

Chapter 1

An Overview of the Potentials, Threats and Conservation of Biodiversity in Africa



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Abstract There is a clear link between human developmental strides and biodiversity status on the African continent. The link exists in the form of drivers, outlooks, emergent properties and multiple feedback dimensions. To sustainably manage this relationship there is a need to identify priority and critical areas for investment and interventions, such as biodiversity and biome-level conservation area analysis that combines climate change and deforestation threats to ensure the preservation of high-value biodiversity and cultural heritage. The result will manifest in the form of a robust monitoring plan as well as adaptation to and mitigation of key stressors, threats and risks. Most of Africa's biodiversity is found outside the limit of native and non-native protected areas and continue to face dynamic threats. Development is the main threat and unless it becomes sustainable will harbour generic issues related to limiting biodiversity potentials and increasing the threats to their use and conservation. This book is a collection of works on the potentials, threats and conservation of biodiversity in Africa and is divided into four sections - an introductory section and other sections on the values of biodiversity in Africa, drivers of biodiversity loss in Africa and trends, scenarios and governance in relation to biodiversity conservation in Africa. This introductory chapter presents an overview of perspectives presented in the book toward a common agenda. Many people only know Africa from the perspective of its unique biodiversity and the values of African biodiversity may be considered from two perspectives—either the whole value or the value of the components. The proximate driver of biodiversity loss in Africa may be biological but the ultimate cause is socio-ecological and economic processes. The major reason

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for this biodiversity loss is not only direct human overexploitation but also due to pollution, urbanization, habitat fragmentation, invasive species, novel diseases and human population growth. A key sustainability target would be to regularly organize public outreach programmes aimed at informing Africa's populace about the ongoing biodiversity loss. Also, knowledge-based sustainable utilization, strategic monitoring and assessment of threats, and technology-driven innovative conservation practices should be used to define all future developmental plan that pertains to Africa's biological resources.

Keywords Biodiversity value · Sustainable use of biodiversity · Biodiversity conservation · Human development · Africa

1.1 Introduction

There is a clear link between human developmental strides and biodiversity status on the African continent. According to Lawler et al. (2021), this link incorporates several other considerations, which include biodiversity utilization and conservation and diverse ecosystem facets, like policy development and implementation, functioning, processes and services. Evidence is presented in the work of Brockerhoff et al. (2017) on the connected relationship between biodiversity and optimal ecosystem functioning that ultimately leads to the provision of services. Hence, human–biodiversity links in Africa exist in the form of drivers, outlooks, emergent properties and multiple feedback dimensions that are evident in land-use systems and changes, agricultural intensification, alien species, wildlife trade, climate change events, like flooding, erosion, habitat loss and fragmentation, as well as biodiversity changes from deforestation, afforestation, urbanization, immigration and emigration, etc. (Ogwu 2019a; Ogwu et al. 2014). Therefore, this defining relationship may be designed and/or managed to hold the requisite amount, type and variety of biodiversity to sustain livelihood (Scherr and McNeely 2008). To effectively establish this sustainable relationship there is a need to identify priority and critical areas for investment and interventions, such as biodiversity and biome-level conservation area analysis that combines both climate change and deforestation threats to ensure the preservation of high-value biodiversity and cultural heritage (Tabor et al. 2018). The result will manifest in the form of robust monitoring plan and adaptation to and mitigation of key stressors, threats and risks. The response to rising population and agricultural effects on biodiversity, culture and the environment is an example.

In the long term, it would be necessary to focus on human capacity development as a means to address biodiversity and environmental woes in Africa. On a small scale, the work of Schuit et al. (2021) presents this perspective using the coffee sector in Ethiopia wherein enhancing human skills led to efficient production, more profitability and numerous environmental gains. This strategy will work considering humans mostly perceive environmental and biological resources from a utilitarian standpoint and continue to explore ways to maximize benefits from these resources. The win-win scenario will be all the more important in Africa where human–

biodiversity–culture seems most intricately connected. Below-ground processes and activities, such as fertilizer use and farming, have above-ground impacts through modification of soil capacity to support and maintain the biodiversity and environment (Nyam-Osor et al. 2021). Therefore, the human capacity development approach to maximize the environmental potential, meet current and future biodiversity threats, as well as their conservation in Africa, can improve through the incorporation of contemporary techniques. For instance, the decline in large carnivores, reduction of forest covers and crude extraction in the pristine environment would benefit from technological cum technique changes. Through the revision of existing practices (using unmanned aircraft systems or drones and satellite imagery) and policies in Africa’s large carnivore conservation, there would be a shift in stakeholder perception and attitude (Franchini et al. 2021; Mulero-Pázmány et al. 2017; Di Marco et al. 2014).

Most of Africa’s biodiversity is found outside the limit of native and non-native protected areas and continue to face dynamic threats. The quality and quantity of this “outside environment” is increasingly changing and may not be able to sustain Africa’s unique biodiversity in the future. Development is the main threat and unless it becomes sustainable will harbour generic issues related to limiting biodiversity potentials and increasing the threats to their use and conservation. A risk assessment framework, such as those recommended in Butler et al. (2007), for predicting species-level conservation status in the light of projected population growth and agricultural intensification on the African continent is paramount. In the opinion of Vogt (2021), improving intrinsic biodiversity values and outcomes requires dissecting all the interactions within the realm of the human natural environment. Gap analysis of this realm can be used to develop a set of measurable and immeasurable indicators for understanding progress and preparing strategic action plans for native and non-native areas and indicator species found therein (Dudley et al. 2005). The recent work of Vogt (2021) provides a conceptual approach for ensuring productive systems of human-managed wild and non-wild coupled systems. This model, a transboundary dynamic approach with rational options to address issues related to environmental issues, biodiversity conservation and human or social challenges, is pertinent to improve the understanding and economic value of natural resources with communal participation and decision making (Ferguson et al. 2013).

This book is a collection of works from diverse global scholars, academics and professionals, practitioners, experts, etc., on the potential, threats, and conservation of biodiversity in Africa. It is divided into three sections—Values of Biodiversity in Africa (Part II), Drivers of Biodiversity Loss in Africa (Part III) and Trends, Scenarios and Governance in Relation to Biodiversity Conservation in Africa (Part IV). This introductory chapter aims to present an overview of perspectives presented in the book toward the common agenda.

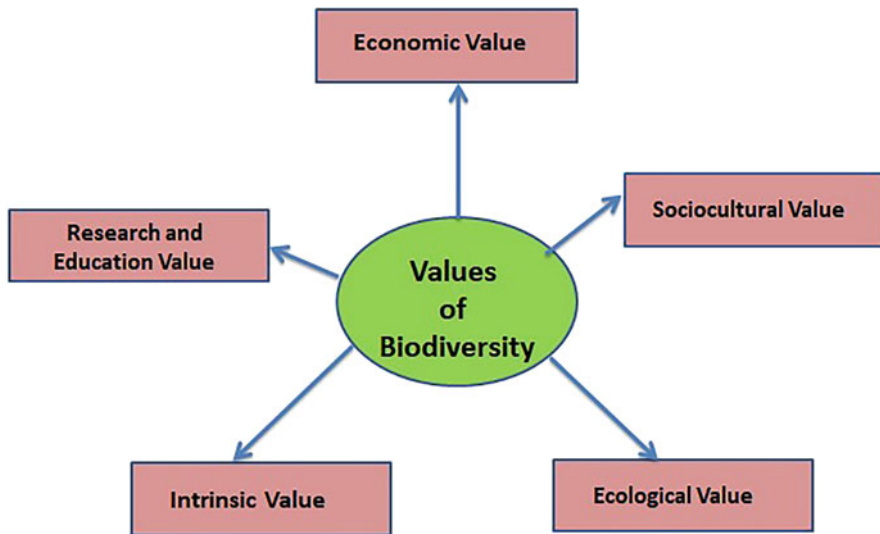


Fig. 1.1 Values of biodiversity in Africa

1.2 Values of Biodiversity in Africa

Biodiversity refers to species and genetic variability within and between populations and their distribution in time and space and their evolutionary histories (NRC 1999). Biodiversity conservation has a unique position to the actual and potential sustainable development of Africa, but diverse human and non-human induced threats are threatening the roles and values of biodiversity on the continent. Nonetheless, efficient planning, effective management and relevant value-based policies guiding the use and conservation and ecological compensation at different scales may protect the position, value and contribution of Africa’s biodiversity to the sustainable development of the continent. The trade-off considerations (such as in species and ecosystem conservation and productivity) may help integrate biodiversity into social strategies for the development of sustainable human–biodiversity–culture systems (Schroth and McNeely 2011). This may be in the way of focusing on biological mechanisms and economic cum environmental drivers. In the past, ecological modelling combined with remote sensing data has been used to predict ecological processes and species conservation (Wegmann et al. 2014).

The values of biodiversity may be considered from two perspectives – whole biodiversity value or value of the components of biodiversity, i.e. genes, species or taxa, and it may be of direct or indirect value. Moreover, biodiversity value may also be viewed from the benefits of the following standpoints (Fig. 1.1):

1.2.1 Economic Value of Biodiversity

Biodiversity is the backbone of many economic products. The economies of many countries in the Global South depend heavily on biodiversity, including tourism. Without biodiversity, there will be no agriculture system. Biodiversity used as food drives the demand and supply of many sectors. The economic value of biodiversity focuses on the quantified cost or estimated cost and benefits of the biological resource and the market for part or the whole biodiversity or associated materials (Osawaru and Ogwu 2020; Evivie et al. 2020; Ogwu 2019b; Naidoo and Adamowicz 2005). The demand and supply of biodiversity can influence the conservation value, policy and strategies.

1.2.2 Sociocultural Value of Biodiversity

Many cultures on Earth are defined by the biodiversity found in their environment and Africa is a prime example. Non-consumptive benefits of biodiversity are included in this category. Preserving biodiversity is for everyone to enjoy and access both locally and globally and is essential for understanding life and may be considered the single most important sustainable development target (Neergheen-Bhujun et al. 2017).

1.2.3 Ecological Value of Biodiversity

The goods and services derived from biodiversity function, processes and services are the realm of the ecological value of biodiversity. The environment will not be the same without biodiversity in it. They also serve as ecological monitors and may be used to manage polluted environments (Ogwu 2019c).

1.2.4 Intrinsic Value of Biodiversity

These are the intangible or existential values of biodiversity and include aesthetic value. Not all the values of biodiversity are known or understood, but these are included here. Spiritual and religious roles of biodiversity are also included here as well as many traditional uses of biodiversity, like in herbalism (Ogwu et al. 2017).

1.2.5 Research and Educational Value of Biodiversity

Biodiversity components may contribute valuably to knowledge systems either as a transformative or informative vehicle for technological, scientific or societal innovations (NRC 1999). The educational value of biodiversity increases our social, economic and ecological value and belief systems. Determining the status and trend of biodiversity is key to making a reliable decision about species management, utilization and conservation as well as ecosystem restoration and rehabilitation (McNellie et al. 2020).

It is important to add that all the individual values of biodiversity function as a unit with each value connected to the other and vice versa resulting in either direct or indirect benefits. Examples of connection-based direct value of biodiversity are products and services obtained from biodiversity, like food, timber and environmental protection, whereas non-monetary, non-consumptive, option and existential benefits, like aesthetic, are examples of connection-based indirect biodiversity value.

Many people only know Africa from the perspective of its unique biodiversity especially wildlife, like lions, elephants, cheetahs, etc., and wide-open spaces from the north to south and east to west of the continent. This is also why Africa excites different categories of professionals, like naturalists, systematists, explorers and conservationists (Huntley 1988). However, speciation and extinction are ongoing at different scales in the continent with around 23% of African mammals being threatened with extinction according to the IUCN Red List (Schipper et al. 2008; Huntley 1988). The IUCN Red List serves as an invaluable resource for conservation planning and monitoring but gaps especially with plants, fungi and invertebrates limit application and widespread acceptance (Bachman et al. 2019, 2020; Eisenhauer et al. 2019; Rodrigues et al. 2006). A large proportion of Africa's biodiversity is categorized either as data deficient or least concerned because they have not been properly assessed. Such consideration led to a policy response by scientists that culminated in the publication of a Sampled Red List Index that outlined the need to prioritize detailed fieldwork, especially in certain locales and on aspects of natural history to produce a more robust categorization system (Brummitt et al. 2015a, b).

Since Africa got separated from South America over 140 million years ago in the Gondwanaland supercontinent, dinosaurs and other animals and vegetation systems comprising vast rainforests and deserts have characterized Africa's environment and biodiversity (Huntley 1988). Today, Africa's biodiversity and environment are only a tiny legacy of what existed originally mainly due to the priority effect of humans—hunter, gatherer, fire maker and developer. Using satellite-borne imagery, Di Marco et al. (2014) classified species extinction risk on the continent to be driven by species distribution state, human pressures, conservation response and species biology.

A total of 20 biogeographic units have been defined for the African continent comprising seven centres of endemism, including Guineo-Congolian, Zambezian, Sudanian, Somali-Masai, Cape, Karoo-Namib and Afro-montane (Huntley 1988). In sub-Saharan Africa, ca. 45,000 unevenly distributed plant species have been documented from 29 million km² with the most diversity reported from the southern

part of the continent and the western part being the poorest (Linder 2014). However, the comparatively small amount of plants supports a significant number of cultures, civilizations and human and animal populations. Their benefits are not well known.

Sosef et al. (2017) suggested that the exploration of tropical Africa flora is not complete and highlighted priority areas for future sampling efforts to include Tanzania, Atlantic Central and West Africa. Same as in other parts of the world, plant conservation in Africa is not attracting the urgency or funding that characterizes animal protection (Corlett 2016). Bird diversity is estimated at 1595 species and is defined mainly by rainfall and vegetation and are impacted mostly by annual burning and intensive livestock grazing since they occur mostly as isolated populations (Huntley 1988; Maphisa et al. 2016). The great lakes of Africa – Victoria, Tanganyika and Malawi hold around 1073 fish species more than the numbers recorded for larger lakes in the Global North (Huntley 1988). Nonetheless, much remains to be discovered about Africa's biodiversity. For instance, to date, there is no accurate record of the amount and variety of biodiversity in the river Nile (Allan et al. 2019). Major threats to fishes are invasive fish species, poor water quality, water abstraction, changes in land use, impoundments, and modification of aquatic habitats (Chakona et al. 2022). It must be noted that Africa has the largest area of wetland sites and are particularly affected by pollution, biological resource use, natural modifications, aqua and agriculture (Xu et al. 2019).

Biodiversity distribution data of species on the continent will foster an understanding of biodiversity patterns and processes (Farooq et al. 2021). Understanding biodiversity distribution patterns and factors that influence them, such as climate change, pollution, fire regimes and invasive species, is a key prerequisite for sustainable utilization and conservation of biodiversity (Sosef et al. 2017; Chown 2010). In Africa, plant functional diversity is controlled by precipitation, whereas that of animals is regulated by temperature, which is indicative of a bottom-up and top-down climatic control in plant–animal interactive networks (Albrecht et al. 2018). Besides distribution data, the value of Africa's biodiversity can be enhanced with better survey, monitoring, systematics, biogeography, ecology and conservation. Distribution models are necessary to identify hotspot areas for biodiversity conservation as well as to assess the impacts of climate change on indicator species and to assign a red list category (Soultan et al. 2019). Further, this may help capture the salient needs of the continent's biodiversity as enumerated in Huntley (1988), which includes the following:

- Biological classification system for Africa's biodiversity
- Assessment of the protected area range and cover for Africa's biodiversity
- Address gaps within native and non-native protected area networks
- Establishment of a recurrent survey and monitoring systems
- Maintaining an institutional support system with experts for Africa's biodiversity

After all, according to Chown (2010), spatio-temporal changes in biodiversity and institutional failure to address them hinders conservation efforts. van Breugel et al. (2015) expressed this as “finer-scale” biodiversity conservation decisions to stem the continuous biodiversity deterioration in Africa using taxa-level baseline

data in ecoregions for a more transparent and informed translation of biodiversity conservation priorities.

1.3 Drivers of Biodiversity Loss in Africa

The proximate driver of biodiversity loss in Africa may be biological, but the ultimate cause is socio-ecological and economic processes (NRC 1992). The IUCN Red List status of (larger) animals, like lion (*Panthers leo*) and Rhinoceros (both black (*Diceros bicornis*) and white (*Ceratotherium simum*)) are attracting more attention than plants and landscapes. Background biodiversity extinction rates are high in a continent where very little is known about their biodiversity richness and distribution. The major reason for this biodiversity loss in Africa is not only direct human overexploitation but also a result of pollution, urbanization, habitat fragmentation, invasive species, human population growth, etc. (Ogwu 2019d, 2020; Ogwu et al. 2014; Osawaru and Ogwu 2014). No doubt human activities and processes are altering the ecosphere and defining aspects of biodiversity loss and recovery in some cases. The rate of biodiversity decline is exponential in this sixth extinction era, especially of genetically distinct population and in some cases beyond where they can retain environmental functionality (Ehrlich 1988). This is a pertinent environmental problem within the African continent and the African Union is yet to establish elaborate targets and tracking systems that are similar to those of the European Union's 2000, 2020, 2030 and 2050 NATURA, EUROPE 2020, Climate Target Plan, Green Deals, European Climate Foundation, etc. Just as in the European Union, these systems and projects would help to decarbonize the economy, cut emissions by up to 50 % and protect 30 % of land and sea areas in a bid to restore ecological integrity, effectively manage threatened species, move towards climate neutrality and provide substantial biodiversity and ecological investments for public-private partnerships (Wolf et al. 2021; Meles et al. 2020; Hermoso et al. 2019). Some member states of the Africa Union have taken the initiative to set targets and monitor threatened species within the continent. Despite being a low carbon emitter, Africa is experiencing significant disruptions tied to climate change, including biodiversity loss and environmental degradation. The decline in certain groups of biodiversity, like plants, is difficult to quantify because of their richness, large number of undiscovered taxa and absence of a standard template for risk assessment (Brummitt et al. 2015a, b). This is threatening approximately 22% of Africa's plant diversity. For such groups, extinction risk may be heightened if unchecked but may be stemmed by constant monitoring and application of the findings of Brummitt et al. (2015a, b), i.e. the application of IUCN Sampled Red List Index for robust monitoring and assessments and measuring performance in line with Goodhart's Law as a baseline for understanding current and future changes.

One way to view biodiversity loss is that of Hanski (2005), which is that there is no actual loss when there is a clear decline in species abundance. While that view incorporates losses due to natural fluctuation because there is no global indicator of

spatial scale biodiversity loss, it does not hold for what is not observable and background losses. A transdisciplinary approach towards developing a better understanding of mechanisms of biodiversity loss and the impacts on the ecosystem and livelihood is the way forward. At the moment, the variety of approaches, methods, scales and hypotheses applied has led to a huge body of predictions that can rarely be easily applied (Bellard et al. 2012). An obvious effect of biodiversity loss is pathogen emergence, such as COVID-19, which has direct and indirect effects on the ecosystem and livelihood (Erinle et al. 2021; Schmeller et al. 2020; Hosseini et al. 2017). The connection with pathogen emergence is found in human modification of the environment that encourages the transmission of infectious diseases from animals to humans in the absence of the “diluting effects” of biodiversity through other susceptible hosts (Platto et al. 2021). Human drivers of biodiversity disease threat include habitat encroachment and destruction, human behaviour, biodiversity loss and human-assisted disease spread (Cunningham et al. 2017; Young et al. 2017). Among other things, this shows the interdependence of sustainability on each member of the human–biodiversity–culture link. Human well-being and health disruption of ecosystems are much more diverse, ill-understood and unstudied (Alves and Rosa 2007). Moreover, the findings of Stephens (2015) highlight the contributions of organismal research to the conservation effort, mitigation response and clear decline of the lion population in West and Central Africa.

Military and political conflict has been mentioned as an immediate cause of environmental degradation and indirect cause of biodiversity loss in Africa as well as poverty by NRC (1992). Others are trophy hunters, food and income insecurities, lack of policies, inefficient resource management and allocation systems, immigration and emigration as well as climate change. There is a need to rethink and refocus biodiversity priorities on the continent if current trends are to be halted. The unprecedented rate of ecosystem decimation through unsustainable agricultural intensification, watershed disruption, emission of greenhouse gases, deforestation for shifting cultivation and other practices should be halted. Chanyandura et al. (2021) recommended the following:

- Organized stakeholder and community participation
- Informed and planned species and environmental management approach
- Legal structures and enforcement that involve surveillance technologies
- Public awareness campaigns
- Good management of information repository

Also, a spatial scale approach that is large enough to encourage mega- and meta-populations to regain functionally relevant density might help stem biodiversity loss in the continent (Norris et al. 2020). In such a system-based approach, the sensitivity of variables that respond to biodiversity change and other abiotic and anthropogenic factors is considered invaluable indices with functional consequences (Norris 2012). To directly address biodiversity loss in Africa, the African Union may adopt an approach that recognizes remote responsibility and promote a shift in economic development towards activities with low biodiversity impacts (Marques et al. 2019).

1.4 Towards Sustainability in African Biodiversity Utilization and Conservation

Maximizing the potential and reducing the threat to Africa's biodiversity will require a consistent policy that is supported by qualitative and quantitative transdisciplinary research records. Research data sourced from a combination of techniques have often proven invaluable for biodiversity conservation and to evaluate specific sectors within the conservation and utilization system (Khan et al. 2013). The sustainability vision for Africa's biodiversity would be to maintain a valuable threshold of biodiversity to retain a constant supply of ecosystem services, functioning and processes as well as a healthy continent. This will require an increase in conservation efforts for endangered and threatened species, protection of existing ecosystem fragments like a disrupted watershed, and sustainable extraction of resources and tourism activities to retain environmental integrity (Locke et al. 2019). Monitoring of access to biodiversity and the environment may promote the culture of sustainable custodianship of the resources and foster human–biodiversity–culture links. Sustainable food production should also be targeted because the production of food to meet Africa's rising population might need agricultural intensification involving the conversion of natural ecosystems and use of pesticides, herbicides and fertilizers (Koch et al. 2019). According to Koch et al. (2019), a systems approach is needed to elucidate the different dimensions of a food production system and value chain in order to make it sustainable. Also required might be the careful study of the complex, multi-variables, non-linear and cross-scale interactions, and how these are changing through time (Liu et al. 2007).

The IUCN Red List of Ecosystems is a powerful tool that provides important insights on the ecosystem risk status and key assessment outcomes for accurate and consistent decision making that can affect biodiversity with the each natural system (Rodríguez et al. 2015). The document provides a baseline category that also applies to African ecosystems and includes collapsed, critically endangered, endangered, vulnerable, near threatened, least concern, data deficient and not evaluated categories. An ecosystem that has not been assessed as is the case for most of Africa is likely to be included in the data deficient or not evaluated category which may also affect sustainability efforts. In that case, it is impossible to attract much-needed attention and may continue to suffer from background collapse risks and decline in quality. The work of Rodríguez et al. (2015) listed a risk assessment process that could be adapted for biodiversity that includes describing the limiting units and their declining distribution status (Criterion A), risk rate from threatening processes (Criterion B), rate of degradation of non-biotic processes on which the biodiversity units depend (Criterion C), impacts of or relationship with other biodiversity units (Criterion D), Criterion E that is an adaptation to collapse, i.e. extinction rate in relation to minimum viable population and finally the synthesis of results from all assessment criteria (A–E) to ascertain and report the outcome (Criterion F) (Fig. 1.2). The output from this straightforward approach may be used to rank biodiversity into one of the nine IUCN Red List categories or even better, for establishing an adapted

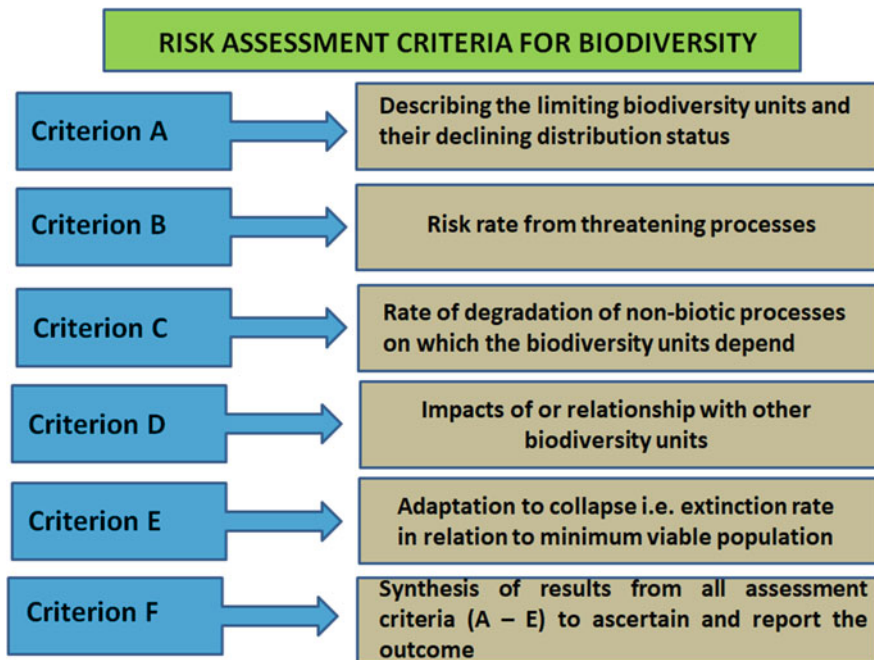


Fig. 1.2 Risk assessment processes for biodiversity

categorization that suits local needs. Moreover, these assessment criteria can impact biodiversity conservation from diverse dimensions, most importantly decision making, scientific knowledge, enhancing awareness among stakeholders and value chains, assigning priorities, funding and other resources, and legislation and policy formulation and implementation (Betts et al. 2020).

For the sustainable use and conservation of Africa’s biodiversity, major interventions and a strategic approach are required to reduce risk, set evidence-based priorities to ensure limited resources are maximized (Scherer et al. 2020). Moreover, strong leadership will be necessary to nurture a sustainable coupled human–biodiversity–culture link by integrating biodiversity and environmental needs with social, economic and cultural growth into the governance system (Owethu and Buschke 2019). Data accessibility to ensure informed decision making on human natural resource management should be maintained on an open, simple and easily accessible platform or databases (Stephenson and Stengel 2020). The findings of Raatikainen et al. (2021) suggest that achieving sustainability requires incorporating diverse people’s views, emphasizing the place value of nature in development and adopting a transdisciplinary approach. The sustainable management of African wetland and aquatic biodiversity would require management and efficient policies, monitoring, knowledge, restoration and funding (Xu et al. 2019).

Research studies are important to sustainability in biodiversity conservation and understanding evolutionary processes. This is also mentioned in the work of

Gristwood (2020) wherein among others it was stated that it contributes to understanding biodiversity distribution, phylogeny, diversity, taxonomy and categorization. In the light of the report of Bradshaw et al. (2021), which suggests that the science underlying the rapid loss of biodiversity is strong but is often weakened by large scale poor awareness, as well as a lack of appreciation of the enormity of the problem. These innate challenges can threaten sustainability efforts and need urgent actions to address and this can be done through educational programmes, media advertisements, town hall meetings and exhibitions. It is also important to reduce uncertainties and failures about biodiversity responses to conservation management while emphasizing effectiveness and biodiversity recovery (Nicol et al. 2019). Therefore, a multiscale effort aimed at informing the populace and a call for action will be needed as a first step. As Africa, strive towards more sustainable development, it would be pertinent to popularize the link between human–biodiversity–culture. This is necessary because human health and social economy are tied to biodiversity and the environment. It is documented in Novacek (2008) that engaging people in biodiversity issues provides the avenue to foster communal understanding and empowerment and action that is driven by reliable recommendation.

1.5 Conclusion

It is not always necessary to increase land use to maximize economic benefits from biological resources in Africa but vital to adopt environmental friendly approaches to safe guide the future of human–biodiversity–culture connection. Knowledge and practices are the supporting structure for future developmental directions of Africa’s biological resources to meet desired potentials, threats and conservation needs of the continent. Moreover, the introduction, innovation and acceptance of contemporary techniques for biodiversity conservation are needed in Africa. A cross-sectional and multi-stakeholder stress and threat indicator and response system is necessary to manage Africa’s biodiversity. The establishment of such a framework will accurately measure biodiversity status and predict changes associated with unsustainable developmental activities, guide policy and management decisions and set meaningful targets to prevent or reduce the threat to biodiversity while promoting conservation and sustainable utilization. Ideal biodiversity protection in Africa would require decision makers to incorporate population analysis to assess management efficiency and effectiveness as well as the perception of species and ecosystem threat (Di Minin et al. 2013). Africans have a unique relationship with biodiversity and their environment that can meaningfully contribute to conservation strategies. Behavioural perspective influences biodiversity conservation strategies and goals. This can also be relevant in stemming the transmission risk of disease vectors due to gaps in biodiversity by understanding the link between host behaviour and communal transmission (Herrera and Nunn 2019).

The entire environment of the African continent should be treated as a corridor for the protection and preservation of the continent’s biodiversity heritage. The

protected area network of Africa presents a usable template but should be expanded to increase the connectivity, size and biodiversity focus. Sampling biases continue to affect data on biodiversity distribution and status on the continent and can benefit from a robust approach and sampling area completeness that focuses on and address species (and other)-level difference. Sustainable utilization and conservation of Africa's biodiversity will need the participation of the populace and government encouragement to prevent conflict and to empower communities for sustainable livelihood. This may be considered a form of the ten human heritage-centred conservation tenets presented in Montgomery et al. (2020). Such a traditional approach to biodiversity conservation has been a part of Africa since time immemorial. However, it is important to increase investment in Africa's biodiversity.

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