Role of Education in Biodiversity Conservation and Waste Management

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Abstract- ***Climate change, industrialization, human population growth and land use change are among the most important threats to environment. Local appreciation of ecosystem services and knowledge of how the foundation of these services is affected by local livelihoods are important for the sustainability of natural resources and thus may fundamentally affect human well-being. The awareness of ecosystem services gained via the education programme suggests that education programmes can be an important tool in conservation of our biodiversity. Environmental education act as a powerful tool for raising awareness and development of a sense of responsibility towards the environment. By giving knowledge to public about the relationships within ecosystems and the importance of biodiversity, environmental education helps in the conservation of natural resources and treatment of waste management. Thus, education is essential for the sustainable and equitable use of biodiversity and its conservation. It is also crucial for mainstreaming biodiversity.***

Indexed Terms- ***Education, Biodiversity Conservation, Waste management.***

I. INTRODUCTION

The most important challenges facing the world today are climate change, environmental pollution, human population growth, overexploitation of natural resources and habitat loss (Prakash, 2021; Verma, 2021). Together, these issues pose a threat to the continued survival and sustainable use of natural resources for both current and future generations, endangering ecosystem services (IPBES 2019). Environmental education plays a key role in encouraging the conservation of biodiversity. As human activities continue to exert significant pressure on natural resources, understanding the importance of biodiversity and its conservation becomes increasingly vital (Prakash and Verma, 2022). Collaboration amongst a range of stakeholders, including individuals, local communities, NGOs, and government agencies, is necessary for biodiversity conservation. Building collaborations and encouraging group action are facilitated by environmental education.

Biodiversity is the 'foundation of human life' on earth (Prakash and Verma, 2020) because each organism plays an important role and helps in producing more productive and stable ecosystem which has the ability to survive in stress conditions. Environmental conditions play a key role in defining the function and distribution of organisms, in combination with other factors. Environmental changes have had enormous impacts on biodiversity patterns in the past and will remain one of the major drivers of biodiversity patterns in the future (Prakash and Srivastava, 2019). The biodiversity has different levels and values (Ashok, 2016). There is a necessity of ecological balance for widespread biodiversity (Ashok, 2017), which is required for human survival (Kumar, 2018). Human demands on freshwater ecosystems in the past century have a threat to biodiversity around the world. As a result of this global crisis, documenting losses of biodiversity, diagnosing their causes and finding solution have become a major part of contemporary freshwater ecology. Pollution and pesticides also badly influence the animals life and biodiversity (Prakash and Verma, 2014; Chaudhary *et al.,* 2021; Singh *et al.,* 2023; Rani *et al.,* 2024). The biodiversity decline is a consequence of an inappropriate environmental risk assessment (Brühl and Zaller, 2019).

Waste is any substance discarded after primary use, or is worthless, defective and of no use. A by-product, by contrast is a joint product of relatively minor economic value. Waste management is the collection, processing, treatment and recycling of waste. The process of Waste Management is constituted of a range of tasks which include: storage, transport, treatment and disposal of waste; monitoring, supervision and regulation of the development, processing, transit, treatment and disposal for better health of our environment. Both direct and indirect environmental effects result from waste disposal, including resource depletion, land occupation, acidification and harmful effects from emissions to air in the case of incineration, and an exacerbation of global warming caused by methane and other greenhouse gas emissions. Microplastics badly affect the nature (Verma and Prakash, 2022).

How Biodiversity has been destroyed:

- Pollution- it is the driving factor to loss of biodiversity which includes; air pollution, water, industrial.
- Habitat distraction- large industrial and commercial activities associated with agriculture, irrigation, construction of dams, mining.
- Poaching- wild spices becoming extinct in the game reserve and conservation areas.
- Over exploitation- increasing exhaustion of natural resources.
- Infectious diseases

Strategies of Conserving Biodiversity:

- Reduction of pesticide use through choosing alternatives.
- Reduce consumption- the more we reduce the demand for new resources the fewer habitats will be destroyed.
- Promoting awareness- education institutions like schools, colleges, among others, national park directorates, public, collections, botanic gardens and Zoos.
- Reverse declines- aims to reinstate ecosystem that lost differentially in locations.
- Recover threatened species and ecological communities- ensures to long term persistence of species and ecosystems at immediate risk of extinction.
- Government laws and legislation- laws that protect natural habitats should be strongly enforced to avoid humans for exploiting biodiversity.
- Research- finding new and direct ways to help protect organisms and biodiversity.
- Habitat restoration- this can be pioneered by government to rebuild natural habitats in endangered areas.
- Education- educating people about biodiversity conservation.

Role of Education to conserve Biodiversity:

Education for biodiversity conservation is very important in the present scenario especially in India which has extremely rich biodiversity recorded. Biodiversity education can then be seen as a model for education for nature conservation and sustainable development. It becomes much more than "showing them animals and plants" and illustrates how concepts of conservation can be applied in teaching. Environmental education happens in school/college level have keep some sort of relationship with education for biodiversity conservation as follows,

- Education for biodiversity conservation is a part of good environmental education.
- Environmental education as a part of education for biodiversity conservation – because education for biodiversity conservation is more comprehensive than environmental education and includes issues of development, species relationships, cultural diversity, social and environmental equity.
- Education for biodiversity conservation and environmental education as partly overlapping, but different concepts.
- Education for biodiversity conservation as a stage in the evolution of environmental education. Here, Education for biodiversity conservation will be considered the next generation of environmental education, which includes issues of ethics, equity and new ways of thinking and learning.

Waste and their Categories:

The Environmental Protection Act 1990 defines waste as any scrap material, effluent or unwanted surplus substance or article that requires disposal

because it is broken, won out, contaminated or otherwise spoiled. These waste categories into following categories.

- The waste originates from agricultural or horticultural sector includes agricultural plastics and packaging, empty pesticides containers.
- Civic amenity waste includes those wastes that normally delivered by the public direct to the sites provided by the local authority and consists generally of bulky items like, beds, cookers and garden waste.
- Controlled waste includes hazardous municipal and household waste; industrial waste, commercial waste, clinical waste and radioactive waste that requires waste management license for treatment, transfer and disposed of.
- Commercial waste rises from any premises that are used wholly or mainly for trade, sports recreation or entertainment, excluding municipal and industrial waste.
- Clinical waste which consists of wholly or partly human or animal tissue, blood or other body fluids, excretions, drugs or other pharmaceutical products, swabs or dressings or syringes.
- Radioactive waste consists wholly or partly of substance contaminated by radioactive material or radioactive waste.
- Composting waste includes garden and kitchen waste are converted into a stable granular material applied to land to improve soil.

Waste Management Strategies

- Compositing- is a way of harnessing the natural process of decomposition to speed up the decay of waste. This requires an accurate understanding of biological, chemical and physical processes.
- Municipal trash collection.
- Compactor is the most effective strategy for those faced with high volumes of both trash and recyclable materials.
- Sewage treatment is mostly applied by organizations in Indonesia as a way to make waste safer for the environment and the people in the community. It involves the process of removing contaminants from municipal waste mainly household sewage and industry sewage.

Therefore, waste management is the need of the time while the sustainability must be infused in all components considering the supply and demand of the resources. It is inevitable that the wastes are now resources and it is our responsibility how we are going to use them. As evident from the past experience, it is not easy, but not impossible if we really consider the Earth as “our home”.

Impact of Climate change on Ecosystem: Climate change will have worldwide impact on ecosystems (IPCC, 2007). An increase in global temperature will not only result in the melting of poles and glaciers with an increase of the sea level. Besides, this increase in temperature will alter species composition in ecosystems. On land, desertification and droughts will also threaten humans.

Strategies for adapting to Climate change:
Passive adaption to improve the resilience of natural systems, allowing them to adopt to change

- Maintaining functional areas
- Ensuring representativeness of environment and associated processes
- Removing and minimizing exiting stressors
- Restoring habitats and system dynamics
- Identifying and protecting climate Refugio
- Managing connectivity
- Increasing matrix permeability and functional connectivity
- Transformation to fundamentally alter ecological processes in an attempt to pre-empt change where irreversible impacts are expected to occur.
- Keystone structuring of changed systems
- Species translocations
- Ex situ conservation

CONCLUSION

This review indicated that the environmental awareness programme led to an increase in knowledge about ecosystem services and biodiversity and their drivers of change among secondary school students. Education is the medium that gives us the skills techniques, information, and knowledge necessary to recognize, comprehend, and respect the responsibilities we have to our communities, families, and country. Although the students’ knowledge improved with education and the students

showed positive attitudes, there is no guarantee that the knowledge and attitudes will persist over time. Possibly, one can only hypothesize that this education programme could contribute to knowledge, attitudes and views that are more stable and that will persist. It would be important to test the effect of a similar education programme that last for a longer teaching period and/or have more lectures. By creating knowledge, encouraging action, and increasing awareness, it acts as a catalyst for the protection of biodiversity. We can develop a more environmentally conscious society that celebrates and preserves the amazing diversity of life on Earth by implementing environmental education into formal and informal learning environments. In conclusion, environmental education plays a crucial role in fostering awareness, knowledge, and skills needed for the conservation of biodiversity and waste management.

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