



BIODIVERSITY AND SUSTAINABLE DEVELOPMENT (SD): A LITERATURE REVIEW

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ABSTRACT

Biodiversity and ecosystem services contribute directly to development priorities. Nearly half of the world's population is directly dependent on natural resources for their livelihoods. Whereas, many of the most vulnerable people depend directly on biodiversity to fulfill their daily subsistence needs. Biodiversity is also at the center of many economic activities, including those related to agriculture, forestry, fisheries, and tourism. The importance of biodiversity and ecosystems is reflected in many of the SDGs and targets. Therefore, consideration of biodiversity and ecosystems will be essential as countries embark on the implementation of the 2030 Agenda and its SDGs, and in the implementation of key national priorities for sustainable development. Primarily, biodiversity is being viewed in the context of sustainable development and offers opportunities for poverty eradication, human well-being, and the livelihood and socio-cultural integrity of people, and in particular in developing countries that are rich in biodiversity but are poor and struggling to catch up with globalization challenges. Biodiversity constitutes the living natural resources that are found inhabiting our aquatic and terrestrial ecological systems. It underpins the provision of food, fiber, and water; it mitigates and provides resilience to climate change; it supports human health, and provides jobs in agriculture, fisheries, forestry, and many other sectors. Without effective measures to conserve biodiversity and use its components in a sustainable manner, the 2030 Agenda will not be achievable.

INTRODUCTION

Biodiversity plays a very important role in maintaining the natural cycle and ecological balance. These are the basis of existence, the wealth of humans, and the sustainment of nature on the earth. At the moment due to many different reasons biodiversity resources have been decreasing in the world. The term biodiversity or biological diversity describes the biological capital held within an area. It refers particularly to the differences between living organisms at different levels of biological organization - genes, individual species, and ecosystems Lockie & Ransan-Coope (2015).

It encompasses multiple values and is vital for the production of food and to conserve the ecological foundations needed to sustain people's livelihood. Besides, sustainable development is the development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. This includes taking into account the impact of present decisions on the options of future generations.

Biodiversity encompasses a variety of life forms on earth, including a variety of genes, species, ecosystems, and ecological processes (Agapow et al. 2004, Rathoure and Patel 2020). It is one of the key concepts in ecology and environmental protection that sustainable development depends on its efficient conservation (Haines-Young and Pots chin 2010, Williams et al. 2020).

In 2019, a report published by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) identified a 47% decline in the condition and extent of natural ecosystems compared to the earliest estimates available. The report also stated that more species on earth are now threatened with extinction compared to any other time in human history (IPBES, 2019). Thus, the IPBES report concludes that global biodiversity¹ can only be saved through 'transformative changes across economic, social, political and technological factors' (IPBES, 2019), including businesses and organizations.

Consequently, the design of the basket of biodiversity indicators seems to be key to supporting biodiversity conservation as an inappropriate basket may lead to the invisibility of biodiversity issues for intervention or interventions being incorrectly classified as

positive towards biodiversity conservation. On the other hand, Sobkowiak et al. (2020) aimed to problematize the indicator framework agreed on under the UN Sustainable Development Goals (SDGs) and the underlying expectations within that framework assuming that accounting for national biodiversity should be globally comparable and commensurable. Instead, they highlight how national biodiversity indicators have to be policy-relevant and applicable to local biodiversity differences and priorities and as such require a bottom-up construction process, rather than the generic top-down approach implemented through the SDG indicator framework.

Sustainable development is the integration of economic, social and environmental development considered as the interdependent and mutually reinforcing pillars which operate at the local, national, regional and global levels. Poverty eradication is the change in unsustainable patterns of production and consumption and the protection and management of natural resources based on economic and social development are constantly cited as the over-arching objectives and essential requirements for sustainable development.

The importance of biological diversity to sustainable development is obvious. Beyond the intrinsic value we ascribe to living organisms and assemblages, biodiversity contributes to numerous ecosystem processes that support ecological, economic, and social well-being. Biodiversity enhances the ability of ecosystems – including heavily modified ecosystems such as those found in farms, gardens, cities, and towns – to cope with climatic and environmental shocks Lockie & Ransan-Coope (2015).

Biodiversity's direct contributions to sustainable development are numerous and wide-ranging. People benefit from biodiversity in many ways that are under-appreciated or ignored. The 2030 Agenda for Sustainable Development (the 2030 Agenda) comprises 17 Sustainable Development Goals (SDGs) (Blicharska et al. 2019).

The 2030 Agenda recognizes that the achievements of the 17 SDGs are linked to human and planetary prosperity, strengthening universal peace, and greater freedom, and promoting the eradication of poverty, discrimination, and inequalities in all forms (UN, 2015). SDG5, 'Achieve gender equality and empower all women and girls', reflects the ever-increasing efforts of the UN towards gender equality, earmarked with the establishment of the Commission on the Status of Women in 1946 (UN Women, 2020) and the adoption of landmark agreements such as the Convention on the Elimination of All Forms of Discrimination against Women in 1979 (OHCHR, 2020). The recognition of the important role of women in global, social, economic, and environmental prosperity is clearly stated in paragraphs 236–243 of the 'Future We Want' (UN, 2012) and in the Open Working Group Proposal for Sustainable Development Goals (2014).

The declaration produced at this summit stated that every effort must be made to counter the irreparable damage caused by human activities that threaten our planet and our people. The basis of this effort to this was drawn from The Millennium Development Goals (MDGs). The MDGs did not specifically address the need to conserve biodiversity, but more generally emphasized sustainable management of the natural resource base and ecosystems. However, as the international community started to embrace the idea of sustainability, the conservation of biodiversity was beginning to be included as a priority. Even before the MDGs in 1992, the Convention on Biological Diversity (CBD) was signed by 157 countries. The CBD represented a historic commitment to conserve biological diversity, its sustainable use, and equitable sharing of benefits arising from that use. It also recognized that biodiversity is at the heart of sustainable agricultural systems and plays a major role in the provision of ecosystem services, and the insurance of life itself, (Convention on Biological Diversity, 2019). The further integration of biodiversity and sustainability is reflected in the 2015 Sustainable Development Goals (SDGs) where the protection and value of biodiversity are specifically addressed in two of the SDGs: Goal 14—Life below Water, and Goal 15—Life on Land (United Nations Sustainable Development on Sustainable Development Goals, 2019).

One of the more cogent arguments for biodiversity preservation is that the maintenance of biodiversity is crucial for ecosystem function and services that also link biodiversity and sustainability (United Nations Educational, Scientific and Cultural Organization, 2019).

Types of ecosystem services are often differentiated. Provisioning services refer to the useable materials or energy that people obtain from ecosystems such as food, water, medicines, and other materials including those for income generation.

Globally, people use tens of thousands of species to sustain their lives in some way. As a result, biodiversity conservation must be considered in conjunction with the economic and social components of sustainability. Effective biodiversity conservation, therefore, cannot be separated from the elimination of poverty, women's health, education, and economic enfranchisement (Craven, et al., 2019). The global centric perspective on conservation led by the north does not always account for the needs among stakeholder groups, but rather, it sees the solution to the biodiversity crises as imposing limits to development and resource use including those harvested for income generation. This approach has been referred to as bio-imperialism which is in contrast to sustainability objectives that require bio-democracy. Also, we need to recognize that the increasing relationship between biodiversity conservation organizations and the private sector makes biodiversity conservation an organized political act that could favor income generation for larger business over community stakeholders. This could include large development projects which both threaten biodiversity and limit income generation by local stakeholders (MacDonald & Devil, 2010).

Regenerative sustainable agriculture techniques must be promoted, but in a way that avoids external or government enforcement. Community-based outreach and demonstration that these techniques at the farm level can actually increase yield over the long term are more effective. This requires knowledge that enables an understanding of biodiversity and how it can be managed to attain sustainable development (Maleksaeidi, et al. 2019). Also, community and individual value of agricultural biodiversity must be cultivated, as should both measures of biodiversity and agrobiodiversity (Maleksaeidi, et al. 2019; Sajise, 2019).

Gabel et al. (2018) compare methods of assessment to evaluate on-farm biodiversity finding that each of them exhibit strengths and weaknesses, again a strong argument for further research on quantifying biodiversity.

Currently, humanity is facing major environmental, social and economic problems worldwide. To address these global issues on

an international cross-border level and to create a more sustainable and better future for all, the United Nations adopted the 17 Sustainable Development Goals (SDGs) in 2015 (United Nations, 2015). Each of the SDGs has indicators that are used to measure progress toward achieving the goals (United Nations, 2017). The individual goals do not stand alone but rather influence each other and are closely linked (Bali Swain and Yang-Wallentin, 2020; Nilsson et al., 2016; Pham-Truffert et al., 2020; Pradhan et al., 2017); each goal addresses environmental, social and economic problems (Elder and Olsen, 2019).

On the other hand, Lockie & Ransan-Coope (2015) argued that sustainable development has to do with meeting the needs of people living in the present without compromising the ability of future generations to meet their own needs has proven a compelling and enduring idea. But moving from general principles of sustainability to concrete actions has always proven difficult.

Moreover, Agyeman and Evans (2004), noted that decisions about sustainability must either accommodate multiple viewpoints, values, and interests or they must force some people to compromise. Too often – as the environmental justice movement has demonstrated – it is those who are already socially and economically marginalized who are forced to do the compromising.

Despite these difficulties, Lockie & Ransan-Coope (2015) further noted that the ideas of sustainability and sustainable development provide useful concepts for discussing the goals and outcomes of environmental and social interventions. Further, by speaking to how we should live in the world, sustainability, and sustainable development become more than concepts or ideas. They become a sort of bridge connecting our thinking and planning about the future to actions and consequences embedded in material ecosystems and social processes.

On the other hand, Matta et al, (2011) noted unsustainable development primarily due to fact that there is a division of human society into the rich and the poor, and there is an ever-increasing gap between the developed and the developing worlds. The global environment is presently under stress because (a) here are high population growth rates acting in concert with other human indicators as underlying causes for habitat degradation and destruction. (b) There is the continuing loss of biodiversity at rates much higher than can be replenished. (c) With the use of modern harvesting and other new technologies essential biodiversity, stocks continue to be depleted. (d) As a result of our own actions and inactions, desertification has claimed more and more fertile lands. (e) The adverse effects of climate change are being witnessed every day. (f) Natural disasters have become more frequent and more devastating. (g) Several developing countries have become more vulnerable to economic hardships and have several compelling reasons to mortgage their natural resources for debt relief, and (h) Air, water, and marine environments continue to be polluted through our industrial activities. 3. The benefits and costs of globalization are unevenly distributed, and these have presented a new set of difficulties for developing countries to meet the globalization challenge. If nothing is done to reverse these global trends, the disparities will become entrenched, and sustainable development as a final goal for the global order will not be achieved.

Drawing on Lockie (2012), it is argued here that the pursuit of sustainable development thus imposes at least three interrelated sets of demands. First, sustainability demands learning. As global environmental change illustrates, the temporal and spatial dynamics of human-nature interactions are characterized by processes of discontinuous change, interactive effects, and unanticipated consequences (Lockie 2014). Maintaining a favorable environment for humans in the long term can never be about maintaining steady-state ecosystems, communities, or economies (Steffen et al. 2007). Nor can it be about continuing to plan on the basis of current knowledge and institutional arrangements for environmental governance. Today's knowledge of Earth-system processes and other socio-ecological assemblages will necessarily be proven incomplete and outmoded as species and ecosystems – along with human communities and institutions – evolve in potentially unpredictable ways. In practice, this would be about re-designing our institutions to build in ongoing learning, as well as the ability to be flexible in light of new knowledge and understanding. The future must be planned but, even more so, it must be learned (Tàbara 2014).

Second, sustainability demands deliberation; that is, reasoned and truthful communication and discussion about important issues open to all those potentially affected by that issue (see Dryzek and Stevenson 2011). This is not simply a matter of peoples' rights to participate in democratic decision-making. Nor, for that matter, is it simply a matter of capturing local or indigenous knowledge. As important as these are (Magnani 2012), deliberation, as demanded by sustainability, is also a matter of recognizing that the human environment is a shifting terrain of knowledge, values, interests, aspirations, and coalitions. As environmental disputes, planning exercises, management regimes etc. play out, multiple stakeholders are brought into contact. The knowledge, values, and aspirations that people bring to any environmental governance process or conflict are always potentially redefined through their interaction with others. Ideas and understandings can shift, new interest groups form, and points of agreement and conflict change. Participatory deliberation is thus fundamental to understanding and responding to the dynamic ways in which social networks, understandings and priorities are constructed and re-constructed through processes of social-ecological change (Lockie 2007).

Third, sustainability demands accountability. It is not enough to implement new programs of action. Our planning and learning towards the future must be evaluated. We must distinguish – both in prospect and retrospect – between appropriate and inappropriate, successful and unsuccessful, good and bad, attempts to assemble future social-ecologies. Numerous institutional arrangements have been implemented throughout human history to impose such accountability (for example, property rights and responsibilities, pollution licensing, production standards etc.). Sustainability demands that critical scrutiny, through learning and deliberation, of these arrangements be extended and intensified (Dryzek and Stevenson 2011). In particular, it demands that scrutiny be focused on the distributive impacts of socio-ecological interventions across both space (intra-generational accountability) and time (inter-generational accountability).

Despite these important roles in sustainable development, biodiversity and ecosystem services which support people's lives and livelihoods continue to be degraded and lost at unprecedented rates. The recent regional assessment reports by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) found that biodiversity is in decline in all regions of the world.⁴ The Strategic Plan for Biodiversity 2011-2020 and its twenty Aichi Biodiversity Targets, adopted by the Conference of the

Parties to the Convention on Biological Diversity (CBD) in 2010 at its tenth meeting⁵, has been recognized by the United Nations General Assembly as the global policy framework for biodiversity. Accordingly, many elements of the 2030 Agenda and its SDGs have been drawn from the Strategic Plan and the Aichi Biodiversity Targets. The Strategic Plan for Biodiversity 2011-2020 itself is framed in the context of sustainable development, with a vision of maintaining and enhancing ecosystem services, sustaining a healthy planet and delivering benefits essential for all people.

Biodiversity and Sustainability Issues in Governance

Review of the governance literature relevant to biodiversity and sustainability issues revealed four distinct governance approaches, namely integrative, inclusive, adaptive and pluralist governance. These approaches have been extensively studied separately, and various authors have studied different combinations of the approaches (Patterson 2017; Bowen et al, 2017; Glass, & Newig, 2019) but none have considered how these approaches need to be combined and operationalized to enable transformative change.

Integrative Governance

Transformative change implies change across places, sectors, issues and scales. However, issues are often still governed independently of each other, producing incoherent and suboptimal outcomes. Integrative governance (IG), defined as the theories and practices focused on the relationships between governance instruments or systems, addresses these challenges (Visseren-Hamakers, 2018; Freeman, 2015). Debates on integrative governance have been ongoing for decades, but have not widely led to more coherent, sustainable policies or practices.

Most approaches underestimate the politics of integrative governance and assume the possibility of win-win outcomes. In a context of transformative change, this is often not the case, especially in the short term, when those with vested interests in unsustainable practices will need to sacrifice power. To contribute to transformative change, IG thus needs to be combined with inclusive approaches, as operationalized below (Freeman, et al, 2015). Meanwhile, an interesting example of IG is compassionate conservation, which integrates attention to animal welfare into biodiversity conservation (Visseren-Hamakers, 2020).

Inclusive Governance

Inclusive governance refers to enabling a wide range of rights holders, knowledge holders, and stakeholders to participate in decision-making to capture diverse values, enhance capacity, and promote accountability, legitimacy, and just outcomes (Brondizio, & Tourneau, 2016; Dedeurwaerdere, 2016).

However, biodiversity-related decision-making processes have often inadequately addressed underrepresented values of nature and the interests of marginalized communities (Clapp & Dauvergne, 2011). To become transformative, inclusive governance must be operationalized in ways that empower those whose interests are currently not being met and represent values underpinning transformative change for sustainability, including bioenvironmental, social greens, deep greens or strong sustainability worldviews and perspectives (Witter et al, 2015; Charli-Joseph et al, 2018; Lam et al, 2020).

It must acknowledge practices that give rise to gender, racial or cultural disparities, and unequal social, economic and institutional structures, such as the exclusion of Indigenous Peoples and local communities (IPLC) as central knowledge and rights-holders in environmental decision-making bodies. It must also go further to integrate new and innovative rights, such as extending rights to nature and animals to include future generations and non-humans in the process of governance (Chapron et al, 2019; Visseren-Hamakers, 2020).

Adaptive Governance

Transformative governance must be adaptive to reflect the inherent complexity of environmental change. Adaptive governance is characterized as a process to enhance resilience that uses continuous opportunities for iterative learning, adjusting responses to uncertainty, social conflicts, and complexity over time. Key elements of this process include management with feedback loops, networked policy actors, nested scales and polycentricity, and institutional and stakeholder diversity (Chaffin et al, 2014). Adaptive approaches have been successful in the real world in dealing with biodiversity loss; for example, in the Amazon, rapid deployment of a livelihood scheme to reduce deforestation included governance mixes (technical assistance, cooperative marketing and land titles) and nested, networked actors (farmers, a women's Brazil nut processing group, donors, and state officials) who shared information and provided legitimacy to collective action processes (Davenport et al, 2017). As another example, IPLC using customary institutions for biodiversity management have long practiced adaptive governance through Indigenous and Local Knowledge (ILK) systems and cultural practices that respond to ecological change (Schultz et al, 2015), leading to calls for improved 'biocultural' conservation approaches modelled on these efforts (Gavin et al, 2015). How adaptive approaches can navigate transformative change is still an open question, however, given the need to reduce root causes of vulnerability and push socio-ecological systems into a new state (Gavin et al, 2018).

There are synergies with other governance approaches; adaptive governance often includes coproduction of knowledge as well as inclusive governance through co-management (Fedele et al, 2020). However, tensions can emerge around intragroup inequalities and failures to address power asymmetries when adaptive approaches increase stakeholder inclusion (Olsson et al, 2014; Wyborn et al, 2019). Further, adaptive approaches can face barriers around disagreement and polarization among actors, or over inflexibility in designing experimental or innovative solutions (Susskind et al, 2012; Tschakert et al, 2016). Specific adaptive tools, such as the 'Open Standards for the Practice of Conservation' and 'Adaptation Action Cycles' can help navigate some of these trade-offs by combining iterative steps in a participatory process to bridge social networks (Karpouzoglou et al., 2016).

Pluralist Governance

Biodiversity governance has traditionally relied on natural science-based tools such as indicator frameworks, or integrated as-

assessment models to assess the state of species and ecosystems and drivers of change, or methods to quantify the economic value of nature (Carr et al, 2017; McElwee, 2017). While these tools are means to assess the biophysical impact and footprints of human action on biodiversity, they do not reflect pluralist perspectives and knowledge systems. Transformative governance requires recognizing the multiple legitimate ways of knowing, defining, valuing, and representing biodiversity, incorporating broader sets of information and indicators, including those that reflect non-Western worldviews on nature, well-being and prosperity (Turnhout, 2018; Yap & Watene, 2019).

CONCLUSION

Putting in the new globalized order, conservation of biodiversity is very much aligned in pursuit of sustainable development goals through the integration of economic, social and environmental development considered as the inter-dependent and mutually reinforcing pillars which operate at the local, national, regional and global levels.

In the first place, biodiversity primarily helps as a means to end poverty in all its forms everywhere as it provides resources and income, particularly for the rural poor, the majority of whom directly depend on biodiversity and ecosystems for their subsistence, which likewise underpins millions of jobs, also known as the 'GDP of the poor'.

Secondly, biodiversity helps achieves food security and improved nutrition and promote sustainable agriculture for it is a key element of food security and a means of improving nutrition. Many of the most vulnerable people depend on food gathered from natural ecosystems, such as forests, grasslands, oceans and rivers. Biodiversity also underpins ecosystem functions, such as pollination and the maintenance of soil fertility, and water quality, which are central to agricultural productivity. Further maintaining genetic and ecosystem diversity in agricultural practices can reduce farmers' vulnerability to climate change and to market variability.

Thirdly, biodiversity helps in ensuring healthy lives and promote well-being for all at all ages healthy ecosystems help to mitigate the spread and impact of pollution by both sequestering and eliminating certain types of air, water, and soil pollution. Agricultural biodiversity contributes to increased sustainable production, reducing the need for pesticides and other chemical inputs, resulting in benefits to human health. Further, a substantial proportion of the world's population depends on traditional medicines derived from biodiversity for their health care needs.

Fourthly, it can achieve gender equality and empower all women and girls. Women play a vital role in agriculture, nutrition, and the well-being of families and communities. Recognizing women's roles as key land and natural resource managers is central to sustainable development. In addition, loss of biodiversity and associated ecosystem services can perpetuate gender inequalities by increasing the time spent by women and children in performing certain tasks, such as collecting valuable resources, including fuel, food, and water.

Fifth, ecosystems help maintain water supply and quality and guard against water-related hazards and disasters. For example, wetlands play a role in surface, and subsurface groundwater water storage, and reduce the risk of flooding. They also help to capture, process, and dilute pollutants. Similarly, vegetation, such as grasslands and forests, supports the healthy functioning of watersheds. Managing ecosystems to maintain these types of services is generally more cost-effective than employing built technologies. It also helps prolong the lifetime and productivity of water infrastructure such as reservoirs, water supply facilities, irrigation networks, and dams.

Sixth, Biodiversity and ecosystems underpin many national and global economic activities, including those related to agriculture, forestry, fisheries and aquaculture, energy, tourism, transport and trade. Biodiversity conservation and sustainable use can lead to higher productivity, more efficient resource use, and long-term viability of resources.

Seventh, biodiversity and healthy ecosystems can provide reliable and cost-effective natural infrastructure. For example, coral reefs and mangrove forests protect coasts against flooding that are expected to increase with climate change. Natural infrastructure such as vegetation in cities can reduce the run-off of pollution into water bodies. Such green infrastructure can offer multiple benefits and are often more effective than built infrastructure in terms of cost, longevity and effectiveness.

Eight, Ecosystems and biodiversity underpin the day-to-day functioning of human settlements by delivering the basic services and conditions that enable, support and protect human production, consumption and habitation. Biological resources provide many of the foods, building materials, energy, and medicines that are consumed in urban centers. Urban planning that integrates biodiversity consideration can contribute to more sustainable, cost-effective and healthy human settlements.

Ninth, Consumption and production of all goods and services require the transformation of many natural resources, which in turn impacts biodiversity. Current unsustainable consumption and production patterns can undermine the ability of ecosystems to provide services for industries and communities that rely upon them.

Tenth, forests, peatlands, wetlands, ocean, and coastal ecosystems represent globally significant carbon stores, and their conservation and sustainable use is a critical element for avoiding dangerous changes to the Earth's atmospheric temperature and climate system. Efforts to protect and restore habitats offer cost-effective and proven ways to mitigate climate change. Such ecosystems can also serve as natural buffers against climate extremes and other disasters, and strengthen adaptation to climate change.

Eleventh, the conservation and sustainable use of biodiversity in marine and coastal ecosystems is a key aspect of sustainable development. Biodiversity underpins all fishing and aquaculture activities, as well as other species harvested for foods and medicines. Conservation and sustainable use of marine and coastal biodiversity is essential to ensure that the world's oceans, seas and marine resources remain vital for current and future generations.

Twelfth, conservation, restoration and sustainable use of terrestrial ecosystems is essential for sustainable development and for achieving other SDGs. Targets under this goal include a call to integrate ecosystem and biodiversity values into national and local development planning, poverty reduction strategies and accounts. Other targets highlight the importance of particular ecosystems, including freshwater, forests, deserts and degraded lands, and mountain ecosystems.

Finally, conflicts over natural resources, environmental degradation and contamination can be one of the factors leading to social inse-

curity and violence. Vulnerable people are often disproportionately affected. Strengthening the rights of communities over natural resources management, combating illegal exploitation and corruption, and ensuring transparent decision-making on social and environmental issues constitute an important process toward building an inclusive society based on justice.

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