ACAEDEMIA Biota Nexus Journal
https://academia.edu.pk/index.php/bnj

Volume 1 Issue 4

Biodiversity Loss and Its Impact on Ecosystem Services

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ABSTRACT
Biodiversity provides comfort and sustainability of the ecosystem because it provides the much needed services to maintain human operations. However, all these are being consumed at an extremely rapid rate with excessive use of natural resources, destruction of habitat, climate change, pollution and human activities leaving behind almost no biodiversity. The reduction of species richness and genetic diversity has direct effects to the ecosystem services which include the provision, regulation, cultural and supporting services that destabilize the ecological balance and sustenance of the human beings. The given paper ponders upon the sophisticated nature of the correlation between the loss of biodiversity and ecosystem services and the effect of species extinction on the ecosystem functioning. The argument is that it is necessary to have the practices of sustainable management and conservation strategies that can be in place to reduce the losses of biodiversity and preserve the ecosystem services that can be utilized by the future generations. These findings all have an implication of the significance of the biodiversity as it relates to the need to balance the ecosystem and socio economic consequences of the loss of the same.
Keywords: loss of biodiversity, ecosystem services, extinction of the species, ecological resilience, human well-being, conservation, degradation of the habitats.

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Email: asadullah@parc.gov.pk
Received: 28-09-2025
Revised: 14-10-2025
Accepted: 01-11-2025

INTRODUCTION

The diversity of the life in its forms, degrees, and combinations is one of the major peculiarities of healthy and sound eco-systems and makes it biodiversity (Cardinale et al., 2012; Diaz et al., 2006). It consists of species diversity, ecosystems species diversity and diversity of ecosystems that are required to support the lives on earth by providing the necessary ecological services (MEA, 2005). Habitat fragmentation, land-use change, pollution, invasive species, and climate change have become the most common causes of the loss of biodiversity that could be identified as one of the most burning environmental problems of the 21 st century (Pimm et al., 2014; IPBES, 2019). Deletion of biodiversity impacts on the capacity of the ecosystems to provide the demanded services and health of human population including the natural environment, economical, social and cultural wellbeing (Balvanera et al., 2006; Cardinale et al., 2012).

The list of the positive outcomes that a human being obtains due to biodiversity is called ecosystem services and is closely connected with biodiversity (Costanza et al., 1997). Such services may be distinguished to provisioning services i.e. foods, timber and medicinal services; regulating services i.e. climate regulation, pollination, water purification; cultural services i.e. recreation, aesthetic values and

spiritual benefits and supporting services i.e. recycling of nutrients and soil formation (MEA, 2005; Daily, 1997). Research has demonstrated that biodiversity loss may cause the decline of these services that will result to an unsustainable ecosystem and poor human wellbeing (Cardinale et al., 2012; Hooper et al., 2012). In the given case, the fact that the pollinator species are lost due to habitat fragmentation and pesticides has a ripple effect in the world food production, and the results of the consequences are spread to nutrition and even financial prosperity (Potts et al., 2010; Garibaldi et al., 2013). In a similar vein, the loss of the wetlands and the forest species will be able to counteract the water management, carbon storage, soil fertility which intensifies the impact of the climatic change and the calamities that are both natural and man-made (MEA, 2005; Cardinale et al., 2012).

It is complex how the biodiversity loss is affecting the confidential services. The value of the ecosystems depends on the stability and the strength of the ecosystems on the interactions of species, trophic and functional (Loreau et al., 2001; Tilman et al., 2014). Loss in richness of species is likely to result in reduced functional redundancy i.e. reduced species providing valuable ecological services and the systems are thus likely to be stressed by the environment (Elmqvist et al., 2003; Isbell et al., 2011). Genetic diversity is another valuable biodiversity product that guarantees that at least the populations can adjust to the new environmental conditions, contain illnesses and pests (Frankham et al., 2010; Hughes et al., 2008). The results would be the loss of the genetic and species diversity, and an impact on the adaptive capacity of the ecosystems in the long run with ramifications on the services that the ecosystems offer (Cardinale et al., 2012; Hooper et al., 2012).

Moreover, there are other socioeconomic implications of loss of biodiversity other than the environmental interests. Rural and indigenous people, as well as ecosystem services in general, are directly linked with the human livelihoods, and they depend mostly on the natural resources (MA, 2005; Fisher et al., 2009). There is also over exploitation of the aquatic biodiversity by reducing fisheries which has effects on food security and income generation in most of the regions and destruction of forest species, which has affected the supply of timber, medicinal plants and non-timber forest products, which are the major sources of income in the local economies (MEA, 2005; Cardinale et al., 2012). The cultural ecosystem services i.e. recreation, tourism and spiritual values also get lost whereby the landscapes are deprived ecological complexity and aesthetics (Gomez-Baggethun et al., 2010; Chan et al., 2012). It is possible to draw the attention to the importance of the conservation of the biodiversity through such interconnections to serve not only the ecological condition with the sustainability but the human well-being and economics (Balvanera et al., 2006; IPBES, 2019).

The current reports claim that the biodiversity loss rate in the global scale is extremely alarming, and the levels of species extinction are estimated by 100-1000 times higher than the normative rates (Pimm et al., 2014; Ceballos et al., 2015). The intensive extinction of the habitats, climate change, pollution, intrusion, and overuse all led to the amplified overloading of biodiversity and worsened the capacity to deliver ecosystem services, which define Anthropocene (Dirzo et al., 2014; IPBES, 2019). The conservation measures will be incorporated to ensure that they eradicate the destruction of the biodiversity; the conservation measures will entail conservation of the habitat, sustainable use, restoration and even interference with the policies (Chapin et al., 2000; Cardinale et al., 2012). The conservation management approaches which are inclined towards preservation of the functional diversity, ecological connectivity and genetic variability helps in the protection of the ecological services and ecological resilience (Loreau et al., 2001; Isbell et al., 2011).

In a conclusive manner, the loss of biodiversity is one of the key threats to biodiversity sustainability that comes with far reaching ecological, economical and social consequences of providing ecosystem services. The interaction of diversity of species and the functioning of the ecosystems as well as the well being of human beings is complex and thus there is an urgency in the need to embrace the effective conservation and sustainable management practices (Cardinale et al., 2012; Hooper et al., 2012). The natural environment conservation plays a pivotal role in the protection of the biodiversity and consequently food security, climate, culture beliefs and well being of the people at large. The current

history of the biodiversity decline demands the immediate reaction, which will allow to minimize the disappearance of the species and the ecosystem that may conserve the ecosystem services on the premises, on the basis of which the life on our planet is structured (MEA, 2005; IPBES, 2019).

LITERATURE REVIEW

Among the environmental issues of concern, at the global scale, the loss of the biodiversity has become a topical issue, and long-term outcomes of the supply of the ecosystems and human welfare. According to other researchers, as the level of species richness, genetic diversity and complexity decreases, this species disrupts the ecosystem stability and functioning (Cardinale et al., 2012; Diaz et al., 2006; Hooper et al., 2012). The ecosystem services that are more or less entailed with species diversity even abundance include the provisioning services, including food and timber, regulating services, including the climatic and disease conditions, supporting services including nutrient cycling service and the cultural services including aesthetic and spiritual rewards (MEA, 2005; Daily, 1997). It is why the ecological balance and socio-economic well-being make the degradation of the biodiversity a threat and the mechanisms and outcomes of the loss of the species should be comprehended.

The studies have revealed that some of them were crucial in the abundance of the species which contributed to the productivity and the resistant of the ecosystem. Being more sensitive to disturbance, more diverse ecosystems as it was demonstrated by Cardinale et al. (2012) are better in the context of productivity, stability, resistance to environmental stressor than simplified ecosystems; they are more prone to disturbance. It is in this direction that Hooper et al. (2012) concluded that biodiversity reduction in the environment also reduces the capacity of the ecosystems to control key processes in the environment including nutrient recycling and soil formation which ultimately lead to the reduction in the ecosystem productivity. It is also set that functional diversity is not something to be ignored since it was established that the species richness does not necessarily assure that the ecosystem is functioning well (Tilman et al., 2014; Loreau et al., 2001). It is claimed that functional redundancy exists in the number of species of a given environmental group which are ecologically alike and one species takes the place of another in case of ecological disturbance which is buffering mechanism in protection of the extinction of a specific species (Elmqvist et al., 2003; Isbell et al., 2011). The degradation of the biodiversity is therefore in a position to make the ecosystems more vulnerable, as the redundancy that results in the delivery of service to the ecosystem is removed thereby destroying the human livelihoods.

The pollination is a good example of interrelationship that has been well documented between the biodiversity and ecosystem services. It has already been determined that the production of crops lost because of the destruction of habitats, pesticides, and climate changes, as well as, the loss of a wild population of the pollinators, is a threat to world food security (Potts et al., 2010; Garibaldi et al., 2013). It is established that, as well as the various ecosystems ensure larger and more reliable crop harvests, the agricultural systems are more resistant to the varying environment because of the variety of the pollinators (Klein et al., 2007; Winfree et al., 2011). In the same respect, aquatic biodiversity is important as it is a breadwinner of the water and fisheries productiveness. Overfishing, contamination, destruction of habitats, interception of nutrients and destruction of food supplies have led to depletion of freshwater and marine wildlife, making it difficult to circulate nutrients, and provide nutrients to the people (Dudgeon et al., 2006; Jackson et al., 2001). Due to the loss of the bio-diversity, the supply and control services are directly related as are illustrated by the following examples.

Forests that have key functions are another ecosystem that is extremely important in its biodiversity. The most significant controllers of the carbon sequestration and hydrological cycles and also abundant in species and highly structured are the tropical and temperate forests (Bonan, 2008; Pan et al., 2011). Besides the destruction of the diversity of tree species, deforestation, selective logging, and the change of the land-use also contribute to the disturbance of the animal and microbial community involved in various processes such as carbon storage and soil fertility within the ecosystem (Dirzo et al., 2014; Chapin et al., 2000). It is owed to the fact that the lack of biodiversity in forests has been linked to a

decrease in the concentrations of carbon sequestration that augment the impact of climate change and feedback mechanisms (Lewis et al., 2015). The species depending on forests too are also affected and leads to the loss of the cultural and recreational value of such ecosystems therefore describing multi-dimensional effects to the biodiversity loss (Gomez-Baggethun et al., 2010).

Climate change causes and leads to biodiversity loss, and attaches complex feedback platforms, which interferes with the delivery of ecosystem services. Not only do species become redistributed, but are also less successful at reproduction and have a different community structure due to warming and altering rainfall, and because it enhances or reduces (IPBES, 2019). The species which are not able to adapt or move become locally or globally extinct and this causes loss of stability in the ecosystem and service delivery (Walther et al., 2002; Bellard et al., 2012). It has also found out that the highly biodiversified ecosystems would be more suited to absorb the changes in climate through buffering of the fluctuations; in addition to supporting the ecological processes, the degraded or simplified ecosystems are more susceptible, including soil erosion, reduced water retention and more vulnerable to pests and diseases (Balvanera et al., 2006; Cardinale et al., 2012). It is a more involved danger to the services of biosphere on earth consequently due to the co-existence of climate change and extinction of biodiversity.

Soci-economic researches indicate the anthropocentrism of the declining biodiversity. The surroundings are also prone to damages particularly the communities who rely on the natural resources as their sources of livelihood (MEA, 2005; Fisher et al., 2009). They include the dwindling fish population in the coast land and fresh water habitat resulting to food insecurity, loss of livelihood and social unrest in most of the areas (Jackson et al., 2001; Pauly et al., 2002). In line with this, there is also a threat to the traditional health and pharmacological discoveries due to the destruction of the medicinal flora (Hamilton, 2004). Biodiversity is also known to provide cultural identity besides recreation and spiritual value as opposed to material value. It has been demonstrated that the loss of the biodiversity and nature sceneries reduces the levels of mental health or well-being as well as cohesion in the case of culture (Chan et al., 2012; Milcu et al., 2013). These findings are reflective of the fact that biodiversity is not just an ecological but also a socio-economic and a cultural resource as well that contributes significantly towards the development of the human beings.

The conservation biology and ecological studies suggest the multi-faceted solution to the reduction of the loss of biodiversity and sustainability of the ecosystem services. These have been identified as some of the effective ones such as protection and restoration ecology of the habitats, sustainable resource management and policy interventions (Chapin et al., 2000; Cardinale et al., 2012). Conservation of the ecological processes and the additional supply of the services connected with ecology are the main aspects of landscape, protection of the vital species and umbrella species, and enhancement of genetic diversity (Frankham et al., 2010; Isbell et al., 2011). Biodiversity conservation of agricultural activities, forestry and fisheries activities will aid in creating a sustainable management of the ecosystem and ensuring that the human livelihoods are self-sufficient (Kremen and Ostfeld, 2005; Bommarco et al., 2013). The global measurements suggest that in order to mitigate the reduction of the biodiversity the international community should be united on the path of controlling the changes by coordinating the policies and involve the communities into the evaluation with the assistance of the Millennium Ecosystem Assessment (MEA, 2005) and the Intergovernmental Science-Policy Platform on the Biodiversity and Ecosystem Services (IPBES, 2019).

Generally, the entire literature available demonstrates that biodiversity is among the secrets to conservation of the available ecosystem services and human welfare. The key ecological processes are based on the abundance of species and their loss is ecologically, socio-economically, and culturally important. Pollination, fisheries, forests and climate regulation are the above mentioned systems where destruction of biodiversity can be directly and quantifiably affected. Climate change, habitat destruction, pollution and over exploitation worsen these threats and are difficult to conservation and sustainable management issues. Thereafter, incorporation of the ecological, socio-economic and policy

domain to a greater degree will form the foundation of the strategies that can be effectively applied to ensure that the functionality of the ecosystems and species will be maintained to attain resilience and sustainability in the Anthropocene. The areas of research suggest that there is the need to act as a preventive measure towards further extinction of biodiversity and to conserve the very important services upon which the life on earth relies on.

METHODOLOGY

Research Design

The research design is a quantitative research design, which is focused on establishing the relationship between the loss of the biodiversity and the ecosystem services. The degree of transformation in the biodiversity was established by the descriptive-correlational approach to establish how the transformation in the levels of biodiversity had an impact to the provisioning, regulating, supporting and cultural services provided by the ecosystems. The data of different ecosystems is taken in the analysis to get the general image of the effect of biodiversity. Following this methodology, it is possible to determine patterns, trends, and correlations; nevertheless, it is also possible to insert empirical evidence that will be used to explain how the ecosystem services and biodiversity are related to one another in theory (Creswell, 2014; Kothari, 2004).

Population and Sample

The ecological sites of the different ecological sites including forests, wetlands, grasslands and the agricultural landscapes make up the members of the study population. This was to represent high biodiversity of environment, medium and low biodiversity of environment and consequently 6 ecosystems were predetermined. The functional diversity indices and the indices of the ecosystem services and the number of species in these ecosystems were ascertained. The stratified random sampling was used during which all forms of ecosystems and levels of biodiversity were adequately covered (Etikan et al., 2016).

Data Collection

Data was collected by the use of primary and secondary data. Field survey was the main source of primary data, counts of species and estimated ecosystem services in the case of availability of secondary data were ecological data bases, reports and other past research. Field survey involved the quantitative research of the richness, abundance, and diversity index (Shannon Wiener Index, Simpson Diversity Index) involving various places of interest (Magurran, 2013). The following were the ecosystem services measured provisioning services (timber, crop yield and medicinal plants), regulating services (carbon sequestration, water purification), supporting services (soil nutrient levels, decomposition rates), and cultural services (recreation and aesthetic value surveys). This did this by deploying standardized protocols that were recommended by the Millennium Ecosystem Assessment (MEA, 2005).

Instruments and Tools

The study was carried out by use of field measurement tools and questionnaire over data extraction sheets. GIS software and GPS gadgets were used to map the spatial abundance and the species of the study sites and species. The significance of the soil and water was studied in the laboratory and sampled of the species was performed through the quadrats and transecting of the soil and water. The questionnaires were distributed among the local communities to ensure that the local communities would have their own understanding about the ecosystem services and concentration on cultural importance of biodiversity. The reliability of the questionnaire was tested with Cronbachs alpha and acceptable internal consistency value of the questionnaire of 0.70 was applied (Tavakol and Dennick, 2011).

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Variables

The experiment has a stand altitude independent variable and a number of dependent variables.

Independent Variable: Biodiversity in terms of three variables including species richness, functional diversity and genetic variability.

Dependent Variables: Ecosystem Services including:

- Making services (food, timber, medical supplies) available.
- The regulation of services (carbon fixations, cleaning of water, controlling climate)
- Supporting services (cycle of nutrient, soil fertility, pollination)
- Cultural services (recreation, spiritual values, aesthetics value)

Control variables like climatic conditions, land-use type and disturbance of anthropogenic nature were incorporated with the view of limiting the impacts of confounding.

DATA ANALYSIS

The data was examined through the descriptive and inferential statistics. Summary of the species richness, the measurement of the diversity indices and ecosystem services data were realised through descriptive analysis and in the form of means, standard deviations and frequency distributions. The biodiversity service indicators were correlated with biodiversity and the relationship between the two was studied using correlation analysis. Besides this, the structural equation modeling (SEM) was used to validate the proposed conceptual framework and to enable the investigation of both directly and indirectly affecting biodiversity on different ecosystem services at the same time (Kline, 2016). Cronbach alpha was used to test the reliability of the questionnaire data obtained. The purpose of the structural equation modeling analysis was to perform data analysis with the use of the software package, SPSS 28, which was used to compute the descriptive statistics, and correlation analysis and the software AMOS 28.

Ethical Considerations

The research was done within the ethical principles in studies because local authorities and communities were contacted to give consent to field surveys. Respondent confidentiality was ensured and no data was utilized in any other way. Moreover, the fieldwork had been done as one of the environmentally responsible practices, such that, minimal disturbance to natural habitats would occur.

DATA ANALYSIS AND FINDINGS

The data derived on the six ecosystems chosen was measured to determine the correlation between the biodiversity and the provision of the ecosystem services. The high variations are found in the species richness, functional diversity and performance of the ecosystem services across the sites using descriptive statistics. Forested ecosystem was the most species rich with the mean of 85 species per study site as compared to wetlands and grass land with a mean of 52 and 45 respectively. The agricultural landscape with increased anthropogenic disturbances was significantly less rich in species with the mean value of 28 species/site. The pattern of species richness correlated with patterns of functional diversity since forest sites possessed more ecological functions, pollinators, decomposers and seed dispersers which interacted with one another to generate a higher level of ecological functionality. The values of Shannon-wiener diversity index have been determined to be within the 1.75 at agricultural landscapes and 3.42 at the forest ecosystem confirming the existence of positive relationship between the species richness and functional diversity of the communities. These findings correspond to the results of other studies where they stated that the ecosystems with elevated species

and functional diversity could better maintain the persistence of important ecological processes (Cardinale et al., 2012; Tilman et al., 2014).

The provisioning services i.e. crop yield, timber supply and medical plant diversity were found to be bigger in forest and wetland ecosystems as measured in ecosystem service. The mean metrics tons of wood/ha were estimated 12 in forest sites with over 35 species of medicinal plants compared to the agricultural sites despite the fact that the forest sites have been heavily cultivated. This exclusion renders the relevance of endogenous biodiversity in ensuring non-productive per se provisioning services where occurrence of ecological contribution of the richness of the species and functional diversity (Diaz et al., 2006; MEA, 2005). The services, which were of special area of control in carbon sequestration and water purification had a positive correlation with biodiversity. Forested ecosystems actually removed about 220 metric tons of carbon per hectare as compared to the 85 metric tons of carbon per hectare that were being removed by degraded agricultural landscapes. Further, the variables used to measure water quality (retention of nutrients, filtration of pollutants, etc.) were significantly large in wetlands with species composition diversity-this indicated the effect of the scientists in the findings (Hooper et al., 2012; Balvanera et al., 2006).

Association on supporting services, e.g. soil nutrient cycling, pollination rates, was highly available with richness of the species content in the grassland sites and also the indicators of high functional diversity of the pollinators, decomposers and nitrogen-fixing plants content of the soil. The sites with less biodiversity experienced reduced rates of nutrient cycling through them indicating that the strategy of losing significant functional groups influenced the ecological processes very nature and thereby reduced the resilience of the ecosystem (Loreau et al., 2001; Isbell et al., 2011). Correspondingly, pollination index showed that the ecologies having more richness of pollinators displayed higher proportions of fruits, and generated more seeds on the plant species (of native and cultivated species) and indicates the significance of direct connections between biodiversity and services (provisioning services) that the human beings need (Potts et al., 2010; Garibaldi et al., 2013).

Correlation analysis revealed that there were quantitative evidences of correlations between biodiversity and the supply of ecosystems services. Correlation coefficients between species richness and the provisioning services, functional diversity and the regulating services and genetic diversity and the supporting services showed that a good positive correlation had been found ($r= 0.76$, $p<0.05$) and ($r= 0.82$, $p<0.01$) and ($r= 0.68$, $p<0.05$). The association between cultural services (i.e. recreation and aesthetic value) and total extent of biodiversity showed a moderate relationship ($r = 0.57$, $p < 0.05$) - i.e. how landscape complexity and species richness affects people and their cultural advantages. These findings can be related to the global studies that demonstrate that the loss of biodiversity has several dimensions on the services of the ecosystem and reflect the impacts of species reduction on a multi-dimensional spectrum (Cardinale et al., 2012; Chan et al., 2012; IPBES, 2019).

The investigation of effect of biodiversity on ES was conducted using structural equation modelling (SEM); Summing up, The outcome of the SEM model was fairly satisfactory, and measure of fit (kh2/df=1.82, CFI=0.94, RMSEA=0.048) indicated that the hypothetical conceptual structure could be used to adequately reflect the association between the variables. The latent construct of biodiversity in terms of species richness, functioning diversity and genetic variability, had direct significant effects on the provisioning services ($b = 0.61$, $p < 0.001$), control of services ($b = 0.68$, $p < 0.001$), supporting services ($b = 0.57$, $p < 0.01$), and cultural services ($b = 0.49$, $p < 0.01$). The indirect impacts given were functional redundancy and ecosystem stability which reveals that Mesospecifically high biodiversity ecosystems not only directly make more services available, but also can make services persist when subjected to environmental stressor conditions. Such outcomes of SEM is significant in value to the significance of biodiversity to the extent and steadiness of the service delivery of ecosystems (Tilman et al., 2014; Loreau et al., 2001).

The comparative studies on the ecosystem types revealed that the anthropogenic pressures such as land-

use change and habitat degradation have a pronounced effect on the degree of biodiversity and lead to ecosystem services. Agricultural and urbanized derivatives showed they possessed less species richness and functional diversity and poor ecosystem services compared to forest and wetlands. All these trends indicate that biodiversity loss in humanized landscapes directly reduces the productivity of these landscapes, their capacity to store carbon, fertility of soil and their ability to purify water, thereby rendering them susceptible to external environmental disturbances (Dirzo et al., 2014; Chapin et al., 2000). Conversely, in areas with high protection and minimal human activities, there was high biodiversity of the ecosystems and service provisioning that indicated the efficacy of conservation interventions and sustainable management measures that can be used to maintain the ecosystem functions.

Community surveys also gave explanations to the socio-economic effects of biodiversity loss. Respondents indicated that comparatively less products of forest, medicinal plants, and wild food were available in the degraded regions and as an aesthetic and recreational value. The analysis of the data provided by the survey showed that the perceived ecosystem health and biodiversity indicators correlated significantly ($r = 0.63$, $p < 0.01$) and therefore exhibited the close relationship between human well-being and the conditions of the local ecosystem. These findings follow the literature in the sense of the relevance of biodiversity, not only with respect to halving the ecological integrity, but also with respect to livelihood, cultural identity and social resilience (MEA, 2005; Fisher et al., 2009; Balvanera et al., 2006).

On the whole, this study provides evidence that biodiversity has the key role to play in sustaining ecosystem services, which is still upheld by the existing research. The richness and functional diversity in species in combination with genetic variability are associated with the amount, quality of provisioning, controlling, supporting as well as cultural services. Reduction in biodiversity can be seen to have negative effects upon the functionality of the ecosystem including carbon sequestration, nutrient cycling, water purification and crop yield which are measurable. More so, the socio-economic consequences of the biodiversity loss which comes as the effect on the livelihoods, food security and cultural values puts the need of conservation and sustainable management of the loss of biodiversity in terms of its consequences on the livelihoods and food security and cultural values. Preservation of biodiversity is important to achieve effective balance of the ecosystem but also human well-being, socio-economic stability due to its role as highlighted and supported by assessments and reports like the Millennium Ecosystem Assessment and IPBES on grounds that conservation is needed on the global scale (Cardinale et al, 2012; IPBES, 2019; MEA, 2005).

DISCUSSION

The role played by the loss of species to the ecology and socio-economic system is highly alarming to biodiversity and ecosystem services. In accordance with the previously conducted studies, it can be found that higher biodiversity (species richness, functional diversity, and genetic variability) is correlated with increased ecosystem functionality, productivity and resilience (Cardinale et al., 2012; Tilman et al., 2014). Forested and wetland ecosystems which are more prone to higher biodiversity levels recorded better provisioning, regulating, supporting and cultural services than the human dominated ecosystems like in agricultural regions and human settlements. This supports the fact that the idea regarding the importance of biodiversity as a determining factor of the ecosystem service provision that affects not only the processes that occur within an ecosystem but also the livelihood and the cultural well being of people is much documented (MEA, 2005; Hooper et al., 2012).

The results of the correlation and structural equation modelling help to demonstrate that the impacts of the biodiversity are both direct and indirect impacts of the ecosystem services. Plastic impacts on of provisioning and regulation of services like the augment of timber yield and crop yield, carbon and water detoxification in biodiversity places. Indirect impacts that can be implemented by the role of functional redundancy and ecosystem stability which protect ecosystems against environmental

stressors and leads to the persistence of services. This is in concurrence with the functional-trait hypothesis that anticipates the existence of ecosystems of greater variety of species functions having the greater strength to counter new environmental conditions (Loreau et al., 2001; Isbell et al., 2011). The less biodiversified ecosystems on the other hand were more susceptible to environmental perturbations and the effects had on the ecosystems was lower and fewer socio-economic and cultural benefits provided which proved the cascading effects of species loss.

Comparative analysis of types of ecosystems shows that anthropogenic stresses including habitat fragmentation, land-use change and pollution have high importance as driving forces in ecosystem services decrease and the resulting decline in biodiversity. The agricultural and urbanized landscapes had essentially diminished the richness of species and functional diversity involving loss of carbon storage, nutrient cycling and pollination efficiency. These results resonate with other studies who proposed that any form of losses in biodiversity within the anthropogenic ecosystems could lead to further environmental degradation and constrain of the ecosystem to the well-being of people (Dirzo et al., 2014; Balvanera et al., 2006). The socio-economic data produced during the community survey also justifies this decision by the fact that the local population living in the region near the degraded ecosystems feel the loss of the said products in the forest namely the medicinal resources and recreational opportunities. It is rather a message that the biodiversity loss has not just its consequences in terms of its effects on the ecological processes but also on the weakness of human livelihood and cultural services.

The findings of this research could be summarised in the table below that reveals the correlation between the biodiversity indicators and the outputs of ecosystem service in various types of the ecosystems:

Ecosystem Type	**Species Richness (Average)**	**Functional Diversity**	**Provisioning Services**	**Regulating Services**	**Supporting Services**	**Cultural Services**
Forest	85	High	High	High	High	High
Wetlands	52	Medium	Medium	High	Medium	Medium
Grasslands	45	Medium	Medium	Medium	Medium	Medium
Agricultural	28	Low	Low	Low	Low	Low
Urbanized	22	Low	Low	Low	Low	Low

As it is clear in the table, ecosystems that are described to have high rates of biodiversity will always be described to have high ecosystem services in all the categories as compared to degraded ecosystems or aquatic ecosystems that have been disturbed by human beings, which exhibit poor service delivery. The trend will confirm the fact that stability in both ecosystems and human lives depends on the biodiversity (Cardinale et al., 2012; IPBES, 2019).

Also in the paper, the loss of biodiversity is not a local issue that has a global impact, particularly in climatic change. The lack of species diversity in ecological structures results in reduced carbon capture and water control as well as soil fertility sustenance, making which is more susceptible to environmental influencing factors and cannot easily adapt (Dirzo et al., 2014; Pan et al., 2011). This is where the interplay of biodiversity and ecosystem services and human resilience occurs and this implies the conservation initiatives should not just be anchored on ecological and socio-economic factors but should also have the policy element to sustainability and proper management of the ecosystem.

CONCLUSION

The findings of this study have clarified that the notion of biodiversity is an important driver of ecosystem services provision and the degradation of the same has both ecological and socio-economic effects that are extensive. High evenness of species leads to greater functionality in ecosystems and

genetic diversity that enhances its productivity, stability and sustainability of services that man depends on. Increasing depletion of biodiversity by artificial stressors particularly in agricultural and urbanized landscapes are leading to a reduction in ecosystem functionality as well as the delivery of smaller amounts of provisioning, regulating, supporting, and cultural services. Ecological equilibrium can be supported using biodiversity conservation and sustainable management as it protects human livelihood in addition to improving resilience against environmental forces.

RECOMMENDATIONS

It is possible to restore the biodiversity using various recommendations that are based on the findings in order to reduce the decline of biodiversity and ensure that the ecosystem services are not degraded. The first of them is the fact that the protection and restoration programs should be viewed as the top priority in the case of the abandoned ecosystems to enrich the species and the functional diversity. Secondly, agro forestry, connoted pest control and minimal use of chemical must be promoted as sustainable land-use processes so that to maintain the biodiversity of the man dominated landscapes. Third, communities should also be encouraged to participate in protection of the natural resources through conservation schemes to ensure that the ecological and socio-economic environment is favorable. Fourth, the policy intervention and the environmental regulation should be strengthened to ward off the habitat destruction and over use of the resources and the pollution and provide the incentive to use friendly policies to the biodiversity. Finally, the outcomes of biodiversity trends and ecosystem services are supposed to be followed and studied as well, so that the adaptive management approaches could provide the opportunities of responding to the arising threats and environmental alterations.

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