate spatio-temporal interactions between them and humans through monitoring programs so as to conceptualize the dimensions of forest-derived infections and prevent the emergence of threats to health. It is further recommended that such monitoring should be incorporated with reforestation initiatives programs when prioritizing planting sites, as this will concomitantly enhance the stability of several landscape-scale processes such as biodiversity conservation, maintenance of atmospheric carbon balance, promoting ecosystem interactions/dynamics, as well as enhancing the overall quality of the environment.

Restricting mass gathering

Mass gatherings should be restricted so as to prevent the transmission of coronavirus (which is transmitted through direct contact from persons to persons) (Gao et al., 2021). From the foregoing, the WHO made precautionary recommendations for the reduction of transmission of the disease such as the avoidance of close contact with people, regular hand washing with hand sanitizers, soap & water, avoidance of unprotected contact with wild or farm animals, maintenance of cough etiquette, among others. Further, all types of cultural, religious, social,

scientific, political and sport mass gathering events across the globe. International ceremonies such as hajj, Olympics, umrah, Hajj and the Olympic Games have already been suspended in order to avoid mass gathering (Ebrahim et al, (2021). Also, the utilization of technology as well as different sources of media provide enormous support to the society for orientation, adherence to safety measures, prevention and control of the COVID-19 pandemic. So, the restriction of mass gathering could be a major preventive approach to the spread of covid-19 (Bielecki et al., 2020).

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